

DRAFT

(Revision 7)

EMERGENCY PROCEDURE GUIDELINES

BWR 1 THROUGH 5

March 26, 1980

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INTRODUCTION

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

- o Level Control A Guideline
- o Level Control B Guideline
- o Shutdown Guideline
- o Containment Control Guideline

The Level Control guidelines restore and stabilize RPV water level. Level Control A Guideline is entered following a reactor scram with low RPV water level, high drywell pressure, or reactor or containment isolation. Level Control B Guideline is entered before a scram with a reactor or containment isolation or an SORV.

The Shutdown Guideline maintains RPV water level while depressurizing the RPV to cold shutdown conditions. This guideline is entered from the Level Control A Guideline or from certain of the contingencies 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, or suppression pool water level is above 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., ) which is keyed to the guideline steps.

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

Where possible, systems which may be used to accomplish a particular step have been prioritized with a "priority number" (). 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.

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. In those cases where the basis for the "Caution" 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 all GE-BWR's 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 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.

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
LOF	-	Loss of Feedwater
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
RPV	-	Reactor Pressure Vessel
RWCU	-	Reactor Water Cleanup
SBA	-	Small Break Accident
SBGT	-	Standby Gas Treatment
SORV	-	Stuck Open Relief Valve
SRV	-	Safety Relief Valve

OPERATOR PRECAUTIONS

General

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

CAUTION #1

Continuously monitor plant conditions for developments which could require entry into a different procedure.

CAUTION #2

Continuously 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 process indications.

CAUTION #4

Do not place ECCS in MANUAL mode unless (1) misoperation in AUTOMATIC mode is confirmed, or (2) adequate core cooling is assured by at least two independent process indications. 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 #5

Do not secure an ECCS unless there are multiple confirming process parameter indications (such as level indications from several instruments) that adequate core and primary containment cooling is assured.

CAUTION #6

Do not use the RHR steam condensing mode unless (1) the suppression pool temperature can be maintained below [120°F (limit for depressurization)] and (2) more than one RHR loop is available.

CAUTION #7

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

CAUTION #8

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].

CAUTION #9

Under development.

CAUTION #10

[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 #11

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, manually transfer RCIC suction from the condensate storage tank to the suppression pool and confirm automatic transfer of HPCI and HPCS suction to the suppression pool.

CAUTION #12

If suppression pool temperature exceeds [95°F (normal operating limit)], drywell temperature exceeds [135°F (normal operating limit)], or suppression pool water level exceeds [12 ft. 6 in. (high level alarm)], 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 #13

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 #14

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

CAUTION #15

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

CAUTION #16

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

CAUTION #17

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 #18

Do not divert RHR pumps from the LPCI mode unless adequate core cooling is assured.

CAUTION #19

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

CAUTION #20

Observe [NPSH requirements] for LPCS and LPCI pumps.

CAUTION #21

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

CAUTION #22

Do not operate recirculation pumps or [drywell cooling fans] when spraying the drywell.

CAUTION #23

Under development.

LEVEL CONTROL A GUIDELINE

LCA-1 PURPOSE

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

The entry condition for this guideline is reactor scram and:

- low RPV water level [+12 in. (low level scram setpoint)], or
- high drywell pressure [2.0 psig (high drywell pressure scram setpoint)], or
- reactor or containment isolation.

LCA-2 OPERATOR ACTIONS

LCA-2.1 Confirm initiation of any of the following automatic actions, preferably by at least two independent indications:

- Reactor scram
- Reactor or containment isolation
- ECCS, RCIC, or IC initiation
- (Emergency diesel generator initiation)

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

LCA-2.2 Enter the (scram procedure) and execute it concurrently with this procedure.

LCA-2.3 (Confirm or place the reactor mode switch in REFUEL).

LCA-2.4 Restore and maintain RPV water level between [+12 in. (low level scram setpoint)] and [+58 in. (high level trip setpoint)] with:

- Ⓟ1 Condensate/feedwater system (1110 - 0 psig (RPV pressure range for system operation)).
- Ⓟ2 CRD system (1110 - 0 psig (RPV pressure range for system operation))

- Ⓕ RCIC system (1110 - 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))

Potential entry to contingency.

- Ⓖ LPCS system (425 - 0 psig (RPV pressure range for system operation))
- Ⓙ LPCI system (250 - 0 psig (RPV pressure range for system operation))

Potential entry to contingency.

LCA-2.5 If SRVs are cycling, initiate the IC or manually open one SRV and reduce RPV pressure to at least (150 psig) below the minimum SRV setpoint.

LCA-2.6 Close any SORV.

LCA-2.7 When the RPV water level has stabilized, enter (procedure developed from the Shutdown Guideline).

LEVEL CONTROL B GUIDELINE

LCB-1 PURPOSE

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

The entry condition for this guideline is reactor not scrammed with:

- SORV, or
- reactor or containment isolation.

LCB-2 OPERATOR ACTIONS

LCB-2.1 Close any SORV.

LCB-2.1.1 If an SORV cannot be closed (within 2 minutes), scram the reactor and enter (procedure developed from Level Control A Guideline).

LCB-2.2 If isolation of a breach is required but cannot be accomplished:

LCB-2.2.1 Scram the reactor.

LCB-2.2.2 If required, initiate SBT and isolate and evacuate the reactor building.

LCB-2.2.3 Enter (procedure developed from Level Control A Guideline).

LCB-2.3 Enter (normal operating procedure).

SHUTDOWN GUIDELINE

SD-1 PURPOSE

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

This guideline is entered from the Level Control A Guideline or from certain of the contingencies after the RPV water level has been stabilized.

SD-2 OPERATOR ACTIONS

SD-2.1 Maintain RPV water level between $[+12 \text{ in. (low level scram setpoint)}]$ and $[+58 \text{ in. (high level trip setpoint)}]$ with:

#11, #13

Ⓟ P1 Condensate/feedwater system $[1110 - 0 \text{ psig (RPV pressure range for system operation)}]$

Ⓟ P2 CRD system $[1110 - 0 \text{ psig (RPV pressure range for system operation)}]$

Ⓟ P3 RCIC system $[1110 - 50 \text{ psig (RPV pressure range for system operation)}]$

#12, #14

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

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

Potential entry to contingency.

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

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

Potential entry to contingency.

SD-2.2 If SRVs are cycling, initiate the IC or manually open one SRV and reduce RPV pressure to at least [150 psig] below the minimum SRV setpoint.

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

#15, #16

Main Condenser
Available

Main turbine bypass valves.

Pressure reduction may be

augmented by:

- o IC
- o HPCI

#12, #14

- o RCIC
- o Other steam driven equipment
- o RWCU (recirculation mode)
- o Main steam line drains
- o RWCU (blowdown mode). Refer to [sampling procedures] prior to initiating blowdown.

Main Condenser
Not Available

(P1) IC

(P2) HPCI

#12, #14

(P3) RCIC

(P4) RWCU (recirculation mode)

(P5) SRVs

#17

Pressure reduction may be augmented by RWCU blowdown to the main condenser or to radwaste. Refer to [sampling procedures] prior to initiating blowdown.

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

SD-2.4.1 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.

Potential entry to contingency.

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

CONTAINMENT CONTROL GUIDELINE

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:

- o Suppression pool temperature exceeds [95°F (normal operating limit)]
- o Drywell temperature exceeds [135°F (normal operating limit)]
- o Suppression pool water level exceeds [12 ft. 6 in. (high level alarm)].

CC-2 OPERATOR ACTIONS

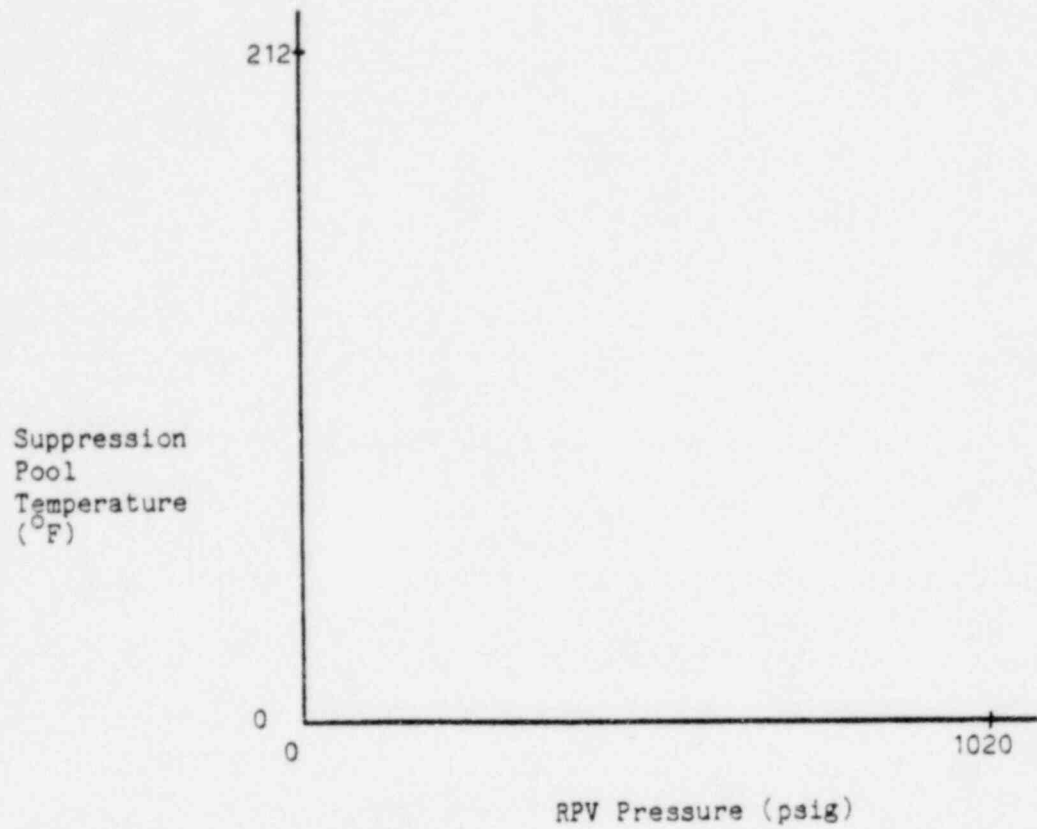
CC-2.1 Monitor and control suppression pool temperature.

CC-2.1.1 Operate available suppression pool cooling when pool temperature exceeds [95°F (normal operating limit)].

#18

CC-2.1.2 If suppression pool temperature reaches [110°F (limit for scram)], scram the reactor.

CC-2.1.3 If suppression pool temperature reaches the heat capacity limit below, depressurize the RPV to maintain RPV pressure below the limit.



#16, #19, #20

Potential entry to contingency.

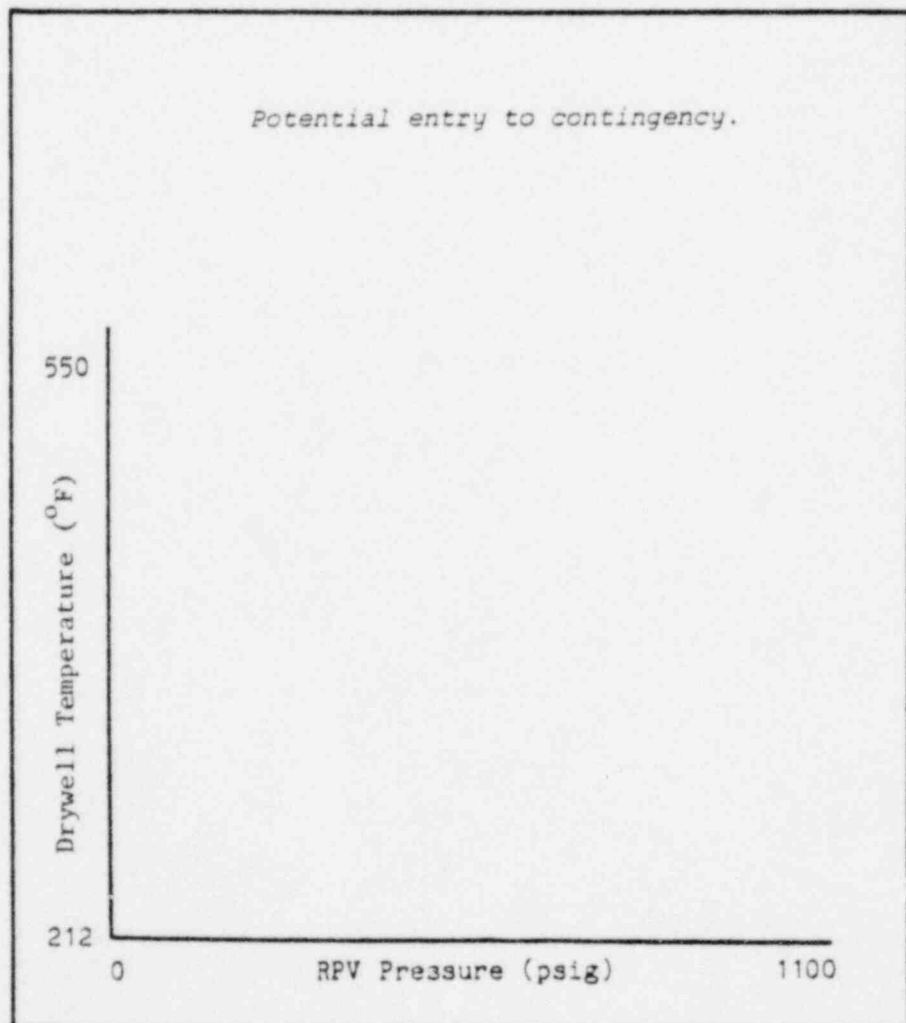
CC-2.2 Monitor and control drywell temperature.

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

#9

Potential entry to contingency.

Potential entry to contingency.



CC-2.3 Monitor and control primary containment pressure with:

- ① SBT when drywell pressure is below [2.0 psig (drywell pressure which initiates ECCS)] and drywell temperature is below 212°F. Refer to [sampling procedures] prior to venting the drywell.

#21

- ② Suppression pool sprays. Initiate suppression pool sprays before suppression pool pressure reaches [28 psig (50% of design pressure)].

#18

- ③ Drywell sprays. Initiate drywell sprays before suppression pool pressure reaches [35 psig (peak safety analysis long term pressure)].

#22, [#23]

Potential entry to contingency.

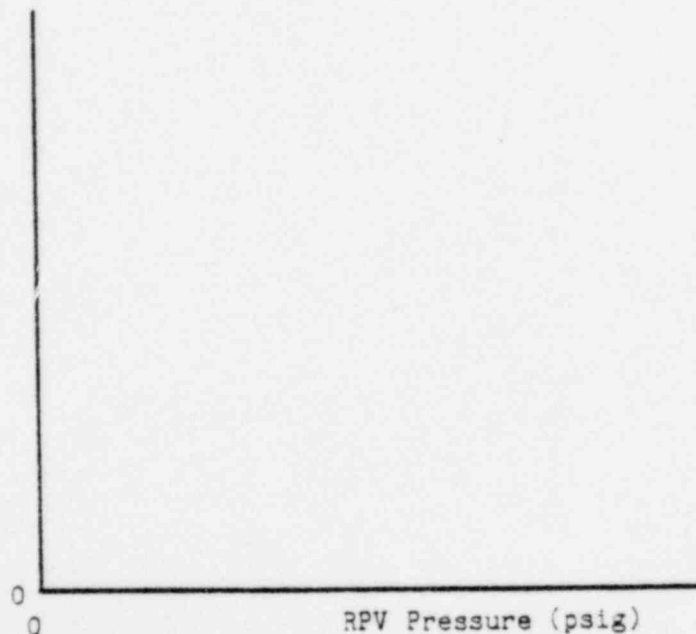
CC-2.4 Monitor and control suppression pool water level.

CC-2.4.1 Maintain suppression pool water level between [12 ft. 6 in. (high level alarm)] and [12 ft. 2 in. (low level alarm)] by discharging water to [radwaste or main condenser]. Refer to [sampling procedure] prior to discharging water.

CC-2.4.2 When adequate core cooling is assured, terminate injection into the RPV from sources external to the primary containment.

CC-2.4.3 If suppression pool water level reaches the suppression pool swell limit below, depressurize RPV to maintain RPV pressure below the limit.

Suppression
Pool Water
Level (ft.)



CC-2.4.4 If suppression pool water level reaches [xx ft. x in. (x in. below bottom of suppression pool to drywell vacuum breakers)], initiate drywell sprays and operate continuously while suppression pool water level is above [xx ft. x in. (x in. below bottom of suppression pool to drywell vacuum breakers)].

[#23]

CONTINGENCIES

Under development.