PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS

2-EOP-CFST-1 - Rev. 25

CRITICAL SAFETY FUNCTION STATUS TREES

- Biennial Review performed Yes___ No____ NA___X___
- Change Package (s) incorporated into this revision:

REVISION SUMMARY

The following changes are included in this revision:

- Revised Figure 6, Coolant Inventory Status Tree to reflect RVLIS DYNAMIC RANGE values of "32%, 42%, 63% and 93%" versus the indicated values of "38%, 50%, 71%, and 100%". Figure 6, RVLIS DYNAMIC RANGE values of 32%, 42%, 63% and 93% were incorporated in Revision 23, and during the revision process for Revision 24, the Revision 22 valves were incorrectly reverted back to.
  This editorial change restores the Figure 6, RVLIS DYNAMIC RANGE values to the correct values as incorporated in Revision 23, and is consistent with the values specified in the Unit 2 Critical Safety Function Status Tree Basis Document.
  [20229708]

Revision bars were not utilized in this revision.

IMPLEMENTATION REQUIREMENTS: Effective Date: 04/07/05

None

APPROVED: _____ for _____ 3/29/05
Operations Manager - Salem Date

EMERGENCY OPERATING PROCEDURE
2-EOP-CFST-1
CRITICAL SAFETY FUNCTION STATUS TREES

1.0 Entry Conditions

See Procedure

2.0 Operator Actions

2.1 Immediate Actions

None

2.2 Subsequent Actions

See Procedure

3.0 Attachment List

3.1 Tables

A - Subcooling Table - Normal Containment
B - Subcooling Table - Adverse Containment
C - Use of the Core Exit Thermocouple Display Panel
D - Subcooling Calculation and Recording Table

3.2 Figures

1 - Shutdown Margin Status Tree
2 - Core Cooling Status Tree
3 - Heat Sink Status Tree
4 - Thermal Shock Status Tree
4A - Thermal Shock Limit A Curve
5 - Containment Environment Status Tree
6 - Containment Inventory Status Tree

3.3 Graphs

None

3.4 Checkoff Sheets

None

3.5 Attachments

1 - Summary of Major Actions for Yellow Path Status Trees
2 - CFST Status Log Sheet
3 – Use of the Subcooling Margin Monitor Display

EMERGENCY OPERATING PROCEDURE

CRITICAL SAFETY FUNCTION STATUS TREES

TABLE OF CONTENTS

EMERGENCY OPERATING PROCEDURE

CRITICAL SAFETY FUNCTION STATUS TREES

1.0 ENTRY CONDITIONS

1.1 2-EOP-TRIP-1, when explicitly directed.

1.2 Upon transition from 2-EOP-TRIP-1 to any other EOP.

2.0 IMMEDIATE ACTIONS

2.1 None

3.0 SUBSEQUENT ACTIONS

NOTE

The Subcooling Margin Monitor (SMM) should be used to determine RCS subcooling. If the SMM is inoperable, then calculate and log RCS subcooling on Table D. The value of T-sat is obtained by using Table A for Normal Containment or Table B for Adverse Containment.

Attachment 3 should be referred to for instructions regarding operation of the Subcooling Margin Monitor (SMM) display.

NOTE

SPDS is not designed to be used as a primary indication, and no actions should be based upon SPDS indications without verification of the primary indications, which are the installed Control Room 1E instruments. The one exception is the SPDS and Plant Computer core exit thermocouple displays which are considered primary displays and are exempt from class 1E requirements. SPDS should be monitored periodically for changes in the CFST condition.

3.1 **IF** AT ANYTIME while monitoring CFSTs, the SPDS and Plant Computer CET Temperature Displays are NOT available,
THEN SCAN the CETs at the CET Display Panel in accordance with Table C and LOG indications on the appropriate Table C data sheet.

The Shift Radiation Protection Technician is to be notified if CET readings are to be taken at the CET Display Panel.

3.2 PERFORM an initial scan of the six CFSTs using Figures 1 thru 6. RECORD on Attachment 2 and give Attachment 2 to the CRS.

3.3 IMPLEMENT continuous monitoring of the CFSTs.

- **WHEN** a change in the evaluation of CFSTs occurs, **THEN** NOTIFY the CRS of the change via Attachment 2.

- **IF** any CFST as indicated on SPDS shows a RED or PURPLE path, **THEN** SCAN that particular CFST manually, using all available Control Room indications and Figures 1 thru 6. LOG any change on Attachment 2.

- **WHEN** both of the following conditions are met:

  All evaluated CFSTs are GREEN or YELLOW

  AND

  Plant is in stable condition,

  THEN the frequency of CFST monitoring may be reduced to every fifteen minutes at the direction of the CRS.

NOTE

CET monitoring may be performed at either the SPDS or Plant Computer displays to track the direction of temperature trends.

3.4 **INFORM** the CRS if any of the following are observed:

- Five or more CETs exceed 700° F.
- Five or more CETs exceed 1200°F.
- An unexpected steady rise in temperature occurs over several minutes.

3.5 **IF** containment pressure exceeds 4 psig, and subsequently lowers to less than 3 psig, **THEN** reset the SPDS to normal by performing the following:

1. Display the Heat Sink Status Tree page.
2. Using the cursor and the keyboard roller ball, LEFT-CLICK the "FORCE NORMAL" button in the upper right portion of the display.
3. VERIFY that "Containment NORMAL" appears in GREEN in the upper left portion of the display

NOTE

If R44 dose rates lower to less than 1E05 R/HR, and the integrated R44 dose has remains less than 1E06 Rad, the SMM and SPDS may be in "Adverse" unnecessarily. The TSC will monitor SPDS and inform the STA when "NORMAL" or "ADVERSE" mode should be selected.

3.6 **IF** informed by the TSC that ADVERSE containment conditions now exist due to high containment radiation,
THEN ensure that the SMM and SPDS displays are in "ADVERSE" mode as follows:

NOTE

The SMM "ADVERSE" pushbutton will flash if adverse containment exists only due to high radiation. If the adverse containment pressure condition also exists, the "ADVERSE" pushbutton will be lit and solid. Once the containment pressure condition clears, the "ADVERSE" pushbutton will begin to flash if R44 readings are still greater than 1E05 R/HR.

- For the SMMs, PERFORM the following:

  1. **IF** an SMM channel "ADVERSE" button is lit solid, take no action on that channel and proceed to the next step.
  2. **IF** either SMM channel "ADVERSE" button is dark **OR** flashing, **THEN** press the "ADVERSE" button on that channel **AND** verify that the light remains on and solid.
  3. **IF** an adverse containment pressure is present and subsequently clears, **THEN** press both SMM "ADVERSE" buttons **AND** verify that their lights remains on and solid.

- For SPDS, PERFORM the following:

  1. Display the Heat Sink Status Tree page.
  2. VERIFY that "Containment ADVERSE" appears in RED in the upper left portion of the display.
  3. **IF** the ADVERSE setting was not verified in the previous step, **THEN**, using the cursor and the keyboard roller ball, LEFT-CLICK the "SET ADVERSE" button in the upper left portion of the display.
  4. VERIFY that "Containment ADVERSE" now appears in RED.

3.7 **IF** DIRECTED by the TSC that adverse conditions due to high radiation no longer exist, **THEN** manually switch the SMM and SPDS displays to "NORMAL" mode as follows:

- **IF** the SMMs were manually selected to "ADVERSE" in Step 3.6, **THEN** DEPRESS the "ADVERSE" pushbuttons on both Channels A & B and verify the "ADVERSE" light is extinguished.

- **IF** the SMM "ADVERSE" pushbuttons are flashing due to previous high radiation, **THEN** DEPRESS the "ADVERSE" pushbutton until the backlight is extinguished.

NOTE

If the SPDS display automatically switched to "ADVERSE" mode due to R44 levels greater than 1E05 R/HR, the "NORMAL" mode cannot be selected unless radiation levels lower to less than 1E05 R/HR.

- **IF** SPDS is to be switched to "NORMAL", **THEN** PERFORM the following:

  1. Display the Heat Sink Status Tree page.

  2. Using the cursor and the keyboard roller ball, LEFT-CLICK the "FORCE NORMAL" button in the upper right portion of the display.

  3. VERIFY that "Containment NORMAL" appears in GREEN in the upper left portion of the display.

NOTE

Attachment 1 will assist the CRS in determining whether there is an FRP which will effect a desired outcome. The desired outcome may not be addressed with specific actions with the EOP in current use. This information should be discussed with the CRS as plant conditions allow. The STA should remain focused on the CFSTs and continue to monitor RCS temperature and pressure, Reactor power, SG parameters and other indications in order to detect unexpected values or trends.

3.8 **IF** the following conditions are met:

- Initial scan of the CFSTs using Figures 1 thru 6 has been completed and results reported to the CRS via Attachment 2

AND

- Verification has been made that no higher priority than a YELLOW PATH exists for the CFSTs,

THEN CONSULT Attachment 1, "Summary of Major Actions for YELLOW Path Status Trees".

3.9 **WHEN** transition is made out of the EOP network and at the CRS direction, **THEN** TERMINATE 2-EOP-CFST-1.

END OF PROCEDURE

SUMMARY OF MAJOR ACTIONS FOR YELLOW PATH STATUS TREES
(Page 1 of 3)

(1) Functional Restoration Shutdown Margin

♦ 2-EOP-FRSM-2 "Response to Loss of Core Shutdown"

Major Actions:

- Check if Loss of Core Shutdown is from core reactivity or instrumentation problems
- Borate the RCS as necessary
- Check shutdown margin

(2) Functional Restoration Core Cooling

♦ 2-EOP-FRCC-3 "Response to Saturated Core Cooling Conditions"

Major Actions:

- Establish ECCS Injection flow to maintain minimum RCS subcooling
- Check for open RCS vent paths (PZR PORVs or Reactor head vents)

(3) Functional Restoration Heat Sink

♦ 2-EOP-FRHS-2 "Response to Steam Generator Overpressure"

Major Actions:

- Isolate FW and release steam from affected SG
- Cooldown RCS using the unaffected SGs

♦ 2-EOP-FRHS-3 "Response to Steam Generator High Level"

Major Actions:

- Isolate affected SG
- Check affected SG for indications of a SGTR
- Establish blowdown from the affected SG

SUMMARY OF MAJOR ACTIONS FOR YELLOW PATH STATUS TREES
(Page 2 of 3)

(3) Functional Restoration Heat Sink (continued)

♦ 2-EOP-FRHS-4 "Response to Loss of SG Atmospheric Reliefs and Condenser Dump Valves"

Major Actions:

- Restore normal steam release capability
- Dump steam locally

♦ 2-EOP-FRHS-5 "Response to Steam Generator Low Level"

Major Actions:

- Verify blowdown isolation
- Determine if the affected SG is faulted
- SG fill rate determination

(4) Functional Restoration Thermal Shock

♦ 2-EOP-FRTS-2 "Response to Anticipated Pressurized Thermal Shock Conditions"

Major Actions:

- Stop RCS cooldown
- Faulted SG isolation
- Decrease RCS pressure to within Tech Spec limits
- Restrict further cooldown if necessary (to less than Tech Spec limits)

(5) Functional Restoration Containment Environment

♦ 2-EOP-FRCE-3 "Response to High Containment Radiation"

Major Actions:

- Verify containment ventilation isolation
- Place CFCUs in service
- Notify TSC of containment radiation levels and perform actions they recommend

SUMMARY OF MAJOR ACTIONS FOR YELLOW PATH STATUS TREES
(Page 3 of 3)

(6) Functional Restoration Coolant Inventory

- 2-EOP-FRCI-1 "Response to High Pressurizer Level"

  Major Actions:

  - **IF** ECCS flow established, **THEN** return to procedure in effect
  - Establish charging and letdown (or excess letdown)
  - Reduce PZR pressure
  - Establish CCW for RCP seal return
  - Energize PZR heaters and control charging and letdown to draw a bubble in the PZR

- 2-EOP-FRCI-2 "Response to Low RCS Inventory"

  Major Actions:

  - Verify normal and excess letdown isolation, establish charging flow
  - Increase charging flow or start ECCS pumps to restore PZR level

- 2-EOP-FRCI-3 "Response to Void in Reactor Vessel"

  Major Actions:

  - Establish charging and letdown (or excess letdown)
  - Repressurize RCS to collapse voids
  - Start a RCP to collapse voids
  - Establish RCS subcooling
  - Vent reactor vessel head

CFST STATUS LOG SHEET

TIME [ ]	RED	PURPLE	YELLOW	GREEN
SHUTDOWN MARGIN	FRSM-1	FRSM-1	FRSM-2	SAT
CORE COOLING	FRCC-1	FRCC-2	FRCC-3	SAT
HEAT SINK	FRHS-1		FRHS-2 FRHS-3 FRHS-4 FRHS-5	SAT
THERMAL SHOCK	FRTS-1	FRTS-1	FRTS-2	SAT
CONTAINMENT ENVIRONMENT	FRCE-1	FRCE-1 FRCE-2	FRCE-3	SAT
COOLANT INVENTORY			FRCI-1 FRCI-2 FRCI-3	SAT

This attachment is to be used:

1) After the first initial scan of the CFSTs is performed.
2) When a change of CFST status is identified.
3) When SPDS indicates a RED or PURPLE path and the individual status tree must be scanned manually.

NOTE: Duplicate copies of this attachment may be contained in this procedure in the event of reproduction device unavailability.

USE OF THE SUBCOOLING MARGIN MONITOR DISPLAY

(Page 1 of 2)

Normal Operations

When the TEST button is extinguished the display is in the "Normal" mode of operation. The ADVERSE and ACK buttons may or may not be backlit in this mode. In the Normal mode, the displayed value is the calculated temperature margin to saturation. Positive values indicate that the RCS is in a subcooled condition while negative readings indicate a superheated condition exist.

NOTE

During accident conditions the TSC must be consulted for use of the Subcooling Margin Monitor ADVERSE button.

Adverse Button Operation

In "Normal" mode, if the Adverse button is illuminated, the displayed temperature margin is adjusted for the adverse conditions of containment pressure and/or radiation.

This is done to compensate the reading for the effect that adverse containment conditions are having on the instrumentation. Depressing the ADVERSE button will illuminate or extinguish its' backlight and manually input or remove the adjustments to the margin calculations. This can be done at any time except during high containment pressure conditions. There is no manual override during high containment pressure conditions.

Containment Pressure - The Adverse button will illuminate whenever the containment pressure setpoint of 4 psig is reached, and will reset and extinguish only at 3 psig. There is no manual reset or override for the overpressure condition.

Containment Radiation - When containment radiation exceeds 1E05 R/HR since last system reset, the Adverse button will flash and the margin displayed will reflect the adjustments made for adverse conditions. Depressing the Adverse button one time will bring the ADVERSE light on solid. Depressing it once more will extinguish the light and remove the adverse adjustments input to the margin calculations.

USE OF THE SUBCOOLING MARGIN MONITOR DISPLAY

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NOTE

The ACK button will be continuously illuminated on channel A & B due to an "Absolute Zero" signal from R44A & R44B wide range radiation monitors. The CETPS sends this signal to the SCMM as an E3 error.

ACK Button Operation

The ACK button is used to acknowledge errors and alarms. A flashing display signifies an error or alarm, and if depressed will remain backlit for as long as the error condition exist. The digital display will go into the flashing mode if a new alarm/error occurs. The following is a list of error numbers that may appear on the SCMM display. After depressing the ACK button, the error number(s) will be displayed twice, then return to the "Normal" display mode

Error #	Description
E0	Any CETC System Error (E65-E73 on chassis front panel)
E1	RCS Pressure Input Shorted or Open
E2	Containment Pressure Input Shorted or Open
E3	Containment Radiation Input Shorted or Open

Diagnostic Test Mode

Procedure SC.OP-SO.CET-0001(Q), Core Exit Thermocouple Processing System Operation, should be referred to for SCMM Diagnostic Test Mode operating instructions.

TABLE A
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SUBCOOLING TABLE - NORMAL CONTAINMENT
(Less than 4 psig AND less than 1E05 R/hr.)

PT403 PT405	T-SAT CET	T-SAT RTD	PT403 PT405	T-SAT CET	T-SAT RTD	PT403 PT405	T-SAT CET	T-SAT RTD
2400	644	646	1600	586	590	800	495	503
2375	642	645	1575	583	587	775	492	499
2350	641	643	1550	581	585	750	488	496
2325	639	642	1525	579	583	725	483	492
2300	638	640	1500	577	581	700	479	488
2275	636	639	1475	574	579	675	475	483
2250	634	637	1450	572	577	650	470	479
2225	633	636	1425	570	574	625	466	475
2200	631	634	1400	567	572	600	461	470
2175	629	632	1375	565	570	575	456	466
2150	628	631	1350	562	567	550	451	461
2125	626	629	1325	560	565	525	446	455
2100	624	627	1300	557	562	500	440	450
2075	623	626	1275	555	560	475	434	445
2050	621	624	1250	552	557	450	428	440
2025	619	622	1225	549	555	425	421	433
2000	617	620	1200	547	552	400	415	428
1975	615	619	1175	544	550	375	407	421
1950	614	617	1150	541	547	350	400	414
1925	612	615	1125	538	544	325	391	407
1900	610	613	1100	535	541	300	383	399
1875	608	611	1075	532	539	275	373	391
1850	606	609	1050	529	535	250	362	382
1825	604	608	1025	526	532	225	351	372
1800	602	606	1000	523	529	200	337	360
1775	600	604	975	520	526	175	321	348
1750	598	602	950	517	523	150	303	332
1725	596	600	925	513	520	125	278	315
1700	594	598	900	510	516	100	242	293
1675	592	596	875	506	513	75	208	263
1650	590	594	850	503	510	50	200	210
1625	588	592	825	499	506	25	200	209

NOTE
Refer to Table D to calculate and record subcooling.

TABLE B
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SUBCOOLING TABLE ADVERSE CONTAINMENT
(Greater than or equal to 4 psig OR 1E05 R/hr.)

PT403 PT405	T-SAT CET	T-SAT RTD	PT403 PT405	T-SAT CET	T-SAT RTD	PT403 PT405	T-SAT CET	T-SAT RTD
2400	629	638	1600	564	576	800	456	471
2375	627	637	1575	562	573	775	451	466
2350	625	635	1550	559	571	750	445	462
2325	624	634	1525	557	569	725	440	456
2300	622	632	1500	554	566	700	434	450
2275	620	631	1475	552	564	675	428	445
2250	618	629	1450	549	562	650	549	562
2225	616	628	1425	546	558	625	414	432
2200	615	625	1400	543	556	600	407	425
2175	613	623	1375	541	554	575	400	418
2150	611	622	1350	538	550	550	391	410
2125	609	620	1325	535	548	525	382	402
2100	607	618	1300	532	544	500	373	393
2075	605	617	1275	529	542	475	362	384
2050	603	614	1250	526	538	450	350	374
2025	601	612	1225	523	536	425	337	362
2000	599	610	1200	519	532	400	321	349
1975	597	609	1175	516	530	375	302	333
1950	596	607	1150	513	526	350	286	315
1925	594	605	1125	509	523	325	278	292
1900	591	602	1100	506	519	300	271	259
1875	589	600	1075	502	516	275	264	211
1850	587	598	1050	499	513	250	256	211
1825	585	597	1025	495	509	225	247	211
1800	583	594	1000	491	505	200	237	211
1775	581	592	975	487	501	175	227	211
1750	578	590	950	483	498	150	215	210
1725	576	588	925	479	494	125	202	210
1700	574	586	900	475	489	100	194	210
1675	571	583	875	470	485	75	194	210
1650	569	581	850	465	481	50	194	210
1625	567	579	825	461	476	25	194	209

NOTE
Refer to Table D to calculate and record subcooling.

TABLE C
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USE OF THE CORE EXIT THERMOCOUPLE DISPLAY PANELS

NOTE

In the "ALL" mode, the display will progress through the first and second highest CETs in each quadrant, then sequentially display all CETs assigned to that channel (channel A or B as applicable). The CET display panel will return to "NORMAL" mode anytime the "TMAX/CET" pushbutton is depressed or the system is left inactive for 3 minutes.

1. SCAN (by selecting the "ALL" mode) and record channel A CETs as follows:

   a. DEPRESS the "SUBMODE/1ST/2ND" pushbutton until "ALL" is indicated on the display and the "SUBMODE/1ST/2ND" pushbutton is illuminated.

   b. RECORD readings on Table C, Page 2 of 3.

2. **IF** Channel A fails,
   THEN SCAN (by selecting the "ALL" mode) and record Channel B CETs as follows:

   a. DEPRESS the "SUBMODE/1ST/2ND" pushbutton until "ALL" is indicated on the display and the "SUBMODE/1ST/2ND" pushbutton is illuminated.

   b. RECORD readings on Table C, Page 3 of 3.

3. INFORM the CRS if any of the following are observed:

   - Five or more CETs exceed 700°F.
   - Five or more CETs exceed 1200°F.
   - An unexpected steady rise in temperature occurs over several minutes.

TABLE C
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CET RECORD CHANNEL A

CET CHAN A	TIME	TIME	TIME	TIME	TIME	TIME	TIME
CE04							
CE14							
CE33							
CE51							
CE57							
CE05							
CE23							
CE35							
CE39							
CE47							
CE21							
CE49							
CE54							
CE58							
CE19							
CE38							
CE48							
CE50							
CE56							
CE15							
CE16							
CE25							
CE37							
CE44							
CE22							
CE45							
CE52							
CE53							
CE55							

TABLE C
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CET RECORD CHANNEL B

CET CHAN B	TIME	TIME	TIME	TIME	TIME	TIME	TIME
CE11							
CE29							
CE30							
CE41							
CE46							
CE02							
CE03							
CE10							
CE13							
CE28							
CE17							
CE18							
CE32							
CE36							
CE43							
CE08							
CE20							
CE26							
CE34							
CE42							
CE01							
CE06							
CE07							
CE12							
CE27							
CE09							
CE24							
CE31							
CE40							

TABLE D
(Page 1 of 1)

RCS SUBCOOLING CALCULATION

TIME	CFST TABLE USED (A/B)	RCS PRESSURE PT-403/405 (PSIG)	Tsat (°F)	RCS* TEMPERATURE T (°F)	SUBCOOLING Tsat-T (°F)

*RCS Temperature - Use CETs (WR Thot RTDs if CETs are not available).

SALEM GENERATING STATION

CRITICAL SAFETY FUNCTION STATUS TREES

BASIS DOCUMENT

EOP Figure No And Title: Figure 1, Block 1

ERG Status Tree No: F-0.1

Decision Block:

POWER RANGE LESS THAN 5%

Purpose:

To determine if nuclear power is significant.

ERG Basis:

Following a reactor trip, nuclear power promptly drops to only a few percent of nominal, and then decays away to a level some 8 decades less. Decay heat levels resulting from radioactive fission product decay are never more than a few percent of nominal power and also decrease in time. Safeguards heat removal systems are sized to remove only decay heat and not significant core power. The 5% level was chosen because it is clearly readable on the power range meters. Nuclear power above a 5% level, in a core supposed to be shutdown, is considered an extreme challenge to the fuel clad/matrix barrier and a RED priority is warranted. The appropriate procedure for function restoration is FRSM-1, RESPONSE TO NUCLEAR POWER GENERATION.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
5%	P.02	Maximum nuclear power level for performance of the EOP network.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 1, Block 2

ERG Status Tree No: F-0.1

Decision Block:

IR SUR ZERO OR NEGATIVE

Purpose:

To determine the behavior of neutron flux on the IR channels.

ERG Basis:

At this point, power range flux has been determined to be not significant, so no extreme challenge exists. However, a positive startup rate (SUR) in the intermediate range will shortly lead to power production if operator action is not taken, since no inherent feedback mechanisms exist below the point of adding heat. A positive SUR is considered a severe challenge to the Safety Function and a PURPLE priority is warranted. The appropriate procedure for function response is EOP-FRSM-1, RESPONSE TO NUCLEAR POWER GENERATION.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 1, Block 3

ERG Status Tree No: F-0.1

Decision Block:

SOURCE RANGE ENERGIZED

Purpose:

To determine if high voltage is applied to the SR detectors.

ERG Basis:

This decision point is used to determine if further evaluation should be directed at the SR flux behavior, or back at the IR channel indications.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 1, Block 4

ERG Status Tree No: F-0.1

Decision Block:

SOURCE RANGE SUR ZERO OR NEGATIVE

Purpose:

To check for adequate indication of subcriticality.

ERG Basis:

Normally, following reactor trip, neutron flux decreases into the source range and stays there. Typically SR count rate fluctuates and does not exhibit any sustained increasing trend. Such a trend, as indicated by a positive SUR, is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRSM-2, RESPONSE TO LOSS OF CORE SHUTDOWN. If source range SUR is zero or negative the Shutdown Margin CFST is satisfied.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: Variations in the source range count rate could cause a temporary positive SUR. A sustained increasing trend indicates a YELLOW priority condition.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 1, Block 5

ERG Status Tree No: F-0.1

Decision Block:

IR SUR MORE NEGATIVE THAN -0.2 DPM

ERG Basis:

Normally, following reactor trip, intermediate range flux decays at a constant -0.3 dpm. A rate of decrease less negative than -0.2 dpm (e.g., -0.1 dpm) is considered to represent a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRSM-2, RESPONSE TO LOSS OF CORE SHUTDOWN. If the rate of decrease is more negative than -0.2 dpm, then the Shutdown Margin CFST criterion are satisfied.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
-0.2 dpm	P.04	Intermediate range startup rate for entry into FRSM-2.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 2, Block 1

ERG Status Tree No: F-0.2

Decision Block:

5 OR MORE CETs GREATER THAN 1200 DEGREES

Purpose:

To determine if inadequate core cooling has been reached.

ERG Basis:

Analyses of inadequate core cooling scenarios show that core exit temperature greater than 1200°F is a satisfactory criterion for basing extreme operator action. At least 5 thermocouples should be reading greater than 1200°F. Five has been chosen to allow for thermocouples failing high. This temperature indicates that most liquid inventory has already been removed from the RCS and that core decay heat is superheating steam in the core. An extreme challenge to the fuel matrix/clad barrier is imminent and a RED priority is warranted. The appropriate procedure for functional response is EOP-FRCC-1, RESPONSE TO INADEQUATE CORE COOLING. If CETs are less than 1200°F, then subsequent blocks check for other extreme, severe, not satisfied or satisfied conditions for the Core Cooling CFST.

EOP Basis:

Same as ERG basis.

Supplemental Information:

Plant-Specific Information: The following criteria should be used to determine which CETs to monitor:

1. At least one CET should be located as close as possible to the geometric center of the core.

2. The other CETs should be located at least one per quadrant over the highest power assemblies in each quadrant. The outer two rows of assemblies should be excluded, since they can receive significant cooling from SG drainage due to refluxing. The CETs should be selected at each refueling to ensure that the highest power assemblies are always being used.

3. If the capability exists to monitor a large percentage or all of the CETs and rapidly determine if five of the CETs are reading greater than 1200°F, then this capability may be used. For example, if a SPDS which monitors all the CETs and automatically selects and displays the highest CET readings in each quadrant is available, then this system could be used during the accident to determine if an inadequate core cooling condition exists. In this case, it is not necessary to preselect five specific CETs to monitor during the accident.

EOP Figure No And Title: Figure 2, Block 1 (CONTINUED)

Supplemental Information: (CONTINUED)

Plant-Specific Information: Hot leg temperature indications are not recommended for use in determining an inadequate core cooling condition. Analyses presented in ERG References 1 and 2 show that hot leg temperature reacts significantly slower than core exit temperature to uncovery of the core for some scenarios. The major reason being that water draining from the SGs to the core can affect the hot leg temperature indication. Also, hot leg temperature at best indicates the average core temperature while CETs indicate a localized exit temperature above the hottest regions of the core.

Plant-Specific Information: It is not necessary to add instrument uncertainties to the 1200°F value. An uncertainty of up to 200°F was factored into the selection of this value.

Setpoints and Numerical Values:

Value	Setpoint	Description
1200°F	G.04	Core exit temperature indicative of superheat conditions.

ERG Deviations:

DEV.1 Specified "5 OR MORE CETs" whereas ERG does not specify any particular number.

JUST. Incorporated basis information requirements, which allow for erroneous readings on one or two CETs.

EOP Figure No And Title: Figure 2, Block 2

ERG Status Tree No: F-0.2

Decision Block:

RCS SUBCOOLING GREATER THAN 0 DEGREES

Purpose:

To determine if core exit subcooling is being maintained and ECCS flow not required.

ERG Basis:

If core exit subcooling is less than 0°F, then ECCS flow should be maintained to the RCS to provide inventory make-up and the Core Cooling CFST criteria are not satisfied. Subsequent blocks check for inadequate or degraded core cooling conditions. If greater than 0°F RCS subcooling is indicated, then the CFST criteria are satisfied.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
0°F	R.01	The sum of temperature and pressure measurement system errors including allowances for normal channel accuracies, translated into temperature using saturation tables - based on Subcooling Margin Monitor.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 2, Block 3

ERG Status Tree No: F-0.2

Decision Block:

IS ANY RCP RUNNING

Purpose:

To determine which RVLIS range is applicable for subsequent symptoms.

ERG Basis:

The reference plant RVLIS has two ranges, full range and dynamic head range, for use without RCPs running and with RCPs running, respectively. This block determines which reading should be used to assess the Core Cooling CFST status in subsequent blocks. If any RCP is running, then the dynamic head range of RVLIS should be used in assessing core cooling conditions. If no RCP is running, then the full range should be used. Refer to the document REACTOR VESSEL LIQUID INVENTORY SYSTEM in the Generic Issues section of the ERG Executive Volume. <The first sentence conflicts with reference plant RVLIS design as described in DW-94-025 (three ranges). DW-96-025 has been submitted by this plant to correct text to be consistent with DW-94-025 basis....Riley>

EOP Basis:

Same as ERG basis, with the following additional information:

Plant design includes three RVLIS ranges-- full, upper, and dynamic. Full and upper range indications are only valid with all RCPs stopped. Dynamic range indication is valid when one or more RCPs are running.

Supplemental Information:

None

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 2, Block 4

ERG Status Tree No: F-0.2

Decision Block:

5 OR MORE CETs GREATER THAN 700 DEGREES

Purpose:

To determine if one of the alternate inadequate core cooling criteria has been exceeded.

ERG Basis:

If at least five core exit thermocouples indicate greater than 700°F, superheat at the core exit is indicated. An inadequate core cooling condition will exist if, in the next block, RVLIS indicates less than 3.5 feet collapsed liquid level in the core. If core exit thermocouples indicate less than 700°F, then an inadequate core cooling condition does not exist and the subsequent RVLIS check will assess whether a degraded core cooling condition has been reached.

EOP Basis:

Same as ERG basis.

Supplemental Information:

Plant-Specific Information: CETs to be monitored should be chosen the same as for 1200°F.

Setpoints and Numerical Values:

Value	Setpoint	Description
700°F	G.03	Core exit temperature corresponding to 670°F plus normal channel accuracy or 700°F, whichever is greater.

ERG Deviations:

DEV.1 Specified "5 OR MORE CETs" whereas ERG does not specify any particular number.

JUST. Incorporated basis information requirements, which allow for erroneous readings on one or two CETs.

EOP Figure No And Title: Figure 2, Block 5

ERG Status Tree No: F-0.2

Decision Block:

RVLIS DYNAMIC RANGE GREATER THAN:
- 44% FOR 4 RCPs
- 30% FOR 3 RCPs
- 20% FOR 2 RCPs
- 13% FOR 1 RCP

Purpose:

To determine if RCS voiding has increased to greater than 50% void fraction with any RCP running

ERG Basis:

If an RCP is operating, then even under a highly voided RCS condition, the CETs can be expected to indicate saturated temperatures. This block checks for RCS voiding less than 50% which, if RCPs are subsequently stopped, would ensure the core would initially be kept covered and adequately cooled. If RVLIS dynamic head range is less than 44%, 30%, 20%, 13%, depending on the number of RCPs running, then a degraded core cooling condition exists. A PURPLE priority is warranted and EOP-FRCC-2, RESPONSE TO INADEQUATE CORE COOLING, is the appropriate procedure for functional response. If RVLIS dynamic head range is greater than 44%, 30%, 20%, 13%, depending on the number of RCPs running, then only a saturated core cooling condition exists. A YELLOW priority is warranted and EOP-FRCC-3, RESPONSE TO SATURATED CORE COOLING CONDITIONS, is the appropriate procedure for functional response.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

EOP Figure No And Title: Figure 2, Block 5 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
44% - 4 RCPs 30% - 3 RCPs 20% - 2 RCPs 13% - 1 RCP	L.01	RVLIS dynamic range value corresponding to an average system void fraction of 50 percent with RCPs running plus uncertainties.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 2, Block 6

ERG Status Tree No: F-0.2

Decision Block:

RVLIS FULL RANGE GREATER THAN 39%

Purpose:

To determine if the core is uncovered to less than 39% and an inadequate core cooling condition exists.

ERG Basis:

If RVLIS full range is less than 39%, then the core is uncovered and an inadequate core cooling condition has been reached. A RED priority is warranted and FRCC-1, RESPONSE TO INADEQUATE CORE COOLING, is the appropriate procedure for functional response. If RVLIS full range is greater than 39%, then a degraded core cooling condition exists since the core exit temperatures are greater than 700°F from the previous block. A PURPLE priority is warranted and EOP-FRCC-2, RESPONSE TO DEGRADED CORE COOLING, is the appropriate procedure for functional response.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
39%	K.01	RVLIS full range value which is 3.5 feet above the bottom of the active fuel in core with zero void fraction plus uncertainties.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 2, Block 7

ERG Status Tree No: F-0.2

Decision Block:

RVLIS FULL RANGE GREATER THAN 39%

Purpose:

To determine if a degraded core cooling condition has been reached

ERG Basis:

If RVLIS full range is less than 39%, then the core is uncovered, but since core exit temperature has not reached 700°F, an inadequate core cooling condition has not been reached. A degraded core cooling condition exists. A PURPLE priority is warranted and EOP-FRCC-2, RESPONSE TO DEGRADED CORE COOLING, is the appropriate procedure for functional response. If RVLIS full range is greater than 39%, then only a saturated core cooling condition exists. A YELLOW priority is warranted and EOP-FRCC-3, RESPONSE TO SATURATED CORE COOLING, is the appropriate procedure for functional response.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
39%	K.01	RVLIS full range value which is 3.5 feet above the bottom of the active fuel in core with zero void fraction plus uncertainties.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 3, Block 1

ERG Status Tree No: F-0.3

Decision Block:

SG NR GREATER THAN 9% (15% ADVERSE) IN AT LEAST ONE SG

Purpose:

To determine if at least one SG has level sufficient for maintenance of a heat sink

ERG Basis:

A level in the NR in any SG, including a ruptured SG, is sufficient to ensure an adequate secondary inventory for a secondary heat sink. If level is not in the NR, the operation of the feed system will determine whether a loss of secondary heat sink is imminent.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
9%	M.02	Value showing S/G level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing S/G level just in the narrow range including allowance for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 3, Block 2

ERG Status Tree No: F-0.3

Decision Block:

TOTAL FEEDWATER FLOW TO SGs GREATER THAN 22E04 LB/HR

Purpose:

To determine, in the absence of SG NR level on span, whether feed flow is sufficient to establish a secondary heat sink.

ERG Basis:

Total feedwater flow of greater than 22E04 LB/HR ensures that, in the absence of NR level in any SG, the capability of feedwater to restore level and maintain a secondary heat sink is available. If not, then an extreme challenge to heat sink is imminent and a RED priority is warranted. The appropriate procedure for functional response is EOP-FRHS-1, RESPONSE TO LOSS OF SECONDARY HEAT SINK.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If feed flow is throttled due to operator action instructed from EOP-LOSC-2, MULTIPLE STEAM GENERATOR DEPRESSURIZATION, EOP-FRTS-1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITIONS, or due to SG level setpoints for normal containment conditions in other procedures, then EOP-FRHS-1 does not need to be implemented.

Setpoints and Numerical Values:

Value	Setpoint	Description
$22x10^4$ lb/hr	S.02	The minimum safeguards AFW flow requirement for heat removal plus allowances for normal channel accuracy (typically one AFW pump capacity at SG design pressure).

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 3, Block 3

ERG Status Tree No: F-0.3

Decision Block:

ALL SG PRESSURES LESS THAN 1125 PSIG

Purpose:

To determine if any SG pressure is above the SG design limits.

ERG Basis:

In the event that pressure in any SG is greater than the highest steamline safety valve setpoint, then the SG design limit may be exceeded and integrity may be challenged. Also, there is no flow path in use removing energy from that SG. The heat sink function is not satisfied and a YELLOW priority is warranted. The appropriate procedure for functional response is EOP-FRHS-2, RESPONSE TO STEAM GENERATOR OVERPRESSURE.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
1125 psig	O.01	Pressure for highest steamline safety valve setpoint.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 3, Block 4

ERG Status Tree No: F-0.3

Decision Block:

ALL SG NR LEVELS LESS THAN 67%

Purpose:

To determine if any SG is approaching an overfill condition.

ERG Basis:

An overfeed due to excess feed flow or a SGTR may lead to a high level in an SG. This block checks all SGs to ensure identification since it may cause unwanted atmospheric releases or challenge SG integrity. Note that although the level in the affected SG may reach the top of the NR span, significant volume still exists before the SG fills with water. The heat sink function is not satisfied and a YELLOW priority is warranted. The appropriate procedure for functional response is EOP-FRHS-3, RESPONSE TO STEAM GENERATOR HIGH LEVEL.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If a high SG level is occurring in an SG identified as ruptured, then guidance provided in the SGTR series procedures is appropriate to prevent further primary-to-secondary leakage.

Setpoints and Numerical Values:

Value	Setpoint	Description
67%	M.04	Value corresponding to high-high S/G level feedwater isolation.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 3, Block 5

ERG Status Tree No: F-0.3

Decision Block:

ALL SG PRESSURES LESS THAN 1070 PSIG

Purpose:

To determine if any SG safety valves are open.

ERG Basis:

If any SG safety valve is open, then an unisolable heat removal path is being used. A better path is to use steam dump to condenser or SG atmospheric steam dumps which are controllable and isolable. Also, condenser steam dump will not release steam to the atmosphere. The heat sink function is not satisfied and a YELLOW priority is warranted. The appropriate procedure for functional response is EOP-FRHS-4, RESPONSE TO LOSS OF SG ATMOSPHERIC RELIEFS AND CONDENSER DUMP VALVES.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
1070 psig	O.02	Pressure for lowest steamline safety valve setpoint.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 3, Block 6

ERG Status Tree No: F-0.3

Decision Block:

ALL SG NR LEVELS GREATER THAN 9% (15% ADVERSE)

Purpose:

To determine if all SGs have level and inventory in the normal range.

ERG Basis:

Feedwater should be maintained until all SGs are in the NR unless a faulted SG is identified. NR level is reestablished in all SGs to maintain symmetric cooling of the RCS. If any level is low, the heat sink function is not satisfied and a YELLOW priority is warranted. The appropriate procedure for functional response is EOP-FRHS-5, RESPONSE TO STEAM GENERATOR LOW LEVEL.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: A faulted SG that has had feed flow isolated to it will result in this indication.

Setpoints and Numerical Values:

Value	Setpoint	Description
9%	M.02	Value showing S/G level just in the narrow range including allowances for normal channel accuracy and reference leg process errors.
15%	M.03	Value showing S/G level just in the narrow range including allowance for normal channel accuracy, post-accident transmitter errors, and reference leg process errors, not to exceed 50%.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 1

ERG Status Tree No: F-0.4

Decision Block:

ALL T-COLD COOLDOWN RATES LESS THAN 100°F IN LAST 60 MINUTES

Purpose:

To determine if a cold leg cooldown in excess of normal cooldown limits has occurred.

ERG Basis:

If the temperature decrease in any cold leg has exceeded 100°F in the previous 60 minutes, then there is a potential concern for thermal shock. If not, then no other checks on rate-dependent limits are necessary. The only concern remaining is cold overpressure which will be checked in subsequent blocks. If the temperature decrease has exceeded 100°F in the previous 60 minutes, the degree of cooldown must be assessed before a thermal shock concern can be identified. This is checked in subsequent blocks.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
100°F	I.04	Maximum cold leg temperature decrease in any 60 minute time period to prevent a challenge to the reactor pressure vessel integrity.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 2

ERG Status Tree No: F-0.4

Decision Block:

ALL T-COLDs GREATER THAN 312°F

Purpose:

To determine if RCS temperature is less than where POPS should be in service.

ERG Basis:

In order to determine if cold overpressure is a concern, a check is made on whether RCS cold leg temperature has decreased to below the temperature at which POPS should be placed in service. Subsequent blocks check if a cold overpressure condition exists.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
312°F	I.06	RCS temperature below which cold overpressure protection system (POPS) is required to be in service.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 3

ERG Status Tree No: F-0.4

Decision Block:

ALL RCS PRESSURE/TEMP POINTS TO THE RIGHT OF LIMIT A

Purpose:

To determine if limits indicating a potential thermal shock have been exceeded.

ERG Basis:

The objective of Limit A is to provide a limit that indicates a potential thermal shock condition exists if it is exceeded. The basis of this limit is to prevent growth of a flaw that could conservatively be present in the vessel wall. The method used to calculate this limit is described in the DESCRIPTION section of the ERG background document. If Limit A has been exceeded, then operator action is necessary to limit further RCS temperature decreases or RCS pressure increases. A RED priority is warranted since an extreme challenge to the function is occurring and EOP-FRTS-1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITION, is the appropriate procedure for functional response.

If Limit A has not been exceeded, then additional checks are made in subsequent blocks to determine if a less severe thermal shock condition exists.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
Table	C.04	Limit A corresponding to the generic category which bounds plant specific vessel RTNDT, including temperature normal channel accuracy and post accident transmitter errors

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 4

ERG Status Tree No: F-0.4

Decision Block:

RCS PRESSURE LESS THAN 375 PSIG

Purpose:

To determine if cold overpressurization limit has been exceeded.

ERG Basis:

If the cold overpressure protection system should be in service and RCS pressure exceeds cold overpressure limits, then action may be necessary to minimize or decrease RCS pressure. The priority of action will be determined in subsequent blocks. If RCS pressure has not exceeded the cold overpressure limit, then the Thermal Shock CFST is satisfied.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
375 psig	B.13	RCS pressure for placing PZR Overpressure Protection System (POPS) in service.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 5

ERG Status Tree No: F-0.4

Decision Block:

ALL T-COLDs GREATER THAN 280°F

Purpose:

To determine if RCS conditions have reached an imminent thermal shock condition where full repressurization should not be allowed.

ERG Basis:

The region between Limit A and 280°F is where a flaw is not calculated to grow, but where Limit A may be quickly exceeded if repressurization occurs. If any cold leg temperature is less than 280°F, then operator action is necessary to minimize further RCS temperature decreases and RCS pressure increases. A PURPLE priority is warranted since a severe challenge to the function exists and EOP-FRTS-1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITIONS, is the appropriate procedure for functional response. If all cold leg temperatures are greater than 280°F, then a subsequent block checks for a less severe thermal shock condition.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
280°F	I.01	RCS cold leg temperature corresponding to temperature T1, including allowances for normal channel accuracy and post-accident transmitter errors. Refer to background document for status tree F-04, INTEGRITY.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 6

ERG Status Tree No: F-0.4

Decision Block:

ALL T-COLDs GREATER THAN 280°F

Purpose:

To determine if full repressurization is allowed for a cold overpressure condition.

ERG Basis:

If cold leg temperature in any RCS cold leg is less than 280°F and RCS pressure is greater than the cold overpressure limit, then a severe challenge to the function exists and operator action is necessary to limit RCS pressure. A PURPLE priority is warranted and EOP-FRTS-1, RESPONSE TO IMMINENT PRESSURIZED THERMAL SHOCK CONDITIONS, is the appropriate procedure for functional response.

If all RCS cold leg temperatures are greater than 280°F, then even though the cold overpressure limit has been exceeded (previous block), there is no extreme or severe challenge to vessel integrity, even at very high pressure. A YELLOW priority is warranted, however, since the function is not satisfied and EOP-FRTS-2, RESPONSE TO ANTICIPATED PRESSURIZED THERMAL SHOCK CONDITIONS, is the appropriate procedure for functional response.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
280°F	I.01	RCS cold leg temperature corresponding to temperature T1, including allowances for normal channel accuracy and post-accident transmitter errors. Refer to background document for status tree F-04, INTEGRITY.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 4, Block 7

ERG Status Tree No: F-0.4

Decision Block:

ALL T-COLDs GREATER THAN 310°F

Purpose:

To determine if RCS conditions are within limits where a thermal shock condition would be anticipated.

ERG Basis:

If any cold leg temperature is less than 310°F, then conditions are close to the point where an extreme or severe challenge to a Thermal Shock limit will exist. The temperature region between 310°F and 280°F is intended to allow time for operator action to try to prevent entering a region of imminent thermal shock. It has also been defined because cooldown limits more restrictive than the Technical Specification normal cooldown curves are required to safely achieve cold shutdown conditions. For these reasons the function is not satisfied and a YELLOW priority is warranted. The appropriate procedure for functional response is EOP-FRTS-2, RESPONSE TO ANTICIPATED PRESSURIZED THERMAL SHOCK CONDITIONS. If all RCS cold leg temperatures are greater than 310°F, then the Thermal Shock CFST is satisfied.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If a YELLOW priority is reached during a greater than 100°F in one hour cooldown, no soak is required but additional restrictions beyond Technical Specifications do apply.

Setpoints and Numerical Values:

Value	Setpoint	Description
310°F	I.02	RCS cold leg temperature corresponding to temperature T2, including allowances for normal channel accuracy. Refer to background document for status tree F-04, INTEGRITY.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 5, Block 1

ERG Status Tree No: F-0.5

Decision Block:

CONTAINMENT PRESSURE LESS THAN 47 PSIG

Purpose:

To evaluate if pressure in containment is less than design pressure.

ERG Basis:

If containment pressure is greater than design pressure, an extreme challenge to the containment barrier exists. The challenge does not necessarily come from the pressure alone, but rather from the potential pressure spike which could result from a hydrogen ignition. The total pressure could then potentially exceed the strength of containment. Also, above containment design pressure, leakage may exceed design basis limits. It is expected that containment pressure suppression equipment should be able to maintain pressure below design pressure. If not, then operator action is necessary to check containment functions and a RED priority is warranted. The appropriate procedure for function restoration is EOP-FRCE-1, RESPONSE TO EXCESSIVE CONTAINMENT PRESSURE.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: It should be noted that once all actions of EOP-FRCE-1 are completed and the operator is returned to the procedure and step in effect, this particular containment function may not be restored and the Containment Environment CFST may continue to display a RED priority. If this is the case, EOP-FRCE-1 does not need to be implemented again since all necessary actions have already been performed.

Setpoints and Numerical Values:

Value	Setpoint	Description
47 psig	T.03	Value corresponding to containment design pressure.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 5, Block 2

ERG Status Tree No: F-0.5

Decision Block:

CONTAINMENT PRESSURE LESS THAN 15 PSIG

Purpose:

To determine if the pressure in containment is less than High-3 pressure setpoint.

ERG Basis:

Pressure above High 3 indicates a significant energy release to containment and merits prompt operation of containment pressure suppression equipment and performance of Phase B Isolation. At pressures below design pressure, it is unlikely that even a hydrogen ignition could result in sufficient overpressure to fail containment. Therefore, pressure above High-3 is considered a severe challenge to the containment barrier, but gives the operator significant margin for pressure suppression and a PURPLE priority is warranted. The appropriate procedure for function restoration is EOP-FRCE-1, RESPONSE TO EXCESSIVE CONTAINMENT PRESSURE.

EOP Basis:

Same as ERG basis with the following additional information:

Salem plant design only includes High-1 and High-2 setpoints for Containment pressure. High-3 for the Reference Plant (CS actuation) corresponds to High-2 (15 psig) for Salem. The Containment Spray System constitutes the "containment pressure suppression equipment" in the ERG basis.

Supplemental Information:

ERG Knowledge Item: It should be noted that once all actions of EOP-FRCE-1 are completed and the operator is returned to the procedure and step in effect, this particular containment function may not be restored and the Containment Environment CFST may continue to display a PURPLE priority. If this is the case, EOP-FRCE-1 does not need to be implemented again since all necessary actions have already been performed.

Setpoints and Numerical Values:

Value	Setpoint	Description
15 psig	T.02	Containment pressure setpoint for spray actuation.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 5, Block 3

ERG Status Tree No: F-0.5

Decision Block:

CONTAINMENT SUMP LESS THAN 78% (75% ADVERSE)

Purpose:

To determine if containment is flooded.

ERG Basis:

High energy line breaks could result in a large volume of water being pumped into containment. As the water level rises, it might threaten the availability of equipment required for long term cooling of the core and/or containment. Such a high water level is considered a severe challenge to the containment barrier and a PURPLE priority is warranted. The appropriate procedure for function restoration is EOP-FRCE-2, RESPONSE TO HIGH CONTAINMENT SUMP LEVEL.

[DW-91-027] Include both normal and adverse sump level values if instrumentation is subject to adverse containment conditions.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: It should be noted that once all actions of EOP-FRCE-2 are completed and the operator is returned to the procedure and step in effect, this particular containment function may not be restored and the Containment Environment CFST may continue to display a PURPLE priority. If this is the case, EOP-FRCE-2 does not need to be implemented again since all necessary actions have already been performed.

EOP Figure No And Title: Figure 5, Block 3 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
78%	T.07	Containment water level just below design flood level minus allowances for normal channel accuracy.
75%	T.08	Containment water level just below design flood level minus allowances for normal channel accuracy and post accident transmitter errors.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 5, Block 4

ERG Status Tree No: F-0.5

Decision Block:

R-44 RADIATION LESS THAN 2 R/Hr

Purpose:

To determine if Containment Building radiation is less than 2 R/hr.

ERG Basis:

Normally, Containment Building radiation levels are fairly low and constant. However, during an accident, significant radioactivity may be released into the containment atmosphere. In-containment systems are available to filter and scrub the contaminants from the atmosphere, and radiation alone does not represent a threat to containment integrity. This is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCE-3, RESPONSE TO HIGH CONTAINMENT RADIATION. If containment radiation is less than 2 R/hr, then the CFST criteria are satisfied.

EOP Basis:

Same as ERG basis.

Supplemental Information:

Plant-Specific Information: Though the 2 R/hr setpoint is plant-specific, a typical setpoint value would be 2 R/hr to 3 R/hr. The radiation alarm setpoint would be reached due to any significant RCS leakage into containment or after a steamline break inside containment assuming Technical Specification leakage from the SGs.

Setpoints and Numerical Values:

Value	Setpoint	Description
2 R/hr	T.20	Radiation level alarm setpoint for post accident containment radiation monitor.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 1

ERG Status Tree No: F-0.6

Decision Block:

PZR LEVEL LESS THAN 92%

Purpose:

To determine if PZR level is above the normal operating range.

ERG Basis:

This decision point allows proper resolution of the actual inventory condition in subsequent decision blocks. If PZR level is above the normal operating range, the next decision block determines if it is due to excess inventory or voids in the vessel. If level is not high, then further questions check for low level and voids in the vessel.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
92%	D.03	Pressurizer high level reactor trip setpoint.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 2

ERG Status Tree No: F-0.6

Decision Block:

PZR LEVEL GREATER THAN 17%

Purpose:

To determine if PZR level is below the normal operating range.

ERG Basis:

This block is entered after having determined that PZR level is not high. If level is also not low, then the PZR inventory is considered satisfactory and a further question is asked about reactor vessel level. If PZR level is not greater than 17%, then the problem is one of low inventory, with or without voids in the vessel. The condition is considered a not satisfied condition and a YELLOW priority is warranted. The Core Cooling Status Tree checks for more severe or extreme challenges to Coolant Inventory that also challenge the Core Cooling CFST. The appropriate procedure for function restoration is EOP-FRCI-2, RESPONSE TO LOW RCS INVENTORY.

EOP Basis:

Same as ERG basis.

Supplemental Information:

None

Setpoints and Numerical Values:

Value	Setpoint	Description
17%	D.02	Pressurizer level letdown isolation setpoint.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 3

ERG Status Tree No: F-0.6

Decision Block:

IS ANY RCP RUNNING (added by DW-94-025)

Purpose:

To determine the proper RVLIS range to use.

ERG Basis:

The reference plant RVLIS has three ranges, full range and upper range, which are used without RCPs running, and dynamic head range which is used with RCPs running. This block determines which range should be used to assess the Coolant Inventory CFST status in subsequent blocks. If no RCP is running, then the full range should be used. If any RCP is running, then there will not be a steam void in the upper head due to RCPs forcing flow into the upper head region. Any indicated void will be in the form of a non-condensable gas/water mixture that is forced through the core via the running RCP. Since subsequent stopping of the RCPs may cause an upper head void when the non-condensables come out of solution, it is desirable to vent in an attempt to remove any non-condensables that have accumulated in the upper head while the RCPs are running. Therefore, the dynamic range RVLIS is used to determine the potential for upper head voiding once the pumps are stopped Refer to the document REACTOR VESSEL LIQUID INVENTORY SYSTEM in the Generic Issues section of the ERG Executive Volume. (DW-94-025)

[DW-94-025] Revised Coolant Inventory Status Tree and clarified RVLIS ranges to be used.

EOP Basis:

Same as ERG basis.

Supplemental Information:

Commitment C0550: This commitment indicates in a general way that EOP-CFST-1 Figure 6 should be revised to address concerns raised in LER 272/94-007-01. DW-94-025 meets the intent of this commitment.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 4

ERG Status Tree No: F-0.6

Decision Block:

IS ANY RCP RUNNING (added by DW-94-025)

Purpose:

To determine the proper RVLIS range to use.

ERG Basis:

The reference plant RVLIS has three ranges, full range and upper range, which are used without RCPs running, and dynamic head range which is used with RCPs running. This block determines which range should be used to assess the Coolant Inventory CFST status in subsequent blocks. If no RCP is running, then the full range should be used. If any RCP is running, then there will not be a steam void in the upper head due to RCPs forcing flow into the upper head region. Any indicated void will be in the form of a non-condensable gas/water mixture that is forced through the core via the running RCP. Since subsequent stopping of the RCPs may cause an upper head void when the non-condensables come out of solution, it is desirable to vent in an attempt to remove any non-condensables that have accumulated in the upper head while the RCPs are running. Therefore, the dynamic range RVLIS is used to determine the potential for upper head voiding once the pumps are stopped Refer to the document REACTOR VESSEL LIQUID INVENTORY SYSTEM in the Generic Issues section of the ERG Executive Volume. (DW-94-025)

[DW-94-025] Revised Coolant Inventory Status Tree and clarified RVLIS ranges to be used.

EOP Basis:

Same as ERG basis.

Supplemental Information:

Commitment C0550: This commitment indicates in a general way that EOP-CFST-1 Figure 6 should be revised to address concerns raised in LER 272/94-007-01. DW-94-025 meets the intent of this commitment.

Setpoints and Numerical Values:

None

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 5

ERG Status Tree No: F-0.6

Decision Block:

RVLIS DYNAMIC RANGE GREATER THAN:
93% FOR 4 RCPs
63% FOR 3 RCPs
42% FOR 2 RCPs
32% FOR 1 RCP

Purpose:

To determine if voids exist in the reactor vessel.

ERG Basis:

Having already determined that PZR level is high, this question tries to define the cause. If the upper head region is full, then the problem is simply one of excess inventory; the condition is considered not satisfied for Coolant Inventory and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-1, RESPONSE TO HIGH PRESSURIZER LEVEL. If the RVLIS does indicate voids in the upper head region, then the problem is likely due to some type of bubble in that region. *If RCPs are running, a steam void is not expected to exist in the upper head. Instead, the void will be in the form of a non-condensable gas/water mixture that is forced through the core via the running RCP. Since the presence of a small void fraction* in itself does not represent a challenge to the Inventory CFST, it is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-3, RESPONSE TO VOID IN REACTOR VESSEL. (DW-94-025)

[DW-94-025] Revised Coolant Inventory Status Tree and clarified RVLIS ranges to be used.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If a controlled cooldown is in progress and cooldown/depressurization must continue, then FRCI-3 should not be implemented.

Commitment C0550: This commitment indicates in a general way that EOP-CFST-1 Figure 6 should be revised to address concerns raised in LER 272/94-007-01. DW-94-025 meets the intent of this commitment.

EOP Figure No And Title: Figure 6, Block 5 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
93% FOR 4 RCPs 63% FOR 3 RCPs 42% FOR 2 RCPs 32% FOR 1 RCP	L.03	RVLIS dynamic range value corresponding to an average system void fraction of 0 percent with RCPs running including allowances for normal channel accuracy.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 6

ERG Status Tree No: F-0.6

Decision Block:

RVLIS UPPER RANGE GREATER THAN 100%

Purpose:

To determine if voids exist in the reactor vessel.

ERG Basis:

Having already determined that PZR level is high, this question tries to define the cause. If the upper head region is full, then the problem is simply one of excess inventory; the condition is considered not satisfied for Inventory and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-1, RESPONSE TO HIGH PRESSURIZER LEVEL. If the RVLIS does indicate voids in the upper head region, then the problem is likely due to some type of bubble in that region. Since the presence of a bubble, in itself, does not represent a challenge to the Coolant Inventory CFST, it is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-3, RESPONSE TO VOID IN REACTOR VESSEL. *It is acceptable to use RVLIS upper range instead of full range in this decision block.* (DW-94-025)

[DW-94-025] Revised Coolant Inventory Status Tree and clarified RVLIS ranges to be used.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If a controlled natural circulation cooldown is in progress and cooldown/depressurization must continue, then FRCI-3 should not be implemented.

Commitment C0550: This commitment indicates in a general way that EOP-CFST-1 Figure 6 should be revised to address concerns raised in LER 272/94-007-01. DW-94-025 meets the intent of this commitment.

EOP Step No: Figure 6, Block 6 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
100%	J.01	RVLIS upper range value indicating upper head region full.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 7

ERG Status Tree No: F-0.6

Decision Block:

RVLIS DYNAMIC RANGE GREATER THAN:
93% FOR 4 RCPs
63% FOR 3 RCPs
42% FOR 2 RCPs
32% FOR 1 RCP

Purpose:

To determine if voids exist in the reactor vessel.

ERG Basis:

Having determined that PZR level is normal, the remaining inventory question relates to water level in the reactor vessel. If level does not indicate that the vessel is full, then some type of voids are present in the vessel upper head. *If RCPs are running, a steam void is not expected to exist in the upper head. Instead, the void will be in the form of a non-condensables gas/water mixture that is forced through the core via the running RCP. Since the presence of a small void fraction in itself* does not represent a challenge to the Coolant Inventory CFST. It is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-3, RESPONSE TO VOID IN THE REACTOR VESSEL. (DW-94-025)

[DW-94-025] Revised Coolant Inventory Status Tree and clarified RVLIS ranges to be used.

EOP Basis:

Having determined that PZR level is normal, the remaining inventory question relates to water level in the reactor vessel. If level does not indicate that the vessel is full, then some type of voids are present in the vessel upper head. The presence of an upper head void does not, in itself, represent a challenge to the Coolant Inventory CFST. It is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-3, RESPONSE TO VOIDS IN THE REACTOR VESSEL.

EOP Figure No And Title: Figure 6, Block 7 (CONTINUED)

Supplemental Information:

ERG Knowledge Item: If a controlled cooldown is in progress and cooldown/depressurization must continue, then FRCI-3 should not be implemented.

Commitment C0550: This commitment indicates in a general way that EOP-CFST-1 Figure 6 should be revised to address concerns raised in LER 272/94-007-01. DW-94-025 meets the intent of this commitment.

Setpoints and Numerical Values:

Value	Setpoint	Description
93% FOR 4 RCPs 63% FOR 3 RCPs 42% FOR 2 RCPs 32% FOR 1 RCP	L.03	RVLIS dynamic range value corresponding to an average system void fraction of 0 percent with RCPs running including allowances for normal channel accuracy.

ERG Deviations:

No deviation from the ERG.

EOP Figure No And Title: Figure 6, Block 8

ERG Status Tree No: F-0.6

Decision Block:

RVLIS UPPER RANGE GREATER THAN 100%

Purpose:

To determine if voids exist in the reactor vessel.

ERG Basis:

Having determined that PZR level is normal, the remaining inventory question relates to water level in the reactor vessel. If level does not indicate that the vessel is full, then some type of voids are present in the vessel upper head. The presence of an upper head void does not, in itself, represent a challenge to the Coolant Inventory CFST. It is considered a not satisfied condition and a YELLOW priority is warranted. The appropriate procedure for function restoration is EOP-FRCI-3, RESPONSE TO VOID IN THE REACTOR VESSEL. *It is acceptable to use RVLIS upper range instead of full range in this decision block.* (DW-94-025)

[DW-94-025] Revised Coolant Inventory Status Tree and clarified RVLIS ranges to be used.

EOP Basis:

Same as ERG basis.

Supplemental Information:

ERG Knowledge Item: If a controlled natural circulation cooldown is in progress and cooldown/depressurization must continue, then FRCI-3 should not be implemented.

Commitment C0550: This commitment indicates in a general way that EOP-CFST-1 Figure 6 should be revised to address concerns raised in LER 272/94-007-01. DW-94-025 meets the intent of this commitment.

EOP Step No: Figure 6, Block 8 (CONTINUED)

Setpoints and Numerical Values:

Value	Setpoint	Description
100%	J.01	RVLIS upper range value indicating upper head region full.

ERG Deviations:

No deviation from the ERG.

2-EOP-CFST-1: CRITICAL SAFETY FUNCTION STATUS TREES

EOP/ERG CORRELATION

NOTES: For the purposes of this step-to-step correlation,

- EOP decision blocks (vertical layout) are numbered from top to bottom|left to right.
- ERG decision blocks (horizontal layout) are numbered from left to right|top to bottom.
- F-0.6 Decision Blocks 3 and 4 were split into three blocks each per DW-94-025.
- There are no "step sequence tables" for the status trees as there are for the other ERGs.

EOP Decision Block	ERG Decision Block
Figure 1, 1	F-0.1, 1
Figure 1, 2	F-0.1, 2
Figure 1, 3	F-0.1, 3
Figure 1, 4	F-0.1, 5
Figure 1, 5	F-0.1, 4
Figure 2, 1	F-0.2, 1
Figure 2, 2	F-0.2, 2
Figure 2, 3	F-0.2, 3
Figure 2, 4	F-0.2, 4
Figure 2, 5	F-0.2, 5
Figure 2, 6	F-0.2, 6
Figure 2, 7	F-0.2, 7
Figure 3, 1	F-0.3, 1
Figure 3, 2	F-0.3, 2
Figure 3, 3	F-0.3, 3
Figure 3, 4	F-0.3, 4
Figure 3, 5	F-0.3, 5
Figure 3, 6	F-0.3, 6

EOP Decision Block	ERG Decision Block
Figure 4, 1	F-0.4, 1
Figure 4, 2	F-0.4, 3
Figure 4, 3	F-0.4, 2
Figure 4, 4	F-0.4, 5
Figure 4, 5	F-0.4, 4
Figure 4, 6	F-0.4, 7
Figure 4, 7	F-0.4, 6
Figure 5, 1	F-0.5, 1
Figure 5, 2	F-0.5, 2
Figure 5, 3	F-0.5, 3
Figure 5, 4	F-0.5, 4
Figure 6, 1	F-0.6, 1
Figure 6, 2	F-0.6, 2
Figure 6, 3	F-0.6, 4a
Figure 6, 4	F-0.6, 3a
Figure 6, 5	F-0.6, 4c
Figure 6, 6	F-0.6, 4b
Figure 6, 7	F-0.6, 3c
Figure 6, 8	F-0.6, 3b

FIGURE 1
SHUTDOWN MARGIN STATUS TREE

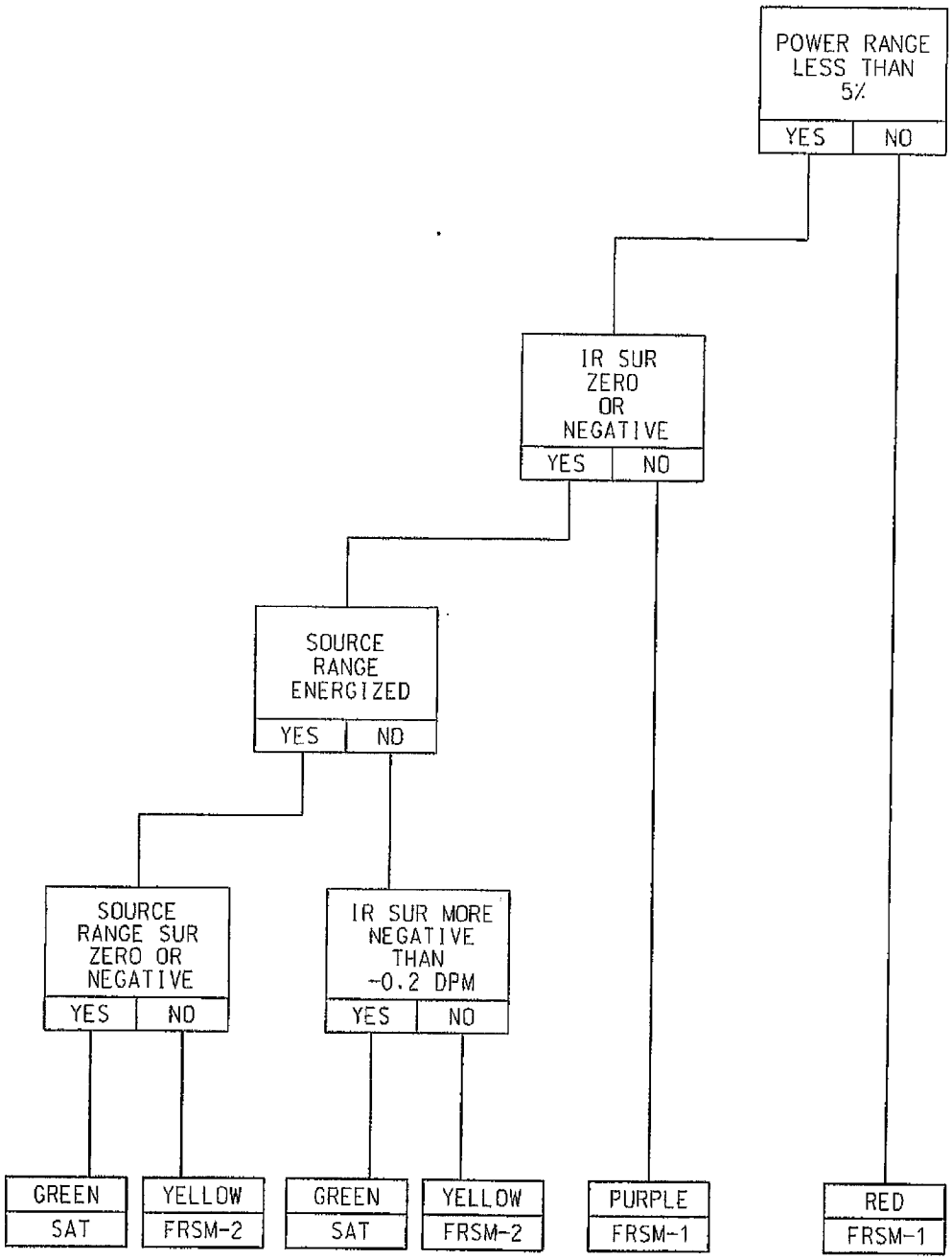

FIGURE 2
CORE COOLING STATUS TREE

EOP-CFST-1

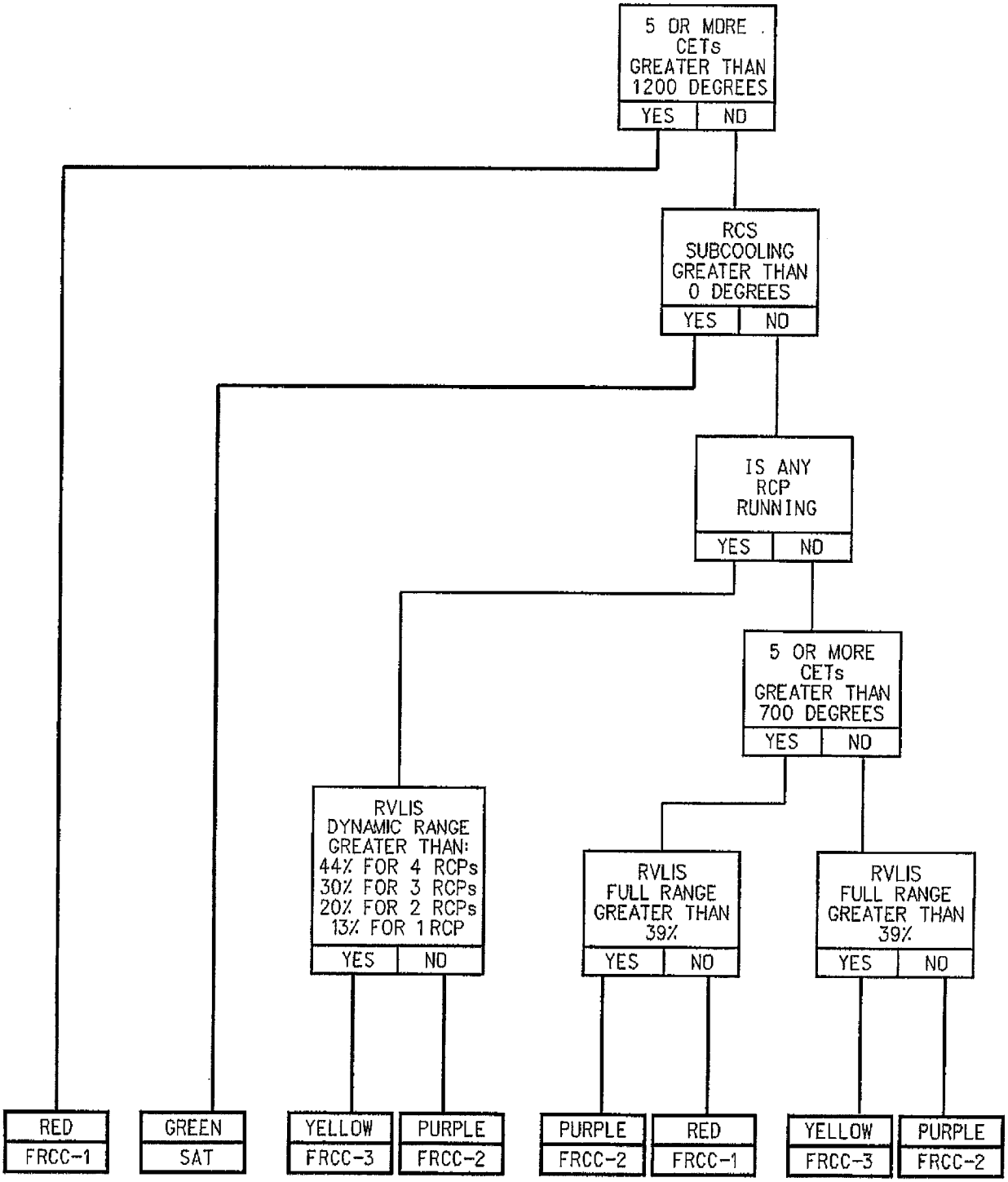

FIGURE 3
HEAT SINK STATUS TREE

EOP-CFST-1

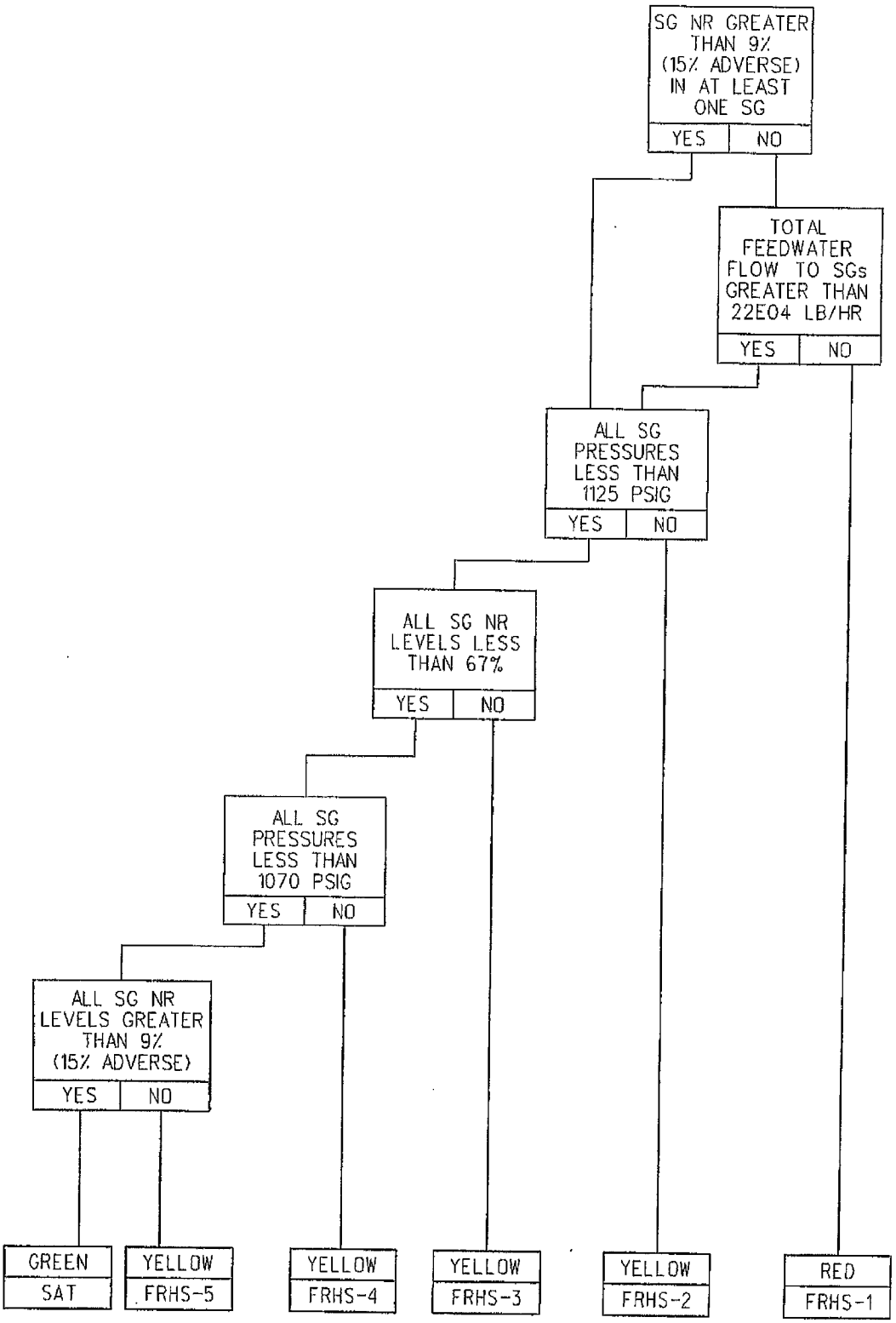

FIGURE 4
THERMAL SHOCK STATUS TREE

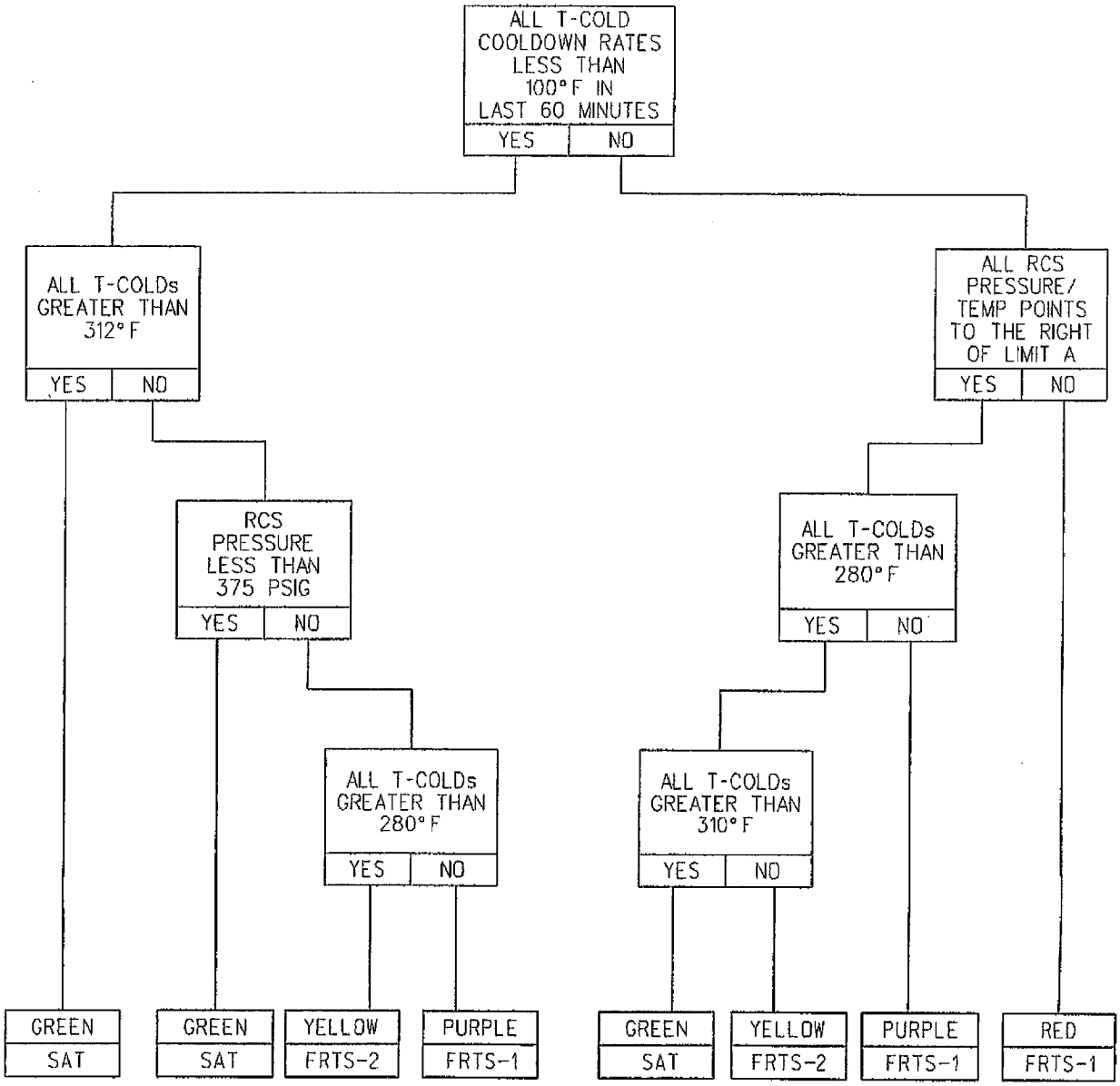

FIGURE 4A
THERMAL SHOCK LIMIT A CURVE

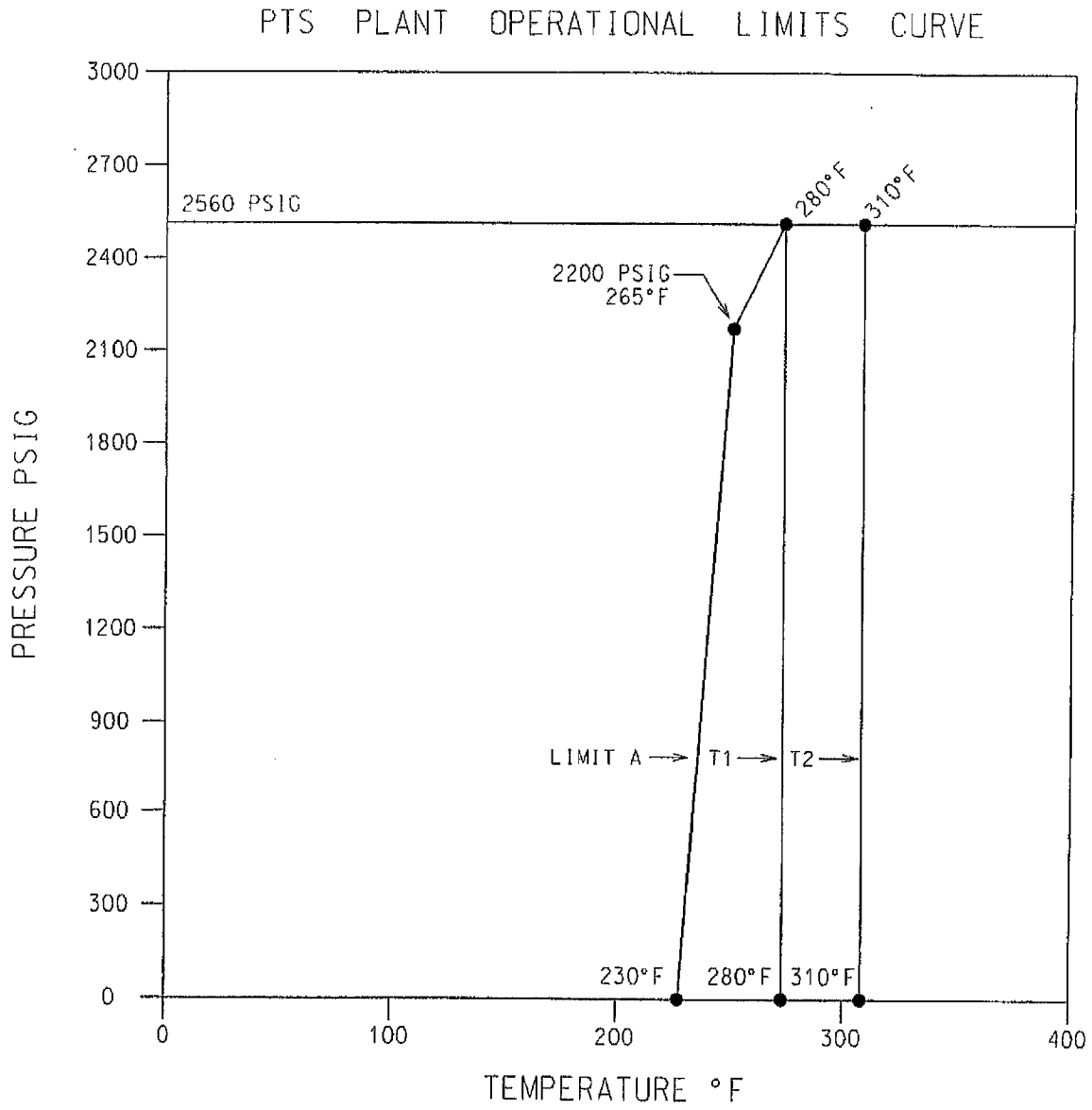

FIGURE 5
CONTAINMENT ENVIRONMENT STATUS TREE

EOP-CFST-1

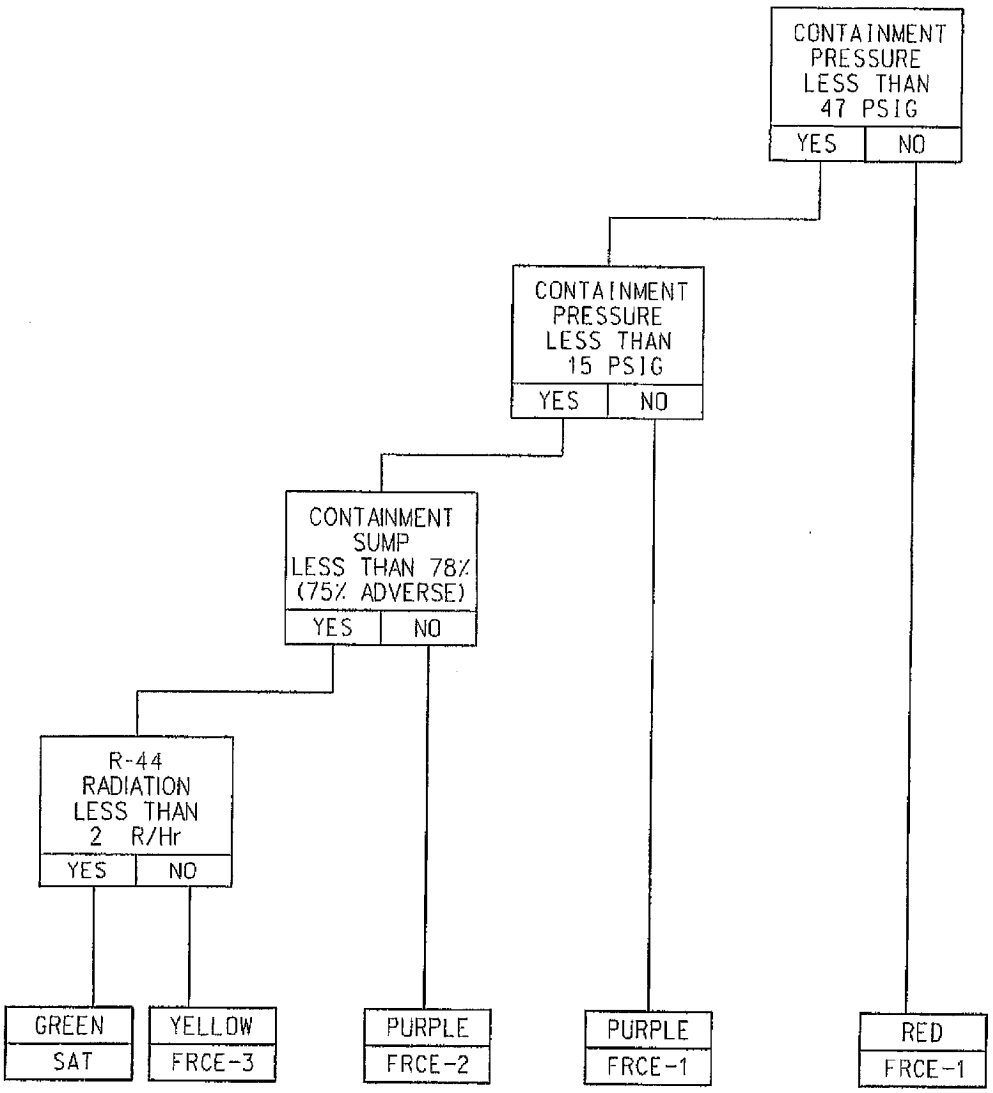

FIGURE 6
COOLANT INVENTORY STATUS TREE

EOP-CFST-1