RPV CONTROL

ENTRY CONDITIONS

RPV water level	RPV pressure	Drywell pressure	Reactor power
below 159.3 in.	above 1037 psig	above 1.68 psig	above 4% or unknown AND a scram is required

Activate the emergency plan, if required, in accordance with EAP-1

Has a reactor scram been initiated ? — No → Initiate a reactor scram — Yes

Section RL

(A) Monitor and control **RPV WATER LEVEL**

CAUTION: An RPV water level instrument may be used to determine RPV water level only when:
- The hottest drywell temperature is below the RPV Saturation Temperature (Figure RPV-1), AND
- RB temperatures near instrument legs are below the RPV Saturation Temperature (Figure RPV-1, EOP-6, Att 28), AND
- The instrument reads above the Minimum Indicated Level

MINIMUM INDICATED LEVEL	
Instrument	Level
Shutdown Range	200 in.
Upset Range	190 in.
Narrow Range	150 in.
Wide Range	25 in.
Fuel Zone	-155 in.

Initiate any of the following which should have initiated but did not (EOP-6, Att 1):
- Isolations
- ECCS
- Diesel generators

While executing the following steps:

IF	THEN
All control rods are not inserted to at least position 02 AND The reactor will not remain shutdown without boron	Exit Section RL of this procedure and enter C5, Level/Power Control
RPV water level cannot be determined	Exit Section RL of this procedure and enter C4, RPV Flooding
Primary Containment water level and suppression chamber pressure cannot be maintained below the Maximum Primary Containment Water Level Limit (Figure RPV-10).	Irrespective of whether adequate core cooling is assured, terminate injection into the Primary Containment from sources external to the Primary Containment until primary containment water level and suppression chamber pressure can be maintained below the curve (Figure RPV-10)

Restore and maintain RPV level between 159.3 in. and 202.3 in. using one or more of the systems listed below:
- Condensate/Feedwater
- CRD (OP-30, Section H.7)

CAUTIONS:
- Operating RCIC below 1500 rpm may result in equipment damage
- Elevated suppression chamber pressure may trip the RCIC turbine

- RCIC with suction from the condensate storage tank, if available (EOP-6, Att 4).
  - Defeat low RPV pressure isolation interlocks, if necessary (EOP-6, Att 2)

CAUTION: HPCS pump damage may occur if NPSH limits are exceeded when taking suction from the suppression pool (Figure RPV-2)

- HPCS
  - Control and maintain pump flow less than the HPCS Vortex Limit (Figure RPV-5) (EOP-6, Att 3)
- LPCS
  - Control and maintain pump flow less than the LPCS Pump NPSH Limit (Figure RPV-3) (EOP-6, Att 3)
  - Control and maintain pump flow less than the LPCS Vortex Limit (Figure RPV-6) (EOP-6, Att 3)
- LPCI
  - Inject through the heat exchangers as soon as possible.
  - Control and maintain pump flow less than the RHR Pumps NPSH Limit (Figure RPV-4) (EOP-6, Att 3)
  - Control and maintain pump flow less than the RHR Vortex Limit (Figure RPV-7) (EOP-6, Att 3)

IF	THEN
RPV water level cannot be restored and maintained above 159.3 in.	Maintain RPV water level above -14 in. Augment RPV water level control with one or more of the systems listed below: • SLC (test tank) (EOP-6, Att 9) • ECCS Keep-Full systems (EOP-6, Att 7) • Condensate Transfer (EOP-6, Att 8) • RHR Service Water crosstie (EOP-6, Att 5) • Fire system (EOP-6, Att 6) • SLC (boron tank) (OP-36A, Section H.1)
The ADS timer has initiated	Place the ADS logic inhibit switches in ON
RPV water level cannot be maintained above -14 in.	Exit Section RL of this procedure and enter C1, Alternate Level Control

WAIT until OP-101C is entered from EOP-RPV Section RP at (D)

Exit Section RL of this procedure and proceed to cold shutdown in accordance with OP-101C

C1 C4 C5 C6 (A)

C2 C4 (C)

Section RP

Monitor and control **REACTOR PRESSURE**

While executing the following steps:

IF	AND	THEN
A high drywell pressure ECCS initiation signal exists (1.68 psig)	.....	Prevent injection from LPCS and LPCI pumps not needed for adequate core cooling prior to depressurizing below their maximum injection pressures
Emergency RPV depressurization is anticipated	All control rods are inserted to at least position 02 OR The reactor will remain shutdown without boron	Rapidly depressurize the RPV using the main turbine bypass valves irrespective of the resulting RPV cooldown rate
✻ Emergency RPV depressurization is required	Less than 7 SRVs are open	Exit Section RP of this procedure and enter C2, Emergency RPV Depressurization
RPV water level cannot be determined	Less than 7 SRVs are open	Exit Section RP of this procedure and enter C2, Emergency RPV Depressurization
	7 or more SRVs are open	Exit section RP of this procedure and enter C4, RPV Flooding

Is any SRV cycling ? — Yes → Manually open SRVs until RPV pressure drops to 960 psig — No

While executing the following steps:

IF	THEN
Suppression pool temperature cannot be maintained below the Heat Capacity Temperature Limit (Figure RPV-8)	Maintain RPV pressure below the curve (Figure RPV-8) irrespective of the resulting RPV cooldown rate
Suppression pool water level cannot be maintained below the SRV Tail Pipe Level Limit (Figure RPV-9)	Maintain RPV pressure below the curve (Figure RPV-9) irrespective of the resulting RPV cooldown rate
▲ Steam cooling is required	Exit section RP of this procedure and enter C3, Steam Cooling
❖ 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 the MSIVs (or prevent MSIV closure), and reestablish the main condenser as a heat sink (EOP-6, Att 10) ☛ Bypass IAS and defeat low RPV water level MSIV isolation interlocks, if necessary (EOP-6, Att 10)

(B) Stabilize RPV pressure below 1037 psig using the main turbine bypass valves.
- ☛ Augment RPV pressure control with the systems listed below, if necessary.

- SRVs.....**ONLY** IF suppression pool water level is above El. 192 ft.
  - ☛ Bypass LOCA isolation interlocks and reopen IAS supply valves, if necessary (2IAS*IOV164, 165, 166, 184)
  - ☛ If the continuous SRV pneumatic supply is or becomes unavailable, place the control switch for each SRV in the AUTO position
  - ☛ Open SRVs in the sequence listed in Figure RPV-11, if possible
- RHR, in the steam condensing mode (OP-31)

CAUTIONS:
- Operating RCIC below 1500 rpm may result in equipment damage
- Elevated suppression chamber pressure may trip the RCIC turbine

- RCIC with suction from the condensate storage tank, if available (EOP-6, Att 4)
- RWCU (recirculation mode).
  - ☛ Bypass filter/demineralizers (OP-37, Section H.5.0)
  - ☛ Defeat SLC and other isolation interlocks, if necessary (EOP-6, Att 11)
- RWCU (blowdown mode).....**ONLY** IF no boron has been injected into the RPV (OP-37, Sections H.5.0 and H.3.0)
  - ☛ Have the chemistry department sample for activity prior to initiating blowdown
- Main steam line drains (EOP-6, Att 10)

FIGURE RPV-11 SRV OPENING SEQUENCE

128, 133, 123, 124, 136, 131, 122, 120, 132, 125, 121, 135, 126, 130, 127, 129, 137, 134

WAIT until
All control rods are inserted to at least position 02
OR
The reactor will remain shutdown without boron
OR
If boron is being injected, SLC tank level drops to 900 gallons (769 pounds injected)
OR
The reactor is shutdown and no boron has been injected

While executing the following steps:

IF	THEN
The reactor is not shutdown	Return to (B)

Depressurize the RPV, maintaining the cooldown rate less than 100°F/hr

IF	AND	THEN
One or more SRVs are being used to depressurize the RPV	The continuous SRV pneumatic supply is or becomes unavailable	Depressurize with sustained SRV opening

(C)

WAIT until
The Shutdown Cooling RPV pressure interlocks clear (RPV pressure below 128 psig) **AND** either:
All control rods are inserted to at least position 02
OR
The reactor will remain shutdown without boron

Initiate the Shutdown Cooling mode of RHR (OP-31)
- ☛ Use only RHR pumps not required to maintain RPV water level above 159.3 in. by operation in the LPCI mode

IF	THEN
Shutdown cooling cannot be established AND further cooldown is required	Continue to cool down using one or more of the systems listed at (B) above.

(D)

Exit Section RP of this procedure and proceed to cold shutdown in accordance with OP-101C

Section RQ

Monitor and control **REACTOR POWER**

While executing the following steps:

IF	THEN
All control rods are inserted to at least position 02 OR The reactor will remain shutdown without boron	1. Terminate boron injection 2. Exit Section RQ of this procedure and enter OP-101C, Section H.1

Verify the reactor mode switch is in SHUTDOWN

Has ARI initiated ? — No → Initiate RRCS (EOP-6, Att 13) — Yes

Are the MSIVs open ? — No — Yes

Is the turbine generator on-line ? — No — Yes

Runback recirculation flow to minimum

Can reactor power be determined — No — Yes

Is reactor power above 4% ? — Yes — No

Trip the recirculation pumps

Insert control rods using one or more of the following methods (EOP-6, Att 14):
- Reset ARI
  - ☛ Defeat logic trips, if necessary
- De-energize the scram solenoids
  - ☛ Power source select switch
  - ☛ Individual scram test switches
- ☛ Vent the scram air header
- Manually initiate additional scrams
  - ☛ Reset the scram, defeat RPS logic, if necessary
  - ☛ Drain the scram discharge volume
  - ☛ Initiate a manual scram
- Drive control rods
  - ☛ Defeat RSCS and RWM interlocks if necessary
- Vent control rod drive overpiston volumes

BEFORE Suppression pool temperature reaches 110°F (Inject boron)

IF	THEN
The reactor cannot be shutdown	**BORON INJECTION IS REQUIRED** • Inject boron into the RPV with SLC (OP-36A, Section H.1) • Place the ADS logic inhibit switches in ON
Boron injection is required AND Boron cannot be injected with SLC	Inject boron with one or more of the following: • Hydro pump (EOP-6, Att 15) • RWCU (EOP-6, Att 19)

◆Section RP

While executing the following steps:

IF	THEN
SLC tank water level drops to 0 gallons	Verify automatic trip of SLC pumps

IF	THEN
RWCU is being used for RPV pressure control or boron injection	Bypass filter/demineralizers (OP-37, Section F.2.0)
RWCU is not being used for RPV pressure control or boron injection	Bypass filter/demineralizers or isolate the system

WAIT until
All control rods are inserted to at least position 02
OR
The reactor will remain shutdown without boron

Terminate boron injection

Exit Section RQ of this procedure and enter OP-101C, Section H.1

FIGURE RPV-1
RPV SATURATION TEMPERATURE

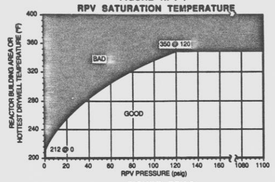


FIGURE RPV-2
HPCS PUMP NPSH LIMIT

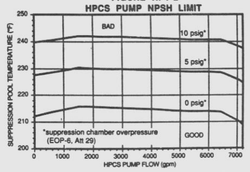


FIGURE RPV-3
LPCS PUMP NPSH LIMIT

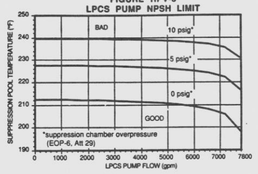


FIGURE RPV-4
RHR PUMPS NPSH LIMIT

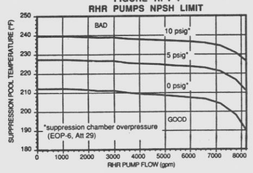


FIGURE RPV-5
HPCS PUMP VORTEX LIMIT

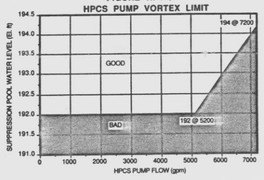


FIGURE RPV-6
LPCS PUMP VORTEX LIMIT

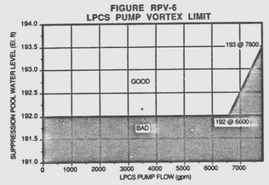


FIGURE RPV-7
RHR PUMP VORTEX LIMIT

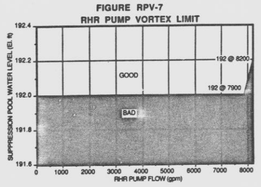


FIGURE RPV-8
HEAT CAPACITY TEMPERATURE LIMIT

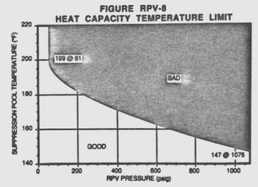


FIGURE RPV-9
SRV TAIL PIPE LEVEL LIMIT

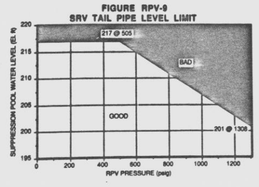
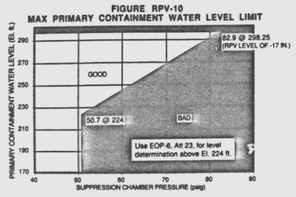


FIGURE RPV-10
MAX PRIMARY CONTAINMENT WATER LEVEL LIMIT



SI APERTURE CARD

FOR INFORMATION ONLY

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT NUCLEAR STATION UNIT 2
EMERGENCY OPERATING PROCEDURE

Plant Manager Date: 11/6/91

This procedure not to be used after: December 1992 Subject to periodic review.

TITLE **RPV CONTROL**

Procedure Number **N2-EOP-RPV** Rev **4**

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