Submitted: ______________________________
(Section Head)

Approved: ______________________________
(Plant Manager)

SP Number 29.Ø23.Ø1

Revision E

Effective Date ____________

LEVEL CONTROL

EMERGENCY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to restore and stabilize RPV water levels.

2.0 ENTRY CONDITIONS

The entry conditions for this procedure are any of the following:

2.1 RPV water level less than 12.5"

2.2 Drywell pressure greater than 1.69 psig

2.3 An isolation condition exists which requires or initiates reactor scram.

3.0 OPERATOR ACTIONS

3.1 Confirm initiation of all of the following. Initiate any of the actions which should have initiated but did not.

3.1.1 VERIFY reactor scram and PERFORM SP 29.Ø1Ø.Ø1, (Emergency Shutdown), concurrently with this procedure. ______

3.1.2 VERIFY group isolations consistent with entry conditions as per technical specification 3/4.3.2. ______

3.1.3 VERIFY automatic initiation of ECCS systems as per technical specification 3/4.3.3. ______

3.1.4 VERIFY diesel generators start at 1.69 psig or -132.5". ______

CAUTION

Avoid RPV high water level trip (54.5") of RFP, HPCI, and RCIC turbines.

3.2 Restore and maintain RPV water level between 12.5" and 54.5" with one or more of the following systems:

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NOTE
The choice of using the foll·wing systems vary with plant conditions. It is preferred that the minimum number of systems be used to accomplish water level restoration.

3.2.1 Feedwater/Condensate 1115 to 0 psig ________

3.2.2 CRD 1115 to 0 psig ________

3.2.3 RCIC 1115 to 50 psig ________

3.2.4 HPIC 1115 to 100 psig ________

3.2.5 C.S. 333 to 0 psig ________

3.2.6 LPCI 238 to 0 psig ________

3.3 IF RPV water level cannot be restored AND maintained above + 12.5", THEN maintain RPV water level above top of active fuel (TAF) ________

NOTE
TAF = +6" as read on fuel zone instrumentation LI-007

3.4 IF RPV water level cannot be determined OR maintained above TAF, THEN enter SP 29.Ø23.Ø4 (Level Restoration). ________

3.5 Notify the Watch Engineer to classify the event and initiate EP-30A as required. ________

3.6 IF RPV water level can be restored and maintained above 12.5" AND it is determined that an emergency does not exist, THEN enter the appropriate station procedure as determined by Shift Supervision. ________

3.7 IF SRV's are cycling, THEN open one SRV and reduce RPV pressure to between 8ØØ and 960 psig to minimize SRV cycling. (Alternate SRV's in the sequence listed below to equalize suppression pool heating, if this step must be repeated). ________

3.7.1 RV-Ø93A ________

3.7.2 RV-Ø93B ________

3.7.3 RV-Ø93C ________

3.7.4 RV-Ø93D ________

3.7.5 RV-Ø93E ________

3.7.6 RV-Ø93F ________

3.7.7 RV-Ø93G ________

3.7.8 RV-Ø93H ________

3.7.9 RV-Ø93J ________

3.7.10 RV-Ø93K ________

3.7.11 RV-Ø93L ________

3.8 WHEN the RPV water level has stabilized above TAF, THEN enter 29.Ø23.Ø2 (Cooldown). ________

4.0 REFERENCES

4.1 SP 29.Ø1Ø.Ø1 Emergency Shutdown

4.2 SP 29.Ø23.Ø2 Cooldown

4.3 SP 29.Ø23.Ø4 Level Restoration

4.4 SP 23.1Ø3.Ø1 Condensate

4.5 SP 23.1Ø9.Ø1 Feedwater

4.6 SP 23.119.Ø1 Reactor Core Isolation Cooling System

4.7 SP 23.2Ø2.Ø1 High Pressure Coolant Injection

4.8 SP 23.2Ø3.Ø1 Core Spray System

4.9 SP 23.2Ø4.Ø1 Low Pressure Coolant Injection

4.10 SP 23.1Ø6.Ø1 Control Rod Drive Injection

4.11 Technical Specifications, Section 3/4.3.2

4.12 Technical Specifications, Section 3/4.3.3

Submitted: ______________________________ (Section Head)

Approved: ______________________________ (Plant Manager)

SP Number 29.Ø23.Ø2

Revision E

Effective Date ______________

COOLDOWN

EMERGENCY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to depressurize and cooldown the RPV to cold shutdown conditions while maintaining RPV water level within a satisfactory range.

2.0 ENTRY CONDITIONS

This procedure is entered from SP 23.Ø23.Ø1 (Level Control) after the RPV water level has been stabilized above the top of active fuel (TAF).

3.0 OPERATOR ACTIONS

CAUTION

IF a high drywell pressure ECCS initiation signal occurs OR exists while depressurizing, THEN prevent injection from those CS and LPCI pumps not required to assure adequate core cooling prior to reaching their maximum injection pressures. WHEN the high drywell pressure ECCS initiation signal clears, THEN restore CS and LPCI to AUTOMATIC/STANDBY mode.

CAUTION

DO NOT secure or place an ECCS in MANUAL mode UNLESS, (1) misoperation in AUTOMATIC mode is confirmed by at least two independent indications OR (2) adequate core cooling is assured by at least two independent indications. IF an ECCS is placed in MANUAL mode, THEN it will not initiate automatically. Make frequent checks of the initiating or control parameter. WHEN manual operation is no longer required, THEN restore the system to AUTOMATIC/STANDBY mode if possible.

3.1 Maintain RPV water level between +6" on Fuel Zone Indicator LI-ØØ7 and 54.5" on LI-ØØ4 with one or more of the following systems: ________

NOTE

The choice of using the following systems vary with plant conditions. It is preferred that the minimum number of systems be used to accomplish water level restoration.

3.1.1 Feedwater/Condensate 1115 to Ø psig ______

3.1.2 CRD 1115 to Ø psig ______

> **CAUTION**
>
> Do not throttle HPCI or RCIC systems below the minimum speed of 2250 RPM.

3.1.3 RCIC 1115 to 5Ø psig ______

3.1.4 HPCI 1115 to 1ØØ psig ______

3.1.5 C.S. 333 to Ø psig ______

3.1.6 LPCI 238 to Ø psig ______

3.2 IF signals of high suppression pool water level (26'11") OR low condensate storage tank water level (3'4") occur, THEN confirm automatic transfer of/or manually transfer HPCI and RCIC suction from the condensate tank to the suppression pool. ______

3.3 IF RPV water level cannot be determined or maintained above TAF, THEN enter SP 29.Ø23.Ø4 (Level Restoration). ______

> **NOTE**
>
> TAF = +6" as read on fuel zone instrumentation LI-007.

3.4 IF SRV's are cycling, THEN open one SRV and reduce RPV pressure to between 8ØØ and 960 psig to minimize SRV cycling. (Alternate SRV's in the sequence listed below to equalize suppression pool heating if this step must be repeated). ______

3.4.1 RV-Ø93A ______

3.4.2 RV-Ø93B ______

3.4.3 RV-Ø93C ______

3.4.4 RV-Ø93D ______

3.4.5 RV-Ø93E ______

3.4.6 RV-Ø93F ______

3.4.7 RV-Ø93G ______

3.4.8 RV-Ø93H ______

3.4.9 RV-Ø93J

3.4.10 RV-Ø93K

3.4.11 RV-Ø93L

CAUTION

Cooldown rates greater than 1ØØ°F/hr may be required to conserve RPV water inventory, protect primary containment integrity, or limit radioactive release to the environment.

CAUTION

Do not depressurize the RPV below 1ØØ psig unless motor driven pump sufficient to maintain RPV water level are running and available for injection.

3.5 Depressurize the RPV and maintain cooldown rate below 1ØØ°F/hr using one or more of the following systems:

3.5.1 Main Turbine Bypass Valves (preferred method) per SP 22.ØØ5.Ø1 (Shutdown to Cold Shutdown)

3.5.2 RCIC per SP 23.119.Ø1 (Reactor Core Isolation Cooling (RCIC) System)

3.5.3 HPCI per SP 23.2Ø2.Ø1 (High Pressure Coolant Injection)

3.5.4 RHR (Steam Condensing Mode) per SP 23.121.Ø1 (Residual Heat Removal (RHR) System)

3.5.5 SRV's (alternate in the sequence listed to equalize suppression pool heating)

3.5.5.1 RV-Ø93A

3.5.5.2 RV-Ø93B

3.5.5.3 RV-Ø93C

3.5.5.4 RV-Ø93D

3.5.5.5 RV-Ø93E

3.5.5.6 RV-Ø93F

3.5.5.7 RV-Ø93G

3.5.5.8 RV-Ø93H ________

3.5.5.9 RV-Ø93J ________

3.5.5.10 RV-Ø93K ________

3.5.5.11 RV-Ø93L ________

> NOTE
>
> Fewer blowdowns with increased pressure reductions are desirable to minimize SRV cycle stresses.

> CAUTION
>
> If the continuous SRV pneumatic supply is or becomes unavailable, depressurize with sustained SRV opening.

3.5.6 RWCU (Blowdown Mode) per SP 23.709.Ø1 (Reactor Water Cleanup). ________

3.5.7 Steam Jet Air Ejectors per SP 23.7Ø1.Ø1 (Condenser Off-Gas Removal) ________

3.5.8 RFPTS per SP 23.1Ø9.Ø1 (Feedwater System) ________

3.5.9 Steam Seal Evaporator per SP 23.124.Ø1 (Steam Sealing) ________

3.5.10 Main Condenser Deaerating Steam per SP 23.1Ø3.Ø1 (Condensate) ________

3.5.11 RWCU (Recirculation Mode) per SP 23.7Ø9.Ø1 (Reactor Water Cleanup System) ________

3.5.12 Main Steam Line Drains per SP 23.116.Ø1 (Main and Auxiliary Steam) ________

3.6 WHEN the RHR shutdown cooling interlocks (135 psig) clear, THEN initiate the shutdown cooling mode of RHR per SP 23.121.Ø1 (Residual Heat Removal (RHR) System).

3.7 IF the RHR shutdown cooling mode cannot be established and further cooldown is required, THEN continue to cooldown with the systems listed in step 3.5 as applicable.

3.8 IF RPV cooldown is required but cannot be accomplished, THEN perform alternate shutdown cooling as follows: ________

3.8.1 Initiate Suppression Pool Cooling per SP 23.121.Ø1 (Residual Heat Removal (RHR) System). ______

3.8.2 Close the following valves:

(A) RPV Head Vents

1B21 MOV-Ø84______ 1B21 MOV-Ø85______

(B) All MSIV's

1B21 A[illegible]______ 1B21 AOV-Ø82A______

1B21 AO[illegible]______ 1B21 AOV-Ø82B______

1B21 AOV-Ø81C______ 1B21 AOV-Ø82C______

1B21 AOV-Ø81D______ 1B21 AOV-Ø82D______

(C) MSL Drain Lines

1B21 MOV-Ø38______ 1B21 MOV-Ø33______

1B21 AOV-Ø88______ 1B21 AOV-Ø89______

(D) RHR Steam Condensing Valve

1E11 MOV-Ø49______

3.8.3 Position SRV's so that only one SRV is open. ______

3.9 Start one CS or LPCI pump with suction from the suppression pool. ______

3.10 Raise RPV water level to establish a flow path through the open SRV back to the suppression pool. ______

3.11 Increase CS or LPCI injection into the RPV to the maximum. ______

3.12 <u>IF</u> RPV pressure does not stabilize ABOVE 100 psig, <u>THEN</u> start another pump. ______

3.13 <u>IF</u> RPV pressure does not stabilize BELOW 184 psig, <u>THEN</u> open one additional SRV. ______

3.14 Control suppression pool temperature to maintain RPV water temperature above 7Ø°F per SP 23.121.Ø1 (Residual Heat Removal (RHR) System). ______

3.15 Continue with Plant Shutdown in accordance with SP 22.ØØ5.Ø1 (Shutdown to Cold Shutdown). ______

4.0 REFERENCES

4.1 SP 29.Ø23.Ø1 Level Control

4.2 SP 29.Ø23.Ø4 Level Restoration

4.3 SP 22.ØØ5.Ø1 Shutdown to Cold Shutdown

4.4 SP 23.119.Ø1 Reactor Core Isolation Cooling (RCIC) System

4.5 SP 23.2Ø2.Ø1 High Pressure Coolant Injection

4.6 SP 23.121.Ø1 Residual Heat Removal (RHR) System

4.7 SP 23.7Ø1.Ø1 Condenser Off Gas Removal

4.8 SP 23.124.Ø1 Steam Sealing

4.9 SP 23.1Ø3.Ø1 Condensate

4.10 SP 23.1Ø9.Ø1 Feedwater System

4.11 SP 23.7Ø9.Ø1 Reactor Water Cleanup System

4.12 SP 23.2Ø3.Ø1 Core Spray System

4.13 SP 23.2Ø4.Ø1 Low Pressure Coolant Injection

Submitted: ______________________ (Section Head)

Approved: ______________________ (Plant Manager)

SP Number 29.Ø23.Ø3

Revision E

Effective Date ______________

CONTAINMENT CONTROL EMERGENCY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to control primary containment temperatures, pressure and level.

2.0 ENTRY CONDITIONS

NOTE

Enter the paragraphs of this procedure as required by the entry condition. The paragraphs can and should be performed concurrently with each other as the entry conditions dictate and concurrently with the procedure from which it was entered.

The entry conditions for this procedure are any of the following:

			Paragraph
2.1	Suppression Pool Temperature	Above 90°F	3.1
2.2	Drywell Temperature	Above 135°F	3.2
2.3	Drywell Pressure	Above 1.69 psig	3.3
2.4	Suppression Pool Level	Above 26'8"	3.4
2.5	Suppression Pool Level	Below 26'0"	3.4

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3.0 OPERATOR ACTIONS

3.1 MONITOR and CONTROL suppression pool temperature by performing the following:

3.1.1 Attempt to close any open SRV which is not required to be open. IF the open SRV is stuck open, THEN enter SP 23.116.Ø1 (Main and Auxiliary Steam) ______

CAUTION

If continuous LPCI is required to assure adequate core cooling, do not divert RHR pumps from the LPCI mode.

3.1.2 IF suppression pool temperature exceeds 9Ø°F, THEN operate available suppression pool cooling per SP 23.121.Ø1 (Residual Heat Removal (RHR) System) ______

3.1.3 IF suppression pool temperature reaches 110°F, THEN scram the reactor per SP 29.Ø1Ø.Ø1 (Emergency Shutdown). ______

CAUTION

Cooldown rates above 1ØØ°F/hr may be required to accomplish the following steps.

CAUTION

Do not depressurize the RPV below 100 psig (HPCI low pressure isolation setpoint) unless motor driven pumps sufficient to maintain RPV water level are running and the systems are available for injection.

CAUTION

NPSH requirements for pumps taking a suction from the suppression pool requires a minimum level of 14 feet.

3.1.4 Maintain suppression pool temperature OR RPV pressure below the heat capacity limit of Figure 1. ______

3.1.5 IF suppression pool temperature AND RPV pressure cannot be restored OR maintained below the heat capacity temperature limit, THEN proceed to SP 29.023.05 (Rapid RPV Depressurization). ______

3.2 MONITOR and CONTROL Drywell Temperature by Performing the Following:

3.2.1 IF drywell temperature exceeds 135°F, THEN operate all available drywell cooling. ______

CAUTION

If continuous LPCI operation is required to assure adequate core cooling, do not divert RHR pumps from the LPCI mode.

3.2.2 IF DRYWELL TEMPERATURE approaches 296°F, THEN SHUTDOWN the Reactor Recirculation Pumps AND Drywell Fans AND initiate Drywell Sprays ______

CAUTION

Do not depressurize the RPV below 1ØØ psig unless motor driven pumps sufficient to maintain RPV water level are running and the systems are available for injection.

CAUTION

Cooldown rates above 1ØØ°F/hr may be required to accomplish the following step.

3.2.3 IF DRYWELL TEMPERATURE reaches the RPV saturation limit OR cannot be maintained below 296°F, THEN enter SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ______

NOTE

Drywell cold leg reference temperature instruments are (Later)

3.3 MONITOR AND CONTROL primary containment pressure with the following systems as required:

CAUTION
ELEVATED SUPPRESSION CHAMBER PRESSURE MAY TRIP THE RCIC TURBINE ON HIGH EXHAUST PRESSURE, 25 psig.

3.3.1 Operate THE POST LOCA HYDROGEN RECOMBINATION SYSTEM per SP 23.402.01. ________

3.3.2 Operate the MSIV Leakage Control System per SP 23.4Ø6.Ø1. ________

3.3.3 Sample and analyze primary containment atmosphere to ensure environmental release limits are met. ________

3.3.4 IF dry well temperature is below 212°F AND release limits are met, THEN vent the primary containment through the RBSVS system per SP 23.418.01. ________

CAUTION
If continuous LPCI operation is required to assure adequate core cooling, do not divert RHR pumps from the LPCI mode.

3.3.5 BEFORE the suppression chamber pressure reaches the suppression pool spray limit (Fig. 3), INITIATE suppression pool sprays. ________

3.3.6 IF suppression chamber pressure reaches the pressure suppression limit (Fig. 4), THEN SHUTDOWN the Reactor Recirculation pumps AND the Drywell Fans AND initiate Drywell Sprays as necessary to maintain suppression chamber pressure below the curve. ________

3.3.7 IF suppression chamber pressure cannot be maintained below the pressure suppression limit (Fig. 4), THEN ENTER SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ________

3.4 MONITOR and CONTROL suppression pool water level by performing the following:

CAUTION

NPSH requirements for pumps taking a suction from the Suppression Pool require a minimum level of 14 feet.

3.4.1 IF suppression pool water level is BELOW 26'0", THEN initiate suppression pool makeup per SP (Later). ______

CAUTION

Do not depressurize the RPV below [illegible]ØØ psig unless motor driven pumps sufficient to maintain RPV water level are running and the systems are available for injection.

CAUTION

Cooldown rates above 1ØØ°F/hr may be required to accomplish the following steps.

3.4.2 IF suppression pool level cannot be maintained above the heat capacity level limit (Fig. 5), THEN enter SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ______

CAUTION

IF high suppression pool level (26'11") exists or low condensate storage tank level (3'4") exists, VERIFY/MANUALLY transfer RCIC and HPCI suctions from the CST tank to the Suppression pool.

3.4.3 IF the suppression pool water level is above 26'8" AND adequate core cooling is assured, THEN terminate injection into the reactor vessel from sources external to the primary containment. ______

3.4.4 Sample and analyze suppression pool water to ensure environmental release limits are met. ______

3.4.5 IF suppression pool water level is above 26'8" AND release limits are met, THEN lower suppression pool level per SP 23.7Ø8.Ø1. ______

3.4.6 IF suppression pool water level cannot be maintained below the suppression pool load limit, THEN maintain RPV pressure below the load limit of Figure 6. ________

3.4.7 IF suppression pool water level AND RPV pressure cannot be restored OR maintained below the suppression pool load limit, THEN proceed to SP 29.Ø23.Ø5, (Rapid RPV Depressurization). ________

3.4.8 IF primary containment water level reaches later feet, THEN terminate injection into the RPV from sources external to the primary containment irrespective of whether adequate core cooling is assured. ________

4.0 REFERENCES

4.1 SP 23.116.Ø1 Main and Auxiliary Steam

4.2 SP 23.121.Ø1 Residual Heat Removal (RHR) System

4.3 SP 29.Ø1Ø.Ø1 Emergency Shutdown

4.4 SP 29.Ø23.Ø5 Rapid RPV Depressurization

4.5 SP 23.4Ø2.Ø1 Primary Containment Post LOCA Hydrogen Recombination

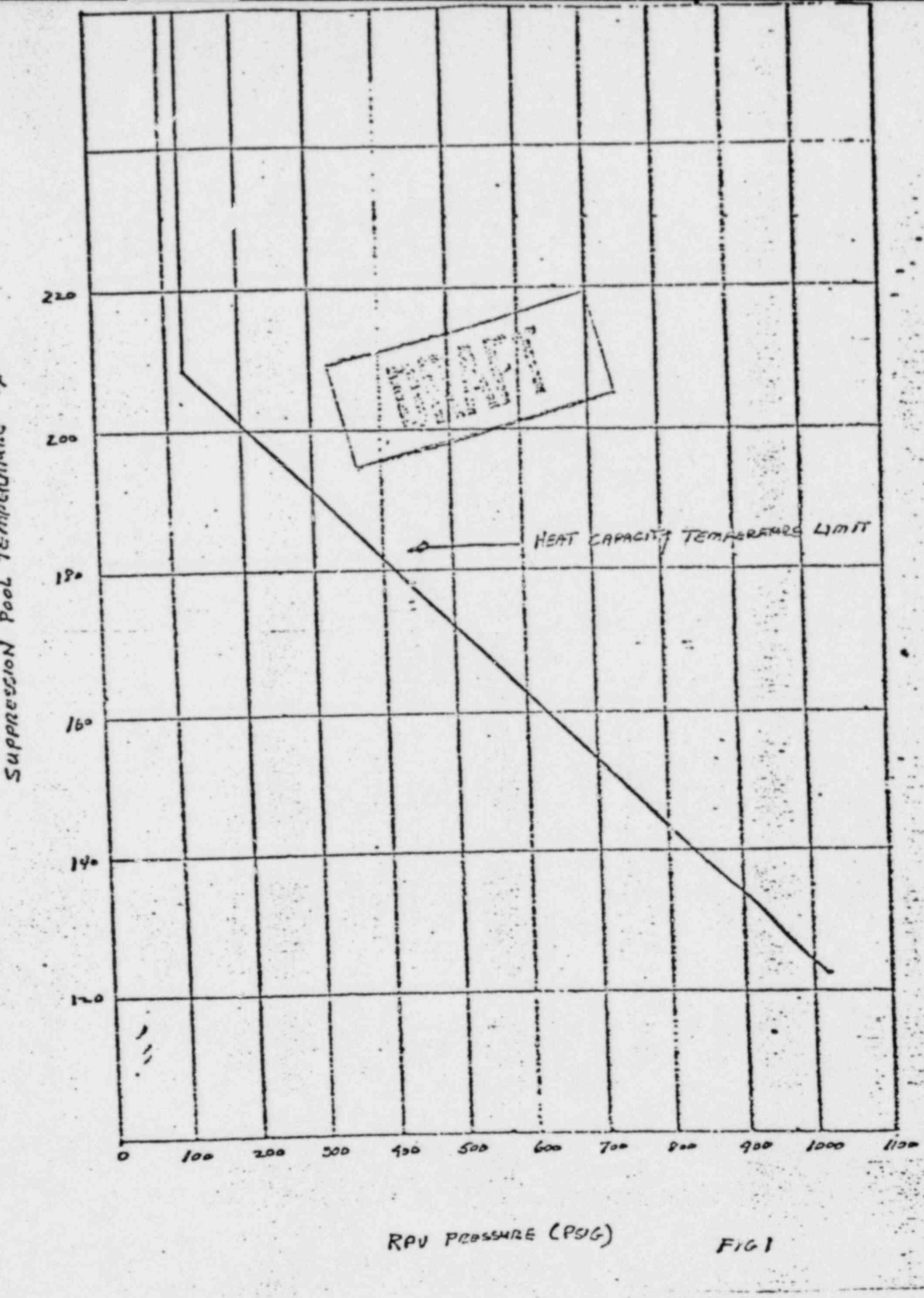
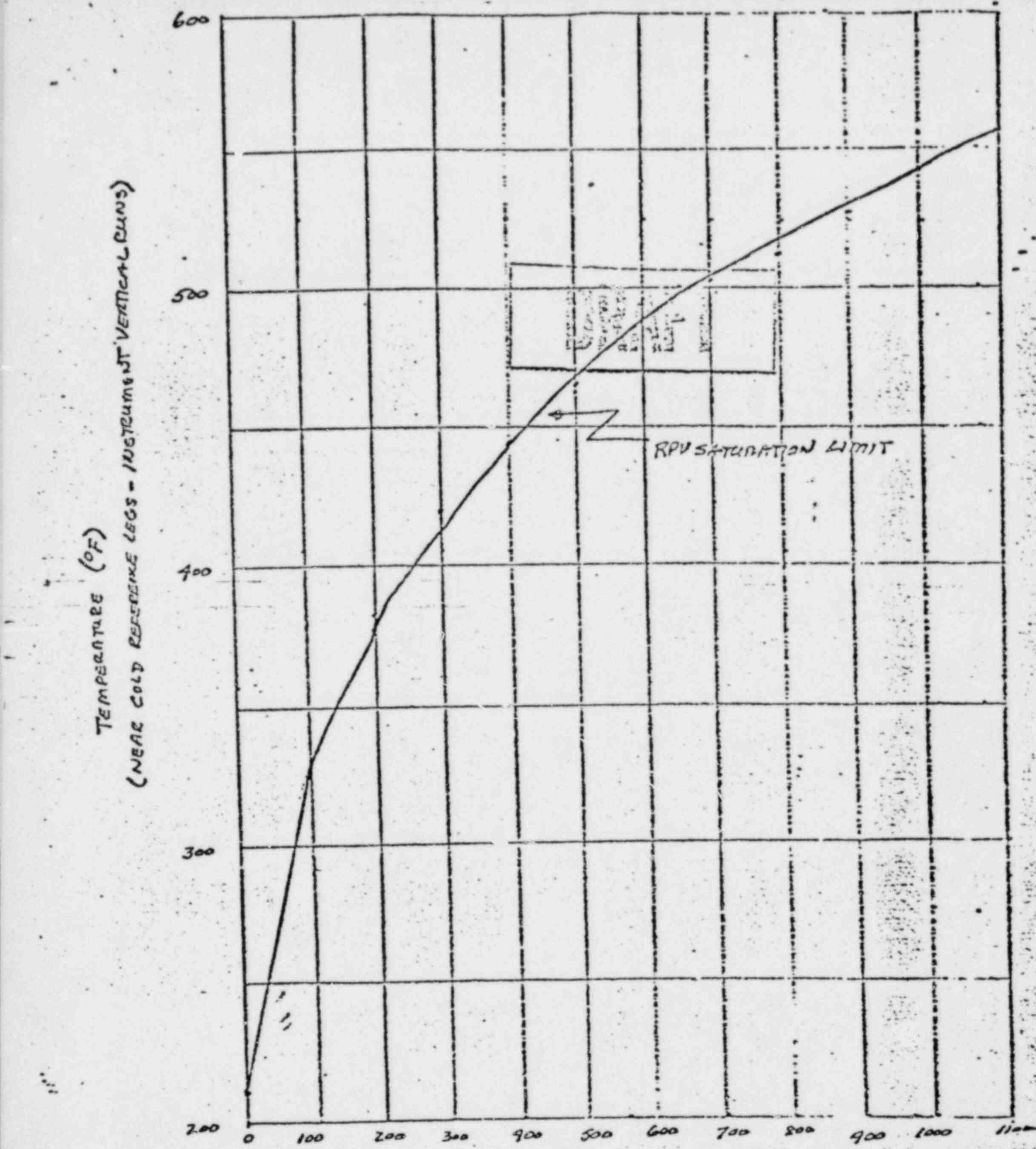

SUPPRESSION POOL TEMPERATURE °F
220
200
180
160
140
120
HEAT CAPACITY TEMPERATURE LIMIT
0
100
200
300
400
500
600
700
800
900
1000
1100
RPV PRESSURE (PSIG)

FIG 1



RPV PRESSURE (PSIG) FIG 2

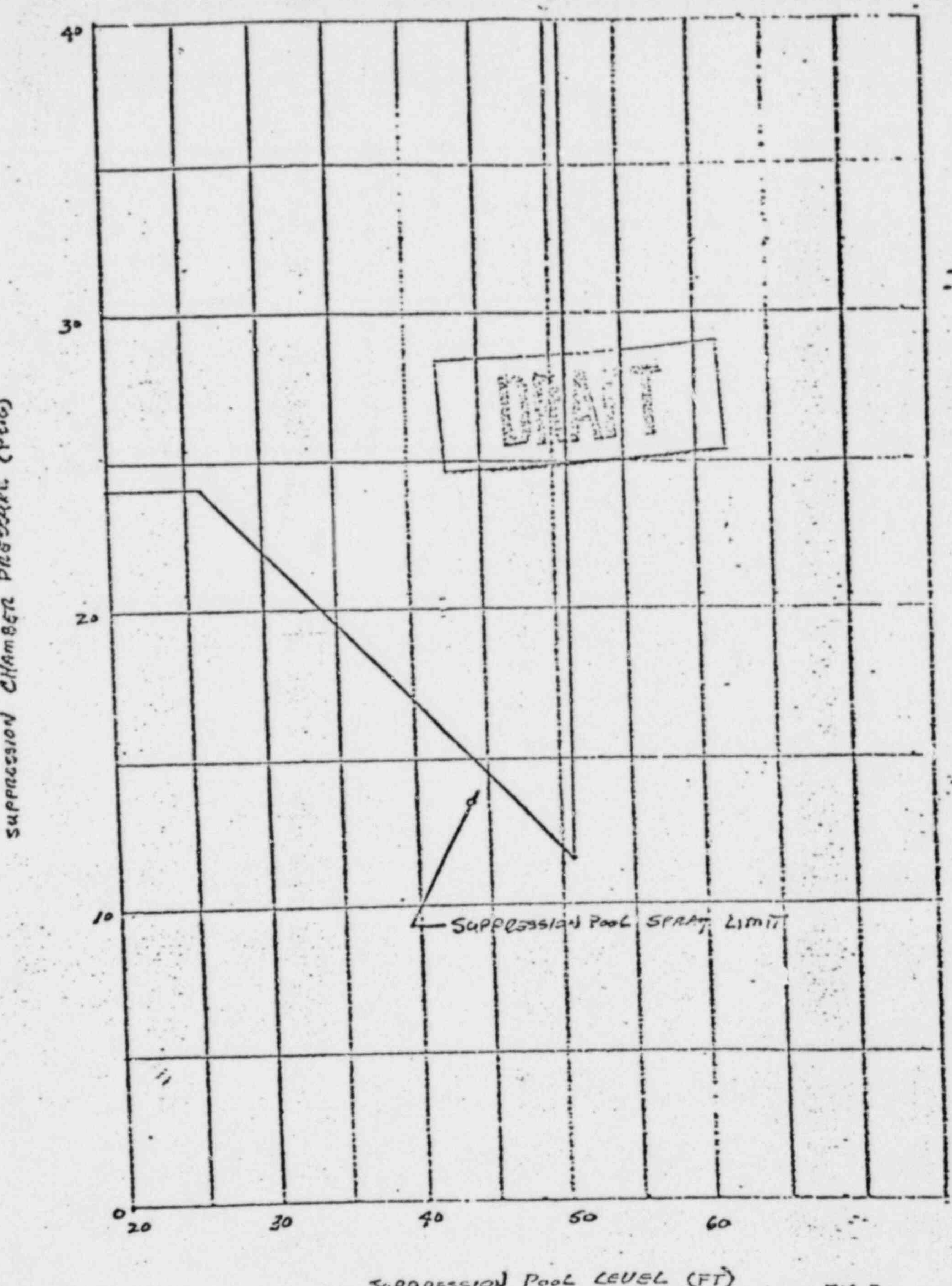
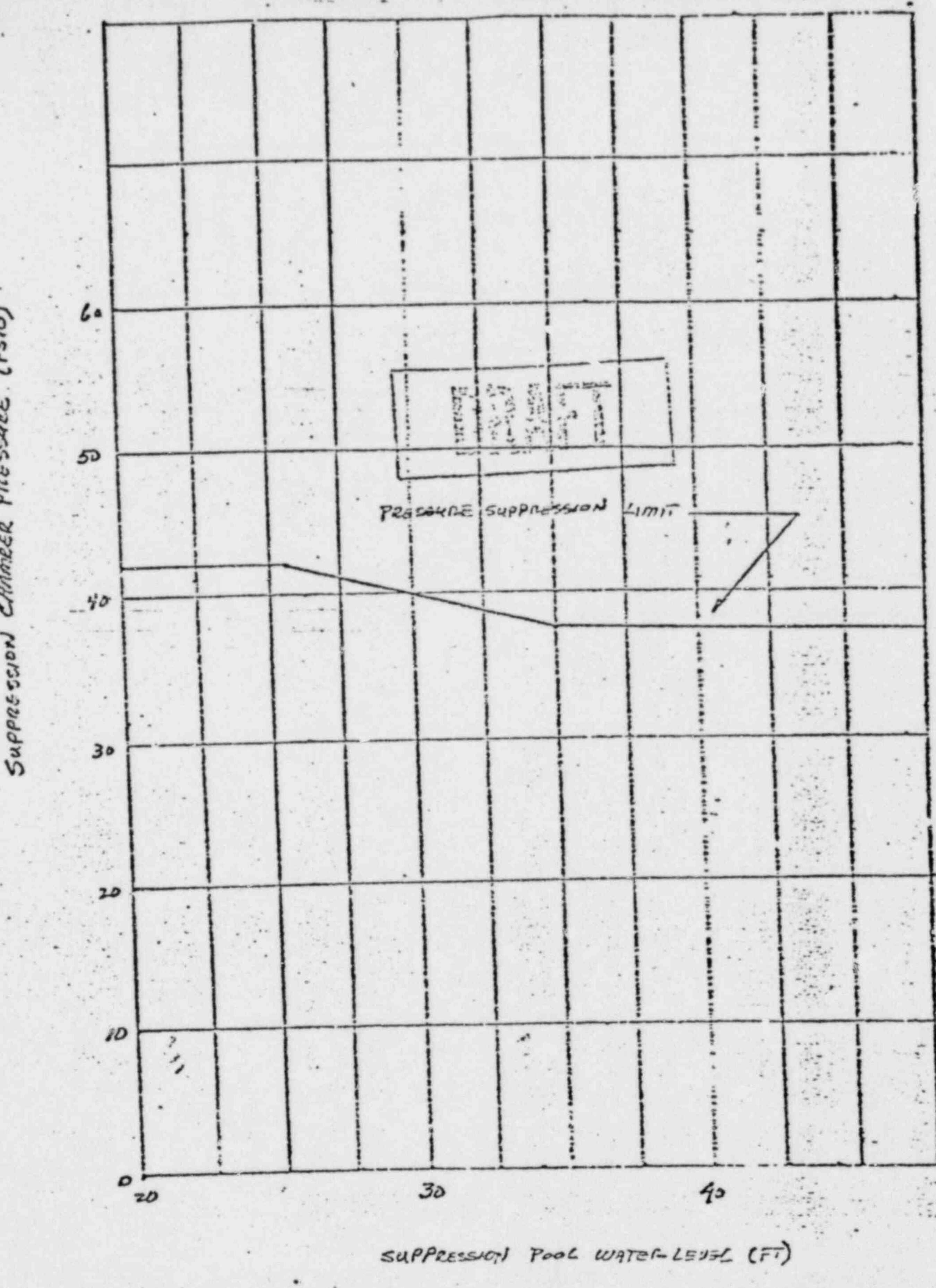

SUPPRESSION CHAMBER PRESSURE (PSIG)
40
30
20
10
0
20
30
40
50
60
SUPPRESSION POOL SPRAY LIMIT
SUPPRESSION POOL LEVEL (FT)

FIG 3



SUPPRESSION CHAMBER PRESSURE (PSIG)
60
50
40
30
20
10
0
PRESSURE SUPPRESSION LIMIT
20
30
40
SUPPRESSION POOL WATER LEVEL (FT)

FIG 4

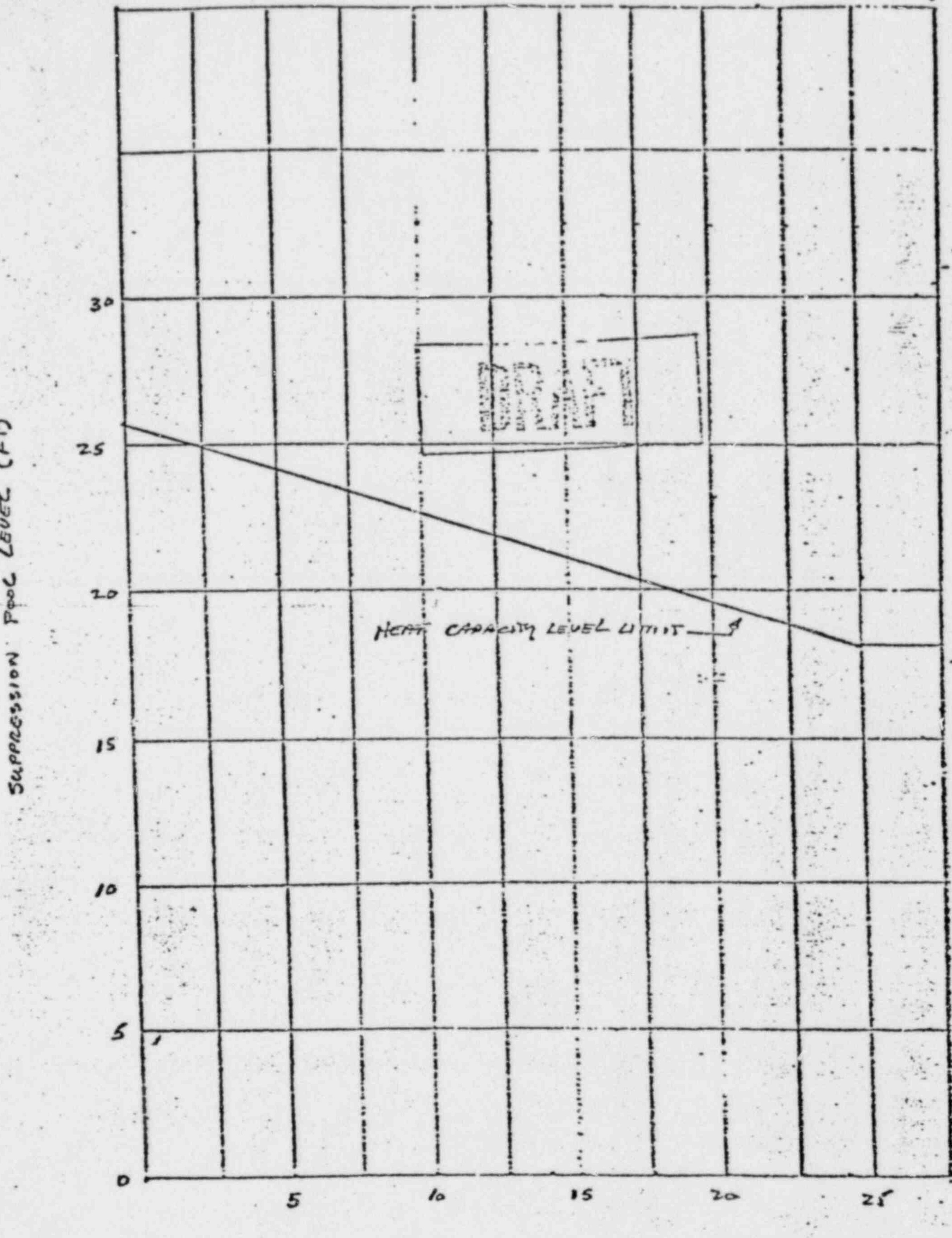
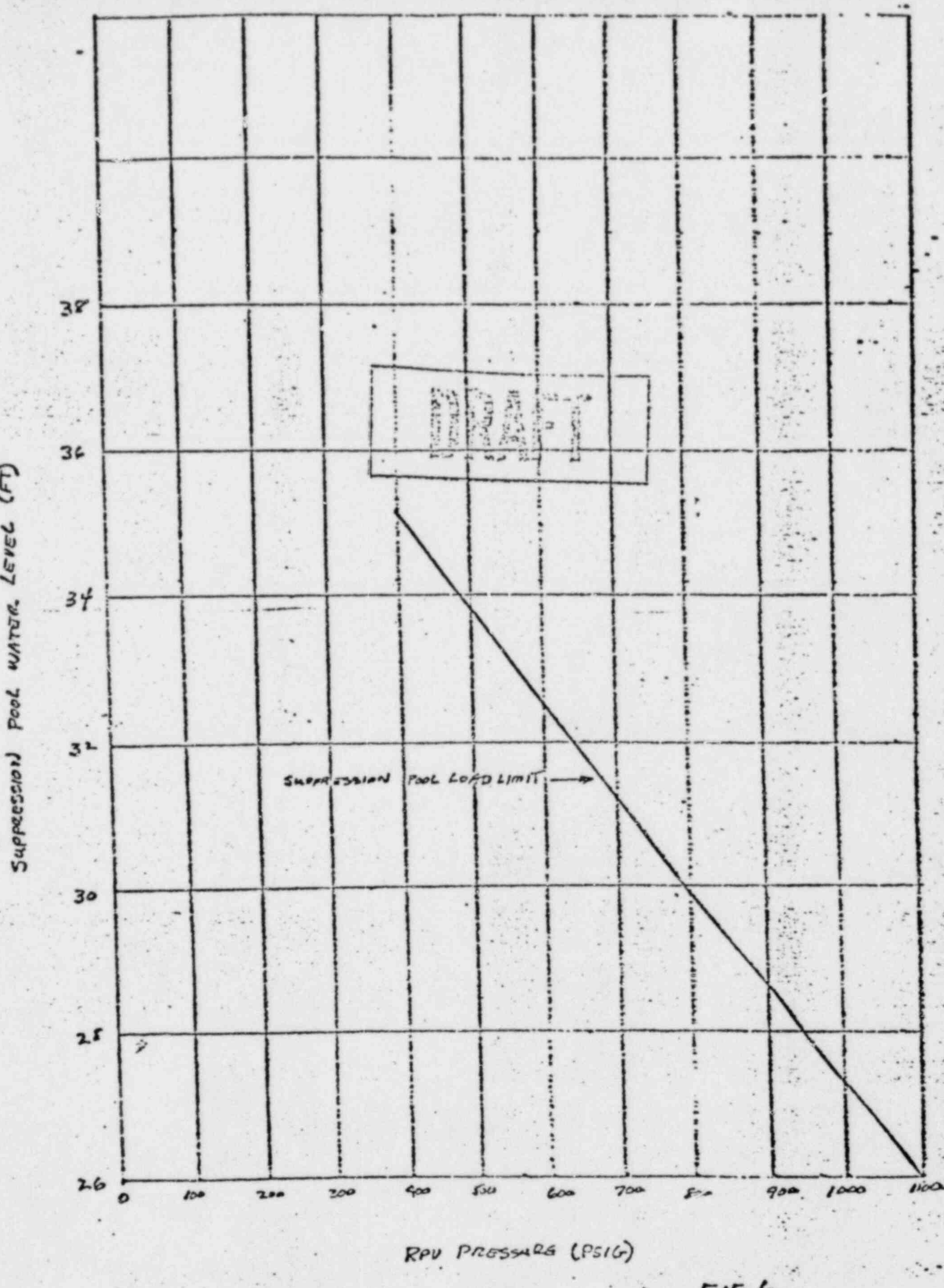


FIG 5

ΔT_{HC} = HEAT CAPACITY TEMPERATURE LIMIT MINUS SUPPRESSION POOL TEMPERATURE



SUPPRESSION POOL WATER LEVEL (FT)
38
36
34
32
30
28
26
SUPPRESSION POOL LOAD LIMIT
0
100
200
300
400
500
600
700
800
900
1000
1100
RPV PRESSURE (PSIG)

FIG 6

Submitted: ______________________ (Section Head)

Approved: ______________________ (Plant Manager)

SP Number 29.Ø23.Ø4

Revision E

Effective Date ______________

LEVEL RESTORATION

EMERGENCY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to restore RPV water level to above top of active fuel.

2.0 ENTRY CONDITIONS

Enter this procedure from 29.Ø23.Ø1 (Level Control) or 29.Ø23.Ø2 (Cooldown) when RPV water level cannot be maintained above top of active fuel (TAF).

> **NOTE**
>
> TAF = +6" as read on fuel zone instrumentation LI-ØØ7.

3.0 OPERATOR ACTIONS

3.1 Lineup for injection and start pumps in at least two of the following normal injection subsystems:

3.1.1 CS A ________

3.1.2 CS B ________

3.1.3 LPCI A ________

3.1.4 LPCI B ________

3.1.5 Condensate ________

3.2 IF less than two normal injection subsystems (Paragraph 3.1) can be lined up, THEN line up of as many of the following alternate injection subsystems as possible but DO NOT inject:

3.2.1 Reactor Building Service Water System through service water/recirc loop ultimate cooling water crossties valves 1P41-MOV-Ø33A, MOV-Ø33B, MOV-Ø33C, and MOV-Ø33D. ________

3.2.2 ECCS connections from the Condensate Transfer System ________

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3.2.3 SLC (test tank or boron tank) per SP 23.123.Ø1 (Standby Liquid Control) ________

CAUTION

IF... At any time RPV water level cannot be determined and one system is lined up for injection with at least one pump running,

THEN... Enter 29.023.05 (Rapid RPV Depressurization).

CAUTION

IF... At any time RPV water level cannot be determined and no system is lined up for injection with at least one pump running,

THEN... Proceed to section 3.7.5, Core Cooling without Injection.

NOTE

If any any time the RPV water level trend reverses or RPV pressure changes region, return to step 3.3.1.

3.3 MONITOR RPV pressure AND water level, THEN proceed at the step indicated in the following table: ________

Table 1

	RPV PRESSURE REGION		
	333 HIGH	333 to 100 INTERMEDIATE	100 LOW
RPV LEVEL INC.	3.4	3.5	3.6
RPV LEVEL DEC.	3.7	3.7	3.8

3.4 RPV level increasing and RPV pressure greater than 333 psig (High Region).

3.4.1 ENTER SP 29.Ø23.Ø1 (Level Control) at Step 3.2. ________

3.5 RPV level increasing and RPV pressure between 333 and 100 psig (intermediate region).

CAUTION
Do not depressurize the RPV below 100 psig unless motor driven pumps sufficient to maintain RPV water level are running and the systems are available for injection.

3.5.1 IF HPCI OR RCIC are injecting AND RPV water level increases to +12.5", THEN ENTER SP 29.Ø23.Ø1 (Level Control) Step 3.3. ________

3.5.2 IF HPCI and RCIC are not injecting AND RPV pressure is increasing, THEN ENTER SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ________

3.5.3 IF HPCI and RCIC are not injecting AND RPV pressure is not increasing, THEN ENTER SP 29.Ø23.Ø1 (Level Control) step 3.2. ________

3.6 RPV level increasing and RPV pressure below 100 psig (low region)

3.6.1 IF RPV pressure is increasing, THEN ENTER SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ________

3.6.2 IF RPV pressure is not increasing, THEN ENTER SP 29.Ø23.Ø1 (Level Control) step 3.2. ________

3.7 RPV level decreasing and RPV pressure greater than 333 psig (Intermediate/High region).

3.7.1 IF HPCI and RCIC are not operating, THEN restart HPCI (per SP 23.2Ø2.Ø1, High Pressure Coolant Injection) or RCIC (per SP 23.119.Ø1, Reactor Core Isolation Cooling (RCIC) System). ________

3.7.2 IF CRD is not operating AND at least 2 normal injection subsystems are lined up for injection with pumps running, THEN ENTER SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ________

3.7.3 IF CRD is not operating AND no normal injection subsystem is lined up for injection with at least one pump running, THEN start pumps in the following alternate injection subsystems which are lined up for injection. ________

3.7.3.1 Reactor Building Service Water System through service water/recirc loop ultimate cooling water crossties valves 1P41-MOV-Ø33A, MOV-Ø33B, MOV-Ø33C, and MOV-Ø33D. ________

3.7.3.2 ECCS connections from the Condensate Transfer System ________

3.7.3.3 SLC (test tank or boron tank) per SP 23.123.Ø1 (Standby Liquid Control) ________

3.7.4 IF CRD is operating OR a normal injection system is lined up for injection with a pump running OR an alternate injection system is lined up for injection with a pump running, THEN enter SP 29.Ø23.Ø5 (Rapid RPV Depressurization) WHEN RPV water level drops to +6" (TAF) on the fuel zone indicator (LI-ØØ7).

3.7.5 IF CRD is not operating AND no normal injection OR alternate injection subsystem is lined up for injection with at least one pump running, THEN perform Core Cooling Without Injection as follows.

[LATER (2/3 CORE HEIGHT)]

3.7.5.1 WHEN RPV water level drops to ~~(2/3 core height)~~ OR if RPV water level cannot be determined, OPEN one SRV. ________

3.7.5.2 WHEN RPV pressure drops below (later), OPEN all ADS valves. ________

3.7.5.3 IF all ADS valves cannot be opened, THEN open other SRV's until a total of 7 valves are open. ________

3.7.5.4 WHEN CRD is operating OR a normal OR an alternate injection system is lined up for injection with at least one pump running, ENTER SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ________

3.8 RPV level decreasing and RPV pressure less than 1ØØ psig (low region).

3.8.1 IF no normal injection system is lined up for injection with at least one pump running, THEN start pumps in the following alternate injection subsystems which are lined up for injection. ________

3.8.1.1 Reactor Building Service Water System through service water/recirc loop ultimate cooling water crossties valves 1P41-MOV-Ø33A, MOV-Ø33B, MOV-Ø33C, and MOV-Ø33D. ________

3.8.1.2 ECCS connections from the Condensate Transfer System ________

3.8.1.3 SLC (test tank or boron tank) per SP 23.123.Ø1 (Standby Liquid Control) ________

3.8.2 IF RPV pressure is increasing, THEN ENTER SP 29.Ø23.Ø5 (Rapid RPV Depressurization). ______

3.8.3 IF RPV pressure is not increasing, AND RPV water level drops to +6" on fuel zone instrumentation (TAF), THEN perform Core Cooling Without Level Restoration as follows. ______

3.8.3.1 Open all ADS valves. ______

> **CAUTION**
>
> NPSH requirements for pumps taking a suction from the Suppression Pool. Require a minimum level of 14 feet.

> **NOTE**
>
> Cooldown rates greater than 1ØØ°F/hr may be required to accomplish the following steps.

3.8.3.1 IF all of the ADS valves cannot be opened, THEN open other SRV's until a total of 7 valves are open. ______

3.8.3.2 Operate CS subsystems with suction from the suppression pool. ______

3.8.3.3 WHEN at least one core spray subsystem is operating with suction from the Suppression Pool AND RPV pressure is less than 29Ø psig, THEN terminate injection into the RPV from sources external to the primary containment. ______

3.8.3.4 IF RPV water level is restored to +6" (TAF) on the fuel zone instrumentation, THEN ENTER SP 29.Ø23.Ø1 (Level Control) step 3.2. ______

4.0 REFERENCES

4.1 SP 29.Ø23.Ø5 Rapid RPV Depressurization

4.2 SP 29.Ø23.Ø1 Level Control

4.3 SP 23.2Ø2.Ø1 High Pressure Coolant Injection

4.4 SP 23.119.Ø1 Reactor Core Isolation Cooling (RCIC) System

4.5 SP 23.1Ø6.Ø1 Control Rod Drive

4.6 SP 29.Ø23.Ø9 RPV Flooding

4.7 SP 23.2Ø3.Ø1 Core Spray System

4.8 SP 23.123.Ø1 Standby Liquid Control

4.9 SP 23.2Ø4.Ø1 Low Pressure Coolant Injection

4.10 SP 23.1Ø3.Ø1 Condensate System

4.11 SP 23.1Ø5.Ø1 Condensate Storage and Transfer System

4.12 SP 23.1Ø9.Ø1 Feedwater System

Submitted: ______________________________
(Section Head)

Approved: ______________________________
(Plant Manager)

SP Number 29.Ø23.Ø5

Revision: E

Effective Date ______________

RAPID RPV DEPRESSURIZATION EMERGENCY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to rapidly depressurize the RPV to allow injection systems to inject and restore RPV water level to an acceptable level above TAF.

2.0 ENTRY CONDITIONS

This procedure is entered from the following Emergency Procedures:

2.1 SP 29.023.03 (Containment Control) when:

2.1.1 Suppression Pool temperature and RPV pressure cannot be maintained below the heat capacity temperature limit.

2.1.2 Drywell temperature near the cold reference leg instrument vertical runs has increased to the RPV saturation limit.

2.1.3 Drywell temperature cannot be maintained below 296°F.

2.1.4 Suppression Pool Water Level cannot be maintained above the heat capacity level limit.

2.2 SP 29.Ø23.Ø4 (Level Restoration) when:

2.2.1 RPV water level cannot be determined and at least one normal injection or alternate injection subsystem is lined up with at least one pump running.

2.2.2 RPV water level is increasing, RPV pressure is between 1ØØ psig and 333 psig and is increasing, HPCI and RCIC are not available.

2.2.3 RPV water level is increasing, RPV pressure is less than 100 psig and RPV pressure is increasing.

2.2.4 RPV water level is decreasing, RPV pressure is greater that 333 psig, CRD is not operating and at least two injection subsystems are lined up for injection with pumps running.

2.2.5 RPV water level is decreasing, RPV pressure is less than 333 psig, any injection or alternate injection subsystem is lined up with pumps running and RPV pressure is increasing.

Disc #57
JA 9/?

2.2.6 RPV water level is decreasing, RPV pressure is greater than 333 psig and low pressure injection subsystems or alternate injection subsystems are lined up for injection with at least one pump running.

3.0 OPERATOR ACTION

3.1 Open all ADS valves. ________

CAUTION
Do not depressurize the RPV below 100 psig (HPCI low pressure isolation setpoint) unless motor driven pumps sufficient to maintain RPV water level are running and the systems are available for injection.

CAUTION
NPSH requirements for pumps taking a suction for the Suppression Pool require a minimum level of 14 feet.

CAUTION
Cooldown rates greater than 100°F/hr may be required to accomplish the following steps.

3.2 IF not all ADS valves can be opened, THEN open other SRV's until a total of 7 valves are open. ________

3.3 IF less than 3 SRV's can be opened, THEN rapidly depressurize the RPV using one or more of the following systems. (Use in the order which will minimize radioactive release to the environment).

CAUTION
Defeating isolation interlocks may be required to complete this step.

3.3.1 RCIC per SP 23.119.Ø1 (Reactor Core Isolation Cooling (RCIC) System). ________

3.3.2 HPCI per SP 23.2Ø2.Ø1 (High Pressure Coolant Injection). ________

3.3.3 RHR (Steam Condensing Mode) per SP 23.121.Ø1 (Residual Heat Removal (RHR) System).

3.3.4 Main Turbine Bypass Valves per SP 22.ØØ5.Ø1 (Shutdown to Cold Shutdown). ________

3.3.5 Steam Jet Air Ejectors per SP 23.7Ø1.Ø1 (Condenser Off-Gas Removal). ________

3.3.6 RFPTS per SP 23.1Ø9.Ø1 (Feedwater System). ________

3.3.7 Steam Seal Evaporator per SP 23.124.Ø1 (Steam Sealing). ________

3.3.8 Main Condenser Deaerating Steam per SP 23.1Ø3.Ø1 (Condensate). ________

3.3.9 RPV Head Vent. ________

3.3.10 Main Steam Line Drains per SP 23.116.Ø1 (Main and Auxiliary Steam). ________

3.3.11 RWCU (Blowdown Mode) per SP 23.7Ø1.Ø1 (Reactor Water Cleanup System). ________

3.4 IF any of the following exist, THEN enter SP 29.Ø23.Ø9 (RPV Flooding).

3.4.1 Suppression chamber pressure cannot be maintained below the pressure suppression limit (Fig. 1). ________

3.4.2 RPV water level cannot be determined. ________

3.4.3 Temperature near the cold reference leg instrument vertical runs reaches the RPV staturation limit (Fig. 2). ________

NOTE

The cold reference leg instruments are (later).

3.5 Proceed to SP 29.Ø23.Ø1 (Level Control) Step 3.2. ________

4.0 REFERENCES

4.1 SP 29.Ø23.Ø3 Containment Control

4.2 SP 29.Ø23.Ø4 Level Restoration

4.3 SP 29.Ø23.Ø9 RPV Flooding

4.4 SP 22.ØØ5.Ø1 Shutdown to Cold Shutdown

4.5 SP 23.119.Ø1 Reactor Core Isolation Cooling (RCIC) System

4.6 SP 23.2Ø2.Ø1 High Pressure Coolant Injection

4.7 SP 23.121.Ø1 Residual Heat Removal (RHR) System

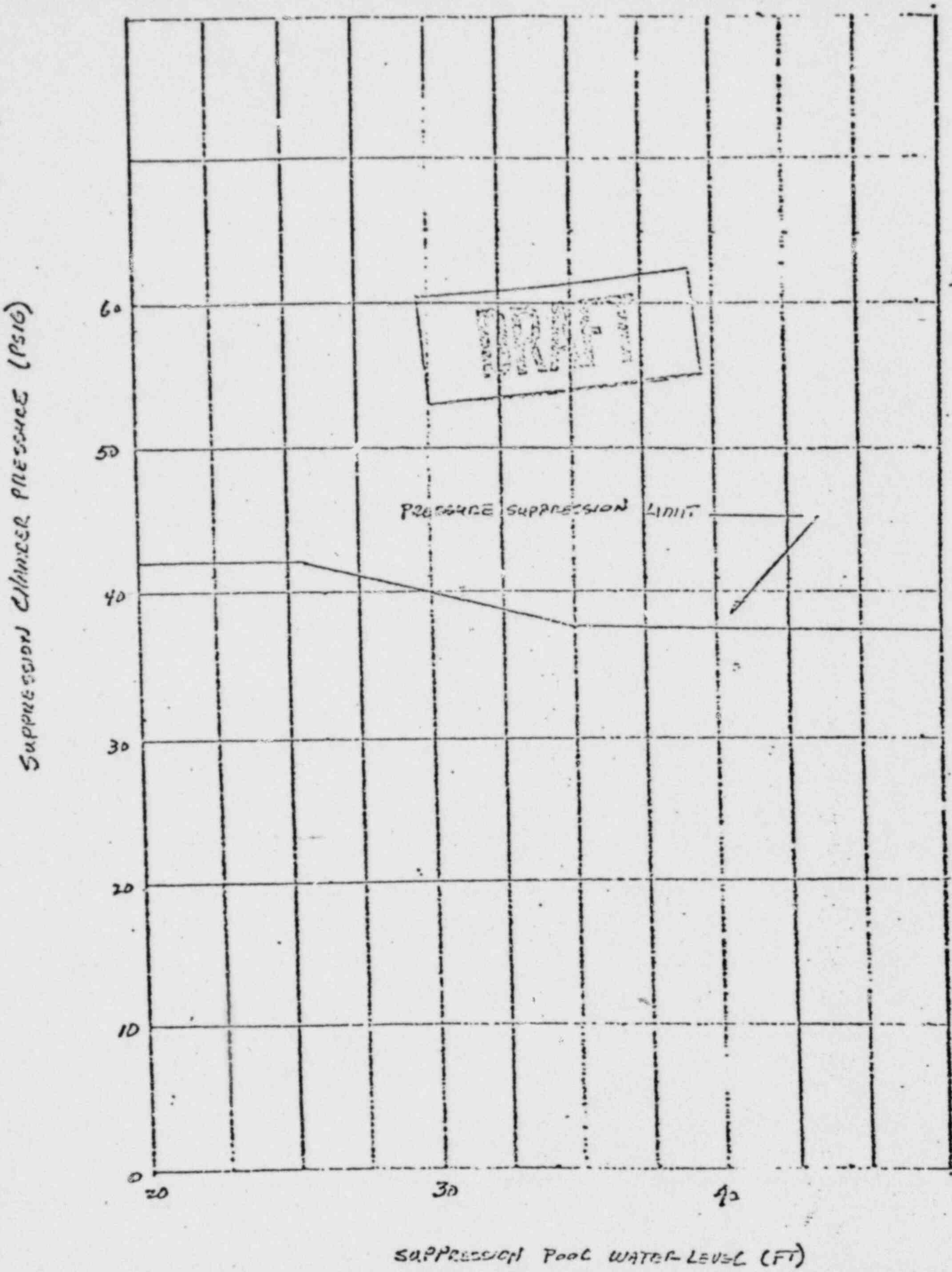
4.8 SP 23.7Ø1.Ø1 Condenser Off Gas Removal

4.9 SP 23.124.Ø1 Steam Sealing

4.10 SP 23.1Ø3.Ø1 Condensate

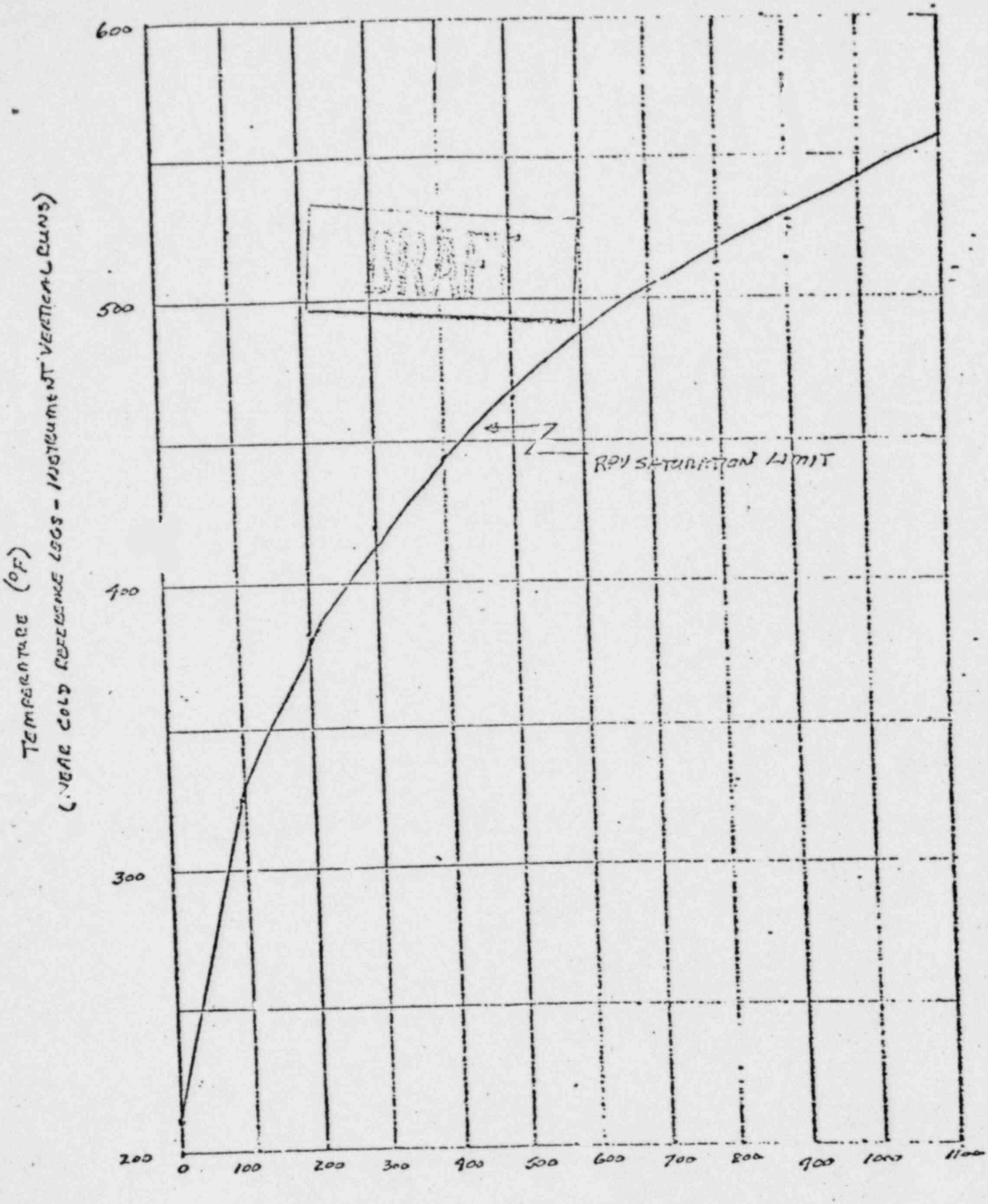
4.11 SP 23.1Ø9.Ø1 Feedwater System

4.12 SP 23.7Ø9.Ø1 Reactor Water Cleanup System



SUPPRESSION CHAMBER PRESSURE (PSIG)
60
50
40
30
20
10
0
PRESSURE SUPPRESSION LIMIT
20
30
40
SUPPRESSION POOL WATER LEVEL (FT)

FIG 1



RPV PRESSURE (PSIG) FIG 2

Submitted: ______________________ SP Number 29.Ø24.Ø1
(Section Head)

Approved: ______________________ Revision E
(Plant Manager)

Date Eff. ______________

TRANSIENT WITH FAILURE TO SCRAM

EMERGENCY PROCEDURE

1.0 SYMPTOMS

1.1 A valid scram signal or condition due to a reactor transient is alarmed or indicated and all control rods do not fully insert as indicated on the full core display, rod position printout on the computer, or four rod display.

1.2 Reactor pressure and/or neutron flux indication increases abruptly and may go off-scale on recorders and meters.

1.3 Safety relief valves may lift.

2.0 AUTOMATIC ACTIONS

2.1 1115 psig reactor vessel pressure and above actuates various safety relief valves. ________

2.2 1120 reactor vessel pressure TRIPS the reactor recirculation pumps. ________

3.0 IMMEDIATE OPERATOR ACTIONS

3.1 Manually scram reactor per SP 29.Ø1Ø.Ø1 (Emergency Shutdown) ________

3.1.1 Arm and depress manual scram pushbutton. ________

3.1.2 Place the Mode switch in refuel. ________

3.3.3 Verify all rods are inserted. ________

3.2 IF the reactor scrams AND all rods insert, AND power is decaying, THEN do not continue this procedure. ________

3.3 Trip the recirculation pumps. ________

3.4 Commence suppression pool cooling per SP 23.121.01 (Residual Heat Removal (RHR) System). ________

3.5 The following attempts to scram the reactor are to be performed concurrently if manpower is available.

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3.5.1 Insert those rods not fully inserted with the reactor manual control system as the Rod Sequence Control System (RSCS) permits.

3.5.2 Bypass the scram discharge volume high level scram switches, reset the RPS trip and verify the vent and drain valves open.

3.5.2.1 Alternately RESET the Reactor Protective System and SCRAM the reactor until all rods are fully inserted.

3.5.3 Confirm all scram valves are open by observation of scram valve position lights. IF not, THEN perform the following:

3.5.3.1 DE-ENERGIZE RP's subchannel logic by opening the following breakers on 1C71*PNL-ØØ1 in the relay room:

a) CB2A

b) CB2B

c) CB7A

d) CB7B

3.5.3.2 Vent air from the scram air system by closing valve C11-Ø2V-Ø7Ø4 and opening vent valve downstream of C11-Ø1V-71Ø4.

3.5.3.3 Restore the breakers and air valves to normal when all scram valves are open.

3.5.4 Bypass the scram discharge volume (SDV) high level scram switches, reset the RPS trip and verify the vent and drain valves open.

3.5.4.1 INDIVIDUALLY SCRAM Control Rods at Local Hydraulic Control Units (HCU's) by placing both NORM-TEST-S.R.I. switches to the TEST position.

3.6 IF reactor power is above 6% OR RPV level cannot be maintained OR suppression pool temperature reaches 110°F, THEN perform the following.

3.6.1 Start either A or B standby liquid control pump and inject the entire contents of the tank.

3.6.1.1 IF RWCU automatic isolation did not occur, THEN manually isolate RWCU. ______

3.6.1.2 Terminate all injection into the RPV with the exception of CRD and RCIC or HPCI to maintain RPV water level above the top of active fuel (TAF). ______

4.0 SUBSEQUENT OPERATOR ACTION

4.1 Verify immediate operator actions. ______

4.2 IF reactor pressure is causing the safety relief valves (SRV's to cycle, THEN perform the following. ______

4.2.1 Manually open enough SRV's to reduce reactor pressure to between 800 and 960 psig. ______

4.2.2 For subsequent SRV operation, the valves should be cycled in order to minimize local heat loading of the suppression pool. ______

4.2.3 If the HPCI system is not in service, it may be placed in full flow test to minimize SRV cycling. ______

4.3 SAMPLE reactor coolant frequently to verify boron concentration above the level determined to maintain the plant shutdown. ______

4.4 After the reactor is shutdown, PROCEED to stabilize Plant Condition in Hot Shutdown by performing either steps 4.4.1, 4.4.2, or 4.4.3. ______

CAUTION

Do not shutdown SLC Injection once it has been started until the SLC Solution Tank is verified to be empty.

4.4.1 Maintain Reactor pressure between 800 and 960 psig by use of Main Turbine Bypass Valves. ______

CAUTION

Consult with the Nuclear Engineer to confirm that boron concentration in the reactor will be sufficient to maintain the reactor shutdown after accounting for a normal startup of the Steam Condensing Mode of RHR.

4.4.2 Maintain reactor pressure between 800 and 960 psig by use of the RHR steam condensing in accordance with SP 23.121.01 (Residual Heat Removal (RHR) System). ______

4.4.3 Maintain reactor pressure between 800 and 960 psig by opening safety relief valves and utilizing Suppression Pool Cooling to limit Suppression Pool temperature. ______

4.5 Place the reactor in COLD SHUTDOWN, by performing the following:

4.5.1 Confirm by sample results and consultations with the Nuclear Engineer that sufficient negative reactivity has been inserted into the reactor to account for the positive reactivity effects of temperature decrease and dilution. ______

4.5.2 Start the reactor recirc pumps at minimum speed. ______

4.5.3 Shutdown and Cooldown in accordance with SP 22.ØØ5.Ø1 (Shutdown to Cold Shutdown). ______

4.6 Override the RHR pump minimum flow valve to the closed position to prevent the loss of borated water when shutdown cooling is placed in service. ______

4.7 When reactor pressure has decreased to 135 psig, Startup RHR Shutdown Cooling in accordance with SP 23.121.01 (Residual Heat Removal (RHR) System). ______

4.8 If flooding the reactor vessel up to the steam dome is necessary, use the SLC system. ______

4.9 Maintain boron concentration in the vessel between 750 and 1000 PPM. ______

5.0 FINAL PLANT CONDITIONS

5.1 The plant is in cold shutdown conditions. ______

5.2 Reactor level being maintained in the normal operating range (between 34" and 42" ______

Watch Engineer Review________________
(Watch Engineer)

6.0 DISCUSSION

An ATWS is extremely unlikely but will require prompt operator action to mitigate the consequences. Operator concerns are as follows:

6.1 Verify Recirc. pumps trip.

6.2 Shutdown the reactor.

6.3 Limit reactor pressure.

6.4 Maintain the core covered.

6.5 Limit Suppression Pool temperature.

6.6 Place plant in Cold Shutdown.

The operator must attempt to scram the reactor with the most readily available means. If the reactor cannot be maintained subcritical with Control Rods and reactor level falls below +12.5" or Suppression Pool temperature can't be maintained below 110°F, SBLC must be initiated to minimize containment heat-up. Suppression Pool Cooling should be initiated as soon as possible to ensure suppression pool temperature limits are not exceeded.

A Cooldown must not be initiated until control rods are inserted or Boron concentration is satisfactory to prevent a restart of the reactor.

Once Boron injection is started, it must be run to completion.

Submitted: ______________________ ________
(Section Head)

Approved: ______________________ ________
(Plant Manager)

SP Number 29.023.09

Revision E

Effective Date ________

REACTOR PRESSURE VESSEL FLOODING

EMERGENCY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to flood the RPV using all the available injection subsystems.

2.0 ENTRY CONDITIONS

This procedure is entered from SP 29.023.05 (Rapid RPV Depressurization) if any of the following occur:

2.1 Temperature near the cold reference leg instrument vertical runs exceeds the RPV saturation limit.

2.2 RPV water level cannot be determined.

2.3 Suppression chamber pressure exceeding pressure suppression limit.

3.0 OPERATOR ACTIONS

3.1 IF at least 3 SRV's are open, OR if core spray or other motor driven feedwater pumps are available for injection, THEN CLOSE the following isolation valves.

3.1.1 MSIV's

1B21-AOV-081A ________	1B21-AOV-082A ________
1B21-AOV-081B ________	1B21-AOV-082B ________
1B21-AOV-081C ________	1B21-AOV-082C ________
1B21-AOV-081D ________	1B21-AOV-082D ________

3.1.2 MSL Drain Line Isolation Valves

1B21 MOV-038 ________	1B21 MOV-033 ________
1B21 AOV-088 ________	1B21 AOV-089 ________

3.1.3 RHR Steam Condensing Isolation Valve

1E11 MOV-049 ________

3.1.4 HPCI Isolation Valves

1E41 MOV-041 ________	1E41 MOV-047 ________
1E41 MOV-042 ________	1E41 MOV-048 ________

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3.1.5 RCIC Isolation Valves

1E51 MOV-041________ 1E51 MOV-047________
1E51 MOV-042________ 1E51 MOV-048________

3.1.6 RWCU Isolation Valves

1G33*MOV-031________ 1G?3*MOV-041________
1G33*MOV-032________

3.2 IF RPV water level cannot be determined, THEN commence and increase ~~until at least~~ UNTIL AT LEAST injection into the RPV with all of the following 3 SRV's are open AND RPV pressure is not decreasing AND is at least 1ØØ psig above suppression chamber pressure. ________

3.2.1 Core spray per SP 23.204.01 (Core Spray System). ________

3.2.2 Condensate/condensate booster pumps per SP 23.103.01 (Condensate). ________

3.2.3 LPCI per SP 23.204.01 (Low Pressure Coolant Injection). ________

3.2.4 CRD per SP 23.106.01 (Control Rod Drive). ________

3.2.5 Service water/recirc loop ultimate cooling water crosstie valves 1P41-MOV-Ø33A, MOV-Ø33B, MOV-Ø33C, and MOV-Ø33D. ________

3.2.6 ECCS connections from the condensate transfer system. ________

3.2.7 SLC (test tank) or SLC (boron tank) per SP 23.123.01 (Standby Liquid Control) ________

3.3 Maintain RPV pressure at least 100 psig above suppression chamber pressure by throttling injection. ________

3.4 IF RPV water level can be determined, THEN commence and increase injection into the RPV with the systems listed in 3.2 until RPV water level is increasing. ________

3.5 IF suppression chamber pressure cannot be maintained below the primary containment pressure limit (Fig. 2), THEN initiate the following systems irrespective of whether adequate core cooling is assured:

3.5.1 Drywell sprays ________

3.5.2 Suppression pool sprays only when suppression pool water level is below (later). ________

CAUTION
Defeating isolation interlocks may be required to accomplish the following step.

3.6 IF suppression chamber pressure exceeds the primary containment pressure limit, THEN vent the primary containment in accordance with (later) to reduce pressure below the primary containment pressure limit. ________

3.7 IF RPV water level cannot be determined, THEN perform the following:

3.7.1 Fill all RPV level instrumentation reference columns. ________

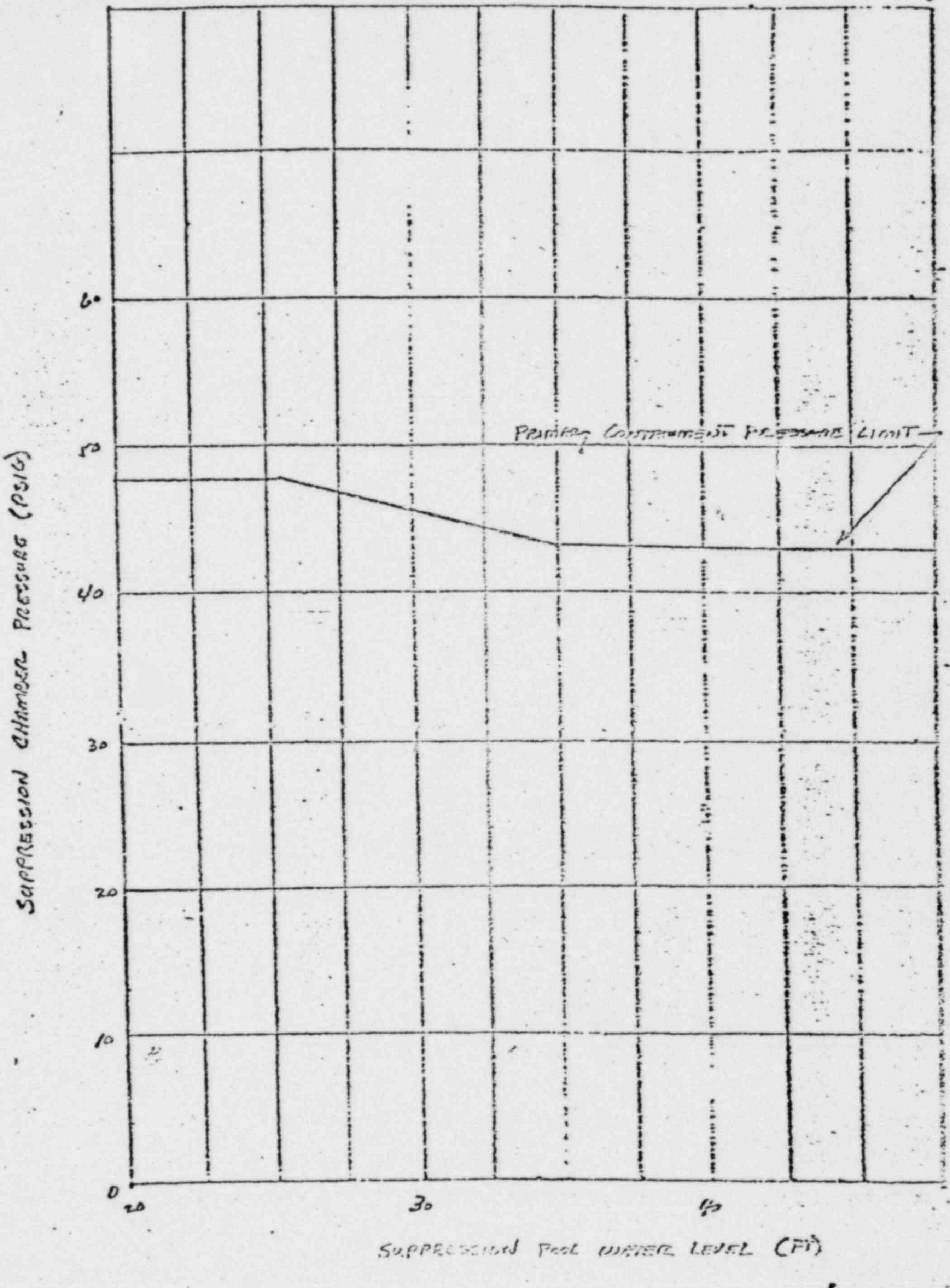
3.7.2 Continue injection until temperature near the cold reference leg vertical runs is below 212°F and RPV water level instrumentation is available. ________

3.8 IF RPV water level can be determined, THEN enter SP 29.Ø23.Ø1 (Level Control) step 3.2. ________

3.9 IF it can be determined that the RPV is filled OR if RPV pressure is at least 100 psig above suppression chamber pressure, THEN terminate all injection into the RPV and reduce RPV water level. ________

3.10 IF RPV water level indication is not restored within the maximum acceptable core uncovery time (Fig. 2) after commencing termination of injection into the RPV, THEN return to step 3.7. ________

3.11 WHEN suppression chamber pressure can be maintained below the primary containment pressure limit (Fig. 1), THEN enter SP 29.Ø23.Ø1 (Level Control) at step 3.2. ________



SUPPRESSION CHAMBER PRESSURE (PSIG)
PRIMARY CONTAINMENT PRESSURE LIMIT
60
50
40
30
20
10
0
20
30
40
SUPPRESSION POOL WATER LEVEL (FT)

FIG 1

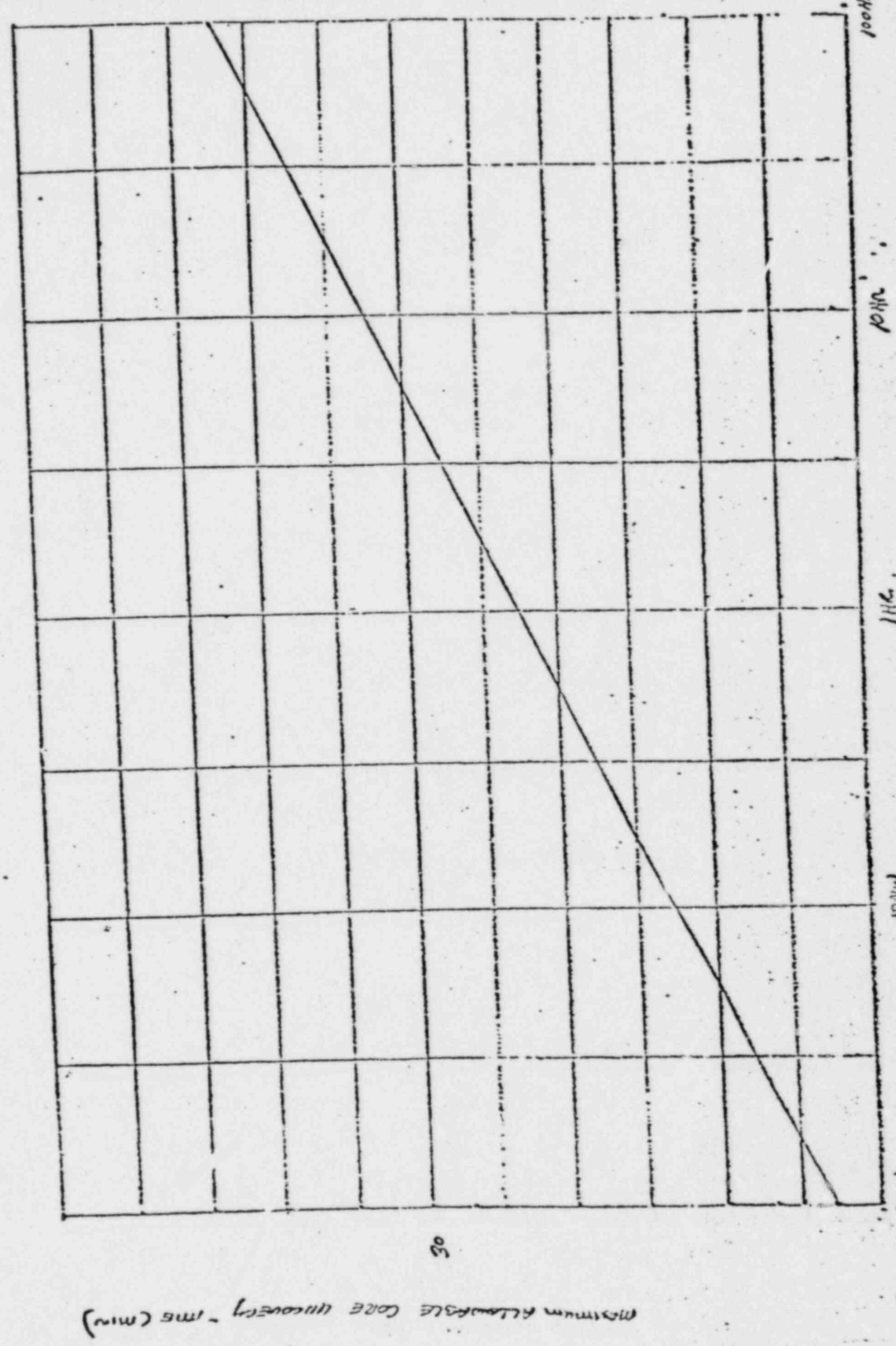

100HR
10HR
1HR
10MIN
1MIN
30
maximum allowable core uncovery - time (min)

FIG 3

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DRAFT

EMERGENCY PROCEDURE GUIDELINES

Revision 1B

BWR 1 through 6

August 27, 1981

INTRODUCTION

Based on the various BWR system designs, the following generic symptomatic emergency procedure guidelines have been developed:

- Level Control Guideline
- Cooldown Guideline
- Containment Control Guideline

The Level Control Guideline restores and stabilizes RPV water level. This guideline is entered after low RPV water level, high drywell pressure, or an isolation has occurred.

The Cooldown Guideline maintains RPV water level while depressurizing the RPV to cold shutdown conditions. This guideline is entered from the Level Control Guideline after the RPV water level has been stabilized.

The Containment Control Guideline controls primary containment temperatures, pressure, and level whenever suppression pool temperature, drywell temperature, containment temperature, drywell pressure, or suppression pool water level is above its normal operating limit or suppression pool water level is below its normal operating limit. This guideline is executed concurrently with the guideline from which it is entered.

Figure 1, Operator Actions Flowchart, illustrates all operator actions within the emergency procedure guidelines. Each action block states briefly the operator action and its purpose. The blocks are correlated from top (high RPV pressure) to bottom (RPV cold shutdown conditions) with a vertical RPV pressure/temperature scale to show continuity of the linked operator actions. Each block is further identified by a numbered symbol (e.g., ▽1) which is keyed to the guideline steps.

Table I is a list of abbreviations used in the guidelines.

Brackets [ ] enclose plant unique setpoints, design limits, pump shutoff pressures, etc., and parentheses ( ) within brackets indicate the source for the bracketed variable. Illustrated in these guidelines are variables for a typical BWR/4 or BWR/6 as appropriate.

At various points throughout these guidelines, precautions are noted by the symbol [#] . The number within the box refers to a numbered "Caution" contained in the Operator Precautions section. These "Cautions" are brief and succinct red flags for the operator. Where the basis for a "Caution" or a step is not completely evident from the text, a full discussion of the basis is contained in Appendix A. Other system details which pertain to the guidelines are also included in this appendix.

The emergency procedure guidelines are generic to GE-BWR 1 through 6 designs in that they address all major systems which may be used to respond to the emergency. Because no specific plant includes all of the systems in these guidelines, the guidelines are applied to individual plants by deleting statments which are not applicable or by substituting equivalent systems where appropriate. For example, plants with no low pressure injection system will delete statements referring to LPCI, and plants with Low Pressure Core Flooding will substitute LPCF for LPCI.

At various points within these guidelines, limits are specified beyond which certain actions are required. While conservative, these limits are derived from engineering analyses utilizing best-estimate (as opposed to licensing) models. Consequently, these limits are not as conservative as the limits specified in a plant's Technical Specifications. This is not to imply that operation beyond the Technical Specifications is recommended in an emergency. Rather, such operation may be required under certain degraded conditions in order to safely mitigate the consequences of those degraded conditions. The limits specified in the guidelines establish the boundaries within which continued safe operation of the plant can be assured. Therefore, conformance with the guidelines does not ensure strict conformance with a plant's Technical Specifications or other licensing bases.

The entry conditions for these emergency procedure guidelines are symptomatic of both emergencies and events which may degrade into emergencies. The guidelines specify actions appropriate for both. Therefore, entry into procedures developed from these guidelines is not conclusive that an emergency has occurred.

TABLE I

ABBREVIATIONS

ADS	-	Automatic Depressurization System
CRD	-	Control Rod Drive
ECCS	-	Emergency Core Cooling System
HPCI	-	High Pressure Coolant Injection
HPCS	-	High Pressure Core Spray
IC	-	Isolation Condenser
LOCA	-	Loss of Coolant Accident
LPCI	-	Low Pressure Coolant Injection
LPCS	-	Low Pressure Core Spray
MSIV	-	Main Steamline Isolation Valves
NDTT	-	Nil-Ductility Transition Temperature
NPSH	-	Net Positive Suction Head
RCIC	-	Reactor Core Isolation Cooling
RHR	-	Residual Heat Removal
RPV	-	Reactor Pressure Vessel
RWCU	-	Reactor Water Cleanup
SBGT	-	Standby Gas Treatment
SLC	-	Standby Liquid Control
SORV	-	Stuck Open Relief Valve
SPMS	-	Suppression Pool Makeup System
SRV	-	Safety Relief Valve

OPERATOR PRECAUTIONS

General

This section lists "Cautions" which are generally applicable at all times.

CAUTION #1

Monitor the general state of the plant. If an entry condition for either [procedure developed from the Level Control Guideline] or [procedure developed from the Containment Control Guideline] occurs, enter that procedure. When it is determined that an emergency no longer exists, enter [normal operating procedure].

CAUTION #2

Monitor RPV water level and pressure and primary containment temperatures and pressure from multiple indications.

CAUTION #3

If a safety function initiates automatically, assume a true initiating event has occurred unless otherwise confirmed by at least two independent indications.

CAUTION #4

Whenever RHR is in the LPCI mode, inject through the heat exchangers as soon as possible.

CAUTION #5

Suppression pool temperature is determined by [procedure for determining bulk suppression pool water temperature]. Drywell temperature is determined by [procedure for determining drywell atmosphere average temperature]. Containment temperature is determined by [procedure for determining Mark III containment atmosphere average temperature].

CAUTION #6

Whenever [temperature near the instrument reference leg vertical runs] exceeds the temperature in the table, the actual RPV water level may be anywhere below the elevation of the lower instrument tap when the instrument reads below the indicated level in the table.

Temperature*	Indicated Level	Instrument	
[any	537 in.	Shutdown Range Level	(500 to 900 in.)]
$105^{o}F$	-109 in.	Wide Range Level	(-150 to +60 in.)
$310^{o}F$	19 in.	Narrow Range Level	(0 to +60 in.)
$379^{o}F$]	239 in.	Fuel Zone Level	(200 to 500 in.)]

* [List in order of increasing temperature].

CAUTION #7

[Heated reference leg instrument] indicated levels are not reliable during rapid RPV depressurization below 500 psig. For these conditions, utilize [cold reference leg instruments] to monitor RPV water level.

CAUTION #8

If signals of high suppression pool water level [12 ft. 7 in. (high level suction interlock)] or low condensate storage tank water level [0 in. (low level suction interlock)] occur, confirm automatic transfer of or manually transfer HPCI, HPCS, and RCIC suction from the condensate storage tank to the suppression pool.

CAUTION #9

If suppression pool temperature exceeds [95°F (normal operating limit)], drywell temperature exceeds [135°F (normal operating limit)], containment temperature exceeds [90°F (normal operating limit)], drywell pressure exceeds [2.0 psig (drywell pressure which initiates ECCS)], or suppression pool water level exceeds [12 ft. 6 in. (normal operating limit)] or decreases below [12 ft. 2 in. (normal operating limit)], enter [procedure developed from the Containment Control Guideline] and execute it concurrently with the procedure from which it was entered.

Specific

This section lists "Cautions" which are applicable at one or more specific points within the guidelines. Where a "Caution" is applicable, it is identified with the symbol [#].

CAUTION #10

Do not secure or place an ECCS in MANUAL mode unless, by at least two independent indications, (1) misoperation in AUTOMATIC mode is confirmed, or (2) adequate core cooling is assured. If an ECCS is placed in MANUAL mode, it will not initiate automatically. Make frequent checks of the initiating or controlling parameter. When manual operation is no longer required, restore the system to AUTOMATIC/STANDBY mode if possible.

CAUTION #11

If a high drywell pressure ECCS initiation signal [2.0 psig (drywell pressure which initiates ECCS)] occurs or exists while depressurizing, prevent injection from those LPCS and LPCI pumps not required to assure adequate core cooling prior to reaching their maximum injection pressures. When the high drywell pressure ECCS initiation signal clears, restore LPCS and LPCI to AUTOMATIC/STANDBY mode.

CAUTION #12

Do not throttle HPCI or RCIC systems below [2200 rpm (minimum turbine speed which yields acceptable continuous operation per turbine vendor manual)].

CAUTION #13

Cooldown rates above [100°F/hr (maximum RPV cooldown rate)] may be required to conserve RPV water inventory, protect primary containment integrity, or limit radioactive release to the environment.

CAUTION #14

Do not depressurize the RPV below [100 psig (HPCI or RCIC low pressure isolation setpoint, whichever is higher)] unless motor driven pumps sufficient to maintain RPV water level are running and available for injection.

CAUTION #15

1. Open SRVs in the following sequence if possible: [SRV opening sequence].

2. If the continuous SRV pneumatic supply is or becomes unavailable, depressurize with sustained SRV opening.

CAUTION #16

If continuous LPCI operation is required to assure adequate core cooling, do not divert RHR pumps from the LPCI mode.

CAUTION #17

Cooldown rates above [100^{o}F/hr (maximum RPV cooldown rate)] may be required to accomplish this step.

CAUTION #18

Observe NPSH requirements for pumps taking suction from the suppression pool.

CAUTION #19

Elevated suppression chamber pressure may trip the RCIC turbine on high exhaust pressure.

CAUTION #20

Defeating isolation interlocks may be required to accomplish this step.

LEVEL CONTROL GUIDELINE

LC-1 PURPOSE

The purpose of this guideline is to restore and stabilize RPV water level.

The entry conditions for this guideline are any of the following:

- RPV water level below [+ 12 in. (low level scram setpoint)], or
- drywell pressure above [2.0 psig (high drywell pressure scram setpoint)], or
- an isolation which requires or initiates reactor scram.

LC-2 OPERATOR ACTIONS

LC-2.1 Confirm initiation of any of the following:

- Reactor scram
- Isolation
- ECCS
- [Emergency diesel generator]

Initiate any of these which should have initiated but did not.

LC-2.2 Enter [scram procedure] and execute it concurrently with this procedure.

LC-2.3 [Confirm or place the reactor mode switch in REFUEL].

2 LC-2.4 Restore and maintain RPV water level between [+12 in. (low level scram setpoint)] and [+58 in. (high level trip setpoint)] with one or more of the following systems:

- Condensate/feedwater system [1110 - 0 psig (RPV pressure range for system operation)]
- CRD system [1110 - 0 psig (RPV pressure range for system operation)]
- RCIC system [1..0 - 50 psig (RPV pressure range for system operation)]
- HPCI system [1110 - 100 psig (RPV pressure range for system operation)]
- HPCS system [1110 - 0 psig (RPV pressure range for system operation)]
- LPCS system [425 - 0 psig (RPV pressure range for system operation)]
- LPCI system [250 - 0 psig (RPV pressure range for system operation)]

If RPV water level cannot be restored and maintained above [+12 in. (low level scram setpoint)], maintain RPV water level above [-164 in. (top of active fuel)].

If RPV water level cannot be maintained above [-164 in. (top of active fuel)] or cannot be determined, enter [procedure developed from CONTINGENCY #1].

3 LC-2.5 If SRVs are cycling, initiate IC or manually open one SRV and reduce RPV pressure to below [940 psig (150 psig below the minimum SRV setpoint)].

LC-2.6 When the RPV water level has stabilized, enter [procedure developed from the Cooldown Guideline].

COOLDOWN GUIDELINE

CD-1 PURPOSE

The purpose of this guideline is to depressurize and cool down the RPV to cold shutdown conditions ([100°F < RPV water temperature < 212°F]) while maintaining RPV water level within a satisfactory range.

This guideline is entered from the Level Control Guideline after the RPV water level has been stabilized.

CD-2 OPERATOR ACTIONS

2 CD-2.1 Maintain RPV water level between [- 164 in. (top of active fuel)] and [+58 in. (high level trip setpoint)] with one or more of the following systems: #8, #10, #11

- Condensate/feedwater system [1110 - 0 psig (RPV pressure range for system operation)]
- CRD system [1110 - 0 psig (RPV pressure range for system operation)]
- RCIC system [1110 - 50 psig (RPV pressure range for system operation)] #9, #12

- HPCI system [1110 - 100 psig (RPV pressure range for system operation)]

- HPCS system [1110 - 0 psig (RPV pressure range for system operation)]

- LPCS system [425 - 0 psig (RPV pressure range for system operation)]

- LPCI system [250 - 0 psig (RPV pressure range for system operation)]

If RPV water level cannot be maintained above [-164 in. (top of active fuel)] or cannot be determined, enter [procedure developed from CONTINGENCY #1].

3 CD-2.2 If SRVs are cycling, initiate IC or manually open one SRV and reduce RPV pressure to below [940 psig (150 psig below the minimum SRV setpoint)].

4 CD-2.3 Depressurize the RPV and maintain cooldown rate below [100°F/hr (maximum RPV cooldown rate)] with one or more of the following systems:

#13, #14

Main Condenser Available	Main Condenser Not Available
Main turbine bypass valves. Pressure reduction may be augmented by:	• IC
• IC	• HPCI [#9, #12]
• HPCI [#9, #12]	• RCIC
• RCIC	• RWCU (recirculation mode) Pressure reduction may be augmented by:
• Other steam driven equipment.	• SRVs [#15]
• RWCU (recirculation mode)	• RWCU (blowdown mode). Refer to [sampling procedures] prior to initiating blowdown.
• Main steam line drains	
• RWCU (blowdown mode). Refer to [sampling procedures] prior to initiating blowdown.	

5 CD-2.4 When the RHR shutdown cooling interlocks clear, initiate the shutdown cooling mode of RHR.

If the RHR shutdown cooling mode cannot be established and further cooldown is required, continue to cool down using one or more of the systems used for depressurization.

> If RPV cooldown is required but cannot be accomplished, enter [procedure developed from CONTINGENCY 05].

6 CD-2.5 Proceed to cold shutdown in accordance with [procedure for cooldown to cold shutdown conditions].

CC-1 PURPOSE

The purpose of this guideline is to control primary containment temperatures, pressure, and level. The Containment Control Guideline is executed concurrently with the guideline from which it is entered.

The entry conditions for this guideline are any of the following:

- Suppression pool temperature above [95°F (normal operating limit)]
- Drywell temperature above [135°F (normal operating limit)]
- Containment temperature above [90°F (normal operating limit)]
- Drywell pressure above [2.0 psig (drywell pressure which initiates ECCS)]
- Suppression pool water level above [12 ft. 6 in. (normal operating limit)]
- Suppression pool water level below [12 ft. 2 in. (normal operating limit)]

Irrespective of the entry condition, enter this procedure at [Steps CC-2.1, CC-2.2, CC-2.3, CC-2.4, and CC-2.5] and execute these steps concurrently with one another.

7 CC-2.1 Monitor and control suppression pool temperature.

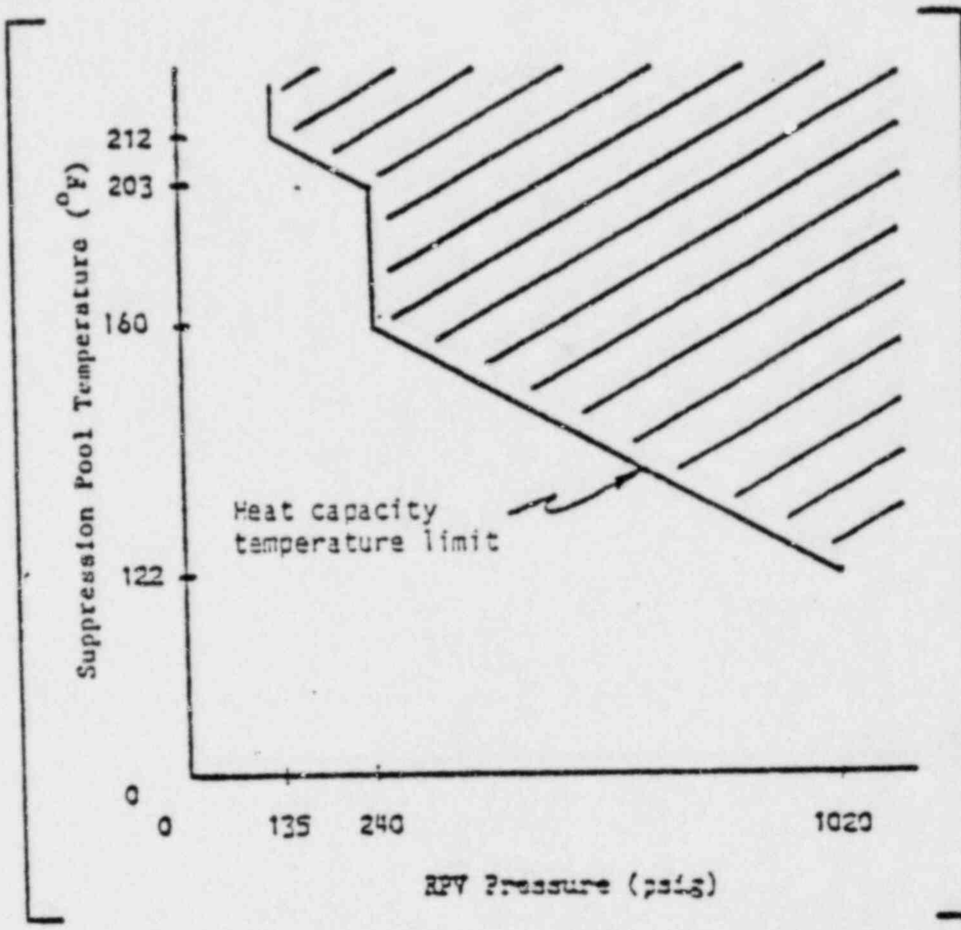
8 CC-2.1.1 Close any SORV.

If any SORV cannot be closed [within 2 minutes], scram the reactor.

9 CC-2.1.2 Operate available suppression pool cooling when pool temperature exceeds [95°F (normal operating limit)]. #16

10 CC-2.1.3 If suppression pool temperature reaches [110°F (limit for scram)], scram the reactor.

11 CC-2.1.4 If suppression pool temperature cannot be maintained below the heat capacity temperature limit, maintain RPV pressure below the limit. #14, #17, #18



If suppression pool temperature and RPV pressure cannot be restored or maintained below the heat capacity temperature limit, enter [procedure developed from CONTINGENCY #2].

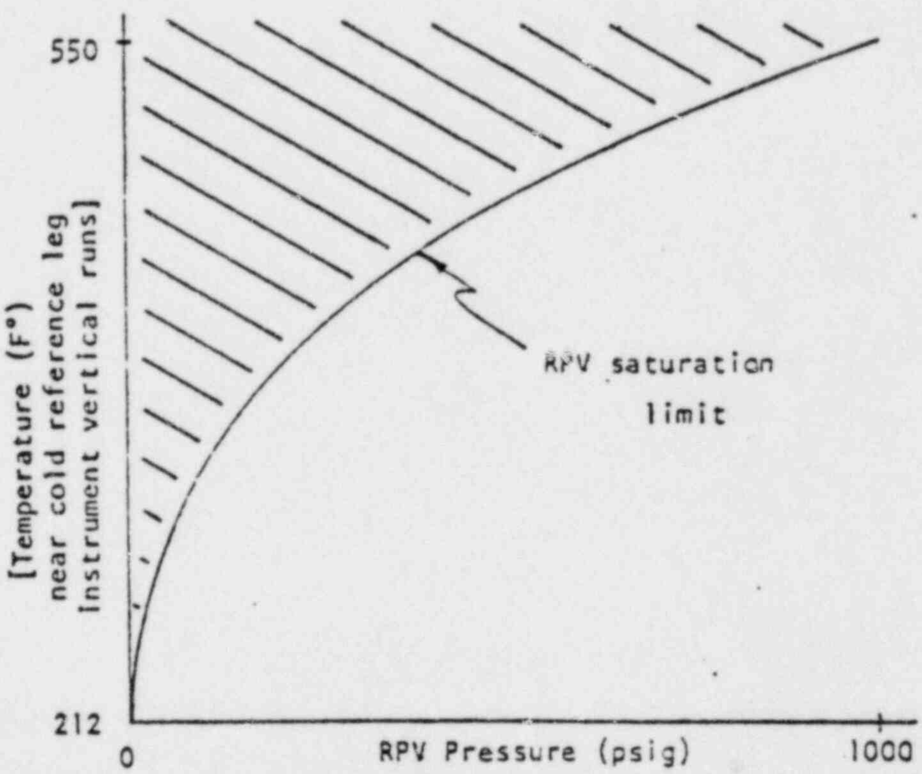
12 CC-2.2 Monitor and control drywell temperature.

13 CC-2.2.1 Operate available drywell cooling when drywell temperature exceeds [135°F (normal operating limit)]. #6

14

CC-2.?.2 Before drywell temperature reaches [340°F (drywell design temperature)], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays. #16

If [temperature near the cold reference leg instrument vertical runs] reaches the RPV saturation limit, enter [procedure developed from CONTINGENCY #2].



If drywell temperature cannot be maintained below [340°F (maximum temperature at which ADS qualified or drywell design temperature, whichever is lower)], enter [procedure developed from CONTINGENCY #2].

27 CC-2.3 Monitor and control containment temperature.

28 CC-2.3.1 Operate available containment cooling when containment temperature exceeds [90°F (normal operating limit)]. #6

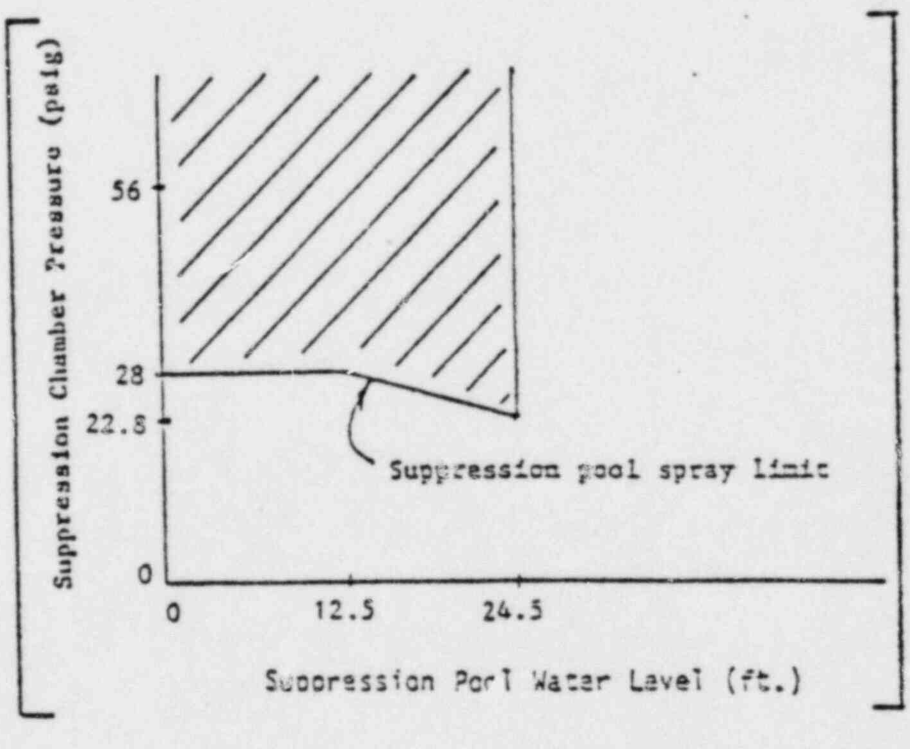
If containment temperature cannot be maintained below [185°F (containment design temperature)], enter [procedure developed from CONTINGENCY #2].

15 CC-2.4 Monitor and control primary containment pressure with the following systems, as required:

16 • [Containment pressure control systems. Use containment pressure control system operating procedure] .

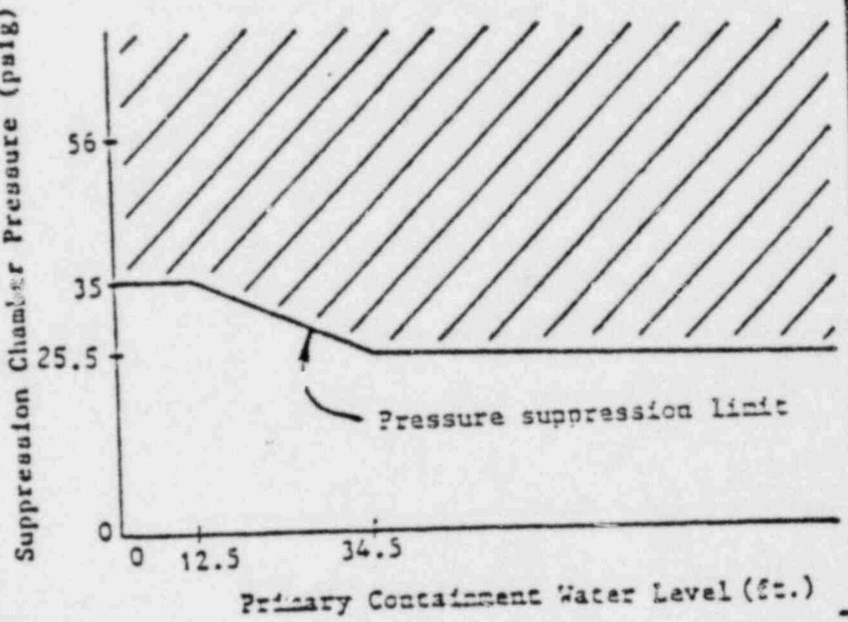
17 • SBGT [and drywell purge] , only when the temperature in the space being evacuated is below 212°F. Use [SBGT and drywell purge operating procedures] . #19

18 • Suppression pool sprays. Before suppression chamber pressure reaches [the suppression pool spray limit] , initiate suppression pool sprays. #16



19

- Drywell sprays. Before suppression chamber pressure reaches [the pressure suppression limit], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays.



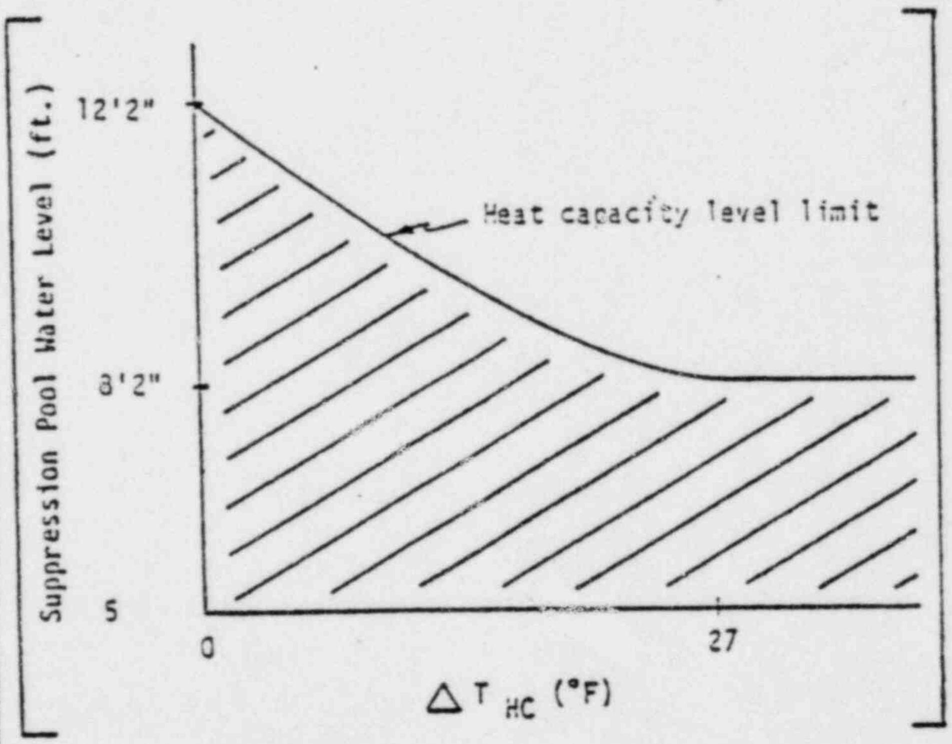
If suppression chamber pressure cannot be maintained below the pressure suppression limit, ente [procedure developed from CONTINGENCY #2].

20 CC-2.5 Monitor and control suppression pool water level.

21 CC-2.5.1 Maintain suppression pool water level between [12 ft. 6 in. and 12 ft. 2 in. (normal operating limits)]. Refer to [sampling procedure] prior to discharging water. [Suppression pool makeup may be augmented by SPMS.]

#8, #18

If suppression pool water level cannot be maintained above the heat capacity level limit, enter [procedure developed from CONTINGENCY #2].



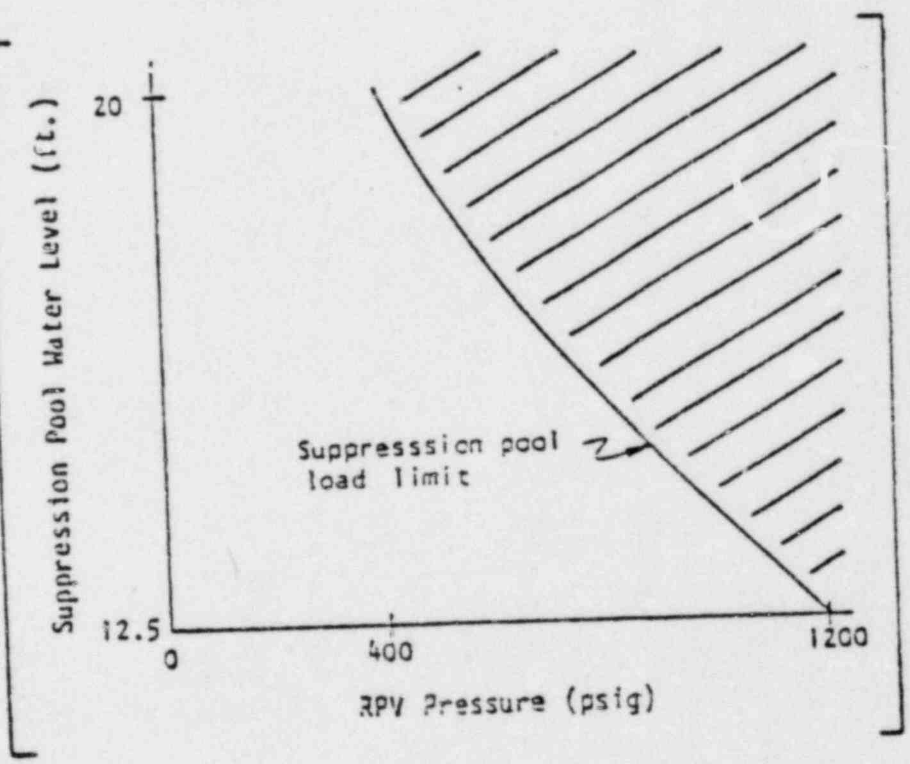
Where ΔT_{HC} = heat capacity temperature limit minus suppression pool temperature

CC-2.5.2 If suppression pool water level cannot be maintained below [12 ft. 6 in. (normal operating limit)]:

23 CC-2.5.2.1 If adequate core cooling is assured, terminate injection into the RPV from sources external to the primary containment.

24 CC.2.5.2.2 If suppression pool water level cannot be maintained below the suppression pool load limit, maintain RPV pressure below the limit.

#14, #17
#18



If suppression pool water level and RPV pressure cannot be restored or maintained below the suppression pool load limit, enter [procedure developed from CONTINGENCY #2].

25

CC-2.5.2.3 Before suppression pool water level reaches [17 ft. 2 in. (elevation of bottom of Mark I internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays and operate continuously while suppression pool water level is above [17 ft. 2 in. (elevation of bottom of Mark I internal suppresion chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)]. #16

26

CC-2.5.2.4 When primary containment water level reaches [104 ft. (maximum safe primary containment water level at 0 psig or highest containment vent elevation, whichever is lower)], terminate injection into the RPV from sources external to the primary containment irrespective of whether adequate core cooling is assured.

CONTINGENCY #1

LEVEL RESTORATION

30 C1-1 Initiate IC.

31 C1-2 Line up for injection and start pumps in 2 or more of the following injection subsystems:

- Condensate
- HPCS
- LPCI-A
- LPCI-B
- LPCI-C
- LPCS-A
- LPCS-B

32 If less than 2 of the injection subsystems can be lined up, commence lining up as many of the following alternate injection subsystems as possible:

- RHR service water crosstie
- Fire system
- Interconnections with other units
- ECCS keep-full systems
- SLC (test tank)
- SLC (boron tank)

If at any time RPV water level cannot be determined:

1. If no system or injection subsystem is lined up for injection with at least one pump running, start pumps in alternate injection subsystems which are lined up for injection.
2. If no system, injection subsystem, or alternate injection subsystem is lined up for injection with at least one pump running, enter [procedure developed from CONTINGENCY #3].
3. Otherwise, enter [procedure developed from CONTINGENCY #2].

33 C1-3 Monitor RPV pressure and water level. Continue in this procedure at the step indicated in the following table.

RPV PRESSURE REGION

[425 psig] [1] [100 psig] [2]

RPV LEVEL	HIGH	INTERMEDIATE	LOW
INCREASING	C1-4	C1-5	C1-6
DECREASING	C1-7		C1-8

[1](RPV pressure at which LPCS shutoff head is reached)

[2](HPCI or RCIC low pressure isolation setpoint, whichever is higher)

If at any time the RPV pressure or water level trend reverses or RPV pressure changes region, return to [Step C1-3].

34 C1-4 Enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

35 C1-5 If HPCI and RCIC are not available and RPV pressure is increasing, enter [procedure developed from CONTINGENCY #2].

If HPCI and RCIC are not available and RPV pressure is not increasing, enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

Otherwise, when RPV water level reaches [+12 in. (low level scram setpoint)] enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

36 C1-6 If RPV pressure is increasing, enter [procedure developed from CONTINGENCY #2].

Otherwise, enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

37 C1-7 If HPCI and RCIC are not operating, restart HPCI and RCIC.

If CRD is not operating but at least 2 injection subsystems are lined up for injection with pumps running, enter [procedure developed from CONTINGENCY #2].

C1-7.1 If CRD is not operating and no injection subsystem is lined up for injection with at least one pump running, start pumps in alternate injection subsystems which are lined up for injection.

C1-7.2 When RPV water level drops to [-164 in. (top of active fuel)]:

If no system, injection subsystem or alternate injection subsystem is lined up for injection with at least one pump running, enter [procedure developed from CONTINGENCY #3].

Otherwise, enter [procedure developed from CONTINGENCY #2].

38

C1-8 If no injection subsystem is lined up for injection with at least one pump running, start pumps in alternate injection subsystems which are lined up for injection.

If RPV pressure is increasing, enter [procedure developed from CONTINGENCY #2].

Otherwise, when RPV water level drops to [-164 in. (top of active fuel)] enter [procedure developed from CONTINGENCY #4].

C1-3 MONITOR RPV PRESSURE AND WATER LEVEL. CONTINUE IN THIS PROCEDURE AT THE STEP INDICATED IN THE FOLLOWING TABLE:

RPV PRESSURE REGION

[425 PSIG (*)] [100 PSIG (*)]

<table>
<tr><th>RPV WATER LEVEL</th><th>HIGH</th><th>INTERMEDIATE</th><th>LOW</th></tr>
<tr><td>INCREASING</td><td>C1-4
ENTER [PROCEDURE DEVELOPED FROM THE LEVEL CONTROL GUIDELINE] AT [STEP LC-2.4].</td><td>C1-5
IF HPCI & RCIC ARE NOT AVAILABLE & RPV PRESSURE IS INCREASING, ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #2].

IF HPCI & RCIC ARE NOT AVAILABLE & RPV PRESSURE IS NOT INCREASING, ENTER [PROCEDURE DEVELOPED FROM THE LEVEL CONTROL GUIDELINE] AT [STEP LC-2.4].

OTHERWISE, WHEN RPV WATER LEVEL REACHES [+12 IN. (LOW LEVEL SCRAM SETPOINT)] ENTER [PROCEDURE DEVELOPED FROM THE LEVEL CONTROL GUIDELINE] AT [STEP LC-2.4].</td><td>C1-6
IF RPV PRESSURE IS INCREASING, ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #2].

OTHERWISE, ENTER [PROCEDURE DEVELOPED FROM THE LEVEL CONTROL GUIDELINE] AT [STEP LC-2.4].</td></tr>
<tr><td>DECREASING</td><td colspan="2">C1-7
IF HPCI AND RCIC ARE NOT OPERATING, RESTART HPCI AND RCIC.

IF CRD IS NOT OPERATING BUT AT LEAST 2 INJECTION SUBSYSTEMS ARE LINED UP FOR INJECTION WITH PUMPS RUNNING, ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #2].

C1-7.1 IF CRD IS NOT OPERATING AND NO INJECTION SUBSYSTEM IS LINED UP FOR INJECTION WITH AT LEAST ONE PUMP RUNNING, START PUMPS IN ALTERNATE INJECTION SUBSYSTEMS WHICH ARE LINED UP FOR INJECTION.

C1-7.2 WHEN RPV WATER LEVEL DROPS TO [-164 IN. (TOP OF ACTIVE FUEL)]:

IF NO SYSTEM, INJECTION SUBSYSTEM, OR ALTERNATE INJECTION SUBSYSTEM IS LINED UP FOR INJECTION WITH AT LEAST ONE PUMP RUNNING, ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #3].

OTHERWISE, ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #2].</td><td>C1-8
IF NO INJECTION SUBSYSTEM IS LINED UP FOR INJECTION WITH AT LEAST ONE PUMP RUNNING, START PUMPS IN ALTERNATE INJECTION SUBSYSTEMS WHICH ARE LINED UP FOR INJECTION.

IF RPV PRESSURE IS INCREASING, ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #2].

OTHERWISE, WHEN RPV WATER LEVEL DROPS TO [-164 IN. (TOP OF ACTIVE FUEL)] ENTER [PROCEDURE DEVELOPED FROM CONTINGENCY #4].</td></tr>
</table>

IF AT ANY TIME THE RPV PRESSURE OR WATER LEVEL TREND REVERSES OR RPV PRESSURE CHANGES REGION, RETURN TO [STEP C1-3].

*[PRESSURE AT WHICH LPCS SHUTOFF HEAD] IS REACHED.

+HPCI OR RCIC LOW PRESSURE ISOLATION SETPOINT, WHICHEVER IS HIGHER.

ALTERNATE FORMAT FOR STEPS C1-3 THROUGH C1-8

RAPID RPV DEPRESSURIZATION

39 C2-1 Initiate IC.

40 C2-2 Open all ADS valves. | #14, #17, #18 |

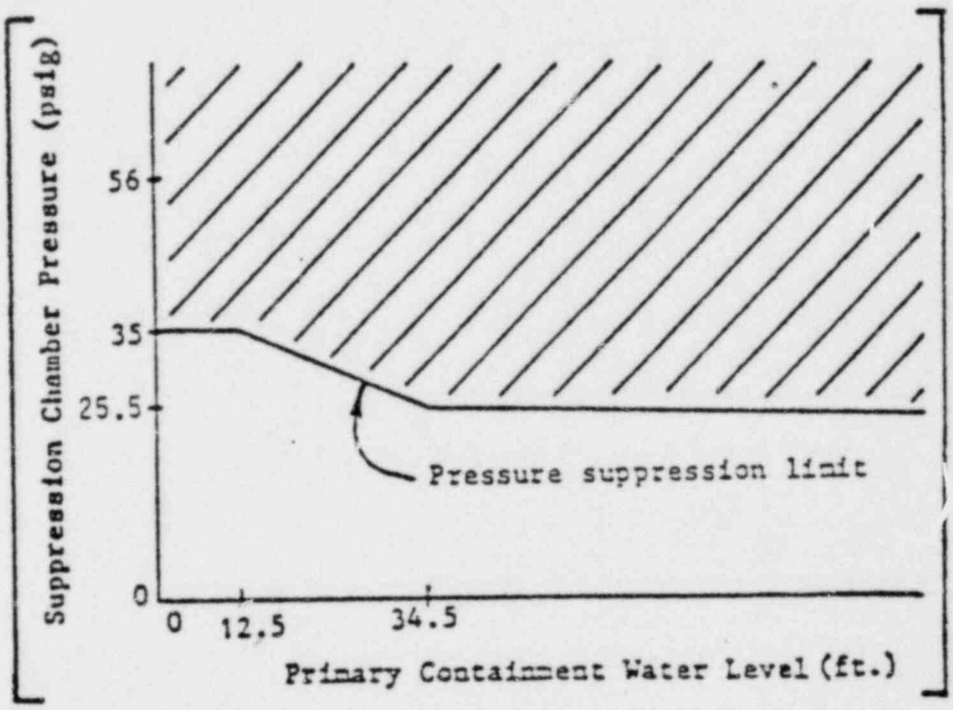
41 C2-2.1 If not all ADS valves can be opened, open other SRVs until [7 (number of SRVs dedicated to ADS)] valves are open.

42 C2-2.2 If less than [3 (minimum number of SRVs required for rapid depressurization)] SRVs can be opened, rapidly depressurize the RPV using one or more of the following systems (use in order which will minimize radioactive release to the environment): | #20 |

- Main condenser
- RHR (steam condensing mode)
- Other steam driven equipment
- Main steam line drains
- RWCU (blowdown mode)
- HPCI steam line
- RCIC steam line
- Head vent
- IC tube side vent

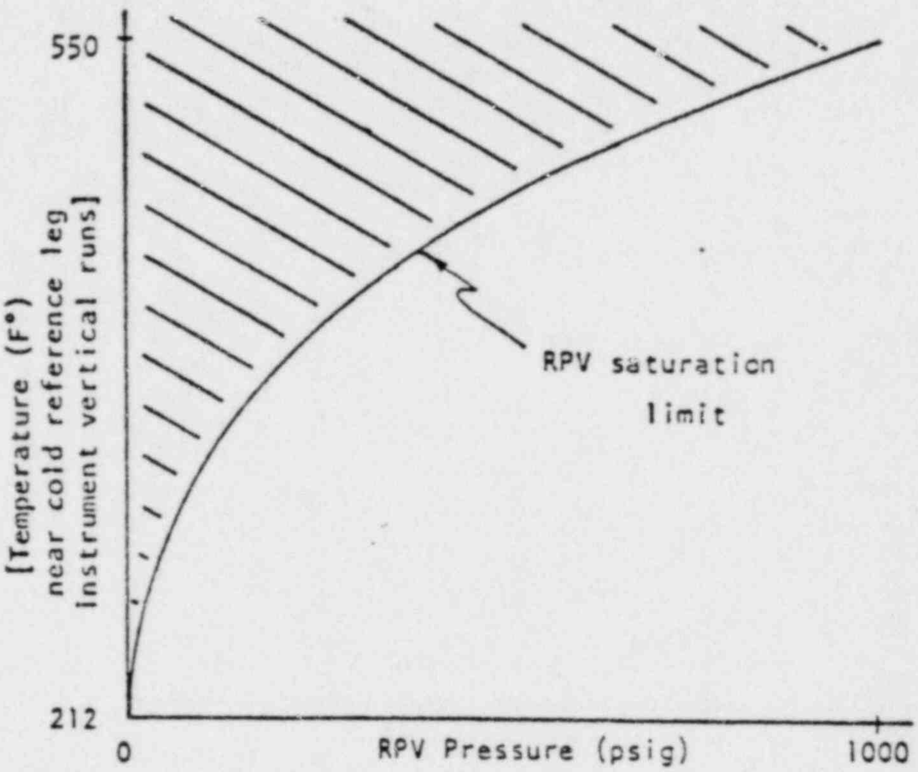
43 C2-3 If suppression pool water level is below [19 ft. 11 in. (Mark III suppression pool normal operating limit)], initiate SPMS.

If suppression chamber pressure cannot be maintained below [the pressure suppression limit], enter [procedure developed from CONTINGENCY #6].



If RPV water level cannot be determined, enter [procedure developed from CONTINGENCY #6].

If [temperature near the cold reference leg instrument vertical runs] reaches the RPV saturation limit, enter [procedure developed from CONTINGENCY #6].



C2-4 Enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

CONTINGENCY #3

CORE COOLING WITHOUT INJECTION

44 C3-1 Confirm initiation of IC.

> If at any time any system, injection subsystem, or alternate injection subsystem is lined up for injection with at least one pump running, enter [procedure developed from CONTINGENCY #2].

If IC cannot be initiated:

45 C3-1.1 When RPV water level drops to [-294 in. (minimum zero-injection RPV water level)] or if RPV water level cannot be determined, open one SRV.

45 C3-1.2 When RPV pressure drops below [500 psig (minimum single SRV steam cooling pressure)] , open all ADS valves.

If not all ADS valves can be opened, open other SRVs until [7 (number of SRVs dedicated to ADS)] valves are open.

CONTINGENCY #4

CORE COOLING WITHOUT LEVEL RESTORATION

40 C4-1 Open all ADS valves.

#17, #18

41 If not all ADS valves can be opened, open other SRVs until [7 (number of SRVs dedicated to ADS)] valves are open.

46 C4-2 Operate HPCS and LPCS subsystems with suction from the suppression pool.

47 When at least one core spray subsystem is operating with suction from the suppression pool and RPV pressure is below [310 psig (RPV pressure for rated LPCS or HPCS flow, whichever pressure is lower)], terminate injection into the RPV from sources external to the primary containment.

C4-3 If RPV water level is restored to [-164 in. (top of active fuel)] enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

CONTINGENCY #5

ALTERNATE SHUTDOWN COOLING

48 C5-1 Initiate suppression pool cooling.

49 C5-2 Close the [RPV head vents,] MSIVs, main steam line drain valves and HPCI, RCIC isolation valves if open.

50 C5-3 Place the control switch for one SRV in the OPEN position.

51 C5-4 Slowly raise the RPV water level to establish a flow path through the open SRV back to the suppression pool.

52 C5-5 Start one LPCS or LPCI pump with suction from the suppression pool.

C5-6 Slowly increase LPCS or LPCI injection into the RPV to the maximum.

C5-6.1 If RPV pressure does not stabilize above [100 psig (minimum RPV pressure which assures sufficient alternate shutdown cooling flow or SRV re-opening pressure, whichever is higher)] ,start another LPCS or LPCI pump.

C5-6.2 If RPV pressure does not stabilize below [172 psig (maximum RPV pressure which assures sufficient alternate shutdown cooling flow for LPCS or LPCI, whichever is lower)], open another SRV.

53 CS-6.3 If the cooldown rate exceeds [100°F/hr (maximum RPV cooldown rate)], reduce LPCS or LPCI injection into the RPV until the cooldown rate decreases below [100°F/hr (maximum RPV cooldown rate)] [or RPV pressure decreases to 100 psig (minimum SRV re-opening pressure), whichever occurs first].

54 CS-7 Control suppression pool temperature to maintain RPV water temperature above [70°F (RPV NDTT or head tensioning limit, whichever is higher)].

6 CS-8 Proceed to cold shutdown in accordance with [procedure for cooldown to cold shutdown conditions].

CONTINGENCY #6

RPV FLOODING

55 C6-1 If at least [3 (minimum number of SRVs required for rapid depressurization)] SRVs are open or if HPCS or motor driven feedwater pumps are available for injection, close the MSIVs, main steam line drain valves, IC, HPCI, RCIC, RWCU and RHR steam condensing isolation valves.

C6-2 If RPV water level cannot be determined:

56 C6-2.1 Commence and increase injection into the RPV with the following systems until at least [3 (minimum number of SRVs required for rapid depressurization)] SRVs are open and RPV pressure is not decreasing and is at least [100 psig (minimum RPV flooding pressure or SRV reopening pressure, whichever is higher)] above suppression chamber pressure.

- HPCS
- Motor driven feedwater pumps
- LPCS
- LPCI
- Condensate pumps
- CRD
- [RHR service water crosstie
- Fire System
- Interconnections with other units
- ECCS keep-full systems
- SLC (test tank)
- SLC (boron tank)]

57 C6-2.2 Maintain RPV pressure at least [100 psig (minimum RPV flooding pressure or SRV reopening pressure, whichever is higher)] above suppression chamber pressure by throttling injection.

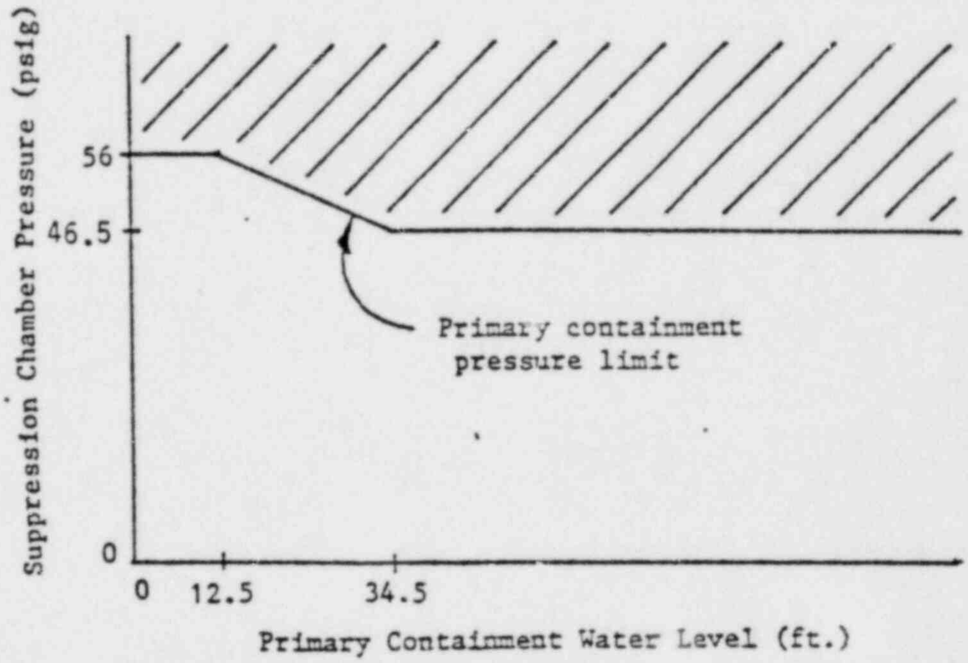
58 C6-3 If RPV water level can be determined, commence and increase injection into the RPV with the following systems until RPV water level is increasing:

- HPCS
- Motor driven feedwater pumps
- LPCS
- LPCI
- Condensate pumps
- CRD
- [RHR service water crosstie
- Fire System
- Interconnections with other units
- ECCS keep-full systems
- SLC (test tank)
- SLC (boron tank)]

59 C6-4 If suppression chamber pressure cannot be maintained below the primary containment pressure limit, initiate the following systems irrespective of whether adequate core cooling is assured:

- Drywell sprays
- Suppression pool sprays [only when suppression pool water level is below 24 ft. 6 in. (elevation of suppression pool spray nozzles)]

[



]

60 C6-5 If suppression chamber pressure exceeds the primary containment pressure limit, vent the primary containment in accordance with [procedure for containment venting] to reduce pressure below the primary containment pressure limit. #20

C6-6 If RPV water level cannot be determined:

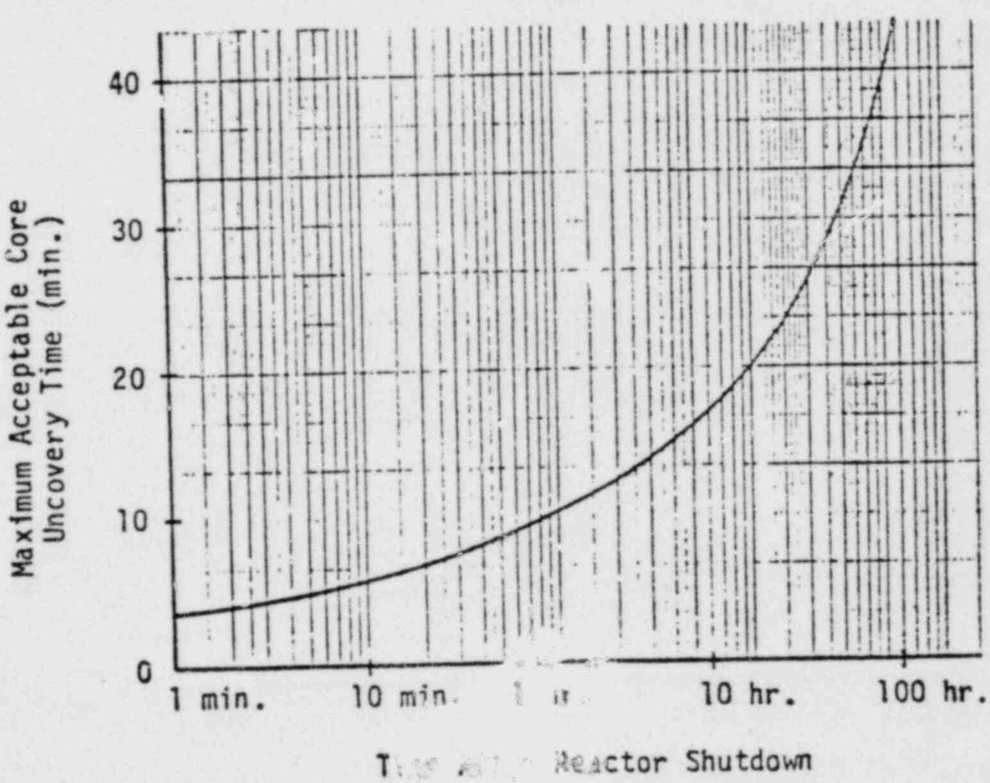
61 C6-6.1 Fill all RPV level instrumentation reference columns.

62 C6-6.2 Continue injecting water into the RPV until [temperature near the cold reference leg instrument vertical runs] is below 212°F and RPV water level instrumentation is available.

C6-6.3 If RPV water level can be determined, continue in this procedure at [Step C6-7].

63 C6-6.4 If it can be determined that the RPV is filled or if RPV pressure is at least [100 psig (minimum RPV floding pressure or SRV reopening pressure, whichever is higher)] above suppression chamber pressure, terminate all injection into the RPV and reduce RPV water level.

C6-6.5 If RPV water level indication is not restored within the maximum acceptable core uncovery time after commencing termination of injection into the RPV, return to [Step C6-2].



C6-7 When suppression chamber pressure can be maintained below the primary containment pressure limit, enter [procedure developed from the Level Control Guideline] at [Step LC-2.4].

BWR EMERGENCY PROCEDURE GUIDELINES

APPENDIX A

APPENDIX A TABLE OF CONTENTS

BASES FOR STEPS (Continued)

INTRODUCTION

Appendix A supplements the Emergency Procedure Guidelines as follows:

(1) Where the basis for a "caution" or a step is not completely evident from the text, a discussion of the basis is provided;

(2) Where a plant-unique number or curve is specified and the method for calculating it is not completely evident from the text, a discussion of the method is provided;

(3) Other system details which pertain to the guidelines are provided.

BASES FOR CAUTIONS

CAUTION #1

Monitor the general state of the plant. If an entry condition for either [procedure developed from the Level Control Guideline] or [procedure developed from the Containment Control Guideline] occurs, enter that procedure. When it is determined that an emergency no longer exists, enter [normal operating procedure].

BASIS: Symptoms rather than events are the entry conditions to procedures developed from the Emergency Procedure Guidelines. Subsequent to entry into a procedure, symptoms may occur which require re-entry into the procedure or entry into and simultaneous execution of another procedure. The Guidelines have been written so that such re-entry or simultaneous execution will provide the operator with the proper instructions under these circumstances.

Similarly, termination of the emergency rather than termination of an event is the exit condition for procedures developed from the Guidelines. Consequently, these procedures may be exited at any point in their execution if the operator determines that an emergency no longer exists. The Guidelines have been written so that if the operator remains in a procedure developed from the Guidelines when an emergency in fact no longer exists, the procedures will provide him with the proper instructions under these circumstances.

CAUTION #4

Whenever RHR is in the LPCI mode, inject through the heat exchangers as soon as possible.

BASIS: Early injection through the heat exchangers minimizes the primary containment heatup and prolongs the preservation of the suppression pool as a heat sink should rapid RPV depressurization subsequently be required. Any flow loss which results from injecting through the heat exchangers is small.

CAUTION #6

Whenever [temperature near the instrument reference leg vertical runs] exceeds the temperature in the table, the actual RPV water level may be anywhere below the elevation of the lower instrument tap when the instrument reads below the indicated level in the table.

Temperature*	Indicated Level	Instrument	
[any	537 in.	Shutdown Range Level	(500 to 900 in.)]
105°F	-109 in.	Wide Range Level	(-150 to +60 in.)
310°F	19 in.	Narrow Range Level	(0 to +60 in.)
379°F	239 in.	Fuel Zone Level	(200 to 500 in.)]

* List in order of increasing temperature.

BASIS: The density of the liquid in the reference legs of RPV water level instruments (both cold leg and heated leg instruments) decreases as temperature near the reference leg vertical runs increases. This decrease in density results in an indicated RPV water level that is higher than actual RPV water level. In extreme cases, a stable on-scale RPV water level may be indicated when the true water level is anywhere below the lower instrument tap. In heated reference leg instruments, the water in the reference leg also becomes hotter and thus less dense if RPV water level is lower than normal for an extended time. The table in CAUTION #6 accounts for both of these phenomena.

For a given instrument, the temperature in the table is the temperature of water in the reference leg which would cause the instrument to read at the extreme low end of the instrument scale when the actual RPV water level is at (or anywhere below) the lower instrument tap. The indicated level in the table is the level which the instrument would read were the water in the reference leg 545°F (the temperature of saturated steam at rated reactor pressure) and the actual RPV water level at (or anywhere below) the lower instrument tap.

CAUTION #7

[Heated reference leg instrument] indicated levels are not reliable during rapid RPV depressurization below 500 psig. For these conditions, utilize [cold reference leg instruments] to monitor RPV water level.

BASIS: Reactor depressurization below the saturation pressure for the temperature of the water in the reference leg causes boiling in the reference leg. Rapid depressurization causes flashing and possible loss of inventory in the reference leg and may result in erratic water level indication or an indicated water level higher than the actual water level.

For heated reference leg instruments, this phenomenon occurs only during rapid RPV depressurization below 500 psig. For cold reference leg instruments, this phenomenon does not occur.

CAUTION #11

If a high drywell pressure ECCS initiation signal [2.0 psig (drywell pressure which initiates ECCS)] occurs or exists while depressurizing, prevent injection from those LPCS and LPCI pumps not required to assure adequate core cooling prior to reaching their maximum injection pressures. When the high drywell pressure ECCS initiation signal clears, restore LPCS and LPCI to AUTOMATIC/STANDBY mode.

BASIS: The low pressure ECCS initiate on a high drywell pressure signal and start to inject whe RPV pressure decreases below the pressure at which pump discharge pressure drops below pump shutoff head. Rapid injection of a large volume of water from these systems may be detrimental to maintaining RPV water level within the desired range. Thus, injection from those LPCS and LPCI pumps not required to assure adequate core cooling should be prevented prior to depressurizing the RPV below the point at which these pumps will inject.

CAUTION #15

1. Open SRVs in the following sequence if possible: [SRV opening sequence].

2. I: the continuous SRV pneumatic supply is or becomes unavailable, depressurize with sustained SRV opening.

BASIS:

1. When manual actuation of multiple SRVs is required, an opening sequence which distributes the heat load uniformly throughout the suppression pool, thereby minimizing SRV discharge loads, is preferred.

2. Loss of the continuous SRV pneumatic supply will limit the number of possible manual SRV actuations. Therefore, when RPV depressurization via the SRVs is required, sustained valve opening should be used to maximize the number of possible valve actuations remaining.

BASES FOR STEPS

LC-2.3	[Confirm or place the reactor mode switch in REFUEL].

BASIS: Placing the reactor mode switch in the REFUEL position (or taking it out of the RUN position) bypasses the main steam line low pressure signal in the closing logic of the MSIVs. Closure of the MSIVs on low steam line pressure is not required when the reactor is not at power. Under this condition, it is preferred to reject decay heat to the main condenser and to preserve the suppression pool as a heat sink should rapid RPV depressurization subsequently be required.

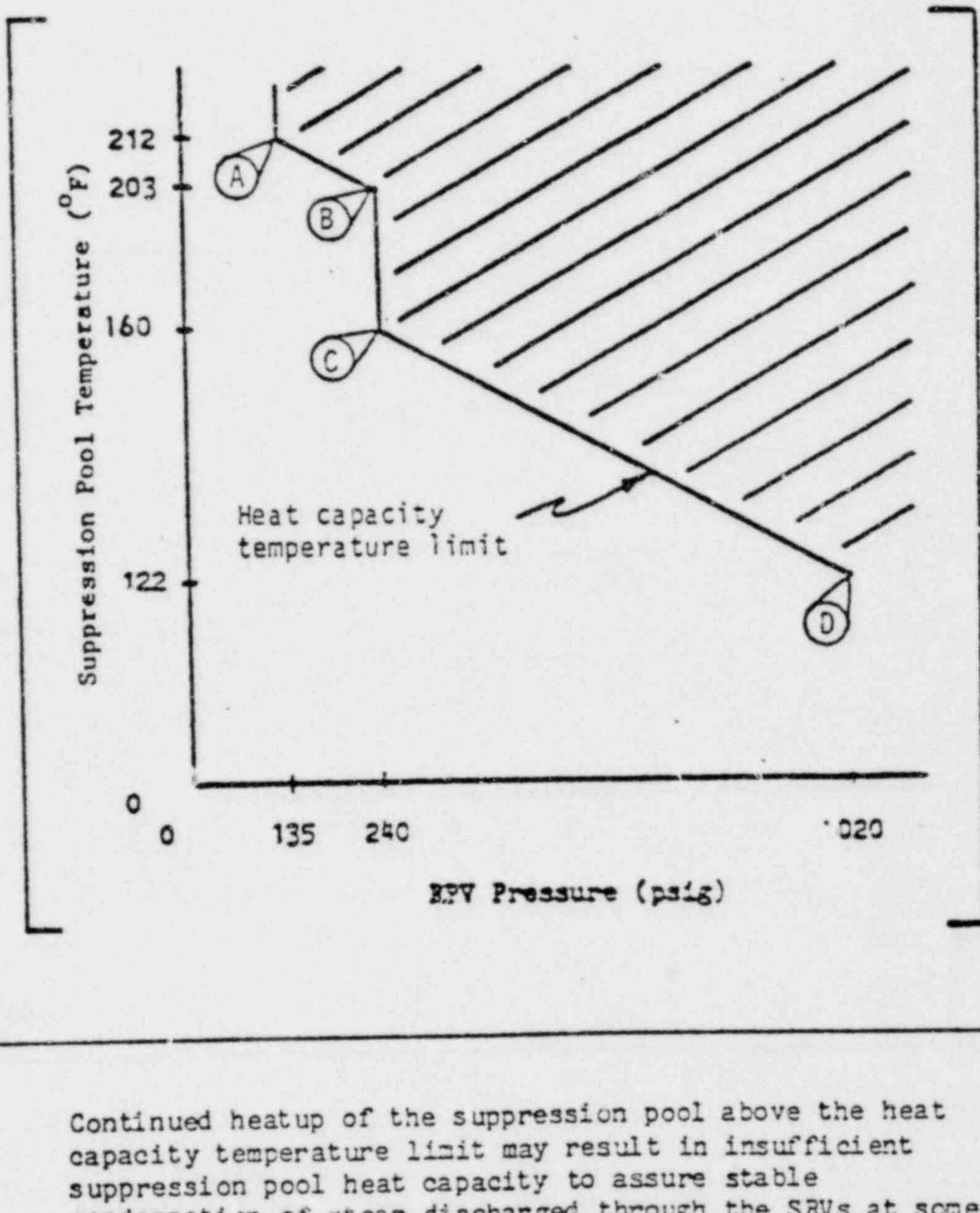
LC-2.5 CD-2.2	If SRVs are cycling, initiate IC or manually open one SRV and reduce RPV pressure to below [940 psig (150 psig below the minimum SRV setpoint)].

BASIS: A reduction of RPV pressure to substantially below the minimum SRV setpoint reduces the number of potential actuations of the SRVs, thereby minimizing the possibility of an SRV sticking open and limiting the containment loading resulting from multiple close-spaced SRV actuations.

CC-2.1.1	If any SORV cannot be closed [within 2 minutes], scram the reactor.

BASIS: A time limit within which the reactor must be scrammed may be appropriate for those plants with few but high-capacity SRVs where prior containment load calculations have indicated a potential reduction in margins if power operation is continued beyond this limit.

CC-2.1.4 If suppression pool temperature cannot be maintained below the heat capacity temperature limit, maintain RPV pressure below the limit.

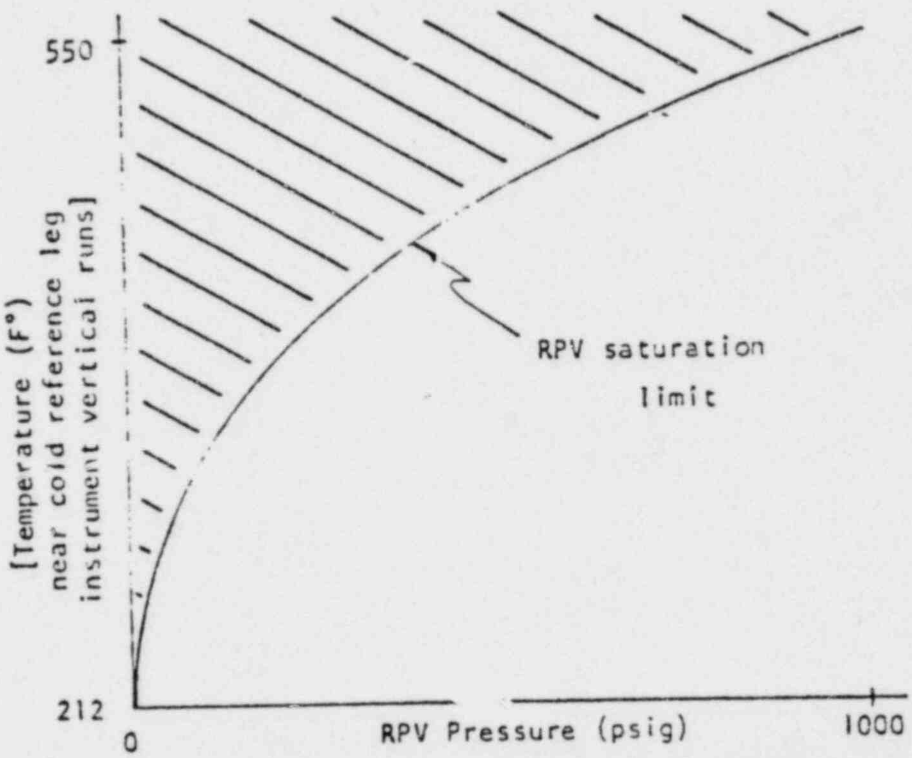


BASIS: Continued heatup of the suppression pool above the heat capacity temperature limit may result in insufficient suppression pool heat capacity to assure stable condensation of steam discharged through the SRVs at some point . lowing an ADS actuation. The maximum bulk pool temperature for stable steam condensation is 212°F. Since SRV actuation may be required to cool down the RPV whenever shutdown cooling is not available, 212°F (or the maximum suppression pool design temperature if below 212°F) and the shutdown cooling interlock pressure (typically 135 psig) define point (A).

Further, for a Ramshead with discharge mass flux in excess of 40 lb_m/ft^2-sec the maximum bulk pool temperature for stable steam condensation is 160°F. Therefore, 160°F and the RPV pressure which will produce a discharge mass flux of 40 lb_m/ft^2-sec (typically 240 psig) define point (C) for this discharge device.

The curves between points (A) and (B) and between points (C) and (D) are determined by a straight-forward energy balance between the reactor system with normal RPV water level and the suppression pool with the suppression pool water level at the normal low operating limit. For example, for the typical BWR/4 chosen to illustrate these Guidelines, an ADS actuation 2 minutes after scram from an RPV pressure of 1020 psig and water level at +37 inches and a suppression pool temperature of 122°F and water level of 12 feet 2 inches with no suppression pool cooling in service will result in RPV pressure and suppression pool temperature following the heat capacity temperature limit curve from point (D) to poir [illegible]).

CC-2.2.2 If [temperature near the cold reference leg instrument
C2-3 vertical runs] reaches the RPV saturation limit, enter [procedure developed from ...].



BASIS: RPV pressure at or below saturation for the existing temperature near the RPV water level cold reference leg instrument vertical runs will cause the water in the reference legs of these instruments to boil off. Loss of inventory from the reference legs results in an increase in the indicated RPV water level. Although it may take some time for the water in the cold reference legs to completely boil off, once the saturation limit is reached the operator can no longer rely on cold reference leg instrument water level indication for verification of adequate core cooling. (Heated reference leg instruments would have become unreliable before reaching this point.)

The RPV saturation limit curve is a plot of steam temperature (°F) against pressure (psig) at saturation for pressures between atmospheric and rated RPV pressure.

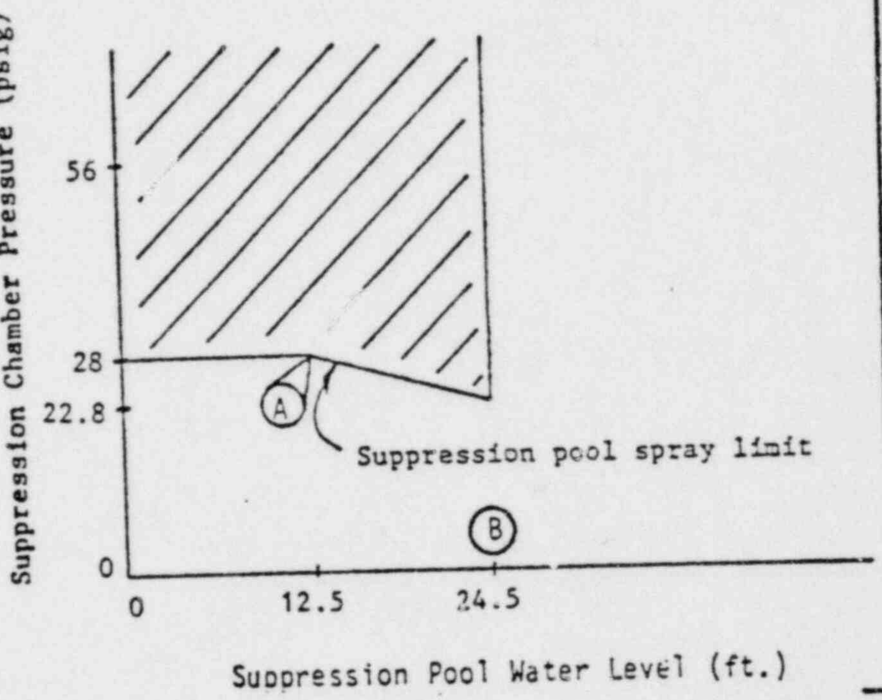
CC-2.4 Monitor and control primary containment pressure with ...

- SBGT [and drywell purge], only when the temperature in the space being evacuated is below 212°F. Use [SBGT and drywell purge operating procedures].

BASIS: At temperatures greater than 212°F, gradual evacuation of all noncondensibles may result in a saturated steam environment. Subsequent rapid cooling of this environment (as by sprays) may result in rapid pressure reduction to less than design negative differential pressure with potential collapse of the space being evacuated.

CC-2.4 Monitor and control primary containment pressure with ...

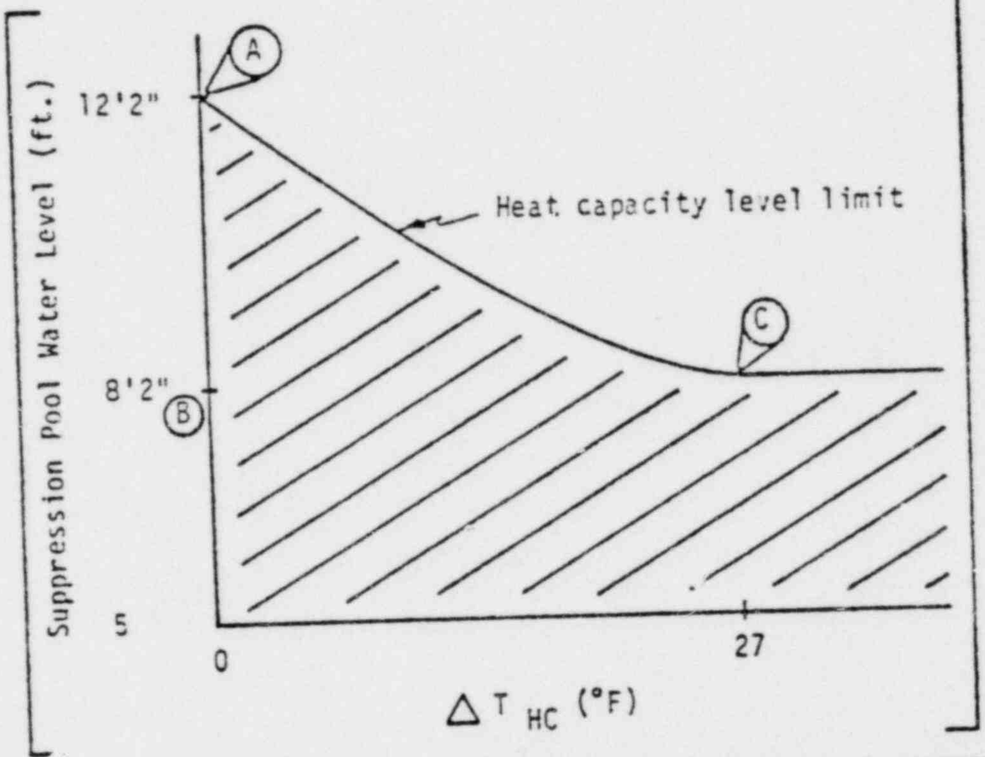
- Suppression pool sprays. Before suppression chamber pressure reaches [the suppression pool spray limit], initiate suppression pool sprays.



BASIS: The suppression pool spray limit provides for suppression pool spray initiation before reaching 50% of the suppression chamber design pressure. Thus, 50% of suppression chamber design pressure with suppression pool water level at design (high water level alarm setpoint) defines point (A). For a given suppression chamber pressure with suppression pool water level below the high water level alarm setpoint, the pressure in the airspace is limiting so that the slope of the curve to the left of point (A) is zero. For a given suppression chamber pressure with suppression pool water level above the high water level alarm setpoint, the pressure at the bottom of the suppression pool is limiting so that the slope of the curve to the right of point (A) is -0.433 psi per foot to compensate for the additional hydrostatic head at the bottom of the pool. For a suppression pool water level at or above the elevation of the spray nozzles, (B) , suppression pool spray is not useful in reducing suppression chamber pressure and a limit above this level is not appropriate.

so that the slope of the curve to the right of point (A) is -0.433 psi per foot to compensate for the additional hydrostatic head at the bottom of the pool. For a suppression pool water level above the elevation of the suppression chamber pressure instrument tap, (B) , the pressure sensor no longer senses suppression chamber airspace pressure alone but rather senses airspace pressure plus the head of water above the instrument tap. Therefore, the slope of the curve to the right of this level is zero.

CC-2.5.1 If suppression pool water level cannot be maintained above [the heat capacity level limit], enter [procedure developed from CONTINGENCY #2].



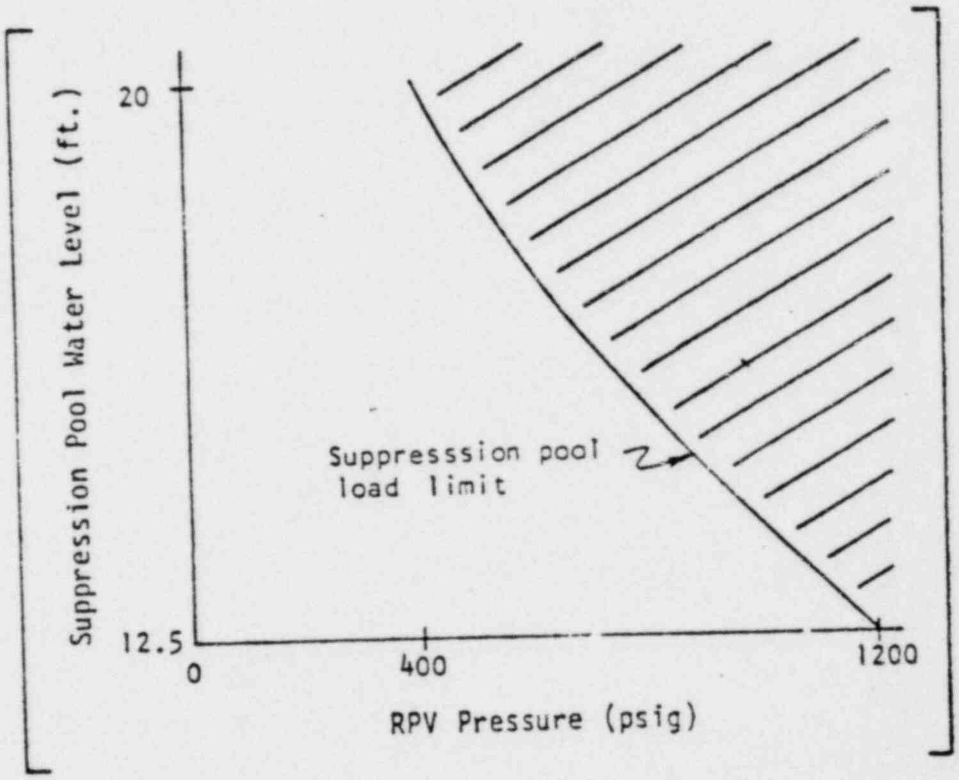
BASIS: Continued decrease of suppression pool water level below the heat capacity level limit may result in insufficient suppression pool heat capacity to assure stable condensation of steam discharged through the SRVs at some point following an ADS actuation, even if suppression pool temperature is maintained below the heat capacity temperature limit, because the heat capacity temperature limit is determined for suppression pool water level at the normal low operating limit.

ΔT_{HC} is the temperature margin between the suppression pool temperature and the heat capacity temperature limit. With no temperature margin, suppression pool water level must be maintained at or above the normal low operating limit in order to provide the mass of water in the suppression pool which was assumed in generating the heat capacity temperature limit. Thus 0°F and the normal low operating limit defines point Ⓐ.

BASIS: (continued) In addition to sufficient suppression pool heat capacity, stable condensation of steam requires that the steam be discharged either vertically downward at or below the surface of the suppression pool or horizontally at or below an elevation 2 feet below the surface of the suppression pool. Thus the elevation of the downcomer openings or 2 feet above the horizontal vents, whichever is higher, defines elevation (B), below which no temperature margin can assure stable steam condensation.

The curve between points (A) and (C) is determined by the same straight-forward energy balance used to generate the heat capacity temperature limit. For a given suppression pool water level between the normal low operating limit and elevation (B), the corresponding temperature margin is obtained by repeating the heat capacity temperature limit calculation assuming suppression pool water level at the given lower level. The maximum difference between the curve thus generated and the heat capacity temperature limit defines the temperature margin which corresponds to the given lower level. For example, for the typical BWR/4 chosen to illustrate these Guidelines, the elevation of the downcomer openings is 8 feet 2 inches. Repeating the heat capacity temperature limit calculation for suppression pool water level at 8 feet 2 inches obtains a curve which differs from the heat capacity temperature limit by a maximum of 27°F. Thus 27°F and 8 feet 2 inches define point (C) on the heat capacity level limit for this plant.

CC-2.5.2.2 If suppression pool water level cannot be maintained below the suppression pool load limit, maintain RPV pressure below the limit.



BASIS: Continued increase of the suppression pool water level above the suppression pool load limit may result in exceeding the capacity of the containment to withstand the dynamic load which results from single or multiple SRV actuations. The curve is obtained by calculating, for various RPV pressures, the suppression pool water level at which the stress in the limiting submerged structural component during single and multiple SRV actuations equals the yield stress in that component.

CC-2.5.2.3 Before suppression pool water level reaches [17 ft. 2 in. (elevation of bottom of Mark I internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)], [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays and operate continuously while suppression pool water level is above [17 ft. 2 in. (elevation of bottom of Mark I internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)].

BASIS: The suppression chamber to drywell vacuum breakers in the Mark I containment cannot be relied upon to adequately control suppression chamber to drywell differential pressure if water is present on either side of these devices. Therefore, drywell sprays should be initiated to condense as much steam in the drywell as possible while the suppression chamber to drywell vacuum relief system is still operable.

CC-2.5.2.4 When primary containment water level reaches [104 ft. (maximum safe primary containment water level at 0 psig or highest containment vent elevation, whichever is lower)], terminate injection into the RPV from sources external to the primary containment irrespective of whether adequate core cooling is assured.

BASIS: Flooding the primary containment above the level at which the hydrostatic head equals the yield stress of the containment at the limiting location may result in a breach of the containment.

C1-7 If CRD is not operating but at least 2 injection subsystems are lined up for injection with pumps running, enter [procedure developed from CONTINGENCY #2].

BASIS: If RPV water level is decreasing and CRD is not available the probability that the level trend will reverse is low. If, in addition, at least two injection subsystems are available, the probability that these can restore level once the RPV is depressurized is high. Depressurization is therefore appropriate.

C1-7.2 When RPV water level drops to [-164 in. (top of active fuel)]:...

BASIS: If RPV water level is decreasing and CRD is not available, the probability that the level trend will reverse is low. If, in addition, only one (or no) injection subsystem is available, the probability that it alone can restore level is likewise low. Therefore, it is appropriate to use the time required to boil down to the top of the active fuel to make additional injection subsystems available.

C1-7.2 If no system, injection subsystem, or alternate injection subsystem is lined up for injection with at least one pump running, enter [procedure developed from CONTINGENCY #3].

BASIS: If RPV water level has decreased to the top of the active fuel and no injection system or subsystem is available, the only mechanism remaining which can assure adequate core cooling is steam cooling.

C1-7.2	Otherwise, enter [procedure developed from CONTINGENCY #2].

BASIS: If RPV water level has decreased to the top of the active fuel and any injection system or subsystem is available, the most probable mechanism by which level can be restored is with that system or subsystem. Therefore, it is appropriate to depressurize the RPV to maximize the injection flow rate from that system or subsystem.

C1-8	If RPV pressure is increasing, enter [procedure developed from CONTINGENCY #2].

BASIS: If RPV pressure is below the isolation setpoint for steam-driven pumps, only motor-driven pumps are available for injection. If, in addition, RPV pressure is increasing, the injection flow rate from these pumps will decrease. Therefore, it is appropriate to depressurize the RPV to maximize the flow rate from these pumps.

C1-8	Otherwise, when RPV water level drops to [-164 in. (top of active fuel)] enter [procedure developed from CONTINGENCY #4].

BASIS: If RPV pressure is below the isolation setpoint for steam-driven pumps, only motor-driven pumps are available for injection. If, in addition, RPV pressure is constant or decreasing, it is appropriate to use the time required to boil down to the top of the active fuel to make additional injection subsystems available. When level drops to the top of the active fuel, core spray becomes the best mechanism to assure adequate core cooling.

C2-2.2 If less than [3 (minimum number of SRVs required for rapid depressurization)] SRVs can be opened, rapidly depressurize the RPV using one or more of the following systems (use in order which will minimize radioactive release to the environment):

- Main condenser
- RHR (steam condensing mode)
- Other steam driven equipment
- Main steam line drains
- RWCU (blowdown mode)
- HPCI steam line
- RCIC steam line
- Head vent
- IC tube side vent

BASIS: The minimum number of SRVs specified in the step is calculated using the best-estimate reactor blowdown and core heatup methods discussed in NEDO-24708 sections 3.1.1 and 3.5.2.4. A zero-break case (the most severe challenge to successful depressurization) was analyzed, assuming that only one LPCI pump was available for injection. The number of SRVs required for rapid depressurization is the minimum number which restricts the calculated peak cladding temperature to 2200°F under these conditions.

C1-7	If CRD is not operating but at least 2 injection subsystems are lined up for injection with pumps running, enter [procedure developed from CONTINGENCY #2].

BASIS: If RPV water level is decreasing and CRD is not available the probability that the level trend will reverse is low. If, in addition, at least two injection subsystems are available, the probability that these can restore level once the RPV is depressurized is high. Depressurization is therefore appropriate.

C1-7.2	When RPV water level drops to [-164 in. (top of active fuel)]:...

BASIS: If RPV water level is decreasing and CRD is not available, the probability that the level trend will reverse is low. If, in addition, only one (or no) injection subsystem is available, the probability that it alone can restore level is likewise low. Therefore, it is appropriate to use the time required to boil down to the top of the active fuel to make additional injection subsystems available.

C1-7.2	If no system, injection subsystem, or alternate injection subsystem is lined up for injection with at least one pump running, enter [procedure developed from CONTINGENCY #3].

BASIS: If RPV water level has decreased to the top of the active fuel and no injection system or subsystem is available, the only mechanism remaining which can assure adequate core cooling is steam cooling.

C1-7.2	Otherwise, enter [procedure developed from CONTINGENCY #2].

BASIS: If RPV water level has decreased to the top of the active fuel and any injection system or subsystem is available, the most probable mechanism by which level can be restored is with that system or subsystem. Therefore, it is appropriate to depressurize the RPV to maximize the injection flow rate from that system or subsystem.

C1-8	If RPV pressure is increasing, enter [procedure developed from CONTINGENCY #2].

BASIS: If RPV pressure is below the isolation setpoint for steam-driven pumps, only motor-driven pumps are available for injection. If, in addition, RPV pressure is increasing, the injection flow rate from these pumps will decrease. Therefore, it is appropriate to depressurize the RPV to maximize the flow rate from these pumps.

C1-8	Otherwise, when RPV water level drops to [-164 in. (top of active fuel)] enter [procedure developed from CONTINGENCY #4].

BASIS: If RPV pressure is below the isolation setpoint for steam-driven pumps, only motor-driven pumps are available for injection. If, in addition, RPV pressure is constant or decreasing, it is appropriate to use the time required to boil down to the top of the active fuel to make additional injection subsystems available. When level drops to the top of the active fuel, core spray becomes the best mechanism to assure adequate core cooling.

C2-2.2 If less than [3 (minimum number of SRVs required for rapid depressurization)] SRVs can be opened, rapidly depressurize the RPV using one or more of the following systems (use in order which will minimize radioactive release to the environment):

- Main condenser
- RHR (steam condensing mode)
- Other steam driven equipment
- Main steam line drains
- RWCU (blowdown mode)
- HPCI steam line
- RCIC steam line
- Head vent
- IC tube side vent

BASIS: The minimum number of SRVs specified in the step is calculated using the best-estimate reactor blowdown and core heatup methods discussed in NEDO-24708 sections 3.1.1 and 3.5.2.4. A zero-break case (the most severe challenge to successful depressurization) was analyzed, assuming that only one LPCI pump was available for injection. The number of SRVs required for rapid depressurization is the minimum number which restricts the calculated peak cladding temperature to 2200°F under these conditions.

C2-3 If RPV water level cannot be determined, enter [procedure developed from CONTINGENCY #6].

BASIS: If RPV water level cannot be determined, flooding the RPV is the best method to assure adequate core cooling.

C3-1 If at any time any system, injection subsystem, or alternate injection subsystem is lined up for injection with at least one pump running, enter [procedure developed from CONTINGENCY #2].

BASIS: Steam cooling provides adequate core cooling only until the RPV is depressurized. Therefore, if any system or subsystem becomes available for injecting into the RPV and restoring RPV water level to above the top of the active fuel, the probability of maintaining adequate core cooling over the long term is increased by rapidly depressurizing the RPV to maximize the injection rate from that system or subsystem. Further, with the RPV depressurized, any additional system or subsystem which subsequently becomes available for injection can immediately inject and assist in restoring and maintaining RPV water level.

Also, the RPV water level and pressure at which actions are specified in CONTINGENCY #3 are based upon the assumption that there is no injection into the RPV while water level is below the top of the active fuel. Injection will reduce or reverse the rate at which RPV water level is decreasing. However, for a given RPV water level below the top of the active fuel, injection may result in a longer heatup, and thus higher peak clad temperatures, of the uncovered portion of the core. Consequently, it is appropriate to exit CONTINGENCY #3 whenever a system or subsystem is injecting into the RPV because the RPV water level and pressure at which actions are specified in CONTINGENCY #3 are based upon no injection into the RPV.

C3-1.1 When RPV water level drops to [-294 in. (minimum zero-injection RPV water level)] or if RPV water level cannot be determined, open one SRV.

BASIS: The minimum zero-injection RPV water level is the minimum RPV water level at which the peak clad temperature in the core is below 2200°F with no injection into the RPV. RPV water level is allowed to decrease to this limit in order to permit sufficient heatup of the clad to provide the necessary temperature gradient for steam cooling of the core.

C3-1.2 When RPV pressure drops below [500 psig (minimum single SRV steam cooling pressure)], open all ADS valves.

BASIS: The minimum single SRV steam cooling pressure is the minimum RPV pressure at which steam flow through one SRV will create sufficient steam updraft through the core to carry away all decay heat via convective steam heat transfer with no clad temperature in excess of 2200°F.

.4-1	Open all ADS valves. If not all ADS valves can be opened, open other SRVs until [7 (number of SRVs dedicated to ADS)] valves are open.

BASIS: SRVs are opened to ensure that the RPV remains depressurized and to minimize the head against which the HPCS and LPCS subsystems must pump.

C4-2	When at least one core spray subsystem is operating with suction from the suppression pool and RPV pressure is below [310 psig (RPV pressure for rated LPCS or HPCS flow, whichever pressure is lower)], terminate injection into the RPV from sources external to the primary containment.

BASIS: One core spray subsystem operating at rated flow is sufficient to assure adequate core cooling, and therefore injection into the RPV from sources external to the primary containment should be terminated to minimize loading on the containment.

C5-6.1 If RPV pressure does not stabilize above [100 psig (minimum RPV pressure which assures sufficient alternate shutdown cooling flow or SRV reopening pressure, whichever is higher)], start another LPCS or LPCI pump.

BASIS: If RPV pressure, and thus differential pressure across the one open SRV, does not stabilize sufficiently high to assure sufficient liquid flow through the SRV to reject all decay heat to the suppression pool and to preclude SRV cycling on low pressure, then the pump selected for Alternate Shutdown Cooling is not performing properly and another pump should be started.

The minimum RPV pressure which assures sufficient alternate shutdown cooling flow is the pressure drop across one SRV which will result from liquid flow through the SRV which removes all decay heat from the core 10 minutes after reactor shutdown from full power with a 100°F temperature rise across the core. For example, for the typical BWR/4 chosen to illustrate these Guidelines, 10 minutes after reactor shutdown from full power, a liquid flow of 1.84×10^6 lb_m/hr would rise 100°F in removing all decay heat from the core. The pressure drop across one SRV which would result from this flow is 35 psi, which is less than than the SRV reopening pressure of 100 psig.

C5-6.2 If RPV pressure does not stabilize below [172 psig (maximum RPV pressure which assures sufficient alternate shutdown cooling flow for LPCS or LPCI, whichever is lower)] , open another SRV.

BASIS: If RPV pressure does not stabilize sufficiently low to assure single-pump flow sufficient to reject all decay heat to the suppression pool, then the SRV selected for Alternate Shutdown Cooling is not passing sufficient flow and an additional SRV should be opened.

The maximum RPV pressure which assures sufficient alternate shutdown cooling flow is the RPV pressure corresponding to the single pump discharge pressure which would result from a pump flow which removes all decay heat from the core 10 minutes after reactor shutdown from full power with a 100°F temperature rise across the core. For example, for the typical BWR/4 chosen to illustrate these Guidelines, 10 minutes after reactor shutdown from full power, a liquid flow of 1.84×10^6 lb_m/hr would rise 100°F in removing all decay heat from the core. One LPCI pump will deliver this flow when RPV pressure is 192 psig, and one LPCS pump will deliver this flow when RPV pressure 172 psig. The maximum RPV pressure which assures sufficient alternate shutdown cooling flow is the lesser of these, or 172 psig.

C6-1 If at least [3 (minimum number of SRVs required for rapid depressurization)] SRVs are open or if HPCS or motor-driven feedwater pumps are available for injection, close the MSIVs, main steam line drain valves, IC, HPCI, RCIC, RWCU and RHR steam condensing isolation valves.

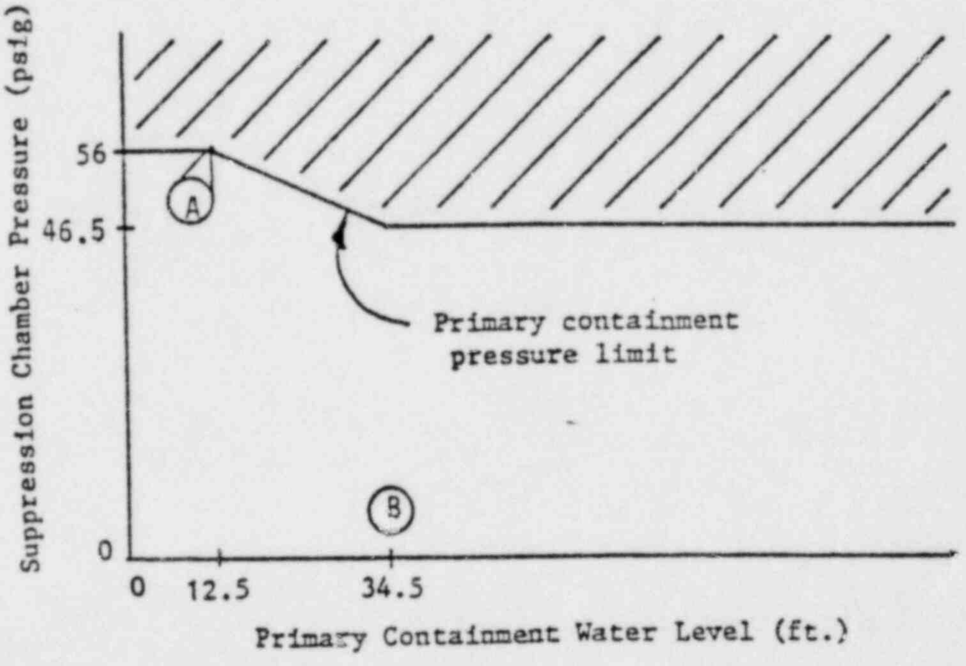
BASIS: If the minimum number of SRVs required for rapid depressurization are open, the RPV can be flooded with low pressure injection systems and steam lines should be isolated to minimize the potential for water hammer damage. Similarly, if high-pressure motor-driven injection systems are available, the RPV can be flooded without depressurization and these same lines should be isolated.

C6-2.1 Commence and increase injection into the RPV with the following systems until at least [3 (minimum number of SRVs required for rapid depressurization)] SRVs are open and RPV pressure is not decreasing and is at least [100 psig (minimum RPV flooding pressure or SRV reopening pressure, whichever is higher)] above suppression chamber pressure.

BASIS: If RPV pressure does not decrease and is maintained above the minimum RPV flooding pressure, the RPV will ultimately reflood to the elevation of the main steam lines. The minimum RPV flooding pressure is that RPV pressure at which the minimum number of SRVs required for rapid depressurization together pass sufficient flow (liquid or steam, whichever requires the higher RPV pressure) to remove all decay heat from the core 10 minutes after reactor shutdown from full power with, in the case of liquid flow, a 100°F temperature rise across the core. For example, for the typical BWR/4 chosen to illustrate these Guidelines, 10 minutes after reactor shutdown from full power, a liquid flow of 1.84×10^6 lb_m/hr would rise 100°F in removing all decay heat from the core. An RPV pressure of 4.0 psig would pass this liquid flow through the 3 SRVs required for rapid depressurization in this plant. Likewise, 10 minutes after reactor shutdown from full power, 1.95×10^5 lb_m/hr liquid would boil in removing all decay heat from the core. An RPV pressure of 86.3 psig would pass this steam flow through the 3 SRVs. However, neither of these pressures is as high as the SRV reopening pressure of 100 psig.

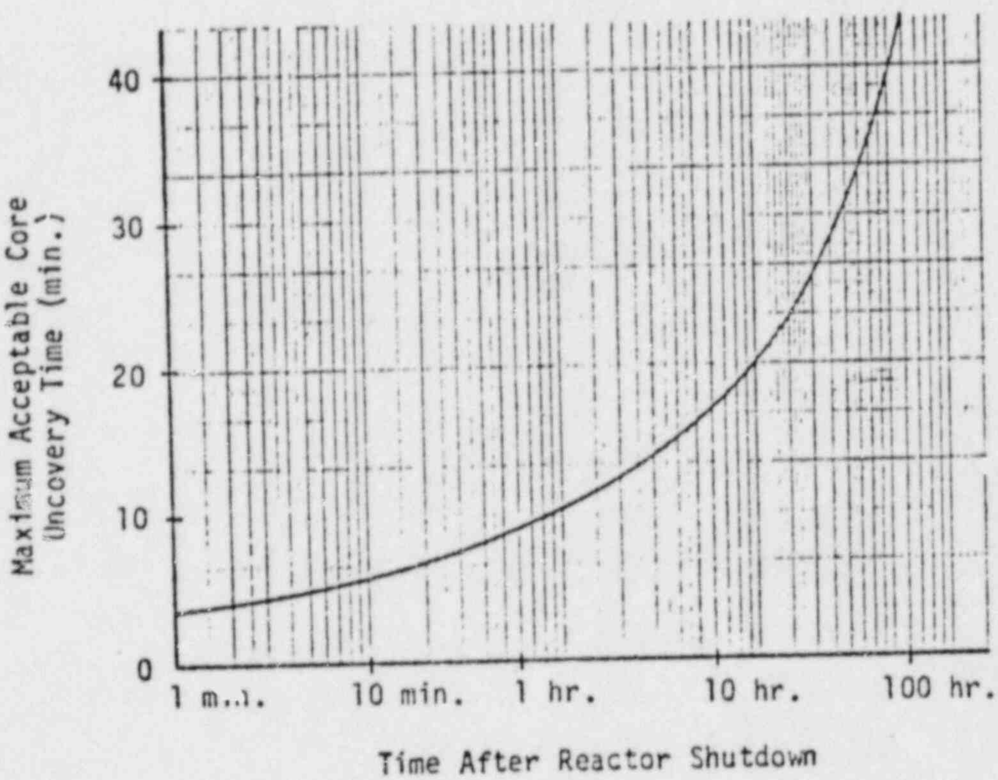
C6-4 If suppression chamber pressure cannot be maintained below the primary containment pressure limit, initiate the following systems irrespective of whether adequate core cooling is assured:

- Drywell sprays
- Suppression pool sprays [only when suppression pool water level is below 24 ft. 6 in. (elevation of suppression pool spray nozzles)]



BASIS: The primary containment pressure limit provides for containment pressure control before containment failure. Thus the best estimate of actual maximum pressure which the containment can withstand with suppression pool water level at design (high water level alarm setpoint) defines point (A). Point (B) and the slope of the curve is determined in the same manner as for the pressure suppression limit (page A-11).

C6-6.5 If RPV water level indication is not restored within the maximum acceptable core uncovery time after commencing termination of injection into the RPV, return to [Step C6-2].



BASIS: For a given time after reactor shutdown, the maximum acceptable core uncovery time is the time required for a completely uncovered core shutdown from full power to heatup from equilibrium at 545°F to a peak clad temperature of 2200°F with no spray or steam cooling.