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DEC 18 1990

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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
GENERIC LETTER 89-06
SAFETY PARAMETER DISPLAY SYSTEM (LTR 890006-1)

South Carolina Electric & Gas Company (SCE&G) has completed the installation of new hardware and software for the Safety Parameter Display System (SPDS) at the Virgil C. Summer Nuclear Station. The new system has been evaluated against the guidelines contained in Generic Letter 89-06 and is considered to be in full compliance with NRC requirements addressed in Supplement 1 to NUREG 0737.

To facilitate NRC review (TAC NO. 73713) of the new system, SCE&G has attached to this letter a description of how the new SPDS meets or exceeds those areas previously evaluated. This documentation, along with the completed checklist and supporting photographs as addressed in Generic Letter 89-06, will be maintained for a minimum of three years.

If you should have any questions in regards to this certification, please contact Mr. Charles McKinney of my staff at (803) 345-4723.

Very truly yours,

John L. Skolds

CJM:JLS:lcd
Attachment

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EVALUATION OF THE V.C. SUMMER NUCLEAR STATION

SAFETY PARAMETER DISPLAY SYSTEM

WITH REGARD TO DOCKET 50-395

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1.0 INTRODUCTION

In a Safety Evaluation Report (letter from J.B. Hopkins to D.A. Nauman dated November 13, 1987) issued by the Office of Nuclear Reactor Regulation, the Nuclear Regulatory Commision identified the strengths and weaknesses of the V.C. Summer Nuclear Station (VCSNS) Safety Parameter Display System (SPDS). The staff audit concluded that the VCSNS SPDS met most of the applicable provisions of Supplement 1 to NUREG-0737 and found no serious safety concerns. As a response to this audit, and due to concerns regarding the ability to maintain the existing hardware, SCE&G committed to replace the existing SPDS . This report provides a description of how the new SPDS meets or exceeds those areas evaluated during the audit.

2.0 SPDS DESCRIPTION

The VCSNS SPDS is based on the Westinghouse Owners Group Guidelines for display of the Critical Safety Functions (CSF). The top level display provides summary indication of several parameters of particular interest to operators during or immediately following the initiation of an event, and contains the CSF status boxes at the bottom of the page. The boxes are color coded in compliance with Westinghouse Owners Group recommendations. In addition, the boxes are arranged in order of significance from left to right, with left being the most significant and right being the least significant.

The SPDS is hosted on a Gould 32/9780 computer, known as the Integrated Plant Computer System (IPCS). The IPCS combines the functions of the SPDS, BISI (Bypassed and Inoperable Status Indication), reactivity computer, and other process computer applications (previously hosted on a Westinghouse P2500 computer) onto one platform. The Gould computer contains a redundant CPU configuration. During normal operations both processing units are operational and used in performing calculations. Should one processor fail, the computer may be restarted with only one processor operational to provide the necessary SPDS

information. The software was developed by Scientific Applications International Corporation (SAIC).

Sensor inputs are scanned at varying intervals depending on the type of input. There are six general scan classes ranging from 0.1 seconds to 60 seconds per scan. Sequence of Events points may also be designated which are timetagged to within 1 millisecond. Points are scanned relative to their importance to plant operations and emergency assessment. Generally, digital inputs are scanned once per second and analog inputs once per two seconds. Radiation and meteorological inputs are scanned once per ten seconds, averaged over selected intervals, and transferred to the VAX computer system for dose assessment use. This data is also accessible for display on the IPCS. Most SPDS points are scanned once per two seconds, which is consistent with the display update rate for SPDS displays.

The usual time for SPDS display initialization is approximately 1 second with data updates occurring every 2 seconds. Many other diagnostic features are available on the IPCS; however, their update rate may be greater than 2 seconds based on the function performed and its priority relative to SPDS. In addition, all terminals on the IPCS have a continuous display of SPDS Critical Safety Function status in the upper right corner of the screen, and all terminals except the dedicated alarm terminals on the Main Control Board may access more detailed SPDS displays. SPDS terminals are provided at the same locations as the previous terminals but were upgraded as part of the replacement project. Attachment 1 shows the placement of the SPDS terminals in the Control Room, Technical Support Center , and Emergency Operations Facility.

All screens are easy to access through the use of a Turn-on-code or keyboard function keys. Turn-on-codes are names of displays or programs which are accessed through keyboard input. Samples of SPDS and related displays are shown in Attachment 2. A general keyboard layout of both the standard keyboard and special function keypad are given in Attachment 3.

3.0 EVALUATION

This section provides responses to the staff's conclusions contained in the safety evaluation report for the VCSNS with regard to the essential elements of the SPDS required by Supplement 1 to NUREG-0737.

3.1 THE SPDS SHOULD PROVIDE A CONCISE DISPLAY OF PLANT VARIABLES.

The SPDS follows Westinghouse Owners Group recommendations for display of CSFs which have been previously approved by the Nuclear Regulatory Commission.

3.2 THE SPDS SHOULD BE LOCATED CONVENIENT TO THE CONTROL ROOM OPERATORS.

The previous evaluation noted that there were two SPDS terminals in the Control Room. At the time of this report, there are five SPDS terminals in the Control Room. All five terminals provide a summary indication of the CSFs. Three of the terminals have access to more detailed information so that an accurate assessment of plant conditions may be made. Two additional terminals will be replaced following approval of the BISI application on the IPCS. Contained in Figures 1-3 in Attachment 1 of this report are layout drawings which indicate the locations of SPDS terminals.

3.3 THE SPDS SHALL CONTINUOUSLY DISPLAY INFORMATION FROM WHICH THE SAFETY STATUS OF THE PLANT CAN BE ASSESSED.

All SPDS displays except for the Operational Limits Curve contain the CSF status boxes at the bottom of the page. In addition, each CSF status is displayed in the upper right corner of any terminal connected to the IPCS. With all CSFs fully satisfied the status box is solid green. Any CSF which is not fully satisfied will be indicated by a stripe of the appropriate color. CSFs which do not necessarily require operator action (completely satisfied <green> or not completely satisfied <yellow>) are displayed as a solid bar in the status block. All other conditions (threatened <orange>, severely

threatened <red>, or indeterminate by the computer <magenta>) are displayed as a blinking bar in the status block to attract operator attention more quickly. This status bar is displayed continuously, updated approximately once per second, and not operator changeable.

3.4 THE SPDS SHALL HAVE RAPID AND RELIABLE DISPLAY OF THE SAFETY STATUS OF THE PLANT.

SPDS CSF status is continuously displayed at each terminal and updated once per second. System response to operator commands for SPDS displays is extremely fast, usually within 1 second, but occasionally as long as 2 seconds. Currently both SPDS systems are operational and available in the Control Room. The old system is only being used to run the BISI application (not a part of SPDS). Combined system availability has been nearly perfect. Following the certification of the BISI application on the IPCS, the old system will be formally decomissioned. SCE&G fully expects, and operating statistics indicate, that overall system availability will remain at the intended goal of greater than 99 percent.

3.5 THE SPDS SHALL BE SUITABLY ISOLATED FROM ELECTRICAL OR ELECTRONIC INTERFERENCE.

The isolation of the SPDS inputs met the requirements of NUREG-0737, Supplement 1. No changes to the input isolations were made as a part of this computer replacement therefore the existing isolation still satisfies the requirement.

3.6 THE SPDS DISPLAY SHALL BE DESIGNED TO INCORPORATE HUMAN FACTORS PRINCIPLES.

Scientific Applications International Corporation performed a complete review of the SPDS displays based on the Westinghouse Owners Group critical safety function status trees used as a part of the Emergency Response Facility Information System for Carolina Power and Light Company's Shearon Harris and H.B. Robinson plants. The V.C. Summer Nuclear Station SPDS was designed and built using these same human factors principles.

3.7 THE SPDS SHALL DISPLAY MINIMUM INFORMATION SUFFICIENT TO DETERMINE THE PLANT SAFETY STATUS (CRITICAL SAFETY FUNCTIONS) DURING ABNORMAL AND EMERGENCY CONDITIONS.

Westinghouse Owner's Group Guidelines for evaluation and dispiay of the CSFs were used extensively in the development of the SPDS. The second level displays provide paths which lead the operator to the appropriate Emergency Operating Procedures for further action. Additionally, a tabular summary of the relevant information for each tree is displayed on the page along with information on the trend of the parameter.

3.8 PROCEDURES TO BE DEVELOPED AND OPERATORS SHOULD BE TRAINED TO RESPOND TO ACCIDENT CONDITIONS BOTH WITH OR WITHOUT THE SPDS AVAILABLE.

A user's guide is available in the Control Room, TSC, and EOF along with a list of points used on the SPDS. The SPDS displays are designed for minimal operator action and an online help facility provides operators with an easy to use quick reference guide. A copy of the help file for SPDS is provided in Attachment 2 along with the SPDS displays and a copy of Emergency Operating Procedure EOP-12 is enclosed in Attachment 4. Operators are trained to respond to plant conditions both with and without the SPDS and use it routinely in simulator scenarios.

3.9 NUREG-0800 SECTION 18.2 REVIEW OF SPDS VERIFICATION AND VALIDATION.

Both the factory and site acceptance tests were conducted by the vendor and witnessed by Nuclear Computer Services and Operations personnel. In addition to these tests, the Nuclear Regulatory Commission witnessed the use of the SPDS on the VCSNS Training Simulator during an on site EOP audit in August 1990. The SPDS received only favorable responses from the audit team.

The VCSNS verifies and validates the use of all software applications , including SPDS, through a Quality Review Board process. The Quality Review Board is a multidisciplined group whose job is to review the verification and validation process and results to ensure that the application is consistent with station requirements.

4.0 SUMMARY

The VCSNS SPDS is an entirely new system written primarily by SAIC and based on Westinghouse Owners Group recommendations for display of CSFs. This system provides continuous display on all SPDS terminals with the ability to acquire detailed information quickly and reliably. Terminals are located in strategic areas in the plant: Control Room, Technical Support Center, Emergency Operations Facility, and Central Command Centers. An Operator's Guide and information specifically concerning the SPDS are available in these areas, along with a complete list of computer points. The software is hosted on a Gould computer system, a hardware platform which has been proven reliable throughout the nuclear industry for many years. The VCSNS SPDS provides concise, rapid, and reliable information so that Operations personnel may continuously assess the safety status of the unit.

Attachment 1

Location of SPDS Terminals

Figure 1

CONTROL ROOM LAYOUT

1-7 SPDS terminals*
P Printer

*4 and *7 are future IPCS SPDS terminals and are currently TSC BISI terminals

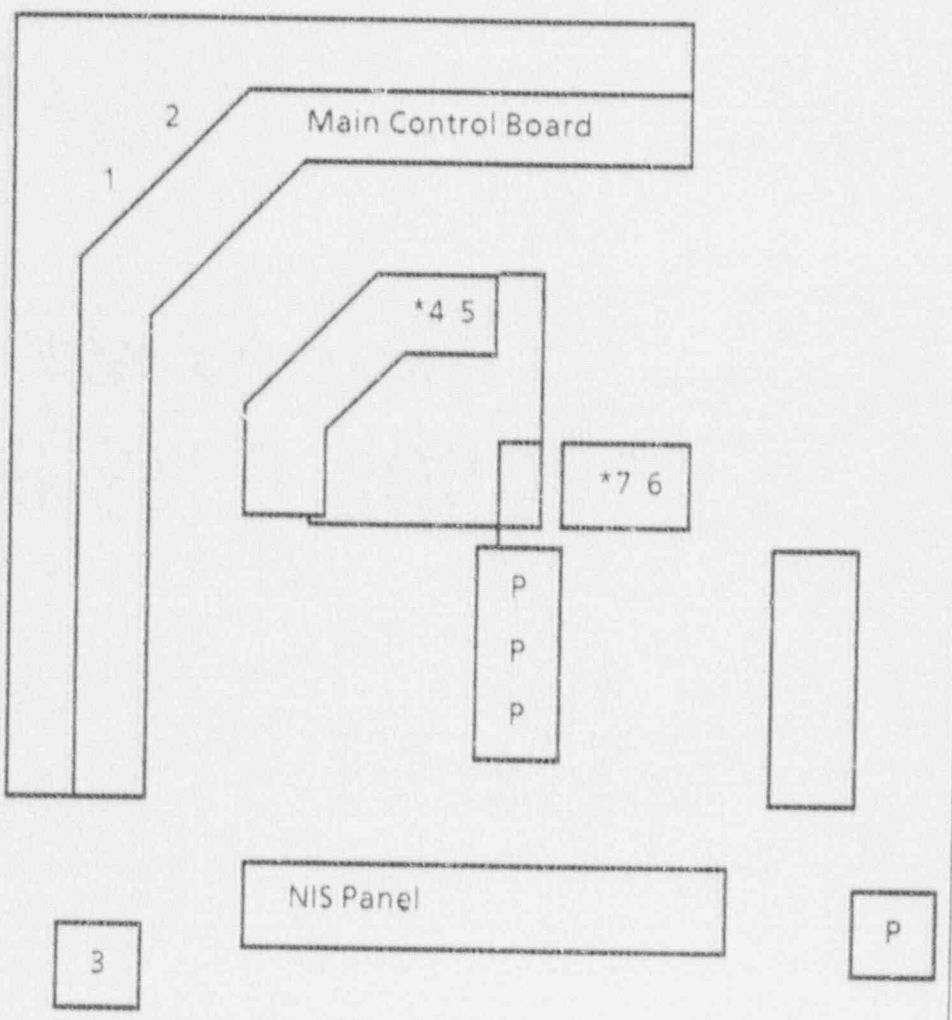


Figure 2

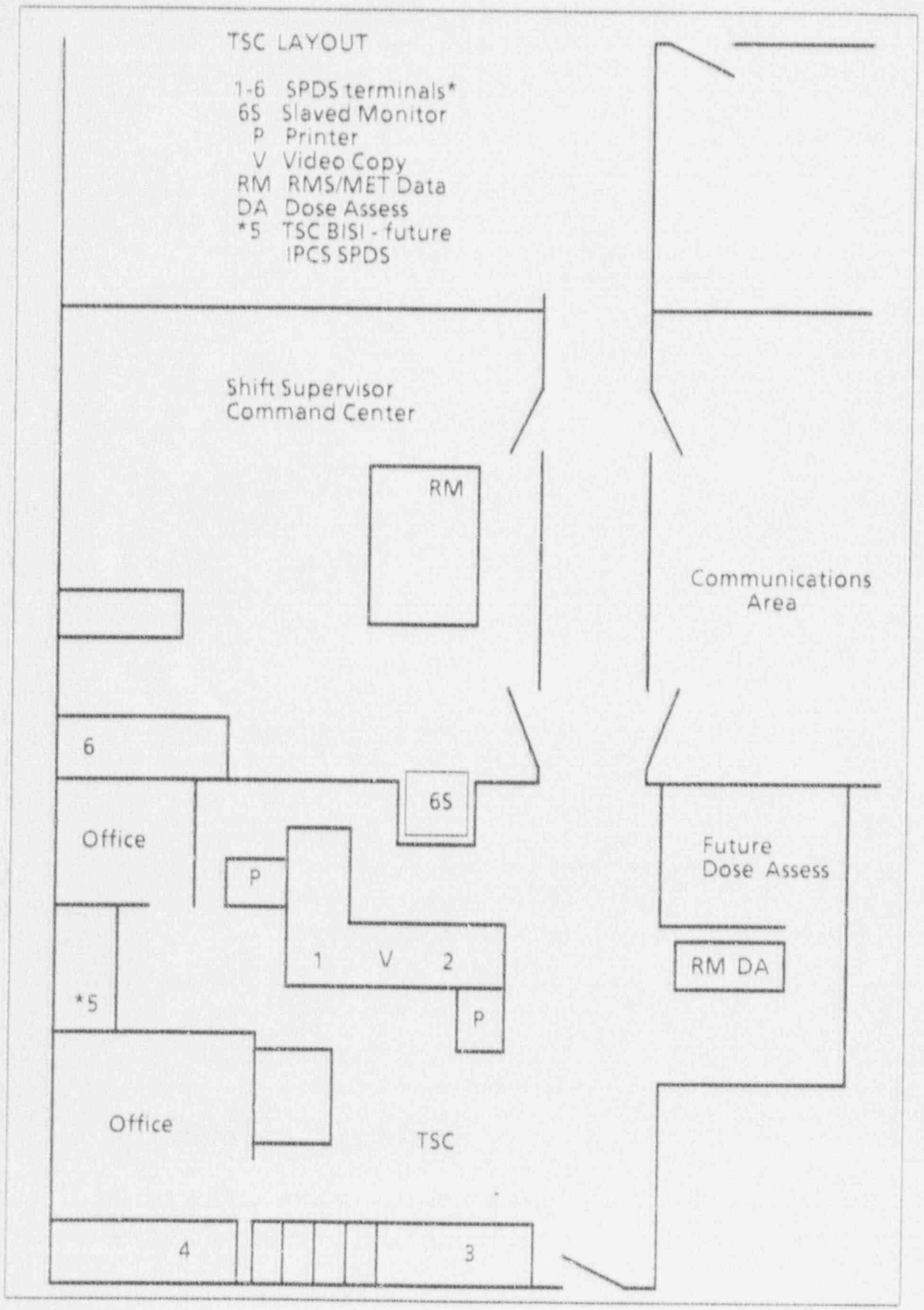
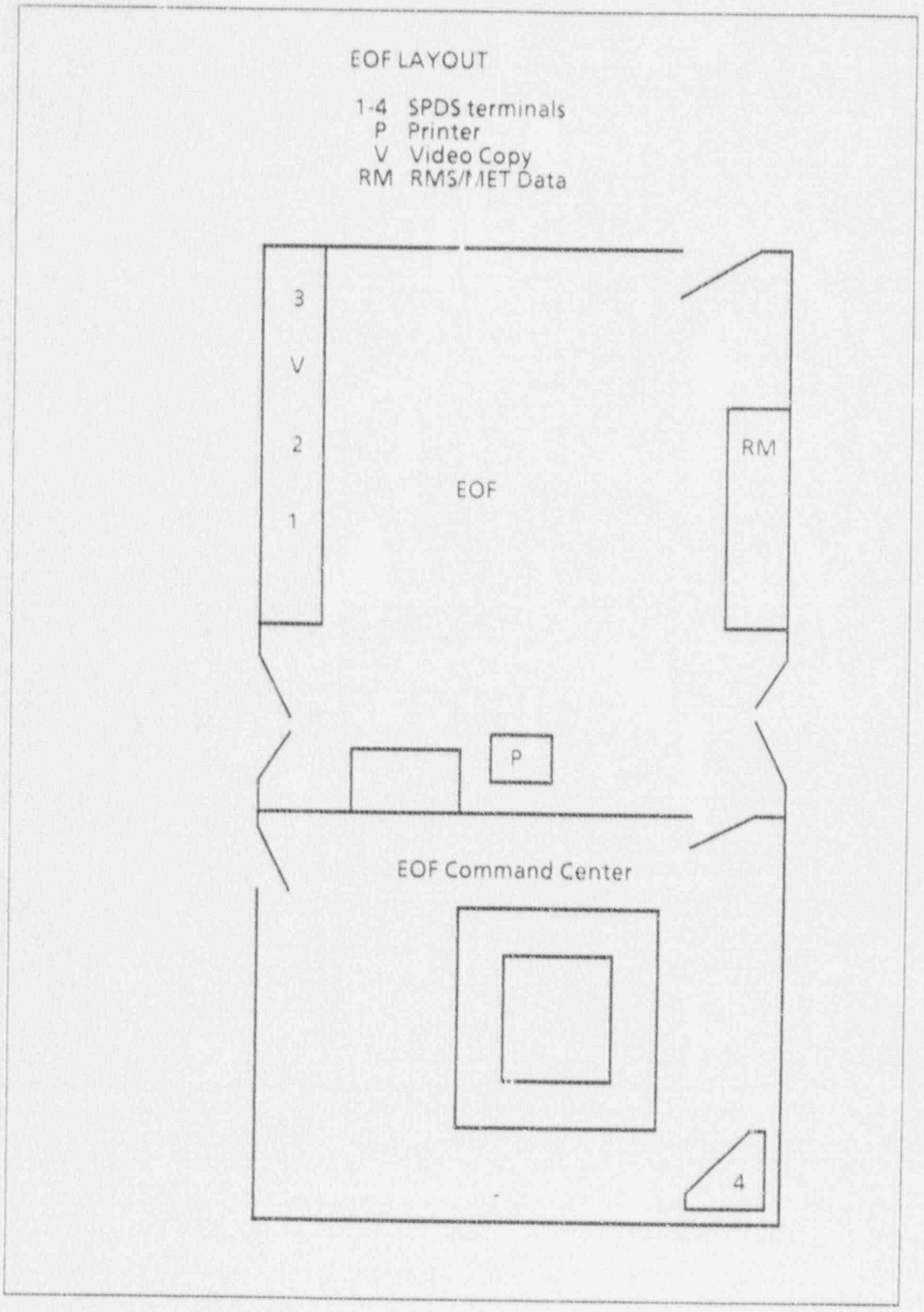

TSC LAYOUT
1-6 SPDS terminals*
6S Slaved Monitor
P Printer
V Video Copy
RM RMS/MET Data
DA Dose Assess
*5 TSC BISI - future IPCS SPDS
Shift Supervisor Command Center
RM
Communications Area
6
6S
Office
P
Future Dose Assess
1 V 2
RM DA
*5
P
Office
TSC
4
3

Figure 3


EOF LAYOUT
1-4 SPDS terminals
P Printer
V Video Copy
RM RMS/MET Data
3
V
2
1
EOF
RM
P
EOF Command Center
4

Attachment 2

SPDS and Supporting Displays

SELECT FUNC. KEY OR TURN-ON CODE SPTOP

DEC 11,1990
15:29:18

SPDS TOP LEVEL

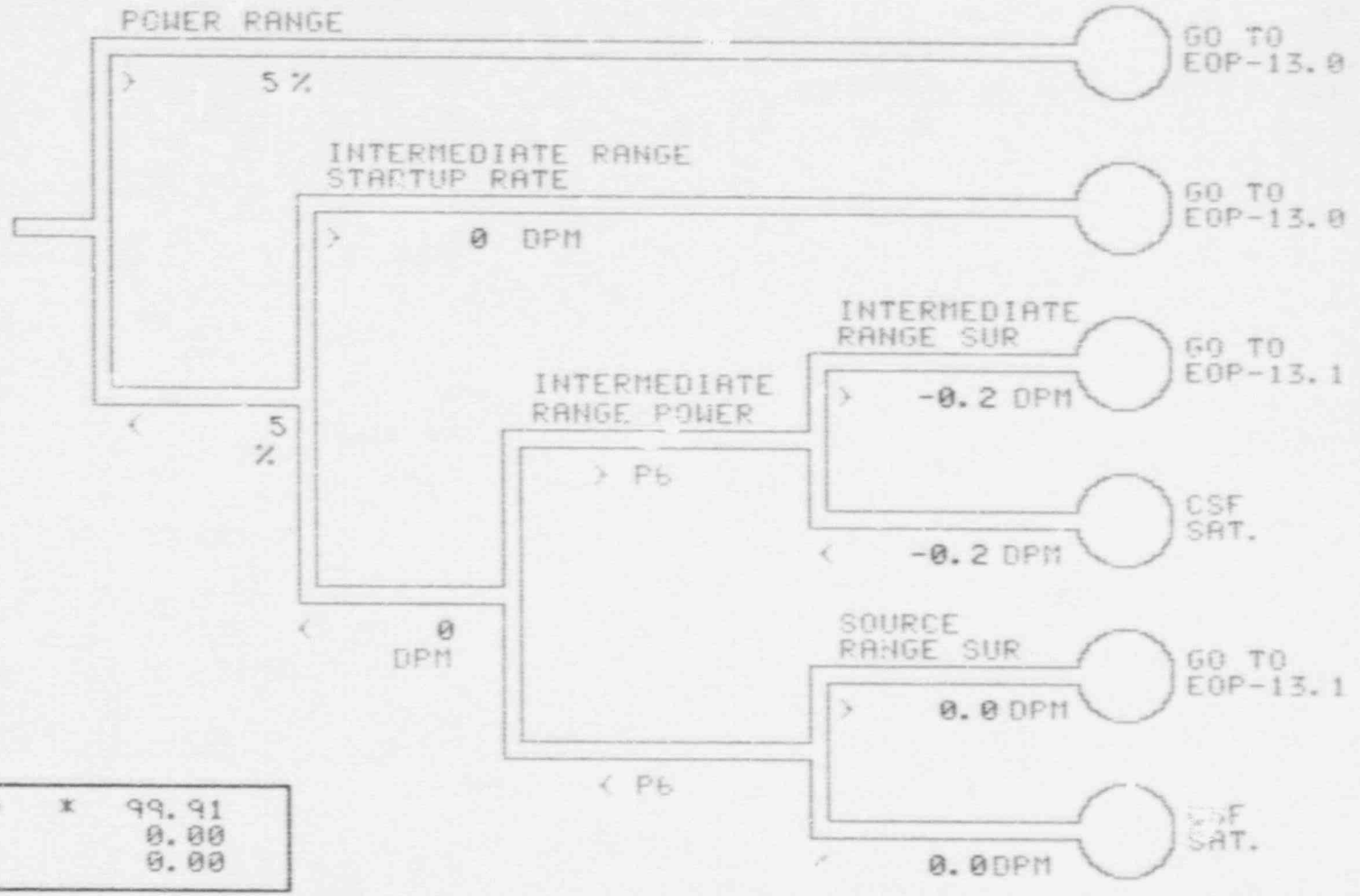
CONTAINMENT CONDITIONS:	* NORMAL
SI TERMINATION:	* NO
INTEGRATED CONTAINMENT DOSE:	* <1.0E6
RWST SWAPOVER	NOT REQUIRED
CST SWAPOVER	NOT REQUIRED
RCP TRIP CRITERIA	NOT SATISFIED
NATURAL CIRCULATION	NOT APPLICABLE
FEED & BLEED (EOP-15.0)	* NOT REQUIRED

G SUBCRITI-CALITY | G CORE COOLING | G HEAT SINK | G RCS INTEGRITY | G CONTAINMENT | G RCS INVENTORY

F1=CLEAR F2= KBD=NORMAL F3= F4= F5= AMODE=POWER OPERATION F6= EXTR= 0% P'.NT

Attachment 2
Page 1 of 11

SUBCRITICALITY



POWER RANGE (%)	*	99.91
IR SUR (DPM)		0.00
SR SUR (DPM)		0.00

G SUBCRITI-CALITY | G CORE COOLING * | G HEAT SINK * | G RCS INTEGRITY | G CONTAINMENT | G RCS INVENTORY *

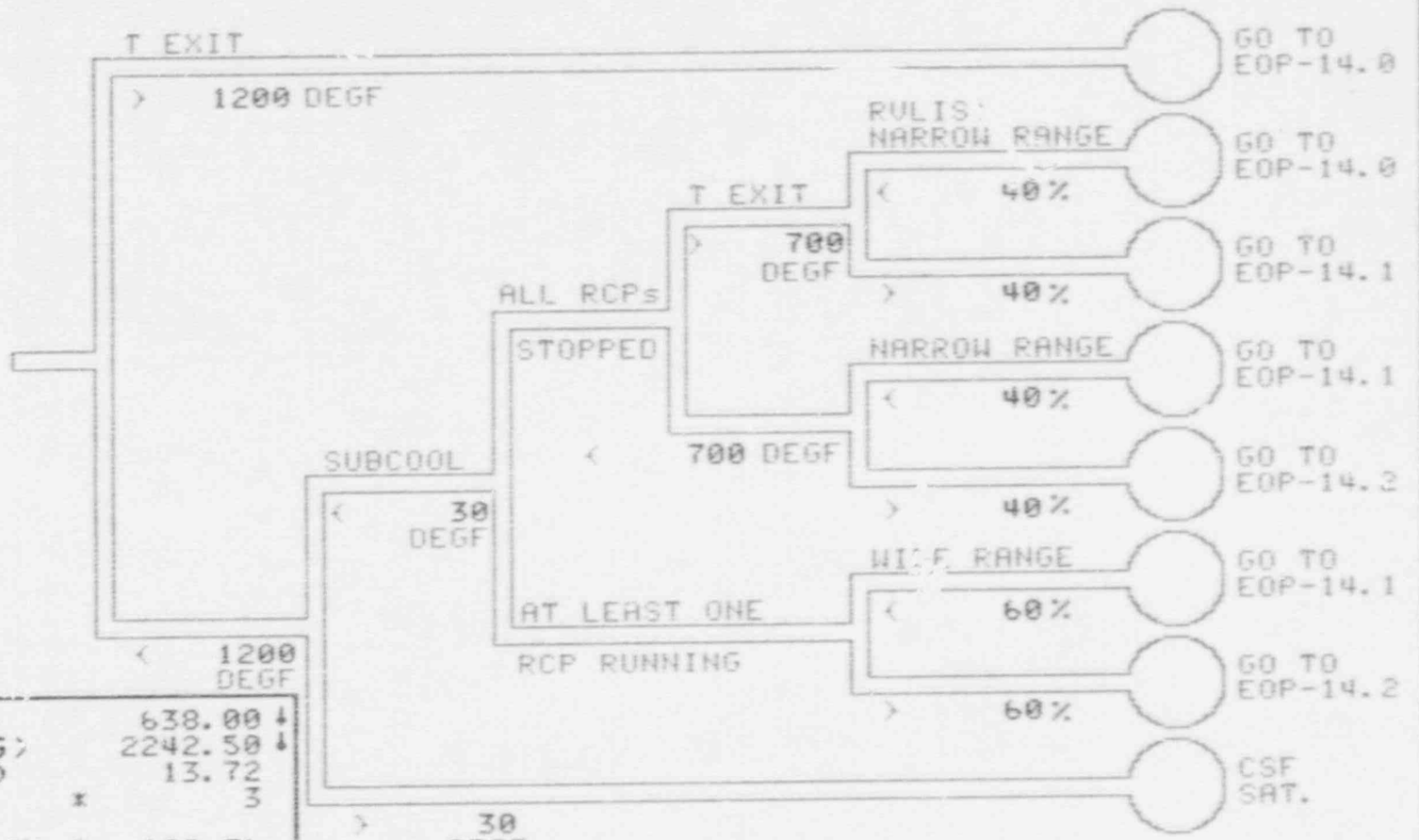
F1=CLEAR F2= F3= F4= F5= F6=

KBD=NORMAL AMODE=POWER OPERATION PRINT

SELECT FUNC. KEY OR TURN-ON CODE

DEC 7,1990
09:10:22

CORE COOLING



T EXIT (DEGF)		638.00 ↓
RCS PRES (PSIG)		2242.50 ↓
SUBCOOL (DEGF)		13.72
RCPs (OF 3)	*	3
RVLIS:		
NARROW RANGE (%)	*	122.76
WIDE RANGE (%)		114.41 ↓

SUBCRITI-CALITY | CORE COOLING | HEAT SINK | RCS INTEGRITY | CONTAINMENT | RCS INVENTORY

F1= F2= F3= F4= F5= F6=

KBD=NORMAL

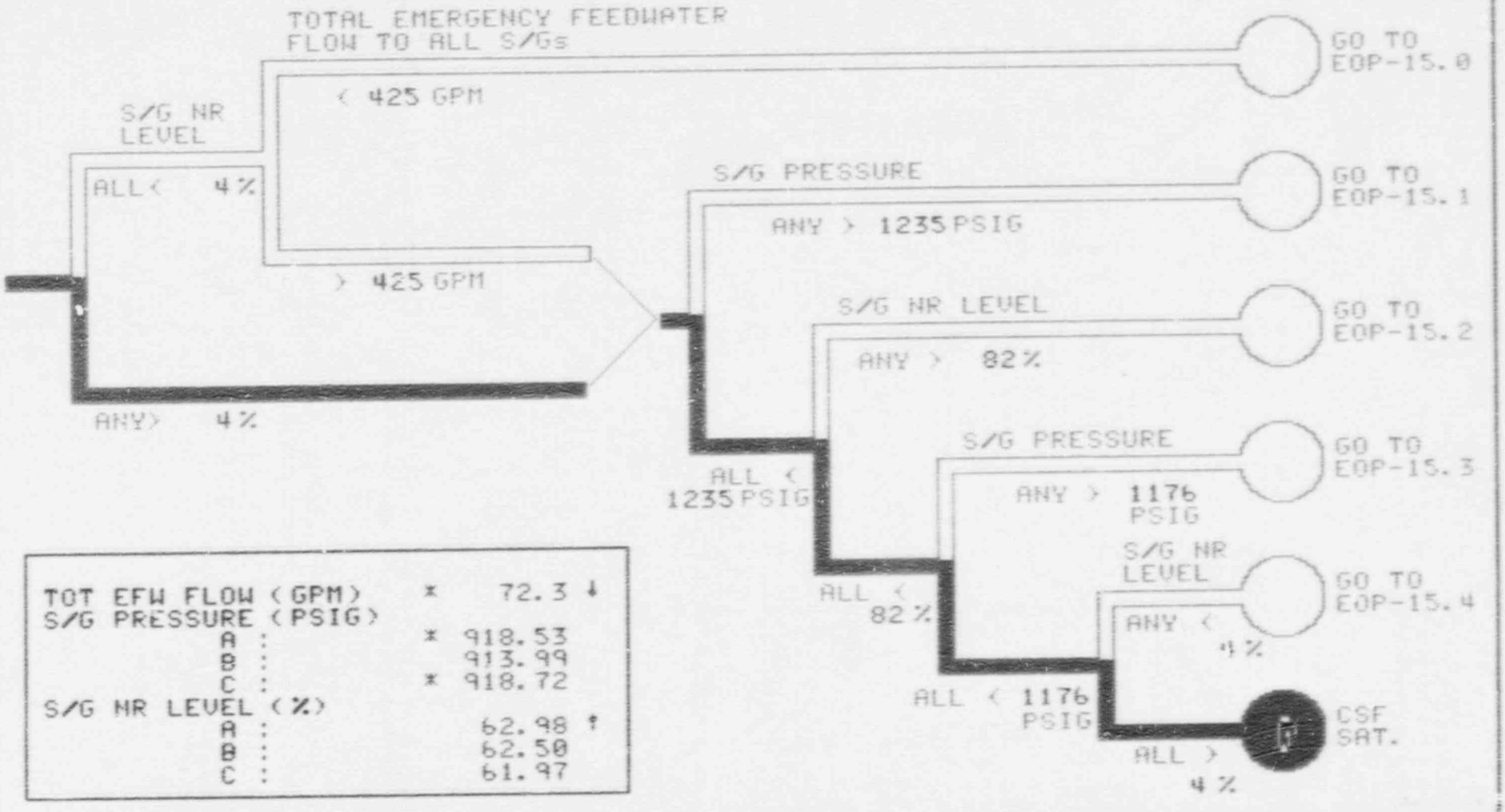
AMODE=POWER OPERATION

PRINT

SELECT FUNC. KEY OR TURN-ON CODE SPSINK

DEC 7,1990
09:12:06

HEAT SINK

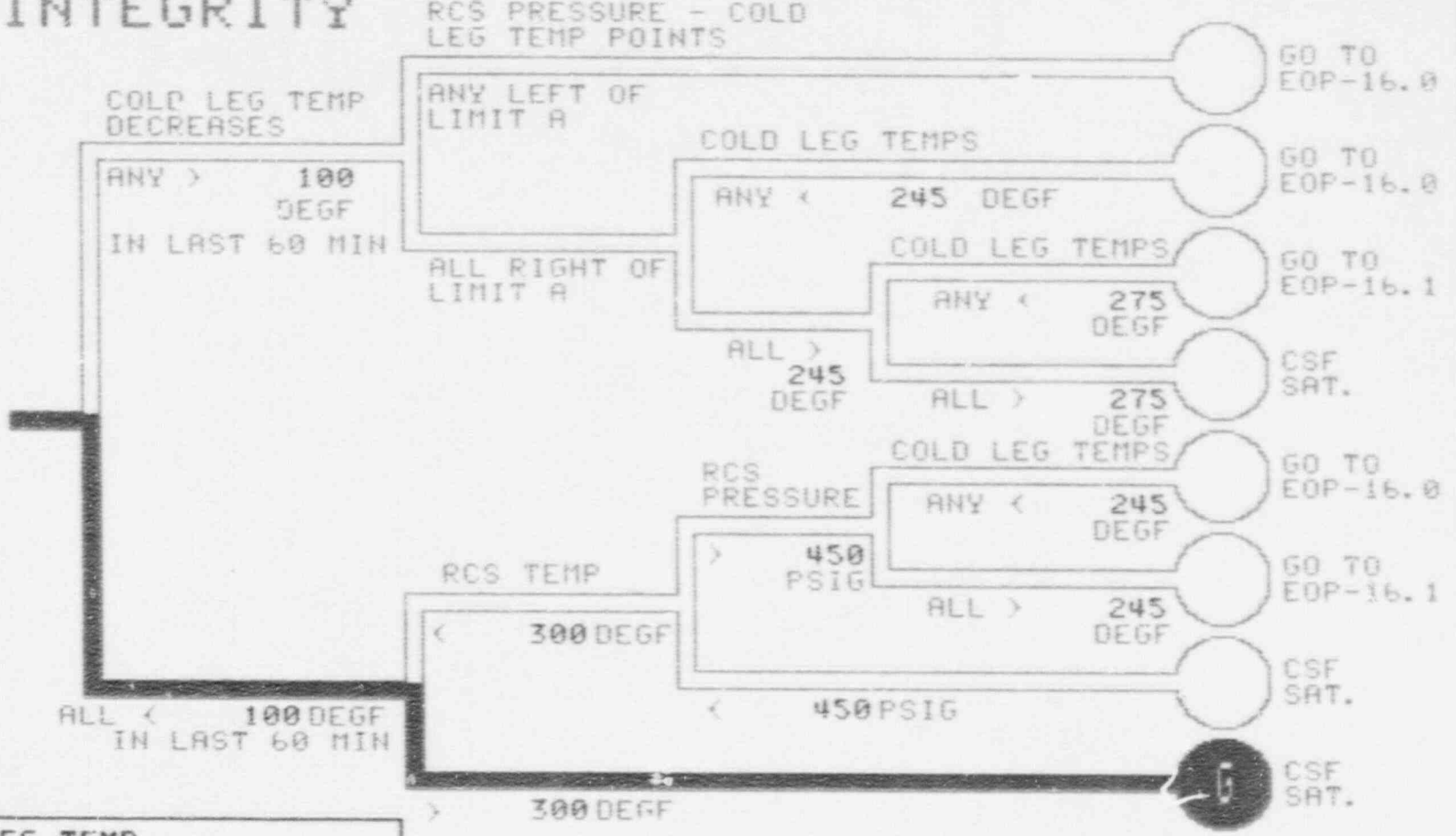


TOT EFW FLOW (GPM)	*	72.3 ↓
S/G PRESSURE (PSIG)		
A :	*	918.53
B :		913.99
C :	*	918.72
S/G NR LEVEL (%)		
A :		62.98 ↑
B :		62.50
C :		61.97

G SUBCRITI-CALITY | G CORE COOLING | G HEAT SINK | G RCS INTEGRITY | G CONTAINMENT | G RCS INVENTORY

F1=CLEAR F2= KBD=NORMAL F3= F4= F5= AMODE=POWER OPERATION F6= PLNT

RCS INTEGRITY



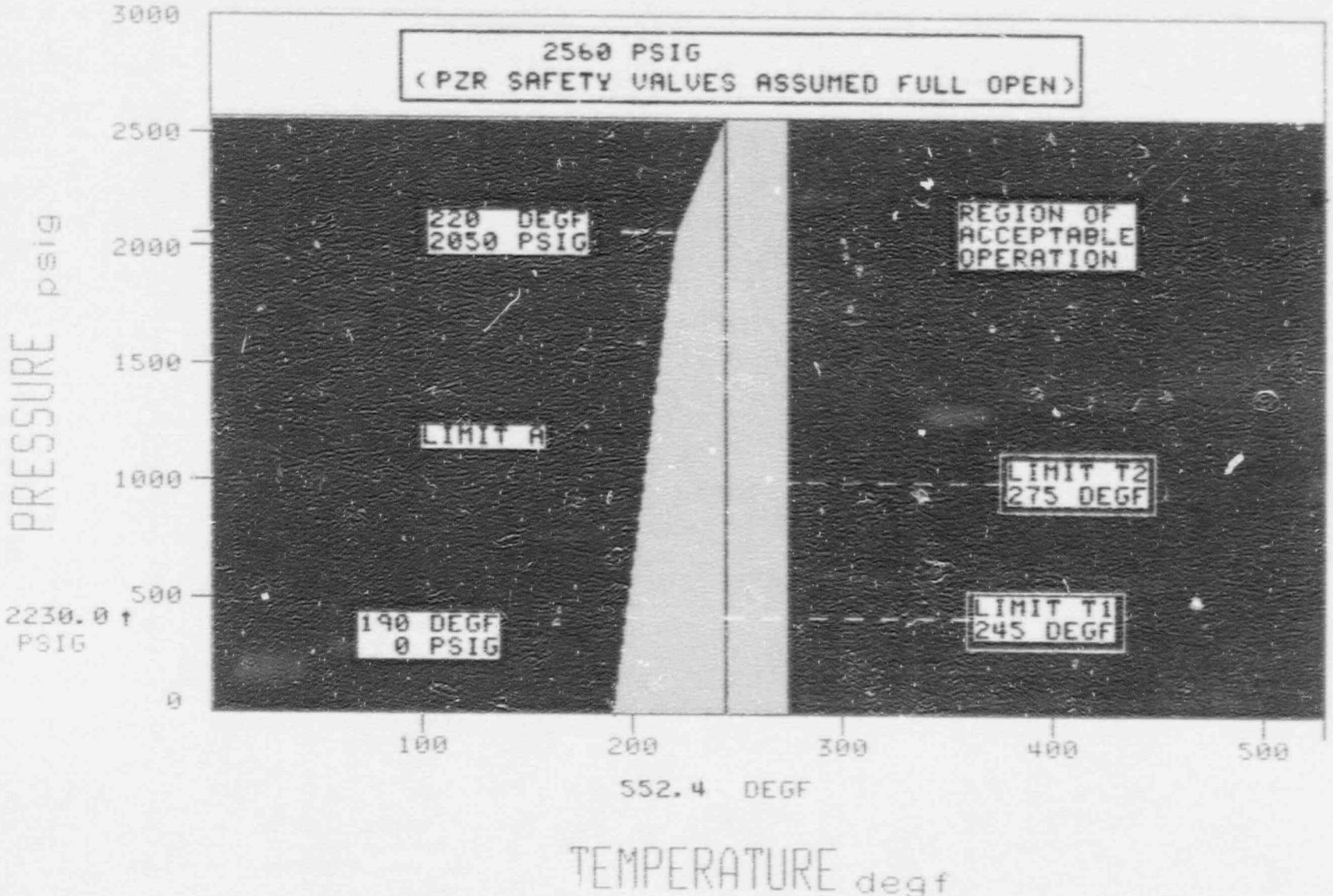
HIGH COLD LEG TEMP DECREASE (DEGF/HR)	0.26
RCS PRES (PSIG)	2242.85
RCS TEMP (DEGF)	552.45
(LOW COLD LEG TEMP)	

SUBCRITI-CALITY | CORE COOLING | HEAT SINK | RCS INTEGRITY | CONTAINMENT | RCS INVENTORY

F1= F2= F3= F4= F5= F6=

KBD=NORMAL AMODE=POWER OPERATION PLNT

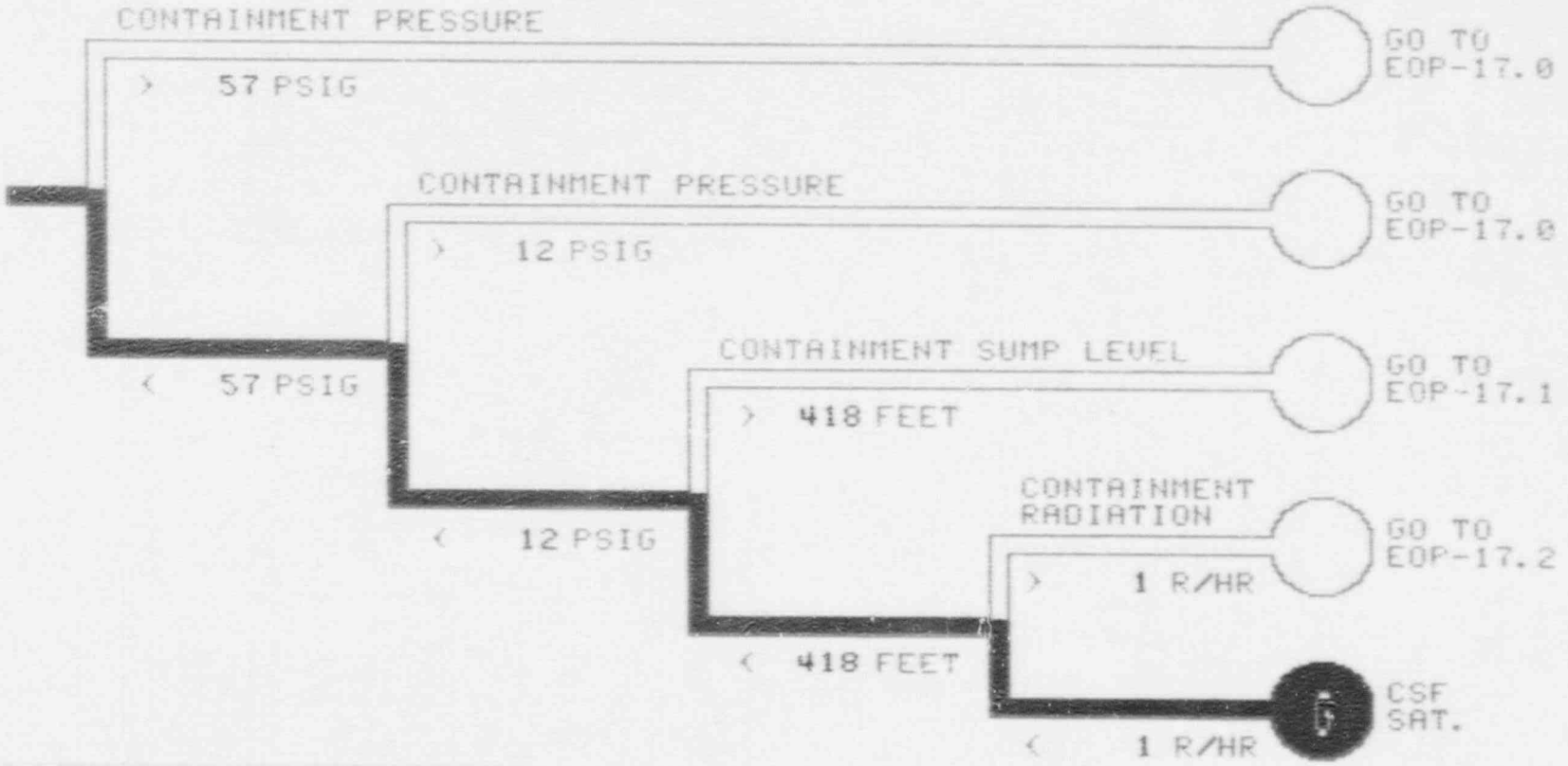
Operational Limits Curve



SELECT FUNC. KEY OR TURN-ON CODE

DEC 7,1990
09:19:29

CONTAINMENT



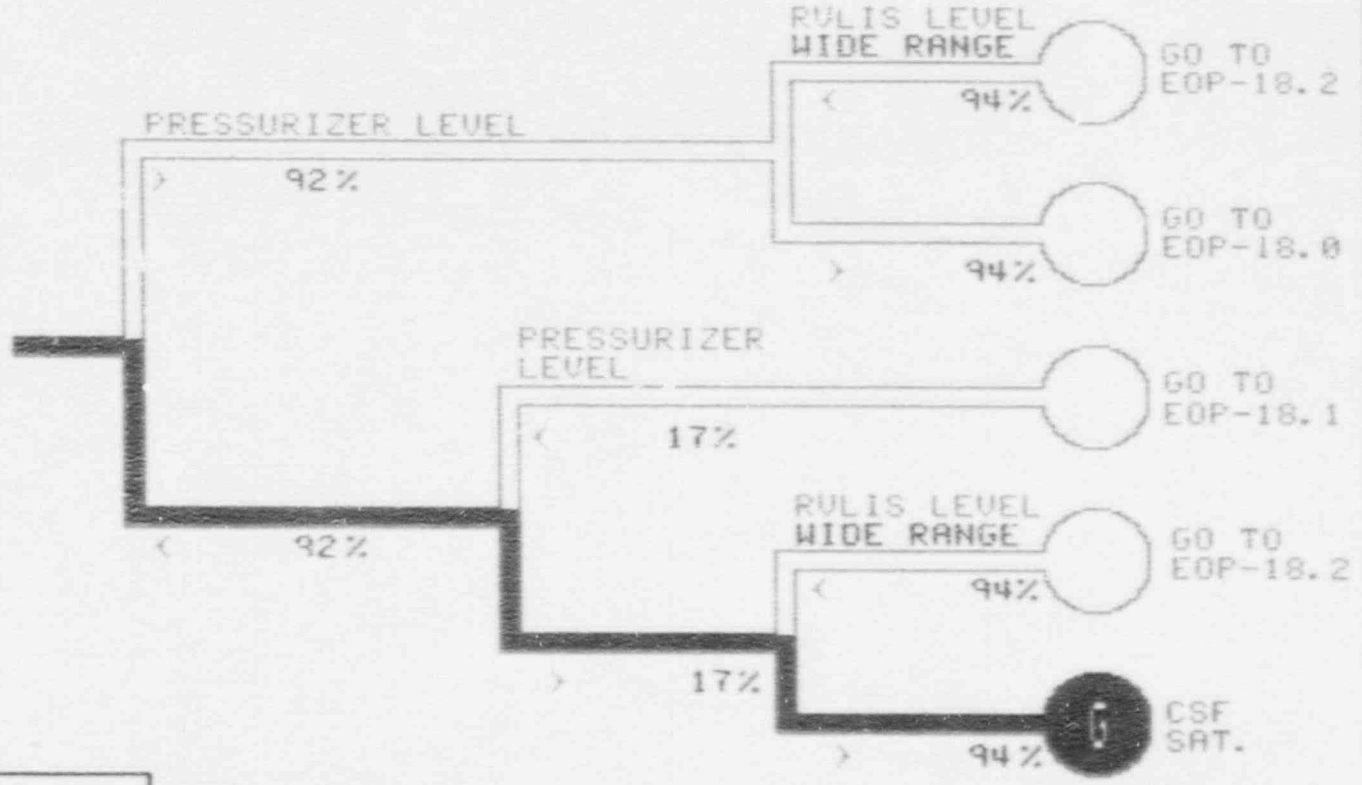
PRESSURE (PSIG)	0.12
SUMP LEVEL (FEET)	408.00
RADIATION (R/HR)	0.50

SUBCRITI-CALITY | CORE COOLING | HEAT SINK | RCS INTEGRITY | CONTAINMENT | RCS INVENTORY

F1= F2= F3= F4= F5= F6=

KBD=NORMAL AMODE=POWER OPERATION PLNT

RCS INVENTORY



PZR LEVEL (%)		59.88
RVLIS		
UPPER PLEN (%)	*	64.00
WIDE RANGE (%)		114.61
RCPs RUNNING	*	3

G SUBCRITI-CALITY | G CORE COOLING | G HEAT SINK | G RCS INTEGRITY | G CONTAINMENT | G RCS INVENTORY

F1= F2= F3= F4= F5= F6=

KBD=NORMAL AMODE=POWER OPERATION PLNT

SELECT FUNCTION KEY OR HELP FILE

DEC 11,1990
10:37:49

HELP PAGE FOR SPTOP

SPDS TOP LEVEL DISPLAY (SPTOP)

SPTOP gives a summary of the Critical Safety Functions in the plant. The six critical safety functions are: Subcriticality, Core Cooling, Heat Sink, RCS Integrity, Containment, and RCS Inventory. Additionally, the Operational Limits Curve is available as a part of Integrity. The CSF Boxes are color coded for severity and are interpeted as follows:

GREEN -- CSF fully satisfied (no further action required)
YELLOW -- CSF not fully satisfied (action may be necessary)
ORANGE -- CSF is threatened (action is required)
RED -- CSF is severly threatened (immediate action)
MAGENTA -- Computer is not currently calculating the CSF due to a problem. (USE EOP-12 MANUAL STEPS)

In addition to the CSF status boxes at the bottom, additional information which may be of interest to the operator is provided on the top level display. A brief description of each parameter follows:

Containment Conditions -- either NORMAL or ADVERSE. This is determined by either high containment pressure as indicated by P1003D or high integretated containment dose (U6054 > 1.0E6 rem).

SI Termination -- either YES or NO. This status message informs the operator if the conditions for terminating safety injection exist (or if safety injection is not yet necessary). Safety injection can be terminated if:

1) RCS pressure is stable or increasing, and
2) RCS subcooling is >= 30 DEGF, and
3) PZR Level is >= 4% for normal containment; 39% for adverse containment, and
4) A healthy heat sink exists, defined as heat sink csf status not in a red color.

Integrated Containment Dose -- either <1.0E6 or >1.0E6. This

F1=PAGE DOWN F2= F3= F4= F5= F6=
KBD=NORMAL AMODE=POWER OPERATION PLNT

Attachment 2
Page 9 of 11

HELP PAGE FOR SPTOP

is calculated by converting RMG7 and RMG18 readings to Rem based on the calculation intervals of points and summing (integrating) over time. The integrated dose may be reset to 0 using L6096.

RWST Swapover -- either REQUIRED or NOT REQUIRED. This message informs the operator if the RWST has reached low level, and the suction of the SI pumps must be switched to the RHR/RBS Sumps. If 1/2 of the RWST levels, L0990A and L0992A are < 18% swapover is required.

CST Swapover -- either REQUIRED or NOT REQUIRED. This status message informs the operator if 2/4 of the CST press. (Y9008A,Y9009A,Y9010A,Y9011A) have reached the low setpoint of 11.94 psig indicating that EFW Pump suction must be switched from the CST.

RCP Trip Criteria -- either SATISFIED or NOT SATISFIED. This message informs the operator if the conditions for tripping the RCPs have been met. The trip is allowed if RCS pressure is <= 1380 psig.

Natural Circulation -- either SATISFIED (color), NOT SATISFIED, or NOT APPLICABLE. This message informs the operator if natural circulation is in effect. A loop is in natural circulation if:

1) RCS Subcooling > 30 DEGF, and
2) Core exit Temp is stable or decreasing, and
3) SG Pressure is stable or decreasing, and
4) Hot Leg Temp is stable or decreasing, and
5) Cold leg Temp is at the saturation temp for the prevailing SG Pressure.

In addition to the above criteria, natural circulation is NOT APPLICABLE unless all RCP breakers are open. Each RC loop is checked and determined to see if it is in natural circulation based on the criteria above. If all loops are in natural circulation, the display will

HELP PAGE FOR SPTOP

show SATISFIED in green. If only two loops are in natural circ. the display will show SATISFIED in yellow. If only one RC Loop is in Natural Circ. the display will show SATISFIED in orange. If no loops are in natural circulation the display will show NOT SATISFIED in red. There is a 5 minute delay after the RCP breakers open prior to a proper natural circ. indication. Until that time, the display will indicate NOT APPLICABLE.

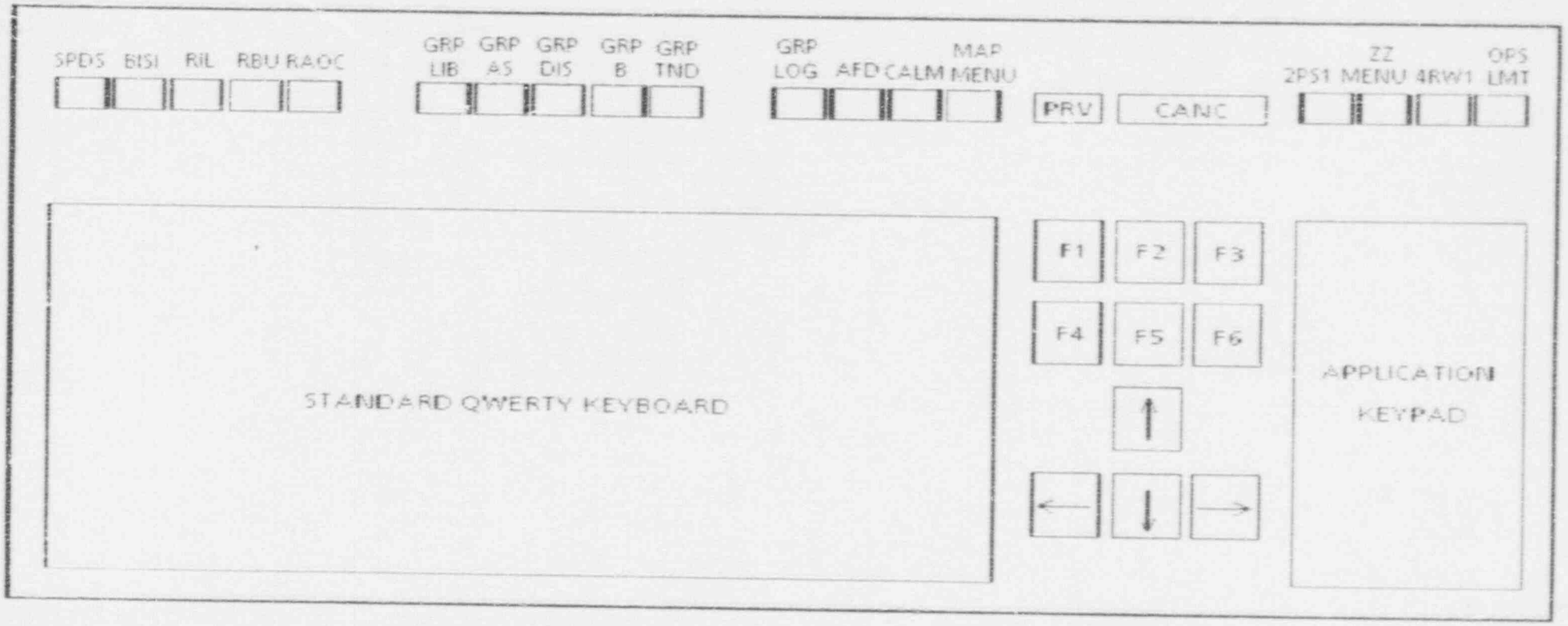
Heat Sink (Feed & Bleed) -- either REQUIRED or NOT REQUIRED. This message alerts the operator that Feed & Bleed per EOP-15.0 may be necessary. The underlying assumption is that the Steam Generators are not serving as a viable heat sink and additional heat removal capabilities may be required. This occurs if 2 of 3 Steam Generator Levels are < 10% OR Primary Pressure > 2335 with loss of Heat Sink as indicated by a RED Heat Sink CSF Status.

By each parameter on the top level display and asterisk may or may not appear. This is the suspect tag for computer points and is usually used to indicate a calculated point which uses several inputs did not use all of them to perform the calculation. An example of this would be Average SG Level where 3 inputs are averaged. If one of the input levels is bad, it will not be used, the level calculated using the other two inputs, and the resultant value tagged as suspect.

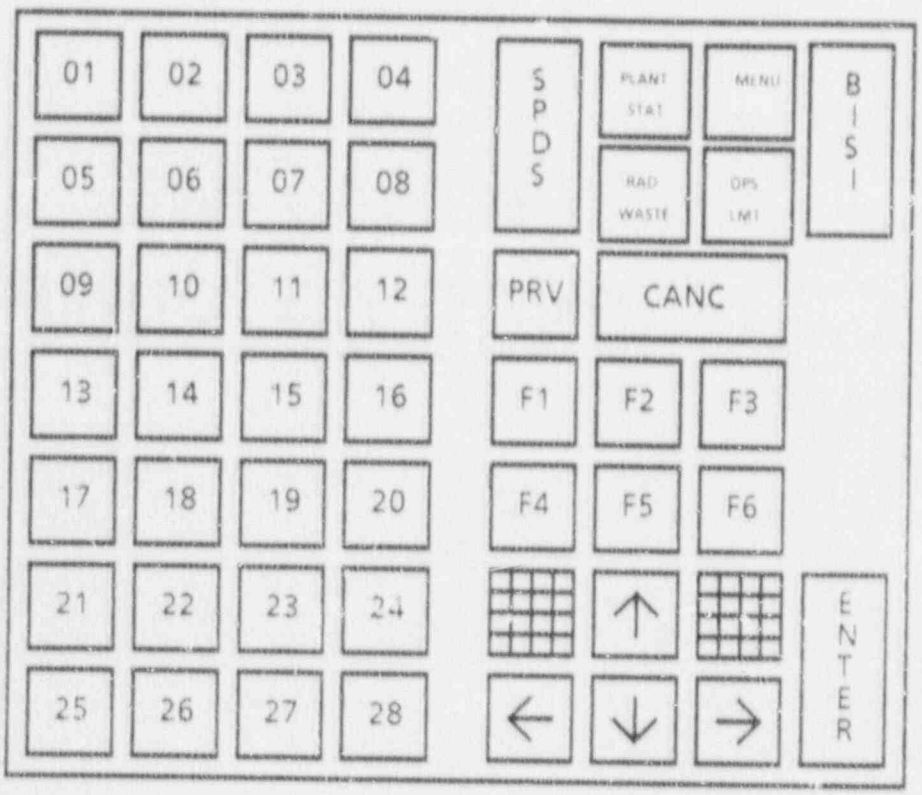
Attachment 3

Keyboard / Keypad Layouts

STANDARD VT220 KEYBOARD LAYOUT



SPECIAL FUNCTION KEYPAD LAYOUT



Attachment 4

Emergency Operating Procedure EOP-12