NIAGARA MOHAWK POWER CORPORATION ϕ7-187-91

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-LOT-006-344-2-02 Revision 4 12/13/90

TITLE: EMERGENCY OPERATING PROCEDURES, RPV REACTIVITY CONTROL (RQ)

	SIGNATURE	DATE
PREPARER		11-30-90
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TRAINING AREA SUPERVISOR		12-5-90
PLANT SUPERVISOR/ USER GROUP SUPERVISOR	Frank Smith for D Topley	12/10/90

Summary of Pages

(Effective Date: 12/10/90)

Number of Pages: 20

Date	Pages
December 1990	1 - 20

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION:

DATA ENTRY:

RECORDS:

5/3/241

ATTACHMENT 6
LESSON PLAN TEMPORARY/PUBLICATION/ADDENDUM CHANGE FORM

The attached change was made to:

Lesson plan title: Emergency Operating Procedures RPV Reactivity Control (RQ)

Lesson plan number: 02-LOT-0006-344-2-02

Name of instructor initiating change: D. Penfield

Reason for the change: Change revision to Rev. 4 due to typographical error

Type of change:

1. Temporary change ____
2. Publication change X
3. Addendum change ____

Disposition:

X 1. Incorporate this change during the next scheduled revision.

____ 2. Begin revising the lesson plan immediately. Supervisor initiate the process.

____ 3. To be used one time only.

Approvals:

Instructor: _____ /Date 12-17-90

Training Area Supervisor (or designee): _____ /Date 12-13-90

I. TRAINING DESCRIPTION

A. Title of Lesson: Emergency Operating Procedures, RPV Reactivity Control (RQ)

B. Lesson Description: This lesson discusses the actions taken to control reactor power on a failure to scram.

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: 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-RQ, 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 RQ
5. Training Record

B. Trainee Materials:

1. EOP Flowchart for RQ
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 Procedure, use the procedure to place the plant in a stable condition as prescribed in the procedure.	
TO-2.0	(SRO ONLY) Direct the actions required per N2-EOP-RPV Section RQ.	(3449390603)
TO-3.0	Direct the actions for Alternate Rod Insertion.	(3449880403)
TO-4.0	Perform the actions for a high drywell pressure.	(2000070501)
TO-5.0	Perform the actions required for an anticipated trip without scram (ATWS).	(2000200501)
TO-6.0	Manually inject poison solution into the reactor from the Control Room.	(2000250501)
TO-7.0	Scram the reactor manually and take immediate actions.	(2010130101)
TO-8.0	Perform post-scram recovery actions in accordance with N2-OP-101C.	(2019250101)
TO-9.0	Manually initiate Alternate Rod Insertion from the Relay Room panel.	(2949040401)
TO-10.0	Verify operation of the RRCS auto initiation for high reactor pressure.	(2949060401)

B. Enabling Objectives:

EO-1.0	State the purpose of the RPV Reactivity Control Procedure.
EO-2.0	State the entry conditions for the RPV Reactivity Control Procedure.
EO-3.0	Given the procedural step, discuss the technical basis for that step.
EO-4.0	Describe changes in core injection paths, that prevent a power excursion.
EO-5.0	Describe all methods of inserting negative reactivity under accident conditions and their preferred order.

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 The reactivity control procedure provides the necessary actions to initiate a Reactor Scram, and if unsuccessful, to shutdown the Reactor by manual rod insertion, and, if required, boron injection.		EO-1.0
C. Procedural Overview		
1. The RPV Reactivity Control Procedure is executed concurrently with the following procedures.		
a. N2-EOP-RL RPV Water Level Control		
b. N2-EOP-RP RPV Pressure 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).

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
- Reactor 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 may 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 determines 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 as a weakness on Operator 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: EO-2.0
      1) RPV Water Level below 159.3 in.
         - LOCAs where the makeup capacity is less than break flow.
         - Loss of feedwater transients where makeup to the RPV has been lost or where the feedwater control system does not adequately respond to steam demand.
      2) RPV pressure above 1037 psig
         - SRV failures
         - Turbine trip with bypass valve failure.

- Steam line breaks and fuel element failure events because these conditions initiate a closure of the Main Steam Isolation Valves.

3) Drywell pressure above 1.68 psig
   - LOCAs inside the Drywell
   - Loss of Drywell cooling
4) Reactor power is above 4% or unknown AND a Scram is required.
   - Failure to Scram events where the Reactor remains at power or where power cannot be determined.

EO-2.0

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 any one of them.

Show TP or flowchart of procedure while discussing steps.

2. Execute the following two steps concurrently:
   a. Activate the emergency plan, if required, in accordance with EAP-1.

EAP-1 directs action in emergency plan activation. The SSS generally determines if plan activation is necessary.

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 condition 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 be initiated only once.

3. Monitor and control Rx power

a. This general statement allows the operator to use his prior experience and knowledge to determine how control of Rx power can best be accomplished.

4. While executing the following steps:
   a. IF All control rods are inserted to or beyond position 02
      THEN
      Terminate boron injection. Exit Section RQ of this procedure and enter OP-101C, Section H.1.
      - Maximum Subcritical Banked withdrawal position.
      - Reactor is and will remain shutdown under all conditions.

      EO-3.0

   b. IF It has been determined that the Reactor will remain shutdown under all conditions without boron
      THEN
      Terminate boron injection and enter OP-101C, Section H.1.
      - Reactor Analyst will make this determination.

      Normal shutdown procedure.

   c. IF The Rx is shutdown and no boron has been injected:
      THEN
      Exit section RQ of this procedure and enter OP-101C H.1.

1) This step must be kept in mind throughout the performance of this procedure.

EO-3.0

2) If all rods are inserted to position 02, the Reactor will remain shutdown under all circumstances. Therefore, no further reactivity control actions are necessary and the operator is directed to exit this procedure.

3) This last step addresses the situation where the Reactor is shutdown with a small number of control rods not inserted.

4) If the Reactor returns to criticality during the plant cooldown, the steps of the RPV Pressure Control Procedure (being executed concurrently) will prevent further cooldown until the Reactor is again shutdown.

NOTE: You would not exit RP and RL when directed out of RQ.

5. Confirm or place the Reactor mode switch in SHUTDOWN

a. This step inserts a redundant Scram signal.

EO-3.0

b. Taking the mode switch out of the RUN position may also preclude a MSIV isolation due to low steam line pressure. This will maintain the main condenser as a heat sink and minimize heat added to the Suppression Pool.

6. Has ARI initiated
   a. YES - continue at STEP #6
   b. NO - Initiate RRCS
      - This actuates the ARI System, which then independently depressurizes the Scram air header and re-aligns the Scram discharge volume vent & drain valves.

EO-3.0

7. Is the main turbine-generator on the line, - YES -, are the MSIV's open - YES -, confirm or initiate recirculation flow to minimum.
   a. IF the main turbine-generator is not on line or the MSIVs are closed then proceed with step #7.
   b. Reducing Rx power prior to tripping the recirculation pumps may prevent a possible immediate turbine trip.

Q: Why is a main turbine trip undesirable at this point? EO-3.0

A: The increase in steam pressure and subsequent void collapse will cause power to increase.

c. A rapid and controlled power reduction may be accomplished by running back recirc. flow.

8. Can Rx Power be determined
   a. YES - go to STEP #8
   b. NO - go to STEP #9
      - This step decides if Reactor power indications are available to determine if a recirc pump trip is warranted.

EO-3.0

9. Is Reactor Power above 4%
   a. YES - go to STEP #9
   b. NO - go to STEP #8b
      - If Reactor power is below 4% tripping the recirculation pumps results in little, if any, reduction of Rx power. Forced recirculation flow will maximize boron mixing should boron injection be required.

Void content extremely low at 4% power.

EO-3.0

EO-4.0

- Tripping the recirc. pumps above 4% power causes a prompt reduction in power. Scale model tests have shown that natural circulation flow provides adequate boron mixing should boron injection be required.

EO-3.0

10. Trip the recirculation pumps
    - If boron injection is later required, tests have shown that natural circulation flow in the core will ensure adequate boron mixing.

EO-3.0
EO-4.0

11. Concurrently execute the following paths:
    a. The following steps addresses both control rod insertion and boron injection.
    b. Concurrent execution of the two methods specified for shutting down the Reactor is appropriate to optimize prompt shutdown.

Steps 11 & 18 point out on TP or flowchart. Steps will attempt to insert control rods and insert boron for negative reactivity effect.

EO-5.0

12. Inject Boron BEFORE - Suppression Pool temperature reaches Boron Injection Initiation Temperature (Fig. RPV-11)

a. If the core remains submerged, fuel integrity and RPV integrity are not directly challenged, even under failure-to-scram conditions.

EO-3.0

b. To prevent the potential failure of the Primary Containment, which may result from overheating of the Suppression Pool water, boron injection is required to shutdown the Reactor.

13. IF

The Reactor cannot be shutdown

THEN

Boron injection is required

a. Inject boron into the RPV with SLC

b. Place the ADS logic inhibit switches in "ON"

- ADS initiation is prevented to preclude power excursions caused by the injection of large volumes of cold unborated water from low pressure ECCS as RPV pressure decreases.

Cold unborated water is a source of positive reactivity.

EO-3.0

- If depressurization of the RPV is subsequently required, explicit direction is provided in the appropriate EOP.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
14. IF Boron cannot be injected with SLC, THEN Inject boron into the RPV using the hydro pump. a. This technique is slow and tedious but some attempt must be made to shutdown the Rx.	OP-36, Section H provides detailed instructions to accomplish this task.	EO-3.0
15. While executing the following steps: IF SLC tank level drops to 0 gals. THEN Verify that the SLC pumps automatically trip or manually trip the pumps. a. To ensure the long-term availability of the SLC pumps the operator is made aware of the need to ensure that the pumps trip or effect a pump trip at 0 gals. remaining in the SLC tank. b. This level will prevent the SLC pump suction inlet from becoming uncovered which may result in mechanical damage to the pumps.	SLC pumps have auto trip at 0 gallons.	EO-3.0

16. IF
RWCU is not isolated
THEN
Bypass Filter demineralizers

a. Bypassing of RWCU filter demineralizers desirable because:

1) The filter and demineralizer volume is not included in the calculation of the boron weight for shutdown. — EO-3.0

2) Demineralizer action removes boron from the Reactor coolant through ion exchange. — Boron dilution would reduce negative reactivity in core.

3) Boron may precipitate out in the relatively cool sections of the RWCU system piping.

b. If the system is needed for pressure control then the filter demineralizers must be bypassed.

17. WAIT until
SLC tank level drops to 900 gallons

a. Once boron injection is initiated it should be continued until sufficient boron has been injected to maintain the Reactor shutdown under cold conditions. — More difficult to stay shutdown cold due to the negative temperature coefficient. — EO-3.0

b. This preclude a potential criticality even if a positive temperature coefficient were to exist.	Positive temperature is possible at cold temperatures late in core life.	EO-3.0
18. Exit section RQ of this procedure and enter OP-101C.		
a. With Reactor shutdown assured, OP-101C provides appropriate instructions for post-shutdown conditions.	OP-101C is normal shutdown procedure.	
19. Reset ARI defeat ARI logic trips if necessary.		
• Since the initiation of ARI restricts other methods of inserting control rods, it is appropriate to defeat initiation signals which would otherwise prevent resetting ARI.		EO-3.0
20. Insert Control Rods using one or more of the following methods IAW OP-97 Section H.2.	OP-97 Section H.2 provides the method and allows the operator to use his judgement as to which path to follow.	
a. De-energize the Scram solenoids		
b. Vent the Scram air header		
c. Reset the Scram		
1) Defeating RPS logic trips if necessary.		
2) Drain the Scram discharge volume		
3) Initiate a Manual Scram		
d. Open individual Scram test switches		

e. Drive Control Rods

1) If necessary, defeat RSCS and RWM interlocks.

OP-95B Section H gives the procedure for these steps.

f. Vent control rod drive overpiston volumes.

21. Basis for the above steps

a. Both the inlet and outlet Scram valves must be open to Scram a control rod using accumulator pressure.

EO-3.0

b. De-energize the Scram pilot valve solenoids by tripping the EPAs that directly supply power to them. This is done by repositioning the power source selector switch.

c. If a pneumatic or electrical problem prevented the Scram valves from opening, venting the Scram air header should cause the Scram valves to open.

d. If the Scram cannot be reset, as would be the case if an automatic Scram signal had not cleared, appropriate instructions for manually inserting control rods are provided.

e. The Scram discharge volume must be drained after it has been filled in order for a subsequent Reactor Scram to effect inward rod motion.

f. Repeated Scrams and resets are performed so long as inward control rod motion continues and the Scram discharge volume can be vented and drained.

Q: What is the purpose of EOP-RQ?

A: To provide the necessary actions to initiate a Rx scram and, if unsuccessful, to shutdown the Rx by manual rod insertion and, if required, boron injection.

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

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 EOP-RQ?

A:
- N2-EOP-RP
- N2-EOP-RL

III. WRAP-UP

A. Summary

The RPV Reactivity Control Procedure provides the operator actions necessary to shutdown the Reactor by manual control rod insertion and, if required, boron injection. The preferred order being:

1. Control Rod insertion by Scram
2. Control Rod insertion manually
3. Liquid Poison by SLC
4. Liquid Poison by hydro pump

When the Reactor is and will remain shutdown, this procedure is exited and procedure OP-101 is entered.

EO-5.0