NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

Ø7-189-91

LESSON PLAN

ROD BLOCK MONITOR

02-REQ-001-215-2-82-4

Prepared By: Unit #2 Training Department

APPROVALS	SIGNATURES	DATE AND INITIALS REVISION 4
Training Supervisor Nuclear - Unit #2 G. L. Weimer		6/8/88
Assistant Training Superintendent - Nuclear R. Seifried		6/17/88
Superintendent of Operations Unit #2 R. G. Smith		6/16/88

Summary of Pages

Revision: 4 (Effective Date: 6/17/88)

Number of Pages: 12

Date	Pages
May 1988	1 - 12

NIAGARA MOHAWK POWER CORPORATION

38pp

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Attachment "A"

OBJECTIVE APPROVAL

Author: UNIT 2 OPS TRAINING

Training Dept: Unit II OPS.

Lesson Title: ROD BLOCK MONITOR

Lesson Plan #: NZ-OLP-32

Training Setting(s): Classroom

Purpose: 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.

Trainee Job Title: LICENSED OPERATOR CANDIDATE
Non-Licensed Operator
LICENSED OPERATOR REQUALIFICATION

Approvals/Review	Signatures	Date
Training Supervisor	[signature]	6/18/88
Plant Supervisor	[signature]	6/16/88
Training Analysts Supervisor	[signature]	5/19/88

When complete, attach this form to the master lesson plan.

I. TRAINING DESCRIPTION

A. Title: Rod Block Monitor

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: 2.5 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. Technical Specifications
   a. 3/4.1.4.3 Rod Block Monitor
   c. 3/4.3.6 Control Rod Block Instrumentation
2. Procedures
   a. N2-OP-92 Neutron Monitoring System
3. NMP-2 FSAR
   a. Design Basis, Vol 16, Section 7.7-40

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 and Continuing Training
4. NTP-12, Rev. 2, Unlicensed Operator Training

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 Two or a similar plant, or successful completion of SRO training, including Simulator certification at the SRO level for Nine Mile Point Unit Two.
   c. Qualified in instructional skills as certified by the Training Analyst Supervisor. 4
2. Students
   a. Meet eligibility requirements per 20CFR55, 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. N2-OLP-32
5. N2-OLT-32
6. See Section I.E.1
7. See Section I.E.2

B. Student Materials:

1. N2-OLT-32
2. See Section I.E.1
3. See Section I.E.2

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. LEARNING OBJECTIVES FOR THE ROD BLOCK MONITOR SYSTEM (RBM)

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

32-1 State the purpose of the Rod Block Monitoring System (RBM).

32-2 State the purpose of the following major components:

a. Low Amplitude Trip Circuit
b. Count circuit
c. Averaging circuit
d. Flow Control Trip Reference
e. RBM Selection Matrix
f. Gain change amplifier
g. RBM trip units.

32-3 For the automatic functions of the RBM.

a. List all signals which would cause the automatic function.
b. State the setpoint (if any) at which the signal will cause the automatic function.
c. State when and how the automatic function is bypassed, either automatically or manually.

32-4 State what other systems must be in operation to support the RBM system including principles of operation.

32-5 State the power supplies for the RBM.

32-6 Given N2-OP-92, use the procedure to identify the appropriate actions and/or locate information related to:

a. Start-Up
b. Normal Operations
c. Shutdown
d. Off-Normal Operations 4
e. Procedures for Correcting Alarm Conditions

32-7 SRO ONLY

Given Technical Specifications, identify the appropriate actions and/or locate information relating to Limiting Conditions for Operation, Bases and Surveillance Requirements for the Rod Block Monitor System.

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
I. INTRODUCTION			
A. Purpose	1		1
1. The Rod Block Monitor (RBM) is a monitoring system which ensures that local neutron flux levels do not exceed preset limits during control rod withdrawal.			
2. The RBM prevents the power in the fuel bundles surrounding the control rod being withdrawn from approaching thermal limits thereby preventing gross overpower in the local region which would not exceed core power limits.			
3. The RBM will apply rod withdrawal blocks to prevent a local over-power condition, when power is above 30%.			
B. General Description			
1. Rod Block Monitor is a subsystem of the Neutron Monitoring System.			
a. Composed of RBM ch's A/B which monitor local flux levels during rod withdrawal, and generates trip signals (if APRM's >30%).			
b. Generates flow-biased trip signals (blocks), related to RRS driving flow			
II. DETAILED DESCRIPTION			
A. Selection Matrix			
1. Each RBM channel contains a selection matrix which utilizes a signal from the Rod Select Module (RSM) to select up to eight Local Power Range Monitor (LPRM) detectors adjacent to the selected rod.			2e

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
a. RBM Channel A selects A and C LPRM detectors.	2		4
b. RBM Channel B selects B and D LPRM detectors.			
2. The LPRM signals are sent to the averaging circuit and the count circuit.			
B. Averaging Circuit		1	2c
1. The averaging circuit receives the LPRM signals from the selection matrix and outputs a local core average power signal.			
2. The average power signal is sent to a gain change amplifier.			
C. Gain Change Amplifier			2f
1. The Gain Change Amplifier compares the local power signal from the averaging circuit with the Average Power Range Monitor (APRM) channel output.			
a. RBM A uses APRM C and E.			4
b. RBM B uses APRM D and F.			
2. If the local core power is less than average core power, the gain change amplifier increase the local core power signal until it equals the average core power signal.			
a. This moves power as seen by the trip units closer to a trip point before rod withdrawal starts.			
b. This limits the amount that the selected rod may move to increase power.			

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
3. If the local core power is equal to or greater than average core power, no amplification takes place.	2	1	4
4. This comparison and gain change is called a nulling sequence and takes place immediately after a rod selected on the RSM.			
5. The output of the amplifier is applied to the RBM trip units and to recorders on panel 603.	3		
D. Low Amplitude Trip Circuits			2a
1. Each of the eight low amplitude trip circuits monitors an LPRM signal from the selection matrix that will be used by the averaging circuit and removes the signal it is monitoring, from the averaging circuit, if the signal fails low.			
2. An output from each low amplitude trip circuit is applied to the count circuit.			
E. Count Circuit			2b
1. The count circuitry ensures that a significant number (at least half) of the LPRM signals are being averaged by counting the number of low amplitude trip units untripped.			
2. The count circuit determines the number of LPRM signals required to be averaged by receiving a signal from the selection matrix and corrects itself for a rod from a center, 3 LPRM string, or 2 LPRM string group.			

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
3. Its output is sent to an RBM trip unit if an insufficient number of LPRM's are available.	3		2b
F. Flow Units			
1. Reactor Recirculation Flow Units provide two inputs to each RBM channel.			
a. RBM A from flow units A and C.			4
b. RBM B from flow units B and D.			
2. The flow signal with the lowest value is used.			
G. Flow Control Trip Reference	4		2d
1. The flow control trip reference circuit receives the flow input signal and outputs four flow reference signals for the RBM trip units.			
H. RBM Trip Units			2g,3
1. The RBM trip units compare the local core power with core flow and provide rod block signals to the reactor manual control sytem if setpoints are reached.			
2. By receiving the four flow references they provide the means by which a rod block can occur at a low, intermediate, or high level.			
a. The last flow reference is used for a backup trip unit, set above the high (normal) level to provide a rod block if the normal trip unit fails.			
3. A trip unit that compares power against a fixed reference will provide a rod block if the RBM channel fails low.			

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
4. The APRM signals used in the gain change amplifier comparator are also used by a trip unit for automatic bypassing of the RBM below 30% power.	4		
5. A rod block will occur if another trip unit determines the RBM is inoperative.			
III. INSTRUMENTATION, CONTROLS, AND INTERLOCKS			
A. Instrumentation			
1. Power			
a. The LPRM strings provide input to the RMB for local core power indication and averaging.			
b. The APRM channels provide input to the RMB for core power signal and automatic bypassing of the RBM.			
2. Flow	5		
a. The Reactor Recirculation flow units provide core flow for comparison with power in the RBM trip units.			
B. Controls			
1. Operator controls and indications are provided on panel 603 to set the intermediate and high trip levels and a joystick for manual bypass of one (1) channel (A or B).			4
C. Interlocks (Refer to Table 1)	8	3	

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
IV. SYSTEM OPERATION	5		3
A. Normal Operation			
RBM			
1. RBM auto initiated at 30% (increasing)			
2. Effects of increasing power -Alarm Set Lo lite lit			
a. As power increases (locally) the "Push to Set Up" light illuminates (rod block setpt minus 2%). This informs the operator that the Low Level rod block is near.			
b. Operator presses "Push to Set Up", which transfers the RBM to the next higher trip level (prevents getting an unwanted rod block).			
c. "Alarm Set Low" and "Push to Set Up" lights extinguish, "Alarm Set Intm" light illuminates.			
d. If further power increases (local) cause the Normal Transfer Level trip to reset, the "Push to Set Up" light illuminates again.	6		
e. Operator presses "Push to Set Up" which extinguishes "Push to Set Up" an "Alarm Set Intm" lights, and illuminates "Alarm Set Hi" light.			
f. Further rod withdrawal is limited to the rod block setpoint (Normal).			

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
g. The Rod Block Backup (Upscale) will limit withdrawal if others fail.	6		3
3. RBM will be automatically bypassed when power decreases below 30%.			
B. Infrequent Operation			
RBM Infrequent Operation			
Bypasses (RBM)			
1. One RBM may be manually bypassed without a rod block.			
2. Automatic bypasses of RBM:			
a) Peripheral rod selected			
b) No rod selected			
c) APRM level <30%			
Bypass termination initiates null sequence.			
V. SYSTEM INTERRELATIONS	6		4,5
A. Plant Electrical Distribution			
The RBM is powered by 120 VAC instrument bus 2 VBS*PNLA100 and 2 VBS*PNLB100			
B. Neutron Monitoring System	7		
The RBM receives signals from APRM and LPRM system.			
C. Reactor Manual Control System			
The RBM receives signals from the Rod Select Module and sends output to Reactor Manual Rod Control System.			

VI. LESSON CONTENT

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O.
VI. DETAILED SYSTEM REFERENCE REVIEW	7		
Review each of the following referenced documents with the class.			
A. Technical Specifications			7
1. 3/4.1.4.3 Rod Block Monitor			
2. 3/4.3.6 Control Rod Block Instrumentation			
B. Procedures			6
1. N2-OP-92 Neutron Monitoring System			
VII. RELATED PLANT EVENTS			
A. Refer to Addendum "A" and review related events with class (if applicable).			
VIII. SYSTEM HISTORY			4
A. Refer to Addendum "B" and review related modifications with class (if applicable).			
IX. WRAP-UP			
A. Review the Student Learning Objectives			