Ø2-189-91

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-REQ-001-205-2-00-3 Revision 5

TITLE: RESIDUAL HEAT REMOVAL SYSTEM

	SIGNATURE	DATE
PREPARER	[signature]	2/22/90
TRAINING SUPPORT SUPERVISOR	[signature] for JAL	2-22-90
TRAINING AREA SUPERVISOR	[signature]	2/27/90
PLANT SUPERVISOR/ USER GROUP SUPERVISOR	[signature] for MJ Colomb	3/2/90

MASTER CONTROLLED DOCUMENT

Summary of Pages

(Effective Date: 3/2/90)

Number of Pages: 35

Date	Pages
January 1990	1-35

THIS LESSON PLAN IS A GENERAL REWRITE

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION: ______ ______

DATA ENTRY: ______ ______

RECORDS: ______ ______

38pp

5/4/39

ATTACHMENT 5
LESSON PLAN TEMPORARY/PUBLICATION/ADDENDUM CHANGE FORM

The attached change was made to:

Lesson plan title: Residual Heat Removal

Lesson plan number: 02-RHR-001-205-2-00

Name of instructor initiating change: P. Walsh

Reason for the change: Add SOER 87-02 as a reference (Pg 2)

Type of change:

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

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 7/30/91

Supervisor Operations Training (or designee): [signature] for J. Reid /Date 7/30/91

ATTACHMENT 3: LESSON PLAN TEMPORARY/PUBLICATION CHANGE FORM

The attached change was made to:

Lesson plan title: Residual Heat Removal

Lesson plan number: 02-REQ-001-205-2-00-3

Name of instructor initiating change: J. COBB

Reason for the change: TCO-02-REQ-90-086

SDER 82-2 and SIL 357 Pg 2

Sect VIII pg 30

Type of change: Temporary change X Publication change ____

Disposition:

X 1. Incorporate this change during the next scheduled revision. The change does not alter the intent of the lesson plan.

____ 2. Begin revising the lesson plan immediately. Supervisor initiate the process.

Approvals:

Instructor: Jeffrey L Cobb /Date 7-19-90

Senior Instructor: [signature] /Date 7/19/90

Supervisor: J Kaminski for S. Poindexter /Date 7/20/90

I. TRAINING DESCRIPTION

A. Title of Lesson: Residual Heat Removal System

B. Lesson Description:

Provide a general review of the RHR System for licensed operators.

C. Estimate of the Duration of the Lesson: 3.0 Hours

D. Method of Evaluation, Grade Format and Standard of Evaluation:

Open reference written examination. 80% minimum passing grade.

E. Method and Setting of Instruction:

1. Classroom Lecture
2. 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.

F. Prerequisites:

1. Instructor:
   a. Instructors shall be qualified for the material being delivered in accordance with NTP-16, Rev. 3, Attachment A.
   b. Qualified in instructional skills as certified by NTP-16.
2. Trainee:
   a. Meet eligibility requirements per 10CFR55, <u>or</u>
   b. Be recommended for this training by the Operations Superintendent or his designee or the Training Superintendent.

G. References:

1. Technical Specifications
   a. 3/4.5.1 ECCS (Operating)
   b. 3/4.5.2 ECCS (Shutdown)
   c. 3/4.4.9.1 RHR Hot Shutdown
   d. 3/4.4.9.2 RHR Cold Shutdown
   e. 3/4.6.2.2 Suppression Pool and Drywell Spray
   f. 3/4.6.2.3 Suppression Pool Cooling
   g. 3/4.9.11 Refueling Operations
2. Procedures
   a. N2-OP-31 Residual Heat Removal
3. NMP-2 FSAR
   a. Design Basis, Vol. 13, Ch. 5, Pg. 5.9-17
      Vol. 13, Ch. 6, Pg. 6.3-6
      Vol. 16, Ch. 7, Pg. 7.4-1
4. GEK83337 Residual Heat Removal System

5. GE807E170TY 8. SOER 87-02 7/30/91

6. RHS-ESKs

7. SOER 87-02

II. REQUIREMENTS

A. Requirements for Class:

1. AP-9, Rev. 2, "Administration of Training"

2. NTP-11, Rev. 5, "Licensed Operator Retraining and Continuing Training"

II. TRAINING MATERIALS

A. Instructor Materials:

1. Transparency Package
2. Overhead Projector
3. Whiteboard and Felt Tip Markers
4. N2-OLP-15
5. N2-OLT-15
6. See Section I.G.1
7. See Section I.G.2
8. Lesson Plan

B. Trainee Materials:

1. N2-OLT-15, Residual Heat Removal System

IV. EXAM MASTER ANSWER KEYS

Exams and master answer key(s) filed with the official records.

V. LEARNING OBJECTIVES

A. Terminal Objectives

1. Reactor Operator

TO-1 2030020101 Place the LPCI system in standby readiness.

TO-2 2030070201 Perform the LPCI full flow operability test.

TO-3 2039080101 Discuss precautions associated with the LPCI injection during emergency condition from the control room.

TO-4 2050010101 Perform lineups on the RHR system.

TO-5 2050020101 Fill and vent the RHR system.

TO-6 2050030101 Startup the RHR system in shutdown cooling mode.

TO-7 2050050101 Operate a RHR heat exchanger.

TO-8 2050070101 Operate the RHR system with the fuel pool cooling system.

TO-9 2050080101 Monitor the RHR system.

TO-10 2050100201 Perform ECCS functional test (N2-OSP-RHR-R001)

TO-11 2050110101 Shutdown the RHR system.

TO-12 2050120101 Drain the RHR system.

TO-13 2050150101 Operate the containment spray system.

TO-14 2059010501 Respond to a loss of the RHR system.

TO-15 2059220101 Conduct drywell spray nozzle air test.

TO-16 2059300101 Startup the steam condensing mode of the RHR system.

TO-17 2059330101 Perform RPV/Containment service water flooding from the control room.

TO-18 2059340401 Perform the RHR keep fill pump alternate RPV injection from the control room.

TO-19 2059350401 Perform RHR suppression pool alternate fill from the control room.

TO-20 2059370401 Perform RHR emergency fill from the control room.

TO-21 2059380101 Throttle LPCI injection flow from the control room.

TO-22 2059390101 Perform RHR alternate shutdown cooling from the control room.

TO-23 2059410201 Perform the RHR shutdown cooling system integrity test N2-OSP-LIQ-R001.

B. Enabling Objective

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 each of the five (5) modes of the Residual Heat Removal System (RHS).

EO-2 Given a diagram of the RHS system show the flow path for each mode of operation, components, system interconnections and instrumentation available to the control room operator.

EO-3 State the purpose of the following:

a. RHS pumps
b. RHS heat exchangers
c. Jockey pumps

EO-4 State the power supplies for the following components:

a. RHS pumps
b. Jockey pump

EO-5 Explain the purpose of the three (3) additional capabilities of the RHS system, including the flow paths.

EO-6 State the setpoints and functions for the automatic isolations of the RHS System.

EO-7 Describe the system automatic response to the following plant casualties:

a. Large break LOCA
b. Small break LOCA which does not depressurize RPV

EO-8 State the interlocks for the following, including its function and/or bases:

a. RHR pump suction valves
b. Test return valve FV-38
c. Suppression pool spray valve
d. Drywell spray valves
e. LPCI injection valves
f. Minimum flow valve

EO-9 State which plant systems support the operation of the RHS system and what aspects of the RHS system operation each supports.

EO-10 Given N2-OP-31, Residual Heat Removal System, identify the appropriate actions and/or locate information related to:

a. Start-Up

b. Normal Operations

c. Shutdown

d. Off-Normal Operations

e. Procedures for Correcting Alarm Conditions

f. Precautions/Limitations

EO-11 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 Residual Heat Removal System.

I. INTRODUCTION

Student Learning Objectives — EO-1

A. Purpose

1. LPCI system along with LPCS, HPCS and ADS ensure we meet the requirements of 10CFR50.46.

   a. Peak clad temperature <2200°F.

   b. Maximum cladding oxidation <17% of original thickness.

   c. H_2 generation <1% of the theoretical maximum of all zircalloy reacted.

   d. Core geometry maintained so that core cooling is not prevented.

   e. Capable of long term core cooling.

2. The Residual Heat Removal System (RHS) operates in five different modes, each having a specific purpose.

   a. The Low Pressure Coolant Injection (LPCI) mode restores and maintains the desired water level in the reactor vessel following a Loss of Coolant Accident (LOCA).

b. The Containment Spray Cooling mode condenses steam and reduces pressure in the drywell and the free air volume of the suppression chamber following a LOCA.

c. The Shutdown Cooling mode removes decay heat from the core following a reactor shutdown. The B RHS Loop has a head spray line that could be used in conjunction with the Shutdown Cooling Mode.

Note: Head spray not used except for testing because of cooldown rate concerns.

d. The Reactor Steam Condensing mode condenses reactor steam and returns the condensate to the reactor vessel through the Reactor Core Isolation Cooling (ICS) system.

Note: Normal heat sink unavailable.

EO-1

e. The Suppression Pool Cooling mode removes heat from the suppression pool water volume following safety-relief valve blowdown, prolonged Reactor Core Isolation Cooling system operation, or during post-accident conditions.

3. The RHS system has three additional capabilities. It can be used to flood the containment or RPV, if required, for long term post-accident recovery operations (B loop only). It can also augment the Spent Fuel Cooling and Cleanup System (SFC) if additional cooling capacity is required. It has a full flow test capability to return the water to the Suppression Pool. EO-5

B. General Description EO-2

1. Use figure 1 to discuss system flowpaths, components, interconnections and instrumentation.

   Delivery notes: Show TP of Figure 1. Discuss flowpaths

   a. RHS consists of three independent loops.
   b. Each pump is provided with a suction path from the suppression pool.
   c. Pump discharge can be either to the reactor vessel or back to the suppression pool.
   d. A and B loops have heat exchangers cooled by the service water system.
   e. A and B loops can also take suction from the reactor recirculation system or the spent fuel pool.

f. A and B loops can discharge into the reactor recirculation system, spent fuel cooling system, or to the drywell and suppression pool spray cooling rings.

g. Heat exchangers can condense steam from the reactor and discharge the condensate to the ICS pump suction or to the suppression pool during steam condensing mode.

2. There are controls at the Remote Shutdown Panel for operating Shutdown Cooling and Suppression Pool Cooling.

II. DETAILED DESCRIPTION

A. Suction Piping (Loop A discussed)

1. Normal suction is from the suppression pool.

a. A strainer removes particles that may damage the RHS pump seals or clog the containment or suppression pool spray nozzles.

b. Even if the strainer is 50% clogged, it can still provide adequate NPSH to the RHS pump.

c. Suppression pool suction isolation valve MOV-1A is normally open.
   1) Interlocked with MOV-2, if MOV-2 is open then MOV-1 will not open.

d. Relief valve RV-61A is set at 220 psig, relieves back to suppression pool.

2. Shutdown Cooling suction
   a. The suction originates at the suction line of reactor recirculation pump A.
   b. Valves inside the primary containment:
      1) MOV-112 is normally closed motor operated gate valve, group 5 isolation.
      2) RV-152 protects piping between MOV 112/113 set at 1235, relieves to the equipment drains.
   c. Valves outside the primary containment:
      1) MOV-113, normally closed motor operated gate valve, group 5 isolation.
      2) Relief valve RV-110, is set at 200 psig, relieves to the suppression pool.

Q: When will a group 5 isolation occur?

A: L3 159.3, High RPV pressure 128 psig, RHR pump room high temp 135°F, Rx Bldg general area temp 130.2°F, Rx Bldg pipe chase temp 135°F.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
3) Shutdown cooling suction valve MOV-2A is a normally closed motor operated butterfly-type valve.		
a) MOV-2A will not close on a LPCI initiation signal.	Q: What interlocks must be met to open MOV-2?	EO-9
3. Branch Lines	A: MOV33, FV-38 and MOV-1 must be shut.	
a. Upstream of MOV-2A a branch line provides a connection between RHS and the Spent Fuel Cooling and Cleanup System via a spool piece.		
b. Downstream of MOV-2A a branch line permits Low Pressure Core Spray system testing with suction taken from the reactor vessel when a spool piece is installed.	Note: Spool piece is permanently installed.	
B. RHS Pumps P1A,B,C		EO-3
1. The RHS pumps are three stage, vertical centrifugal motor-driven pumps.		
a. The pump has a rated capacity of 7,450 gpm at a discharge pressure of 152 psig.		
2. Mechanical seals prevent leakage of water along the pump shaft.		

a. Cooling of the seals is accomplished by directing pump discharge water to the seals via a centrifugal separator, which removes solids, and a seal cooler.

b. The seal cooler is cooled by RBCLCW with a manual backup supply from service water.

c. A Shaft bushing is installed to limit leakage along the shaft in the event of a mechanical seal failure.

3. Each RHS pump is driven by an induction motor.

a. The motor is designed to accelerate the pump to full speed and rated flow with the discharge path open within 27 seconds of receiving an initiation signal.

Note: System response based on MOV-24 stroke time.
$\leq$ 10 secs DG on bus
$\leq$ 20 secs injection valve open

b. Power supply-pump A 2ENS*SWG101, Div. I pumps B and C 2ENS*SWG103, Div. II. EO-4

C. RHS Jockey Pump

1. The RHS jockey pump supplies water to the discharge headers of RHS B and C to keep them full and pressurized to avoid water hammer upon system initiation. EO-3

2. Loop A of RHS is maintained full and pressurized by CSL jockey pump.
3. Power supply 2EHS*MCC303D

D. RHS Discharge Piping — EO-4

1. Minimum Flow Bypass Line
   a. Minimum flow valve MOV-4A/B/C opens automatically on low flow signal to provide a flow path for pump discharge when flow is less than 1400 gpm. — Use Figure 2 and 3: MOV4B control circuits. (6RHS26, Sh.9) — EO-8
   b. 8 sec. TD was based on keeping the valve closed when starting RHR in the shutdown cooling mode.
2. RHS Heat Exchanger (Loop A & B only) — EO-3
   a. The RHS heat exchanger is a single pass shell and U-tube heat exchanger using Station Service Water on the tube side for cooling.
      1) Its heat transfer capacity, 150 x 10^6 BTUs per hour, is based on providing sufficient heat removal in the Shutdown Cooling mode 20 hours after "all rods in" with RPV temp 125°F and service water temp 10°F below it's maximum temperature. — Increase in service water maximum temperature did not change design basis because the analysis was conservative.

2) Its also rated for steam condensing heat removal with max service water temp. 1.5 hrs after "all rods in".

3) The HX shell is vented to the Suppression Pool through two motor operated isolation valves, MOV-26A/B and MOV-27A/B.

4) The heat exchanger inlet valve MOV9A/B is a normally open motor operated valve used to supply water to the shell side of the heat exchanger.

5) The heat exchanger is provided with a normally open motor operated bypass valve (MOV-8A/B).

   a) Interlocked open for 10 minutes following an initiation. This allows for full flow through the system.

Figure 4 and 5 show the valve control circuity (6RHS05/Sh 8) for MOV-8.

6) Heat exchanger outlet valve MOV12A/B is a normally open motor operated valve.

7) The heat exchanger shell side outlet line has a branch for the return of condensate to the suction of the ICS pump using heat exchanger level control valve LV17A/B and MOV-32A/B a motor operated valve which isolates the heat exchanger outlet from ICS pump suction.

3. RHS Discharge Branch Headers (Loops A & B)

a. Suppression Pool Cooling Return

1) Normally closed full flow test valve (FV38A/B) is throttled for flow testing. It is also used for suppression pool cooling. EO-8

a) FV-38 interlocked closed if MOV-24 open with a LOCA signal sealed in.

2) The suppression pool return isolation valve MOV-30A/B is normally open and provides a flow path to the suppression pool for full flow testing, min flow and suppression pool cooling.

b. Suppression Pool Spray Line

1) Above the water line in the Suppression Pool is a spray ring which is used by RHS loops A and B.

2) The spray line is isolated by normally shut MOV-33A/B.

a) Closed if open on LOCA signal and cannot be opened if MOV-24 open with LOCA signal. EO-8

c. Shutdown Cooling Return Line

1) This line returns water to the A or B reactor recirculation pump discharge piping.

2) The header is provided with an outboard isolation valve MOV40A/B and an inboard isolation valve AOV39A/B. (Group 5 isolation)

a) AOV39A/B is an air operated testable check valve.

b) Normally shut testable check bypass valve MOV-67A/B is provided to allow system piping warmup prior to going to shutdown cooling operation.

d. Head Spray Line (Loop B only)

e. LPCI Injection Line

1) All three RHS loops have LPCI injection lines.

2) LPCI injection valve MOV-24A/B/C opens automatically during LPCI initiation or it can be opened from the control room on PNL601

Q: What indication would you have if MOV-24 is overridden closed? EO-8

A: Amber light indication.

3) An inboard containment air-operated testable check valve, AOV-16A/B/C is provided on the LPCI line.

4) LPCI piping enters Rx vessel and empties inside the core shroud over the fuel bundles.

a) Baffle plate prevents direct impingement on in core monitoring instrumentation.

f. Drywell Spray Line

1) There are two drywell spray rings.

2) Each drywell spray line is provided with two isolation valves (MOV15A/B and MOV25A/B)

3) MOV15 and MOV25 are interlocked so that both valves cannot be opened at the same time unless there is an ECCS initiation signal, high drywell pressure and MOV-24 is shut.

III. INSTRUMENTATION, CONTROLS AND INTERLOCKS

EO-2

A. Instrumentation

1. Temperature - Measured at various points in system and SW cooling the RHS Heat Exchangers. Sent to recorder on PNL 601.

2. Pressures

   a. Heat exchanger pressure.

   b. Shutdown Cooling suction line -alarm at 128 psig

   c. Pump Discharge - permissive to ADS

      a) A and B 134 psig, C-147 psig (NO HX).

   d. LPCI Injection Valves - differential pressure - open permissive (130 psid)

   e. Steam Supply -Steam condensing Mode - close pressure control bypass valve at 465 psig

   f. RHS HX Inlet - controls pressure controller (steam) in steam condensing mode.

3. Flow - Monitor flow in modes:

   a. Total Flow

   b. Drywell Spray Flow

c. Suppression Pool Header Flow

d. Service Water flow is indicated on PNL 601.

4. Level

a. RHS HX Level - Cross-section to level controller in steam condensing mode.

5. Conductivity

Alarm and indication on PNL 601-RHS HX discharge

B. Controls

1. Pressure

a. RHS HX pressure controller allows 0-500 psig control in steam condensing mode.

b. Condensate pressure in RCIC return line regulated by HX outlet control valves. This also regulates level.

Use figures 5, 6, 7 to show how control of LV-17 works.

2. Manual Initiation

a. Pushbuttons on PNL 601

1) Div. I = LPCI A & LPCS

2) Div. II = LPCI B & C

C. Interlocks

EO-8

1. Automatic Initiation Setpoints

Use figure 8 to show initiation logic then figure 9 and 10 to show operation of MOV-24.

a. Level 1 = 17.8"

b. High Drywell Pressure = 1.68 psig

2. Primary Containment Isolation
   a. Gp 4: RHS Sampling and Radwaste Discharge
      1) Initiates on L3 159.3 inches or drywell pressure 1.68 psig.
   b. Gp 5: Shutdown Cooling and Head Spray
3. System Valve Interlocks: Prevent inadvertent vessel draining

   Use figure 11 (MOV 2B) to show how interlocks work.

   a. S/D cooling suction valves cannot be opened unless all the following are met.
      1) SP suction valves fully closed (MOV 1)
      2) Test return valve closed (FV-38)
      3) SP spray valve closed (MOV-33)
   b. Test return valves and suppression pool spray valves cannot be opened unless shutdown cooling system valve is shut.
   c. SP suction valves cannot be opened unless the S/D cooling suction valves are closed.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
4. RHS Pump/Valve Interlocks	Use Figure 12, 13, 14 to show pump initiation and pump/valve interlocks.	
a. Pump starting is prohibited unless:		
1) There is a S/D cooling suction flowpath <u>or</u>		
2) There is a suction from the Suppression Pool		
b. Loss of suction flowpath will cause a pump trip		
5. Valve Interlocks		EO-6
a. S/D cooling isolation valves, head spray valve, S/D cooling return and bypass valves shut on:		
1) High Rx pressure of 128 psig		
2) Low vessel level of 159.3"		
3) High RHS area temp of 135°F		
4) High Rx Building Temp (130.2°F)		
5) High Rx Building Pipe Chase temp (135°F)		
b. In steam condensing: Pressure control bypass valve closed at 465 psig		
c. LPCI injection valve cannot be opened unless D/P across valve is <130 psid		EO-7
d. S/P cooling valve (FV-38) cannot be opened during a LOCA unless MOV-24 is shut.	Use figures 15 (FV-38A) and figure 5 to show interlocks.	

e. SP spray valve (MOV-33) cannot be opened during a LOCA unless:
   1) Injection valve is shut <u>and</u>
   2) A high drywell pressure exists.
      It will auto shut when the high drywell pressure clears.
      If open, it will auto shut on a LPCI initiation

Use figure 16 (MOV 33A) and figure 5 to show control circuits.

f. Drywell spray valves cannot be opened unless:
   1) Initiation signal is sealed in <u>and</u>
   2) High drywell pressure exists, <u>and</u>
   3) Associated LPCI injection valve is shut

Use figure 17 (MOV-15B) and figure 18 to show control circuit 5.

IV. SYSTEM OPERATION

EO-1
EO-7

A. Normal Operations
   1. RHS is in standby status ready for LPCI or Containment Spray initiation.
   2. Heat exchanger inlet, outlet, and bypass valves are fully open.
   3. Each pump's suppression pool suction valve is open.
   4. RHS and CSL jockey pumps are running continuously to keep the loops filled.

5. The shutoff valve for flow return to the suppression pool, MOV-30A/B is open.
6. Minimum flow valves are open (MOV 4A, B and C).
7. All other remotely operated valves in the various subsystem flow paths are closed.
8. The suppression pool is filled to its normal operating level.

B. Shutdown Cooling Mode (SDC)

1. The SDC mode can be initiated when steam dome pressure is less than 128 psig. It is used to complete the reactor cooldown and maintain the reactor in a cold shutdown condition.
2. B loop is preferred to loop A because of it's ability to be flushed and warmed without the extensive operation of unusual valves.
3. If SDC mode fails, operator can use Alt. SDC IAW N2-OP-31.

C. Steam Condensing Mode

1. The Steam Condensing mode provides a heat sink for the reactor when the main condenser is not available.

a. This mode can be used to maintain the reactor at or near operating temperature.

b. This mode can be used to cool the reactor from hot shutdown conditions to a temperature within the capacity of the Shutdown Cooling mode (350°F).

D. Suppression Pool Cooling Mode

1. The suppression pool cooling mode is used to reduce suppression pool temperatures following reactor blowdown via safety relief valves, operation of ICS or after a loss of coolant accident.

E. Low Pressure Coolant Injection Mode

1. Following a LOCA, LPCI mode of RHS initiates automatically on high drywell pressure (1.68 psig) and/or triple-low level (17.8 inches) with 1 out of 2 twice logic.

2. All three pumps auto start, taking suction from the suppression pool.

3. Heat exchanger bypass valves MOV-8A/B open or remain open (sealed in for ten minutes).

4. Injection valves, MOV-24A/B/C, open when the 130 psid differential pressure interlock is satisfied.
5. If the LOCA is a small break LOCA which does not depressurize the Rx, High Pressure Core Spray should provide sufficient core cooling. If not, LPCI injection will be delayed until ADS can depressurize the Rx vessel.

F. Containment Spray
1. After a LOCA, primary containment pressure increases due to the release of steam from the break and the accumulation of non-condensible gases.
2. The drywell is provided with two spray headers supplied from RHS loops A and B while a single suppression chamber spray header is serviced by both loops.
   a) This mode is manually initiated by the operator and manually secured by the operator.

b) RHS loop A or B must have its LPCI injection valve shut, a high drywell pressure signal present, and a LOCA signal sealed in to permit drywell spray initiation.

3. Drywell spray water cools the drywell air and condenses the steam.

H. Suppression Pool Spray

1. The suppression pool sprays can be initiated without a LOCA signal present. However, if a LOCA occurs, and a LPCI initiation signal is received, the suppression pool spray valve will shut.
2. With a sealed in initiation signal present, the valves can be reopened if a high drywell pressure (1.68 psig) signal is present and the respective LPCI injection valve is shut.
3. The valve will automatically close when the high drywell signal clears.

I. Containment or RPV Flooding

1. Service water system connects to RHS B loop downstream of the heat exchanger outlet valve.

2. Valves MOV-116 and MOV-115 are opened to admit an inexhaustible supply of water from Lake Ontario into the RHS system to flood the RPV or containment as directed by the EOP's.

V. SYSTEM INTERRELATIONS (Other than already discussed) EO-9.0

A. Condensate Storage and Transfer System (CNS)

1. Fittings are provided in RHS system piping close to each RHS primary containment isolation valve to permit the flushing of all parts of the system piping with pure water from the CNS system.

B. Radioactive Liquid Waste System (LWS)

1. Prior to and following operation of the RHS system in the shutdown cooling mode, the piping is flushed to LWS.

C. Low Pressure Core Spray System (CSL)

1. RHS A loop discharge piping filled with water by CSL jockey pump when the system is in its normal standby lineup.

2. CSL and RHS loop A have a common test return line to the suppression pool.

3. CSL pump can take a suction from RHS (using a spool piece).

D. Reactor Water Sampling (SSR)

1. RHS process water samples can be drawn from the A and B heat exchanger shell side effluent piping.

E. Instrument Air System (IAS)

1. The steam pressure control valves and the heat exchanger condensate outlet control valves are operated by instrument air.

2. Loss of the IAS system prevents operation of the RHS system in the steam condensing mode.

F. Remote Shutdown System

1. Control of various RHS system pumps and valves for operation of shutdown cooling and suppression pool cooling mode of RHS.

VI. DETAILED SYSTEM REFERENCE REVIEW

Review each of the following referenced documents with the class — EO-11

A. Technical Specifications

1. 3/4.5.1; ECCS Operating
2. 3/4.5.2; ECCS Shutdown
3. 3/4.9.1; RHR Hot Shutdown
4. 3/4.9.2; RHR Cold Shutdown
5. 3/4.6.2.2 Suppression Pool and Drywell Spray
6. 3/4.6.2.3 Suppression Pool Cooling
7. 3/4.9.11 Refueling Operations

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
B. Procedures	Note: Must cover precautions/limitations and off-normal procedures.	EO-10
1. N2-OP-31 Residual Heat Removal		
VII. RELATED PLANT EVENTS	LER 86-087	
A. Refer to Addendum "A" and review related events with class (if applicable).	86-036 85-008 85-046	
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		

JK 7/20/90

B. Review the following industry events with the class

1. SOER 82-2
2. SIL 357

X. LIST OF FIGURES

XI. ATTACHMENTS

1.	LER 86-087	Perry 1
	LER 86-036	Browns Ferry 1
	LER 85-008	Riverbend 1
	LER 85-046	LaSalle 2

Inadequate operating instruction results in Tech Spec violation.
Event Date: 112686 Report Date: 122386 NSSS: GE Type: BWR

On 11-27-86 at 1700 it was discovered during a review of the potential LCO Log that alternate methods capable of decay heat removal were not demonstrated operable on 11-26, as required by Tech Spec. On 11-26 at about 1500, while in operational condition 3 (Hot Shutdown), Reactor Vessel pressure was decreased below 135 psig (the RHR cut-in permissive setpoint). However, both loops of RHR Shutdown cooling had previously been declared inoperable requiring the demonstration of alternate methods of decay heat removal. The cause of this event was a deficiency of integrated operating instruction "Cooldown - Main Condenser No Available". The IOI did not alert operators to the applicability of the Tech Spec LCO for the change in plan conditions while in operational condition 3. To prevent recurrence, IOI-4 "Shutdown", IOI-7 "Cooldown following a reactor scram main condenser available", and IOI-6, will be revised to alert operators to the additional requirements of Tech Specs when reactor pressure is decreased below the RHR Cut-In permissive setpoint while in operational condition 3. Additionally, a review will be performed to ensure other appropriate Tech Spec requirements which have conditional applicability are addressed in an IOI.

LER 86-086 Browns Ferry 1

Inoperable diesel generators causing Technical Specification noncompliance.
Event Date: 120886 Report Date: 010287 NSSS: GE Type: BWR

On December 8, 1986, at 2155 with diesel generator 1D Out-of-Service for maintenance, diesel generator 1A was declared inoperable during the performance of the monthly surveillance instruction. This placed a second train of the standby gas treatment system in an inoperable status according to Technical Specification (TS) definition. The plant was then in a configuration that was not in compliance with Technical Specification for secondary containment. At approximately 2340, the residual heat removal (RHR) the exchanger 3C was mistakenly removed from service according to a hold order request. This, in combination with the two inoperable diesel generators, left unit 3 with only one operable RHR heat exchanger. This was not in compliance with Tech Specs. DG 1A was returned to service at 2355 the same day, placing the plant in compliance with the aforementioned Tech Spec.

Inadvertent loss of primary coolant to the suppression pool causes reactor scram.

At 0100 on 9-23-85, with the unit in operational condition 5, the RPS actuated due to water level below the level 3 scram setpoint. This was caused by operator error during the performance of surveillance test procedures (Div I, 18 month ECCS Test). An operator began opening RHR 'A' Suppression Pool suction valve before RHR 'A' shutdown cooling suction valve was completely closed. This allowed water to flow from the RPV into the suppression pool actuating the RPS at 0100 hrs when RPV water level fell below the level 3 scram setpoint. Plant operation staff implemented procedures which reestablished reactor pressure vessel level using CRD flow. All safety systems functioned as designed. A caution statement has been added to the procedure.

Failure to declare LPCI Train inoperable during maintenance on minimum flow valve operator.

Event Date: 100785 Report Date: 112585 NSSS: GE Type: BWR

On October 7, 1985, at 0421 hours, the low pressure coolant injection system A (LPCI) minimum flow valve, was taken out of service for maintenance (closed). The high pressure core spray system (HPCS) was already inoperable. At 1545 hours, the LPCI A system was declared inoperable due to an interpretation of the definition of operability. A shutdown was not required because the minimum flow valve was restored to operable status at 1644 hours. The event was caused by an incorrect decision concerning the definition of operability. A more conservative approach to ECCS operability will be taken. Long term criteria will be developed to evaluate the impact of a component being out of service on system operability.