NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

LESSON PLAN

02-REQ-006-344-2-19

EMERGENCY OPERATING PROCEDURES

LEVEL/POWER CONTROL (C7)

Prepared By: Unit 2 Training Department

APPROVALS	SIGNATURES	DATE AND INITIALS REVISION 3
Training Supervisor Nuclear - Unit #2 G. L. Weimer	G. L. Weimer	11/8/88
Assistant Training Superintendent - Nuclear R. T. Seifried	R. T. Seifried	RTS 11/8/88
Superintendent of Operations Unit #2 R. G. Smith		11/7/88 for RGS

Summary of Pages

Revision: 3 (Effective Date: 11/8/88)

Number of Pages: 20

Date	Pages
January 1988	1 - 3
November 1988	4 - 20

MASTER

NIAGARA MOHAWK POWER CORPORATION

MASTER CONTROLLED DOCUMENT

4/27/82

I. TRAINING DESCRIPTION

A. Title: Emergency Operating Procedures, Level/Power Control (C-7)

B. Purpose: In a lecture presentation, the instructor shall present information for the student to meet each Student Learning Objective. Additionally, he shall provide sufficient explanation to facilitate the student's understanding of the information presented.

C. Total Time: 2 Hours

D. Teaching Methods:

- Classroom Lecture
- 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.

E. References:

1. BWRCG Emergency Procedure Guidelines, Rev. 3
2. Plant Procedure N2-EOP-C7

II. REQUIREMENTS AND PREREQUISITES

A. Requirements for Class:

1. AP-9, Rev. 2, Administration of Training
2. NTP-10, Rev. 3, Training of Licensed Operator Candidates
3. NTP-11, Rev. 4, Licensed Operator Retraining

B. Prerequisites:

1. Instructor
   a. Demonstrated knowledge and skills in the subject at or above the level to be achieved by the trainees, as evidenced by previous training or education, or
   b. SRO license for Nine Mile Point Unit 2 or a similar plant, or successful completion of SRO training, including Simulator Certification at the SRO level for Nine Mile Point Unit 2.
   c. Qualified in instructional skills as certified by the Training Analyst Supervisor.

2. Students

a. Meet eligibility requirements per 10CFR55 or

b. Be recommended for this training by the Operations Superintendent or his designee or the Training Superintendent.

III. TRAINING MATERIALS

A. Teaching Materials:

1. Transparency Package
2. Overhead Projector
3. Whiteboard and Felt Tip Markers
4. EOP Flowchart for C7

B. Student Materials:

1. EOP Flowchart for C7
2. OLP-C7

IV. QUIZZES, TESTS, EXAMS AND ANSWER KEYS.

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

V. STUDENT LEARNING OBJECTIVES FOR THE LEVEL/POWER CONTROL PROCEDURE

Upon completion of this lesson, mastery of the required procedure knowledge will be demonstrated by performing the Enabling Objectives listed below.

EO-1 State the purpose of the Level/Power Control Procedure.

EO-2 State the entry conditions for the Level/Power Control Procedure.

EO-3 Given the procedural step, discuss the technical basis for that step.

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

I. INTRODUCTION

A. Student Learning Objectives

B. Purpose

The actions specified in this procedure control RPV water level and power under conditions when boron injection is required. 1

II. DETAILED DESCRIPTION

A. Entry Conditions

This procedure is entered only as directed from other emergency operating procedures. 2

B. Procedural Steps

1. While executing this procedure | 3

IF, RPV flooding is required

OR

RPV water level cannot be determined, THEN Control injection into the RPV to maintain Rx power greater than 8% but as low as practicable.

a. This step must be remembered throughout the performance of this procedure. 3

b. With power indication available, lowering RPV level to control Rx power takes precedence over the requirement to flood.

c. Lowering RPV level will reduce the natural circulation driving head and thereby reduce core flow. Reducing core flow will lower Rx power.

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

d. 8% power is the power at which a reactor will stabilize if a full power failure to scram has occurred and level is low enough to inhibit all natural circulation except that which occurs within the shroud area.

e. Once this flow stagnation power level has been reached, further level reduction will not result in any further decrease in power level and could result in uncovering the core.

f. As boron injection continues, Rx power will decrease below 8% power. The operator will increase injection to maintain 8%. This process will cause RPV level to rise and eventually flood the RPV to the main steam lines.

g. Level will be held here until level indication is restored.

1a. <u>IF</u> RPV flooding is required <u>OR</u> RPV water level cannot be determined and |3

a. <u>IF</u> Rx power cannot be determined or maintained above 8%, Then RPV flooding is required, exit this procedure and enter C6, RPV flooding. |3 |3

1. If power indication is not available the operator is directed to the flooding procedure. — S.L.O. 3

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

b. In the flooding procedure, reactor pressure indication will be utilized to assure adequate core cooling is being maintained during the flooding evolution.

c. This step must be remembered throughout the performance of this procedure.

2. IF Emergency Depressurization is required THEN - continue at 8 in this lesson plan. 3

3. IF Rx power is above 4% OR cannot be determined,

AND

Suppression pool temperature is above 110°F

AND

An SRV is open, OR opens, OR drywell pressure is above 1.68 psig.

THEN

a. Place the ADS Logic inhibit switches in ON. 3

b. Irrespective of any reactor power oscillations lower RPV water level by terminating and preventing all injection into the RPV except from boron injection systems and CRD until either:

- Rx power is less than 4%

OR

Activity		Text Ref. Page	Text Ref. Fig.	S.L.O.
	• RPV water level reaches - 14 in OR • All SRVs remain closed AND drywell pressure remains below 1.68 psig.			
	1. The combination of the reactor at power, suppresion pool temperature high, and an SRV open or drywell pressure high is symptomatic of plant conditions where heat is being rejected to the suppression pool at a rate in excess of that which can be removed by the suppression pool cooling systems.			3
	2. If this rise in supression pool temperature is not terminated, it will ultimately result in: 1) Loss of NPSH for ECCS pumps. 2) Unstable steam condensation leading to containment failure.			
	3. The operator has already been directed in other EOPs to:			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

1) Reject as much heat as possible to the main condenser.
2) Maximize supression pool cooling.
3) Shutdown the reactor using control rods and boron.

4. The operator must now reduce the heat generation rate using the only remaining mechanism for power control; core flow.
5. This is accomplished by lowering RPV water level which reduces the natural circulation driving head and thereby reduces core flow.
6. Reducing core flow reduces Rx power and therefore reduces the rate at which heat is rejected to the suppression pool.
7. RPV water level is allowed to continue to decrease until either:

1) The suppression pool heatup is terminated or reduced to near that which results from the absorption of decay heat.

2) RPV water level has decreased to TAF.

8. Boron and CRD are not terminated because they are being utilized to shutdown the Rx.

9. The operator is cautioned that large RX power oscillations may be observed while executing this step. 3

c. If the RPV must be rapidly depressurized, these systems must be operated in a way that will minimize the potential for injection of large volumes of cold, unborated water as RPV pressure decreases.

d. If this override does not apply, to 6 in this lesson plan. 3

4. CAUTION: Increasing RPV injection rapidly while performing the following step may cause a large power excursion and result in substantial core damage.

a. Using only the systems listed below, maintain RPV water level at the level to which it was lowered.

- Condensate/Feedwater
- CRD

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
• RCIC- maintain turbine speed greater than 1500 RPM			3

- If CST level drops to 6.15 ft, verify auto suction transfer
- Elevated suppression chamber pressure may trip the RCIC turbine

b. IF
RPV water level cannot be maintained at the level to which it was lowered.
THEN
Maintain RPV water level above - 14 inches (TAF)
IF
RPV water level cannot be maintained above - 14 inches (TAF)
THEN
EMERGENCY DEPRESSURIZATION IS REQUIRED - continue at 8 page 12 in lesson plan. 3

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

5. WAIT until:
   - All control rods are inserted to at least position 02 3

     OR

   - SLC tank level drops to 2,900 gal.

6. CAUTION: Increasing RPV injection rapidly while performing the following step may cause a large power excursion and result in substantial core damage.

   a. Using only the systems listed below, maintain RPV water level between 159.3 inches and 202.3 inches.
      - Condensate and Feedwater
      - CRD
      - RCIC - maintain turbine speed >1500 RPM
        - If CST level drops to 6.15 feet, verify auto suction transfer
        - Elevated suppression chamber pressure may trip the RCIC turbine

   b. IF

      RPV water level cannot be maintained above 159.3 inches.

      THEN

      Maintain RPV water level above -14 inches (TAF).

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

c. IF

RPV water level cannot be maintained above - 14 inches (TAF)

THEN

Emergency depressurization is required - continue at _8_ page _12_ in lesson plan. 3

7. WAIT until:

- All control rods are inserted to at least position 02

OR

- SLC tank level drops to 2,900 gals.

NOTE: The next step can be arrived at via:

- Any override stating - Emergency Depressurization is required.

8. Terminate and prevent all injection into the RPV except boron and CRD.

9. Can at least 2 SRV's be opened?

a. Yes - WAIT until RPV pressure is below the valve listed in Table C7-1.

1. As long as RPV pressure remains above the Minimum Alternate Flooding Pressure, the core is adequately cooled irrespective of whether any water is being injected into the RPV.

Activity		Text Ref. Page	Text Ref. Fig.	S.L.O.
	2. The Minimum Alternate Flooding pressure is defined to be the minimum RPV pressure at which steam flow out of the open SRVs is sufficient to remove all decay heat from a completely uncovered core by steam heat transfer alone.			
	3. This is based on the 8% flow stagnation power.			
	4. This pressure is dependent on the number of SRVs that are open, as illustrated in Table 2.			
	5. If less than two SRVs can be opened or RPV pressure falls below the appropriate value in Table 2, injection must be re-established in order to adequately cool the core and increase RPV level (C7-12).			
	6. Boron and CRD are not terminated because they are being used to shutdown the Rx.			3
	b. No - Continue at 10.			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
10. CAUTION: Increasing RPV injection rapidly while performing the following step may cause a large power excursion and result in substantial core damage.			3

a. Using only the systems listed below, commence and SLOWLY increase RPV injection to restore RPV water level above - 14 inches (TAF).

- Condensate/Feedwater
- CRD
- RCIC - maintain turbine speed >1500 RPM
  - If CST level drops to 6.15, verify auto suction transfer
  - Elevated suppression chamber pres- sure may trip RCIC turbine

1. The systems chosen for RPV water level control are those which inject outside the shroud.

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

2. These are preferred because they allow for mixing of the cold, unborated water, with the warm, borated water prior to it reaching the core.

b. IF
RPV water level cannot be restored and maintained above - 14 inches (TAF)
THEN
Commence and SLOWLY increase RPV injection with the systems listed below to restore and maintain RPV water level above - 14 inches (TAF)

- HPCS - if CST level drops to 12.5 feet or suppression pool level rises to El. 201 feet, verify auto suction transfer.
- LPCS
- LPCI - inject through the heat exchanger as soon as possible. 3
- Service water to RHR cross-tie

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

- Fire water
- ECCS keep full
  1. If RPV level cannot be restored and maintained above the top of active fuel using the preferred systems, alternate systems must be used.
  2. The systems listed are less desirable because they either:
     a. Inject inside the shroud which does not allow for mixing of the cold, unborated water prior to it reaching the core.
     b. Take a suction on low quality water sources.

11. WAIT until:
    - All control rods are inserted to position 02

      OR
    - SLC tank level drops to 2,900 gal.

3

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

a. When the SLC tank level is lowered to the level which corresponds to the Hot Shutdown Boron Weight having been injected, the operator is directed to raise RPV level. As level is increased, natural circulation flow is increased and the stratified boron in the lower plenum is mixed and distributed throughout the core. 3

b. The Hot Shutdown Boron Weight is defined to be the weight of soluble boron required for injection in order to place the reactor in a hot (545°F) shutdown condition at the most reactive time in core life assuming:

1) 100% power control rod pattern.
2) No voiding in the core.

3) The boron is uniformly distributed throughout the RPV.

4) RPV water level is at the high RPV water level trip.

Thus injection of this weight of soluble boron into the RPV assures that the reactor will remain shutdown at normal operating temperature irrespective of control rod position. 3

NOTE: It should be noted that all flowpaths for EOP-C7 end with the above statement prior to combining into the next series of steps and overrides.

12. While executing the following steps:
    a. IF - Reactor Power commences and continues to increase.
    b. THEN - Return to 3A page 6 (terminating injection) in lesson plan.

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
13. Restore and maintain RPV water level between 159.3 inches and 202.3 inches.			
a. IF - RPV water level cannot be restored and maintained above 159.3 inches.			
b. THEN - Maintain RPV water level above - 14 inches (TAF).			
c. IF - RPV water level cannot be maintained above - 14 inches (TAF)			3
d. THEN - Emergency depressurization is required, continue at 8 page 12 (in lesson plan).			
14. Exit this procedure and proceed to cold shutdown in accordance with OP-101C.			
a. After RPV pressure has been reduced to below the shutdown cooling interlocks or the reactor has been shutdown either by rods or boron, then OP-101C provides appropriate instructions for RPV water level control.			

3

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.

III. WRAP-UP

A. Summary

The actions specified in this procedure control RPV water level and power under conditions when boron injection is required (i.e., the reactor cannot be shutdown before suppression pool water temperature reaches 110°F). Whenever entry into this procedure is required, the previously effective RPV water level control procedure is exited. This precludes the possibility of having concurrently effective but conflicting steps irecting control of RPV water level.

The actions to control RPV water level in this procedure are different from those contained in the RPV Water Level Control procedure for three reasons:

1. When boron is injected into the RPV, the systems used to control level must be selected so as to minimize the potential for diluting the boron concentration or injection cold water into the core region.
2. When boron is being injected into the RPV, water level must be controlled so as to not only adequately cool the core, but also to promote mixing of the boron at the appropriate time in order to shut down the reactor.
3. RPV level must be controlled so as to not only adequately cool the core, but to also minimize the suppression pool water temperature rise.