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CLASS I
MARCH 1987

BWR OWNERS' GROUP

EMERGENCY PROCEDURE GUIDELINES

REVISION 4

Prepared for the

BWR OWNERS' GROUP

By the

Emergency Procedures Committee

8705060276

and

General Electric Company
175 Curtner Avenue
San Jose, CA 95125

Operations Engineering, Inc.
39650 Liberty Street, Suite 400
Fremont, CA 94538

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INTRODUCTION

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

- RPV Control Guideline
- Primary Containment Control Guideline
- Secondary Containment Control Guideline
- Radioactivity Release Control Guideline

The RPV Control Guideline maintains adequate core cooling, shuts down the reactor, and cools down the RPV to cold shutdown conditions. This guideline is entered whenever low RPV water level, high RPV pressure, or high drywell pressure occurs, or whenever a condition which requires reactor scram exists and reactor power is above the APRM downscale trip or cannot be determined.

The Primary Containment Control Guideline maintains primary containment integrity and protects equipment in the primary containment with respect to the consequences of all mechanistic events except the consequences of hydrogen generation in a Mark III containment. This guideline is entered whenever suppression pool temperature, drywell temperature, containment temperature, drywell pressure, suppression pool water level, or primary containment hydrogen concentration is above its high operating limit or suppression pool water level is below its low operating limit. Suppression pool, drywell, and containment temperatures are determined by plant-specific procedures for determining bulk suppression pool water temperature, drywell atmosphere average temperature, and Mark III containment atmosphere average temperature, respectively.

The Secondary Containment Control Guideline protects the secondary containment, limits radioactivity release to the secondary containment, and either maintains secondary containment integrity or limits radioactivity release from the secondary containment. This guideline is entered whenever a secondary containment temperature, radiation level, or water level is above

its maximum normal operating value or secondary containment differential pressure reaches zero.

The Radioactivity Release Control Guideline limits radioactivity release into areas outside the primary and secondary containments. This guideline is entered whenever offsite radioactivity release rate is above that which requires an Alert.

Table I is a list of the 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. Where the basis for a bracketed variable or curve is not evident from the text, a description of its basis is provided in Appendix A.

At various points throughout these guidelines, operator 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.

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 an emergency except systems used to mitigate the consequences of the generation of hydrogen in a Mark III containment. Because no specific plant includes all of the systems in these guidelines, the guidelines are applied to individual plants by deleting statements 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 generally 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 any emergency. Rather, such operation is required and is now permitted 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.

At other points within these guidelines, defeating safety system interlocks and initiation logic is specified. This is also required in order to safely mitigate the consequences of degraded conditions, and it is generally specified only when conditions exist for which the interlock or logic was not designed. Bypassing other interlocks may also be required due to instrument failure, etc., but these interlocks cannot be identified in advance and are therefore not specified in the guidelines.

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.

Each procedure developed from these emergency procedure guidelines is entered whenever any of its entry conditions occurs, irrespective of whether that procedure has already been entered or is presently being executed. The procedure is exited and the operator returns to non-emergency procedures when either one of the exit conditions specified in the procedure is satisfied or it is determined that an emergency no longer exists. For example, the

procedure developed from the RPV Control Guideline specifies cooldown to cold shutdown conditions by various methods and exit after the shutdown cooling interlocks have cleared, but entry into this procedure does not require any cooldown if it can be determined that an emergency no longer exists prior to establishing the conditions required to commence the cooldown as specified in the procedure. After a procedure developed from these guidelines has been entered, subsequent clearing of all entry conditions for that procedure is not, by itself, conclusive that an emergency no longer exists.

Procedures developed from these emergency procedure guidelines specify symptomatic operator actions which will maintain the reactor plant in a safe condition and optimize plant response and margin to safety irrespective of the initiating event. However, for certain specific events (e.g., earthquake, tornado, blackout, or fire), emergency response and recovery can be further enhanced by additional auxiliary event-specific operator actions which may be provided in supplemental event-specific procedures intended for use in conjunction with the symptomatic procedures. As with actions specified in any other procedure intended for use with the symptomatic procedures, these event-specific operator actions must not contradict or subvert the symptomatic operator actions specified in the symptomatic procedures and must not result in loss or unavailability of equipment the operation of which is specified in these procedures.

TABLE I

EPG ABBREVIATIONS

ADS	-	Automatic Depressurization System
APRM	-	Average Power Range Monitor
ARI	-	Alternate Rod Insertion
CRD	-	Control Rod Drive
ECCS	-	Emergency Core Cooling System
HPCI	-	High Pressure Coolant Injection
HPCS	-	High Pressure Core Spray
HVAC	-	Heating, Ventilating and Air Conditioning
IC	-	Isolation Condenser
LCO	-	Limiting Condition for Operation
LPCI	-	Low Pressure Coolant Injection
LPCS	-	Low Pressure Core Spray
MSIV	-	Main Steamline Isolation Valves
NPSH	-	Net Positive Suction Head
RCIC	-	Reactor Core Isolation Cooling
RHR	-	Residual Heat Removal
RPS	-	Reactor Protection System
RPV	-	Reactor Pressure Vessel
RSCS	-	Rod Sequence Control System
RWCU	-	Reactor Water Cleanup
RWM	-	Rod Worth Minimizer
SBGT	-	Standby Gas Treatment
SLC	-	Standby Liquid Control
SPMS	-	Suppression Pool Makeup System
SRV	-	Safety Relief Valve

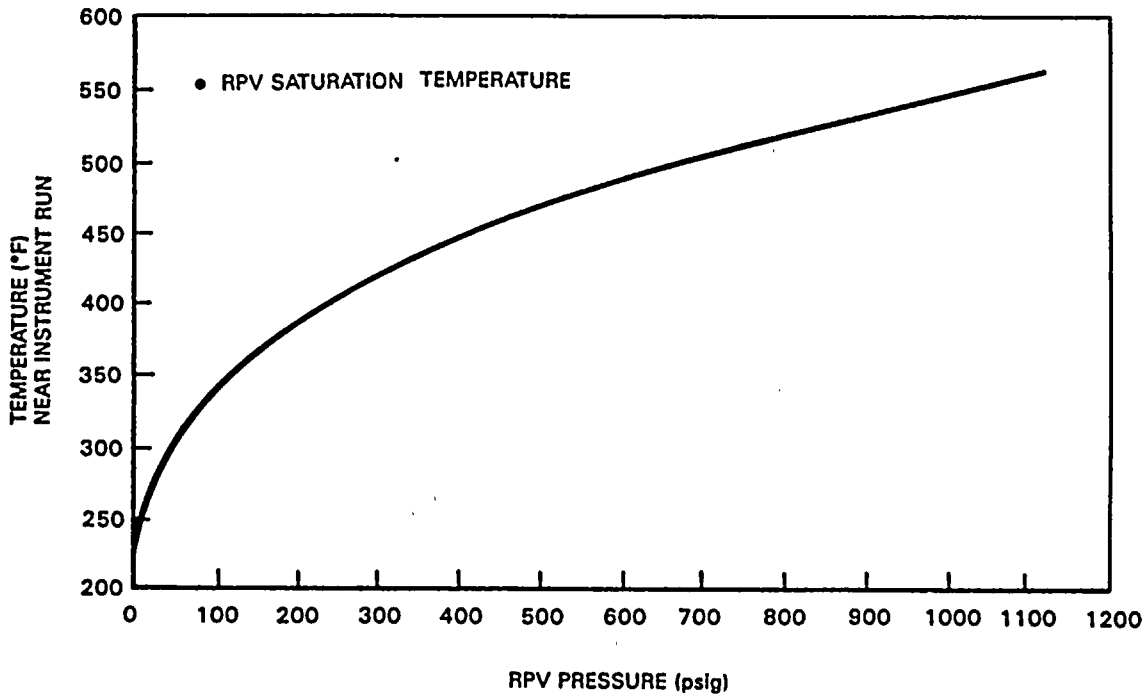
OPERATOR PRECAUTIONS

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 #1

An RPV water level instrument may be used to determine RPV water level only when all the following conditions are satisfied for that instrument:

1. The temperatures near all the instrument runs are below the RPV Saturation Temperature.



2. For each of the instruments in the following table, the instrument reads above the Minimum Indicated Level or the temperatures near all the instrument reference leg vertical runs are below the Maximum Run Temperature.

Instrument	Range (in.)	Maximum Run Temperature (°F) DW Runs	RB Runs	Minimum Indicated Level (in.)
[Fuel Zone	-317 to -17	324	NA	-301

3. For each of the following instruments, the instrument reads above the Minimum Indicated Level associated with the highest temperature near an instrument reference leg vertical run:

a. Narrow Range (0 to 60 in.)

Highest Drywell Run Temperature (°F) Between Low	High	Minimum Indicated Level (in.)
-	278	0
278	350	5
350	450	13
450	550	25

b. Wide Range (-150 to +60 in.)

Highest Drywell Run Temperature (°F) Between Low	High	Minimum Indicated Level (in.)
-	211	-150
211	350	-138
350	450	-128
450	550	-115

c. Shutdown Range (-17 to +383 in.)

Highest Drywell Run Temperature (°F) Between Low	High	Minimum Indicated Level (in.)
-	150	10
150	250	25
250	350	43
350	450	67
450	550	99

CAUTION #2

[Heated reference leg instruments] may not be used to determine RPV water level during rapid RPV depressurization below 500 psig.

CAUTION #3

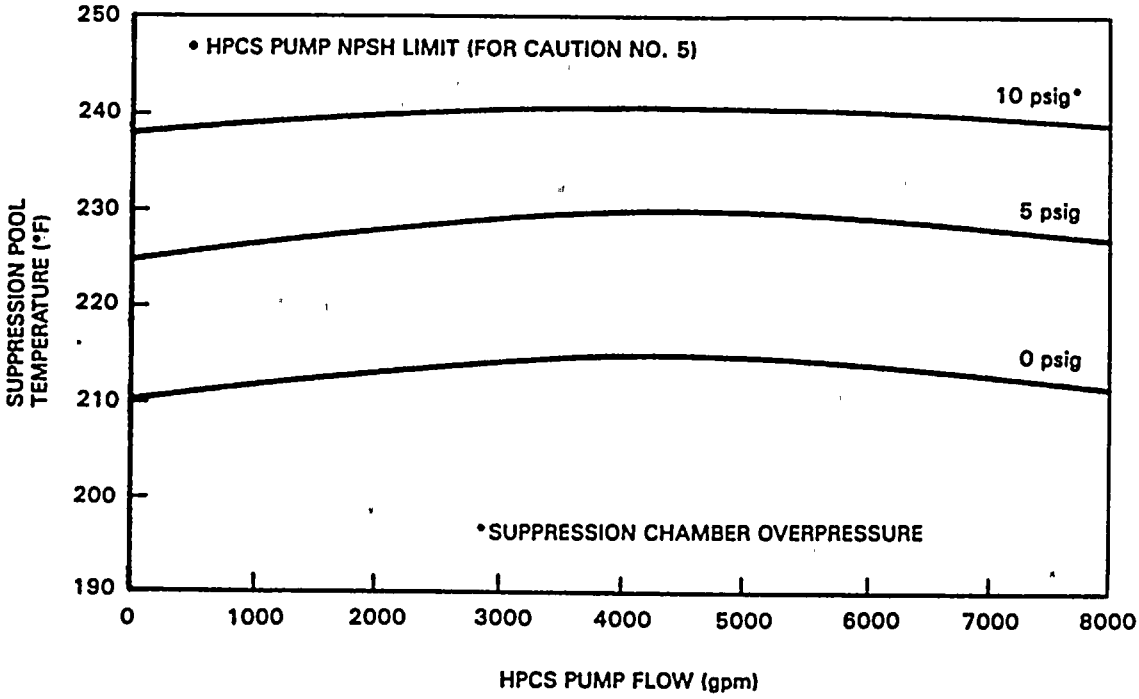
Operating HPCI or RCIC turbines below [2200 rpm (minimum turbine speed limit per turbine vendor manual)] may result in unstable system operation and equipment damage.

CAUTION #4

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

CAUTION #5

If HPCS is taking suction from the suppression pool and suppression pool temperature exceeds the HPCS Pump NPSH Limit, the pump may be damaged and become inoperable.



CAUTION #6

Cooldown rates above [100°F/hr (RPV cooldown rate LCO)] may be required to accomplish this step.

CAUTION #7

A rapid increase in injection into the RPV may induce a large power excursion and result in substantial core damage.

RPV CONTROL GUIDELINE

PURPOSE

The purpose of this guideline is to:

- Maintain adequate core cooling,
- Shut down the reactor, and
- Cool down the RPV to cold shutdown conditions ([100°F < RPV water temperature <212°F (cold shutdown conditions)]).

ENTRY CONDITIONS

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

- RPV water level below [+12 in. (low level scram setpoint)]
- RPV pressure above [1045 psig (high RPV pressure scram setpoint)]
- Drywell pressure above [2.0 psig (high drywell pressure scram setpoint)]
- A condition which requires reactor scram, and reactor power above [3% (APRM downscale trip)] or cannot be determined

OPERATOR ACTIONS

RC-1 If reactor scram has not been initiated, initiate reactor scram.

Irrespective of the entry conditions, execute [Steps RC/L, RC/P, and RC/Q] concurrently.

RC/L Monitor and control RPV water level. #1 #2

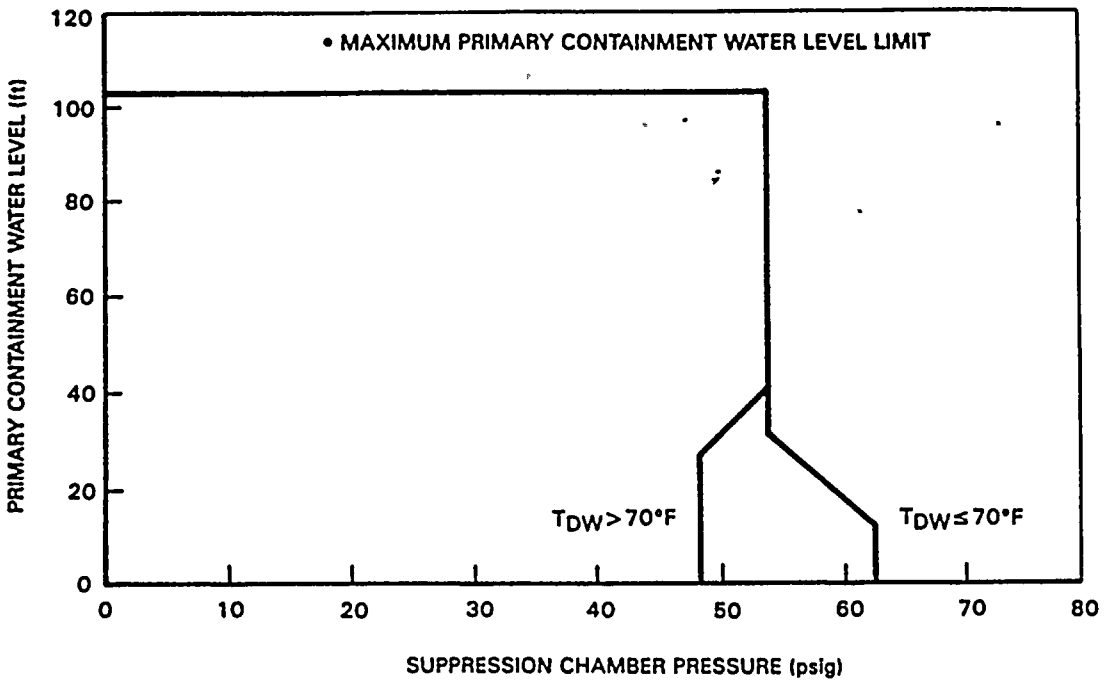
RC/L-1 Initiate each of the following which should have initiated but did not:

- Isolation
- ECCS
- [Emergency diesel generator]

If while executing the following step:

- Any control rod cannot be determined to be inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] and it has not been determined that the reactor will remain shutdown under all conditions without boron, enter [procedure developed from Contingency #5].
- RPV water level cannot be determined, enter [procedure developed from Contingency #4].

If while executing the following step primary containment water level and suppression chamber pressure cannot be maintained below the Maximum Primary Containment Water Level Limit, then irrespective of whether adequate core cooling is assured terminate injection into the RPV from sources external to the primary containment until primary containment water level and suppression chamber pressure can be maintained below the Maximum Primary Containment Water Level Limit.

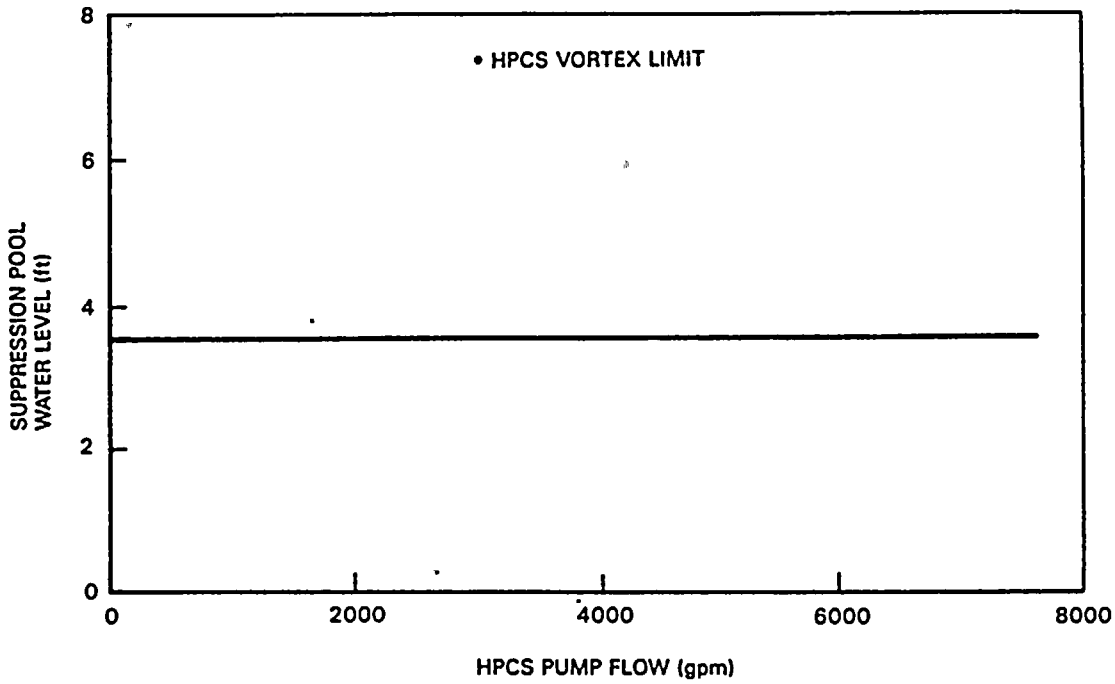


RC/L-2 Restore and maintain RPV water level between [+12 in. (low level scram setpoint or shutdown cooling RPV water level interlock, whichever is higher)] and [+58 in. (high level trip setpoint)] with one or more of the following systems:

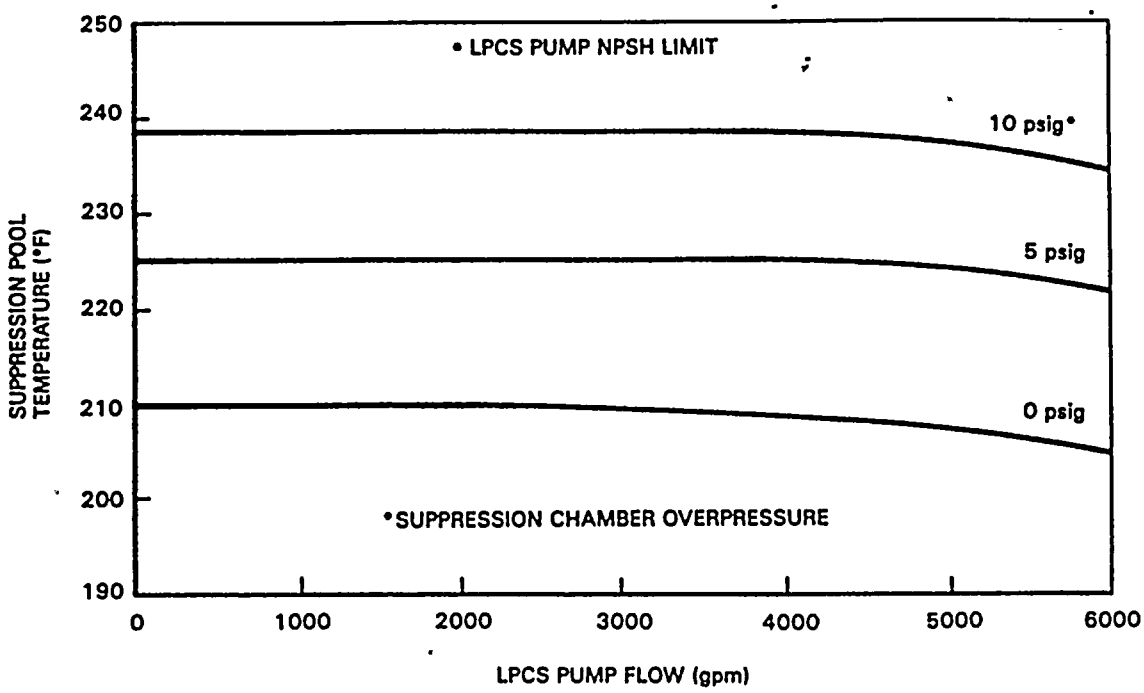
- Condensate/feedwater
- CRD
- RCIC with suction from the condensate storage tank, defeating low RPV pressure isolation interlocks and high suppression pool water level suction transfer logic if necessary. #3 #4
- HPIC with suction from the condensate storage tank, defeating high suppression pool water level suction transfer logic if necessary. #3

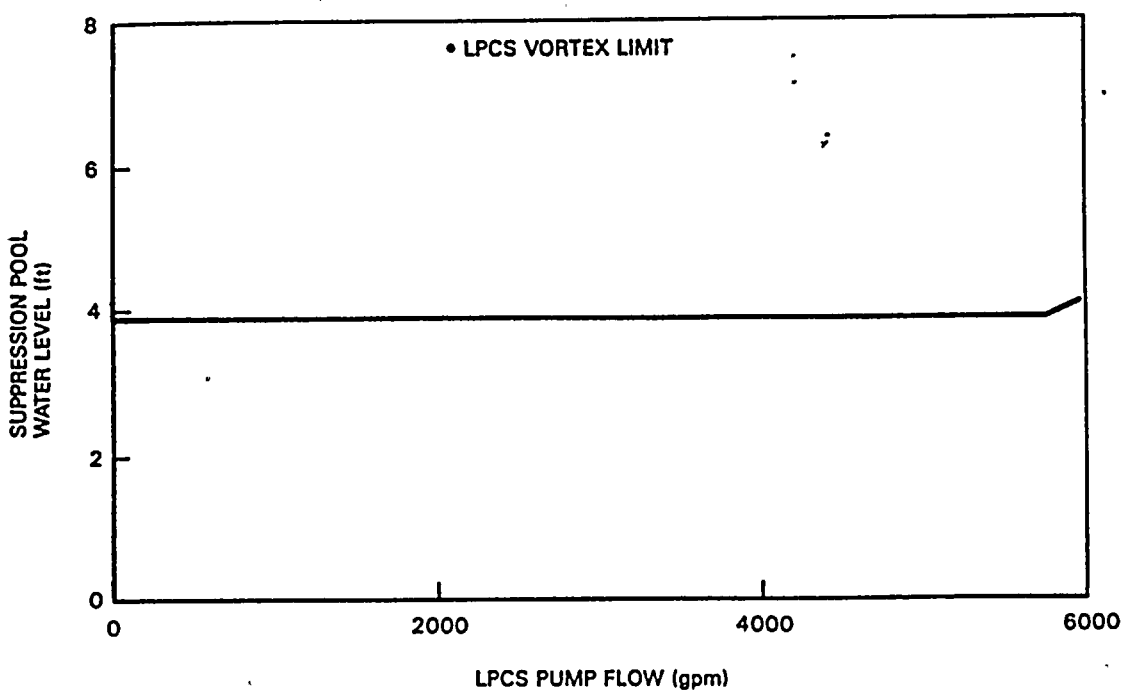
#5

- HPCS; control and maintain pump flow less than [the HPCS Vortex Limit].

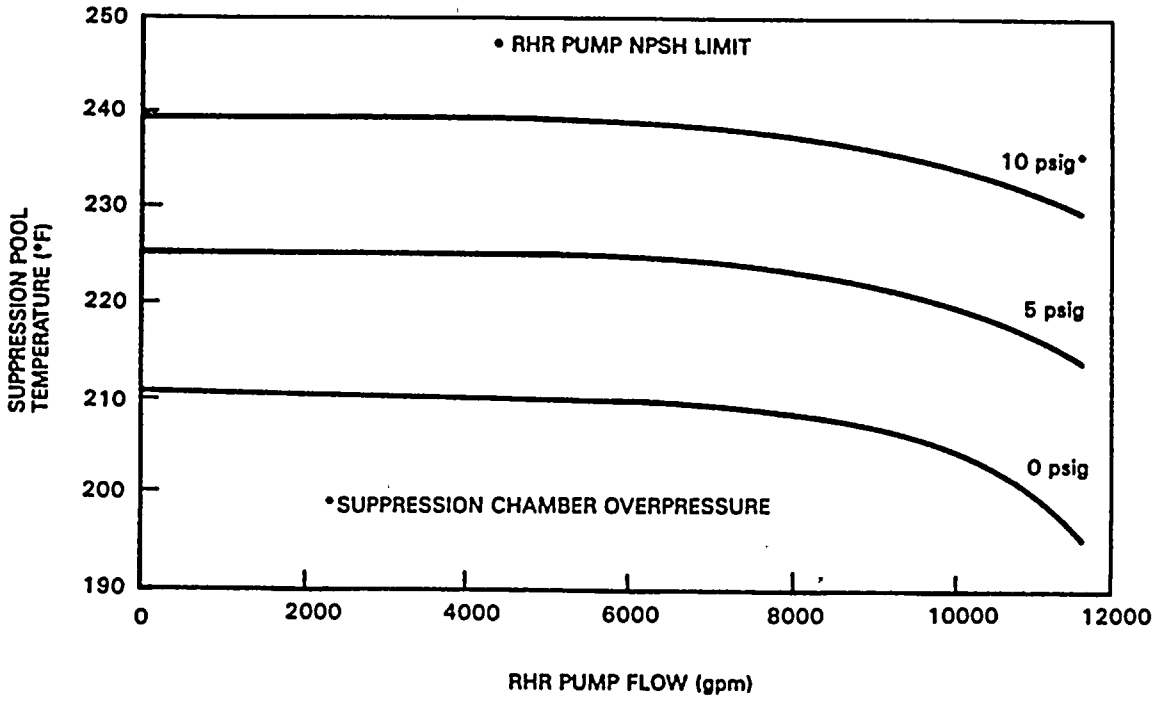


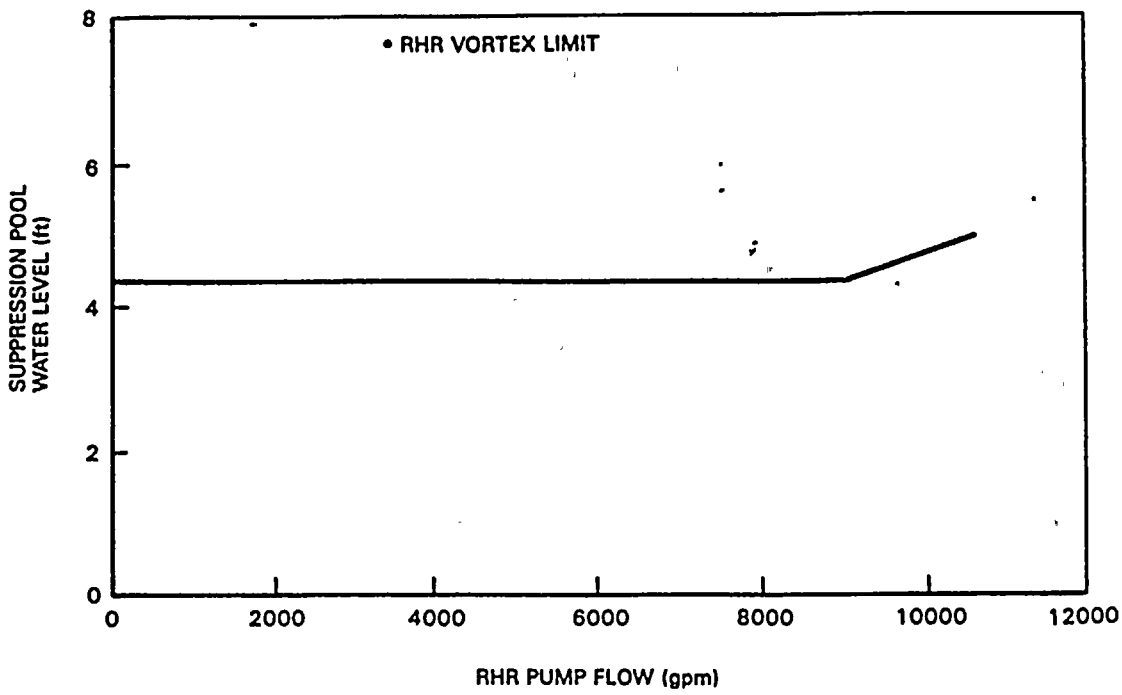
- LPCS; control and maintain pump flow less than the LPCS Pump NPSH Limit and [the LPCS Vortex Limit].




• LPCS VORTEX LIMIT
SUPPRESSION POOL WATER LEVEL (ft)
8
6
4
2
0
0
2000
4000
6000
LPCS PUMP FLOW (gpm)

- LPCI with injection through the heat exchangers as soon as possible; control and maintain pump flow less than the RHR Pump NPSH Limit and [the RHR Vortex Limit].





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

RPV water level control may be augmented by one or more of the following systems:

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

If RPV water level can be maintained above [-164 in. (top of active fuel)] and the ADS timer has initiated, prevent automatic RPV depressurization by resetting the ADS timer.

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

RC/L-3 When [procedure for cooldown to cold shutdown conditions] is entered from [Step RC/P-5], proceed to cold shutdown in accordance with [procedure for cooldown to cold shutdown conditions].

RC/P Monitor and control RPV pressure.

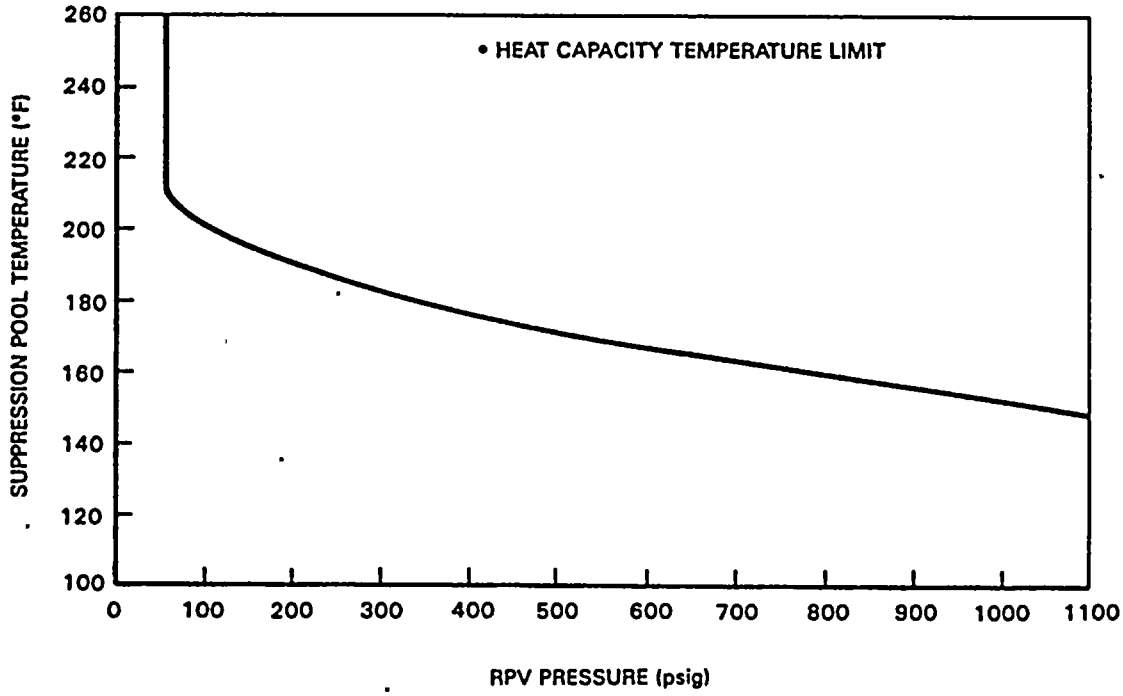
If while executing the following steps:

- A high drywell pressure ECCS initiation signal ([2.0 psig (drywell pressure which initiates ECCS)]) exists, prevent injection from those LPCS and LPCI pumps not required to assure adequate core cooling prior to depressurizing below their maximum injection pressures.
- Emergency RPV Depressurization is anticipated and either all control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] or it has been determined that the reactor will remain shutdown under all conditions without boron, rapidly depressurize the RPV with the main turbine bypass valves. #2 #6
- Emergency RPV Depressurization is required and less than [7 (number of SRVs dedicated to ADS)] SRVs are open, enter [procedure developed from Contingency #2].
- RPV water level cannot be determined and less than [7 (number of SRVs dedicated to ADS)] SRVs are open, enter [procedure developed from Contingency #2].
- RPV water level cannot be determined and at least [7 number of SRVs dedicated to ADS)] SRVs are open, enter [procedure developed from Contingency #4].

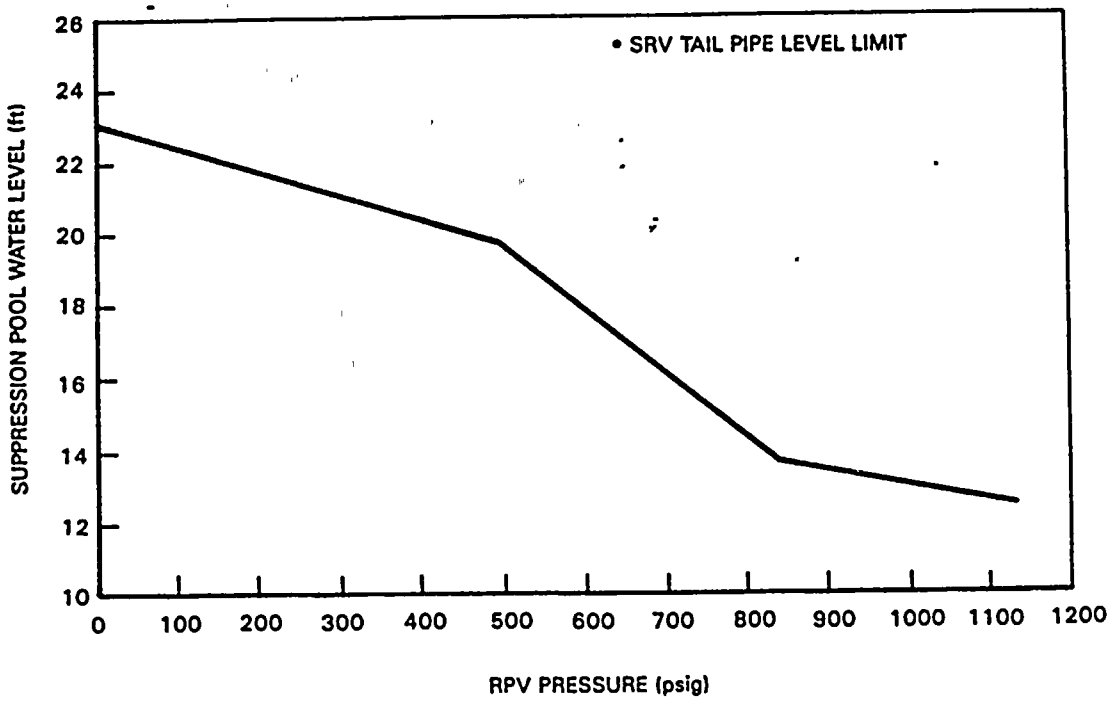
RC/P-1 If any SRV is cycling, initiate IC and manually open SRVs until RPV pressure drops to [935 psig (RPV pressure at which all turbine bypass valves are fully open)].

If while executing the following steps:

- Suppression pool temperature cannot be maintained below the Heat Capacity Temperature Limit, maintain RPV pressure below the Limit. #6



- Suppression pool temperature cannot be maintained below the SRV Tail Pipe Level Limit, maintain RPV pressure below the Limit. #6



- Steam Cooling is required, enter [procedure developed from Contingency #3].

If while executing the following steps:

- Boron Injection is required, and
- The main condenser is available, and
- There has been no indication of gross fuel failure or steam line break,

open MSIVs, bypassing pneumatic system and low RPV water level isolation interlocks if necessary, to re-establish the main condenser as a heat sink.

RC/P-2 Stabilize RPV pressure at a pressure below [1045 psig (high RPV pressure scram setpoint)] with the main turbine bypass valves.

RPV pressure control may be augmented by one or more of the following systems:

- IC
- SRVs only when suppression pool water level is above [4 ft. 9 in. (elevation of top of SRV discharge device)]; open SRVs in the following sequence if possible: [M, B, G, F, D, L, K, C, A (SRV opening sequence)]; if the continuous SRV pneumatic supply is or becomes unavailable, place the control switch for each SRV in the [CLOSE or AUTO] position.
- HPCI with suction from the condensate storage tank. #3
- RPCI with suction from the condensate storage tank. #3 #4
- [Other steam driven equipment]
- RWCU (recirculation mode), bypassing [regenerative heat exchangers and] filter/demineralizers and, if necessary, defeating SLC and other isolation interlocks.
- Main steam line drains
- RWCU (blowdown mode) if no boron has been injected into the RPV; refer to [sampling procedures] prior to initiating blowdown.

If while executing the following steps the reactor is not shutdown, return to [Step RC/P-2].

RC/P-3 When either:

- All control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)], or
- It has been determined that the reactor will remain shutdown under all conditions without boron, or
- [700 pounds (Cold Shutdown Boron Weight)] of boron have been injected into the RPV, or
- The reactor is shutdown and no boron has been injected into the RPV,

depressurize the RPV and maintain cooldown rate below [100°F/hr (RPV cooldown rate LCO)].

If one or more SRVs are being used to depressurize the RPV and the continuous SRV pneumatic supply is or becomes unavailable, depressurize with sustained SRV opening.

RC/P-4 When the shutdown cooling RPV pressure interlock clears, initiate shutdown cooling [using only those RHR pumps not required to maintain RPV water level above [10 in. (RPV water level shutdown cooling interlock)] by operation in the LPCI mode].

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

RC/P-5 When either:

- All control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)], or
- It has been determined that the reactor will remain shutdown under all conditions without boron, or

- [700 pounds (Cold Shutdown Boron Weight)] of boron have been injected into the RPV,

proceed to cold shutdown in accordance with [procedure for cooldown to cold shutdown conditions].

RC/Q Monitor and control reactor power.

> If while executing the following steps:
>
> - All control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)], terminate boron injection and enter [scram procedure].
> - It has been determined that the reactor will remain shutdown under all conditions without boron, terminate boron injection and enter [scram procedure].
> - The reactor is shutdown and no boron has been injected into the RPV, enter [scram procedure].

RC/Q-1 [Confirm or place the reactor mode switch in SHUTDOWN.]

[RC/Q-2 If ARI has not initiated, initiate ARI.]

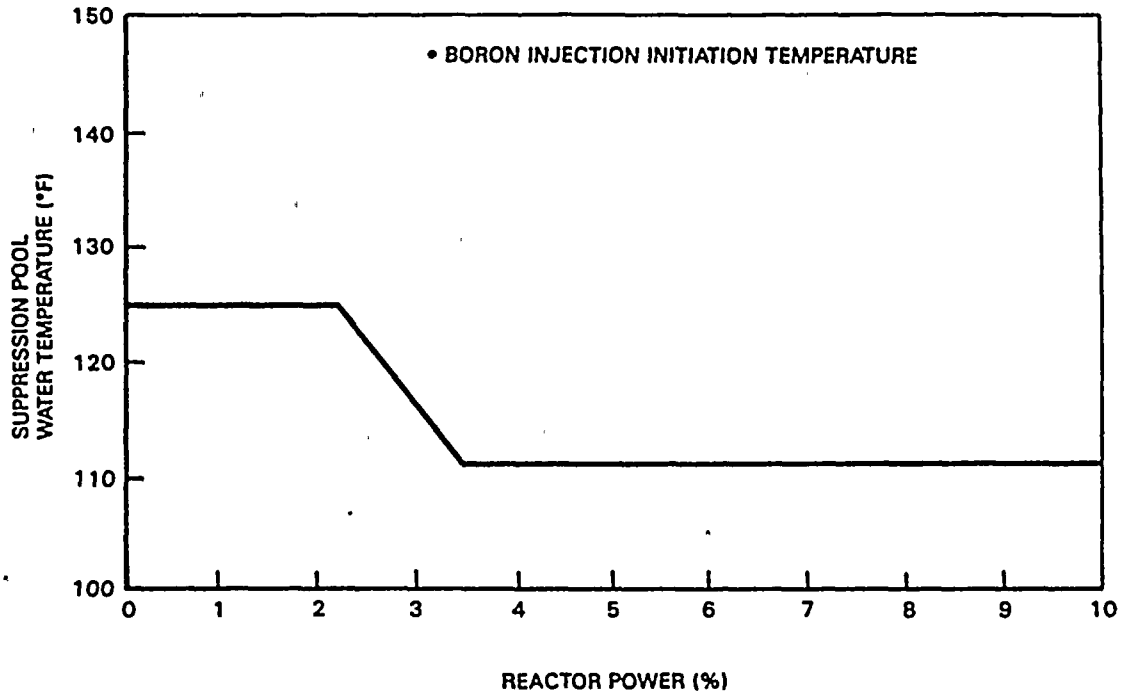
RC/Q-3 If the main turbine-generator is on-line [and the MSIVs are open], confirm or initiate recirculation flow runback to minimum.

RC/Q-4 If reactor power is above [3% (APRM downscale trip)] or cannot be determined, trip the recirculation pumps.

[RC/Q-5 If ARI has not initiated, initiate ARI.]

> Execute [Steps RC/Q-6 and RC/Q-7] concurrently.

RC/Q-6 Before suppression pool temperature reaches [the Boron Injection Initiation Temperature] but only if the reactor cannot be shut down, BORON INJECTION IS REQUIRED; inject boron into the RPV with SLC and prevent automatic initiation of ADS.



If boron cannot be injected with SLC, inject boron into the RPV by one or more of the following alternate methods:

- CRD
- HPCS
- RWCU
- Feedwater
- HPCI
- RCIC
- Hydro pump

If while executing the following steps SLC tank water level drops to [0% (low SLC tank water level trip)], confirm automatic trip of or manually trip the SLC pumps.

RC/Q-6.1 If boron is not being injected into the RPV by RWCU and RWCU is not isolated, bypass [regenerative heat exchangers and] filter/demineralizers.

RC/Q-6.2 Continue to inject boron until [700 pounds (Cold Shutdown Boron Weight)] of boron have been injected into the RPV.

RC/Q-6.3 Enter [scram procedure].

RC/Q-7 Insert control rods as follows:

RC/Q-7.1 Reset ARI, defeating ARI logic trips if necessary.

RC/Q-7.2 Insert control rods with one or more of the following methods:

- De-energize scram solenoids
- Vent the scram air header
- Reset the scram, defeating RPS logic trips if necessary, drain the scram discharge volume, and initiate a manual scram
- Open individual scram test switches
- Increase CRD cooling water differential pressure
- Drive control rods, defeating RSCS and RWM interlocks if necessary
- Vent control rod drive overpiston volumes

- RADIOACTIVITY RELEASE CONTROL GUIDELINE

PURPOSE

The purpose of this guideline is to limit radioactivity release into areas outside the primary and secondary containments.

ENTRY CONDITIONS

The entry condition for this guideline is:

- Offsite radioactivity release rate above the offsite release rate which requires an Alert.

OPERATOR ACTIONS

> If while executing the following steps turbine building HVAC is shutdown [or isolated due to high radiation], restart turbine building HVAC, defeating isolation interlocks if necessary.

RR-1 Isolate all primary systems that are discharging into areas outside the primary and secondary containments except systems required to assure adequate core cooling or shut down the reactor.

RR-2 When offsite radioactivity release rate approaches or exceeds the offsite release rate which requires a General Emergency but only if a primary system is discharging into an area outside the primary and secondary containments, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

PRIMARY CONTAINMENT CONTROL GUIDELINE

PURPOSE

The purpose of this guideline is to:

- Maintain primary containment integrity, and
- Protect equipment in the primary containment.

ENTRY CONDITIONS

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

- Suppression pool temperature above [95°F (most limiting suppression pool temperature LCO)]
- Drywell temperature above [135°F (drywell temperature LCO or maximum normal operating temperature, whichever is higher)]
- Containment temperature above [90°F (containment temperature LCO)]
- Drywell pressure above [2.0 psig (high drywell pressure scram setpoint)]
- Suppression pool water level above [12 ft 6 in. (maximum suppression pool water level LCO)]
- Suppression pool water level below [12 ft 2 in. (minimum suppression pool water level LCO)]
- Primary containment hydrogen concentration above [2% (high hydrogen alarm setpoint)]

OPERATOR ACTIONS

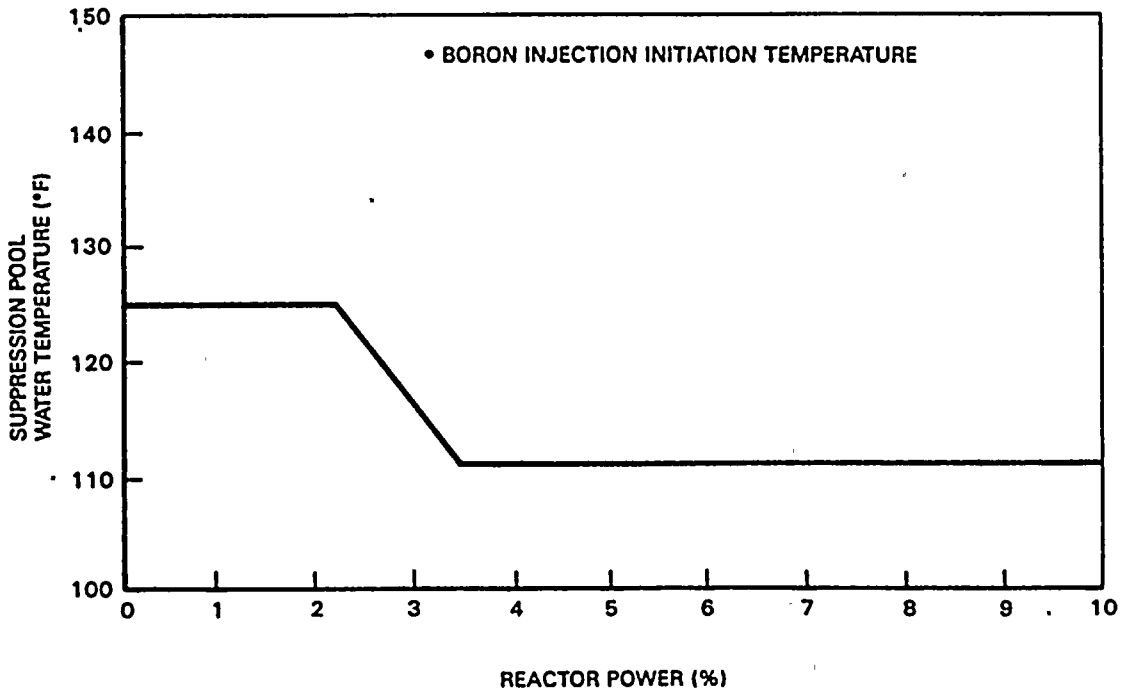
Irrespective of the entry conditions, execute [Steps SP/T, DW/T, CN/T, PC/P, SP/L, and PC/H] concurrently.

SP/T Monitor and control suppression pool temperature below [95°F (most limiting suppression pool temperature LCO)] using available suppression pool cooling.

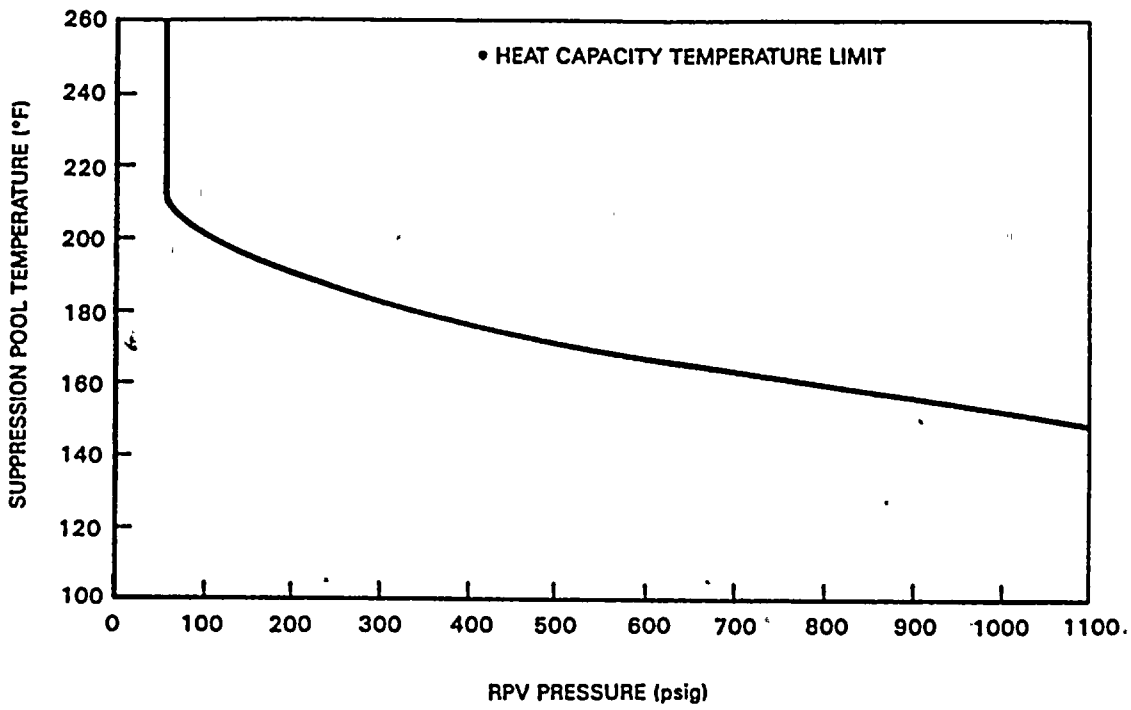
When suppression pool temperature cannot be maintained below [95°F (most limiting suppression pool temperature LCO)]:

SP/T-1 Operate all available suppression pool cooling [using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode].

SP/T-2 Before suppression pool temperature reaches [the Boron Injection Initiation Temperature], enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.



SP/T-3 When suppression pool temperature and RPV pressure cannot be maintained below the Heat Capacity Temperature Limit, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.



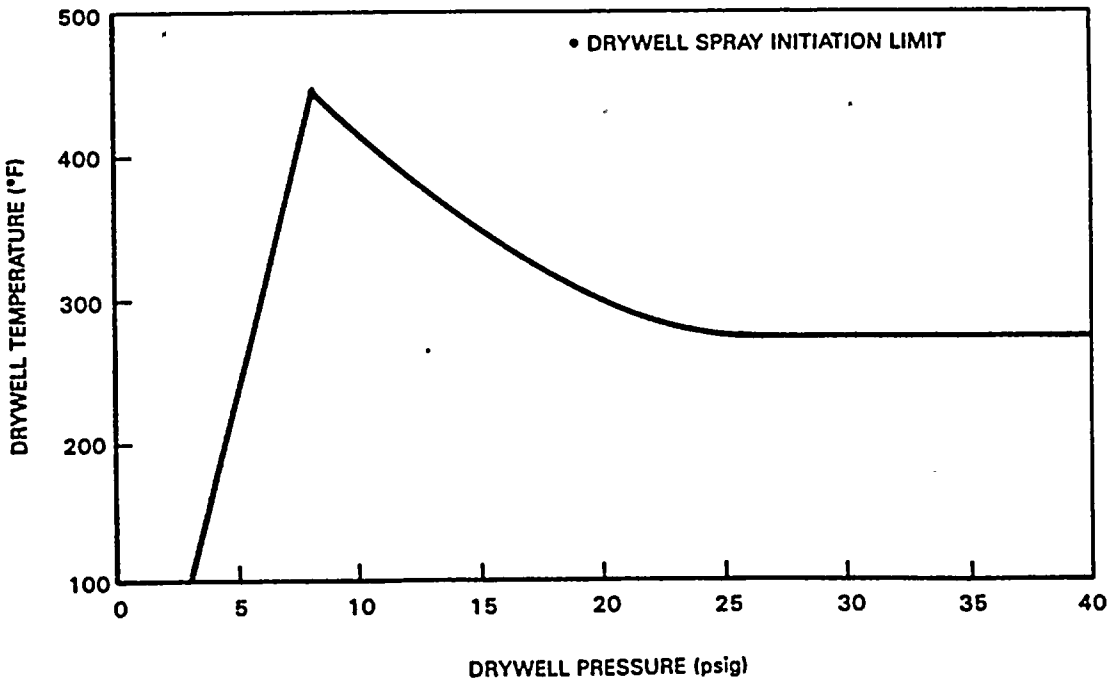
DW/T Monitor and control drywell temperature below [135°F (drywell temperature LCO or maximum normal operating temperature, whichever is higher)] using available drywell cooling.

When drywell temperature cannot be maintained below [135°F (drywell temperature LCO or maximum normal operating temperature, whichever is higher)]: #1

DW/T-1 Operate all available drywell cooling, defeating isolation interlocks if necessary.

If while executing the following steps drywell sprays have been initiated and drywell pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate drywell sprays.

DW/T-2 Before drywell temperature reaches [340°F (maximum temperature at which ADS qualified or drywell design temperature, whichever is lower)] but only if [suppression pool water level is below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)] and] drywell temperature and pressure are within the Drywell Spray Initiation Limits, [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays [using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode].



DW/T-3 When drywell temperature cannot be maintained below [340°F (maximum temperature at which ADS qualified or drywell design temperature, whichever is lower)], EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

CN/T Monitor and control containment temperature below [90°F (containment temperature LCO)], using available containment cooling.

When containment temperature cannot be maintained below [90°F (containment temperature LCO)]: #1

CN/T-1 Operate all available containment cooling.

> If while executing the following steps suppression pool sprays have been initiated and suppression chamber pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate suppression pool sprays.

CN/T-2 Before containment temperature reaches [185°F (containment design temperature)], but only if suppression chamber pressure is above [2.2 psig (Mark III Containment Spray Initiation Pressure Limit)], initiate suppression pool sprays using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode.

CN/T-3 When containment temperature cannot be maintained below [185°F (containment design temperature)], EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

PC/P Monitor and control primary containment pressure below [2.0 psig (high drywell pressure scram setpoint)] using the following systems:

- Containment pressure control systems; use [containment pressure control system operating procedures].
- SBGT [and drywell purge]; use [SBGT and drywell purge operating procedures].

YOU DO NOT DEFEAT INTERLOCKS, IT WILL BE ISOLATED HOWEVER, UNDER RADIATION SIGNALS(?)

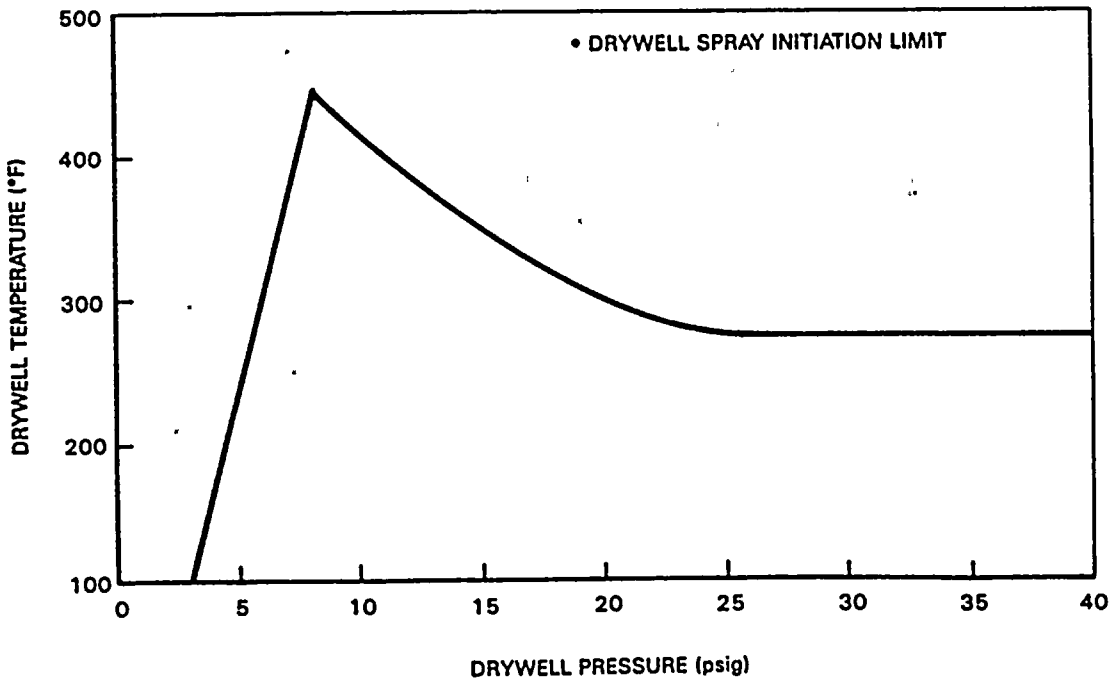
When primary containment pressure cannot be maintained below [2.0 psig (high drywell pressure scram setpoint)]:

> If while executing the following steps suppression pool sprays have been initiated and suppression chamber pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate suppression pool sprays.

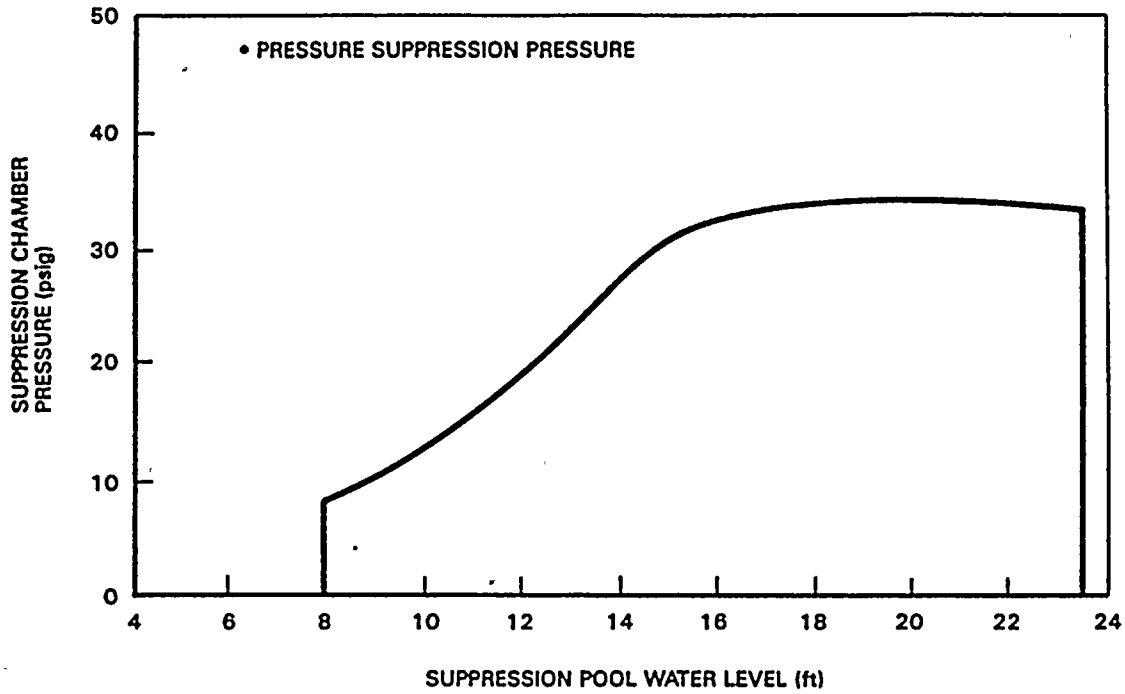
PC/P-1 Before suppression chamber pressure reaches [the Pressure Suppression Pressure] [13.8 psig (Suppression Chamber Spray Initiation Pressure)], but only if [suppression chamber pressure is above 2.2 psig (Mark III Containment Spray Initiation Pressure Limit)] [suppression pool water level is below 24 ft 6 in. (elevation of suppression pool spray nozzles)], initiate suppression pool sprays [using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode].

If while executing the following steps drywell sprays have been initiated and drywell pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate drywell sprays.

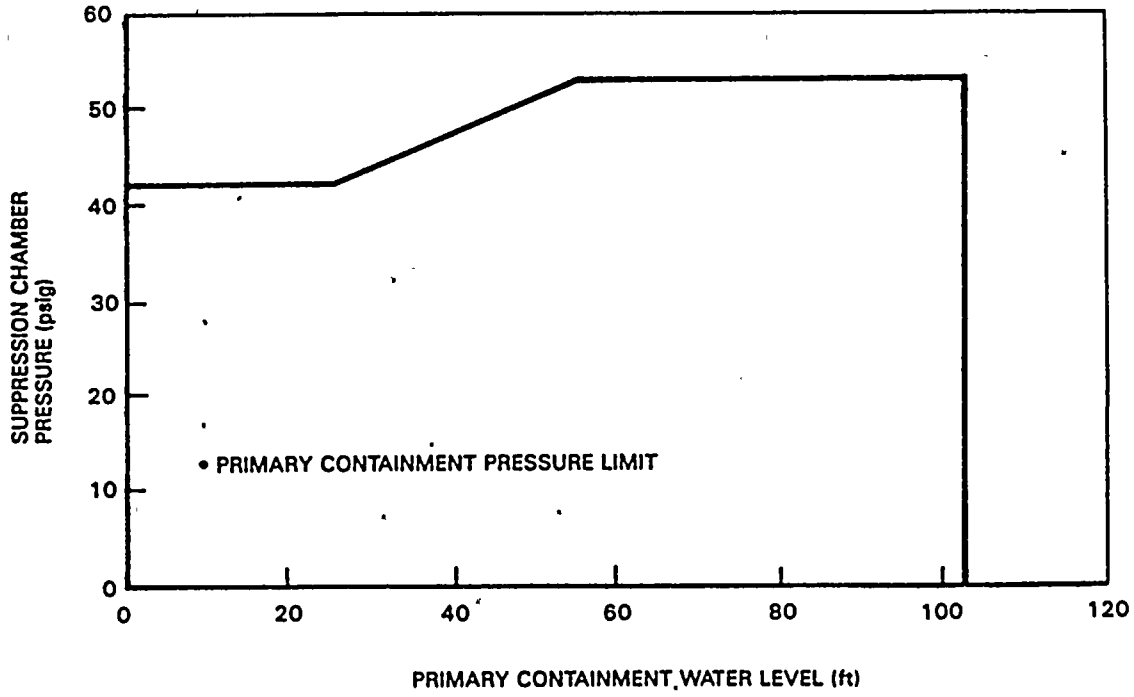
PC/P-2 When suppression chamber pressure exceeds [13.8 psig (Suppression Chamber Spray Initiation Pressure)] but only if [suppression pool water level is below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)] and] drywell temperature and pressure are within the Drywell Spray Initiation Limits, [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays [using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode].



PC/P-3 When suppression chamber pressure cannot be maintained below the Pressure Suppression Pressure, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.



PC/P-4 Before suppression chamber pressure reaches [the Primary Containment Pressure Limit], then irrespective of the offsite radioactivity release rate, vent the primary containment, defeating isolation interlocks if necessary, to reduce and maintain pressure below [the Primary Containment Pressure Limit] as follows:



- If suppression pool water level is below [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)], vent the suppression chamber in accordance with [procedure for primary containment venting].

- If suppression pool water level is at or above [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)] or if the suppression chamber cannot be vented, vent the drywell in accordance with [procedure for primary containment venting].

PC/P-5 When suppression chamber pressure exceeds [the Primary Containment Pressure Limit], then irrespective of the offsite radioactivity release rate or whether adequate core cooling is assured, vent the primary containment, defeating isolation interlocks if necessary, to reduce and maintain pressure below [the Primary Containment Pressure Limit] as follows:

- If suppression pool water level is below [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)], vent the suppression chamber in accordance with [procedure for primary containment venting].

- If suppression pool water level is at or above [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)] or if the suppression chamber cannot be vented, vent the drywell in accordance with [procedure for primary containment venting].

PC/P-6 When suppression chamber pressure cannot be maintained below [the Primary Containment Pressure Limit], then irrespective of whether adequate core cooling is assured:

- [If suppression pool water level is below 24 ft 6 in. (elevation of suppression pool spray nozzles),] initiate suppression pool sprays.

- If [suppression pool water level is below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)] and] drywell temperature and pressure are within the Drywell Spray Initiation Limits, [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays.

SP/L Monitor and control suppression pool water level.

If while executing the following steps Primary Containment Flooding is required, enter [procedure developed from Contingency #6].

SP/L-1 Maintain suppression pool water level between [12 ft 6 in. (maximum suppression pool water level LCO)] and [12 ft 2 in. (minimum suppression pool water level LCO)]; refer to [sampling procedure] prior to discharging water; [suppression pool makeup may be augmented by SPMS].

If SPMS has been initiated, maintain suppression pool water level between [23 ft 9 in. (SPMS initiation setpoint plus suppression pool water level increase which results from SPMS operation)] and [19 ft 11 in. (minimum suppression pool water level LCO)].

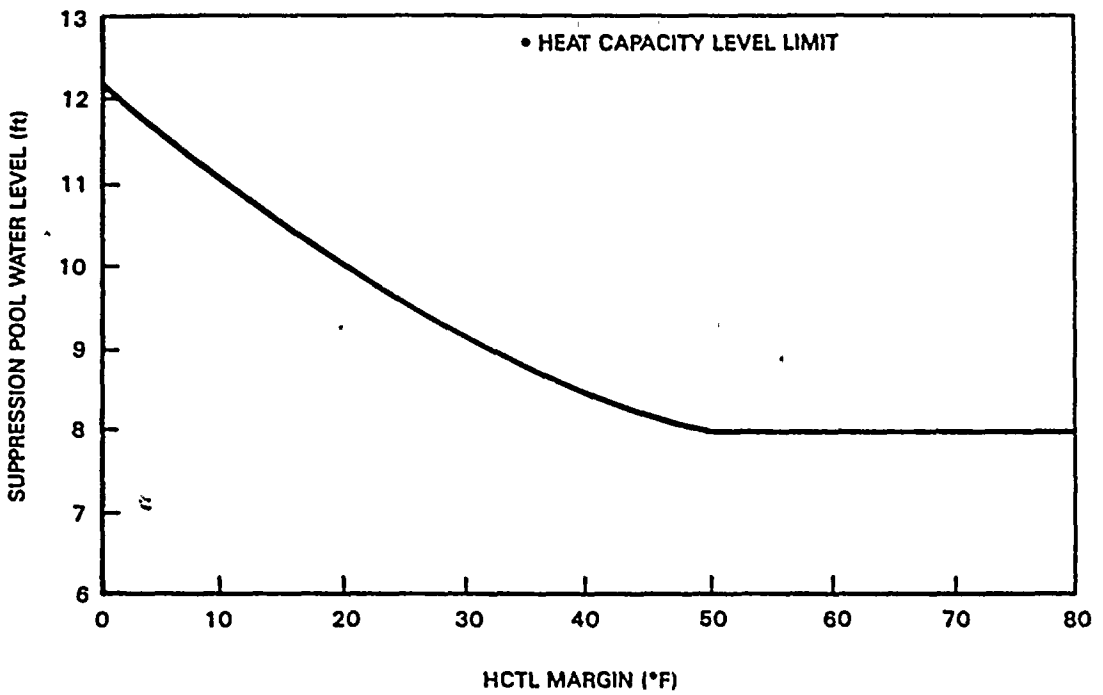
If suppression pool water level cannot be maintained above [12 ft 2 in. (minimum suppression pool water level LCO)], execute [Step SP/L-2].

If suppression pool water level cannot be maintained below [12 ft 6 in. (maximum suppression pool water level LCO)] ([23 ft 9 in. (SPMS initiation setpoint plus suppression pool water level increase which results from SPMS operation)] if SPMS has been initiated), execute [Step SP/L-3].

SP/L-2 SUPPRESSION POOL WATER LEVEL BELOW [12 ft 2 in. (minimum suppression pool water level LCO)]

[Execute [Steps SP/L-2.1 and SP/L-2.2] concurrently.]

SP/L-2.1 Maintain suppression pool water level above the Heat Capacity Level Limit.



Where HCTL Margin = Heat Capacity Temperature Limit minus suppression pool temperature

If suppression pool water level cannot be maintained above the Heat Capacity Level Limit, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

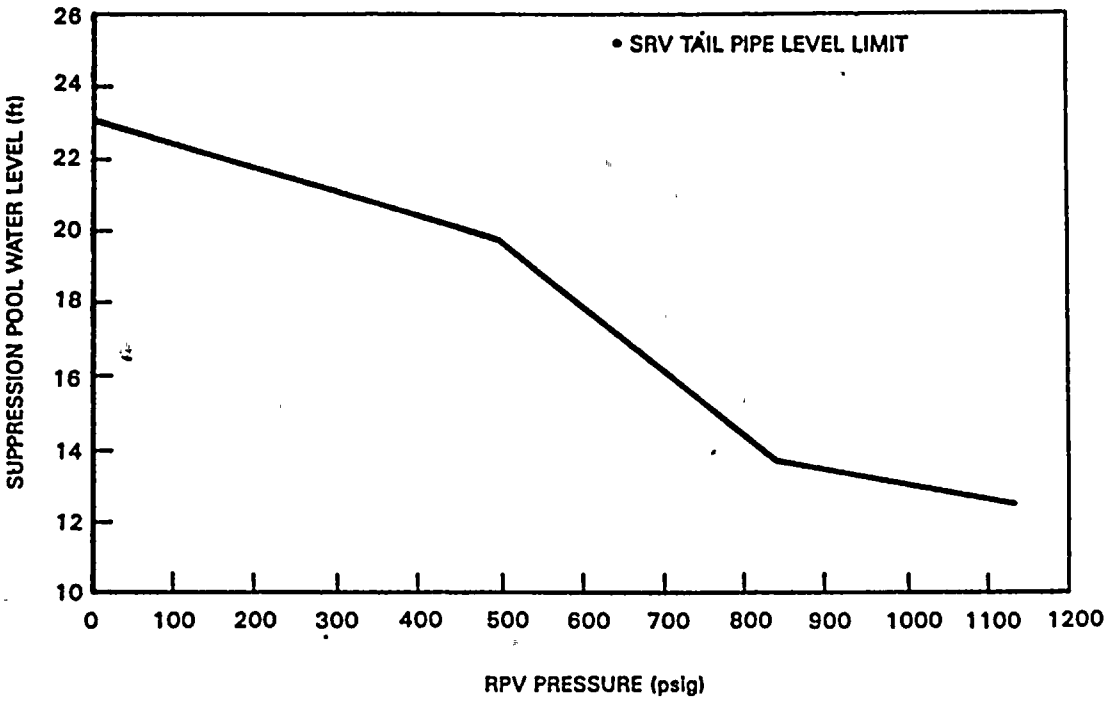
SP/L-2.2 Maintain suppression pool water level above [8 ft 0 in. (elevation of the top of the HPCI exhaust)].

If suppression pool water level cannot be maintained above [8 ft 0 in. (elevation of the top of the HPCI exhaust)], secure HPCI irrespective of whether adequate core cooling is assured.

SP/L-3 SUPPRESSION POOL WATER LEVEL ABOVE [12 ft 6 in. (maximum suppression pool water level LCO)] ([23 ft 9 in. (SPMS initiation setpoint plus suppression pool water level increase which results from SPMS operation)] if SPMS has been initiated)

Execute [Steps SP/L-3.1, SP/L-3.2, and SP/L-3.3] concurrently.

SP/L-3.1 Maintain suppression pool water level below the SRV Tail Pipe Level Limit.



If suppression pool water level cannot be maintained below the SRV Tail Pipe Level Limit, enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

If suppression pool water level and RPV pressure cannot be maintained below the SRV Tail Pipe Level Limit but only if adequate core cooling is assured, terminate injection into the RPV from sources external to the primary containment except from boron injection systems and CRD.

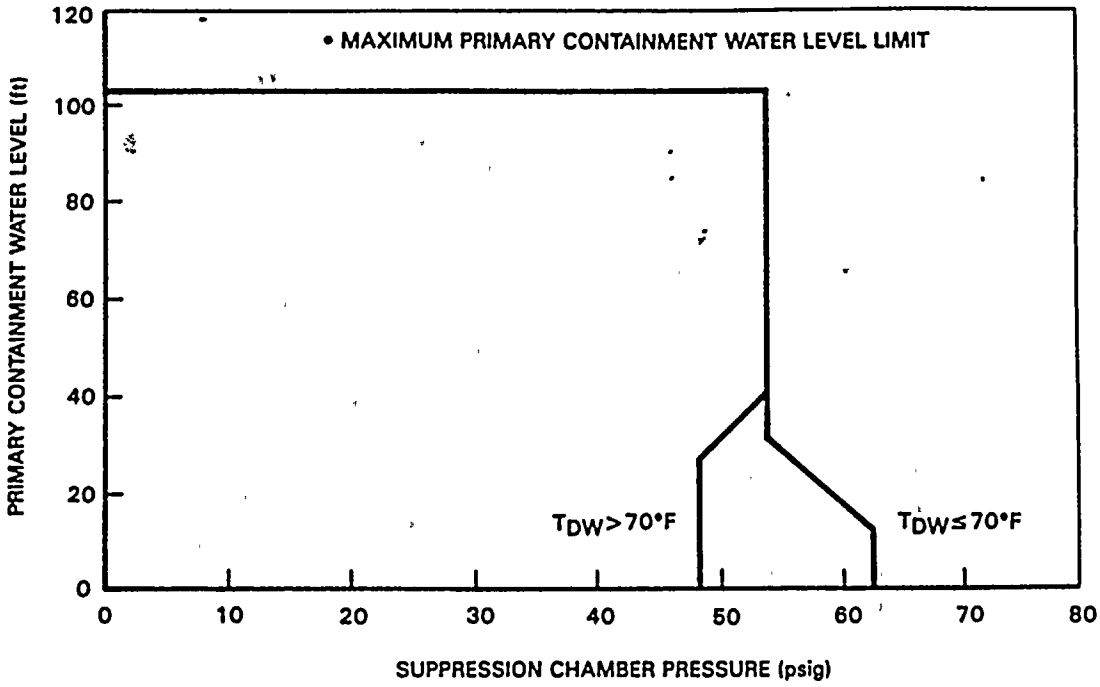
If suppression pool water level and RPV pressure cannot be restored and maintained below the SRV Tail Pipe Level Limit, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

SP/L-3.2 Maintain suppression pool water level below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)].

If suppression pool water level cannot be maintained below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)]:

- Terminate drywell sprays.
- If adequate core cooling is assured, terminate injection into the RPV from sources external to the primary containment except from boron injection systems and CRD.

SP/L-3.3 Maintain primary containment water level below the Maximum Primary Containment Water Level Limit.



If primary containment water level cannot be maintained below the Maximum Primary Containment Water Level Limit, terminate injection into the RPV from sources external to the primary containment irrespective of whether adequate core cooling is assured.

PC/H Monitor and control hydrogen and oxygen concentrations

If while executing the following steps:

- The hydrogen or oxygen monitoring system is or becomes unavailable, sample the drywell and suppression chamber for hydrogen and oxygen in accordance with [sampling procedure].
- Drywell or suppression chamber hydrogen concentration cannot be determined to be below 6% and drywell or suppression chamber oxygen concentration cannot be determined to be below 5%, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure; secure and prevent operation of hydrogen mixing systems and recombiners and, irrespective of the offsite radioactivity release rate, vent and purge the primary containment in accordance with [Steps PC/H-4.1 through 4.4] until drywell and suppression chamber hydrogen concentrations can be determined to be below 6% or drywell and suppression chamber oxygen concentrations can be determined to be below 5%.

PC/H-1 When drywell or suppression chamber hydrogen concentration reaches [0.5% (minimum detectable hydrogen concentration)], but only if the offsite radioactivity release rate is expected to remain below the offsite release rate LCO, vent and purge the primary containment, defeating isolation interlocks, if necessary, to restore and maintain drywell and suppression chamber hydrogen concentrations below [0.5% (minimum detectable hydrogen concentration)] as follows:

THIS IS TOO VAGUE EXPAND APPENDIX B.

If while executing the following steps the offsite radioactivity release rate reaches the offsite release rate LCO, isolate the primary containment vent and purge.

PC/H-1.1 Refer to [sampling procedure].

PC/H-1.2 If suppression pool water level is below [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)], vent the suppression chamber in accordance with [procedure for primary containment venting].

If suppression pool water level is at or above [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)] or if the suppression chamber cannot be vented, vent the drywell in accordance with [procedure for primary containment venting].

PC/H-1.3 If the suppression chamber or drywell can be vented:

- If drywell oxygen concentration is below 5%, initiate and maximize the drywell nitrogen purge flow.

WHY IF UPON ENTRY @ O_2 = 5.1% WOULD YOU WANT TO AIR PURGE?

If drywell oxygen concentration is not below 5%, initiate and maximize the drywell air purge flow.

Execute [Steps PC/H-2 and PC/H-3] concurrently.

PC/H-2 Monitor and control hydrogen and oxygen concentrations in the drywell.

PC/H-2.1 When drywell hydrogen concentration reaches [1% (minimum hydrogen concentration for recombiner operation or minimum detectable hydrogen concentration, whichever is higher)] but only if drywell hydrogen concentration is below [6% (maximum

hydrogen concentration for recombiner operation or 6%, whichever is lower)] or drywell oxygen concentration is below [5% (maximum oxygen concentration for recombiner operation or 5%, whichever is lower)], place hydrogen recombiners in service taking suction directly on the drywell and operate the drywell hydrogen mixing system.

PC/H-2.2 When drywell hydrogen concentration reaches [6% (maximum hydrogen concentration for recombiner operation or 6%, whichever is lower)] and drywell oxygen concentration reaches [5% (maximum oxygen concentration for recombiner operation or 5%, whichever is lower)], secure any hydrogen recombiner taking suction on the drywell.

PC/H-2.3 Continue in this procedure at [Step PC/H-4].

PC/H-3 Monitor and control hydrogen and oxygen concentrations in the suppression chamber.

PC/H-3.1 When suppression chamber hydrogen concentration reaches [1% (minimum hydrogen concentration for recombiner operation or minimum detectable hydrogen concentration, whichever is higher)] but only if suppression chamber hydrogen concentration is below [6% (maximum hydrogen concentration for recombiner operation or 6%, whichever is lower)] or suppression chamber oxygen concentration is below [5% (maximum oxygen concentration for recombiner operation or 5%, whichever is lower)], place hydrogen recombiners in service taking suction directly on the suppression chamber.

If no hydrogen recombiner can be placed in service taking suction directly on the suppression chamber but only if the drywell hydrogen concentration is below [6% (maximum hydrogen concentration for recombiner operation or 6%, whichever is lower)] or drywell oxygen concentration is below [5% (maximum oxygen concentration for recombiner operation or 5%, whichever is lower)], place hydrogen recombiners in service taking suction indirectly on the suppression chamber by way of the drywell.

PC/H-3.2 When suppression chamber hydrogen concentration reaches [6% (maximum hydrogen concentration for recombiner operation or 6%, whichever is lower)] and suppression chamber oxygen concentration reaches [5% (maximum oxygen concentration for recombiner operation or 5%, whichever is lower)], secure all hydrogen recombiners taking suction directly on the suppression chamber.

PC/H-4 [When drywell or suppression chamber hydrogen concentration reaches 6% and drywell or suppression chamber oxygen concentration is above 5%,] EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure; secure hydrogen mixing systems and, irrespective of the offsite radioactivity release rate, vent and purge the primary containment, defeating isolation interlocks if necessary, to restore and maintain drywell and suppression chamber hydrogen concentrations below 6% or drywell and suppression chamber oxygen concentrations below 5% as follows:

If while executing the following steps suppression pool or drywell sprays have been initiated and:

- Suppression chamber pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate suppression pool sprays.
- Drywell pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate drywell sprays.

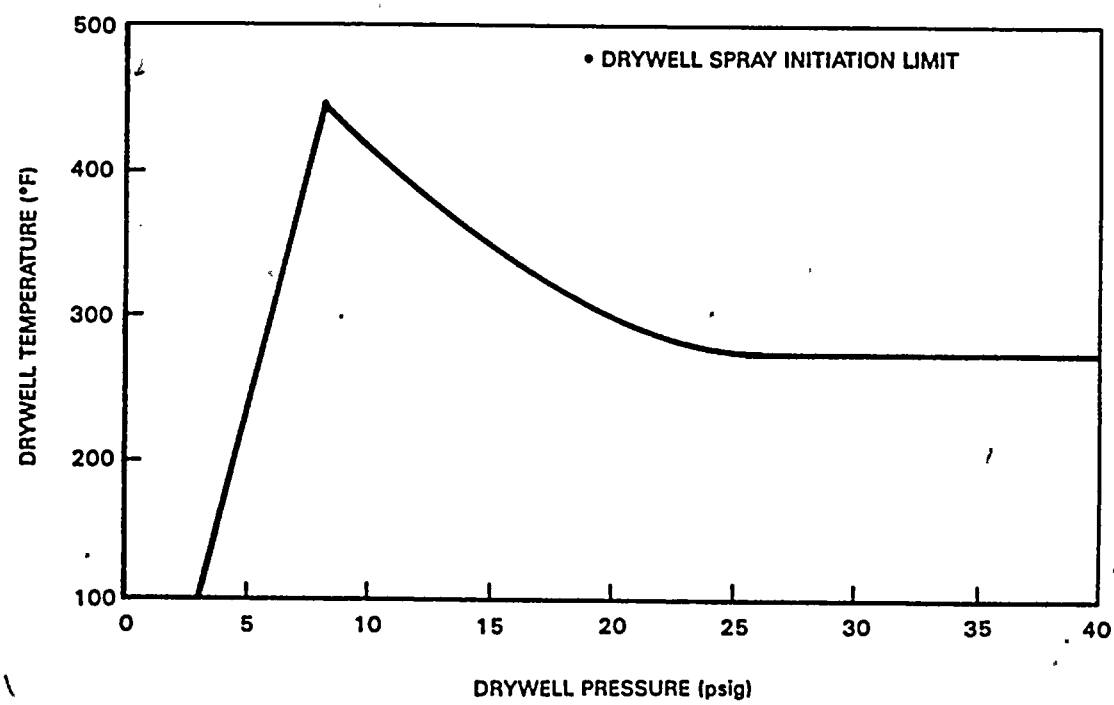
PC/H-4.1 If suppression pool water level is below [24 ft 6 in. (elevation of suppression pool spray nozzles)], initiate suppression pool sprays [using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode].

PC/H-4.2 If suppression pool water level is below [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)], vent the suppression chamber in accordance with [procedure for primary containment venting].

If suppression pool water level is at or above [26 ft 9 in. (elevation of the bottom of the suppression chamber vent)] or if the suppression chamber cannot be vented, vent the drywell in accordance with [procedure for primary containment venting].

PC/H-4.3 If the suppression chamber or drywell can be vented, initiate and maximize the drywell purge flow.

PC/H-4.4 If [suppression pool water level is below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)] and] drywell temperature and pressure are within the Drywell Spray Initiation Limits, [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays [using only those RHR pumps not required to assure adequate core cooling by continuous operation in the LPCI mode].



PC/H-5 When drywell or suppression chamber hydrogen concentration cannot be restored and maintained below 6% and drywell or suppression chamber oxygen concentration cannot be restored and maintained below 5%, then irrespective of whether adequate core cooling is assured:

If while executing the following steps suppression pool or drywell sprays have been initiated and:

- Suppression chamber pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate suppression pool sprays.
- Drywell pressure drops below [2.0 psig (high drywell pressure scram setpoint)], terminate drywell sprays.

PC/H-5.1 If suppression pool water level is below [24 ft 6 in. (elevation of suppression pool spray nozzles)], initiate suppression pool sprays.

PC/H-5.2 If [suppression pool water level is below [17 ft 2 in. (elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water)] and] drywell temperature and pressure are within the Drywell Spray Initiation Limits, [shut down recirculation pumps and drywell cooling fans and] initiate drywell sprays.

SECONDARY CONTAINMENT CONTROL GUIDELINE

PURPOSE

The purpose of this guideline is to:

- Protect equipment in the secondary containment,
- Limit radioactivity release to the secondary containment, and either:
- Maintain secondary containment integrity, or
- Limit radioactivity release from the secondary containment.

ENTRY CONDITIONS

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

- Differential pressure at or above 0 in. of water
- An area temperature above the maximum normal operating temperature
- A HVAC cooler differential temperature above the maximum normal operating differential temperature
- A HVAC exhaust radiation level above the maximum normal operating radiation level
- An area radiation level above the maximum normal operating radiation level
- A floor drain sump water level above the maximum normal operating water level
- An area water level above the maximum normal operating water level

OPERATOR ACTIONS

If while executing the following steps secondary containment HVAC exhaust radiation level exceeds [20 mR/hr (secondary containment HVAC isolation setpoint)]:

- Confirm or manually initiate isolation of secondary containment HVAC, and
- Confirm initiation of or manually initiate SBGT.

If while executing the following steps:

- Secondary containment HVAC isolates, and,
- Secondary containment HVAC exhaust radiation level is below [20 mR/hr (secondary containment HVAC isolation setpoint)],

restart secondary containment HVAC, defeating high drywell pressure and low RPV water level isolation interlocks if necessary.

Irrespective of the entry condition, execute [Steps SC/T, SC/R, and SC/L] concurrently.

SC/T Monitor and control secondary containment temperatures.

SC/T-1 Operate available area coolers.

SC/T-2 If secondary containment HVAC exhaust radiation level is below [20 mR/hr (secondary containment HVAC isolation setpoint)], operate available secondary containment HVAC.

SC/T-3 When an area temperature exceeds its maximum normal operating temperature, isolate all systems that are discharging into the area except systems that are discharging into the area except systems required to shut down the reactor, assure adequate core cooling, or suppress a fire. [#1]

Execute [Steps SC/T-4 and SC/T-5] concurrently.

SC/T-4 If a primary system is discharging into secondary containment:

SC/T-4.1 Before any area temperature reaches its maximum safe operating temperature, enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

SC/T-4.2 When an area temperature exceeds its maximum safe operating temperature in more than one area, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

SC/T-5 When an area temperature exceeds its maximum safe operating temperature in more than one area, shut down the reactor.

SC/R Monitor and control secondary containment radiation levels.

SC/R-1 When an area radiation level exceeds its maximum normal operating radiation level, isolate all systems that are discharging into the area except systems required to shut down the reactor, assure adequate core cooling, or suppress a fire.

Execute [Steps SC/R-2 and SC/R-3] concurrently.

SC/R-2 If a primary system is discharging into secondary containment:

SC/R-2.1 Before any area radiation level reaches its maximum safe operating radiation level, enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

SC/R-2.2 When an area radiation level exceeds its maximum safe operating radiation level in more than one area, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

SC/R-3 When an area radiation level exceeds its maximum safe operating radiation level in more than one area, shut down the reactor.

SC/L Monitor and control secondary containment water levels.

SC/L-1 When a floor drain sump or area water level is above its maximum normal operating water level, operate available sump pumps to restore and maintain it below its maximum normal operating water level.

If any floor drain sump or area water level cannot be restored and maintained below its maximum normal operating water level, isolate all systems that are discharging water into the sump or area except systems required to shut down the reactor, assure adequate core cooling, or suppress a fire.

Execute [Steps SC/L-2 and SC/L-3] concurrently.

SC/L-2 If a primary system is discharging into secondary containment:

SC/L-2.1 Before any area water level reaches its maximum safe operating water level, enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure.

SC/L-2.2 When an area water level exceeds its maximum safe operating water level in more than one area, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

SC/L-3 When an area water level exceeds its maximum safe operating water level in more than one area, shut down the reactor.

TABLE 1

OPERATING VALUES OF SECONDARY CONTAINMENT PARAMETERS

SECONDARY CONTAINMENT PARAMETER	Max Normal Operating Value	Max Safe Operating Value
AREA TEMPERATURE	°F	°F
RWCU "A" pump room 158 ft	130	215
RWCU "B" pump room 158 ft	130	215
RWCU Hx room 158 ft at Hxs	130	215
RWCU Hx room 158 ft at discharge to hotwell	130	215
RWCU phase separator room 158 ft	130	215
RWCU holding pump room 185 ft	130	215
NE Diagonal	175	214
SE Diagonal	175	214
HPCI room, area A	175	214
HPCI room, area B	175	214
HPCI room, area C	175	214
Torus room, westwall	175	214
Torus room, eastwall	175	214
Torus room, northwall	175	214
Torus room, southwall	175	214
Main steam tunnel	200	215
SE, Reactor 130 ft area A	150	214
SE, Reactor 130 ft area B	150	214
NW Diagonal, area A	175	310
NW Diagonal, area B	175	310
NW Diagonal, area C	175	310

TABLE 1

OPERATING VALUES OF SECONDARY CONTAINMENT PARAMETERS (Continued)

SECONDARY CONTAINMENT PARAMETER	Max Normal Operating Value	Max Safe Operating Value
HVAC COOLER DIFFERENTIAL TEMPERATURE	°F	
RWCU "A" pump room 158 ft	75	
RWCU "B" pump room 158 ft	75	
RWCU Hx room 158 ft at Hxs	75	
RWCU Hx room 158 ft at discharge to hotwell	75	
RWCU phase separator room 158 ft	75	
RWCU holding pump room 185 ft	75	
Torus room, NW A	50	
Torus room, west A	50	
Torus room, NW B	50	
Torus room, west B	50	
Torus room, NW C	50	
Torus room, west C	50	
Torus room, NW D	50	
Torus room, west D	50	

TABLE 1

OPERATING VALUES OF SECONDARY CONTAINMENT PARAMETERS (Continued)

SECONDARY CONTAINMENT PARAMETER	Max Normal Operating Value	Max Safe Operating Value
HVAC EXHAUST RADIATION LEVEL	mR/hr	
Reactor building	50	NA
Refuel floor	50	NA
AREA RADIATION LEVEL	mR/hr	mR/hr
158 ft southeast area	50	1250
158 ft northeast area	50	1250
158 ft northwest area	50	1250
130 ft northeast area	50	1250
130 ft northwest area	50	1250
Decontamination pump & equipment room	50	1250
South CRD hydraulic units	50	1250
Spent fuel pool passageway	50	1250
158 ft operating floor	50	1250
158 ft sample panel area	50	1250
158 ft RWCU control panel area	50	1250
Fuel pool demin panel area	50	1250
CRD repair area	50	1250
RCIC equipment area	50	1250
CRD pump room SW	50	1250
RHR & core spray room northeast	50	1250
RHR & core spray room southeast	50	1250

TABLE 1

OPERATING VALUES OF SECONDARY CONTAINMENT PARAMETERS (Continued)

SECONDARY CONTAINMENT PARAMETER	Max Normal Operating Value	Max Safe Operating Value
FLOOR DRAIN SUMP WATER LEVEL	Inches	
Sump A (NE diagonal)	47	NA
Sump B (NW diagonal)	52	NA
AREA WATER LEVEL	Inches	Inches
CRD compartment	7	260
RCIC compartment	7	22
RB NE corner room	7	14
RB SE corner room	7	15
HPCI compartment	7	14
Torus compartment NW	7	11
Torus compartment NE	7	11
Torus compartment SE	7	11
Torus compartment SW	7	11

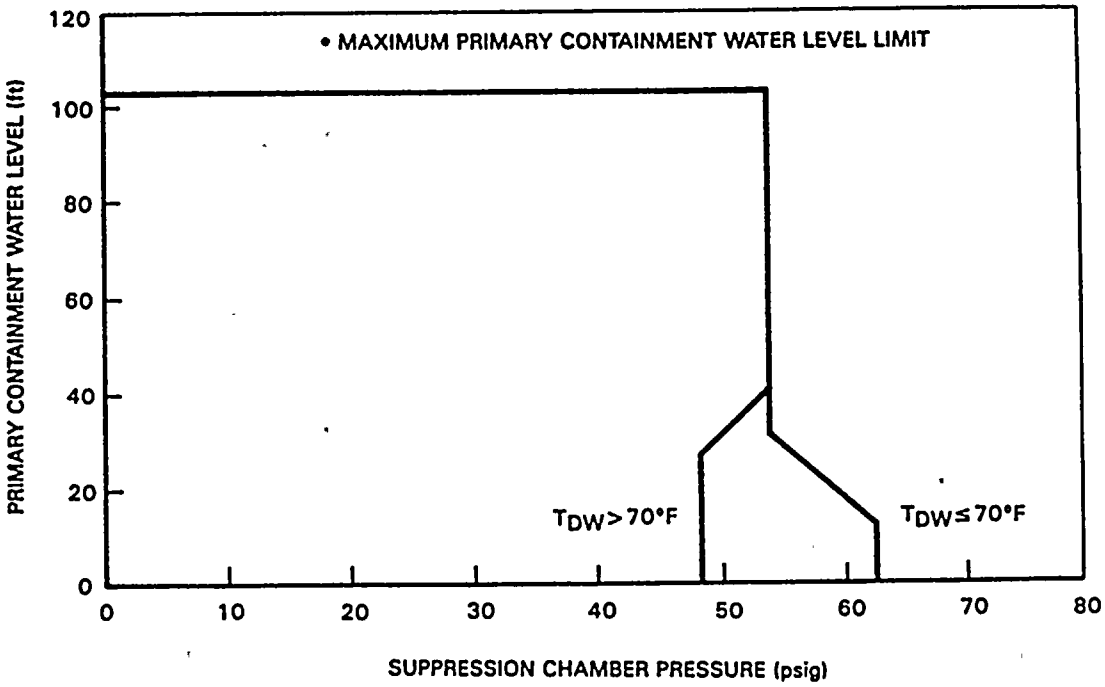
CONTINGENCY #1

ALTERNATE LEVEL CONTROL

If while executing the following steps:

- Any control rod cannot be determined to be inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] and it has not been determined that the reactor will remain shutdown under all conditions without boron, enter [procedure developed from Contingency #5].
- RPV water level cannot be determined, enter [procedure developed from Contingency #4].
- RPV water level is increasing, enter [procedure developed from the RPV Control Guideline] at [Step RC/L].
- RPV water level drops below [-146 in. (ADS initiation setpoint)], prevent automatic initiation of ADS.

If while executing the following steps primary containment water level and suppression chamber pressure cannot be maintained below the Maximum Primary Containment Water Level Limit, then irrespective of whether adequate core cooling is assured terminate injection into the RPV from sources external to the primary containment until primary containment water level and suppression chamber pressure can be maintained below the Maximum Primary Containment Water Level Limit.



C1-1 Initiate IC.

C1-2 Line up for injection, start pumps, and irrespective of pump NPSH and vortex limits, increase injection flow to the maximum with 2 or more of the following injection subsystems:

- Condensate
- HPCS
- LPCI-A with injection through the heat exchanger as soon as possible.
- LPCI-B with injection through the heat exchanger as soon as possible.
- LPCI-C with injection through the heat exchanger as soon as possible.
- LPCS-A
- LPCS-B

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)

C1-3 If RPV pressure is above [87 psig (highest RPV pressure at which the shutoff head of a low-water-quality alternate injection subsystem (excluding SLC) is reached)]:

> If while executing the following steps RPV pressure drops below [87 psig (highest RPV pressure at which the shutoff head of a low-water-quality alternate injection subsystem (excluding SLC) is reached)], continue in this procedure at [Step C1-4].

C1-3.1 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.

C1-3.2 When RPV water level drops to [-164 in. (top of active fuel)]:

- If any system, injection subsystem or alternate injection subsystem is lined up with at least one pump running, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.
- If no system, injection subsystem or alternate injection subsystem is lined up with at least one pump running, STEAM COOLING IS REQUIRED.

C1-4 When RPV pressure drops below [87 psig (highest RPV pressure at which the shutoff head of a low-water-quality alternate injection subsystem (excluding SLC) is reached)]:

C1-4.1 Line up for injection, start pumps, and irrespective of pump NPSH and vortex limits, increase injection flow to the maximum with all systems and injection subsystems.

C1-4.2 When RPV water level drops to [-164 in. (top of active fuel)], EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; line up for injection, start pumps, and increase injection flow to the maximum with all alternate injection subsystems.

If RPV water level cannot be restored and maintained above [-164 in. (top of active fuel)], PRIMARY CONTAINMENT FLOODING IS REQUIRED; enter [procedure developed from Contingency #6].

CONTINGENCY #2
EMERGENCY RPV DEPRESSURIZATION

C2-1 When either: #2 #6

- Any control rod cannot be determined to be inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] and it has not been determined that the reactor will remain shutdown under all conditions without boron and all injection into the RPV except from boron injection systems, CRD, and RCIC has been terminated and prevented, or
- All control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] or it has been determined that the reactor will remain shutdown under all conditions without boron,

C2-1.1 If a high drywell pressure ECCS initiation signal ([2.0 psig (drywell pressure which initiates ECCS)]) exists, prevent injection from those LPCS and LPCI pumps not required to assure adequate core cooling.

C2-1.2 Initiate IC.

C2-1.3 If suppression pool water level is above [4 ft 9 in. (elevation of top of SRV discharge device)]:

- Open all ADS valves.
- If any ADS valve cannot be opened, open other SRVs until [7 (number of SRVs dedicated to ADS)] valves are open.

C2-1.4 If less than [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRVs are open [and RPV pressure is at least 50 psig (Minimum SRV Reopening Pressure) above suppression chamber pressure], rapidly depressurize the RPV, defeating isolation interlocks if necessary, using one or more of the following:

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

If RPV water level cannot be determined, enter [procedure developed from Contingency #4].

C2-2 When either:

- All control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)], or
- It has been determined that the reactor will remain shutdown under all conditions without boron, or
- [700 pounds (Cold Shutdown Boron Weight)] of boron have been injected into the RPV, or
- The reactor is shutdown and no boron has been injected into the RPV,

enter [procedure developed from the RPV Control Guideline at [Step RC/P-4].

CONTINGENCY #3
STEAM COOLING

C3-1 Confirm initiation of IC.

> If while executing this step Emergency RPV Depressurization is required, RPV water level cannot be determined, or 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, when RPV water level drops to [-208 in. (Minimum Zero-Injection RPV Water Level)] enter [procedure developed from Contingency #2].

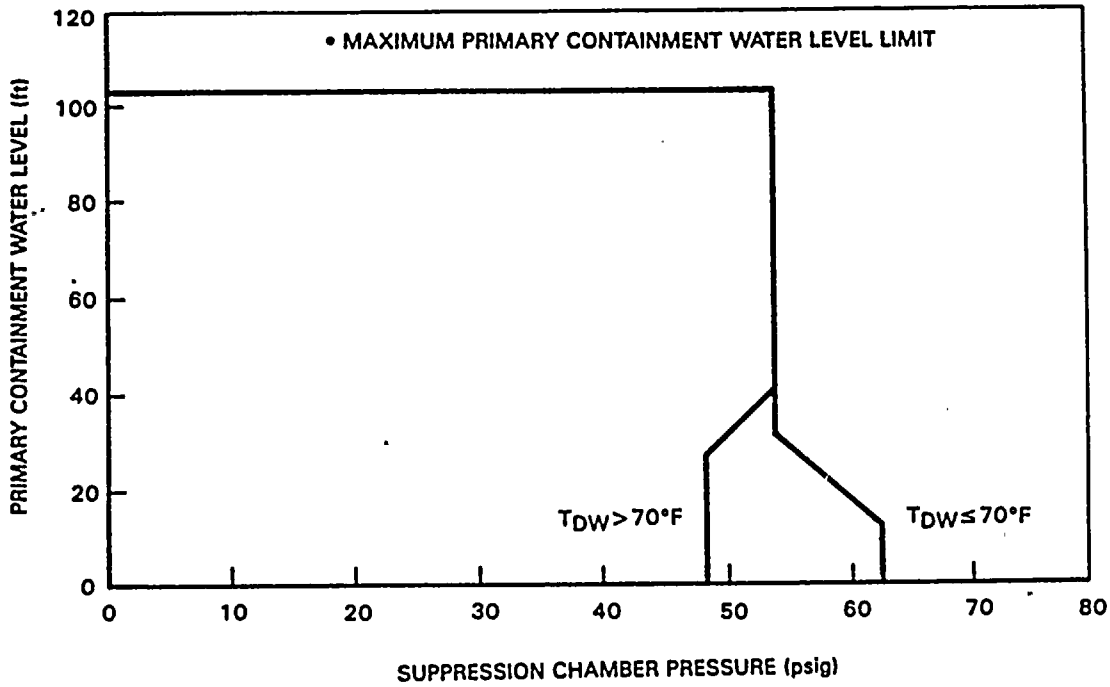
CONTINGENCY #4

RPV FLOODING

If while executing the following steps RPV water level can be determined:

- If any control rod cannot be determined to be inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] and it has not been determined that the reactor will remain shutdown under all conditions without boron, enter [procedure developed from Contingency #5] and [procedure developed from RPV Control Guideline] at [Step RC/P-4] and execute these procedures concurrently.
- If all control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] or it has been determined that the reactor will remain shutdown under all conditions without boron, enter [procedure developed from the RPV Control Guideline] at [Steps RC/L and RC/P-4] and execute these steps concurrently.

If while executing the following steps primary containment water level and suppression chamber pressure cannot be maintained below the Maximum Primary Containment Water Level Limit, then irrespective of whether adequate core cooling is assured terminate injection into the RPV from sources external to the primary containment until primary containment water level and suppression chamber pressure can be maintained below the Maximum Primary Containment Water Level Limit.



C4-1 If any control rod cannot be determined to be inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] and it has not been determined that the reactor will remain shutdown under all conditions without boron, flood the RPV as follows:

If while executing the following steps either all control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] or it has been determined that the reactor will remain shutdown under all conditions without boron but RPV water level cannot be determined, continue in this procedure at [Step C4-2].

C4-1.1 Terminate and prevent all injection into the RPV except from boron injection systems and CRD until RPV pressure is below the Minimum Alternate RPV Flooding Pressure.

Number of open SRVs	Minimum Alternate RPV Flooding Pressure (psig)
[7 or more	94]
[6	112]
[5	137]
[4	175]
[3	238]
[2	364]
[1	743]

If less than [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] can be opened, continue in this procedure.

C4-1.2 If at least [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRVs can be opened, close the MSIVs, main steam line drain valves, and IC, RCIC, and RHR steam condensing isolation valves.

C4-1.3 Commence and, irrespective of pump NPSH and vortex limits, slowly increase injection into the RPV with the following systems until at least [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] [is] open and RPV pressure is above the Minimum Alternate RPV Flooding Pressure: #7

- Motor driven feedwater pumps, defeating high RPV water level isolation interlocks if necessary.
- Condensate pumps
- CRD
- [LPCI with injection through the heat exchangers as soon as possible.]

If less than [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] [is] open or RPV pressure cannot be increased to above the Minimum Alternate RPV Flooding Pressure, commence and, irrespective of pump NPSH and vortex limits, slowly increase injection into the RPV with the following systems until at least [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] [is] open and RPV pressure is above the Minimum Alternate RPV Flooding Pressure:

- HPCS, defeating high RPV water level isolation interlocks if necessary.
- LPCS

[
- RHR service water crosstie
- Fire System
- Interconnections with other units
- ECCS keep-full systems
]

If less than [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] [is] open or RPV pressure cannot be increased to above the Minimum Alternate RPV Flooding Pressure, enter [procedure developed from Contingency #6] and [procedure developed from the RPV Control Guideline] at [Step RC/P-4] and execute these procedures concurrently.

C4-1.4 When at least [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] [is] open and RPV pressure is above the Minimum Alternate RPV Flooding Pressure, control injection to maintain at least [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] open and RPV pressure above the Minimum Alternate RPV Flooding Pressure but as low as practicable.

C4-1.5 When all control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] or it has been determined that the reactor will remain shutdown under all conditions without boron, continue in this procedure.

C4-2 If at least [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRVs can be opened or if a HPCS or motor driven feedwater pump is available for injection, close the MSIVs, main steam line drain valves, and IC, RCIC, and RHR steam condensing isolation valves.

C4-3 Flood the RPV as follows:

C4-3.1 Commence and, irrespective of pump NPSH and vortex limits, increase injection into the RPV with the following systems until at least [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRVs are open and RPV pressure is not decreasing and is [50 psig (Minimum RPV Flooding Pressure)] or more above suppression chamber pressure:

- HPCS, defeating high RPV water level isolation interlocks if necessary.
- Motor driven feedwater pumps, defeating high RPV water level isolation interlocks if necessary.
- LPCS
- LPCI with injection through the heat exchangers as soon as possible.
- Condensate pumps
- CRD
- RHR service water crosstie
- Fire System
- Interconnections with other units
- ECCS keep-full systems
- SLC (test tank)
- SLC (boron tank)

> If less than [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRV[s] are open or RPV pressure cannot be maintained at least [50 psig (Minimum RPV Flooding Pressure)] above suppression chamber pressure, enter [procedure developed from Contingency #6] and [procedure developed from the RPV Control Guideline] at [Step RC/P-4] and execute these procedures concurrently.

C4-3.2 When at least [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRV[s] are open and RPV pressure can be maintained at least [50 psig (Minimum RPV Flooding Pressure)] above suppression chamber pressure, control injection to maintain at least [4 (Minimum Number of SRVs Required for Emergency Depressurization)] SRVs open and RPV pressure at least [50 psig (Minimum RPV Flooding Pressure)] above suppression chamber pressure but as low as practicable.

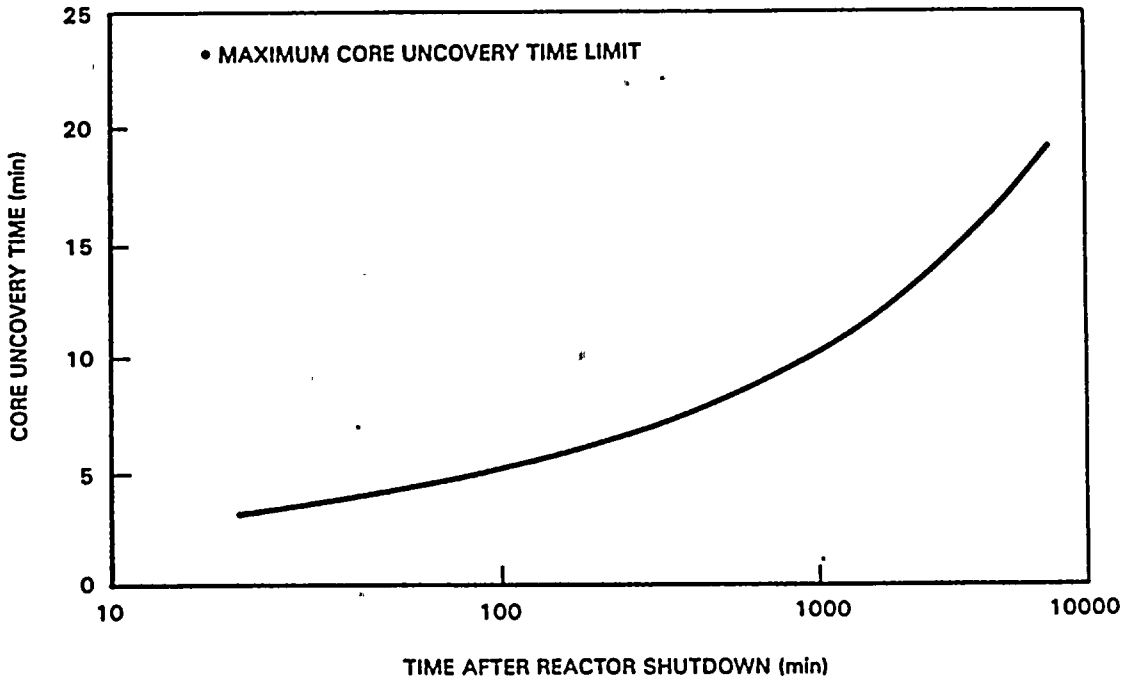
C4-4 When:

- RPV water level instrumentation is available, and
- Temperature[s] [near the cold reference leg instrument vertical runs] are below 212°F, and
- RPV pressure has remained at least [50 psig (Minimum RPV Flooding Pressure)] above suppression chamber pressure for at least [the Minimum Core Flooding Interval]

Number of open SRVs	Minimum Core Flooding Interval (min)
7 or more	21
6	29
5	43
4	72

Terminate all injection into the RPV and reduce RPV water level until RPV water level indication is restored.

If RPV water level indication is not restored within the Maximum Core Uncovery Time Limit after commencing termination of injection into the RPV, return to [Step C4-3.1].

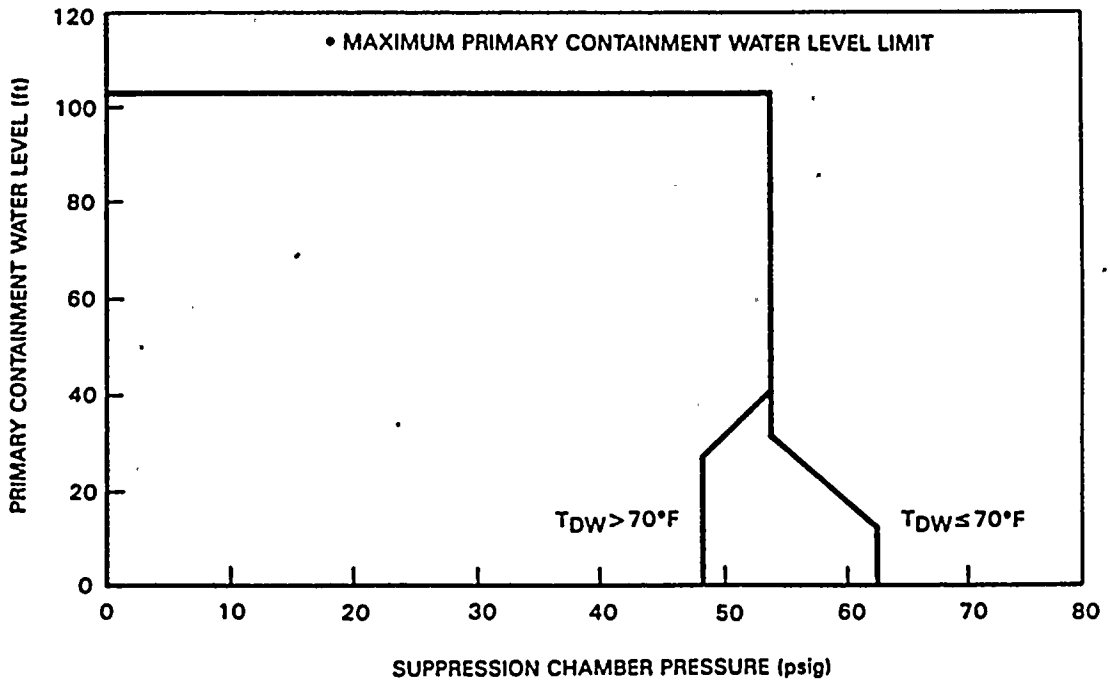


C4-5 Enter [procedure developed from the RPV Control Guideline] at [Steps RC/L and RC/P-4] and execute these steps concurrently.

CONTINGENCY #5
LEVEL/POWER CONTROL

If while executing the following steps:

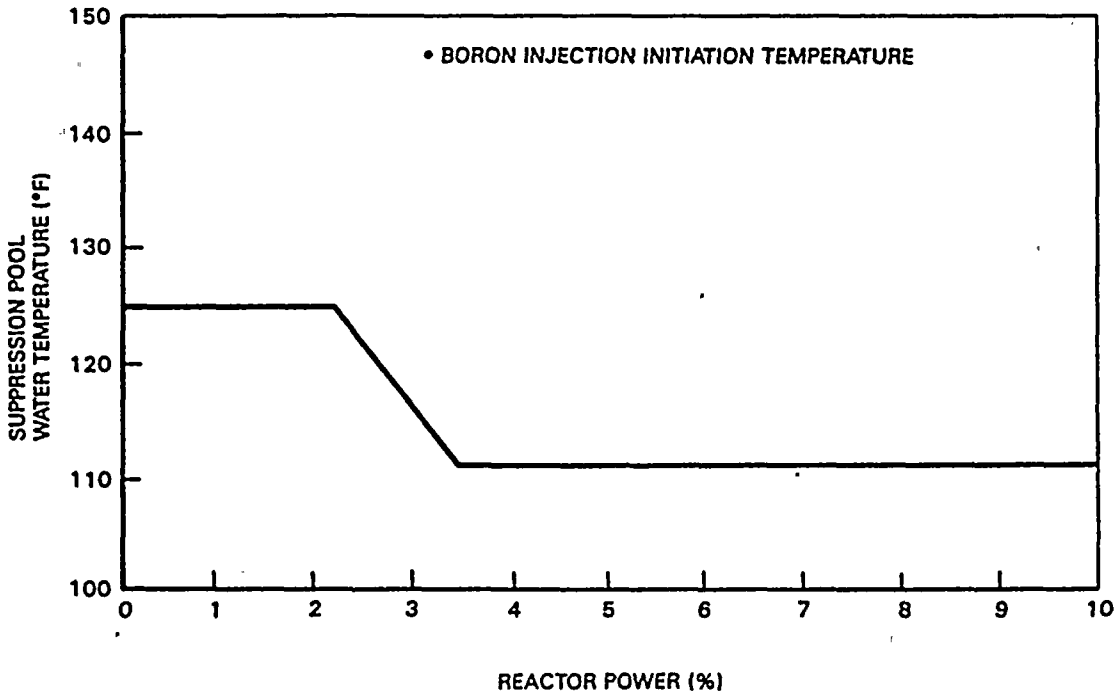
- RPV water level cannot be determined, enter [procedure developed from Contingency #4].
- All control rods are inserted to or beyond position [02 (Maximum Subcritical Banked Withdrawal Position)] or it has been determined that the reactor will remain shutdown under all conditions without boron, enter [procedure developed from the RPV Control Guideline] at [Step RC/L].
- Primary containment water level and suppression chamber pressure cannot be maintained below the Maximum Primary Containment Water Level Limit, then irrespective of whether adequate core cooling is assured terminate injection into the RPV from sources external to the primary containment until primary containment water level and suppression chamber pressure can be maintained below the Maximum Primary Containment Water Level Limit.



C5-1 Prevent automatic initiation of ADS.

C5-2 If:

- Reactor power is above [3% (APRM downscale trip)] or cannot be determined, and
- Suppression pool temperature is above [the Boron Injection Initiation Temperature], and



- Either an SRV is open or opens or drywell pressure is above [2.0 psig (high drywell pressure scram setpoint)],

Then:

- If any MSIV is open, bypass low RPV water level pneumatic system and MSIV isolation interlocks and restore the pneumatic supply [to the containment], and
- Lower RPV water level, irrespective of any consequent reactor power or RPV water level oscillations, by terminating and preventing all injection into the RPV except from boron injection systems and CRD until either:

  - Reactor power drops below [3% (APRM downscale trip)], or
  - RPV water level reaches [-164 in. (top of active fuel)], or
  - All SRVs remain closed and drywell pressure remains below [2.0 psig (high drywell pressure scram setpoint)].

> If while executing the following steps Emergency RPV Depressurization is required, continue in this procedure at [Step C5-3.1].

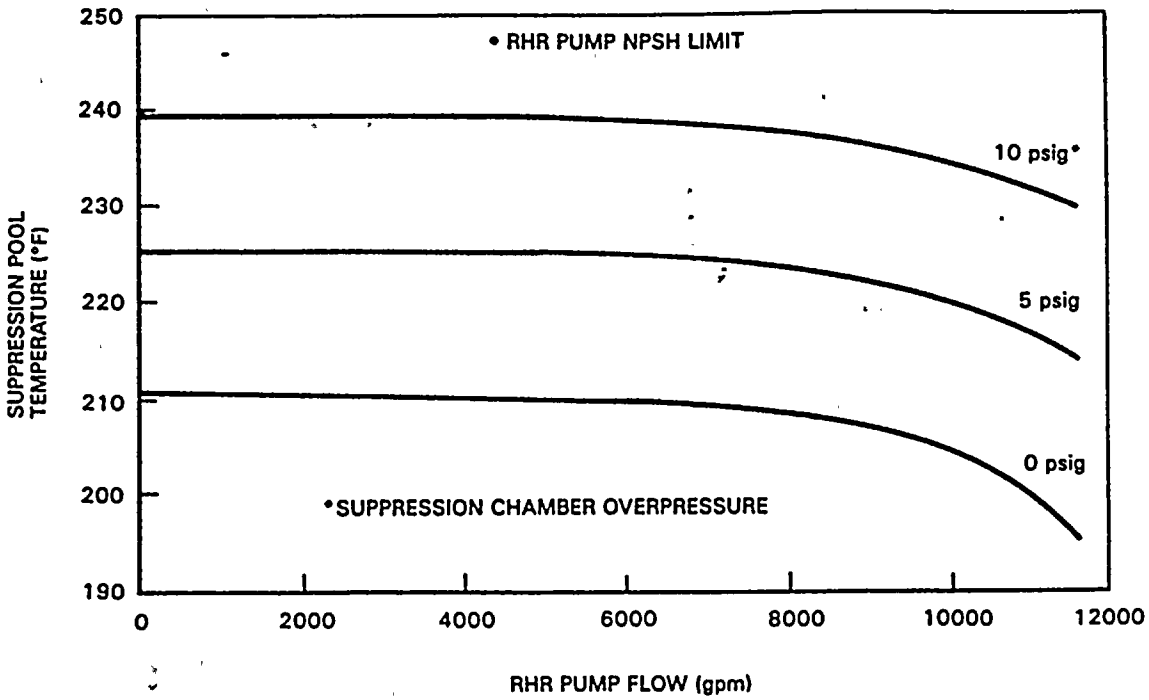
> If while executing the following step:
>
> - Reactor power is above [3% (APRM downscale trip)] or cannot be determined, and
> - RPV water level is above [-164 in. (top of active fuel)], and
> - Suppression pool temperature is above [the Boron Injection Initiation Temperature], and
> - Either an SRV is open or opens or drywell pressure is above [2.0 psig (high drywell pressure scram setpoint)],
>
> return to [Step C5-2].

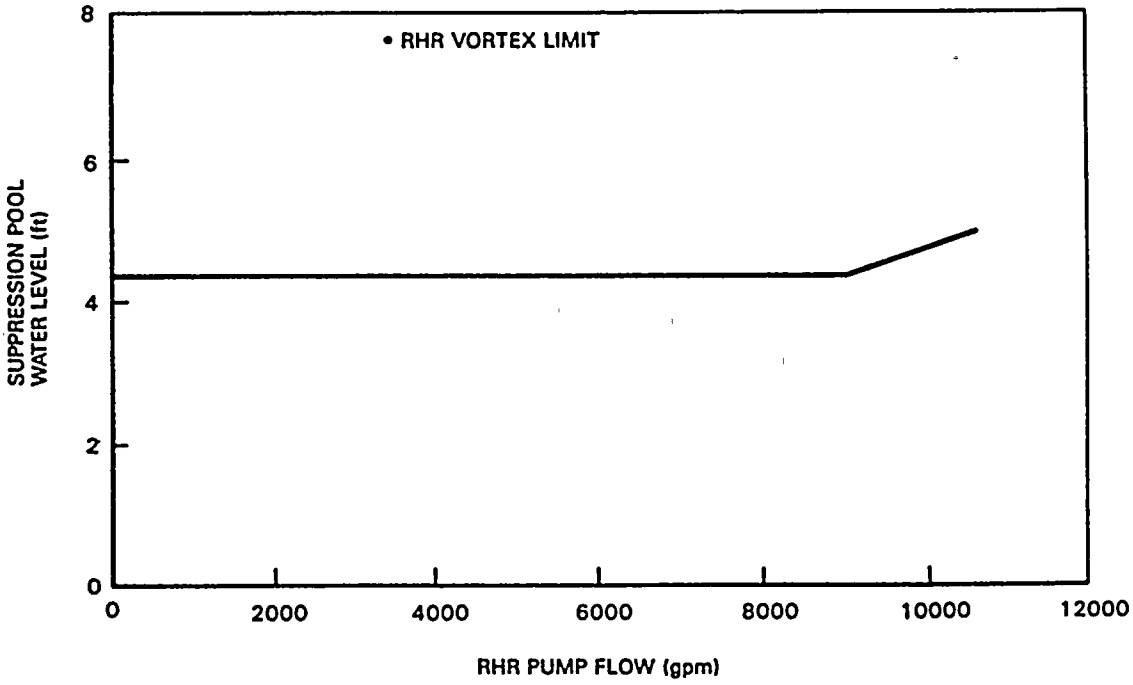
C5-3 Maintain RPV water level either: #7

- If RPV water level was deliberately lowered in [Step C5-2], between [-195 in. (Minimum Steam Cooling RPV Water Level)] and the level to which it was lowered, or
- If RPV water level was not deliberately lowered in [Step C5-2], between [-164 in. (top of active fuel)], and [+58 in. (high level trip setpoint)],

with the following systems:

- Condensate/feedwater
- CRD
- RCIC with suction from the condensate storage tank, defeating low RPV pressure isolation interlocks and high suppression pool water level suction transfer logic if necessary. #3 #4
- HPCI with suction from the condensate storage tank, defeating high suppression pool water level suction transfer logic if necessary. #3
- LPCI with injection through the heat exchangers as soon as possible; control and maintain pump flow less than the RHR Pump NPSH Limit and [the RHR Vortex Limit].


• RHR PUMP NPSH LIMIT
10 psig*
5 psig
0 psig
*SUPPRESSION CHAMBER OVERPRESSURE
SUPPRESSION POOL TEMPERATURE (°F)
250
240
230
220
210
200
190
0
2000
4000
6000
8000
10000
12000
RHR PUMP FLOW (gpm)


• RHR VORTEX LIMIT
SUPPRESSION POOL WATER LEVEL (ft)
8
6
4
2
0
0
2000
4000
6000
8000
10000
12000
RHR PUMP FLOW (gpm)

If RPV water level was not deliberately lowered in [Step C5-2] and RPV water level cannot be maintained above [-164 in. (top of active fuel)], maintain RPV water level between [-195 in. (Minimum Steam Cooling RPV Water Level)] and [+58 in. (high level trip setpoint)].

If RPV water level cannot be maintained above [-195 in. (Minimum Steam Cooling RPV Water Level)], EMERGENCY RPV DEPRESSURIZATION IS REQUIRED:

C5-3.1 Terminate and prevent all injection into the RPV except from boron injection systems, CRD, and RCIC until RPV pressure is below the Minimum Alternate RPV Flooding Pressure.

Number of open SRVs	Minimum Alternate RPV Flooding Pressure (psig)
[7 or more	94]
6	112
5	137
4	175
3	238
2	364
1	743]

If less than [1 (minimum number of SRVs for which the Minimum Alternate RPV Flooding Pressure is below the lowest SRV lifting pressure)] SRV[s] can be opened, continue in this procedure.

C5-3.2 Commence and, irrespective of pump NPSH and vortex limits, slowly increase injection into the RPV with the following systems to restore and maintain RPV water level above [-164 in. (top of active fuel)]: #7

- Condensate/feedwater

- CRD
- RCIC with suction from the condensate storage tank, defeating low RPV pressure isolation interlocks and high suppression pool water level suction transfer logic if necessary.
- [HPCI with suction from the condensate storage tank, defeating high suppression pool water level suction transfer logic if necessary.
- LPCI with injection through the heat exchangers as soon as possible.]

If RPV water level cannot be restored and maintained above [-164 in. (top of active fuel)], restore and maintain RPV water level above [-195 in. (Minimum Steam Cooling RPV Water Level)].

If RPV water level cannot be restored and maintained above [-195 in. (Minimum Steam Cooling RPV Water Level)], commence and, irrespective of pump NPSH and vortex limits, slowly increase injection into the RPV with the following systems to restore and maintain RPV water level above [-195 in. (Minimum Steam Cooling RPV Water Level)]:

- HPCS
- LPCS
- [RHR service water crosstie
- Fire System
- Interconnections with other units
- ECCS keep-full systems]

> If RPV water level cannot be restored and maintained above [-195 in. (Minimum Steam Cooling RPV Water Level)], enter [procedure developed from Contingency #6].

C5-3.3 When RPV water level can be maintained above [-195 in. (Minimum Steam Cooling RPV Water Level)], return to [Step C5-3].

> If while executing the following step reactor power commences and continues to increase, return to [Step C5-2].

C5-4 When [364 pounds (Hot Shutdown Boron Weight)] of boron have been injected, restore and maintain RPV water level between [+12 in. (low level scram setpoint)] and [+58 in. (high level trip setpoint)].

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)], EMERGENCY RPV DEPRESSURIZATION IS REQUIRED; return to [Step C5-3.1].

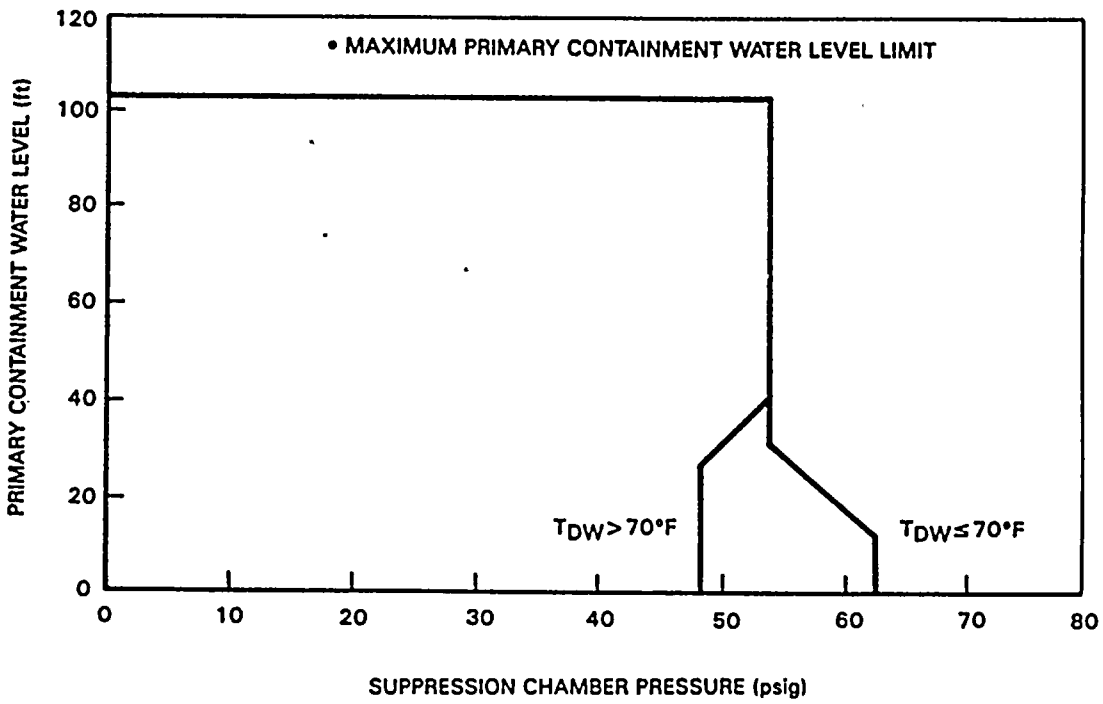
C5-5 When [procedure for cooldown to cold shutdown conditions] is entered from [procedure developed from the RPV Control Guideline] at [Step RC/P-5], proceed to cold shutdown in accordance with [procedure for cooldown to cold shutdown conditions].

CONTINGENCY #6

PRIMARY CONTAINMENT FLOODING

If while executing the following steps:

- Primary containment water level and suppression chamber pressure cannot be maintained below the Maximum Primary Containment Water Level Limit, then irrespective of whether adequate core cooling is assured terminate injection into the RPV from sources external to the primary containment until primary containment water level and suppression chamber pressure can be maintained below the Maximum Primary Containment Water Level Limit.



- RPV water level can be restored and maintained above [-164 in. (top of active fuel)] enter [procedure developed from the RPV Control Guideline] at [Step RC/L].

C6-1 Initiate SPMS.

C6-2 Operate the following systems:

- HPCS with suction from the condensate storage tank when available.
- LPCS; operate one LPCS with suction from the condensate storage tank [or fire system] only when the other LPCS is operating with suction from the suppression pool.
- Condensate/feedwater
- CRD
- RCIC with suction from the condensate storage tank only, defeating low RPV pressure isolation interlocks and high suppression pool water level suction transfer logic if necessary.
- LPCI with suction from sources external to the primary containment [only.] [if possible.]
- [RHR service water crosstie
- Fire system
- Interconnections with other units
- ECCS keep-full systems
- Other primary containment fill systems]

Execute [Steps C6-3 and C6-4] concurrently.

C6-3 When primary containment water level reaches [26 ft 3 in. (elevation of the bottom of the lowest recirculation piping)], then irrespective of the offsite radioactivity release rate vent the RPV, defeating isolation interlocks if necessary, until RPV water level reaches [-164 in. (top of active fuel)] with one or more of the following:

- Flood vent valves
- MSIVs
- Main steam line drains

- HPCI steam line
- RCIC steam line
- IC tube side vents
- RHR

C6-4 when primary containment water level reaches [83 ft 5 in. (elevation of top of active fuel)], maintain primary containment water level between [83 ft 5 in. (elevation of top of active fuel)] and the Maximum Primary Containment Water Level Limit with the following systems taking suction from sources external to the primary containment only when required:

- HPCS
- LPCS
- Feedwater/condensate
- CRD
- LPCI
- Head spray
- [RHR service water crosstie
- Fire system
- Interconnections with other units
- ECCS keep-full systems
- Other primary containment fill systems]

NEDO-31331
SUPPLEMENT A
CLASS I
MARCH 1987

APPENDIX A

TO
BWR OWNERS' GROUP

EMERGENCY PROCEDURE GUIDELINES

REVISION 4

Prepared for the

BWR OWNERS' GROUP

By

Operations Engineering, Inc.
39650 Liberty Street, Suite 400
Fremont, CA 94538