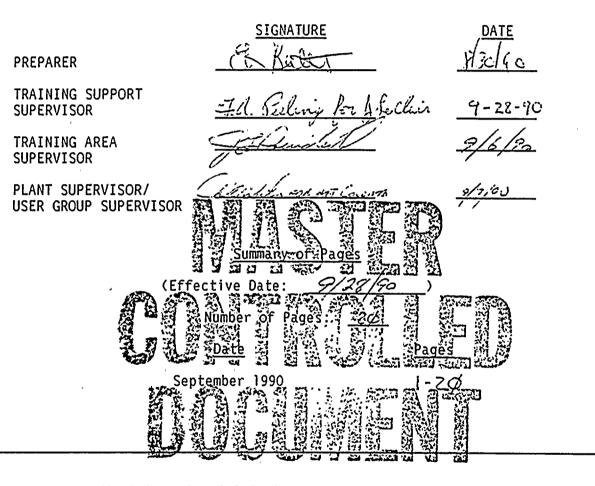
NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

<u>02-REQ-006-344-2-16</u> <u>Revision</u> 4

TITLE: <u>EMERGENCY OPERATING PROCEDURE, RPV FLOODING (C-4)</u>



TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

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- VERIFICATION:
- DATA ENTRY:

RECORDS:

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I. TRAINING DESCRIPTION

- A. Title of Lesson: Emergency Operating Procedures, RPV Flooding (C-4)
- B. Lesson Description: This lesson discusses the actions taken to flood the RPV whether or not the core is completely shutdown.
- C. Estimate of the Duration of the Lesson: 2 hours
- D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written Examination with 80% minimum passing grade.
- E. Method and Setting of Instruction:
 - 1. Classroom Lecture
 - 2. Assign the Student Learning Objectives as review problems with the students obtaining answers from the text, writing them down and handing them in for grading.

F. Prerequisites:

- 1. Instructor:
 - a. Qualified in instructional skills per NTP-16 and/or 16.1.
- 2. Trainee:
 - a. In accordance with NTP-10 and NTP-11 or
 - Be recommended for this training by the Operations Superintendent or his designee or by the Training Superintendent.

G. References:

BWROG Emergency Procedure Guidelines, Rev. 4, Plant Procedure N2-EOP-C3

II. <u>REQUIREMENTS</u>

- A. AP-9, Administration of Training
- B. NTP-10, Training of Licensed Operator Candidates
- C. NTP-11, Licensed Operator Regualification Training

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III. TRAINING MATERIALS

- A. Instructor Materials:
 - 1. Copy of this Lesson Plan
 - 2. Whiteboard and Felt Tip Markers
 - 3. EOP Flowchart for C4
- B. Trainee Materials:
 - 1. EOP Flowchart for C4

IV. EXAM AND MASTER ANSWER KEYS

Will be generated and administered as necessary. They will be on permanent file in the Records Room.

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- V. LEARNING OBJECTIVES
 - A. Terminal Objectives:
 - TO-1.0 Given conditions requiring the use of the Emergency Operating Procedures, use the procedure to place the plant in a stable condition as prescribed in the procedure.
 - TO-2.0 Given an emergency condition, determine when RPV Flooding is required.
 - TO-3.0 Given an emergency condition requiring RPV Flooding determine the actions required by EOP-C4, "RPV Flooding".
 - B. Enabling Objectives:
 - EO-1.0 State the purpose of the RPV Flooding Procedure.
 - EO-2.0 State the entry conditions for the RPV Flooding Procedure.
 - EO-3.0 Given the procedural step, discuss the technical basis for that step.

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. LESSON TENT		
SSON_CONTENT	DELIVERY NOTES	NOTES
INTRODUCTION		¥
A. Student Learning Objectives		
B. Purpose		
To inject water into the RPV and	d increase RPV	EO-1.0
, water level until either the mai		
flood, or if Reactor is not shut		
adequately cooled.		
. DETAILED DESCRIPTION		
A. Entry Conditions		
This procedure is entered only a	as directed from	EO-2.0
other emergency procedures.		
1. RPV Control - Level/Pressur	re	
2. Alternate Level Control		
3. Emergency Depressurization		
4. Level/Power Control		a
B. Procedural Steps		
 While executing the following 	ing steps:	
a. IF		
RPV water level can be	e determined	
AND		
All control rods are r	not inserted to at	
least position O2 AND	The Reactor will	
not remain shutdown wi	ithout boron	
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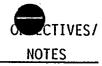
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LESSON CONTENT





THEN

Exit this procedure and enter C5, Level/Power Control and RPV Control Section RP and execute them concurrently.

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 With the Reactor at power and level determinable, the appropriate procedure is C-5, Level/Power (or the potential is present for the Reactor to return to power).

b. IF

RPV water level can be determined AND

All control rods are inserted to position O2 OR The reactor will remain shutdown without boron

THEN

Exit this procedure and enter RPV Control Section RL and section RP and execute them concurrently.

• After entering this procedure, if the Reactor is shutdown and RPV water level is known, then it is appropriate to use the directions of RPV Control RL and RP sections.

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EO-3.0

EO-3.0 ·

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DELIVERY NOTES

 Flooding should be discontinued as soon as RPV Water level can again be determined, due to the severe hydraulic loading imposed on the SRVs and their tailpipes.

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c. IF

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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 Primary Containment from sources external to the Primary Containment until Primary Containment water level pressure can be maintained under the curve. EO-3.0

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CTIVES/

Show TP of Fig. C4-1.

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DELIVERY NOTES

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EO-3.0

 This action precludes any further increase in Primary Containment water level, the consequence of not performing this action may be a complete and uncontrolled loss of Primary Containment integrity. Without knowing where the failure
 of the containment would occur, loss of the Suppression Pool is
 assumed with a subsequent loss of adequate core cooling.

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- 2. Are all control rods inserted to at least position 02?
 - a. YES continue at STEP #14
 - b. NO continue at STEP # 3
- 3. Will the Reactor remain shut down without boron?
 - a. YES continue at STEP #14

b. NO - continue at STEP # 4

- These two steps determine which "sub" path in C4 is most appropriate.
- 4. While executing the following STEPS: IF

All control rods are inserted to at least position O2 OR The Reactor will remain shutdown without boron

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AND

RPV water level cannot be determined THEN

Continue at step #14

 Should the Reactor become shutdown there is no need to continue in this "Sub" path as the actions are directed toward preventing power excursions while maintaining adequate core cooling.

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- 5. Terminate and prevent all injection in to the RPV except from boron injection systems and CRD.
 - The consequences of a return to criticality here, where the cooldown may be very rapid, could include significant damage to both the core and the RPV.
 - Therefore, to control the rate of positive reactivity addition, all sources of cold unborated water are prevented from injecting.
 - Boron and CRD are not terminated because they are being utilized to shutdown the Reactor.

EO-3.0

EO-3.0

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ESSON CONTENT	······································	DELIVERY NOTES	NOTES
6.	Can any SRV be opened.		
0.	a. YES - continue at STEP #7	-	
	b. NO - Continue at STEP #9		
	 In order to utilize step #7, at 		
	least one SRV must be open.		
7.	WAIT - until RPV pressure is below the	Show TP of Figure C4-1.	EO-3.0
	minimum Alternate RPV Flooding Pressure.		20-3.0
	 Definition – the minimum RPV pressure 		EO-3.0
	at which steam flow through the open		20-3.0
	SRVs is sufficient to preclude the		*
	temperature of the hottest fuel rod		
	from exceeding 1500°F even if the		
	Reactor core is not completely covered		
	or the Reactor is at power.		
8.	IF .		
	At least 4 SRVs can be opened		
	THEN		-
	Close the following valves: .		
	a. MSIVs		=
-	b. Main Steam Line Drains		
	c. RCIC Isolation Valves		
	d. RHR steam condensing isolation valves.		

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LESSON CONTENT		DELIVE	ERY NOTES	NOTES
	•	These valves are closed to prevent damage due to excessive thermal	,	EO-3.0
		stress and/or excessive loading of pipe hangers, and flooding of	·	
		turbine driven equipment.		
	•	If at least 4 are not open, these are left open to help keep the RPV		
		depressurized during flood up.		

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

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- This caution warns against to rapidly injecting relatively cold, unborated water into a Reactor cold, unborated water into a Reactor that may be just slightly shutdown.
- a. Commence and, irrespective of pump NPSH and vortex limits, <u>slowly</u> raise injection into the RPV with the following systems until RPV pressure is above the Minimum Alternate RPV Flooding Pressure for the number of SRVs which can be opened.

EO-3.0

Show TP of Fig. C4-2.

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. - , ECTIVES/ LESSON CONTENT **DELIVERY NOTES** NOTES With RPV pressure below the . EO-3.0 Minimum Alternate Flooding Pressure, sufficient steam flow to cool the core through steam cooling alone dose not exist. Therefore, injection must be re-established. Injecting to maintain RPV pressure • EO-3.0 above the Minimum Alternate Flooding Pressure assures that either: The RPV will flood. The core will be adequately cooled if it returns to criticality. b. Systems Feed water pumps - If necessary 1) defeat high RPV water level trip interlocks. 2) Condensate pumps 3) CRD ' . .

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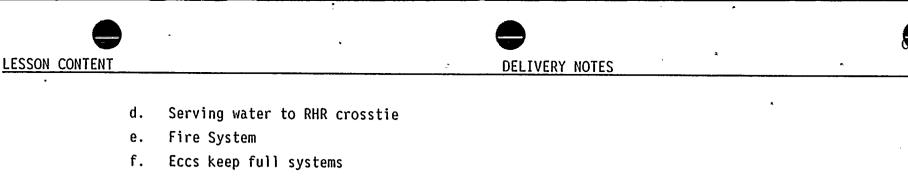
ON_CONTENT	-	DELIVERY NOTES	NOTES
•	 The systems listed here were chosen because they inject outside the shroud (allows for mixing of the cold unborated water with the warm, borated water prior to reaching the core). 		EO-3.0
10.			
	No SRV is open	Show Figure C4-2	
	OR	TP .	
	RPV pressure cannot be raised to above the		
	Minimum Alternate RPV Flooding pressure		
	(Figure C4-2)		
	THEN		
	Commence and, irrespective of pump NPSH and	Show Figure C4-2	_
		ТР	×
	the RPV with the following systems until RPV		
	pressure is above the Minimum Alternate RPV Flooding Pressure for the number of SRVs		
	which can be opened.		
	a. HPCS - If necessary, defeat high RPV		
	water level isolation interlocks		
	b. LPCS		•
	c. LPCI – with injection through the heat		
	exchanger as soon as possible.		

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- g. Condensate Transfer
 - If RPV pressure cannot be maintained above MAFP using the preferred systems, these systems must be used.
 - These systems are alternates because they either:
 - Inject inside the shroud, or
 - Take a suction on low quality water.

11. IF

No SRV is open

⁻Show TP of Figure C4-2.

Show TP of Figure C4-2.

CTIVES/

NOTES

EO-3.0

OR

RPV pressure cannot be raised to above the Minimum Alternate RPV Flooding Pressure.

THEN

Primary Containment Flooding is

required-Exit this procedure and Enter C6,

Primary Containment Flooding and RPV Control

at "C" and execute them concurrently.

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LESSON CONTENT		DELIVERY NOTES	DECTIVES/
	 If flooding conditions cannot be established, the covering of the core is attempted by flooding the containment. 		EO-3.0
12.	-	Show TP of Figure C4-2.	
	 Maintaining RPV pressure above the Minimum Alternate Flooding Pressure assures that either: The RPV will flood If the Reactor returns to criticality it will be adequately cooled. 		EO-3.0
	 Injection is throttled to: Minimize the thermal and hydraulic loads resulting from the flooding evolution. Minimize the dilution rate of the borón. 	Ξ 	EO-3.0
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DELIVERY NOTES

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13. WAIT - until all control rods are inserted to at least position O2 OR

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The Reactor will remain shutdown without boron.

- 14. Can at least 4 SRVs be opened?
 - a. YES continue at STEP #16
 - b. NO continue at STEP #15
- 15. Is a HPCS or Feedwater pump available for injection?
 - a. YES continue at STEP #16
 - b. NO continue at STEP #17
- 16. Close the following valves:
 - a. MSIVs
 - b. Main steam line drain valves
 - c. RCIC isolation valves
 - d. RHR steam condensing isolation valves
 - If four SRVs are open the operator can be reasonably assured that the RPV is being and will remain depressurized. Therefore, all other steamlines can then be isolated to protected steam driven equipment and piping.

EO-3.0

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SSON_CONTENT	DELIVERY NOTES	NOTES
 If the feedwater pumps or HP available the steam lines calisolated since these pumps a capable of flooding the RPV high pressure. 17. Commence and, irrespective of pump NPS vortex limits, raise injection into the with the following systems until: At least 4 SRVs are open AND RPV pressure is not dropping and psig or more above Suppression Chipressure When RPV water level cannot determined, RPV pressure indication must be used to c that sufficient water is bei injected to flood the RPV. The confirmation of RPV floo is accomplished by establish the following plant conditio 1) RPV pressure maintained psig above Suppression Chamber pressure. 	PCS are in be are at 3H and he RPV is 61 hamber be confirm ng ding hing hns.	EO-3.0 t

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× . . CTIVES/ LESSON CONTENT DELIVERY NOTES NOTES 2) At least four SRVs open. 61 psig is the minimum Flooding . EO-3.0 Pressure. This pressure is defined to be the lowest differential pressure between the Differential pressure across the SRV's. RPV and the Suppression Chamber at which steam flow through the Minimum Number of SRVs required for Emergency Depressurization is sufficient to remove all decay heat from the core by boiling heat

EO-3.0

Increasing injection until RPV

pressure is above the Minimum Flooding Pressure assures that

sufficient water is being injected to remove all decay heat generated and to ultimately flood the RPV.

HPCS - if necessary, defeat high

RPV water level trip interlocks. Feedwater pumps - if necessary,

defeat high RPV water level trip

transfer.

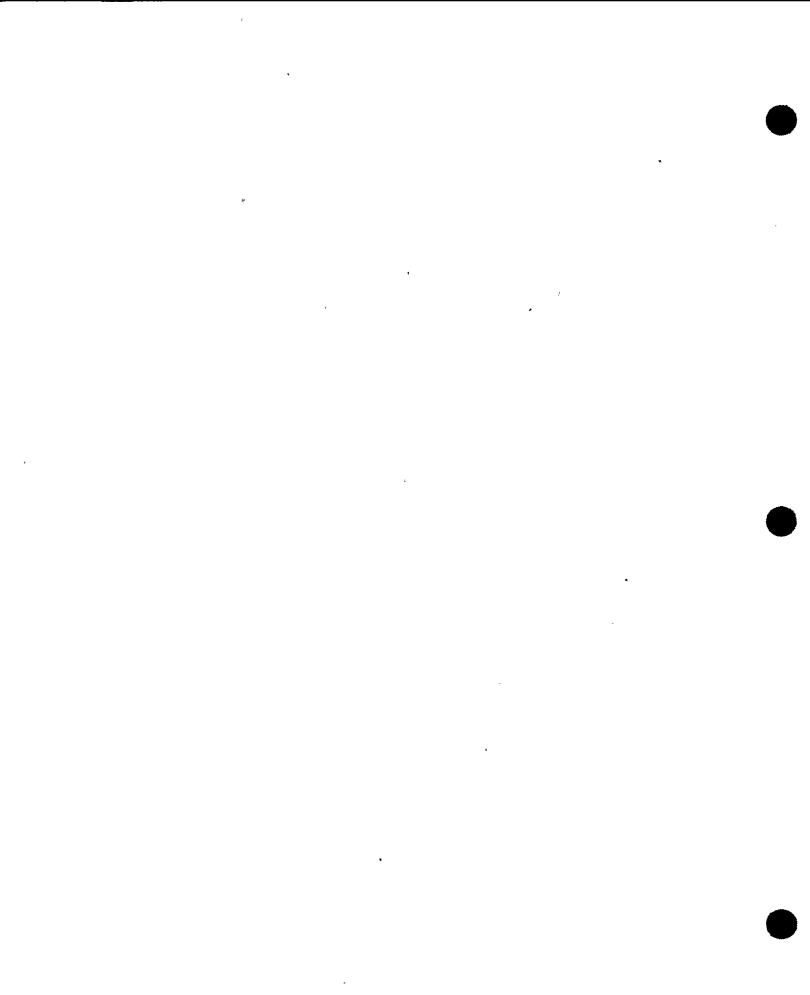
interlocks.

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Systems:

1)

2)









- 3) LPCS
- LPCI with injection through the heat exchangers as soon as possible.

:

- 5) CRD
- 6) Service water to RHR crosstie
- 7) Fire system
- 8) ECCS Keep Full system
- 9) SLC (test tank)
- 10) SLC (boron tank)
- 11) Condensate transfer

18. IF

Less than 4 SRVs are open

OR

RPV pressure cannot be maintained at least 61 psig above Suppression Chamber pressure THEN

Primary Containment Flooding is required; Exit this procedure and enter C6, Primary Containment Flooding and RPV Control at "C" and execute them concurrently.

 Control injection to maintain at least 4 SRVs open and RPV pressure at least 61 psig above Suppression Chamber pressure but as low as practicable. Show entry point into C6.

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LESSON CONTENT		DELIVERY NOTES	NOTES
	 Once the Minimum Flooding Pressure has been established, it must be maintained 		EO-3.0
	 to assure that the RPV will flood. Maintaining pressure above 61 psig but as low as practicable will reduce the flooding rate, thereby minimizing the 	·	EO-3.0
20.	thermal and hydraulic loads on the RPV. WAIT - until		
20.	a. RPV water level instrumentation is available AND	· · · · · · · · · · · · · · · · · · ·	
	 b. Hottest Drywell temperature is below 212°F AND 	- » •	
	c. RPV pressure has remained at least 61 psig above Suppression Chamber pressure for at least the Minimum Core Flooding Internal.	Show TP of Fig. C4-3.	
	 The MCFI is the greatest amount of time to flood the RPV to the TAF with RPV pressure at the Minimum RPV flooding pressure and at least 4 SRV's open. 	- · ·	EO-3.0
21.	Terminate all injection into the RPV and reduce RPV water level until RPV water level indication is restored.		x
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LESSON CO	ONTENT		DELIVERY NOTES	NOTES
within the Maxi after commencin into the RPV.	RPV water level indication is not restored within the Maximum Core Uncovery Time Limit after commencing termination of injection	Note: Indication if restored when a consistent change in an RPV water level instrument is observed or a trend between RPV level instruments is established.		
		 Return to "B" STEP #17 The MCUTL is the greatest amount of time that the core can remain uncovered with heat transfer to water or steam and clad temperature will not exceed 1500°F. 	Show Fig. C4-3	EO-3.0
	23.	Exit this procedure and enter RPV Control Section RL at "A" and Section RP at "C" and execute them concurrently.	Show entry points to R1 and RP.	-
II. WR/	AP-UP			
Α.	Acti the not comb The assu cond	nary: ons of this procedure to inject water into RPV and increase RPV water level until either main steamlines flood or, if the Reactor is shutdown, the core is adequately cooled by a ination of submergence and steam cooling. steps of this procedure may be required to re adequate core cooling under plant itions were RPV water level cannot be rmined.		
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