NINE MILE POINT NUCLEAR STATION

07-488-91

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** 

**REVISION 5** 

DATE AND INITIALS

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Summary of Pages

Revision:  $\underline{5}$  (Effective Date:  $\underline{7/12/90}$ 

Number of Pages: 16

Pages

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

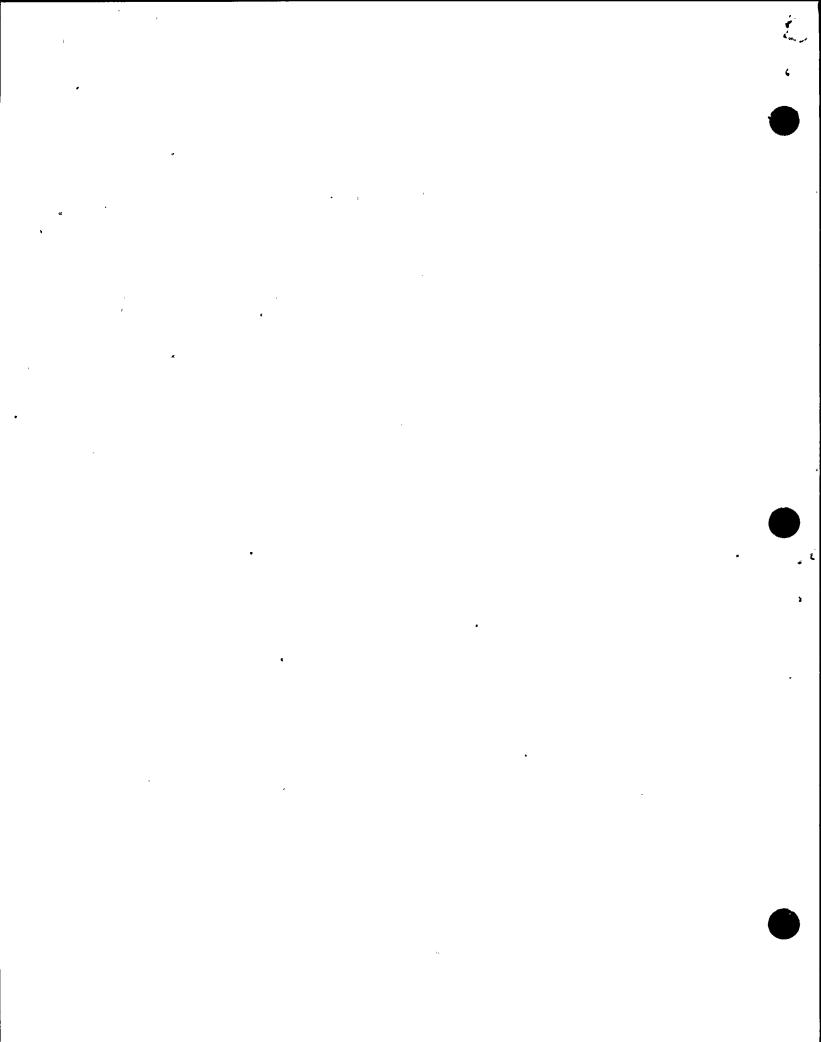
NIÁGARA MOHAWK POWER CORPORATION

# OBJECTIVE APPLICABILITY MATRIX

OBJECTIVE NUMBER	LICENSE CLASS	NON-OPS
TO-1	X	
T0-1 T0-2		X
E0-1	X	X
EO-2	X	X
EO-3	X	X
EO-4	X	
EO-5	SRO ONLY	
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UNIT 2 OPS/2142



#### 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

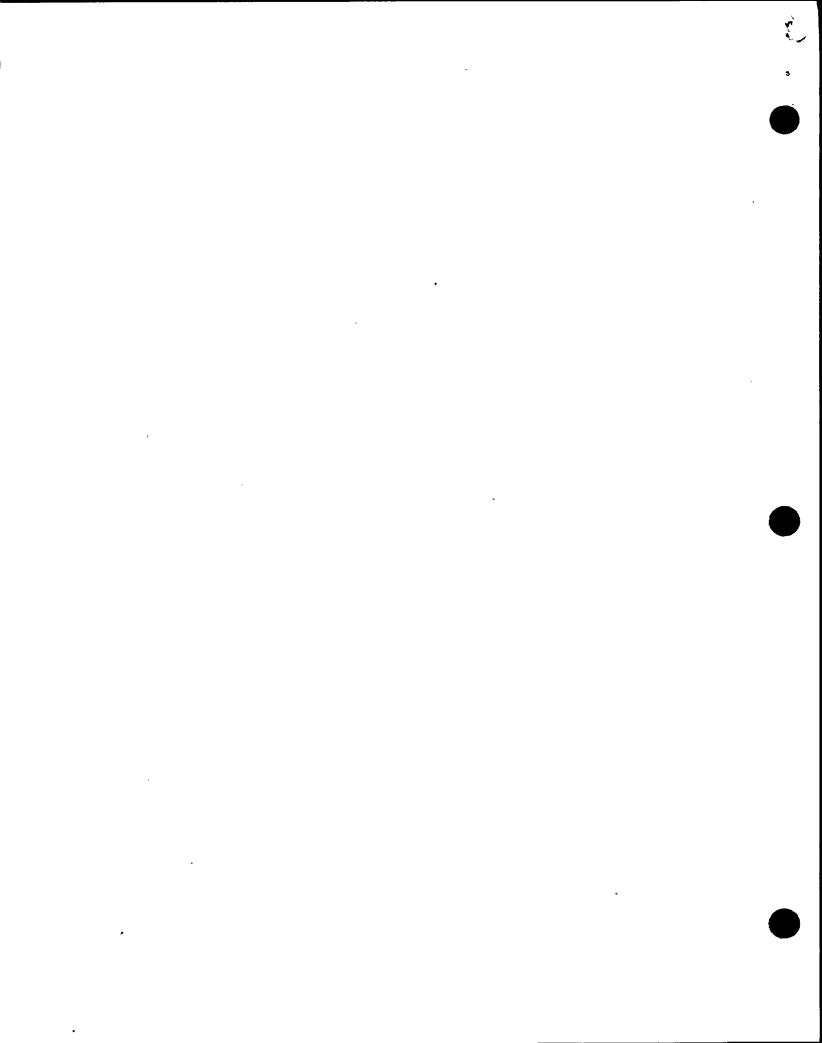
#### II. REQUIREMENTS AND PREREQUISITES

- 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.

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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.

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- 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.

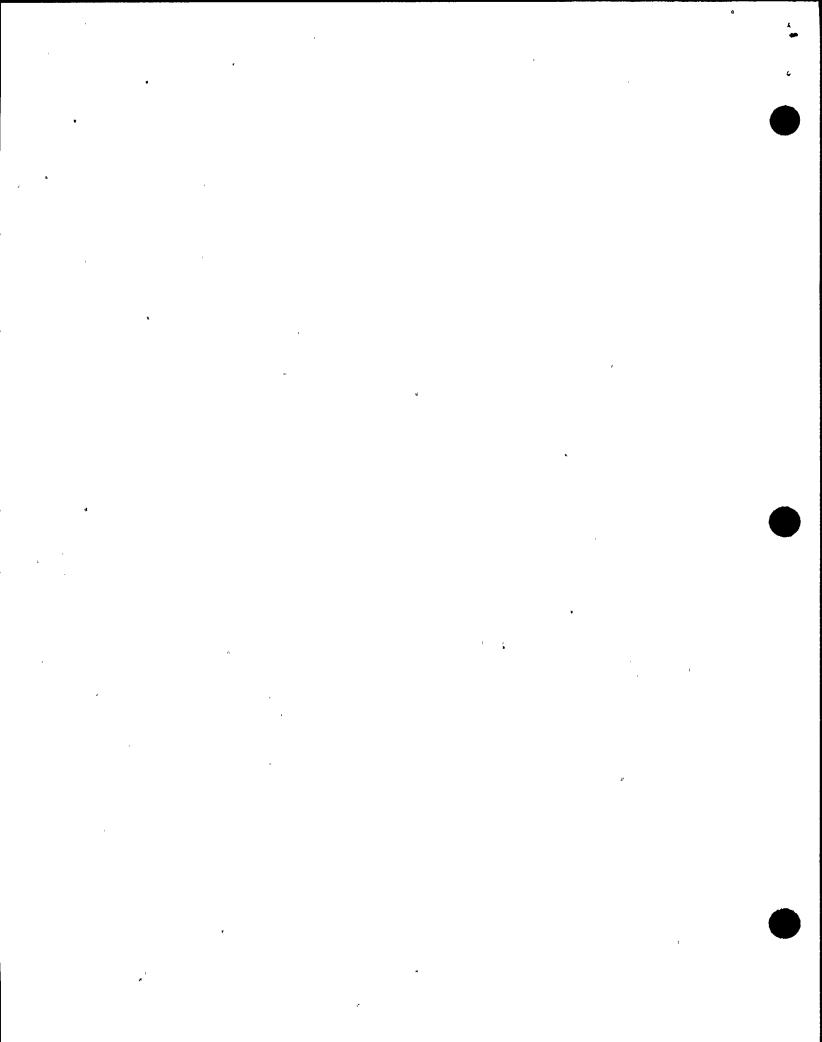
- EO-1 State the purpose of the Condensate Demineralizer System.
- EO-2 Discuss the purpose of the following components:
  - a. Condensate Demineralizers
  - b. Resin Transfer
  - c. Ultrasonic Resin Cleaning
  - d. Resin Regeneration
  - e. Regenerant and Recovered Acid
  - f. Regenerant and Recovered Caustic
  - g. Waste Neutralizing
  - h. Low Conductivity Waste System
- EO-3 Describe the normal mode of operation including system flow path.

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- 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.



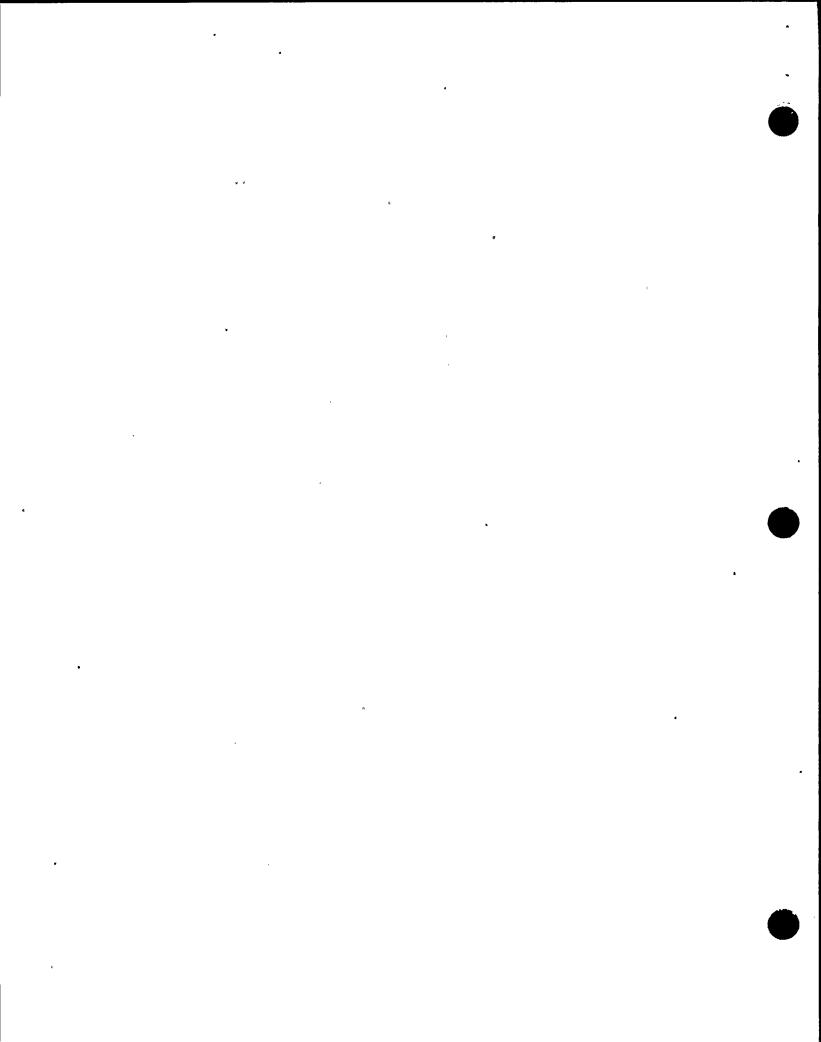
>			Text	Text	ı	
	۷ī.	LESSON CONTENT	Ref. <u>Page</u>	Ref. <u>Fig.</u>	<u>S.L.0</u>	
İ.	INT	RODUCTION				
	Stu	dent Learning Objectives	<b>i</b> .			
	Α.	System Purpose	1 ,		1	
		The condensate demineralizer system				
		removes soluble and insoluble impurities	1			
		from the condensate to maintain reactor				
		feedwater purity.			ı	

The system also cleans and regenerates the condensate demineralizer resin and the radio-active 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.
- 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.



1	Text Ref.	Text Ref.	
<u>Activity</u>			<u>S.L.0</u>

3

- 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.
- 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.

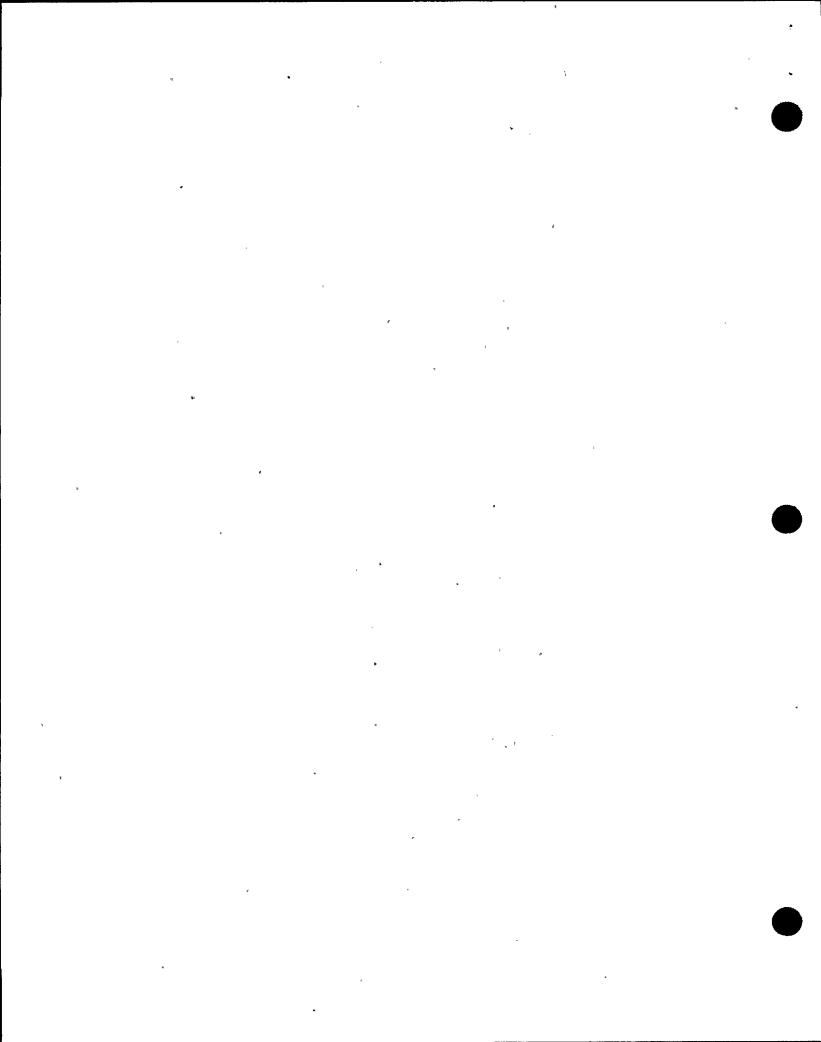
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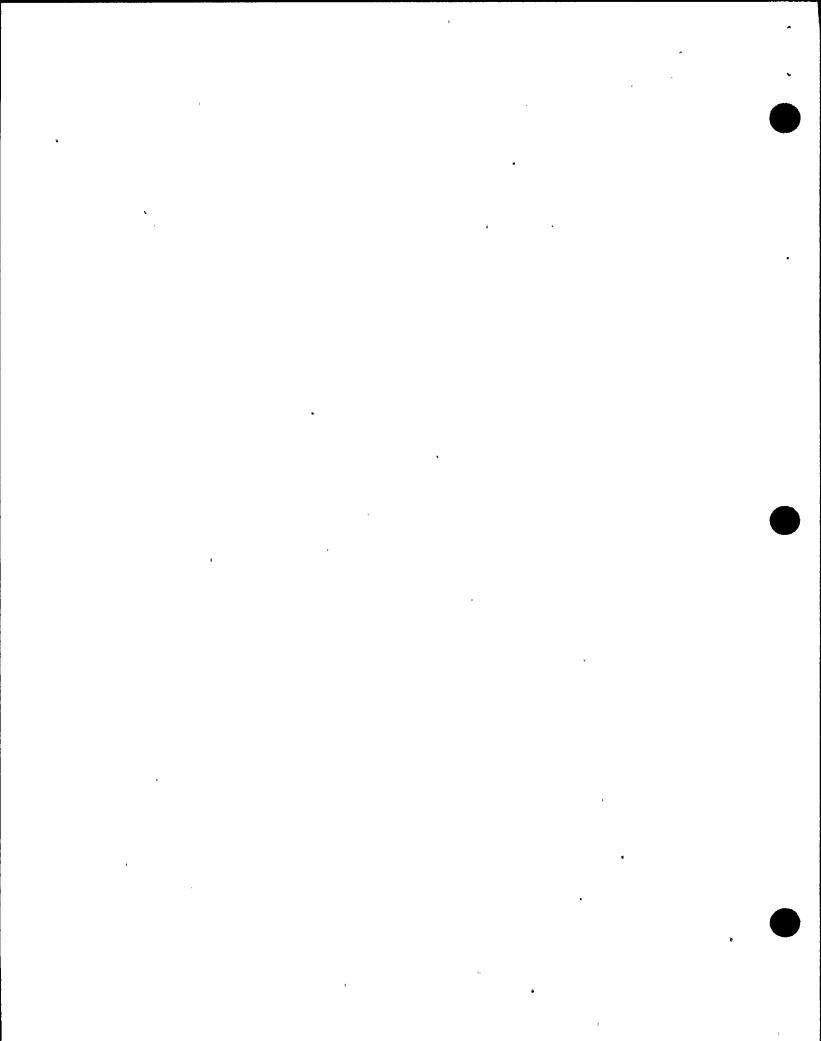
8. The regenerating acid and caustic are 2	^
supplied thru subsystems. These sub- systems store strong acid or caustic and dilute it for use in the regener- ation tanks.	2
9. The recovered acid and caustic sub- systems collect for re-use the acid and caustic solutions from the previous resin regeneration cycle.	
II. <u>DETAILED DESCRIPTION</u>	
A. <u>Condensate Demineralizers</u> 3	2a
<ol> <li>Function-The condensate demineralizers     remove soluble and insoluble impurities</li> </ol>	
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	<b>a</b> l-
1. Function-Transfer of resin between	2b .
the demineralizers, the regeneration	
system and the ultrasonic cleaning system (URC) is controlled auto- matically by timed programmers	

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<u>Activity</u>		•	Text Ref. <u>Page</u>	Text Ref. <u>Fig.</u>	<u>S.L</u>
	a.	Demineralizers to the regeneration system	3		2
	b.	Demineralizers to the URC system			
	с.	URC system to the regeneration system			_
		URC or regeneration system to the demineralizers.		1	•
		Radwaste demineralizers to the regeneration or URC system.			
÷		Radwaste resin return to the radwaste demineralizers from the regeneration or URC system.			
3.		transfer driving force is			
<b>J.</b>		ded by:	1		
	·a.	Condensate system water (CNM) (normal supply)			
	b.	Condensate Storage and Transfer system water (CNS) (alternate supply)	4		
		Service Air System air (SAS)		ğ.	
C. Ulti		Resin Cleaning			2c
1.	Funct	ion-The URC system physically			
	clean	s dirty resin			
2.	Resin	enters the URC resin receiver			
	tank head	via the resin transfer er		•	
3.	The r	esin is then transferred to the			
	Ultra	sonic Resin Cleaner			



Text Text Ref. Ref. Ref. Page Fig.

4. The Resin is ultrasonicly cleaned as it 4 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.

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

- Function-The resin regeneration system restores the ion exchange capability of (regenerates) exhausted resin.
- 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.
  - Anion resin-regenerated with caustic.
- 4. The regenerated resins are then sent to the resin mix and hold tank.

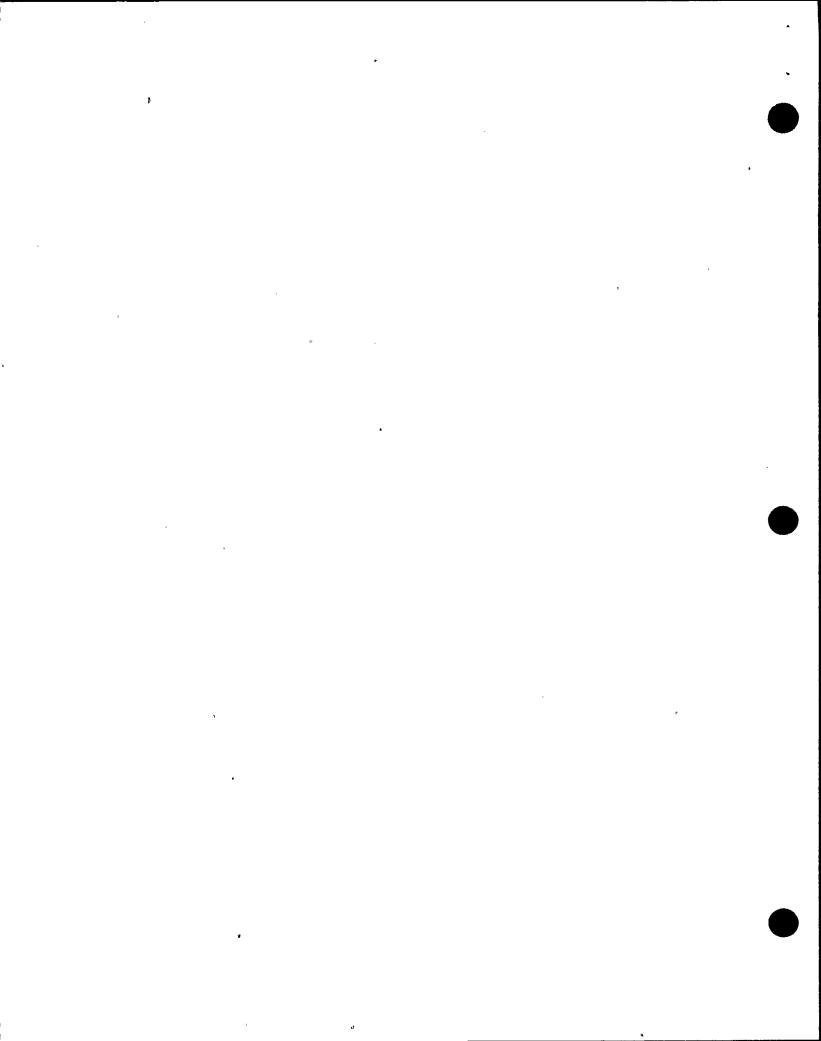
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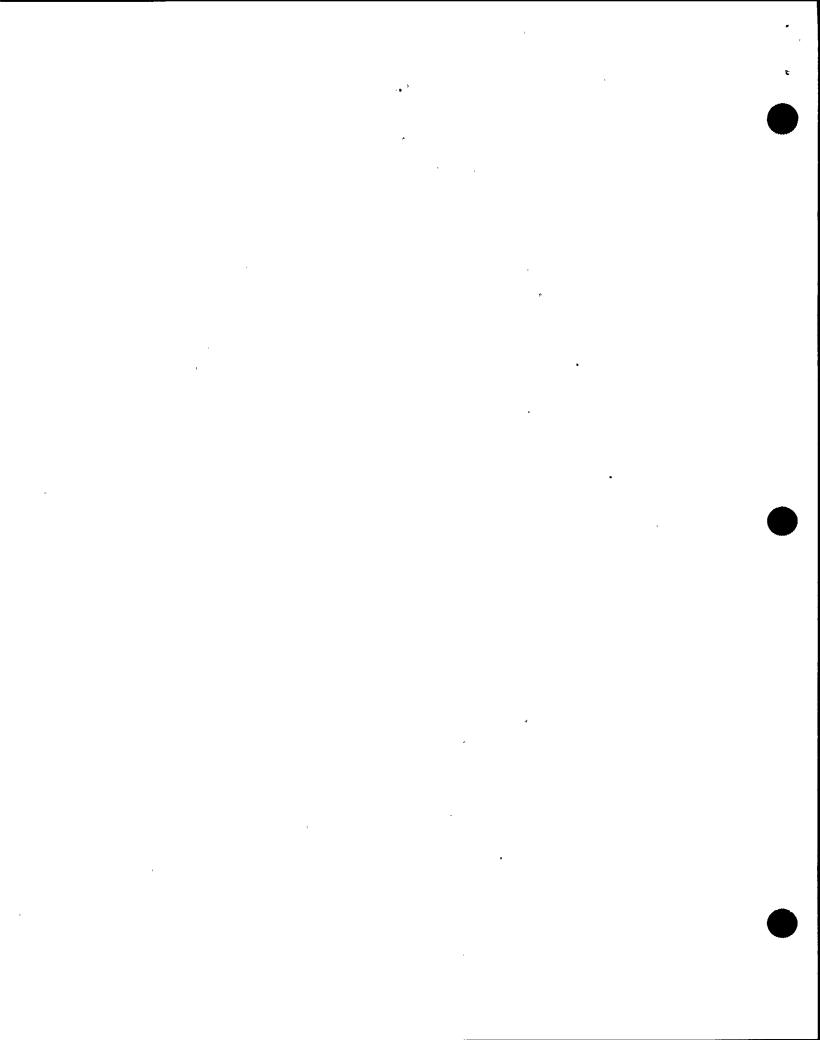
2d

S.L.0

2c

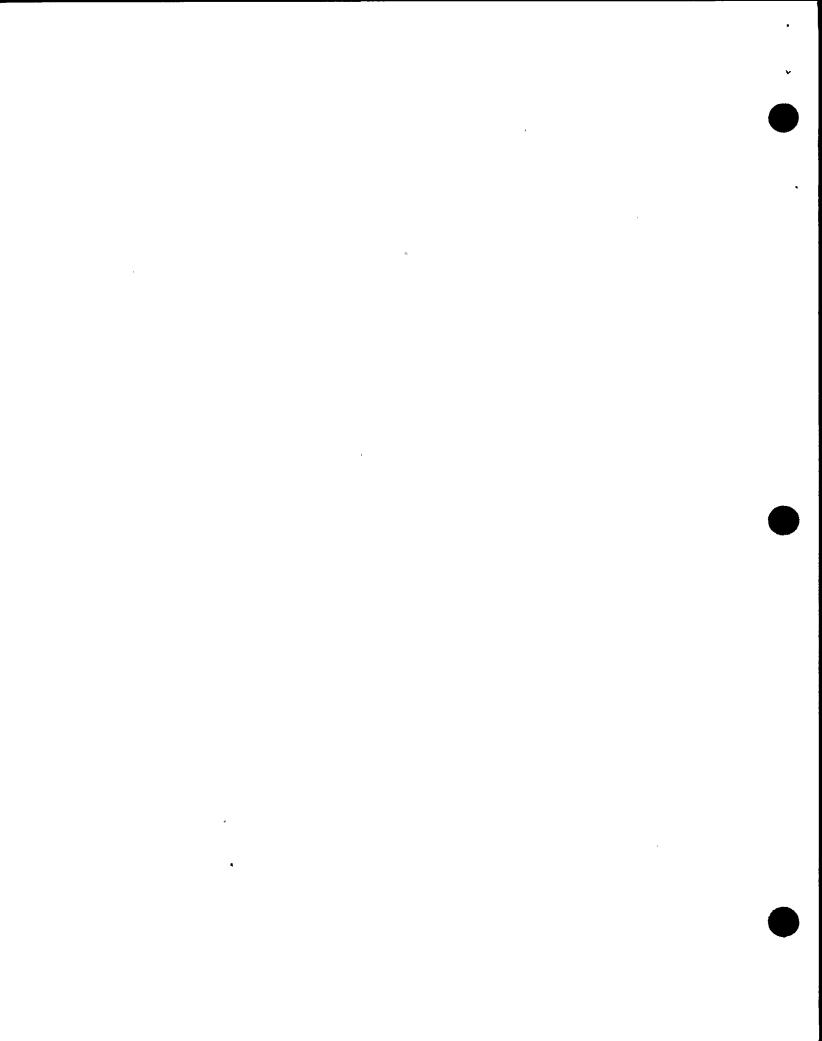


<u>Act</u>	<u>ivity</u>		Text Ref. <u>Page</u>	Text Ref. <u>Fig.</u>	<u>S.L.0</u>
		a. The resins are mixed, washed	4		2d
		and transferred as necessary.			
	5.	Fresh resin is added in the respective			•
		regeneration tank as required			
Ε.	Rege	enerant and Recovered Acid	5		2e
	1.	Function-The regenerant 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).			ŧ
	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		k	
		regeneration system.			
1	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.	<u>Rege</u>	nerant and Recovered Caustic			2f
	1.	Function-The Regenerant Caustic			
		system supplies dilute caustic for			
		anion resin regeneration.		1	
	2.	The Caustic Day Tank receives sodium			
		hydroxide (NaOH) from the Makeup Water			
1		Treatment system (WTS)			



Text Text Ref. Ref. Fig. <u>Activity</u> Page <u>S.L.0</u> 3. 5 2f Caustic regeneration feed pumps pump caustic to mixing tee where the caustic is mixed with water from: The CNM or CNS system. a. b. Heated water from the caustic dilution water tank. 4. Recovered caustic operates identically as the recovered acid system using the recovered caustic tank. Transfer and Generation Water Supply G. 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. Н. Transfer and Regeneration Air Supply 6 Function-Air is supplied to the 1. the transfer and regeneration system from the service air system. 2. 3 separate setpoints provide pressure settings for various evolutions: I. Waste Neutralizing 2g 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. The chemical waste sump collects 2. low volume, high conductivity wastes. 2 chemical waste sump pumps transfer 3. the sump contents to the waste neutralizing tank. 02-L0T-001-257-2-00 -11-June 1990

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Text Ref. Page Fig.

S.L.0 2g

4.. 2 waste recirculation and transfer pumps 6 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).

#### J. Low Conductivity Waste System

2h

- 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

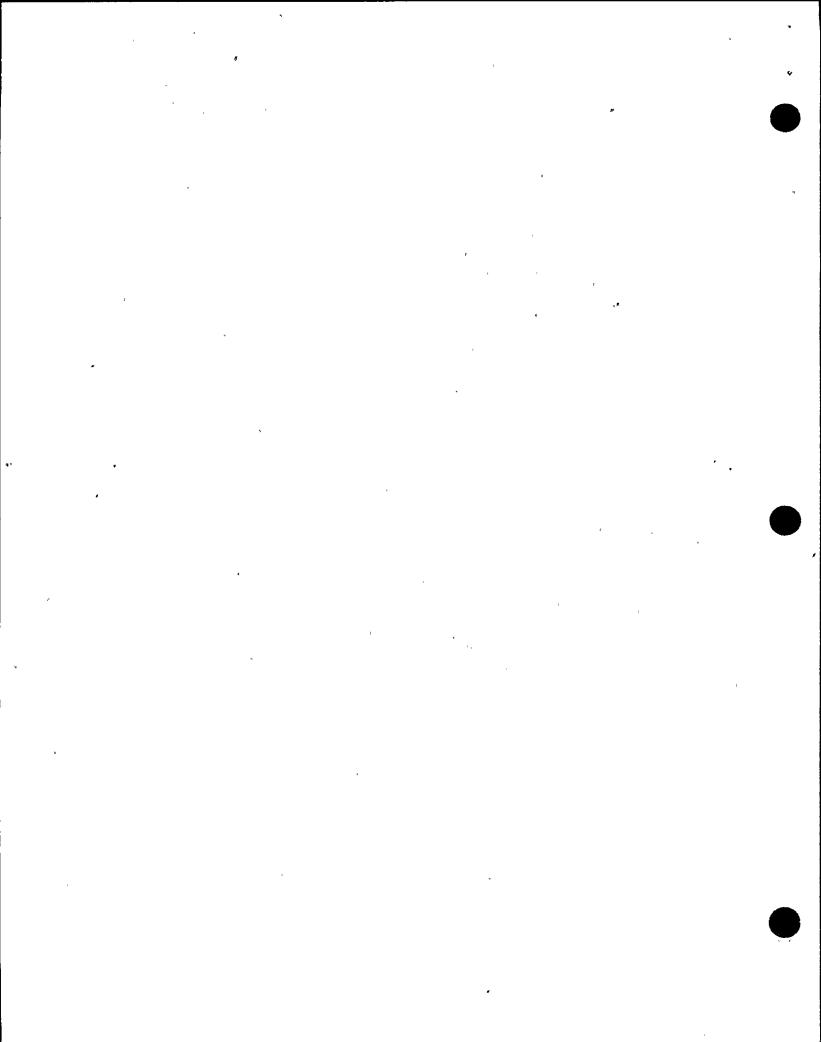
Α. Indications

> No CR indication, only two annunciators on P851.

В. Controls 7

No system controls are located in the main control room. They are located at local control panels.

- C. Valve Interlocks
  - When the Demineralizer vessel 1. condensate inlet and outlet valves are open, the demineralizer vent valve resin inlet valve and resin outlet valve are closed.



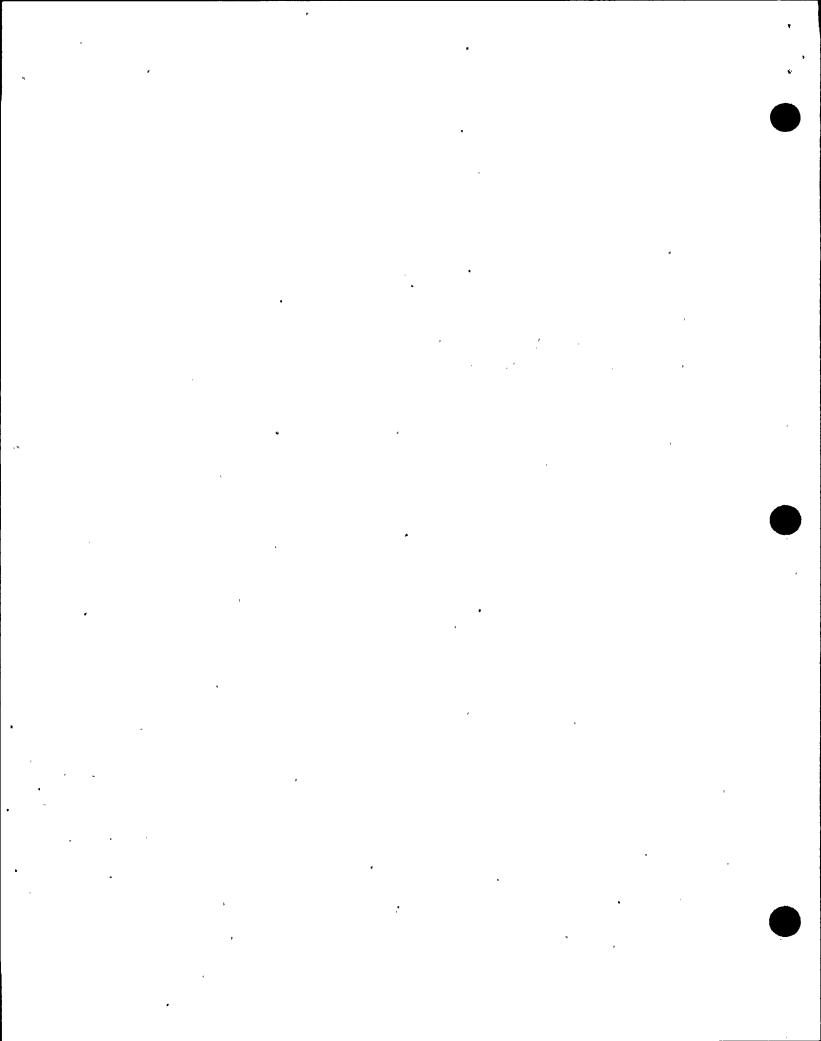
	T. Control of the Con	16xt	iext	
		Ref.	Ref.	
<u>Activity</u>		<u>Page</u>	<u>Fig.</u>	<u>S.L.0</u>

Demineralizer condensate rinse
 outlet valve is interlocked
 such that it is closed when the
 demineralizer condensate outlet
 valve is open.

## IV. SYSTEM OPERATION

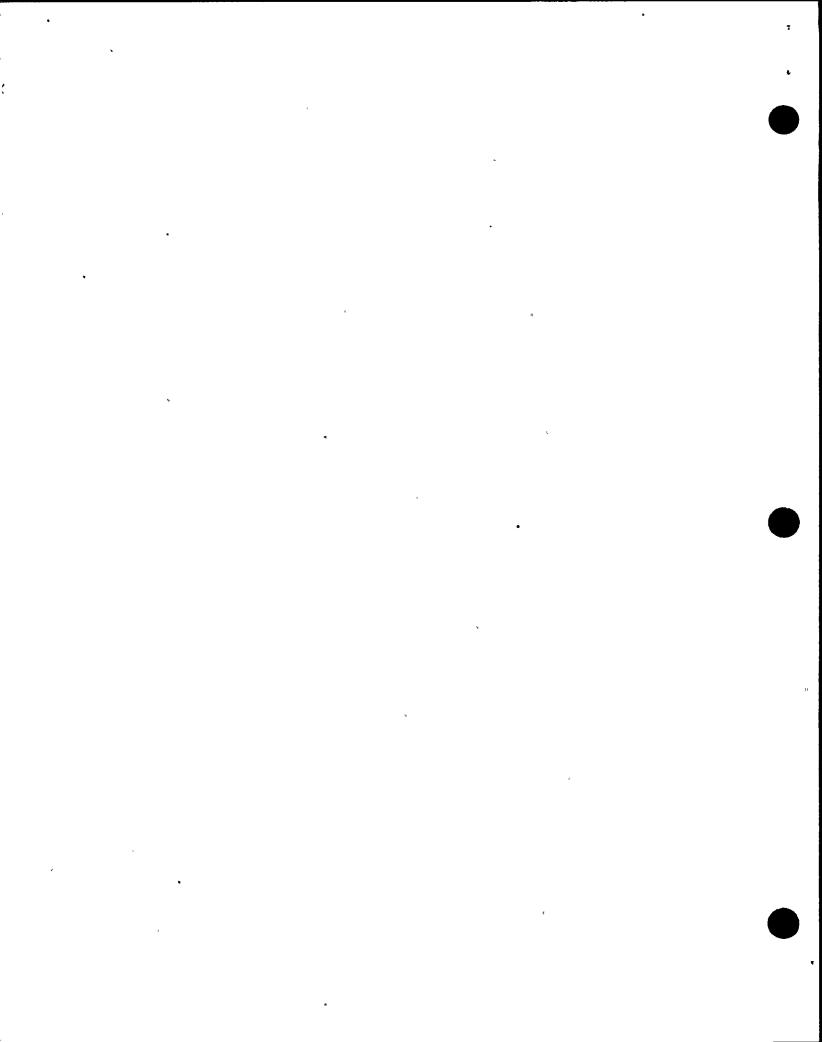
#### A. Normal Operation

- 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.
- 2. Auto Resin Transfer is performed by:
  - 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. <u>Page</u>	Text Ref. <u>Fig.</u>	<u>S.L.0</u>
<b>-</b>	<ol> <li>The resin transfer, cleaning, or regeneration is performed automatically by the programmer.</li> </ol>	8		3
٧.	<ul> <li>SYSTEM INTERRELATIONS</li> <li>A. Service Air System-supplies air to the air transfer header.</li> <li>B. Instrument Air System-provides air for the system pneumatic valves.</li> <li>C. Condensate System-provides normal flow and resin sluicing water.</li> <li>D. Condensate Transfer and Storage System-provides an alternate supply of sluicing water.</li> <li>E. Water Treating System-supplies concentrated acid and caustic and receives any excess of the solutions.</li> </ul>	9		
VI.	F. Liquid Radioactive Waste System-receives the low conductivity waste produced. The radwaste demineralizer resin is also treated by the system.  DETAILED SYSTEM REFERENCE REVIEW Review each of the following referenced documents with the class.  A. Technical Specification 1. 3/4.4.4 Chemistry	10		
	B. <u>Procedures</u>			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

