07-~~[illegible]~~ 73.2 -91

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-NLO-001-204-2-01 Revision 0

TITLE: REACTOR WATER CLEANUP SYSTEM

	SIGNATURE	DATE
PREPARER	Robert Hagquist	6-18-90
TRAINING SUPPORT SUPERVISOR	F.A. Peeling for J LeClair	6-21-90
TRAINING AREA SUPERVISOR	Richard K. Slade Jr.	6-25-90
PLANT SUPERVISOR/ USER GROUP SUPERVISOR	[illegible] FOR MJ Colomb	7/12/90

Summary of Pages

(Effective Date: 7/12/90)

Number of Pages: 41

Date	Pages
June 1990	1 - 41

MASTER CONTROLLED DOCUMENT

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION: ____

DATA ENTRY: ____

RECORDS: ____

6/3/32

59

I. <u>TRAINING DESCRIPTION</u>

A. Title of Lesson: Reactor Water Cleanup System

B. Lesson Description: Provide instruction in the function and operation of plant equipment associated with the Reactor Water Cleanup System. Emphasis is placed on knowledge and activities normally associated with Auxiliary Operator duties in the plant.

C. Estimate of the Duration of the Lesson: 5 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/facilitated discussion should be conducted in the classroom.

F. Prerequisites:

1. Instructor:

a. Certified in accordance with NTP-16.

2. Trainee:

a. In accordance with NTP-12.

G. References:

1. SD-37, Reactor Water Cleanup System Description
2. N2-OP-37, Reactor Water Cleanup System
3. GEK-8333, RWCU Operation and Maintenance Instruction
4. GE SIL 436

II. <u>REQUIREMENTS</u>

A. Requirements for class:

1. INPO NLO Guidelines
2. NTP-12

III. <u>TRAINING MATERIALS</u> [(*) optional]

A. Instructor Materials:

1. Whiteboards, markers, erasers
2. Transparencies
3. Overhead Projector
4. Working Copy of this Lesson Plan
5. Scientific Calculator(*)
6. Handouts, worksheets with answer keys (*)

7. Student Text
8. Copies of Activities #1 through #6 (with answer sheets if desired)
9. Flipchart (*)

B. Trainee Materials:

1. Text
2. Pens, pencils, paper
3. Binders (*)

IV. EXAM AND MASTER ANSWER KEYS

A. Exams and answer keys will be on permanent file in the Records Room.

V. LEARNING OBJECTIVES

A. Terminal Objectives:

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

TO-1.0	Perform line-ups on the Reactor Water Clean-up System.	(2040010104)
TO-2.0	Perform walkdown of the Reactor Water Clean-up System and identify major components.	(2049040104)
TO-3.0	Monitor the Reactor Water Clean-up System.	(2050130104)
TO-4.0	Perform initial fill and vent of the Reactor Water Clean-up System.	(2049030104)
TO-5.0	Perform Venting of the Non-regenerative and Regenerative Heat Exchangers.	(2049020104)
TO-6.0	Backwash a Filter/Demineralizer.	(2040110104)
TO-7.0	Precoat a Filter/Demineralizer.	(2049060104)
TO-8.0	Place a Filter/Demineralizer in service.	(2040090104)
TO-9.0	Backwash a Filter/Demineralizer Strainer	(2040160104)
TO-10.0	Operate the Reactor Water Clean-up System while reducing Reactor pressure.	(2040030104)
TO-11.0	Remove the Reactor Water Clean-up System from service with the Reactor at rated pressure.	(2040050104)
TO-12.0	Place a cold Reactor Water Clean-up pump in service with the system hot.	(2049050104)

B. Enabling Objectives:

EO-1.0 Explain the purpose and function of the Reactor Water Clean-up System.

EO-2.0 List the major components of the Reactor Water Clean-up System.

EO-3.0 Given a list of major components in the Reactor Water Clean-up System, describe the purpose and function of the:

a. System inlet taps
b. Reactor Water Cleanup Pumps
c. Regenerative Heat Exchanger
d. Non-Regenerative Heat Exchanger
e. Filter/Demineralizer Units
f. Precoat Pump

g. Precoat Tank

h. Resin Feed Tank

i. Resin Metering Pump

j. Precoat and Resin Agitators

k. Holding Pump

l. Reject Line

m. Feedwater Return Thermal-Sleeved Tees

Dont use Resin Precoat Tank or Pump

EO-4.0 Regarding the Reactor Water Clean-up System, 1)-locate the correct drawing and 2)-use drawings to perform the following

a. Identify electrical and mechanical components

b. Trace the flowpath of fluids

c. Describe system operation

d. Locate information about specific components

e. Identify system interrelations

EO-5.0 List the systems that interrelate with the Reactor Water Clean-up System and describe that interrelationship.

EO-6.0 For the Precautions and limitations listed in N2-OP-37 explain the basis for each Precaution and Limitation.

EO-7.0 Regarding the Reactor Water Clean-up System, determine and use the correct procedure to identify the actions and/or locate information related to NLO duties for the following:

a. Start-up

b. Normal operation

c. Shut down

d. Off normal operation

e. Correcting alarm conditions

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
I. INTRODUCTION	NOTE: Inform trainees about enabling objectives work sheet.	
A. Review Learning Objectives		
B. System Purposes		
1. Removes Fission products, corrosion products, and other soluable and insoluable impurities.		EO-1.0
a. Minimizes fouling of Heat Transfer surfaces		
b. Fewer impurities to become activated which reduces Beta/Gamma Radiation levels.		
2. Provides for Reactor Coolant removal during all modes of plant operation.	NOTE: Coolant removal is known as "Flow Rejection"	
3. In an emergency, the WCS System can be used to aid in Reactor Vessel Pressure Control.	NOTE: As directed by the EOP's only	
C. The System is Designed to:		
1. Minimize system heat loss		
2. Enable a major portion of the system to be serviced while in operation		
3. Prevent the removal of Reactivity Control Material introduced into the Reactor by Standby Liquid Control System.		
D. System Flow Path	Use TP 1 to illustrate system flowpath	EO-4.0b
1. 3 Inlet water taps		
a. One from each Recirc. Pump suction line		
b. The third from vessel bottom head drain line		

2. 2 Reactor Water Cleanup Pumps provide motive force
3. Through the tube side of the Regenerative Heat Exchanger
4. Through the tube side of the Non-regenerative Heat Exchanger
5. Normally flows through filter/demins next
   a. Can bypass filter/demins to reject or,
   b. Bypass directly to shell side of Regenerative Heat Exchanger.
6. After filter/demins flow to reject or Regenerative Heat Exchanger (shell side).
7. Water is returned to the Reactor via Feed Water Lines.

II. DETAILED DESCRIPTION

A. System Inlet Piping

1. Suction from "A" Recirc. Loop — EO-2.0, EO-3.0a
   a. Suction side of Recirc. Pump
   b. Via Isolation Valve 2WCS-MOV105
2. Suction from "B" Recirc. Loop
   a. Suction side of Recirc. Pump
   b. Via Isolation Valve 2WCS-MOV104
3. Suction from Reactor Vessel Bottom Head
   a. Via Bottom Head Drain Line
   b. Via Isolation Valve 2WCS-MOV101

4. Recirc. Loop Suctions join after MOV104 and 105 and pass through MOV103.
5. Down stream of MOV103 the bottom head suction ties in.
6. Next flow passes through Inboard and Outboard Containment Isolation Valves MOV102 and MOV112.

B. Reactor Water Cleanup Pumps

1. Two 50% capacity pumps supply system flow
2. Single-stage, Centrifugal Pumps with Mechanical seals.
3. 600 VAC 150 hp induction motor
4. Rated at 460 GPM

   NOTE: Flow rate is equivalent to ~1% of Reactor inventory per hour.
5. Pump cooling provided by CCP
6. Pump discharge supplies Seal Flushing Water
7. 13 feed of water required NPSH is supplied by pumps being 50 feet below normal vessel water level.
8. Normally both pumps are running
9. P1A powered by 2NJS-US5
10. P1B powered by 2NJS-US6
11. Both pumps are located on the 215 foot elevation of the Reactor Building in separate shielded rooms.
12. Manual suction (V27 and V28) and discharge (V30) valves are normally locked open

13. Pump normally discharges to RHX

NOTE: With MOV111 (100% bypass) open, can discharge directly to the Return Header.

C. Regenerative Heat Exchanger
   1. Heat exchanger used to recover heat — EO-2.0, EO-3.0c
      a. Reactor water into WCS is cooled by cleaned water returning to the Reactor
      b. Reduces cycle heat loss
      c. Hot influent on tube side
      d. Cool effluent on shell side
   2. Single-pass, counterflow shell and u-tube heat exchanger
   3. Reduces Reactor water from nominal 534°F to about 233°F
   4. Shell side heats from A nominal 120°F to about 500°F
   5. Both shell and tube sides are designed for 1410 PSIG and 500°F
      a. Both sides have vent and drain lines
      b. Over pressure protection relief valves for both sides
   6. Located in shielded heat exchanger room on 306 foot elevation of the Reactor Building

D. Non-regenerative Heat Exchanger — EO-2.0, EO-3.0d
   1. Reduces water temperature further
      a. Low enough to prevent resin damage
      b. From about 233°F to 120°F

2. Reactor Water on tube side
3. CCP on shell side
4. Higher temperatures are seen by NRHX during reject operations
   a. Due to reduced RHX efficiency
   b. Rejected water does not cool influent to RHX
5. Single-pass, counterflow, shell and u-tube heat exchanger
6. Shell side designed for 370°F and 150 PSIG
   a. Relief valve protected
   b. Vent and drain lines
7. Tube side rated for 575°F and 1410 PSIG
   a. Relief valve protected
   b. Vent and drain lines
8. Located in Reactor Building on Elevation 306 foot (same room as RHX)

E. Filter/Demineralizers EO-2.0

1. Removes soluable and insoluable impurities from Reactor Water EO-3.0e
   a. ION exchange for soluable
   b. Mechanical filtering for insoluable
2. 2 Filter/demin units
   a. 2 Vessels per unit
   b. Each unit can handle 50% WCS flow
   c. Units and vessels are piped in parallel

3. Pressure precoat filter/demins

NOTE: Flow through vessel holds resin cake in place.

4. Uses finely ground, non-regenerable mixed cation and anion resin
5. Vertical, cylindrical vessel

NOTE: Same design as SFC filter/demins.

   a. Divided in two by a horizontal tube sheet
   b. Filter septae drop down through tube sheet
6. Vessels are located in separate shielded rooms on the 328 foot elevation of the Reactor Building
7. Inlet and outlet strainers
   a. One set for each filter/demin
   b. Minimizes resin introduction into the Reactor Vessel in case of a septae failure
   c. Piped to be flushed to LWS
8. Each vessel has an Outlet Flow Control Valve
   a. FV16A, B, C, and D
   b. Maintains constant flow through vessel with varied pressure drop across that vessel.

F. Precoat System

1. Designed to rapidly apply a resin coat to the filter/demin septae

2. Each filter/demin unit has it's own precoat system
3. Panel P187 controls filter/demin's 4A and 4B and their Precoat System
4. Panel P188 controls 4C and 4D and their Precoat System
5. Precoat Pumps (P12A and P12B) — EO-2.0, EO-3.0f
   a. Takes a suction from precoat tank
   b. Delivers a resin slurry to filter/demin
   c. Resin builds up on septae and water is returned to Precoat Tank
   d. Can also take a suction from Resin Feed Tank via Resin Metering Pump
      NOTE: Not used because Solka-Flok Filter aid is not used
   e. P12A powered from 2NHS-MCC008
   f. P12B powered from 2NHS-MCC009
   g. Located in shielded room Reactor Building 328 foot elevation
6. Precoat Tank (TK11A and TK11B) — EO-2.0, EO-3.0g
   a. Provides for resin addition to filter/demins
   b. Sized for precoating one filter/demin
   c. Motor driven agitator for mixing slurry — EO-2.0, EO-3.0j
   d. Receives CNS water to mix slurry
   e. Located in the same room as the precoat pumps

7. Resin Feed Tank and Resin Metering Pump — EO-2.0
   a. Not used — EO-3.0h
   b. Resin is added via precoat tank — EO-3.0i

G. Holding Pump (P6A, B, C, and D) — EO-2.0
1. Starts automatically to maintain flow through filter/demin. — EO-3.0k
   a. When normal process flow is disrupted or,
   b. When vessel is taken out of service.
   c. Flow keeps resin cake from dropping off
2. P6A and P6B powered from 2NHS-MCC008
3. P6C and P6D powered from 2NHS-MCC009
4. All pumps are located in a shielded room adjacent to the filter/demin vessel rooms on the 328 foot elevation of the Reactor Building.

H. Reject Line — EO-2.0
1. Removes water from the Reactor Vessel to Control Reactor Vessel Level. — EO-3.01
   a. During startup when control rod drive water is filling vessel and no steam is produced to carry this water away.
   b. Also during heatup, WCS is in full reject to prevent thermal stratification of feed lines.

   NOTE: From 200°F until Reactor Power exceeds 80%.
2. Reject line taps between filter/demins and RHX

3. Water is rejected to condenser (normal) or LWS.
4. FV 135 maintains reject flow rate
5. Restricting oriface reduces WCS pressure by 800 PSI
   a. Piping downstream is not rated for normal Reactor pressure
   b. Flows about 90 GPM 100°F
6. Isolation valves (MOV106 for LWS and MOV107 for condenser) are down stream of restricting oriface.
7. Relief valve on LWS line relieves to condenser line to prevent overpressurizing LWS line.

I. WCS Outlet Piping

EO-2.0
EO-3.0m

1. After exiting the shell side of the RHX, the Reactor water is returned via the feed lines.
2. Thermal - Sleeved tees
   a. Dissipates thermal stresses due to difference in feed and WCS return temperatures.
   b. Returned to both feed lines via thermal tees

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
III. INSTRUMENTS, CONTROLS, AND INTERLOCKS		
A. Instrumentation	Use P&ID-37 to locate instruments	EO-4.0a
1. Rounds		
a. 2WCS-TIS36A/2WCS-TIS36C	NOTE: 100°F to 180°F nominal readings. High reading indicates pump is overheating (or being undercooled).	
1) WCS Pump P1A cavity temperatures		
2) Located with pump on 289 foot elevation of Reactor Building		
b. 2WCS-TIS36B/2WCS-TIS36D		
1) Monitors P1B cavity temperature		
2) Also located with pump		
c. Panels 187 and 188		
1) Check annunciators		
2) 2WCS-FIC1016A, B, C and D	NOTE: Abnormal flow can indicate a problem with the filter/demin vessel	
a. Filter/demin output flow		
b. Should be > 20% if in service		
d. Precoat pump oil levels	NOTE: Not on P&ID-37	
1) Check oiler glasses on pumps		
2) Ensure oil level is visible in glass		
2. Periodic Checks	NOTE: Listed in N2-OP-37	
a. 2CCP-TI77A and 2CCP-TI77B	NOTE: High reading is due to high seal leakage or low CCP flow	
1) WCS Pump (P1A and P1B) seal cooling water outlet temperatures		
2) Temp must be <140°F		
3) Located on seal cooler CCP outlet lines	NOTE: Not on P&ID-37	

Lesson Content	Delivery Notes
b. WCS Pump oil levels checked normal	NOTE: Not on P&ID-37
c. 2WCS-PI186	
1) Combined WCS Pump discharge pressure	NOTE: Indicates proper WCS pump operation
2) Local indicator on discharge line	
3) Should read approximately Reactor press. plus 250 PSIG	
d. 2WCS-IPNL187 and 2WCS-IPNL188	
1) 2CWS-PDT20A, B, C and D (PI1020A, B, C, and D)	NOTE: High dp indicates a dirty filter/demin
a) Filter/demin differential pressure	
b) Should be <15 PSID	
2) 2WCS-PI1019A, B, C, and D	NOTE: High dp indicates clogged strainer, could be from a damaged septae.
a) Filter/demin post strainer (STR5A, B, C, and D) differential pressure	
b) Should be < 5 PSID	
3) 2SSR-CI6A, B, C, and D	NOTE: High conductivity indicates resin is spent.
a) Filter/demin outlet conductivity	
b) Should be < 0.1 micromhos/cm	

e. Visual inspection of pumps for excessive seal leakage
   1) Seal water is WCS process water which is Reactor water
   2) Contamination consideration

3. Other local instruments
   a. Use Activity #1 — NOTE: Do not allow use of text since answers are in text. — EO-4.0e
      1) Hand out P&ID-37
      2) Hand out N2-OP-37

B. Controls — NOTE: Use P&ID-37 to locate controls — EO-4.0d

1. 2WCS-IPNL187 and 188
   a. 187 controls Unit "A" and filter/demins "A" and "B"
   b. P188 controls Unit "B" and filter/demins "C" and "D"
   c. Control filter/demins and precoat equipment

2. Controls on P187 and P188
   a.

Valve Number	Function
• 2WCS-FV16A,B,C, and D	- Filter/ Demin Outlet Flow Control Valves

- 2WCS-AOV22A,B,C, and D - Filter/Demin Inlet (inboard) Isolation Valves
- 2WCS-AOV23A,B,C, and D - Filter/Demin Inlet (outboard) Isolation Valves
- 2WCS-AOV25A,B,C, and D - Service Air to Vessel Isolation Valves
- 2WCS-AOV26A,B,C, and D - Outboard Filter/Demin Outlet Make ready valves
- 2WCS-AOV27A,B,C, and D - Filter/demin outlet Isolation Valves
- 2WCS-AOV28A,B,C, and D - Inboard Dome Drain Valves

- 2WCS-AOV29A,B,C, and D - Outboard Dome Drain Valves
- 2WCS-AOV30A,B,C, and D - Dome Vent Valves
- 2WCS-AOV31A,B,C, and D - Holding Pump Discharge Valves
- 2WCS-AOV44A,B,C, and D - Inboard Bottom Drain Valves
- 2WCS-AOV51A,B,C, and D - Outboard Bottom Drain Valves
- 2WCS-AOV52A,B,C, and D - Inboard Filter/Demin Outlet Make Ready Valves
- 2WCS-AOV53A,B,C, and D - Outboard Filter/Demin Make Ready Valves
- 2WCS-AOV54A,B,C, and D - Inboard Filter/Demin Inlet Make Ready Valves

- 2WCS-AOV61A,B,C, and D - Dome Vent Valves
- 2WCS-AOV46A and B - Precoat Pump-Precoat Tank Suction Isolation Valves
- 2WCS-AOV47A and B - Condensate Control Valves (to the Precoat Tanks)
- 2WCS-AOV48A and B - Condensate Control Valves (to the Resin Feed Tanks)
- 2WCS-AOV49A and B - Precoat Pump-Resin Feed Tank Suction Isolation Valves
- 2WCS-FV55A and B - Precoat Flow Control Valve

b. Also located on Panels 187 and 188 are the following controls:

- Backwash Initiate Pushbuttons
- Precoat Initiate Pushbuttons
- Filter/Hold Selector Switches (A, B,C, and D Filter/Demins)
- Solka Flock/Resin Selector Switches (A,B,C, and D Filter Demins)
- Filter/Demineralizer Effluent Flow Controllers (A,B,C, and D Filter/ Demins)
- Precoat Pumps (P12A/B) Start-Stop Pushbuttons
- Resin Metering Pumps (P16A/B) Start-Stop Pushbuttons
- Holding Pumps (P6A,B,C, and D) Start-Stop Pushbuttons

3. Programmable logic controller
   a. The programmer monitors inputs
   b. The hold process in initiated by monitored input
   c. Backwash, precoat and online functions are operator initiate

      NOTE: Once initiated they progress automatically.

   d. The microprocessor

      EO-4.0e

      1) Performs functions in discrete steps

         NOTE: Show logic diagram

      2) Inputs to controller determine path microprocessor takes to perform it's function.

3) Changes & variations are made via programming terminal

NOTE: I&C makes all program changes

e. Advantages over tenor drum switch

NOTE: Reference to programmers that control condensate demin's. The programmer is actually a motor driven drum that times the activation of micro switches that control the process.

1) Micro processor verifies previous action prior to performance of next step.

2) Fewer moving parts

f. Located within Panels P187 and P188

C. Interlocks

1. WCS isolation

NOTE: Closure of MOV102 and MOV112

a. High ambient temperature in WCS Pump Room

NOTE: Ambient temperatures indicate leakage of high temperature fluid (most likely Reactor water) into the space.

1) Pump Room "A" 131°F

2) Pump Room "B" 146°F

b. High ambient temperature in WCS Heat Exchanger Room

1) 131°F

c. High Reactor Building pipe chase temperature

1) 135°F

d. High WCS differential flow

NOTE: Indicates a leakage of Reactor water from WCS

1) Between inlet flow and outlet plus reject flows

2) 150.5 GPM

3) 45 second time delay to allow system startup

e. Low-low reactor vessel water level
   1) 108.8 inches

NOTE: On loss of vessel level, likely non-essential leakage sources are isolated

f. SLS initiation
   1) MOV112 shuts if SLS Pump "A" starts
   2) MOV102 shuts if SLS Pump "B" starts

Question: Why is WCS isolated on SLS initiation?

Answer: To prevent removal of shutdown chemicals from Reactor Water.

g. High outlet temperature from tube side of NRHX
   1) 140°F
   2) Only MOV112 shuts

Question: Why is WCS isolated for high temperature out of NRHX?

Answer: Protects the Filter/Demin Resin

2. Reject Flow Control Valve (FV135) shuts on
   a. Low pressure upstream (5 PSIG)
   b. High pressure downstream (140 PSIG)

NOTE: Prevents draining WCS

NOTE: Protects low pressure reject piping.

3. The holding Pump (P6A,B,C, or D) for a given filter/demin vessel starts automatically if the flow through that vessel drops below 90% of normal flow.

Question: Why does the holding pump start on Reduced Vessel Flow?

Answer: Maintains the filter cake on the Septae.

4. WCS Pumps (P1A and P1B) trip on:
   a. Low flow
      1) 70 GPM
      2) 15 minute time delay to allow startup
   b. Anytime MOV102 or MOV112 shut
      1) This is instantaneous
      2) Protects pump from loss of suction head.

IV. SYSTEM INTERRELATIONS — EO-5.0

A. Reactor Building Closed Loop Cooling Water (CCP) — NOTE: Locate tie points on P&ID-37 — EO-4.0f

1. Cooling for HRHX
2. Cooling for WCS pumps

B. Reactor Plant Sampling System (SSR)

1. Samples filter/demin influent
2. Samples filter/demin effluent

C. Primary Containment Isolation System (ISC)

1. Provides auto closure signals to MOV102 and MOV112

D. Condensate Storage and Transfer (CNS)

1. Mixing water to precoat and Resin Feed Tanks
2. Filter/demin backwash water supply

E. Liquid Radwaste System (LWS)

1. Can receive WCS reject

F. Condensate System (CNM)

1. Condenser can receive WCS Reject

G. Service Air System (SAS)

1. Filter/demin backwash and air scrub air supply

H. Instrument Air System (IAS)

1. Valve operations air

I. Plan Electrical Distribution

1. WCS Pumps (P1A and P1B)
   a. P1A from 2NJS-US5
   b. P1B from 2NJS-US6
   c. 120VAC control power from 2VBS-IPNLB102 and 2SCA-IPNL201
2. Valve control power
   a. 2BYS-IPNLA101
3. Filter/demin instrument and control 120VAC/125VDC
   a. 2SCA-IPNL200 and 2SCA-IPNL201 (120VAC)
   b. 2BYS-IPNLA101 and 2BYS-IPNLB102 (125VDC)
   c. 2NHS-MCC008 and 2NHS-MCC009
4. Holding Pumps (P6A, B, C, and D)
   a. P6A and P6C from 2NHS-MCC008
   b. P6B and P6D from 2NHS-MCC009
5. Precoat Pumps (P12A and P12B)
   a. P12A from 2NHS-MCC008
   b. P12B from 2NHS-MCC009
6. Resin Metering Pumps (P16A and P16B)
   a. P16A from 2SCA-IPNL200
   b. P16B from 2SCA-IPNL201

J. System Interconnections

1. Physical piping connections with 5 systems

   a. Inlet from Reactor Recirc. Loops "A" and "B"

   b. Inlet from bottom head drain line

   c. Outlet to feed lines

   d. Reject to LWS

   e. Reject to Main Condenser

V. PRECAUTIONS AND LIMITATIONS

EO-6.0

1.0 When RWCU is being used to reject water, non-regenerative heat exchanger outlet temperature must be monitored. As reactor temperature and pressure increase, reject flow must be reduced to maintain heat exchanger outlet temperature less than 130°F. If heat exchanger outlet temperature is allowed to increase to 140°F, a cleanup system isolation will result.

A. Rejected Water Does Not Pass Through RHX

1. This reduces RHX Heat Removal Ability

2. Places more load on NRHX

   a. Overload NRHX causes outlet temperature to rise

   b. 140°F causes WCS isolation to protect resin

2.0 Do not exceed the maximum non-regenerative heat exchanger closed cooling water (CCP) exit temperature of 180°F.

B. Limit is Based on Design Heat Loading of NRHX on CCP

3.0 Do not exceed the maximum non-regenerative heat exchanger shell side pressure of 150 psig.

C. Shell side design pressure limit

4.0 Maintain CCP to the RWCU pumps anytime the pumps are in operation or pump temperature is greater than 130°F.

D. Provides cooling for pump running or process water heating.

5.0 2WCS-MOV106 and 2WCS-MOV107 (Appendix R Valves) will be energized only when RWCU is being operated in blowdown.

E. Smart Fire Causes MOV106 and MOV107 to Fail Open

1. Loss of Condenser Vacuum
2. Loss of condenser as a heat sink

6.0 When venting high temperature water, the water may flash to steam. Exercise extreme caution during these operations. Always slowly throttle open vent valves.

F. Personnel Hazard

7.0 Do not return the RWCU system to operation following actuation of the Standby Liquid Control System as it will remove the Sodium Pentaborate from the reactor water.

G. Removal of Shutdown Chemical can Cause a Restart Accident

8.0 The heatup rate of the RWCU pumps should not exceed 10°F per minute.

H. Limits Pump Thermal Stress

9.0 All RWCU areas should be considered high radiation areas. Contact radiation protection prior to entering these areas.

I. Cleanup System Concentrates Activated Corrosion Products and Fission Products and N-16 Gamma Radiation is Present

10.0 Remove all filter/demineralizers from service per Section F.2.0 prior to starting or stopping a RWCU Recirculation Pump.

J. Abrupt Flow Changes Cause:
   1. Release of soluable and insoluable impurities
   2. (Extreme) cause resin cake break through
      a. Clogs outlet strainers
      b. Requires backwash/precoat of filter/demin

11.0 All evolutions causing changes in RWCU flow should be made slowly. Rapid changes in flow fan result in filter/demineralizer breakthrough. This may cause plugging of the filter/demineralizer effluent strainers and will require removal of the filter/demineralizer from service and backwash of the strainers.

K. Same Reasoning s Precaution #10.0

12.0 Monitor Filter Demineralizer effluent conductivity. Backwash and precoat F/D if the following guidelines are exceeded:

a. If RWCU is operating with FW return and outlet conductivity approaches 0.1 mho/cm.

b. If RWCU is operating with full reject to condenser and outlet conductivity approaches inlet conductivity.

12.1 The Chemistry Department will sample RWCU daily and advise that a F/D be backwashed and precoated if the influent sample silica count exceeds 100 ppb and the effluent sample of an individual F/D exceeds 50 ppb silica.

12.2 When WCS System is isolated and unavailable for continuous conductivity monitoring per Tech. Spec. 3/4.4.4.c, alternate sampling must be performed. See OP-17 and Tech. Spec. 3/4.4.4.c.

L. WCS Filter/Demin Operational Limits

1. 0.1 micromho/cm is Tech Spec RCS Limit
2. 12.0 b. limit ensures that filter/demin is still removing some impurities

   NOTE: Water is not returning to the Reactor Vessel.

3. The silica count normally determines resin exhaustion.
   a. Silica sample is more accurate and more sensitive
   b. Conductivity still applies since it is a continuous sample
4. Alternate sampling is required by tech. spec. for verification of Reactor Water Chemistry.

13.0 Rapid loss of RWCU flow may result in the filter media being dropped from the septa. Following an RWCU isolation or RWCU pump trip it is good practice to backwash and precoat the filter/ demineralizers prior to restoring the system to service.

M. The Hold Pump May Not Start Fast Enough to Maintain Flow

1. Since cake may be disturbed filter/demins should be backwashed and precoated
2. Limits downtime since outlet strainers are not clogged

   NOTE: If filter/demins placed in service with disturbed resin cake can allow resin to plug outlet strainer.

3. Prevents process flow through filter/demin with bare sepate

14.0 Anytime operations are being performed at Panel 2WCS-IPNL187 and 2WCS-IPNL188 the operator at the local panels should remain in direct voice communication with the Main Control Room.

N. Due to WCS Sensitivity

1. Allows Control Room to directly supervise
2. Allows communications with operator monitoring differential flow

NOTE: Allows faster response to help prevent high differential flow isolation.

15.0 Prior to resetting an isolation of the RWCU system, the cause of the isolation must be determined and corrected.

O. Prevents Second Isolation

1. First isolation required 4 hour NRC notification
2. Second isolation would require a second notification

NOTE: NRC notifications are not good.

16.0 Always precoat the filter/demineralizers prior to pumping water through them. Pumping through bare filter septor may cause them to corrode and/or plug.

P. Manufacturer's Precaution

17.0 Do not attempt to backwash more than one filter/demineralizers at the same time. The filter/demineralizers share a common drain path to Phase Separator. Attempting to backwash two filter demins simultaneously may result in restriction to flow and a poor backwash.

Q. Common Drain Line is Sized for Backwash of One Filter/Demin at a Time.

1. 2 at a time slows flow
2. Backwash is a timed function
3. Less flow for given time prevents proper backwash.

18.0 Prior to backwash of RWCU filter/demineralizers notify Radiation Protection that a backwash will be performed.

R. Required Heads Up to Radprotection

1. Movement of large amount of contaminated material
2. Not an every day occurrence

19.0 RWCU shall be operating in total reject to main condenser when Reactor Water Temperature is greater than or equal to 200°F and Reactor Power is less than 20%.

S. Prevents Statification of Water Temperature in Feed Lines

1. Caused by temperature difference
   a. Between WCS outlet and feed
   b. Large difference occurs between 200°F and 20%.
2. Statification causes thermal stress on feed lines.

20.0 Observe all precautions to limit radiation exposure and the spread of contamination. Water from leakage or drain/vent operations should be treated as contaminated. Whenever possible, make provisions to contain the source of the water.

T. Due to High Contamination Potential of Water and Resin

21.0 Do not change valve position indication light bulbs on the filter/demineralizer control panels, 2WCS-IPNL187 & 2WCS-IPNL188 when they are energized this will cause fuses to blow and a possible shutdown of a cleanup filter.

U. Light Socket Design Allows Shorting When Bulb is Installed

1. Fuse blows
2. Possible loss of micro processor power

22.0 When changing system flow; i.e., starting/stopping pumps, changing lineups, adding/removing F/D's from service; station an operator at PNL's 2CEC*PNL632/642 to monitor the differential flow meters so that a system isolation may be avoided.

V. Isolation Requires NRC Notification

1. Differential flow isolation has 45 seconds time delay.
2. May have time to correct condition prior to isolation.

3. Also can correct condition if differential flow approaches set point.

23.0 Do not simultaneously open 2WCS-MOV107 and 2WCS-MOV106 as a loss of condenser vacuum could occur.

W. Allows a Path for Air Introduction

1. LWS Receiving Tank is vent to atmosphere
2. Condenser is at a vacuum

25.0 During single Rx. Recirculation Loop Operation (1 loop isolated) maintain WCS System Flow below 500 gpm to ensure adequate NPSH is available to the pump (2WCS-P1A,B). Only one pump should be in operation with the other isolated in standby. The second pump can be started for pump swap.

X. This is a Pipe Size Limitation

1. Each Recirc. Loop tap is a 4" line

NOTE: 8" total flow diameter

2. Reducing flow area by 1/2 requires reducing flow by 1/2
3. Single WCS pump limit during Single Recirc. Loop Operations.

26.0 Notify SSS prior to any manipulation of those vales listed in Attachment 2.

Y. Read LER 89-033

NOTE: Attachment #1

27.0 The Chemistry Department should be notified to isolate their sample lineups from the WCS Demineralizer influent and effluent sample points if the WCS system is isolated or shutdown for ≥ 30 minutes.

Z. Sampling Causes WCS Inventory Loss

1. This allows introduction of air into WCS
2. Air gathers in flow transmitter sensing lines
3. Amplifies flow inaccuracies and oscillations
4. Has caused high differential flow isolation

28.0 When starting up the WCS system, venting is required if the WCS system has been isolated or shutdown for ≥ 30 minutes.

AA. Goes Along With Precaution No. 27.0

1. Venting removes air from WCS piping
2. Read LER 89-031

NOTE: Attachment #2

29.0 Mode "B" operation of the WCS system, (utilizing the WCS system to prevent thermal stratification of the reactor vessel during periods when no recirc. flow and feed flow are available), is prohibited due to thermal stress on the Feedwater System. (GE SIL #436)

BB. Read GE SIL #436

NOTE: Highlight temp difference causes excessive thermal stress and the conditions causing the use of Mode "B" operation unlikely.

VI. SYSTEM OPERATION

NOTE: Supply N2-OP-37, P&ID 37A 37F, and LSK-37

A. Startup Procedure

1. Activity #2

- Have trainees complete Activity #2 — EO-7.0a, EO-4.0c

B. Normal Operations

1. Activity #3

- Have trainees complete Activity #3 — EO-7.0b, EO-4.0c

C. Shutdown Procedure

1. Activity #4

- Have trainees complete Activity #4 — EO-7.0c, EO-4.0c

D. Off Normal Procedure

1. Activity #5

- Have trainees complete Activity #5 — EO-7.0d, EO-4.0c

E. Annunciator Response

1. Activity #6

- Have trainees complete Activity #6 — EO-7.0e, EO-4.0c

VII. SYSTEM HISTORY

A. System Modification

1. PN2Y87MX023

a. Old Design

1) 2WCS*MOV200 was seal in Open or Shut

2) 2WCS*MOV109 was throttleable

b. New Design

1) 2WCS*MOV200 is throttleable

2) 2WCS*MOV109 is seal in Open or Shut

c. Why was this done

1) MOV200 is downstream of the flow transmitters

2) Throttling MOV200 maintains a more constant press on the flow transmitters

3) Minimizes oscillations in indicated flow when the Reactor is depressurized

2. PN2Y87MX119

a. Old Design

1) 2WCS-V400 was installed to maintain a constant non-vacuum pressure on flow element/transmitter

2) Prevented flashing and erratic indications

NOTE: Due to Condenser Vacuum

3) This was a temporary fix

4) Also flow transmitter was downstream FV135

b. New Design

1) Removed V400

2) Moved 2WCS*FE126 upstream of FV135

3) FV135 now supplies back pressure

c. Why was this done

1) Vacuum and pressure oscillation caused erroneous flow readings

2) Back pressure helped

3) Removed temporary valve and used installed FV135

3. PN2Y87MX167 (PN2Y88MX065)

NOTE: PN2Y87MX167 covered *FT67Y and tubing reroute for *FT67X. PN2Y88MX065 completed all FT's after initial good results.

a. Old design

1) 2WCS*FT67X and Y and 2WCS*FT69X and Y had Flex Hose Sensing Lines

2) Also high points in sensing lines that were hard to vent

b. New design

1) Replaced flex hose with rigid tubing

2) Rerouted lines to eliminate entrapped air

c. Why was this done

1) Flex hoses caused noisy flow readings

2) Lines trapped air which amplified hose

3) Erroneous flow readings that caused transmitter failures and WCS isolations on high differential flow

B. LER's

1. LER 88-002

a. Initial conditions

1) WCS isolated

NOTE: By Tech. Spec. 3.3.2 due to a failed flow instrument

2) Reactor in cold shutdown

b. Event

1) WCS unisolated

2) Preparations made to start WCS pump

3) WCS isolates on high differential flow

NOTE: This is an engineer safety feature (ESF actuation.

c. Cause

1) Suction flow transmitter calibration shift

2) WCS design deficiency

NOTE: The CAL shift caused the high differential flow trip and the design allows air to be trapped in the transmitter sensing lines which is thought to have caused the calibration shift.

d. Corrective actions

1) Calibrate flow transmitter

2) Information sent to WCS trouble-shooting task force

2. LER 88-015

a. Initial conditions

1) Reactor at 100% power

2) Reactor Building Glycol Heating (HVG) shutdown for repairs

3) Reactor Building Ventillation (HVR) placed in off normal lineup by N2-OP-52

NOTE: Lineup has HVR in recirc and Standby Gas Treatment running to maintain Reactor Building negative pressure.

b. Event

1) Received high temp alarms for WCS A and B Pump and Heat Exchanger Rooms.

2) WCS isolates on high "A" Pump Room temp.

c. Cause

1) HVR design deficiency

2) Off normal ventilation mode draws air from WCS rooms but supplies no cooling air

3) Air is drawn in via doorway

4) Curtain on door restricts flow

d. Corrective actions

1) Reduced WCS room temperatures

2) Returned WCS to service

3) HVR procedure change to supply normal HVR during off normal ventilation lineup

4) Engineering analysis of HVR off normal lineup

3. LER-88-048

   a. Initial conditions

      1) 35% Reactor Power

      2) Mode switch in run

   b. Event

      1) Attempted to swap from full reject to normal return

      2) Hi differential flow trip

      3) Attempted to stabilize flow

      4) Timer timed out and WCS isolated

   c. Cause

      1) Erratic flow indication problems

      2) Flow perturbations caused by transient

      3) Root cause is design deficiency

   d. Corrective actions

      1) MOD PN2Y88MX044

         NOTE: Not yet accomplished. Meant to improve reject flow control.

      2) MOD PN2Y88MX065

         NOTE: Removed flex hoses from flow transmitter sensing lines.

      3) N2-OP-37 revised to add additional warnings and requirements

      4) Engineering evaluation of flow oriface accuracy

4. LER 90-005 (1st event)

a. Initial conditions

1) Reactor at 4% power

2) Mode switch in startup

b. Event

1) 2WCS-FV16D found 15% open during rounds

NOTE: Required to be at least 20% open by N2-OP-37. FV16D is flow control valve for filter/demin 4D

2) CSO informed, tried to adjust FV135

NOTE: FV135 is reject flow control valve. Since in full reject, shutting down on FV135 should allow FV16D to open.

3) Flow did not change as expected

4) Controller for FV16D found in manual

5) Operator took local control to adjust FV16D

6) WCS isolated on high differential flow

c. Cause

1) Not yet determined

d. Corrective action

1) Pending cause determination

ACTIVITY #1

Using P&ID-37 and N2-OP-37, locate the following local instruments and determine their purpose by listing the parameter they monitor. (Example: 2WCS-PI113 Monitors WCS pump suction pressure.)

INSTRUMENT	PARAMETER MONITORED
2WCS-PI113	
SWCS-PI118	
2WCS-PI121	
2WCS-PI1017A,B,C,&D	
2WCS-PI1070A,B,C,&D	
2WCS-PI1018A,B,C,&D	
2WCS-PI124	
2WCS-PI38A & B	
2WCS-PI57A & B	
2WCS-PI39A & B	
2WCS-PI40A & B	
2WCS-TIS1008	
2WCS-LI1056A & B	
2WCS-FG60A,B,C,&D	
2WCS-FG14A,B,C,&D	
2WCS-FG15A,B,C,&D	
2WCS-FG37A,B,C,&D	

ACTIVITY #1
(Cont'd)

Using P&ID-37 and N2-OP-37, locate the following local instruments and determine their purpose by listing the parameter they monitor. (Example: 2WCS-PI113 Monitors WCS pump suction pressure.)

INSTRUMENT	PARAMETER MONITORED
2WCS-PI113	WCS pump suction pressure
SWCS-PI118	NRHX inlet pressure/RHX outlet pressure
2WCS-PI121	NRHX outlet pressure
2WCS-PI1017A,B,C,&D	Filter/demin inlet pressure (individual vessel
2WCS-PI1070A,B,C,&D	Filter/demin inlet strainer dp
2WCS-PI1018A,B,C,&D	Filter/demin outlet pressure (individual vessel)
2WCS-PI124	Filter/demin combined outlet pressure
2WCS-PI38A & B	Service air pressure to filter/demin vessels
2WCS-PI57A & B	Resin metering pump discharge pressure
2WCS-PI39A & B	Fill/flushing water to resin feed and precoat tanks
2WCS-PI40A & B	Precoat pump discharge pressure
2WCS-TIS1008	NRHX outlet temperature
2WCS-LI1056A & B	Precoat tank level
2WCS-FG60A,B,C,&D	Filter/demin bottom drain flow sight-glass
2WCS-FG14A,B,C,&D	Filter/demin dome drain flow sightglass
2WCS-FG15A,B,C,&D	Filter/demin dome vent flow sightglass
2WCS-FG57A,B,C,&D	Filter/demin to precoat tank flow sightglass

ACTIVITY #2

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTIONS CONCERNING STARTUP OF THE REACTOR WATER CLEANUP SYSTEM.

1. Read through the startup section of N2-OP-37. Determine and list the applicable precautions from Section D. PRECAUTIONS/LIMITATIONS.

2. What verifications are made prior to starting a WCS pump?

3. What verifications are made after a Filter/Demineralizer is placed in service?

4. How long do you have to complete system venting before the WCS pump trips on Low Flow?

   What is the Low Flow setpoint?

ACTIVITY #2

(ANSWERS)

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTIONS CONCERNING STARTUP OF THE REACTOR WATER CLEANUP SYSTEM.

1. Read through the startup section of N2-OP-37. Determine and list the applicable precautions from Section D. PRECAUTIONS/LIMITATIONS.

   The Following Precautions are Applicable:

5.0	22.0
6.0	23.0
8.0	28.0
9.0	MAY LIST:
11.0	1.0
14.0	2.0
16.0	3.0
19.0	4.0
20.0	15.0

2. What verifications are made prior to starting a WCS pump?
   E. 2.1.3
   a. Pump Oil Level is Normal
   b. Pump Shaft can be Freely Rotated by Hand
   c. Seal Cooling Water is Available at the Pump Seal Coolers

3. What verifications are made after a Filter/Demineralizer is placed in service?
   E. 3.11
   a. Effluent Conductivity is Less Than 0.1 umho/cm
   b. Filter/Demin dp is Less Than 15 psid
   c. Effluent Strainer dp is Less Than 5 psid

4. How long do you have to complete system venting before the WCS pump trips on Low Flow?

   15 Minutes

   What is the Low Flow setpoint?

   140 gpm

ACTIVITY #3

USING THE APPLICABLE REFERENCES, ANSWER THE FOLLOWING QUESTIONS ABOUT THE NORMAL OPERATION OF THE REACTOR CLEANUP SYSTEM.

1. What interlocks must be met before a Filter/Demin will Backwash?

2. How many buckets of resin are required to precoat a Filter/Demin?

   At what rate is the resin added to the Precoat tank?

   Why is this addition rate important?

ACTIVITY #3

(ANSWERS)

USING THE APPLICABLE REFERENCES, ANSWER THE FOLLOWING QUESTIONS ABOUT THE NORMAL OPERATION OF THE REACTOR WATER CLEANUP SYSTEM.

1. What interlocks must be met before a Filter/Demin will Backwash? F.4.1.1
   a. Phase Separator Tank Level is not High
   b. The Other Filter/Demin is not in Backwash
   c. Power to Microprocessor is off no Longer Than 1 Second
   d. Local Functions Interlock Switch is Normal or Set to Other Filter/Demin

2. How many buckets of resin are required to precoat a Filter/Demin?

   4.5 Buckets of "EPI FLOC 21-H" Resin

   At what rate is the resin added to the Precoat tank?

   1 Bucket every 3 to 4 minutes

   Why is this addition rate important?

   Rapid resin addition causes uneven precoating of the filter/demin which greatly reduces it's performance and longevity.

ACTIVITY #4

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTION ABOUT THE SHUTDOWN OF THE REACTOR WATER CLEANUP SYSTEM.

1. Assuming all 4 Filter/Demins are in service, describe how they are removed from service.

ACTIVITY #4

(ANSWERS)

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTION ABOUT THE SHUTDOWN OF THE REACTOR WATER CLEANUP SYSTEM.

1. Assuming all 4 Filter/Demins are in service, describe how they are removed from service

   - First, throttle the flow through 2 of the 4 filter/demins until the flow control valves are shut.

   - Ensure the hold pumps have started and place the mode switch in "HOLD".

   - Throttle open the "CLEANUP DEMIN BYPASS VALVE" to establish 600 gpm SYSTEM FLOW.

   - Remove the remaining 2 filter/demins as above.

ACTIVITY #5

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTIONS ABOUT THE OFF NORMAL OPERATIONS OF THE REACTOR WATER CLEANUP SYSTEM.

1. Concerning the starting of a WCS pump when the system is hot:
   a. When is the pump considered "cold"?

   b. If the pump is cold, what is the maximum heatup rate?

2. List the valves which may become "hydraulically locked".

3. How is the hydraulic lock removed?

4. When is special venting procedure H.7.0 used?

ACTIVITY #5

(ANSWERS)

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTIONS ABOUT THE OFF NORMAL OPERATIONS OF THE REACTOR WATER CLEANUP SYSTEM.

1. Concerning the starting of a WCS pump when the system is hot:
   a. When is the pump considered "cold"?

      When the pump is more than 100 degrees colder than the WCS

   b. If the pump is cold, what is the maximum heatup rate?

      10 degrees per minute MAXIMUM

2. List the valves which may become "hydraulically locked".

   2WCS-AOV51A,B,C&D
   2WCS-AOV54A,B,C&D

3. How is the hydraulic lock removed?

   Relieve the pressure in the line by opening V74, V84, V94, or V104 (for AOV54A,B,C,&D). When pressure bleeds off the valve should open.

4. When is special venting procedure H.7.0 used?

   Whenever the system has been breached (opened to atmosphere) or partially drained.

ACTIVITY #6

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTIONS CONCERNING ANNUNCIATOR RESPONSES FOR THE REACTOR WATER CLEANUP SYSTEM.

1. What is the automatic system response to a Filter/Demin effluent strainer HI DP?

   a strainer HI-HI DP?

2. What is the corrective action for a Filter/Demin vessel HI DP?

ACTIVITY #6

(ANSWERS)

USING THE REQUIRED REFERENCES, ANSWER THE FOLLOWING QUESTIONS CONCERNING ANNUNCIATOR RESPONSES FOR THE REACTOR WATER CLEANUP SYSTEM.

1. What is the automatic system response to a Filter/Demin effluent strainer HI DP?

   NONE

   a strainer HI-HI DP?

   The filter/demin isolates (FV16, AOV22, AOV23, and AOV27 for the associated filter/demin shut) and goes into the "HOLD" mode.

2. What is the corrective action for a Filter/Demin vessel HI DP?

   Verify the automatic response has occurred and the backwash, precoat, and if desired, return the filter/demin to service.

Event 2 - WCS Blowdown to Phase Separator LER 89-33

An operator on rounds discovered a leak in the WCS Valve Room. Due to radiological conditions the operator was not able to enter the room to determine the source of the leak.

The operator informed the Control Room of the leak. Since the D WCS filter/demin was in service, the SSS directed that the D filter/demin be secured and isolated in an attempt to secure the leak. The operator involved decided to take the additional and prudent action of depressurizing the filter vessel by opening the inlet strainer blowdown valves. The operator did not adequately log this action, nor did he inform the CSO of this action, nor was this information turned over to the on-coming operator.

When the source of the leak was determined not to be the D filter/demin, the next shift decided to put D filter/demin back in service. When the filter/demin was unisolated reactor water had a direct path from the Reactor to the phase separator via the open strainer blowdown valves. The increase in WCS flow to the non-regenerative heat exchanger exceeded the capability to CCP to remove heat from WCS, causing WCS to isolate on high non-regenerative heat exchanger outlet temperature (140°F).

An operator took action to depressurize a reactor water cleanup filter/demin by opening the filter/demin inlet strainer blowdown valves. The operator did not adequately log this action, nor did he inform the CSO of this action, nor was this information turned over to the on-coming shift.

Lesson Learned

1. It is required to notify the SSS and CSO of off-normal system configurations.

2. N2-OD1-5.01, LOG MAINTENANCE, provides instruction for the maintenance of operations log books to ensure day-to-day shift evolutions are properly documented. Section 2.6 specifically states that valve or electrical lineups not in accordance with approved procedures are to be logged, along with the reason for this configuration.

3. N2-OD1-3.01, SHIFT TURNOVER GUIDELINES, provides BUILDING TURNOVER CHECKLISTS. These checklists have provision to annotate system configurations that are out-of-normal.

LER 89-31

I. DESCRIPTION OF EVENT

On October 13, 1989, at 1746 hours, Nine Mile Point Unit 2 (NMP2) experienced the actuation of an Engineered Safety Feature (ESF), specifically, isolation of the Reactor Water Cleanup (WCS) system on an erroneous high differential flow signal. At the time of the event, the plant was in "HOT SHUTDOWN" (Operational Condition 3) with reactor temperature at approximately 418 degrees Fahrenheit and reactor pressure at approximately 307 pounds per square inch gauge.

Following a reactor scram, which occurred earlier in the day (LER 89-35), the Reactor Water Cleanup system had been secured per Operating Procedure N2-OP-101C "Plant Shutdown".

While attempting to restart the WCS system to normal operation, an isolation signal occurred causing closure of WCS inlet flow valve 2WCS*MOV102 (containment isolation) and tripping of WCS pump 2WCS*P1B. Because of plant conditions at the time of the WCS system startup, the evolution differed from normal system startup. The WCS system return flowpath to the Reactor Pressure Vessel (RPV) via Feedwater system (FWS) could not be utilized due to potential stratification problems in the FWS system piping. This condition exists when reactor coolant temperature is greater than or equal to 200 degrees Fahrenheit and the plant is less than 20 percent power. This condition requires the full reject mode of operation to be used. This involves discharging the WCS system to the main condenser (Condensate system) or the Liquid Radwaste system. The cleanup system is designed to isolate when the differential flow between system inlet and outlet flow exceeds 150.5 gallons per minute for 45 seconds.

At 1732 hours on October 13, 1989, the WCS system Division II pump 2WCS*P1B was started in accordance with Operating Procedure N2-OP-37 "Reactor Water Cleanup System". The differential flow meters located at Control Room Panels 632 (Division I) and 642 (Division II) immediately began exhibiting erratic output (excessive indicator movement with intermittent upscale and downscale indication). At 1746 hours, while establishing a 170-175 gpm flow to the main condenser, the Division II isolation occurred. An immediate investigation was then started as to the cause of the trip.

II. CAUSE OF EVENT

The root cause of the event was determined to be equipment malfunction with procedure deficiency as a contributing factor.

A combination of events created the conditions resulting in the cleanup system isolation:

- Leaking drain valves on three flow transmitters caused air introduction into the instrument sensing lines which contributed to flow perturbations.

- One cleanup flow transmitter was damaged and reading erroneously.

- Operating procedure did not require sampling from the cleanup system to be secured which contributed to lost inventory leading to flow perturbations on system startup.

III. ANALYSIS OF EVENT

This event is reportable under the requirements of 10CFR50.73 (a) (2) (iv), which requires the licensee to report "Any event or condition that resulted in the manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)". The Reactor Water Cleanup isolation function is an ESF function which is part of the Primary Containment and Reactor Vessel Isolation Control System.

The NMP2 Final Safety Analysis Report, Section 5.4.8 states: "The WCS System is classified as a primary power generation system (not an engineered safety feature), a small part of which is part of the Reactor Coolant Pressure Boundary (RCPB) up to and including the outside isolation valve. The other portions of the system are not part of the RCPB and can be isolated from the Reactor. The WCS System may be operated any time during planned reactor operations or it may be shutdown, if water quality is within the Technical Specification limits".

A WCS System isolation does not impair the station's capability to achieve a safe shutdown condition. The WCS isolation function operated as designed with no other transients or inoperable systems contributing to the event.

IV. CORRECTIVE ACTIONS

The following corrective actions were taken:

1. Issue Work Requests (WR) 165129, 165130, 165131, and 165132 to troubleshoot/recalibrate the Reactor Water Cleanup system flow transmitters.

2. Replace out of calibration Reactor Water Cleanup system flow transmitter 2WCS*FT67Y (WR#165131).

3. Replace/repair leaking drain valves located on the instrument sensing lines.

4. Operating Procedure N2-OP-37 "Reactor Water Cleanup" will be revised to include the following steps:

   A. Direct the Chemistry Department to secure their sampling lineups from the WCS system anytime the system is shutdown for periods of time equal to or great than 30 minutes.

   B. Vent the WCS system from its high points on any system startup when system has been idle for periods of time equal to or greater than 30 minutes. This will assure that the system is full and will minimize flow disturbances.