NIAGARA MOHAWK [illegible] CORPORATION

NINE MILE POINT [illegible] STATION

02-LOT-001 [illegible] Revision 6

TITLE: REACTOR RECIRCULATION SYSTEM

	SIGNATOR	DATE
PREPARER	[signature]	4-8-91
TRAINING AREA SUPERVISOR	[signature]	4/11/91
TRAINING SUPPORT SUPERVISOR	[signature] for J. LeClair	4-15-91
PLANT SUPERVISOR/ USER GROUP SUPERVISOR	[signature] for D. TOPLEY	4/19/91

Summary of Pages

(Effective Date: 4/23/91)

Number of Pages: 27

Date	Pages
April 1991	27

THIS LESSON PLAN IS A GENERAL REVIEW

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION: _____

DATA ENTRY: _____

RECORDS: _____

30 5/3/90

ATTACHMENT 6
LESSON PLAN TEMPORARY/PUBLICATION/ADDENDUM CHANGE FORM

The attached change was made to:

Lesson plan title: Reactor Recirc

Lesson plan number: 02-601-001-202-2-01

Name of instructor initiating change: McSparran

Reason for the change: INCORPORATES MOD 87 MX143 For Vibration and displacement monitoring. (Page 27)

Type of change:

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

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 7/31/91

Training Area Supervisor (or designee): _____ /Date 8/2/91

ATTACHMENT 6

LESSON PLAN TEMPORARY/PUBLICATION/ADDENDUM CHANGE FORM

The attached change was made to:

Lesson plan title: REACTOR RECIRCULATION SYSTEM

Lesson plan number: O2-LOT-001-202-2-01

Name of instructor initiating change: CARPENTIER

Reason for change: TCO-02-LOT-91-002 CHANGES THE THE ALERT SETPOINT FOR THE RECIRC PUMP VIBRATION. THIS ADDENDUM CHANGE IS TO ADD REVIEW OF THESE SETPOINT CHANGES TO THE PROCEDURE REVIEW SECTION (pg. 25) OF THE LESSON PLAN.

Type of change:

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

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: [signature] /Date 5-13-91

Training Area Supervisor (or designee): [signature] /Date 5/13/91

INSTRUCTIONS:

The instructor should complete the following:

1. Enter the lesson plan title
2. Enter the lesson plan number
3. Enter the name of the instructor initiating the change
4. Enter the reason(s) for the change. Include page numbers affected.
5. Place a check in the space provided to indicate whether the change is a Temporary, Publication or Addendum change.
6. Have the Training Area supervisor indicates the disposition by placing a check in the appropriate space provided.
7. The instructor should sign and date and obtain the approval of the Training Area Supervisor (or designee).

I. TRAINING DESCRIPTION

A. Title of Lesson: Reactor Recirculation System

B. Lesson Description: This lesson contains information pertaining to the Reactor Recirculation System. The scope of this training is defined by the learning objectives and in general covers the knowledge required of a Licensed Control Room Operator.

C. Estimate of the Duration of the Training: 4 hours

D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written exam passing grade of 80% or greater.

E. Method and Setting of Instruction:
This lecture should be conducted in the classroom.

F. Prerequisites:

1. Instructor:
   a. Certified in accordance with NTP-16.
2. Trainee:
   a. Initial License Candidate - In accordance with the eligibility requirements of NTP-10.
   b. Licensed Operator Requal - In accordance with the requirements of NTP-11.

G. References:

1. Technical Specifications
   a. 3.4.1.1, Recirculation Loops
   b. 3.4.1.2, Jet Pumps
   c. 3.4.1.3, Recirculation Loop Flow
   d. 3.4.1.4, Idle Recirculation Loop Startup
   e. 3.3.4.1, ATWS Recirculation Pump Trip System Instrumentation
   f. 3.3.4.2, End of Cycle Recirculation Pump Trip System Instrumentation
2. Procedures
   a. N2-OP-29, Reactor Recirculation System
   b. N2-OP-101A, Plant Startup
   c. N2-OP-101C, Plant Shutdown
3. NMP-2 FSAR
   Design Basis, Vol. 13, Chapter 5

II. REQUIREMENTS

A. AP-9 Administration of Training

B. NTP-10 Training of Licensed Operator Candidates

C. NTP-11 Licensed Operator Requalification Training

D. NTP-12 Unlicensed Operator Training

III. TRAINING MATERIALS

A. Instructor Materials:

1. Classroom
2. Lesson plan
3. TR
4. Transparency package
5. Overhead projector
6. Applicable references
7. Trainee handouts
8. Course Evaluation Sheets

B. Trainee Materials:

1. Handouts (can include text, drawings, objectives, procedures, etc.)
2. Pens, pencils, paper
3. Course Evaluation

IV. EXAM AND MASTER ANSWER KEYS

A. Exams will be generated and administered as necessary.

B. Exams and master answer keys will be on permanent file in the records room.

V. LEARNING OBJECTIVES

A. Terminal Objectives:

Upon completion of this lesson, the trainee will demonstrate the knowledge to:

TO#	Terminal Objective	Task Number
TO-1.0	Perform the actions for one recirc pump trip	2000010501
TO-2.0	Perform the actions required for two recirc pump trip	2000020501
TO-3.0	Determine that power oscillations, following recirc flow reduction are occuring and take appropriate actions	2009160601
TO-4.0	Perform actions for a recirc pump seal malfunction	2009260501
TO-5.0	Respond to an increase in recirculation flow	2009270501
TO-6.0	Perform lineups on the Recirc System	2020010101
TO-7.0	Monitor the recirc pump MG sets from the Control Room	2020020101
TO-8.0	Conduct RCS pressure/temperature verification, N2-OSP-RCS-@001	2020020201
TO-9.0	(SRO ONLY) Determine jet pump operability	2020030203
TO-10.0	Startup a second recirc pump	2020040101
TO-11.0	Monitor operation of recirc pumps	2020060101
TO-12.0	Monitor jet pump operation	2020070101
TO-13.0	Secure a recirc pump	2020080101
TO-14.0	(SRO ONLY) Determine power to flow to be within Tech Spec limits	2029010403
TO-15.0	(SRO ONLY) Determine applicable limits for single loop operation	2029020403
TO-16.0	(SRO ONLY) Determine if flow mismatch exceeds Tech. Spec. requirements	2029050403
TO-17.0	Transfer recirc pump speed from 15 Hz to 60Hz	2029090101
TO-18.0	Restart a tripped recirc pump from single loop operation	2029140101
TO-19.0	Transfer a recirc pump from 60Hz to 15Hz	2029150101

TO-20.0	Operate the Recirc System in single loop mode	2029180101
TO-21.0	Monitor recirc pump performance parameters	2029260101
TO-22.0	Perform the required actions for a loss of seal purge and/or RBCLC cooling to the recirc pump	2029280401
TO-23.0	Perform the actions necessary during low core flow conditions	2029290101
TO-24.0	Perform the actions required for recirc pump high vibration (motor)	2029310401
TO-25.0	Discuss Technical Specifications associated with single loop operation	2029320501
TO-26.0	Startup a recirculation pump from no flow	2029360101
TO-27.0	(SRO ONLY) Direct the removal of a recirc pump from service	3419080303
TO-28.0	(SRO ONLY) Direct reactor power changes (>10%) using recirc flow or control rods	3419140103
TO-29.0	(SRO ONLY) Direct the actions required for power oscillations following a two recirc pump trip evolution	3449050503
TO-30.0	(SRO ONLY) Respond to a reactor recirc pump trip	3449650403
TO-31.0	(SRO ONLY) Respond to a trip of both reactor recirc pumps	3449660403
TO-32.0	(SRO ONLY) Respond to a loss of seal injection water to the reactor recirc pumps	3449670403
TO-33.0	(SRO ONLY) Respond to a loss of cooling water to the recirculation pumps	3449680403
TO-34.0	(SRO ONLY) Respond to a recirc pump seal failure	3449700403
TO-35.0	(SRO ONLY) Operate the plant in the single recirculation loop mode	3449710403

B. Enabling Objectives:

EO-1.0 Explain the purpose and function of the Reactor Recirculation System.

EO-2.0 Describe the purpose and function of each of the following major components of the Reactor Recirculation System.

a. RRS Suction Valve
b. RRS pumps
c. RRS Discharge Valve
d. RRS Flow Elbow
e. RRS Control Valve
f. RRS Pump Seals

EO-3.0 State the set point and describe the purpose of the following interlocks.

a. RRS Pump Start Sequence Interlocks
b. High Speed Start Sequence Interlocks
c. Low Speed Start Sequence Interlocks
d. Manual High-to-Low Speed Transfer
e. Auto High-to-Low Speed Transfer
f. Low-to-High Speed Transfer
g. Trips From High Speed
h. Trips From Low Speed
i. Temperature Interlocks

EO-4.0 Describe the interrelationship between the Reactor Recirculation System and the following list of systems.

a. Reactor Building Closed Loop Cooling
b. Reactor Recirculation Flow Control
c. Control Rod Drive Hydraulics
d. Residual Heat Removal
e. Reactor Water Cleanup
f. Feedwater Level Control
g. Reactor Protection System
h. Neutron Monitoring
i. Redundant Reactivity Control System
j. Electrical Systems

EO-5.0 Explain the design basis for each of the precautions and limitations listed in N2-OP-29.

EO-6.0 Determine and use the correct procedure to identify the actions and/or locate information related to the following Reactor Recirculation System operations.

a. Startup
b. Shutdown
c. Normal Operations
d. Off-Normal Operations
e. Annunciator Responses

EO-7.0 Describe the immediate operator actions required for a given set of specific plant conditions.

EO-8.0 (SRO ONLY) Determine the appropriate bases, limiting conditions for operation, and limiting safety system settings, and/or action statement as applicable when given the NMP2 Technical Specifications and a set of plant conditions.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
I. INTRODUCTION		
A. Introduction		
1. Have students fill out TR.		
2. Explain purpose of Course Evaluation and how to use it.		
3. Explain method of evaluation.	Describe daily quizzes/weekly exams.	
4. Review Student Learning Objectives.		
B. System Purpose		EO-1.0
1. Provides forced circulation of water through the reactor core.		
2. In conjunction with the Reactor Recirculation Flow Control (RRFC) System, provides a means of controlling reactor power over a limited range without adjusting control rods.		
C. General Description		
1. The RRS consists of two parallel loops each containing:	Show T.P. Figure 1	
a. 10 jet pumps (internal to vessel)		
b. one recirculation pump		
c. one flow control valve		
d. one suction and one discharge stop valve		
e. instrumentation		
f. connections to vessel		

2. Recirculated water consists of saturated water returning from steam separators and dryers which is then subcooled by incoming feedwater.
3. Portion of this coolant is drawn into recirculation pump suction piping which penetrates vessel downcomer annulus.
   a. Coolant passes through pump suction valves, the pumps, the flow control valves, pump discharge valves, and into jet pump supply header.
   b. Flow passes through multiple (5 per loop) nozzles on vessel shell which then connects the flow (driving flow) to jet pump nozzles (10 per loop)
   c. Driving flow passes through jet pumps entraining water (driven flow) from downcomer region of the vessel.
   d. The combined flow (driven and driving) is discharged through jet pump diffusers to core inlet pleuum.
4. Sum of all jet pump flow (20 total) is called core flow
   a. 90% enters fuel bundles
   b. 10% is designed bypass flow to cool incore components.

II. DETAILED DESCRIPTION

A. Recirculation Loop Suction — Show T.P. Fig 2 — EO-2.0a

1. Suction taken from the reactor downcomer annulus.
2. Flow sensing elbow used to measure recirculation loop flow.
3. WCS inlet comes from a line off each recirculation loop suction.
4. "A" recirculation loop suction has an additional penetration that is not present on the "B" loop.
   a. This penetration provides for the suction to shutdown cooling mode of RHS.
5. RRS pump differential pressure transmitter taps are located on the suction and discharge of the RRS pump.
6. Suction Isolation Valve (MOV-10A/B)
   a. Motor operated, double disk, gate valves.
   b. Remote operated from the Control Room on panel P602.
   c. Used to isolate recirc pump suction.

B. Reactor Recirculation Pumps — Show T.P. Fig 3 — EO-2.0b

1. RRS pumps are single-stage, centrifugal pumps used to provide the "driven" portion of core flow.

2. Motors are energized from 60 Hz, 13.8 Kv electrical buses for 100% rated speed.

Show T.P. Fig 7

3. For reactor startup or low power operations the motors are energized from 15Hz, LFMG sets for 25% rated speed.
4. Rated flow 47,200 gpm at a discharge pressure head of 805 ft.
5. Net Positive Suction Head
   a. Low speed NPSH is from the height of water in the reactor vessel.
   b. High speed NPSH is mostly provided by the subcooling effect of incoming feedwater flow with remainder provided by height of water.

C. Reactor Recirculation Pump Shaft Seals

Show T.P. Fig 5

EO-2.0f

1. Dual mechanical shaft seal.
2. Can be replaced without removing the motor from the pump.
3. Each seal is designed for full pump pressure.
4. Breakdown bushing reduces leakage to approx. 50 gpm in the event of gross failure of both shaft seals.

5. Seal purge flow of 3 to 5 gpm from the CRDH system keeps the seal clean and cool.
   a. 1 gpm as staging flow through seal no. 1.
   b. Remainder flows around shaft and throttle bushing into impeller cavity.

Show T.P. Fig 6

6. Cooling of the pump seal cavity is provided by the Reactor Building Closed Loop Cooling Water through a cooling jacket around the seal assembly.
7. Each seal provides about 500 psid across its surface; staging flow allows the second seal to provide some of the sealing load (equal pressure drop across each seal).
8. Controlled leak off (approx. 1.3 gpm) is directed to the equipment drain system through 2RCS-AOV90A(B). This valve is normally open but will isolate if the recirc pump is not running and both RDS pumps are not running. AOV-90 fails open on a loss of power.

TCO 02-LIC-90-016

9. Detecting a seal failure

Use Figure 6 to explain seal failures and how they are detected.

D. <u>Reactor Recirculation Pump Motor</u>

1. Three-phase, induction motor- capable of 100 and 25 percent rated speed.

2. Kingsbury thrust bearings and radial bearings are lubricated from oil reservoirs in the motor. Levels are monitored by level switches. Oil coolers cooled by CCP.
3. Air-water heat exchanger cools the motor windings. CCP provides the coolant flow through the heat exchanger cooling coils.
4. Slow coastdown time aids in core cooling during a loss of electrical power transient.

E. Recirculation Pump Speed Control

1. Breaker arrangement determines pump speed.
2. 5 breakers
   a. CB-1 supplies power to the LFMG set drive motor
   b. CB-2 connects the LFMG set generator output to the RRS pump motor.
   c. CB-3, CB-4, and CB-5 supply the 60 Hz power to the pump motor.
3. All breakers are interlocked to prevent paralleling both power sources to the pump simultaneously.
4. Pump is always started at high speed because the LFMG cannot supply the breakaway torque required.
5. Logic controls sequencing of breakers
   a. High speed - Pump accelerates to 100% speed and remains there.

Use T.P. of Recirc Pump Speed Control Handout to explain.

b. Slow speed - Pump accelerates to 95% speed then downshifts to slow speed.

F. LFMG Set

1. LFMG sets are driven by 400 hp Kv buses.
   a. Externally excited
   b. Generator output voltage is maintained by voltage regulators that vary the field current to the exciter.
2. Bearings lubricated by individual internal oil reservoir.

G. Recirc Flow Control Valve (HYV 17A/B) — EO-2.0e

1. 24 inch, electrohydraulic operated.
2. Provides linear flow response throughout its entire stroke.
3. Positioned by an independent Hydraulic Control Unit (HCU).
4. FCV fails "as is" on loss of power or control signal.

Operation of the Flow Control Valve will be covered in detail in the Reactor Recirc Flow Control lesson.

H. Discharge Isolation Valve (MOV-18A/B) — EO-2.0c

1. Motor operated, double disc, gate valves,
2. Remotely operated from Control Room panel 602,
3. Open against RCS pump shutoff head.
4. Used to isolate the pump discharge from the Rx vessel.

I. Reactor Water Sample Connection

1. Samples taken from the "A" recirculation loop - used when WCS out of service.
2. Sample station located outside the drywell.

J. Reactor Recirculation Loop Discharge

1. Each pump discharges to a semi-circular distribution manifold.
   a. Feeds 5 vertical risers
   b. Each riser feeds two jet pumps
2. Located in annular region to minimize flux exposure to the nozzles and welds.

Use T.P. of Fig 1 to show location

3. Contains RHS Shutdown Cooling return line (each loop).
4. "A" loop contains sample line.
5. Jet pumps utilized to minimize the pump and piping size requirements.

K. Reactor Vessel Bottom Head Drain

1. Connects to the Reactor Water Cleanup System.
2. Temperature sensors provide indication and inputs to RRS pump interlocks.

III. INSTRUMENTATION, CONTROL AND INTERLOCKS

A. Instrumentation

1. Flow
   a. Detected by flow elbow on each pump suction line.

EO-2.0d

b. Flow elbow signal sent to four flow drawers to be used by Nuclear Instruments, Rod Block Monitor, and Process Computer.

c. Indication on Panel 602 from Flow Drawer "A".

2. Pressure

a. Pump seals and D/P are indicated on Panel 602.

B. Controls

1. Panel 602 Control Switches are:

a. Pump suction/discharge valves

b. CB 1-5

c. Loop Flow Control Valves

C. RRS Pump Start Sequence Interlocks

Use T.P. of Recirc. Pump Speed Control to explain start sequence.

EO-3.0a

1. The following permissives must be met before any start sequence will initiate.

a. Incomplete start sequence relay not actuated.

b. CB-5 breaker fully inserted in switchgear

c. FCV in Manual mode.

d. FCV at minimum position

e. Pump suction valve greater than 90% open
f. Pump discharge valve greater than 90% open
g. Vessel thermal shock interlocks satisfied

2. Incomplete start sequence relays activate:
   a. On a low speed start if pump is not operating between 20-26% speed with CB-2 closed after 40 sec.
   c. On a high speed start if the pump is not at 100% speed after 40 sec.
   d. Loss of 125 VDC logic power during any start sequence will immediately initiate the incomplete sequence.
   e. Incomplete sequence relay trips CB-1 and CB-5.
   f. Incomplete start sequence seal-in is reset by taking respective high speed control switch to pull-to-lock.
3. FCV is in manual during pump start to prevent valve cycling.
4. FCV is in minimum to prevent excessive starting current during pump starts.

5. a. Suction valve open - allows adequate suction pressure to pump.
   b. Discharge valve open - provides a flowpath for pump minimum flow requirements.
6. Temp Interlocks — EO-3.0i
   a. Temperature difference between the reactor vessel bottom head drain and steam dome shall not exceed 145°F.
   b. Temperature difference between the steam dome and the applicable RRS loop suction shall not exceed 50°F.
   c. Temperature difference between the loop suction lines shall not exceed 50°F.

D. <u>High Speed Start Sequence Interlocks</u> — Use T.P. of Recirc. Pump Speed Control Handout to explain start sequence. — EO-3.0b

1. For CB-5 to close the following additional permissives must be met:
   a. Feedwater flow >24% (Power interlock)
   b. Feedwater flow >24% (cavitation interlock)
   c. Reactor vessel level above level 3 - reduces velocity head effects on WR level instruments.

d. Low speed start sequence not activated - ensures CB-5 and CB-2 do not close simultaneously

e. RR pump trip signal (EOC-RPT) not present - signal prevents closing CB-3 and CB-4.

f. Pump suction/dome steam differential temp. >10.7°F - ensures adequate NPSH for he jet pumps and RRS pumps.

g. Pumps speed less than 20% - prevents excessive shaft torques in case the pump has tripped from high speed.

h. Pump motor lockout relay reset - prevents pump start if tripped.

i. LFMG lockout relay reset - prevents LFMG start if tripped

j. CB-2 open - ensures pump power supply lineup correct.

k. CB-3 closed - ensures pump power supply lineup correct.

l. CB-4 closed - ensures pump power supply lineup correct.

E. Low Speed Start Sequence Interlocks

1. CB-5 closes to accelerate the pump when the following permissives are satisfied:
   a. Feedwater flow <24% (power interlock)
   b. Feedwater flow <24% (Cavitation interlock)
   c. Pump speed less than 20%
   d. Pump motor lockout relay reset
   e. LFMG generator lockout relay reset
   f. CB-2 open
   g. CB-3 and CB-4 closed
2. Simultaneously CB-1 closes to start the LFMG if the following permissives are satisfied:
   a. Low speed start sequence activated
   b. CB-1 control switch not in the PULL TO LOCK position
   c. Pump motor lockout relay reset
   d. CB-2 open
   e. LFMG generator lockout relay reset
3. At 95% speed CB-5 trips, allowing the pump to coast down.
4. When pump speed between 20-26%, CB-2 closes to hold pump at 25% speed if the following permissives are satisfied:
   1. Pump speed 20 - 26%

Use T.P of Recirc. Pump Speed Control Handout to explain start sequence.

EO-3.0c

2. CB-1 Closed
3. Motor line voltage less than 75 VAC in 12 seconds
4. LFMG at Rated Volts
5. CB-2 in normal
6. CB-5 open

F. Manual High-to-Low Speed Transfer — Use T.P. of Fig 7 to show breaker sequencing — EO-3.0d

1. Both CB-5 control switches to Transfer M-G position
2. CB-5 trips, CB-1 closes
3. As the pump coasts down, LFMG comes up to rated speed and voltage.
4. CB-2 closes when pump speed between 20-26% (460-350 rpm).
5. Any high to low speed transfer shifts FCV to manual mode.
6. Incomplete transfer actuated if not 20-26% speed with CB-2 closed in 40 sec. - trips CB-1.

G. Auto High-to-Low Speed Transfer

1. ΔT between steam dome and recirc. loop suction <10.7°F for 15 sec. — EO-3.0e
2. FW flow <24% rated for 15 sec.
3. Vessel water level < level 3.
4. EOC-RPT trip present
5. RRCS high dome pressure signal present (1050 psig)

H. Low-to-High Speed Transfer — EO-3.0f

1. CB-5 control switch is positioned to START.
2. CB-1 and CB-2 will trip if the following permissives are satisfied:
   a. Reactor power level interlock satisfied (>24% FW flow)
   b. FW flow >24% (cavitation interlock)
   c. Vessel level above level 3
   d. Low speed auto start sequence not activated
   e. EOC-RPT relays not actuated
   f. Dome steam/pump suction interlock not actuated (>10.7°F)
3. CB-5 closes when the following permissives are satisfied:
   a. Pump speed less than 20%
   b. Pump motor lockout relay reset
   c. LFMG generator lockout relay reset
   d. CB-2 open
   e. CB-3 and CB-4 closed

I. Trips From High Speed — EO-3.0g

1. Reactor Vessel Level 2 (RRCS) Trip
2. Suction valve less than 90% open.
3. Discharge valve less than 90% open.

4. Pump motor lockout relay actuated.
5. CB-3 open/Control Switch in PTL.
6. CB-4 open/Control Switch in PTL.
7. CB-5 open/control switch in PTL.

J. Trips from Low Speed — EO-3.0h

1. Suction valve less than 90% open.
2. Discharge valve less than 90% open
3. RRCS Level 2 Trip.
4. LFMG generator lockout relay actuated.
5. Pump motor lockout relay actuated.
6. CB-1 control switch positioned to TRIP or PULL TO LOCK.
7. Loss of 240 VAC to LFMG voltage regulator.
8. RRCS Trip, high RPV pressure with APRMs not downscale after a TD of 25 seconds
9. CB-2 control switch to trip or Pull to Lock
10. Incomplete sequence relay actuated

K. Flow Control Valve

1. Valve motion inhibit on high drywell pressure.

IV. SYSTEM OPERATION

A. Normal

1. Startup
   a. FCV to minimum, pumps started on high voltage supply.
   b. When pump approaches 95% speed, high speed breaker tripped. When pumps coast to 25% then low speed breaker closes.
   c. Pump at 25% speed (15 Hz) (450 rpm)
2. Low to High
   a. Power at approximately 35%, increasing
   b. Shut flow control valves to minimum
   c. Shift pumps up individually.
3. High to Low
   a. Power at approximately 35%, decreasing
   b. Downshift pumps simultaneously
   c. Open flow control valves fully.
4. Shutdown
   a. When directed, trip LFMG sets
   b. Shut discharge blocking valve (5 mins) to stop pump.

V. SYSTEM INTERRELATIONS

Use T.P. of R.R. Overview Handout to show interrelations.

A. Reactor Building Closed Loop Cooling
Cools recirculation pump motor windings, bearings and mechanical seals. EO-4.0a

B. Reactor Recirc Flow Control
Controls loop flow control valves. EO-4.0b

C. Control Rod Drive Hydraulics
Provides purge water to RRS pump seals. EO-4.0c

D. Residual Heat Removal
RRS "A" loop is shutdown cooling supply. Return is to both loops. EO-4.0d

E. Reactor Water Cleanup
RRS A & B loops provide supply for RWCU system EO-4.0e

F. Feedwater Level Control
Provide low feedwater flow and low total feedwater flow interlocks. EO-4.0f

G. Reactor Protection System
Supplies EOC-RPT Trip signal for reactor recirculation pump EO-4.0g

H. Neutron Monitoring
Flow elbows supply flow signal to Neutron Monitoring EO-4.0h

I. Redundant Reactivity Control System
Provides ATWS trip signal to RRS pumps EO-4.0i

J. Electrical Systems
Provide Electrical Power EO-4.0j

VI. DETAILED SYSTEM REFERENCE REVIEW

Review each of the following referenced documents with the class

A. Procedures

1. N2-OP-29 Reactor Recirculation System
2. N2-OP-101A Plant Startup
3. N2-OP-101C Plant Shutdown

B. Technical Specifications

Specification For:	SL	LSSS	LCO	SR	Applicable Section Including Bases
1. Recirculation loops		3.4.1.1		4.4.1.1	
2. Jet Pumps		3.4.1.2		4.4.1.2	
3. Recirculation Loop Flow		3.4.1.3		4.4.1.3	
4. Idle Recirculation Loop Startup		3.4.1.4		4.4.1.4	
5. ATWS Recirculation Pump Trip System Instrumentation		3.3.4.1		4.3.4.1	
6. End of Cycle Recirculation Pump Trip System Instrumentation		3.3.4.2		4.3.4.2.1	

Special attention should be given to reviewing the sections of OP-29 dealing with operation in the "Restricted Zone" and power oscillations.

Implement setpoint change for High Vibration Alert level when coming N2-OP-29. per TCO-02-LOT-91-002

5-13-91

5/13/91

EO-5.0
EO-6.0
EO-7.0
TCO
02-LIC
90-026
EO-8.0

TCO
per 02-LOT-91-002
5-13-91

VII. RELATED PLANT EVENTS

A. Modified Case Study

Using the modified case study format, discuss the events described in SER 14-88, "SCRAM CAUSED BY NEUTRON FLUX OSCILLATIONS" (LaSalle Event)

Have each student read a paragraph of the event description. After each paragraph, have the class pick key points of that paragraph to be listed on the board to aid in analysis of the event.

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After reading the event description use a guided class discussion to determine:

1. Probable root cause
2. Recommended corrective actions (as if you were the licensee)
3. Relevance to NMP2 (ie. is the event described, a concern at NMP2?).
4. Actions that can be taken to prevent this event from happening at NMP2.

INSTRUCTOR NOTE: Use of OEA response to NRC BULLETIN NO. 88-07 may be useful for the discussion of items 3 and 4 above.

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VIII. SYSTEM HISTORY

A. Modifications

1. PN2Y87MX157: Reactor recirculation pump seal replacement.
2. PN2Y87MX184 Replacement of 2RCS*AOV45A&B
3. PN2Y87MX143 Vibration Monitoring for RCS pumps.

IX. WRAP-UP

A. Review Student Learning Objectives