Φ7-187-91

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-LOT-006-344-2-01 Revision 4

TITLE: EMERGENCY OPERATING PROCEDURES, RPV PRESSURE CONTROL (RP)

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Summary of Pages

(Effective Date: 12/10/90)

Number of Pages: 24

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THIS LESSON PLAN IS A GENERAL REWRITE
THIS LESSON PLAN SUPERSEDES LESSON PLAN #N2-OLP-RP

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION: _____ _____

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25
5/3/238

I. TRAINING DESCRIPTION

A. Title of Lesson: Emergency Operating Procedures, RPV Pressure Control (RP)

B. Lesson Description: This lesson discusses the actions taken to control high RPV pressure.

C. Estimate of the Duration of the Lesson: Approximately 1 hour

D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written Examination with 80% minimum passing grade.

E. Method and Setting of Instruction: Classroom Lecture

F. Prerequisites:

1. Instructor:

a. Certified in accordance with NTP-16.

2. Trainee:

a. Certified in accordance with NTP-10.

G. References:

1. BWROG Emergency Procedure Guidelines, Rev. 4

2. Plant Procedure N2-EOP-RP, Rev. 4

II. REQUIREMENTS

A. AP-9, Administration of Training

B. NTP-10, Training of Licensed Operator Candidates

III. TRAINING MATERIALS

A. Instructor Materials:

1. Transparencies Package

2. Overhead Projector

3. Whiteboard and Felt Tip Markers

4. EOP Flowchart for RP

5. Training Record

B. Trainee Materials:

1. EOP Flowchart for RP

2. Course Evaluation Form

IV. EXAM AND MASTER ANSWER KEYS

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

V. LEARNING OBJECTIVES

Upon completion of this training, the trainee will have gained the knowledge to perform the following:

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	(SRO ONLY) Direct the operation of the shutdown cooling mode of the RHR System.	(2059050103)
TO-3.0	(SRO ONLY) Direct the operation of the steam condensing mode of the RHR System.	(2059060103)
TO-4.0	(SRO ONLY) Direct the actions required per EOP-RPV Section RP.	(3449410603)
TO-5.0	(SRO ONLY) Respond to the failure of the Turbine Bypass Valves to open.	(3449940403)
TO-6.0	(SRO ONLY) Direct the actions for a fuel clad failure or a high activity in the reactor coolant or offgas.	(3449750403)
TO-7.0	Perform the actions for a high drywell pressure.	(2000070501)
TO-8.0	Startup the steam condensing mode of the RHR System.	(2059300101)
TO-9.0	Perform manual injection of LPCS from the Control Room.	(2099020401)
TO-10.0	Manually initiate the RCIC System from the Control Room and monitor for proper operation.	(2170030101)
TO-11.0	Manually inject poison solution into the reactor from the Control Room.	(2000250501)
TO-12.0	Perform the actions required for an anticipated trip without scram (ATWS).	(2000200501)
TO-13.0	Perform the actions required for a fuel caldding failure.	(2009060501)

TO-14.0 Perform the actions required for a turbine trip without bypass. (2009070501)

TO-15.0 Scram the reactor manually and take immediate actions. (2010130101)

TO-16.0 Perform post-scram recovery actions in accordance with N2-OP-101C. (2019250101)

TO-17.0 Maximize RWCU cooling to assist RPV pressure control per N2-EOP-RP. (2049120101)

TO-18.0 Control reactor pressure using the RCIC System. (2179070401)

B. Enabling Objectives:

EO-1.0 State the purpose of the RPV Pressure Control Procedure.

EO-2.0 State the entry conditions for the RPV Pressure Control Procedure.

EO-3.0 Given the procedural step, discuss the technical basis for that step.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
I. INTRODUCTION	Preliminary Activities: 1. Introduce self to class (if unfamiliar). 2. Distribute TR for completion. 3. Distribute Course Evaluation Forms and describe their use. 4. Discuss Method of Evaluation.	
A. Student Learning Objectives	Review Learning Objectives with the class.	
B. Purpose Provide necessary actions to first stabilize RPV pressure and then to depressurize and cooldown the RPV to cold shutdown conditions.		EO-1.0
C. Procedure Overview		
1. The RPV pressure control procedure is executed concurrently with the following procedures.		
a. N2-EOP-RL RPV Water Level Control		
b. N2-EOP-RQ RPV Reactivity Control		
2. Concurrent execution of these procedures is necessary because:		
a. The actions taken to control any one RPV parameter may directly effect control of the others.		

b. This procedure is based on the symptomatic approach to emergency response, where the initiating event of the transient is not known in advance. Assignment of priorities to any one of the three parameters is therefore not possible.

3. The values and trends of parameters, and the status of plant equipment during the event will dictate the order of execution of each flowpath (procedure). Primary concern of the operator should be, "I am controlling Reactor Pressure via use of": Section RP

II. DETAILED DESCRIPTION

A. Entry Conditions

1. Setpoints

a. The conditions which require entry into this procedure are:

- RPV Water Level below 159.3 in.
- RPV Pressure above 1037 psig
- Drywell Pressure above 1.68 psig
- Rx power is above 4% OR unknown AND a Scram is required.

b. The occurrence of any one of these conditions requires entry into this procedure.

NOTE: TP's may be used to highlight points of interest on flowcharts; use TP's to show procedural steps if flowchart not used.

EO-2.0

c. If an entry condition clears prior to exiting this procedure, and then re-occurs, re-entry at the beginning of the procedure is required.

d. If a second entry condition occurs while performing the procedure, re-entry at the beginning is again required.

e. If all entry conditions clear while executing this procedure, this procedure <u>may</u> be exited.

f. Termination of the emergency rather than termination of an event is the basis for exiting conditions for EOP's. Consequently, these procedures may be exited at any point during their execution if the operator determine that an emergency no longer exists. The EOP's have been written so that if an operator remains in a procedure when an emergency no longer exists, they still provide proper guidance. Alternately, if the operator exits a procedure prematurely, reoccurrence of an entry condition will follow and the appropriate EOP procedure will be re-entered.

TMR #02-88.232
Noted weaknesses on previous NRC Requal exam.

2. Setpoint Bases

   a. The values selected were chosen on the basis of being simple, readily identifiable and operationally significant. They also provide advance warning of potential emergency conditions, allowing action to be taken which may prevent more severe circumstances.

   b. The entry conditions address the following plant conditions:

      1) RPV Water Level below 159.3 in. EO-2.0

         - Addresses LOCAs where make up flow is inadequate for break flow.
         - Although RPV water level at the low level Scram setpoint does not in itself constitute an emergency, correct & prompt operator action is required.
         - The setpoint is sufficiently high to allow prompt correct operator action restore RPV level without automatic initiation of ECCS.

2) RPV pressure above 1037 psig
   - SRV failures
   - Turbine trip with bypass valve failure
     - Indirectly addresses steam line breaks and/or fuel failures which both cause MSIV closure.

3) Drywell pressure above 1.68 psig.
   - LOCAs inside the Drywell
   - Loss of Drywell cooling

4) Reactor power above 4% or unknown
   AND
   a Scram is required
   - Failure to Scram events where the Reactor remains at power.
   - 4% is the APRM downscale setpoint.

B. Procedural Steps

1. Execute EOP-RL, RP and RQ concurrently.

   a. As previously discussed, concurrent control of all three RPV parameters is required when taking action to control and stabilize any one of them.

Use TP of procedure of flowchart to show steps.

2. Execute the following two steps concurrently:
   a. Activate the emergency plan, if required, in accordance with EAP-1.
   b. Has a Reactor Scram been initiated?
      1) A "Yes" answer directs the operator to each leg in the RPV Control Procedure.
      2) A "No" answer directs the operator to initiate a Scram prior to entry into the RPV Control Procedure.
         - The purpose of this step provides for a Scram initiation if entry is directed from a procedure where no conditions existed which would have automatically initiated a Scram.
         - Re-entry into this procedure is required whenever any entry condition occurs or reoccurs. however, a Reactor Scram need to be initiated only once.

EAP-1 gives guidance on how to implement the Emergency Plan. The SSS will generally determine if the plan needs to be implemented.

EO-3.0

EO-3.0

3. Monitor and control RPV PRESSURE
   a. The possibility exists that RPV pressure is not the concern, this step provides instruction to monitor RPV pressure and to maintain pressure as directed by the following steps.

EO-3.0

4. While executing the following steps:
   a. IF A high Drywell pressure ECCS initiation signal exists (1.68 psig)
      - Reminder that 1.68 psig is auto start for ECCS.

      THEN Before depressurizing below their maximum injection pressures, prevent injection from LPCS and LPCI pumps not needed for adequate core cooling.
      - Uncontrolled injection, if not needed, only complicates actions to maintain control of RPV water level.
      - The term "prevent" permits securing pumps as well as closing injection valves.
        - Placing the pump control switch in PTL is preferred.

EO-3.0

IF

b. Emergency RPV Depressurization is anticipated, AND all control rods are inserted to at least position 02 OR the Reactor will remain shutdown without boron, THEN Rapidly depressurize the RPV using the main turbine bypass valves, irrespective of the resulting RPV cooldown rate.

Ensure the term anticipated is emphasized here.

- The operator is told that cooldown rates greater than 100°F/hr may be required to accomplish this step.
- If emergency depressurization is anticipated discharging as much heat as possible to the main condenser will minimize the heat loading of the Suppression Pool.
- Bypassing or defeating isolation interlocks is NOT authorized by this override.

This point should be stressed.

- During ATWS events, depressurization of the RPV is not allowed due to the possibility of injecting large amounts of cold water.

EO-3.0

c. Emergency RPV Depressurization is required
AND
less than 7 SRVs are open. THEN exit section RP of this procedure and enter Emergency RPV Depressurization.

EO-3.0

- Entry into C2 Emergency Depressurization is required to provide guidance to perform the depressurization.
- C-2 provides the "transition" to restore, prolong or establish the means of providing adequate core cooling.
- The direction of C-2 are in conflict with the direction of RP, therefore exiting appropriate.

d. If RPV water level cannot be determined AND less than 7 SRVs are open THEN exit section RP of this procedure and enter C2, Emergency RPV Depressurization.

e. RPV water level cannot be determined
AND
at least 7 SRV are open THEN exit section RP of this procedure and enter C4, RPV flooding.

- Since entry into the EOP-C2 is not necessary due to the number of SRVs opened EOP-C4 is entered directly to prevent failure of the containment or loss of adequate core cooling. Since the direction provided in these procedures is in conflict with this procedure, this procedure, must be exited.

EO-3.0

5. Is any SRV cycling? Yes, then manually open SRVs until RPV pressure drops to 960 psig, returning switches to the auto position. NO - continue on in RP section.

- "SRV cycling" is defined as multiple, closely sequenced relief/safety valve actuations with valve opening being initiated in response to RPV pressure increasing to or above the lifting setpoint, and the subsequent valve closure being governed by RPV pressure decreasing to or below the SRV reset setpoint.

EO-3.0

- Reducing RPV pressure to well below the lowest SRV lifting setpoint will minimize:

1) Dynamic loading on containment structures resulting from multiple, closely sequenced SRV actuations.
2) The possibility of a stuck open SRV or failure of one to open.
3) Fluctuating RPV water level.

- Reducing RPV pressure below 960 psig may cause the turbine bypass valves to partially close and increase steam flow to the Suppression Pool.
- Terminating RPV pressure reduction at 960 psig will therefore:
  1) Prolong the availability of the Suppression Pool as a heat sink.
  2) Provide adequate operating margin to the SRV lift setpoint.

a. Following a specific SRV opening sequence is unwarranted at this time since a prompt reduction in pressure is desired.

EO-3.0

6. While executing the following steps:
   IF

   a. Suppression Pool Temperature cannot be maintained below the Heat Capacity Temperature Limit.
   THEN - irrespective of resulting RPV cooldown rate, maintain RPV pressure below the Heat Capacity Temperature Limit (Fig. RPV-8)

   Show TP of Figure RPV-8 (HCTL)

   - This action is required to prevent exceeding 1) the Suppression Chamber design temperature or 2) the Primary Containment Pressure Limit before the rate of energy transfer from the RPV to the containment is within the capacity of the containment vent.

   EO-3.0

   b. IF
   Suppression Pool water level cannot be maintained below the SRV Tail Pipe Level Limit (Fig. RPV-9)
   THEN - Irrespective of the resulting RPV cooldown rate, maintain RPV pressure below the SRV Tail Pipe Level Limit (Fig. RPV-9)

   Show TP of Figure RPV-9

• This action is necessary to prevent SRV system damage and containment failure.		EO-3.0
c. IF Steam cooling is required, THEN - exit Section RP enter EOP-C3, Steam Cooling.	Steam cooling required would be directed by C-1.	EO-3.0
• The requirements of the Steam Cooling procedure are contrary to that of RPV pressure control therefore exiting RP is appropriate.		
d. IF Boron injection is required		
• Boron injection is required if the Reactor cannot be shutdown before Suppression Pool temperature reaches 110°F.	This would be the case in a failure to Scram condition with an MSIV closure.	EO-3.0
AND Main condenser is available		
• includes circ. water, steam seals injectors, etc. are available.		
AND No indication of gross fuel failure or steam line break		

- High steam line Rad. isolation would be indicative of "gross fuel failure".
- High steam flow isolations indicative of a steam line break.

THEN - open MSIVs to re-establish main condenser as a heat sink.

IF necessary, bypass IAS and low RPV water level MSIV isolations in accordance with OP-1, Section H.1.

Direction to open MSIVs in OP-1; Section H.1.

- If the Rx was at power and all the heat generated was discharged solely to the Suppression Pool, the HCTL would be reached quickly.
- Therefore, utilization of the condenser as a heat sink is of sufficient importance to warrant bypassing the low RPV water level isolation signal.

Show TP of Fig. RPV-8 (HCTL).

EO-3.0

7. Stabilize RPV pressure below 1037 psig using the main turbine bypass valves.
   - Main turbine bypass valves are preferred for RPV pressure control to:

- Eliminate further challenges to the SRVs.
- Preserve the heat capacity of the Suppression Pool.
- Simplifies RPV water level control by eliminating fluctuations and oscillations in RPV water level.

• No RPV pressure control range is specified in this step to allow stabilization of RPV pressure at any point below the Scram setpoint. EO-3.0

IF necessary, augment RPV pressure control with one or more of the following systems:

a. SRVs when Suppression Pool level is greater than El. 192 ft. If pneumatic supply is or becomes unavailable, place the control switch for each SRV in the Auto position. If possible, open sequence listed in Table RPV-1.

No prioritization is implied regarding the order of this list.

• Ensuring pool water level above water level above El. 192' ensures the T-Quenchers are submerged and prevents rapid pressurization of containment. EO-3.0

b. RHR in the Steam Condensing Mode

c. RCIC with suction from condensate storage tank - maintain turbine speed > 1500 RPM.
   - Provides makeup as well as removing heat through turbine operation. — EO-3.0
   - Elevated Suppression Chamber pressure may trip RCIC turbine.

d. RWCU (Recirculation mode)
   - Bypass filter demineralizers to prevent the filtering out of boron. — This is discussed in lesson on RQ. — EO-3.0
   - If necessary, defeat SLC and other isolation interlocks.
   - Approximately 1.5×10^7 BTU/hr through non-regenerative heat exchanger.

e. RWCU (blowdown mode)
   - ONLY IF no boron has been injected into the RPV. — EO-3.0
     - Prevents rejecting boron.
   - Have the chemistry department sample for activity prior to initiating blowdown.

f. Main Steam drains.

8. WAIT until all control rods are inserted to position 02.

   OR

   the Reactor will remain shutdown without boron

   OR

   If boron is being injected, SLC tank level drops to 900 gallons.

   - Corresponds to the amount equivalent to Cold Shut Down Boron Weight.

   Max. Subcritical Banked Rod Withdrawal Position.

9. While executing the following steps

   IF .

   the Rx is not shutdown

   THEN return to "B"

   "B" states to maintain pressure below 1037 psig.

   - The remaining steps of RP depressurize and cooldown the RPV to cold shutdown conditions.

     EO-3.0

   - If the positive reactivity added during the cooldown causes the Rx to return to power, the cooldown must be secured.

     Positive reactivity due to the negative temperature coefficient.

- The operator is directed to return to maintain RPV pressure below 1037, where RPV pressure will be stabilized and maintained until the RPV is shutdown.
- Prior to initiating RPV depressurization, the Reactor must be shutdown.
- With the Reactor not shutdown any significant depressurization and associated cooldown will not be possible because the positive reactivity added during the cooldown will increase Rx power and ultimately generate more steam than can be removed.
- If RPV cooldown should result in criticality, the cooldown is terminated per the instructions of maintaining RPV pressure.

EO-3.0

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

- The term "continuous" includes any backup or alternate means of pressurizing the pneumatic SRV supply system continuously in addition to the permanent source.
- This action preserves long term SRV availability should plant conditions degrade.

Note: This does not authorize exceeding 100°F/hour cooldown.

EO-3.0

EO-3.0

11. WAIT until the shutdown cooling interlocks clear.

RPV pressure below 128 psig.

- Shutdown cooling is the normal method of RPV cooldown to cold shutdown.
  - Section RP relies on Section RL to restore and maintain level above the level 3 (159.3") shutdown cooling interlock.

12. Initiate the Shutdown Cooling mode of RHR.
    a. Use only RHR pumps not required to maintain RPV water level above 159.3 inches by operation in the LPCI mode.

13. IF - RHR shutdown cooling mode cannot be established, AND further cooldown is required: THEN - continue to cooldown using one or more of the systems used during pressure control-B.
    - As pressure/temperature decrease it may be necessary to re-evaluate the most appropriate method of further cooldown.

Discuss what is meant by "is required" when continuing a cooldown.

EO-3.0

14. Exit section RP of this procedure and proceed to cold shutdown IAW OP-101C,
    a. With RPV cooldown completed, it is appropriate to return to normal operating procedures.

OP-101C is the normal shutdown procedure.

Q: What is the purpose of EOP-RP?

A: To provide the necessary actions to first stabilize RPV pressure and then to depressurize and cooldown the RPV to cold shutdown conditions.

Q: What are the entry conditions of EOP-RP?

A:
- RPV water level below 159.3 in.
- RPV pressure above 1037 psig
- Drywell pressure above 1.68 psig
- Rx power above 4% OR unknown AND a scram is required.

Q: Which EOP's are executed concurrently with with EOP-RP?

A:
- N2-EOP-RL
- N2-EOP-RQ

III. WRAP-UP

A. Summary

This procedure provides direction on how to first stabilize RPV pressure and then to depressurize and cool down the RPV to cold shutdown conditions. The main condenser is the preferred heat sink, but alternate methods to cooldown the RPV are provided for conditions when the main condenser is not available. When the status of plant parameters requires control of RPV pressure different from the normal 100°F/hr cooldown, appropriate instructions to enter other EOPs are provided.