07-188-91

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

LESSON PLAN

02-LOT-001-257-2-00 (OPS)
OS-STC-001-257-2-00 (NON-OPS)

CONDENSATE DEMINERALIZER

Prepared by: Unit #2 Training Department

APPROVALS	SIGNATURES	DATE AND INITIALS REVISION 5
Training Supervisor Nuclear-Unit #2 J. G. Poindexter	J. G. Poindexter	6/22/90 JGP
Assistant Training Superintendent-Nuclear R.T. Seifried	R.T. Seifried	6/20/90 RTS
Superintendent Operations-Unit #2 M. J. Colomb	FOR MJ Colomb	7/12/90 FOR MJC

Summary of Pages

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Date	Pages
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THIS LESSON PLAN SUPERCEDES LESSON PLAN #N2-OLP-51

17pp

5/3/340

OBJECTIVE APPLICABILITY MATRIX

OBJECTIVE NUMBER	LICENSE CLASS	NON-OPS
TO-1	X	
TO-2		X
EO-1	X	X
EO-2	X	X
EO-3	X	X
EO-4	X	
EO-5	SRO ONLY	

I. TRAINING DESCRIPTION

A. Title: N2-OLP-51, Condensate Demineralizer

B. Purpose: In a lecture presentation, the instructor shall present information for the student to meet each Student Learning Objectives. Additionally, he shall provide sufficient explanation to facilitate the student's understanding of the information presented.

C. Estimated Duration: Approximately 1.5 hours

D. Training 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. 3/4.4.4, Chemistry
2. Procedures
   a. N2-OP-5, Condensate Demineralizer System
3. NMP-2 FSAR
   a. None

II. REQUIREMENTS AND PREREQUISITES

A. Requirements for Class:

1. AP-9, Rev. 2, Administration of Training
2. NTP-10, Rev. 4, Training of Licensed Operator Candidates
3. NTP-11, Rev. 5, Licensed Operator Retraining and Continuing Training
4. NTP-12, Rev. 3, 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 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.

2. Students

a. Meet eligibility requirements per 10CFR55, 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-51
5. N2-OLT-51
6. See Section I.E.1
7. See Section I.E.2

B. Student Materials

1. N2-OLT-51
2. See Section I.E.1
3. See Section I.E.2

IV. EXAMINATIONS, QUIZZES AND ANSWER KEYS

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

V. LEARNING OBJECTIVES FOR THE CONDENSATE DEMINERALIZER SYSTEM

TO-1 To provide the trainee with knowledges of the following that will allow safe and efficient operation of the Condensate Demineralizer System:

a. System purpose
b. Indications
c. Alarms
d. Major components
e. Normal and abnormal operation
f. Operator responsibilities according to procedures
g. Technical Specifications
h. Normal precautions and limitations

TO-2 To provide the trainee with a basic knowledge of the Condensate Demineralizer System.

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

EO-1 State the purpose of the Condensate Demineralizer System.

EO-2 Discuss the purpose of the following components:

a. Condensate Demineralizers
b. Resin Transfer
c. Ultrasonic Resin Cleaning
d. Resin Regeneration
e. Regenerant and Recovered Acid
f. Regenerant and Recovered Caustic
g. Waste Neutralizing
h. Low Conductivity Waste System

EO-3 Describe the normal mode of operation including system flow path.

EO-4 Given N2-OP-5, Condensate Demineralizer, identify the appropriate actions and/or locate information related to:

a. Startup
b. Normal Operations
c. Shutdown
d. Off-Normal Operations
e. Procedures for correcting alarm conditions

EO-5 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 CND System.

VI. LESSON CONTENT	Text Ref. Page	Text Ref. Fig.	S.L.O
I. INTRODUCTION			
Student Learning Objectives	i		
A. System Purpose	1		1
The condensate demineralizer system removes soluble and insoluble impurities from the condensate to maintain reactor feedwater purity.			
The system also cleans and regenerates the condensate demineralizer resin and the radioactive waste demineralizer resin.			
Maintains condensate water conductivity < 2 umhos/cm and pH of 6.5 - 7.5.			
B. General Description			
1. Use figure 1 to discuss system flowpaths and operation.		1	3
2. The Condensate Demineralizer System consists of:			
a. Nine condensate demineralizers served by five parallel flow paths, and			
b. The regeneration subsystem.			
3. Condensate flow from the condenser is directed to the demineralizer for treatment then returned to the Condensate system. A condensate system demineralizer bypass is provided.			

Activity		Text Ref. Page	Text Ref. Fig.	S.L.O
4.	When the flow rate thru a mixed resin bed becomes low or the resin ion exchange capability is exhausted, the resin is transferred to the External Regeneration system. The transfers are operator initiated, and then proceed automatically.	2	1	3
5.	The mixed resin is physically cleaned in the Ultrasonic Resin Cleaner (URC) and then stored until it is sent to a demineralizer or to the resin regeneration tanks.			
6.	In the regeneration process,			
	a. The mixed resin is separated and placed into the cation and the anion regeneration tanks.			
	b. The cation resin is regenerated by flushing with a dilute regenerate acid.			
	c. The anion resin is regenerated by flushing with a dilute regenerate caustic.			
7.	When the resins have been regenerated, they are transferred to a mix and hold tank where they are:			
	a. Flushed and mixed by water flow through the tank,			
	b. And then held for transfer to a demineralizer.			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
8. The regenerating acid and caustic are supplied thru subsystems. These subsystems store strong acid or caustic and dilute it for use in the regeneration tanks.	2		2
9. The recovered acid and caustic subsystems collect for re-use the acid and caustic solutions from the previous resin regeneration cycle.			
II. DETAILED DESCRIPTION			
A. Condensate Demineralizers	3	1	2a
1. Function-The condensate demineralizers remove soluble and insoluble impurities from the condensate.			
2. Condensate flow paths			
a. The condensate inlet header divides into 5 parallel lines to supply the nine demineralizers. (A and F, B and G, C and H, D and J, and E only)			
b. Five stainless steel underdrain resin retainers located in each demineralizer vessel and a resin strainer in each demineralizer discharge line prevent resin release from the demineralizer.			
c. Outlet conductivity is monitored by a conductivity element.			
B. Resin Transfer			2b
1. Function-Transfer of resin between the demineralizers, the regeneration system and the ultrasonic cleaning system (URC) is controlled automatically by timed programmers			
2. Resin transfers:			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
a. Demineralizers to the regeneration system	3		2b
b. Demineralizers to the URC system			
c. URC system to the regeneration system			
d. URC or regeneration system to the demineralizers.			
e. Radwaste demineralizers to the regeneration or URC system.			
f. Radwaste resin return to the radwaste demineralizers from the regeneration or URC system.			
3. Resin transfer driving force is provided by:			
a. Condensate system water (CNM) (normal supply)			
b. Condensate Storage and Transfer system water (CNS) (alternate supply)	4		
c. Service Air System air (SAS)			
C. Ultrasonic Resin Cleaning			2c
1. Function-The URC system physically cleans dirty resin			
2. Resin enters the URC resin receiver tank via the resin transfer header			
3. The resin is then transferred to the Ultrasonic Resin Cleaner			

Activity		Text Ref. Page	Text Ref. Fig.	S.L.O
4.	The Resin is ultrasonicly cleaned as it settles in the cleaner. Dirt is removed from the resin beads by the force of sound waves produced in the cleaner hitting the bead. A small counterflow of backwash water is used to carry the dirt out of the top of the cleaner. The backwash flow is sent to the low conductivity waste tank.	4		2c
5.	Clean resin is transported to the URC cleaned resin storage tank , where it is held for transfer to the demineralizer or sent.to the regeneration system.			
D.	Resin Regeneration			2d
1.	Function-The resin regeneration system restores the ion exchange capability of (regenerates) exhausted resin.			
2.	Resin is transferred to the cation regeneration tank from the resin transfer header.			
3.	Anion resin separated and transferred to the anion regeneration tank by a reverse flow in the cation tank. The anion resin is lighter than the cation resin.			
a.	Cation resin-regenerated with acid.			
b.	Anion resin-regenerated with caustic.			
4.	The regenerated resins are then sent to the resin mix and hold tank.			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
a. The resins are mixed, washed and transferred as necessary.	4		2d
5. Fresh resin is added in the respective regeneration tank as required			
E. Regenerant and Recovered Acid	5		2e
1. Function-The regenerant acid system supplies fresh dilute acid for cation resin regeneration. The recovered acid has been previously used in an earlier regeneration cycle.			
2. The Acid Day Tank receives sulfuric acid from the Acid Treatment System (WTA).			
3. Acid regenerant feed pumps pump acid to a mixing tee where it is mixed with CNM or CNS water to produce a dilute acid solution for the regeneration system.			
4. After the regeneration process the acid is recovered and stored in the recovered acid tank and used in the initial stages of the next cation resin regeneration. Recovered Acid is used once and sent to the waste neutralization tank for processing.			
F. Regenerant and Recovered Caustic			2f
1. Function-The Regenerant Caustic system supplies dilute caustic for anion resin regeneration.			
2. The Caustic Day Tank receives sodium hydroxide (NaOH) from the Makeup Water Treatment system (WTS)..			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
3. Caustic regeneration feed pumps pump caustic to mixing tee where the caustic is mixed with water from:	5		2f
a. The CNM or CNS system.			
b. Heated water from the caustic dilution water tank.			
4. Recovered caustic operates identically as the recovered acid system using the recovered caustic tank.			
G. Transfer and Generation Water Supply			
1. Function-Water is supplied to the transfer and regeneration components and piping, from either the condensate demineralizer outlet header or the CNS system, as selected by the operator.			
H. Transfer and Regeneration Air Supply	6		
1. Function-Air is supplied to the the transfer and regeneration system from the service air system.			
2. 3 separate setpoints provide pressure settings for various evolutions:			
I. Waste Neutralizing			2g
1. Function-The pH of the waste liquids produced in the regeneration process is neutralized by the addition of strong acid or caustic to produce a pH neutral waste which can be more easily processed.			
2. The chemical waste sump collects low volume, high conductivity wastes.			
3. 2 chemical waste sump pumps transfer the sump contents to the waste neutralizing tank.			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
4. . 2 waste recirculation and transfer pumps can recirculate the waste neutralizing contents for mixing during acid or caustic neutralization or pump the neutralized waste to the radioactive liquid waste system (LWS).	6		2g
J. Low Conductivity Waste System			2h
1. Function-Relatively high quality, low conductivity wastes are collected in the low conductivity waste tank			
a. The wastes are transferred by the low conductivity waste pumps to LWS, or to the waste neutralizing tank if conductivity is too high.			
III. INSTRUMENTATION, CONTROLS, AND INTERLOCKS			
A. Indications			
No CR indication, only two annunciators on P851.			
B. Controls	7		
No system controls are located in the main control room. They are located at local control panels.			
C. Valve Interlocks			
1. When the Demineralizer vessel condensate inlet and outlet valves are open, the demineralizer vent valve resin inlet valve and resin outlet valve are closed.			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
2. Demineralizer condensate rinse outlet valve is interlocked such that it is closed when the demineralizer condensate outlet valve is open.	7		
IV. SYSTEM OPERATION			
A. Normal Operation			
1. During normal operations 7 demineralizers are on the line, and 2 demineralizers are on standby, one of which may be in the process of resin transfer.		1	3
2. Auto Resin Transfer is performed by:	8		
a. Place the demineralizer in standby.			
b. Select demineralizer as the origin of the transfer.			
c. Select destination of transfer (sepaerate switch for each programmer to select types of transfer for that programmer).			
d. Turn on programmer timing motors.			
e. Verify the Master Mode Selector in "Auto".			
f. Depress the start button.			

Activity	Text Ref. Page	Text Ref. Fig.	S.L.O
3. The resin transfer, cleaning, or regeneration is performed automatically by the programmer.	8		3
V. SYSTEM INTERRELATIONS			
A. Service Air System-supplies air to the air transfer header.			
B. Instrument Air System-provides air for the system pneumatic valves.	9		
C. Condensate System-provides normal flow and resin sluicing water.			
D. Condensate Transfer and Storage System-provides an alternate supply of sluicing water.			
E. Water Treating System-supplies concentrated acid and caustic and receives any excess of the solutions.	9		
F. Liquid Radioactive Waste System-receives the low conductivity waste produced. The radwaste demineralizer resin is also treated by the system.			
VI. DETAILED SYSTEM REFERENCE REVIEW	10		
Review each of the following referenced documents with the class.			
A. Technical Specification			
1. 3/4.4.4 Chemistry			
B. Procedures			4
1. N2-OP-5 Condensate Demineralizer System			

VII. RELATED PLANT EVENTS

A. Refer to Addensum "A" and review related events with class (if applicable).

VIII. SYSTEM HISTORY

A. Refer to Addendum "B" and review related modifications with class (if applicable).

IX. WRAP-UP

A. Review the Student Learning Objectives