SALEM GENERATING STATION UNITS 1 & 2

REVISED SAFETY PARAMETER DISPLAY SYSTEM

SAFETY ANALYSIS REPORT

March 23, 1987

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SAFETY ANALYSIS FOR SPDS PARAMETERS

1.0 FUNCTIONAL DESCRIPTION

The Safety Parameter Display System will serve as an aid to the control room personnel in determining the safety status of the plant during abnormal and emergency conditions. It will also function as an operator aid during normal operation by monitoring other parameters or graphic displays that are determined to be important to the operators for maintaining safe operation of the plant. The displays will serve to concentrate a set of plant parameters to aid in assessing plant safety status without surveying the entire control room. The primary display will provide an overview of plant conditions in the form of seven blocks, six of which represents the Critical Safety Functions (CSFs) and one representing radiation monitoring. The second, third and fourth level displays will provide more detailed information in the form of CSF status trees, a list of the parameters that drive the status trees and trends respectively.

2.0 SYSTEM DESCRIPTION

2.1 General

The Safety Parameter Display System will be a redundant computer system with CRTs located in the TSC, EOF and Units 1 and 2 Control Room. This system is independent of the Plant Computer. The major components are as follows:

- four 1E multiplexer cabinets per unit
- one NON-1E multiplexer cabinet per unit
- two data concentrators
- two SEL 32/8750 Central Processing Units
- two color CRT/keyboards per unit control room (one 19" and one 25" diagonal)
- one video copier per unit control room
- one line printer per unit control room
- four color CRT/keyboards for TSC (19" diagonal)
- one video copier for TSC
- two color CRT/keyboards for EOF (19" diagonal)
- one video copier for EOF
- two 40KVA Uninterruptable Power Systems

The data concentrators and the two Central Processing Units (CPUs) will be shared by both Units. Attachment 1 shows the system configuration. The database for the system will reside in the data concentrators and the CPUs. It consists of 542 points (analog and digital) for Unit #1 and 543 points (analog and digital) for Unit #2.

2.2 Data Acquisition Subsystem

The data acquisition system is intelligent and consists of two data concentrators, eight 1E Multiplexers and two Non-1E Multiplexers (four 1E and one Non-1E per unit). Each multiplexer in the subsystem functions as an independent unit utilizing a 16 bit microprocessor. Complete isolation of field inputs is maintained by use of fiber optic communication links to the rest of the system. The intelligent data acquisition system is supplied by Computer Products Incorporated.

2.3 Computer Subsystem

The computer subsystem utilizes two SEL 32/8750 processors in a fully redundant configuration. Each CPU acquires and processes the data from all multiplexers via the data concentrator and maintains its own data base. One CPU is designated as the primary unit and handles all display subsystem interfacing. This allows the other CPU to be utilized for development work while maintaining a hot standby condition for smooth fail-over. A full duplex RS-232 "watchdog" communication channel is provided so that the CPUs can monitor each other. All communication with equipment outside the computer environs is via fiber optic links or standard RS-232 modems.

The system utilizes an off-the-shelf Gould software package (PACE/32) with the MPX3.2C operatng system. This software package has been modified as necessary to provide the specified SPDS functions.

2.4 Display Subsystem

The display system provides the primary means of information presentation to the operator. Man-Machine Interface (MMI) considerations have been addressed by utilizing a CRT/keyboard configuration. Included in this system are color video copiers for

hard copy of CRT displays and high-speed printers for hard copy of logs, reports and nongraphic CRT displays.

The CRTs will utilize a full ASCII keyboard with 60 functional keys for interactive system dialog as well as presentations of all system displays. The keyboard will consist of special function keys for the first and second level displays. All SPDS keys will be color coded.

The system consists of four main levels of displays which are dynamic. Attachment 2 shows an example of each level and the display hiearchy. The primary display (top level display) consists of seven color bars, six of which represents the Critical Safety Functions (CSF) and one representing radiation monitoring. These blocks will change color depending on which CSF is challenged. The colors in order of severity starting from the less severe are green, yellow, purple and red. This display will be duplicated in a miniature form on the top left corner of the second, third and fourth level displays.

The second level displays are the CSF status trees which are associated with the CSFs. These displays are direct representations of the status trees in the Emergency Operating Procedures. The second level display for the radiation monitoring color bar is a simple display representing a message referring the user to the section of the event classification guide that is appropriate for the radiation levels. The message will be color coded as to the severity level in accordance with the four levels used with the EOPs and the other second level displays.

The third level displays are lists of the parameters which drive the logic of the second level displays. There will be essentially one display for each Critical Safety Function Status Tree however, there may be cases where because of the amount of parameters, the third level display will have more than one page. This display will consist of the following information:

° Point Identification
° Point Description
° Point value with engineering units
° Quality of point

The fourth level displays will be trend plots. The system will have the capability of trending every point on the third level displays with a maximum of three plots per display showing the last 30 minutes of data. This display will consist of the following information:

° Point Identification
° Point Description
° Current point value
° Engineering Units

Other SPDS displays include:

1. Unit Master Menu
2. Process Variable table
3. Digital Variable table
4. Report List
5. Latest Alarm Display

The graphics CRTs in the system are IDT #2250 with full graphics editing capabilities for building and modifying color displays. These devices utilize four (4) microprocessors for graphics processing and I/O handling.

Included with each CRT system are:

° Standard keyboard with minimum of 60 functional keys;
° Eight color (plus blink) display capability;
° Two serial ports for host computer communication;
° 2MBIT of Bubble Memory for program storage;
° Real-time clock and CMOS RAM for system functions;
° Hardware vector generator for fast display processing;
° Extended plot and complex fill routines for fast display processing.

3.0 SUBSYSTEM OPERATION

Static picture information for displays is initially created in an off-line environment using the Interactive Display Editor. Display information is data compressed utilizing an encoding technique and stored on the system data disks.

Static picture information is kept within each graphic CRT and stored in bubble memory. When a display is requested, the static information is obtained from the local CRT

memory and written to the screen. The current dynamic data for the display is assembled at the host computer and transmitted to the CRT for screen display. The call-up times for the displays (time from keyboard entry to complete static and dynamic screen display) are as follows:

a. First to second level - 3 seconds
b. Second to third level - 7 seconds
c. Third to fourth level - 7 seconds

Once a display has been called up on a CRT, only the dynamic portions need to be periodically updated. This is done by the primary host computer every two seconds for all the displays that are dynamic. Note that since only dynamic data is regularly assembled and distributed by the host computer, system loading is dependent only on the number of display CRTs and is not a function (except for static picture storage) of the total number of displays in the data base. Communication between the host and the CRTs is accomplished via 19.2KB RS-232 serial links.

Future addition of displays can be readily accommodated. Based on an average compressed size of 5000 bytes per static display, bubble memory capacity exceeds 70 mimic type displays.

Hard copy of a screen image is initiated directly by the operator using an illuminated button at the primary CRT. Upon initiation, the screen image is transferred through a high-speed parallel interface to the video copier. Printing takes approximately one minute. Upon completion, the hard copy may be used immediately because no drying time is required. During the print cycle, the copier input buffer is disabled. Hard copy of logs, reports and nongraphic screen images can be initiated for printing on the line printers.

The system for display selection will be as follows:

- Special function keys will be provided for the first and all second level displays.
- Page LEFT and RIGHT to move from one display to another on the same level.
- Page UP and DOWN to move between display levels (1 through 4).
- The Core Cooling (CC), Thermal Shock (TS) and Radiation Monitoring (RM) displays have supplemental displays. These displays will be accessed by using the cursor and the return key.

° In cases where the third level display has multiple pages, the page numbers will be displayed across the bottom of the pages. To access the pages, depress the shift key and the number of the page.

4.0 HUMAN FACTORS

Accepted Human Factors Principals will be incorporated in the design of the Safety Parameter Display System. The reference documents are as follows:

° NUREG 0700, Section 6.
° NUREG 0835, Section 6.
° Human Engineering Principles for Control Room Design Review, Section 3.7, published by the Nuclear Utility Task Action Committee.
° "Human Factors SPDS Guidelines" prepared by General Physics Corporation for PSE&G.

A contract was awarded to General Physics Corporation to perform a human factors review. This is currently in progress.

The first and second level displays were developed by PSE&G personnel from the following disciplines:

° Engineering
° Operations
° Training

These displays were reviewed by the above mentioned disciplines and a human factor specialist. The third and fourth level displays were developed jointly by representatives from the Engineering, Operations and Training Departments of PSE&G and a human factor specialist. These displays were then built using the Intelligent Industrial Data Terminals CRT and all displays were then reviewed on the CRT by a human factors specialist. A final dynamic review was performed by a human factors specialist and a report is presently being generated.

5.0 ISOLATION

The intelligent data acquisition system which is supplied by Computer Products, Inc. consists of five multiplexer cabinets and one data concentrator per unit and is configured to meet redundancy requirements. Four of the cabinets are 1E which are physically separated and the one dual cabinet is Non-1E. The data concentrator is Non-1E.

There are 323 class 1E field signals per unit which go to the 1E cabinets and 220 Non-1E field signals per unit which go to the Non-1E cabinets. The foregoing indicates that no isolation devices are required prior to the multiplexer cabinets. The signals from these cabinets are transmitted to the data concentrator by means of fiber optic cables. These cables isolate the multiplexer cabinets from data concentrator and the rest of the system. Fiber optic cables were used for the Non-1E cabinets because of their noise immunity capability. The fiber optic cable specification is as follows:

Vendor:	Chromatic Technologies, Inc.
Fiber Manufacturer:	Corning Corporation or Corning Corporation Licensee
Core Diameter:	50 Micron
Core and Cladding Diameter:	125 Micron
Numerical Aperature (NA):	0.2
Attenuation:	<3.5dB/km
Bandwidth/length:	>200MHZ/km
Fiber Type:	Glass core and cladding

Attachment 3 shows the 1E and non-1E portions of the SPDS in block diagram form. An isolation test was successfully performed on a fiber optic link by Computer Products Inc. This fiber optic link is similar to that being used in the design of the SPDS. The voltage used was 240VAC RMS and this was determined to be the highest voltage that can develop on the non-1E side of the fiber optic link. The test procedure is shown in Attachment 8.

6.0 AVAILABILITY

The Host processor/display system will be designed to achieve an availability of 99.0% under the following conditions:

° All of the ERF on-line functions are executing without degradation and the following minimum complement of hardware is operational.

1. One of the two CPUs with all of its main memory and its programmer's I/O device, and with sufficient hardware in the CPU interfaces to communicate with all of the field multiplexers communication circuits at the specified scan rates.
2. One of the two auxiliary memories.
3. One printer in either unit control room.

4. One of the two unit CRTs in the control room, one of the two unit CRTs in the TSC and one of the two CRTs in the EOF excluding the modems and phone lines.

° Each multiplexer will be designed to achieve the availability under the following conditions:

1. The multiplexer is considered available unless:

   a. Any function is lost for all points of a single type, or
   b. More than one input card of the same type fails, or
   c. One input card of each type fails.

7.0 PARAMETER SELECTION

PSE&G has selected a total of sixty parameters which make up the database for the Emergency Response Facilities (ERF) Computer System. Regulatory Guide 1.97 was used as a guideline. These parameters are listed on Attachment 4.

The basis of the SPDS is the Critical Safety Function Status Trees. The Critical Safety Functions were identified and Status Trees developed by PSE&G based on the Westinghouse Emergency Response Guidelines, Revision 1. The Status Trees and the procedures associated with them are contained within the Emergency Operating Procedure Set, which was also developed based on the Westinghouse Owners Group Emergency Response Guidelines. For any transient or accident condition, the Emergency Operating Procedures will direct the operator to monitor the Status Trees. Operator training also addresses the use of the Status Trees during transient or accident conditions. The following is a list of the six Critical Safety Functions for Salem Generating Station:

1. Shutdown Margin
2. Core Cooling
3. Heat Sink
4. Thermal Shock
5. Containment Environment
6. Coolant Inventory

The CSF status trees are used to monitor specific plant conditions while the Emergency Operating Procedures are in use. The conditions that are monitored relate directly to the barriers to prevent the release of fission products to the environment. These barriers are the fuel matrix and cladding, RCS pressure boundary and containment. Because

of the foregoing, it is prudent to use the CSFs as the basis for SPDS. Attachment 5 shows the status trees color codes and Attachment 6 shows the critical safety function status trees.

The CSFs are associated with the barriers in the following manner:

Barrier	Critical Safety Function
Fuel Matrix and Fuel Clad	Maintenance of SUBCRITICALITY (minimize energy production in the fuel)
	Maintenance of CORE COOLING (provide adequate reactor coolant for heat removal from the fuel)
	Maintenance of a HEAT SINK (provide adequate secondary coolant for heat removal from the fuel)
	Control of Reactor Coolant INVENTORY (maintain enough reactor coolant for effective heat removal and pressure control)
Reactor Coolant System Pressure Boundary	Maintenance of a HEAT SINK (provide adequate heat removal from the RCS)
	Maintenance of Reactor Coolant System INTEGRITY (prevent failure of RCS)
	Control of Reactor Coolant INVENTORY (prevent flooding and loss of pressure control)
Containment Vessel	Maintenance of CONTAINMENT Integrity (prevent failure of containment vessel)

The SPDS parameters were selected based on the CSF status trees. The parameters are used to satisfy the status trees and their association with the CSFs are as follows:

CRITICAL SAFETY FUNCTION		PARAMETER
1. SHUT DOWN MARGIN		a. Reactor Trip
	Neutron Flux	b. Power Range
		c. Start up Rate
		d. Source Range
		e. Intermediate Range
2. CORE COOLING		a. Core Exit Temperature
		b. RCS Subcooling
		c. RCP Status
		d. Reactor Vessel Level
3. HEAT SINK		a. Steam Generator Level
		b. Total Feedwater Flow
		c. Steam Generator Pressure
4. THERMAL SHOCK		a. RCS Loop Average Temperature
		b. RCS Pressure
		c. RCS Temperature (CIT)
		d. RCS Cold Legs Temperature
5. CONTAINMENT ENVIRONMENT		a. Containment Pressure
		b. Containment Sump Level
		c. Containment Area Radiation
6. COOLANT INVENTORY		a. Pressurizer Level
		b. Reactor Vessel Level

Attachment 7 shows in table format, a comparison of the Critical Safety Functions in Salem with those listed in Supplement 1 to NUREG 0737.

Of the total parameters that were selected for the system, twenty are directly related to the critical safety function status trees and the radiation monitoring displays. These parameters are as follows:

1. Neutron Flux
2. RCS Cold Leg Water Temperature
3. RCS Pressure
4. Core Exit Temperature
5. Reactor Vessel Level
6. Degrees of Subcooling (Calculated)
7. Containment Sump Water Level
8. Containment Pressure
9. Containment Area Radiation

10. Reactor Coolant Pump Status
11. Pressurizer Level
12. Steam Generator Level
13. Steam Generator Pressure
14. Auxiliary Feedwater Flow
15. RCS Loop Average Temperature.
16. Reactor Trip Train "A"
17. Reactor Trip Train "B"
18. Plant Vent Flow
19. Containment and Plant Vent Effluent Radioactivity from Identified Release Points
20. Main Steam Radiation

These parameters consist of 144 points.

8.0 DATA VALIDATION

Signal validation is accomplished by using the software developed by Charles Stark Draper Laboratory, Inc., Babcock and Wilcox and EPRI. The software inputs sets of redundant database variables, and compares these values using the parity space basis decision estimator. Data validity of a given signal is determined from its inclusion in, or exclusion from a consistent set/subset of redundant measurements. This module sets a "non-valid" signal indicator in the database when it determines that a measurement is not consistent with a subset of its redundant measurements. This module also provides, where applicable, a "best estimate" of the process variable via output to the database. Six SPDS parameters are validated using this method because of the availability of redundant sensors. These parameters are as follows:

° RCS pressure
° Containment pressure
° Containment sump water level
° Pressurizer level
° Steam generator pressures
° Power range power levels

The remaining parameters which are directly related to the critical safety function status trees and the radiation monitoring displays cannot be validated by the above method because of the unavailability of redundant sensors. However, range and limit checks will be performed and quality flags will be generated for all parameters in the database.

9.0 UNREVIEWED SAFETY QUESTIONS

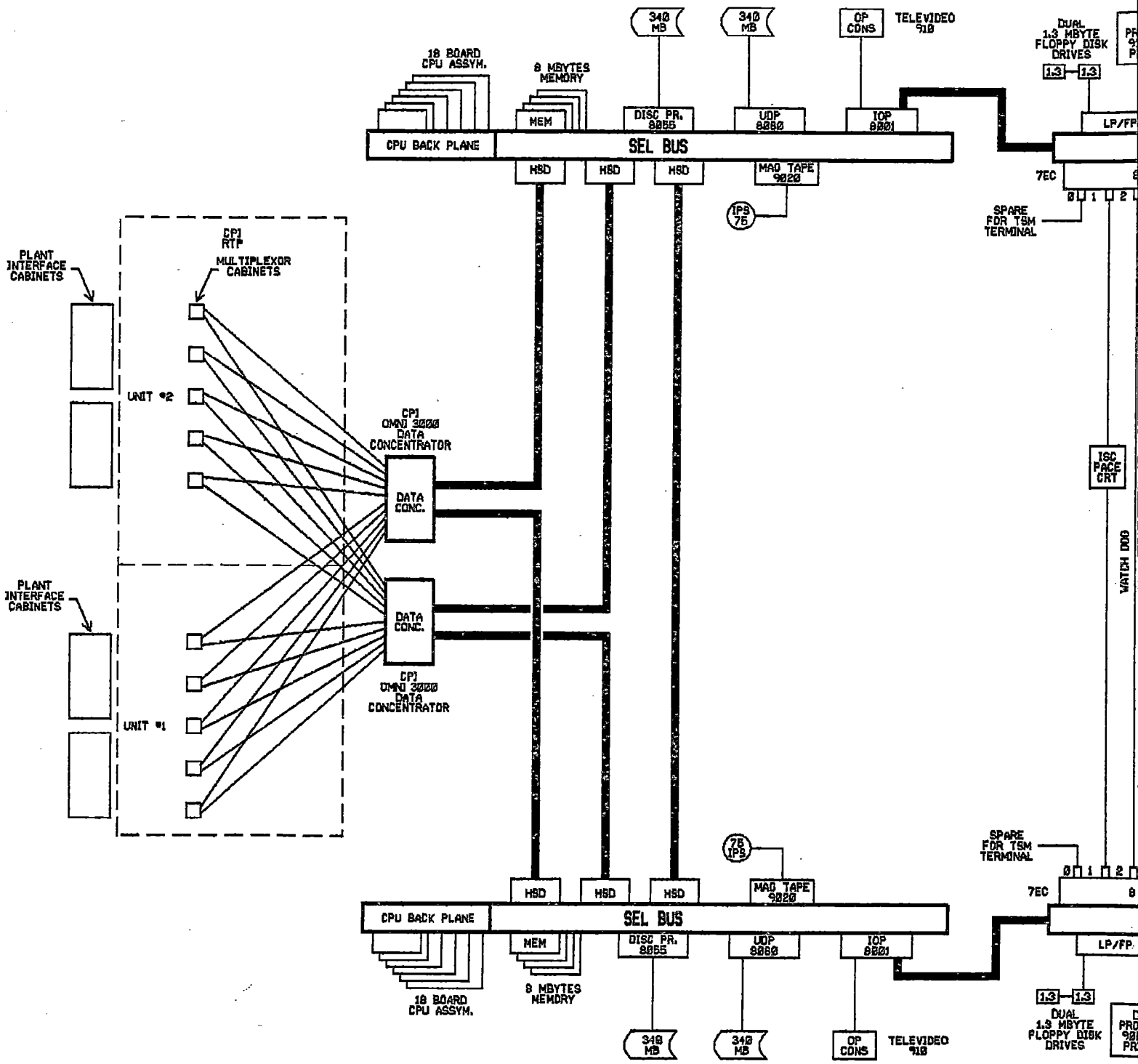
The signals for all parameters used for the Safety Parameter Display System will be acquired from existing instrument loops. During the design of the data acquisition system interface with the plant instruments, the possibility of failure or malfunction due to circuit overload and the effects on existing systems were addressed. The function of the existing systems will not be altered and the safe shut down of the reactor will not be affected. The SPDS interfaces were also designed taking into consideration electrical separation and isolation. This will ensure that failure of the SPDS or any associated equipment will not increase the probability or consequences of accidents analyzed in the FSAR. The margin of safety has not been diminished due to the addition of the SPDS. Because of the foregoing, an unreviewed safety question is not involved.

There will be no new systems added as a result of the installation of the data acquisition system. Since the functions of the existing systems will not be changed, the technical specifications associated with any system or instrument in that system will not be affected.

ATTACHMENT 2

THE FOUR LEVELS OF DISPLAYS AND DISPLAY HIERARCHY

CPU B
GOULD CSD 32/8750

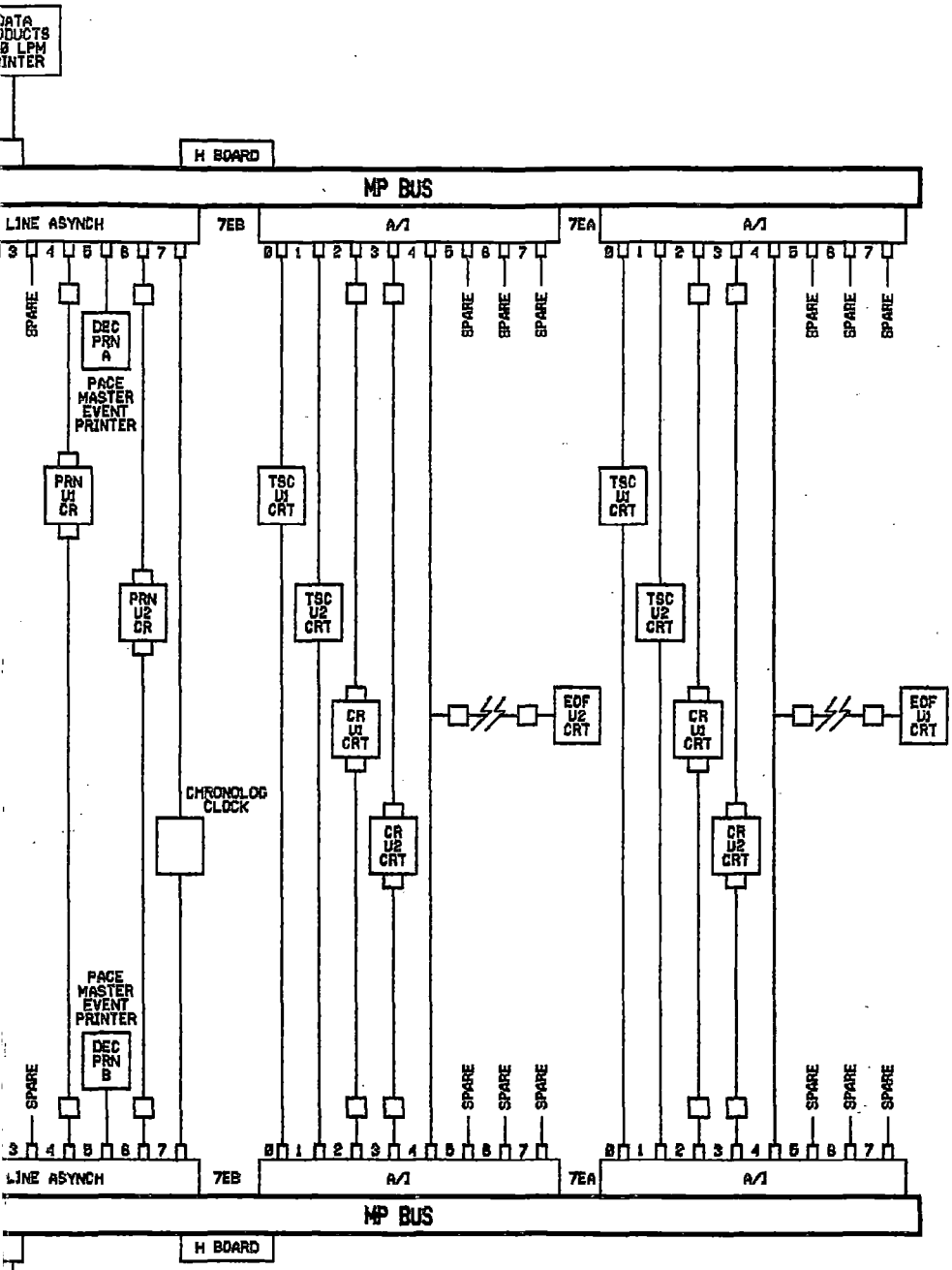


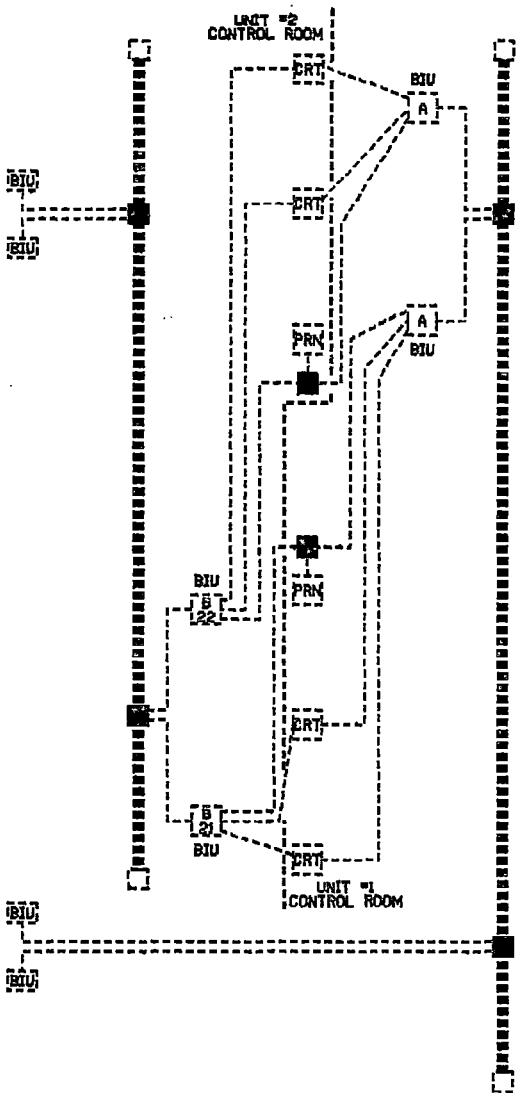
LEGEND:

□ = MODEM
CR = CONTROL ROOM
TSC = TECHNICAL SUPPORT CENTER
EOF = EMERGENCY OPERATIONS FACILITY
PRN = PRINTER
BIU = BUS INTERFACE UNIT

SPDSI

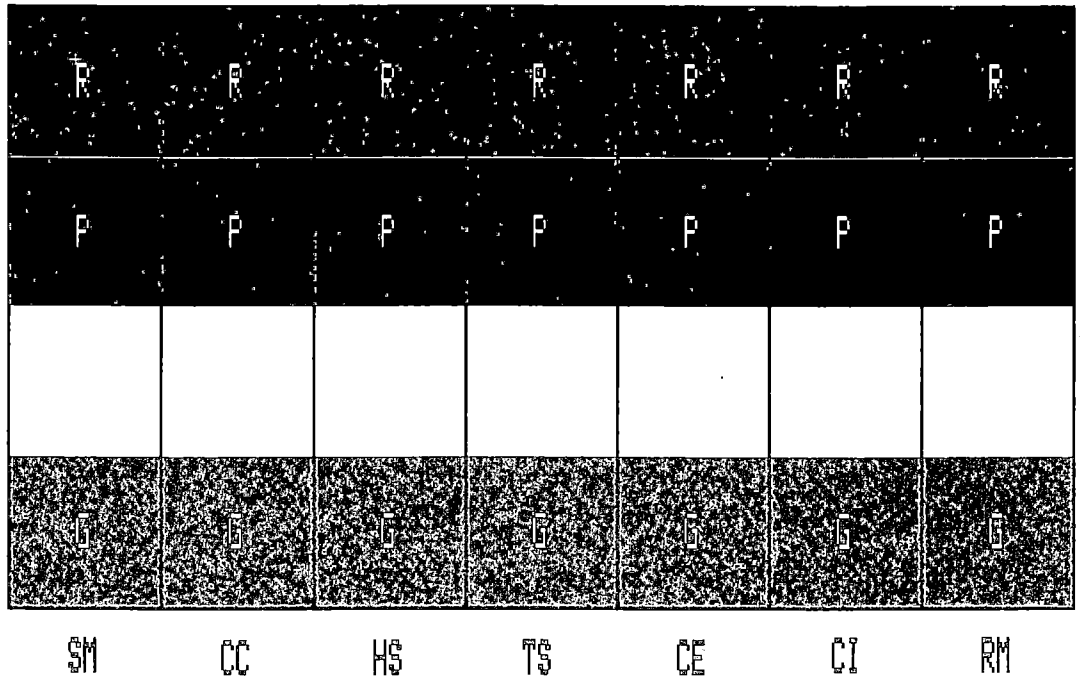
CPU A
GOULD CSD 32/8750





ERF COMPUTER SYSTEM CONFIGURATION

UNIT 1 CRITICAL SAFETY FUNCTIONS

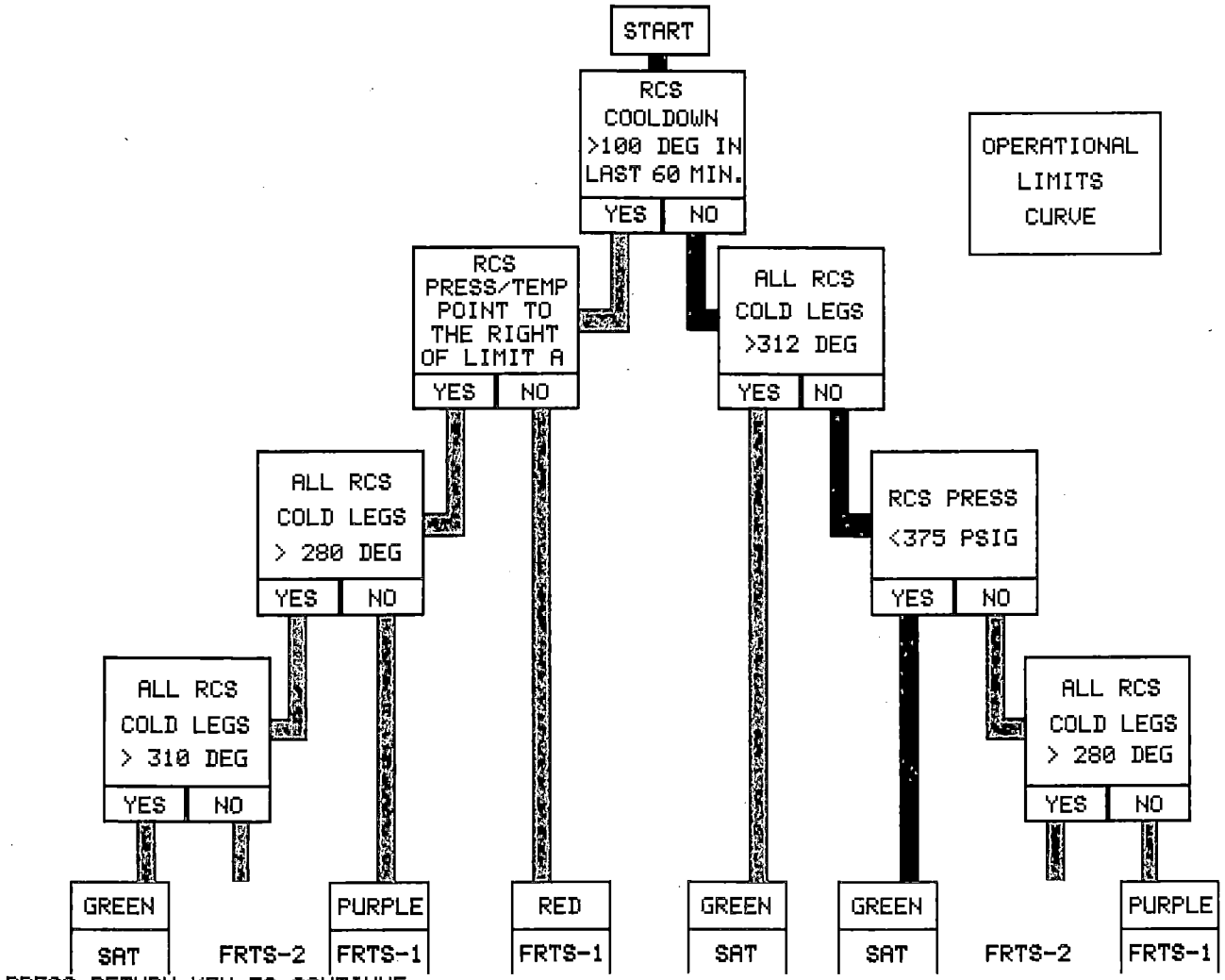


PRESS RETURN KEY TO CONTINUE.

[redacted]

SM CC HS TS CE CI RM

UNIT #1 THERMAL SHOCK



PRESS RETURN KEY TO CONTINUE.

TIME 16:24:40 [redacted]

SM CC HS TS CE CI RM

UNIT 2 - CRT # 2

DECEMBER 3,1986

[redacted]

DISPLAY U23SM1

UNIT #2 SM PARAMETER LIST

NAME	DESCRIPTION	VALUE	UNITS
POWER RANGE			
U2NM0041FS	POWER RNG PERCENT PWR CH I	[redacted]	PCT
U2NM0042FS	POWER RNG PERCENT PWR CH II	[redacted]	PCT
U2NM0043FS	POWER RNG PERCENT PWR CH III	[redacted]	PCT
U2NM0044FS	POWER RNG PERCENT PWR CH IV	[redacted]	PCT
INTERMEDIATE RANGE			
U2NM0035BAS	INTERM RNG STARTUP RATE CH I	0.000L	DPM
U2NM0036BAS	INTERM RNG STARTUP RATE CH II	0.000L	DPM
SOURCE RANGE			
U2NM0031FBS	SOURCE RNG STARTUP RATE CH I	0.000L	DPM
U2NM0032FBS	SOURCE RNG STARTUP RATE CH II	0.000L	DPM
U2NM0031FAS	SOURCE RNG NEUTRON LVL CH I	0.000S	CPS
U2NM0032FAS	SOURCE RNG NEUTRON LVL CH II	0.000S	CPS

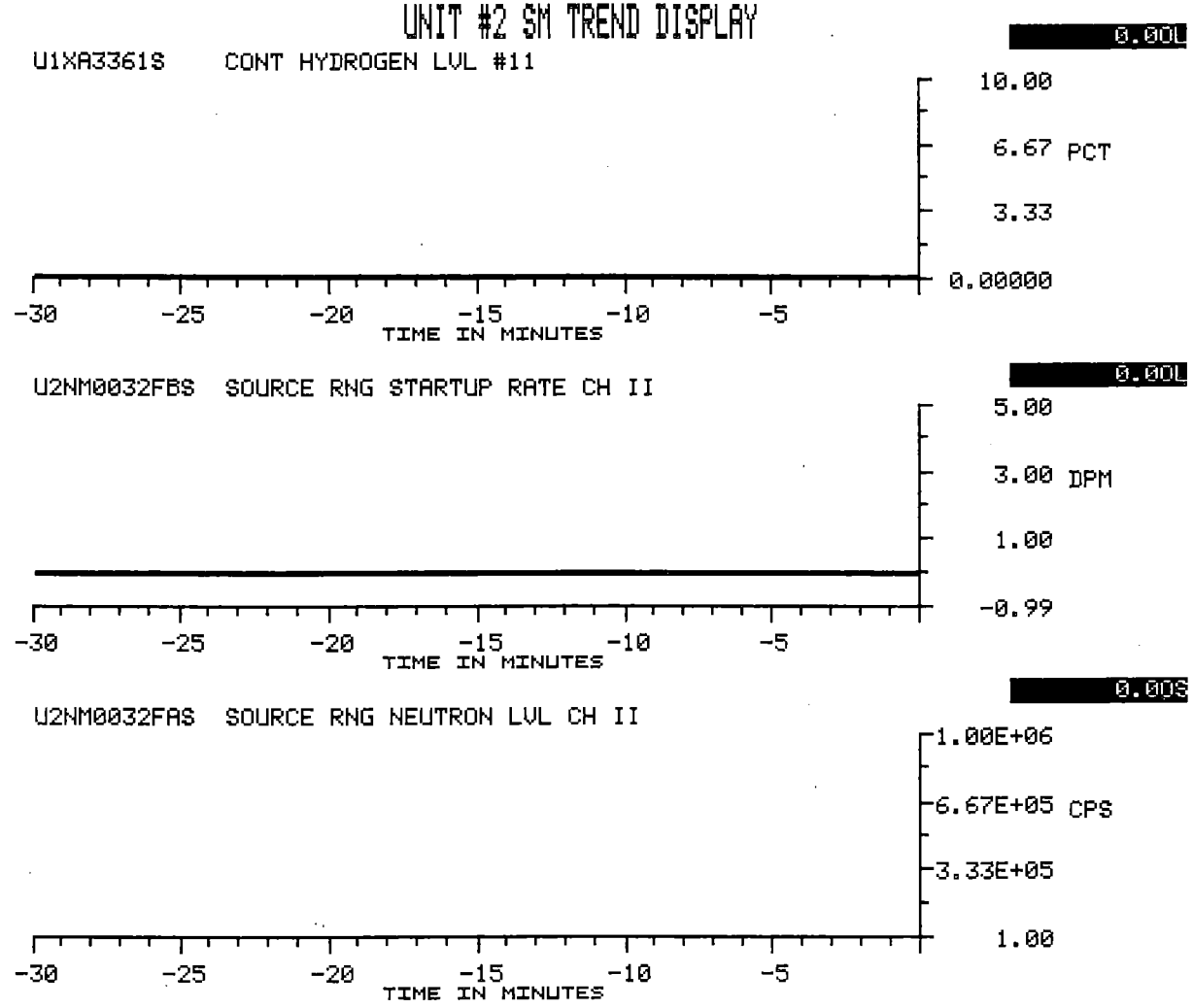
TIME 16:28:19 UNIT 2 - CRT # 2 DECEMBER 3,1986

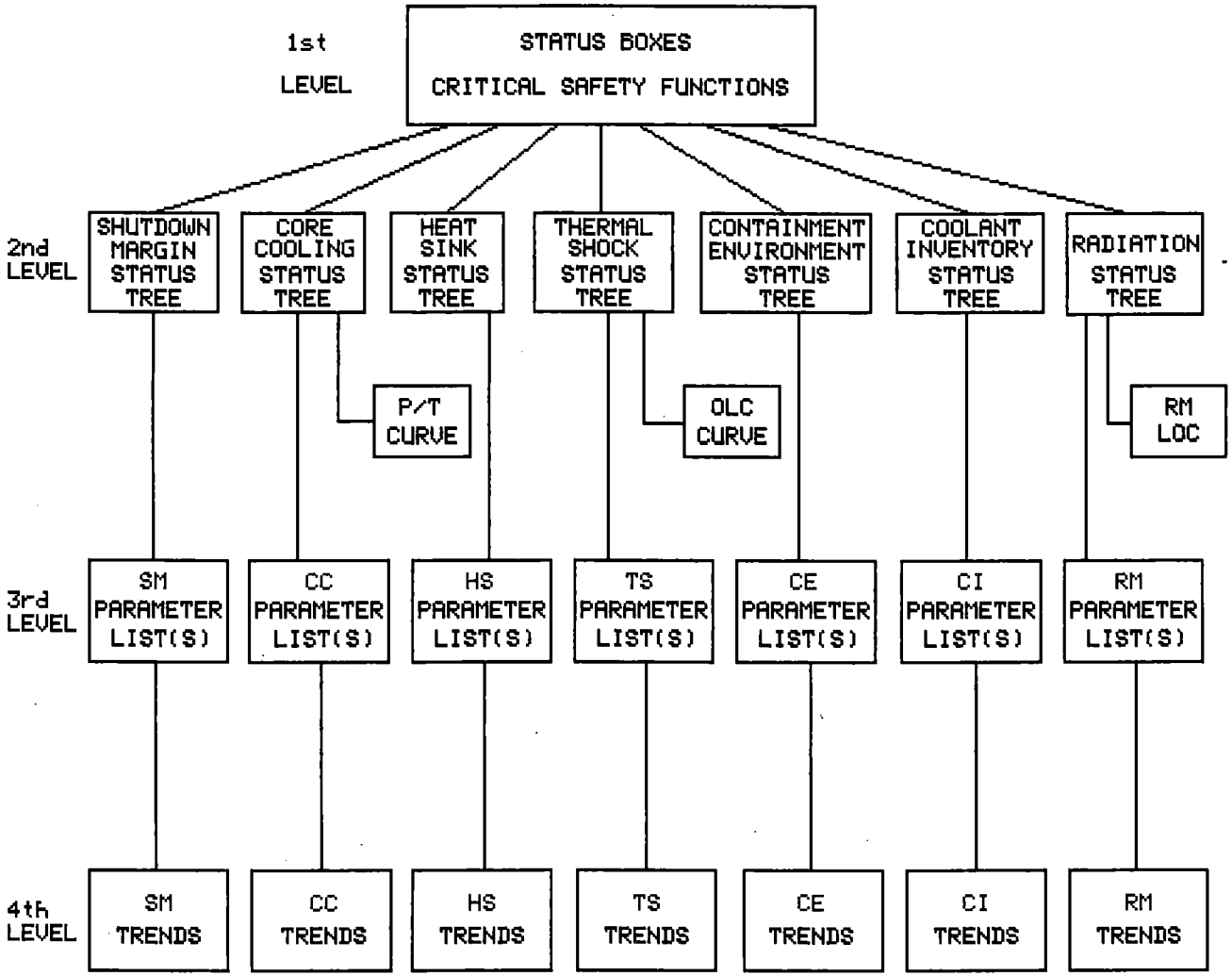
[redacted]

SM CC HS TS CE CI RM

DISPLAY U24SM

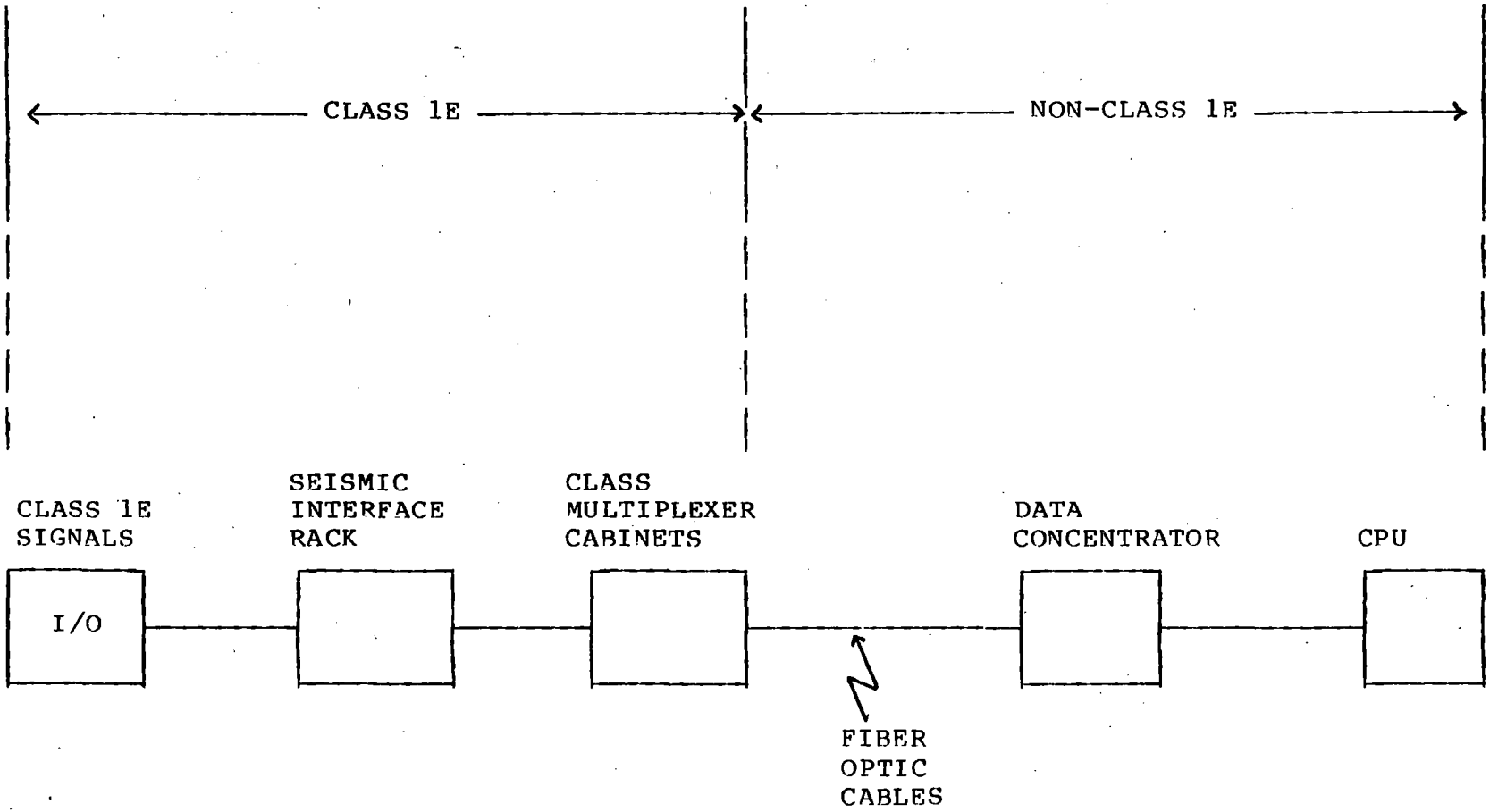
UNIT #2 SM TREND DISPLAY





PRESS RETURN KEY TO CONTINUE.

ATTACHMENT 3



ATTACHMENT 4

SALEM GENERATING STATION UNITS 1 AND 2
SAFETY PARAMETER DISPLAY SYSTEM PARAMETERS

1. Neutron Flux - Source, Power, and Intermediate Ranges, Start-up Rate.
2. Rod Control Positions
3. Plant Vent Flow
4. RCS Cold Leg Water Temperature
5. RCS Hot Leg Water Temperature
6. RCS Pressure
7. Core Exit Temperature
8. Coolant Level in Reactor
9. Degrees of Subcooling (calculated)
10. Containment Sump Water Level
11. Containment Pressure (Wide and Narrow Range)
12. Containment Isolation Valve Position (excluding check valves)
13. Containment Area Radiation
14. Containment Hydrogen Concentration
15. Containment Effluent Radioactivity Noble Gases from Identified Release Points
16. RHR System Flow
17. RHR Heat Exchanger Outlet Temperature
18. Accumulator Tank Level and Pressure
19. Accumulator Isolation Valve Position
20. Boric Acid Charging Flow

21. Flow in HPI System (Charging Pumps Discharge)

22. Flow in LPI System (Safety Inspection Pumps Discharge)

23. Refueling Water Storage Tank Level

24. Reactor Coolant Pump Status (AMPS)

25. Primary System Safety Relief Valve Position

26. Pressurizer Level

27. Pressurizer Heater Status (AMPS)

28. Pressurizer Relief Tank Level

29. Pressurizer Relief Tank Temperature

30. Pressurizer Relief Tank Pressure

31. Steam Generator Level

32. Steam Generator Pressure

33. Main Steam Flow

34. Main Feedwater Flow

35. Auxiliary Feedwater Flow

36. Auxiliary Feedwater Storage Tank Level

37. Containment Spray Flow Additive Rate

38. Heat Removal by the Containment Fan Heat Removal System (Containment Fan Cooler Outlet and Containment Fan Cooler Unit Running)

39. Containment Atmosphere Temperature

40. Letdown Flow

41. Volume Control Tank Level

42. Component Cooling Water Temperature

43. Component Cooling Water Flow

44. High Level Radioactive Liquid Tank Level

45. Radioactive Gas Hold Up Tank Pressure

46. Control Room Emergency Ventilation Damper Position

47. Auxiliary Building Emergency Damper Position

48. Fuel Handling Building Emergency Damper Position

49. Status of Standby Power and Other Emergency Energy Sources Important to safety.

50. Control Air

51. Main Steam Radiation

52. Wind Direction

53. Wind Speed

54. Estimation of Atmospheric Stability

55. Condenser Availability (Condenser Vacuum and Circulator Amperes)

56. RCS heat up/cool down rate (Average Loop Temperature)

57. Main Steam Isolation Valve Position

58. Reactor Trip Demand Signal from Train "A"

59. Reactor Trip Demand Signal from Train "B"

60. Auxiliary Building Roof Radiation Monitor

ATTACHMENT 5.

STATUS TREE COLOR CODES

1.0 ACTIONS Required on Status Tree Evaluation

2.0 RED PATH:

2.1 Suspend procedure in effect.

2.2 Implement the Functional Restorations guideline indicated on Status Tree.

2.3 Record the procedure and step suspended and the Functional Restoration entered in the SS Checklist.

3.0 PURPLE PATH:

3.1 Complete Status Tree scan to ensure no red paths indicated.

3.2 Suspend procedure in effect unless required by a red path or higher priority purple path.

3.3 Implement the Functional Restoration with the highest priority.

3.4 Record procedure and step suspended and the Functional Restoration entered on the SS Checklist.

4.0 YELLOW PATH:

4.1 Complete Status Tree scan to ensure no result with higher priority exists.

4.2 Shift Supervisor may implement indicated Functional Restoration at his discretion.

4.3 Functional Restoration steps take precedence over any conflicting steps in procedure in effect.

4.4 Record any Functional Restoration entered on the SS Checklist.

ATTACHMENT 5.

5.0 SATUS TREE PRIORITY:

5.1 The priority of a Status Tree result is evaluated as follows:

5.1.1 First determine the priority of the color. Color hierarchy (high to low) is:

(1) Red
(2) Purple
(3) Yellow

5.1.2 Second determine the priority of the Status Tree. The Tree hierarchy (high to low) is:

(1) Shutdown Margin.
(2) Core Cooling.
(3) Heat Sink.
(4) Thermal Shock.
(5) Containment Environment.
(6) Coolant Inventory.

ATTACHMENT 6

CRITICAL SAFETY FUNCTION STATUS TREES

FIGURE 1
SHUTDOWN MARGIN STATUS TREE

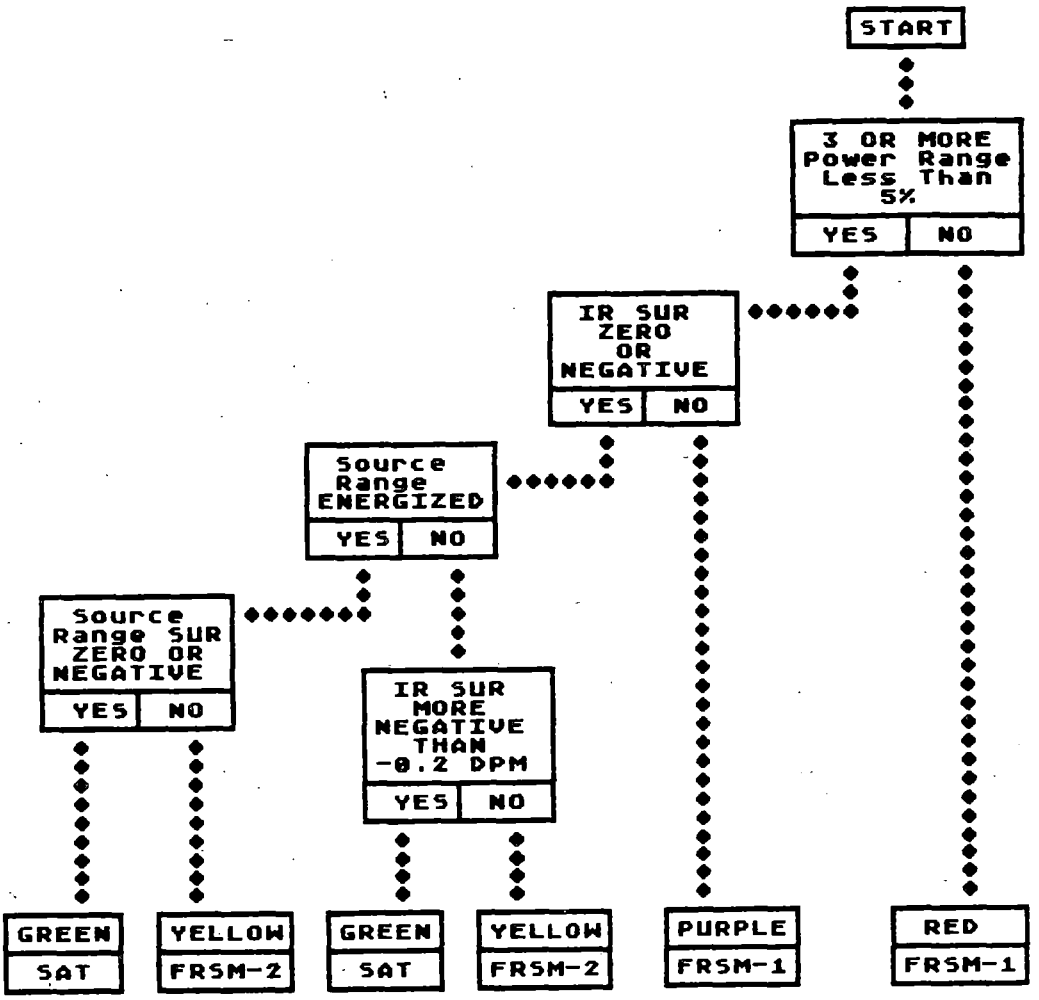


FIGURE 2
CORE COOLING STATUS TREE

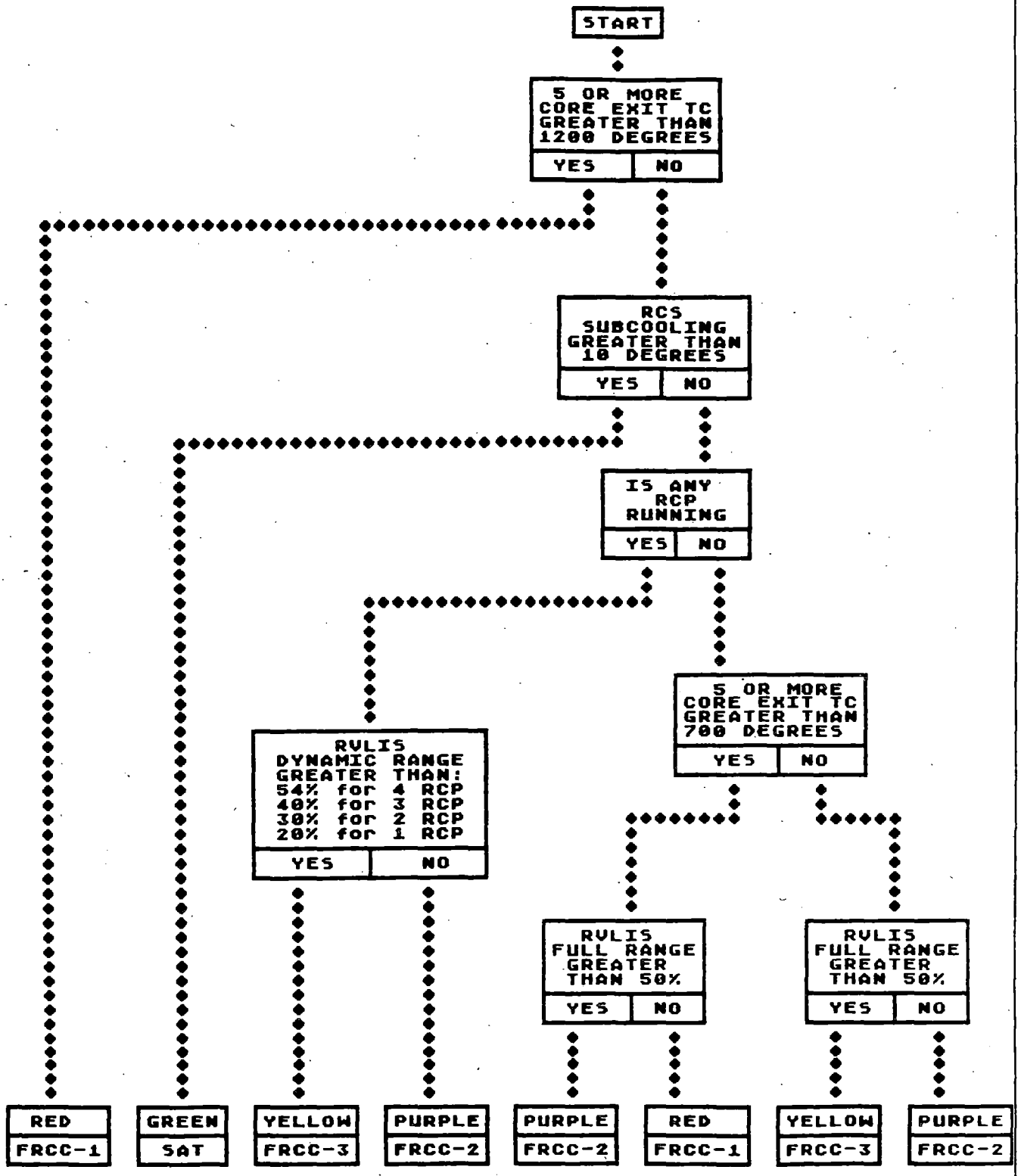


FIGURE 3
HEAT SINK STATUS TREE

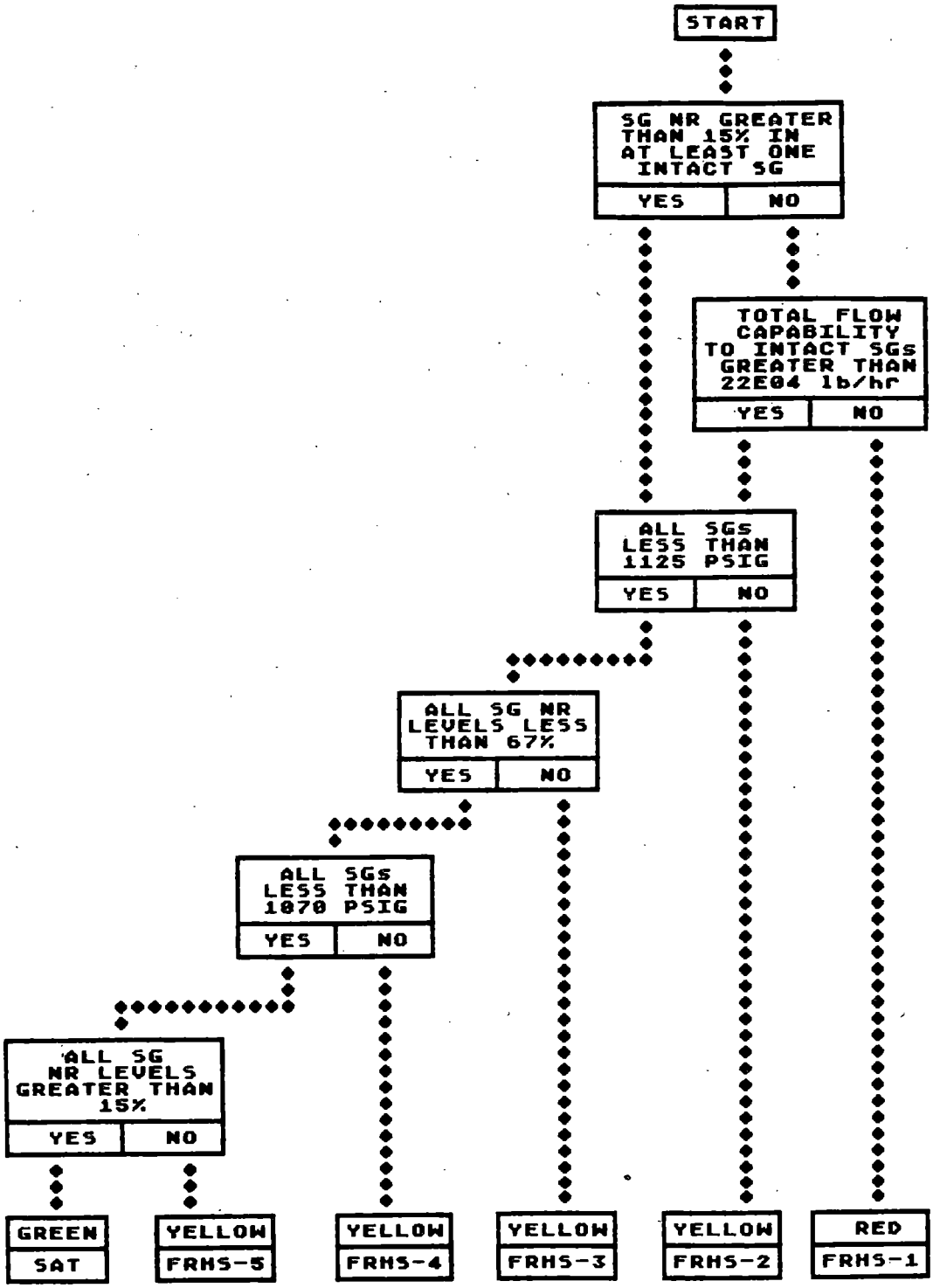
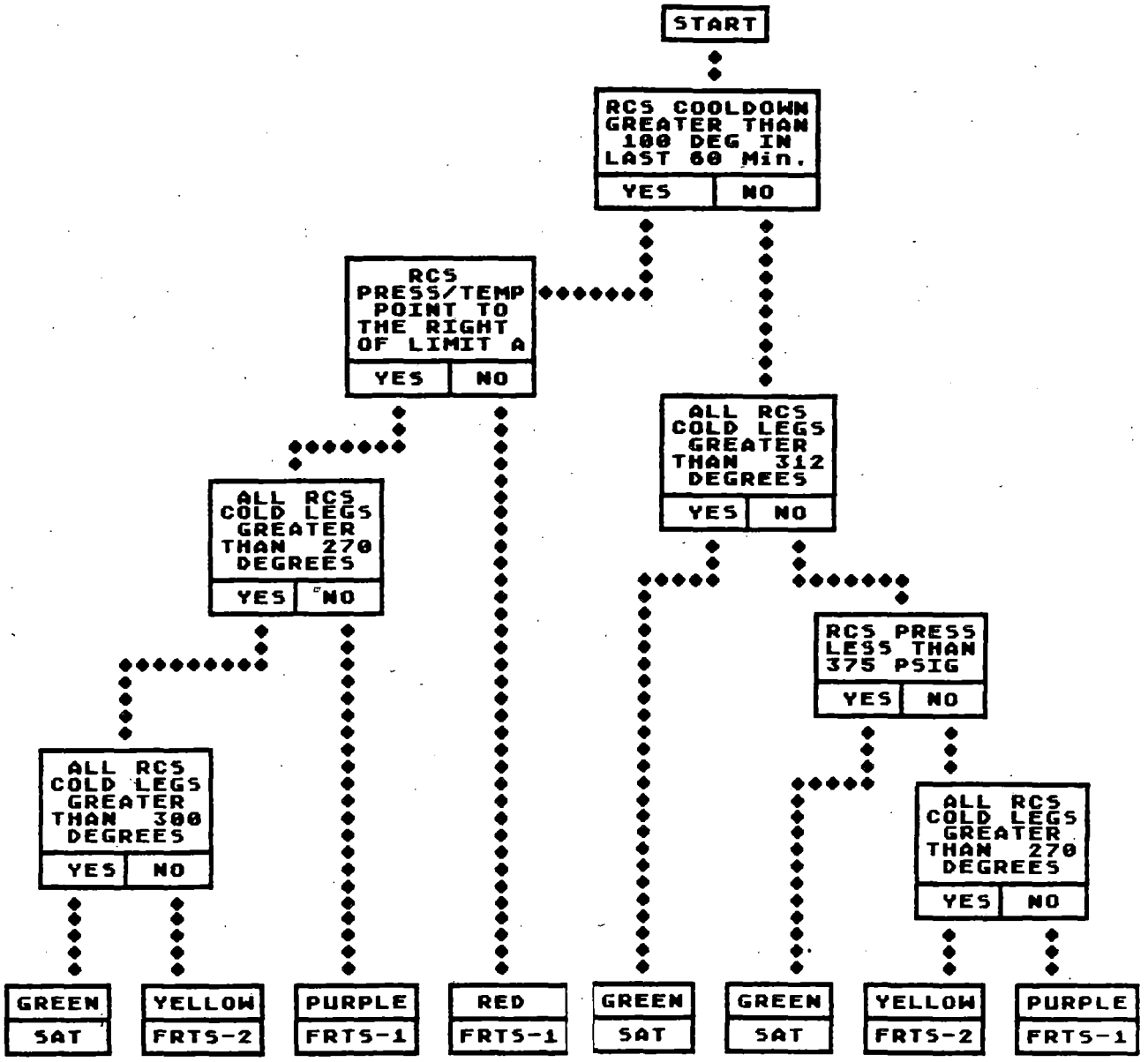


FIGURE 4
THERMAL SHOCK STATUS TREE



MASTER

FIGURE 4A
THERMAL SHOCK LIMIT A CURVE

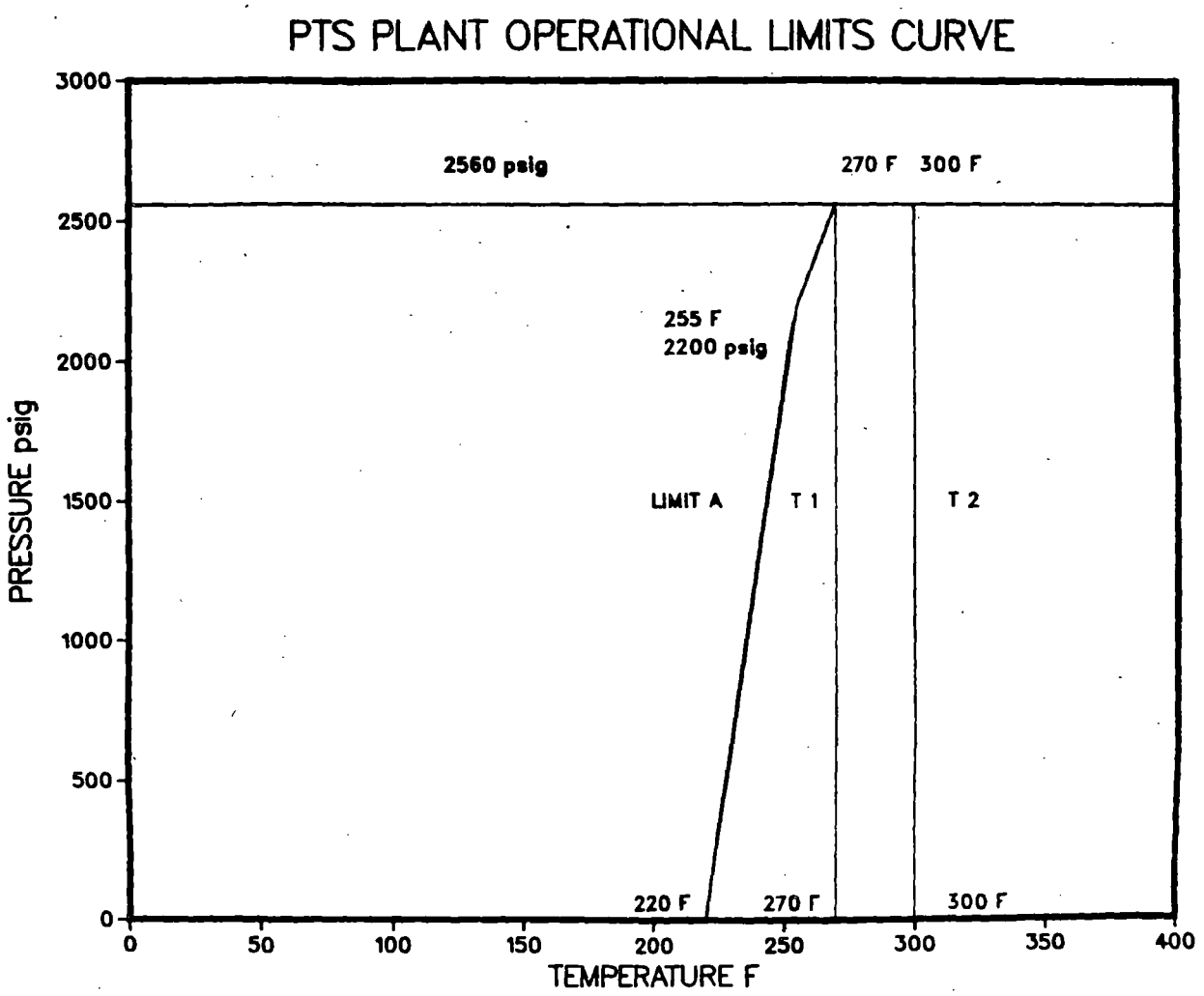


FIGURE 5
CONTAINMENT ENVIRONMENT STATUS TREE

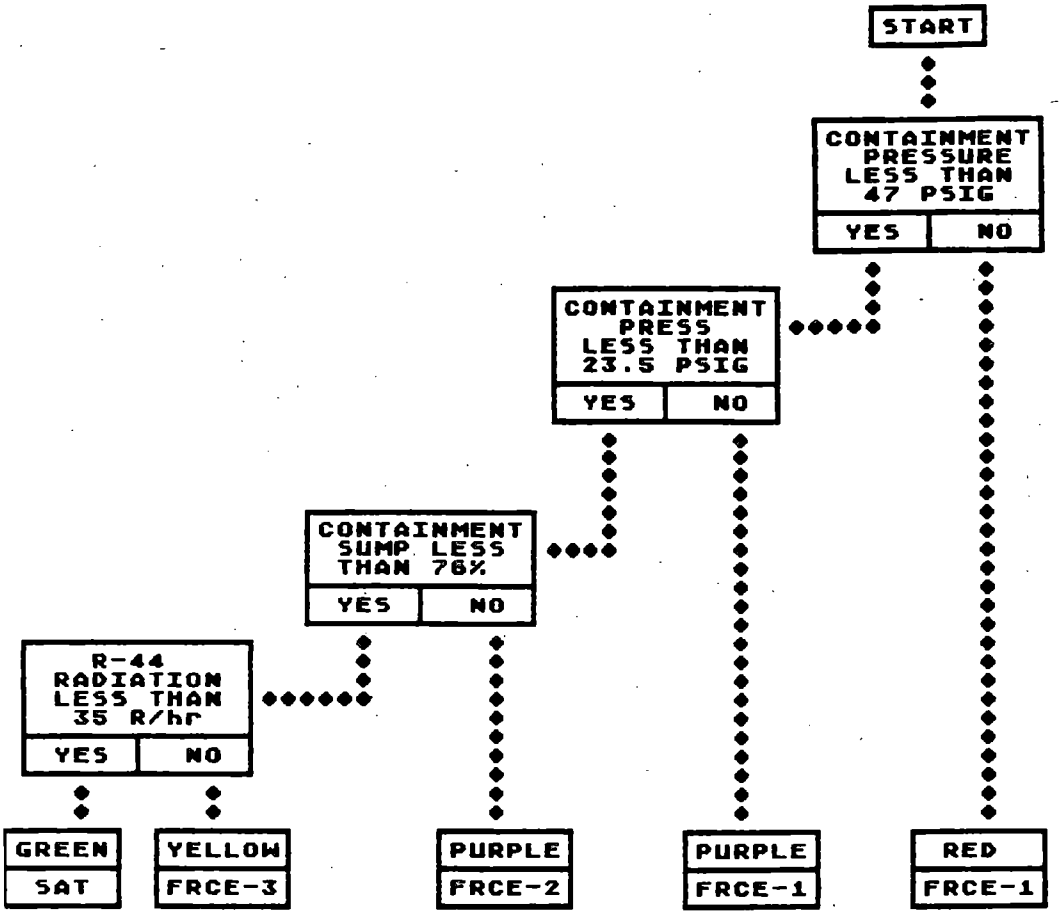
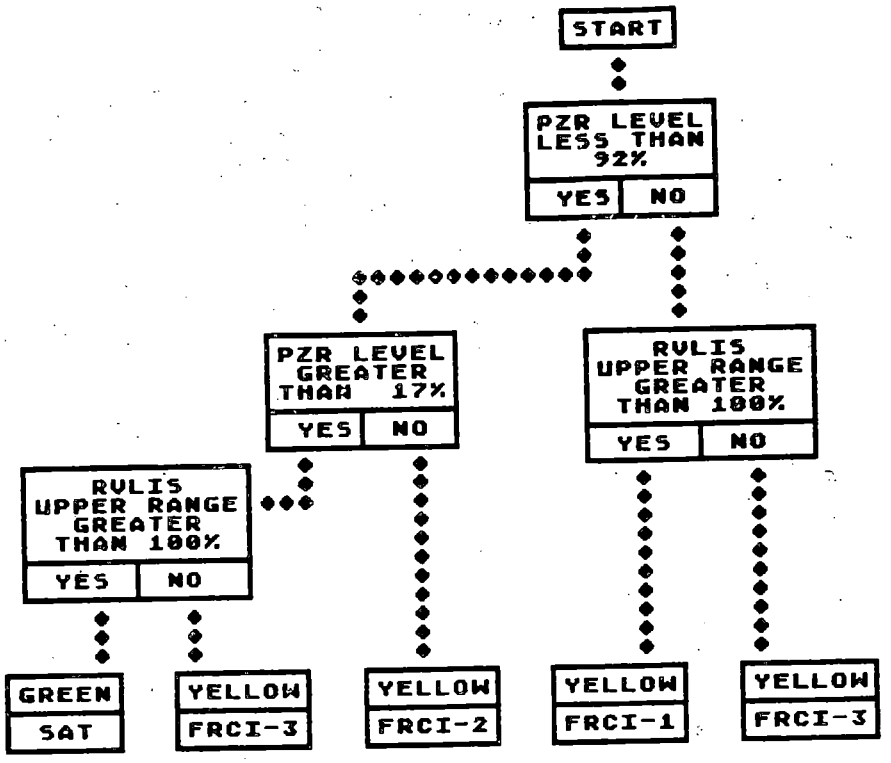


FIGURE 6
COOLANT INVENTORY STATUS TREE



ATTACHMENT 7

CRITICAL SAFETY FUNCTION NUREG 0737, SUPPLEMENT 1)	CRITICAL SAFETY FUNCTION STATUS TREE (SALEM)	PARAMETERS
Reactivity Control	Shut Down Margin	1. Neutron Flux 2. Neactor Trip
Reactor Core Cooling and Heat Removal From the Primary System	Core Cooling	1. Core Exit Temperature 2. Degrees of Subcooling 3. Reactor Coolant Pump Status 4. Reactor Vessel Level
Reactor Coolant System Integrity	Heat Sink	1. Steam Generator Level 2. Steam Generator Pressure 3. Aux. Feedwater Flow
	Thermal Shock	4. RCS Loop Average Temperature 5. RCS Pressure 6. RCS Cold Leg Water Temperature
	Coolant Inventory	7. Pressurizer Level 8. Reactor Vessel Level
Radioactivity Control	Radioactivity at Release Points	1. Plant Vent flow 2. Containment Effluent Radioactivity 3. Plant Vent Effluent Radioactivity 4. Containment Area Radiation 5. Main Steam Radiation
Containment Conditions	Containment Environment	1. Containment Sump Level 2. Containment Pressure 3. Containment Area Radiation

ATTACHMENT 8

COMPUTER PRODUCTS, INC.
ISOLATION TEST PROCEDURE
FOR FIBER OPTICS

ISOLATION TEST PROCEDURE FOR FIBER OPTICS

COMPUTER PRODUCTS, INCORPORATED
MEASUREMENT & CONTROL SYSTEMS DIVISION

TEST PROCEDURE

INITIATED BY: John Newman DATE 11/15/84

DRAWN BY: Kathy Robinson DATE 11/15/84

REVIEWED BY: M Pazmino DATE 12-12-84

APPROVED BY: [signature] DATE 12-13-84

MFG. RELEASED BY: N/A DATE _____

ENG. RELEASED BY: N/A DATE _____

SYSTEMS ENGINEERING APPROVAL REQUIRED YES [X] NO [ ]

RECORD OF REVISIONS

REV	DESCRIPTION	INITIATOR	REVIEWED	APPROVED	DATE

ISOLATION TEST PROCEDURE FOR FIBER OPTICS

I. PURPOSE:

The purpose of this document is to define a procedure for testing the isolation characteristics of fiber optic cabling and the associated transmitters and receivers used in the Computer Products Inc. Data Concentrator (P/N 072-5001-000).

II. SCOPE:

The isolation test shall consist of:

2.1 A test of the Data Concentrator, fiber optic link, and peripherals will be performed before and after each test to assure operation.

2.2 A Common Mode test will be performed on the Emitter and the Detector of the High Speed Serial Ports fiber optic link under test.

2.3 A Transverse Mode test will be performed on the Emitter and the Detector of the High Speed Serial Ports fiber optic link under test.

III. APPLICABLE DOCUMENTS:

3.1 CA072-5001

IV. REQUIREMENTS:

4.1 Equipment - General

4.1.1 000-045 AC-DC Variable Voltage Power Supply

4.2 Equipment - Special

4.2.1 Data Concentrator - Computer Products Inc. P/N 072-5001-000 with High Speed Serial Port (021-5261) option.

4.2.1.1 Brand Rex Duplex fiber optic cable terminated with Amphenol SMA connectors
P/N 001002 (cable)
P/N 906-110-5009 (connectors)

4.2.2 Universal Controller - Computer Products Inc. P/N 070-0004-003 with the following options:

4.2.2.1 Digital Input CPI P/N 021-0024-113

4.2.2.2 D/I Test Fixture CPI P/N 021-0099-000

4.2.2.3 Optical Modem CPI P/N 021-5258-000

4.2.2.4 Intelligent Remote Control Unit (IRCU) CPI P/N 022-5002-000

4.3 Calibration

All equipment requiring calibration, utilized in the performance of this procedure, shall bear valid calibration decals.

4.4 Environment

This procedure shall be performed under standard/normal environmental conditions.

4.5 Power

This procedure shall be performed with a source voltage of 115VAC, 60 Hz.

4.6 Personnel

One technician is required to perform this procedure.

4.7 Test Data Recording:

Test parameters shall be recorded on log sheets. Monitoring personnel shall sign and date the log sheets.

V. CONFIGURATION FOR TEST:

5.1 Configure the Data Concentrator per the assembly drawings (CA072-5001). Connect the fiber optic cabling to Link 0 (CR2, U62).

5.2 Configure the Universal Controller as follows:

Digital Input Card	Slot 6
D/I Test Fixture	300/400 edge D/I Card
Optical Modem	Slot 7
IRCU	Slot 1

5.3 Set-up the Variable Voltage Power Supply for 240VAC RMS.

5.4 De-energize Variable Voltage Source.

VI. TEST: COMMON MODE

6.1 Funtional test of Data Concentrator and peripherals.

6.1.1 Power-on the Data Concentrator test station.

6.1.2 Using the menu prompts define and generate an I/O database addressing the Digital Input Card in the Universal Controller.

6.1.3 Reset the Data Concentrator.

6.1.4 Using the menu prompts display point information pertaining to the Digital Input Card.

6.1.5 Toggle several bits of the Digital Input test fixture to verify acccurate data. SIGN AND DATE THE LOG SHEET.

Note: The following steps refer to the 021-5261 test card.

6.2 Lift pins 2 and 3 of CR2 on the 021-5261 test card and jumper together. Lift pins 1,2,3 and 4 of U62 on the 021-5261 test card and jumper together.

6.3 Connect the Variable Voltage Source between pins 2 and 3 of CR2 and instrument GND.

6.4 Apply power to the Variable Voltage Source and energize for 30 seconds.

6.5 De-energize the Variable Voltage Source.

6.6 Connect the Variable Voltage Source between pins 1,2,3 and 4 of U62 and instrument GND.

6.7 Energize the Variable Voltage Source for 30 seconds.

6.8 De-energize the Variable Voltage Source.

VII. TEST: TRANSVERSE MODE

7.1 Reassemble CR2 and U62 of the 021-5261 test card. Connect the fiber optic cabling to Link 0 (CR2, U62). Repeat step 6.1.3 thru 6.1.5. SIGN AND DATE THE LOG SHEET.

NOTE: If CR2 or U62 are found to be inoperable, replace with new components and repeat step 7.1.

7.2 Disconnect pins 1,2,3 and 4 of U62 on the 021-5261 test card. Disconnect pins 1,2 and 3 of CR2 on the 021-5261 test card.

7.2.1 Short pins 1, 2 and 4 of U62 on the 021-5261 test card.

7.3 Connect the Variable Voltage Source between pin 2 and pin 3 of CR2.

7.4 Energize the Variable Voltage Source for 30 seconds.

7.5 De-energize the Variable Voltage Source.

7.6 Connect the Variable Voltage Source between pins 1, 2, 4 and pin 3 of U62.

7.7 Energize the Variable Voltage Source for 30 seconds.

7.8 De-energize the Variable Voltage Source.

7.9 Disconnect pin 4 from pins 1 and 2 of U62 on the 021-5261 test card.

7.10 Connect the Variable Voltage Source between pin 1 and pin 2 of U62.

7.11 Energize the Variable Voltage Source for 30 seconds.

7.12 De-energize the Variable Voltage Source.

7.13 Reassemble CR2 and U62 of the 021-5261 test card. Connect the fiber optic cabling to Link 0 (CR2, U62). Repeat step 6.1.3 thru 6.1.5. SIGN AND DATE THE LOG SHEET.

NOTE: If CR2 or U62 are found to be inoperable, replace with new components and repeat step 7.13.

If the Data Concentrator or peripherals fail, the failure will be noted in the space allotted for comments pertaining to the steps where the failure occurred.

ISOLATION TEST PROCEDURE FOR FIBER OPTICS

LOG SHEET

Signature signifies proper completion of steps.

Step 6.1 Signature _____ Date 12/13/84

Comments:

Step 6.2 thru 7.1 Signature _____ Date 12/13/84

Comments:

Steps 7.2 thru 7.13 Signature _____ Date 12/13/84

Comments: