SOUTH CAROLINA ELECTRIC & GAS COMPANY

NUCLEAR OPERATIONS EDUCATION

AND TRAINING

INSTRUCTOR LESSON PLAN

SIMULATOR TRAINING FOR RO'S

Time: 25 Days

Recommended _____ Date 7/18/84
Nuclear Operations Training Supervisor

Approved _____ Date 7/19/84
Associate Manager
Nuclear Operations Training

DAY 1

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PWR NORMAL PLANT OPERATIONS

UNIT B-5 Plant Heatup

Overview

This unit will be aimed at commencing the plant heatup. A review of some technical specifications will also be conducted.

Terminal Objective

Upon completion of this unit, the student will have demonstrated effective communication and coordination between control room operators. The student will also have acquired the knowledge required to place the plant in mode V and discuss the major steps in the overall evolution.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- discuss the precautions and limitations of a plant heatup.
2)- demonstrate effective communication between Control Room operators.
3)- describe the major steps of a plant heatup.
4)- describe the primary system alignments in the refueling mode.

References

1. Virgil C. Summer Training Simulator GOP-1, GOP-6, GOP-7, EOP-4, SOP-115, SOP-201, SOP-202, SOP-306, STP-102.001, STP-103.001, STP-134.001
2. Virgil C. Summer Phase III Training Material
3. South Carolina Electric & Gas Company Phase II Training Material
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

Upon completion of this unit, the student will have demonstrated effective communications and coordination between Control Room operators. The student will also have acquired the knowledge required to start plant heatup to hot shutdown and discuss the major steps in the overall evolution.

B. OPERATIONS PLAN:

Initiate heatup to hot shutdown.

C. MALFUNCTIONS SCHEDULED:

- RHR-2, RHR heat exchanger flow control valve failure
- RHR-1, RHR pump trip
- CVC-10, VCT level transmitter (LT-112) failure
- MSS-13 atmospheric steam dump valve failure
- EPS-5 loss of ESF bus
- EPS-6 diesel generator failure

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

LESSON OUTLINE	NOTES AND REFERENCES
II. REVIEW (Optional) A. Summarize the procedure by having a student give a basic outline of the major steps. B. Review the plant heatup procedure, GOP-1, stressing the following: - Purpose - Precautions - Initial conditions - Instructions - Final conditions C. Review the Technical Specification 3/4.4.8 D. Discuss the upcoming simulator operations	
III. PROCEDURE A. Place the plant in the SNAP at cold shutdown and conduct the shift turnover. - Shift: - Plant conditions: Mode 5 B. Scheduled STPs 1. STP-102.001 source range analog channel operation test 2. STP-103.001 RCS and pressurizer heatup/cooldown 3. STP-134.001 shutdown margin calculation C. Commence plant heatup and secondary plant startup per GOP-1.	

LESSON OUTLINE	NOTES AND REFERENCES
D. Malfunctions - Initiate the following malfunctions during the heatup o RHR-1, RHR pump trip o RHR-2, RHR heat exchanger flow Control valve failure o CVC-10, VCT level transmitter (LT-112) failure o MSS-13, atmospheric steam dump valve failure o EPS-5, loss of ESF bus o EPS-6, diesel generator failure - For each malfunction: o Discuss effect on operation o Evaluate response o Clear the malfunction after a reasonable period of time	
E. Continue plant heatup IAW GOP-001 and establish the pressurizer bubble - Have student perform a source range analog channel test during the heatup	STP-102.001
F. Take a SNAP at the end of the shift to use as tomorrow's IC	
G. Students conduct a shift turnover to the instructor. Check for knowledge of current plant condition.	
IV. CRITIQUE A. Review overall operations. B. Review malfunction responses.	1 Hour

LESSON OUTLINE	NOTES AND REFERENCES
INTENTIONALLY BLANK	

DAY 2

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL MINOR OPERATIONS WITH MINOR MALFUNCTIONS

Plant Heatup - Cold Shutdown to Hot Shutdown

Overview

The startup of a nuclear power plant proceeds in an orderly manner from cold shutdown condition to the operational mode. Many systems must be aligned. Safety items must be tested and other requirements must be met and completed in a timely manner. Many operations are completed outside the control room, and effective communications must be established between the control room and operators to control those evolutions.

This unit will be devoted to continuing the plant heatup from the cold shutdown condition.

Terminal Objective

Upon completion of this unit, the student will have acquired the knowledge to perform a plant heatup to hot shutdown and be able to summarize the steps involved.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- demonstrate effective communications between the control room and work stations outside the control room.

2)- describe the steps in the procedure for plant heatup to hot shutdown condition.

3)- discuss the precautions behind the procedure used to conduct a plant heatup.

References

1. Virgil C. Summer Training Simulator GOP-1, SOP-101, SOP-211, SOP-404, and STP-103.001
2. Virgil C. Summer Phase III Training Material
3. South Carolina Electric & Gas Company Phase II Training Material
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
I. INTRODUCTION A. UNIT TERMINAL OBJECTIVE: Upon completion of this unit, the student will have acquired the knowledge to perform a plant heatup to hot shutdown and be able to summarize the steps involved. B. OPERATIONS PLAN: Commence plant pressurization and heatup toward hot shutdown, including drawing a pressurizer bubble. C. MALFUNCTIONS SCHEDULED: - FWM-3, emergency feedwater pump trip - NIS-6, noisy SR channel - PRS-2, pressurizer level channel failure NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions can also be used. STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	
REVIEW (Optional) A. Review procedure GOP-1 - Procedure - Supporting system procedures B. Summarize the procedure by having a student give a basic outline of the major steps. C. Review procedure GOP-2 - Purpose	

LESSON OUTLINE	NOTES AND REFERENCES
- Precautions - Initial conditions - Instructions - Final conditions D. Summarize procedure by having a student give a general outline of the procedure E. Discuss upcoming operations	
III. PROCEDURE A. Set up plant in SNAP taken at the end of the previous shift and conduct shift turnover - Shift - Initial conditions: yesterday's final conditions	
B. Scheduled STPs - STP-103.001 RCS and Pressurizer Heatup/Cooldown	
C. Continue the plant heatup IAW GOP-1 and GOP-2	Use STP-103.001 RCS and Pressurizer Heatup/Cool-down during entire heatup
D. Malfunctions - Initiate the follwoing during the heatup o NIS-6, noisy SR channel o PRS-2, pressurizer level channel failure o FWM-3, emergency feedwater pump trip - For each malfunction o Discuss the effect on plant operations	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
o Evaluate the response	
o Clear the malfunction after a reasonable period of time	
E. At the end of the shift, take a SNAP to use as tomorrow's IC	
F. Students conduct a shift turnover to instructor. Check for knowledge of current plant condition.	
IV. CRITIQUE	1 hour
A. Review overall operations.	
B. Review malfunction responses.	

DAY 3

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

NORMAL PLANT OPERATIONS WITH MINOR MALFUNCTIONS

Plant Heatup and Startup

Overview

It is desirable to accomplish the system heatup in a timely manner; therefore the main steam plant is normally warmed up at the same time as the reactor coolant system. The objective of the plant heatup is to have the steam plant warmed and available for startup when the reactor coolant system has been heated up.

This unit will involve itself with continuing the plant heatup and performing a reactor startup. The plant will be loaded towards 100 percent power in the time remaining.

Terminal Objective

Upon completion of this unit, the student will be able to discuss the procedure for a plant heatup and startup and the importance of each step in the total evolution. The student will also be able to discuss all of the prerequisities such as administrative requirements, precautions and limitations for plant heatups.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- describe the steps listed in the plant heatup procedures.

2)- answer the assigned homework questions.

3)- review secondary plant - Heatup and Startup procedure.

References

1. Virgil C. Summer Training Simulator GOP-2, GOP-3, GOP-4, SOP-208, SOP-210, SOP-404, STP 103.001, and STP 123.002
2. Virgil C. Summer Phase III Traiing Material
3. South Carolina Electric & Gas Phase II Training Material
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES
I INTRODUCTION A. UNIT TERMINAL OBJECTIVE: Upon completion of this unit, the student will be able to discuss the procedure for a plant heatup and reactor startup and the importance of each step in the total evolution. The student will also be able to discuss all of the prerequisite administrative requirements, precautions and limitations for plant heatups. B. OPERATIONS PLAN: Continue plant heatup and perform a reactor startup and plant loading.(Start with snap taken at the end of the previous simulator session). C. MALFUNCTIONS SCHEDULED: - NIS-4, 112 channel gamma compensation failure - FWM-21, MF bypass valve failure - FWM-2, condensate pump trip - FWM-5, feedwater pump speed control oscillates - NIS-3, PR channel failure - ΔI problems - QPTR problems, QPTR calculations NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions can also be used. STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
II. REVIEW (Optional) A. Review the homework B. Review procedure GOP-3 - Purpose - Precautions - Initial conditions - Instructions - Final conditions C. Review procedure GOP-4 - Purpose - Precautions - Initial conditions - Instructions - Final conditions D. Discuss Tech Specs 3/4.5 E. Discuss upcoming operations	
III. PROCEDURE A. Put plant in SNAP taken at the end of the previous session and conduct a shift turnover - Shift: - Initial conditions: SNAP - Load dispatch: 100 percent by the end of the shift B. Scheduled STPs 1. STP 103.001 RCS and pressurizer heatup/cooldown 2. STP 123.002 service water system pump test C. Continue the heatup IAW GOP-2 and GOP-3 D. Perform a reactor startup IAW GOP-3 E. While in IR initiate NIS-4, IR channel gamma compensation failure - Discuss effect on reactor startup	Continue using STP 103.001-RCS and Pressurizer Heatup/ cooldown

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
F. Increase reactor power to POAH and start secondary plant	
G. Initiate FWM-21, MF bypass valve failure, after transfer from emergency feedwater	
- Discuss effect on plant operation	
- Evaluate response	
- Clear malfunction	
H. Continue plant loading to 100 percent	
- Have students a service water system pump test	STP 123.002
I. Initiate FWM-2, condensate pump trip when more than one pump	
- Discuss effect on plant operation	
- Evaluate response	
- Clear malfunction	
J. Initiate ΔI problems	
K. Initiate QPTR problems	
L. Initiate FWM-5, feedwater pump control oscillates	
M. Continue loading as time permits	
N. Students conduct a shift turnover to instructor. Check for knowledge of current plant conditions.	
CRITIQUE	1 Hour
A. Review overall operations.	
B. Review malfunctions responses.	

DAY 4

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Overview

During the normal operation of a nuclear power plant, it is periodically required to shutdown and cooldown the unit for either maintenance or refueling considerations. Since this occurs only once or twice per year, it is a relatively infrequent evolution. Hence it becomes difficult for control room operators to experience the operations required for taking the plant to a cold shutdown condition and the use of the applicable procedures designed to bring the plant to this condition.

This and the following unit are designed to provide a review of the systems which are utilized during a plant cooldown. In addition, it will enable the student to apply the proper procedures and actually perform the plant shutdown and cooldown as a control room operator.

Terminal Objective

The student will be able to describe the series of events encountered in bringing a nuclear plant from full power operation to cold shutdown and manipulate the plant through these events. The program instructor's observation and the student's oral response to questioning will be used in determining satisfactory completion of the course objective.

Enabling Objectives

Upon completion of this unit the student shall be able to:

1)- describe the series of events in power reduction and reactor shutdown.

2)- discuss the different methods of cooling down the Reactor Coolant System (RCS).

3)- describe how the Steam Dump System is used during plant cooldown.

4)- describe when and how the Residual Heat Removal (RHR) System is placed into service.

5)- describe shutdown margin requirements during each mode.

6)- perform a plant shutdown and cooldown following the appropriate plant procedures.

References

1. South Carolina Electric & Gas Company Phase II Training Material
2. Virgil C. Summer Phase III Training Material
3. Technical Specifications
4. Virgil C. Summer Training Simulator GOP-4, GOP-5, GOP-6, GOP-7, EOP-10, SOP-102, SOP-210, STP-103.001, and STP-134.001.

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to adequately describe the series of events encountered in bringing a nuclear plant from at full power operation to cold shutdown as evaluated by the program instructor's observation and student's oral response to questions.

B. OPERATIONS PLAN:

Perform plant shutdown from previous power accent to hot standby. Commence cooldown. Place RHR is service and establish N_2 bubble in the pressurizer. Perform control board misalignments if desired.

C. MALFUNCTIONS SCHEDULED

- CRF-6 uncontrolled rod motion
- FWM-4 feedwater flow transmitter failure
- CVC-9 plugged boric acid filter
- MSS-1 Steam Generator pressure transmitter failure (control)

II. REVIEW (Optional)

A. Present overview of simulator operations:

- Unloading from 100 percent
- Reactor shutdown
- Commence cooldown
- Place RHR in service
- Establish N_2 bubble

LESSON OUTLINE	NOTES AND REFERENCES
- Begin recovery operations - Establish PZR bubble B. Review use of EHC and turbine auxiliaries - EHC o Manual o Standby - Auxiliaries o Motor suction pump o Turning gear oil pump o Bearing lift oil pump C. Review use of steam dumps/atmospheric reliefs during cooldown - T_{avg} mode - Steam pressure mode, manual controllers - Atmospheric reliefs o When used o Auto setpoint o Manual control D. Review technical specification 3/4.2 E. Review RHR system - RCS cooldown - Flow paths o Cold leg injection o Cold leg recirculation o Hot leg recirculation F. Brief review of shutdown procedures - GOP-4 - GOP-5 - GOP-6 - GOP-7	

LESSON OUTLINE	NOTES AND REFERENCES
III. PROCEDURE A. Set up plant in previous day's snap and conduct shift turnover - Shift: - Plant Conditions: 25 percent power, unloading to shutdown B. Scheduled STPs - STP-103.001 RCS and pressurizer heatup/cooldown - STP-134.001 shutdown margin calculation C. Commence load reduction D. Initiate CRF-6, uncontrolled rod motion - Discuss effects on ΔI, HCFs - Evaluate response - Clear malfunction E. Continue load reduction F. Initiate FWM-4 feedwater flow transmitter - Discuss effects on SGWLC - Evaluate response - Do not clear until MSS-1 G. Initiate CVC-9, plugged boric acid filter - Discuss effects on shutdown - Evaluate response H. Initiate MSS-1, Steam Generator pressure transmitter failure (control) - If this is the same loop as FWM-4 and the loop SGWL is low, a reactor trip might occur when bistables tripped - If students miss this and cause a reactor trip, let them conduct EOP-5 and then reinitiate at just before the trip	

LESSON OUTLINE	NOTES AND REFERENCES
- Evaluate response	
- Clear MSS-1 and FWM-4	
I. Continue shutdown as time permits	
- Have students calculate shutdown margin	STP-134.001
- If cooldown is commenced initiate RCS and pressurizer heatup/cooldown STP's	STP-103.001
J. At end of shift take a SNAP and use it as tomorrow's IC	
IV. CRITIQUE	1 Hour
A. Review overall operations.	
B. Review malfunction responses.	

DAY 5

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Plant Shutdown and Cooldown to Cold Shutdown

Overview

During the shutdown and cooldown several systems are used as heat sinks for the reactor coolant system. During the unloading the main steam system and the turbine are used. Once the reactor shuts down, the steam dumps are used to cooldown to ~350°F. The reactor coolant system is then depressurized to ~380 psig and the RHR System is placed in service. The RHR System is then used to cool down to the Cold Shutdown condition (mode V, T_{avg} $\leq$200°F) or to the Refueling Mode (mode VI, T_{avg} $\leq$140°F).

This unit will be directed towards continuing the shutdown and cooldown of the power plant, along with reviewing the procedures necessary to perform those operations.

Terminal Objective

Upon completion of this unit, the student will be able to perform a reactor shutdown and plant cooldown using appropriate procedures. The student will also be able to discuss the importance of major steps in the total operation. Students will also be able to describe the performance of a shutdown margin (SDM) determination.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- discuss shutdown margin determination calculation.

2)- describe the steps applied to the reactor shutdown and plant cooldown procedures.

3)- describe integrated plant relationships involved with plant shutdown and cooldown.

4)- discuss core reactivity effects during plant cooldown.

5)- perform a plant shutdown and cooldown.

References

1. Virgil C. Summer Training Simulator GOP-4, GOP-5, GOP-6, GOP-7, SOP-101, SOP-102, SOP-202, STP-103.001, and STP-112.002.
2. Virgil C. Summer Phase III Training Material
3. Curve Book
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document
6. South Carolina Electric & Gas Company Phase II Training Material

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

Upon completion of this unit, the student will be able to perform a reactor shutdown and plant cooldown using appropriate procedures. The student will also be able to discuss the importance of major steps in the total evolution. Students will also be able to describe the performance of a shutdown margin determination.

B. OPERATIONS PLAN:

Continue the plant shutdown/cooldown.

C. MALFUNCTIONS SCHEDULED:

1. PRS-3, pressurizer spray valve failure (open)
2. PCS-6, inadvertent containment isolation phase A (Train A)
3. MSS-5, steam dump control valve
4. CVC-19, seal injection flow control valve (HCV-186) failure

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions can also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

II. REVIEW (Optional)

A. Emphasize ΔI control during shutdown

B. Review procedure GOP Appendices B and D

C. Have students perform a SDM from known initial conditions.

LESSON OUTLINE	NOTES AND REFERENCES
D. Review tech spec 3/4.4.7	
E. Discuss upcoming simulator operations	
III. PROCEDURE	
A. Put plant in SNAP taken at end of last shift and conduct shift turnover - Shift: - Plant status: continue cooldown from yesterday	
B. Scheduled STPs: 1. STP-103.001 RCS and pressurizer heatup/cooldown 2. STP-112.002 reactor building spray pump test	
C. Continue cooldown	Use STP-103.001 during entire cooldown
D. If still on steam dumps, initiate MSS-5, steam dump control valve - Discuss effects on cooldown - Evaluate response	
E. Initiate PCS-6, inadvertent CISA (Train A) - Discuss effects on cooldown - Evaluate response	
F. While RCPs are still in service, initiate CVC-19, seal injection flow control valve (HCV-186) failure - Discuss effects on RCP - Evaluate response	
G. When the pressurizer spray valve(s) is(are) opened to depressurize the RCS, initiate PRS-3, pressurizer spray valve failure (open)	

LESSON OUTLINE	NOTES AND REFERENCES
- Discuss effect on cooldown - Evaluate response - Clear malfunction	
H. Depressurize to ~380 psig and put RHR in Service.	
I. Continue plant cooldown to cold shutdown using the RHR system, and discuss the following: - Calculation of xenon-free cold shutdown boron concentration using shutdown margin calculation - Pressure/temperature limitations for the RHR system - Interlocks associated with the RHR system - Cooldown limits for the RCS and pressurizer - Cooldown verifying cooldown rates using RCS & pressurizer heatup/cooldown - Verification and adjustment of RHR boron concentration - Alignment of the RHR system during cooldown - Collapsing the pressurizer steam bubble - Letdown flowpath while in RHR cooling alignment	STP-112.002
J. Students conduct shift turnover to instructor. - Check for knowledge of current plant conditions.	
CRITIQUE A. Review overall operations. B. Review malfunctions responses.	

DAY 6

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Plant Startup - Hot Standby to Point of Adding Heat

Overview

The startup of the reactor is probably the most important single event in normal operations. This is a time when many large reactivity additions are made by the operator. Strict attention must be given to plant parameters at all times so that the operator can take decisive and prompt action in the event of any unexplained reactivity excursion. Precise control of the reactor must be maintained at all times.

In this unit you will discuss the startup procedure, conducting a reactor startup, and proceding towards 2% power. The startup should be observed closely by those students not actually performing the evolution. During the course of this 25 day simulator training project each student will have the opportunity to perform at least 10 reactor startups.

Terminal Objective

Upon completion of this unit the student will be able to discuss the basic procedure for a startup and the importance of each step in the total evolution. The operator will also discuss all of the prerequisite administrative requirements, precautions, and limitations for reactor startups. The student will also gain familiarity with the control board and learn important equipment control locations at his particular work station.

Enabling Objectives

Upon completion of this unit the student will be able to:

1)- describe the steps of the reactor startup procedure in a chronological order.
2)- state the locations of various equipment controls and indications.
3)- discuss precautions and limitations of a reactor startup.
4)- describe control system interrelationships incorporated into the procedure.
5)- demonsrate good watch standing practices.
6)- perform a safe and controlled reactor startup.

References

1. Virgil C. Summer Training Simulator GOP-3, GOP-4
2. Virgil C. Summer Phase III Training Material
3. South Carolina Electric & Gas Company Phase II Training Material
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES
I. INTRODUCTION A. UNIT TERMINAL OBJECTIVE: Upon completion of this unit, the student will be able to discuss the basic procedure for a startup and the importance of each step in the total evolution. The operator will also discuss all of the prerequisite administrative requirements, precautions and limitations for reactor startups. Students will also gain familiarity with the control board and learn important equipment control locations at his particular watchstation. B. OPERATIONS PLAN: Perform a reactor startup to power in accordance with general normal operating procedures. Continue plant power increase as time permits. C. MALFUNCTIONS SCHEDULED: NONE STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT II. REVIEW (Optional) A. Review reactor theory homework B. Review procedure for shift and relief turnover - Purpose - Scope - Definitions - Procedure	

LESSON OUTLINE	NOTES AND REFERENCES
C. Review the major parts of the reactor startup procedure, GOP-3, stressing the following: - Precautions and limitations - Initial conditions - Procedure Always attempt to orient the students to the basic procedure to help them attain a "big picture" concept.	
D. Summarize the reactor startup procedure by having a student give a basic outline of it: - Check initial conditions and complete check lists - Adjust Boron concentrations if necessary - Announce reactor startup - Block the high flux at shutdown alarm - Record source range counts - Withdraw control rods in manual to establish criticality - Verify reactor subcritical at RIL - Announce reactor criticality - Proceed to 10^{-8} amps at .75 DPM - Block source range at P-6 - Level power at 10^{-8} amps. Record critical data. - Increase power to 2 percent	
E. Review major parts of the plant operations > 2 percent power, GOP-4, stressing: - Purpose - Precautions	

LESSON OUTLINE	NOTES AND REFERENCES
- Initial conditions - Instructions - Final conditions F. Review operational control area guidelines - Control areas in the control room - Technical specifications manning requirements - Physical restrictions imposed upon the operators G. Review Technical Specifications para. 3.0.4 H. Discuss upcoming simulator operations III. PROCEDURE A. Proceed to Control Room and discuss the following: - Instructor/student relationship - Communication between students and operators outside the control room - Control room manning - Shift turnover - Control room terminology - Simulator problems B. Put plant in MOL, hot standby and conduct shift turnover - Shift: 0000-0800 - Initial conditions: Hot standby, 557°F, 2235 psig C. Students should calculate an ECP and an SDM NOTE: Stress the importance of the reactor operator staying at his control station with control rods in manual and off the bottom	

LESSON OUTLINE	NOTES AND REFERENCES
- Discuss technical specifications requirements needed prior to criticality (summarization) - Para. 3.0.4 changing modes - 2.2.1 limiting safety system settings - 3/4 1.3.1 group height - 3/4 1.3.2 position indicating system - 3/4 1.3.4 rod drop time - 3/4 1.3.5 shutdown rod insertion limit - 3/4 1.3.6 control rod insertion limits - 3/4 3.1.1 reactor trip system instrumentation - Discuss log readings taken prior to pulling rods - Discuss the following: o Operation of the rod control system in manual o Subcritical multiplication o Operation of source range nuclear instruments o Doubling o Minimum and maximum critical postitions o Indications of criticality D. Scheduled STPs: None E. Increase power to 10^{-8} amps and discuss: - Source-intermediate range overlap - Permissive P6 and blocking of the source range high flux reactor trip - Operation of intermediate range nuclear instruments	

LESSON OUTLINE	NOTES AND REFERENCES
- Data taken at 10^{-8} amps and why it is taken F. Increase power to 2 percent. Discuss: - Indications at the point of adding heat - Effects of moderator temperature and Doppler on SUR. - Effect of increasing T_{avg} on steam dump operation G. Final condition: 2 percent power H. Students conduct shift turnover to instructor. Check for knowledge of current plant condition IV. CRITIQUE A. Review overall operations and conduct.	

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Plant Startup - Hot Standby to Full Power

Overview

Before performing a reactor startup, a calculation is required to help predict the point at which criticality will occur. This calculation is called an estimated critical condition (ECC). If we find that from this calculation (ECC) that the reactivity balance of the core has changed significantly, then a more structured approach toward criticality must be used. This is called an inverse count rate ratio plot (ICRR). These two calculations (ECC and ICRR) tell the operator that the reactor is responding properly (as predicted) during the startup and thus ensures the operator that he is maintaining precise control of the reactor. Both of these calculations require reference information which is obtained by the operators during the previous critical operation.

This unit will review the procedures for taking reference critical data (RCD), calculating the ECC and performing an ICRR plot. A review of some items from technical specifications will also be conducted.

Terminal Objective

Upon completion of this unit the student will be able to discuss the data collected and the performance of ECC, RCD AND ICRR plot calculations. Also, the student will recall the function, composition and responsibilities of the Plant Safety Review Committee (PSRC) and Nuclear Safety Review Committee (NSRC).

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- describe the steps taken that are necessary to perform an ECP, ICRR plot and RCD.

2)- discuss the importance of ECP, ICRR plot and RCD calculations.

3)- perform a safe and controlled reactor startup.

4)- explain how a core reactivity balance is calculated.

References

1. Virgil C. Summe Training Simulator GOP-4, GOP Appendix B, GOP Appendix C, GOP Appendix D, STP 125.002
2. Virgil C. Summer Phase III Training Material
3. South Carolina Electric & Gas Company Phase II Training Material
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES
I. INTRODUCTION A. UNIT TERMINAL OBJECTIVE: Upon completion of this unit, the student will be able to discuss the data collected and the performance of ECC, RCD, and ICRR plot calculations. Also, the student will recall the function, composition and responsibilities of the Plant Safety Review Committee (PSRC) and Nuclear Safety Review Committee (NSRC). B. OPERATIONS PLAN: Perform a reactor startup to POAH. Perform a 1/M plot during the startup. Continue plant power to increase to full load. C. MALFUNCTIONS SCHEDULED: NONE STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT II. REVIEW (Optional) A. Review reactor theory homework B. Complete the review of GOP-4 (if required) C. Review Reference Critical Data procedure GOP4 Appendix B - Purpose - Procedure Note to Instructors: Stress the importance of having accurate data to perform subsequent calculation. Have students fill out a sample worksheet of RCD	

LESSON OUTLINE	NOTES AND REFERENCES
D. Review ECC Calculation procedure GOP Appendix C - Purpose - Procedure Note to Instructors: Have students calculate an ECC with the instructor providing data	
E. Review procedure for an ICRR plot, GOP Appendix D using a sample plot	
F. Review the administrative section of tech specs for the review and audit	
G. Discuss upcoming simulator operations	
III. PROCEDURE	
A. Put plant in IC EOL, Hot Standby and - Conduct a shift turnover - Shift - Initial conditions: Hot Standby, 557°F, 2235 psig	
B. Provide students with RCD; have the students calculate the ECCS and shutdown margin	
C. Direct students to conduct a reactor startup guided by a 1/M plot, discuss: - Tech specs requirements - Criticality data - Manual rod control - Subcritical multiplication - Doubling - Indications of criticality	
D. Scheduled STPs: - STP 125.002 Diesel Generator Operability Test	

LESSON OUTLINE	NOTES AND REFERENCES
E. Increase power to 10^{-8} amps, discuss: - NIS overlap - Permissive P-6 F. Increase power to about 2 percent, discuss: - Indications of the point of adding heat - Effects of moderator temperature and doppler on SUR - Effects on increasing T_{avg} on steam dump operation G. Final condition: 2 percent power H. Students conduct shift turnover to instructor. Check for knowledge of current condition IV. CRITIQUE A, Review overall operations and conduct.	

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Plant Startup - Hot Standby to Full Power

Overview

Once the reactor is producing heat, the secondary plant may be aligned in preparation for starting the turbine-generator. The goal of the operators is to make a smooth transition to a loaded generator, and to gradually increase that load toward 100 percent power. Many systems will be operated in manual control until it becomes appropriate to transfer them to automatic control. During power operations it is necessary to periodically check the nuclear instruments for accuracy. This is accomplished by performing a secondary heat balance calculation.

In this unit you will discuss plant operations greater than 2 percent power, heat balance calculations, and the procedure for changing plant load. A review of additional items from the Administrative Section of the Technical Specifications will also be conducted.

Terminal Objectives

Upon completion of this unit, the student will have acquired the knowledge necessary for starting the turbine generator and loading the plant to 100 percent power. The student will also be able to explain how to perform a secondary heat balance calculation.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- discuss the startup of the turbine generator.

2)- describe the integrated plant relationships that are involved with startup and loading of the plant.

3)- describe the steps supplied to the plant loading procedure.

4)- perform a secondary heat balance calculation.

5)- perform a plant loading to 100 percent power.

References

1. Virgil C. Summer Training Simulator GOP-3, GOP-4, Appendix D, STP-102.002 and STP-122.002
2. Virgil C. Summer Phase III Training Material
3. South Carolina Electric & Gas Company Phase II Training Material
4. Technical Specifications
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

Upon completion of this unit, the student will have acquired the knowledge necessary for starting the turbine generator and loading the plant to 100 percent power. The student will also be able to explain how to perform a secondary heat balance calculation.

B. OPERATIONS PLAN:

Perform a reactor startup to 2 percent power. Provide the students with the ECC. Perform a 1/M plot during the startup. Continue plant power increase to full load. Perform a secondary heat balance calculation during the power increase.

C. MALFUNCTIONS SCHEDULED:

NONE

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

REVIEW (Optional)

A. Review the homework assignment

B. Summarize the plant operations > 2 percent power by having a student present a basic outline.

C. Review plant load change procedures in GOP-4

- Purpose
- Precautions
- Initial conditions

LESSON OUTLINE	NOTES AND REFERENCES

- Instructions
- Final conditions

D. Review procedure for performing a secondary heat balance calculation, STP-102.002*

- Purpose
- Precautions
- Initial conditions*
- Procedure

Note to Instructors: Stress importance that initial conditions be met in order to obtain the desired accuracy.

E. Review the following technical specifications (Administrative Section):

- Responsibility (6.1)
- Organization (6.2)
- Offsite (6.2.1)
- Unit staff (6.2.2)

F. Discuss upcoming simulator operations

III. PROCEDURE

A. Put the plant in IC set for MOL, hot stand-by and conduct a shift turnover

B. Have the students calculate an ECC and perform a startup guided by a 1/M plot, discuss:

- Alarms received and cleared during the course of the startup
- Technical specification requirements
- Various factors that can affect the ECC such as
  - o Changing RCS boron concentration

LESSON OUTLINE	NOTES AND REFERENCES

- o Inadvertent opening of steam dump valves
- o Excessive feeding of steam generators
- Manual rod control
- Doubling
- Indications of criticality

C. Scheduled STPs:
- STP-102.002
- STP-122.002

D. Increase power to 10^{-8} amps, discuss:
- Data taken at 10^{-8} amps, and why it is taken
- Permissive P-6
- NIS overlap

E. Increase power to 2 percent
- Indications of the point of adding heat
- Effects of doppler and α_T on start up rate

F. Secondary plant startup
- Start additional condensate pump
- Start a main feedwater pump
- Establish SGWLC with main feedwater bypass valves
- Secure and realign emergency feedwater
- Warm and roll main turbine
- Increase reactor power to 12-15 percent
- Synchronize generator to 5 percent

G. Load generator to 100 percent
- Increase load and reactor power to ~ 10 percent
  - o Loading rate: 0.5 percent/min
  - o P-10, P-13, P-7
  - o Block 1R Hi ϕ, PR Hi ϕ-Lo

LESSON OUTLINE	NOTES AND REFERENCES
- Increase load to 140-145 MW_e, reactor power to 15 percent	
o Rate: 0.5 percent/min	
o Shift from bypass valves to main feed reg valves	
o Verify plant computer AFD operable	
- Increase load to 190 MW_e, 20 percent reactor power	
o Place rods in Auto on:	
+ C-5	
+ $T_{avg} = T_{ref} \pm 1°F$	
o Steam dump in T_{avg} mode	
- Load to 50 percent power	
o Start remaining pumps:	
+ Condensate	
+ Feedwater booster	
+ Feedwater	
o Perform Component Cooling Pump Test	STP-122.002
o 38 percent power: P-8	
o Remove condensate polishing system from service	
o Perform calorimetric at 50 percent	STP-102.002
- Load to 75 percent (~ 710 MW_e)	
o Borate/dilute to maintain ΔI	
o MSR in full service	
o Perform calorimetric at 75 percent	STP-102.002
- Load to 90 percent (~ 900 MW_e)	
o AT 90 percent, put rods in manual	
o Borate/dilute to maintain ΔI	
- Load to 100 percent (~ 950 MW_e)	
o Maintain T_{avg} within control band	
o Perform calorimetric	STP-102.002

LESSON OUTLINE	NOTES AND REFERENCES
H. Final condition: 100 percent power	
I. Students conduct shift turnover to instructor. Check for knowledge of current plant condition	
IV. CRITQUE	1 hour
A. Review overall operations and conduct.	

DAY 7

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Power Operations and Reactor Trip Recovery

Overview

Occasionally during nuclear plant operation, conditions will arise which result in automatic shutdown of the unit. The automatic actions will place the nuclear plant in a safe condition. However, proper operator response is required to place the plant in a stable shutdown condition.

This unit will provide a review of plant and system response to a reactor trip and subsequent recovery. It will discuss proper operator actions following a unit trip along with subsequent requirements and actions in returning the plant to operation.

Terminal Objective

The student will be able to describe nuclear plant response to a reactor trip including precautions and requirements for plant recovery and return to power. Evaluation will be performed by the program instructor's observation and student's oral response to questions.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- describe automatic actions which occur following a reactor trip.

2)- describe, in general terms, the operator actions required to place the unit in a stable condition following a reactor trip.

3)- describe the precautions for performing a reactor startup.

4)- describe ECC requirements for reactor startup following a trip.

5)- describe the sequence of events during a reactor startup.

6)- describe reactor plant response upon return to power operation in relation to boron and xenon concentrations.

7)- perform a reactor trip recovery from power, applying the appropriate off-normal or emergency procedures.

References

1. Virgil C. Summer Phase III Training Materials
2. Technical Specifications
3. South Carolina Electric & Gas Company Phase II Training Materials
4. Precautions, Limitations, and Setpoints Document
5. Virgil C. Summer Training Simulator EOP-5, GOP-2, GOP-3, GOP-4, SOP-102, SOP-403, SOP-404, STP 122.002, and 134.001

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe nuclear plant response to a reactor trip including precautions and requirements for plant recovery and return to power. Evaluation will be performed by the program instructor's observation and student's oral response to questions.

B. OPERATIONS PLAN:

Perform plant shutdown from previous day's operation

C. MALFUNCTIONS SCHEDULED:

- Selected meter failure
- CVC-14 seal injection filter plugged
- RCS-8 RCS RTD failure (T_H, high)
- TUR-12 Turbine impulse pressure transmitter failure
- NIS-5 Source range hi voltage failure to disconnect
- FWM-15 FW control valve position failure

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions can also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

II. REVIEW (Optional)

A. Review reactor theory homework

LESSON OUTLINE	NOTES AND REFERENCES

B. Present overview of simulator operations
- Plant shutdown from 50 percent
- Reactor trip
- Hot Standby
- RCD, SDM, ECC
- Reactor startup
- Turbine loading

C. Discuss system response and operation following a reactor trip
- Main steam system
  - o Steam valves
  - o Atmospheric reliefs, safeties
  - o Extraction steam check valves
- Steam dumps
  - o T_{avg}, Pressure control
- Feedwater system
  - o Feedwater isolation
  - o Feedwater pumps
- Emergency feedwater
  - o Auto start
  - o Flow control
  - o Operator actions
- Reactor coolant system and pressurizer, factors which help limit pressure excursion
  - o Control heaters off
  - o Pressurizer sprays
  - o PORV
  - o Safeties

LESSON OUTLINE	NOTES AND REFERENCES
- Review xenon transient following reactor trip and return to power o Buildup o Decay o Burnout D. Discuss SOP-404 NIS malfunction Off-Normal - Symptoms - Automatic actions - Immediate corrective actions - Followup actions - Use of instrument failure guide E. Discuss reactor trip, EOP-5 - Symptoms - Automatic actions - Immediate actions - Followup actions F. Review ECC requirements - Data for calculation - Time requirements G. Review GOP-03 startup precautions H. Discuss Technical Specification 3/4.3.1 - NIS Instrumentation requirements for S/U III. PROCEDURE A. Set up plant in IC from previous day and conduct shift turnover - Shift - Initial conditions:n 50 percent, MOL - Load dispatch orders: shutdown by end of shift B. Scheduled STPs - STP-122.002 Component Cooling Pump Test	

LESSON OUTLINE	NOTES AND REFERENCES
- STP-134.001 Shutdown Margin Calculations	
C. Have students continue plant shutdown	
D. Fail selected meter(s) for each operator and allow him to detect and determine meter via instrument failure	
E. Return meter to service after detected	
F. Initiate CVC-14, seal injection filter plugged	
- Discuss effects on RCP, seals	
- Ensure student contact auxiliary operator for repair	
G. Initiate NIS-5, source range hi voltage failure to disconnect, below P-10	
H. Initiate RCS-8, RCS RTD failure (T_H control channel, high)	
- Discuss effects on control, protection	
- Ensure students contact I&C tech for repair, bistable trips	
I. Initiate TUR-12, turbine impulse pressure transmitter failure	
- Discuss effects on control	
- Ensure students contact turbine building operator for repair	
J. Respond to reactor trip IAW EOP-5	
- Have students perform a Shutdown Margin Calculation before beginning reactor startup	STP-134.001
K. Perform a reactor startup, discuss precautions and expected NIS response	
- During startup have BOP do a Component Cooling Pump Test	STP-122.002

LESSON OUTLINE	NOTES AND REFERENCES
L. At 10^{-8} amps discuss actions for NIS-5 and effects on operation	
M. Continue to POAH and commence secondary plant startup and turbine loading	
N. Initiate FWM-15, FW control valve position failure	
O. Following shiftover to main feed reg valve and discovery of faulty FRV, discuss: - Actions taken - Possible causes - Note in procedure to verify proper valve response - Clear malfunction	
P. Continue plant loading as time permits	
Q. Students conduct shift turnover to instructor. Check for knowlege of current plant situation	
IV. CRITIQUE	1 hour
A. Review overall operations.	
B. Review malfunction responses.	

DAY 8

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Reactor Startup During Xenon Transients

OVERVIEW

Nuclear plant startups are significantly affected by certain variables. Xenon, a reactivity variable over which the operator has no control, is the major variable for which the operator calculates and compensates. In order to perform a startup within the Estimated Critical Condition calculation (ECC) guidelines, the operator has to be familiar with the calculations and procedures involved. In addition, he has to insure all requirements are established for a startup, and be aware of maintenance tasks in progress so that he can adequately estimate plant startup time.

This unit is designed to allow the students to perform the required calculations and reactor startup during a xenon transient, thus experiencing the uniqueness of a startup which requires a timely completion of the procedures.

Terminal Objective

The student will be able to satisfactorily explain and analyze xenon transient effects on reactor startups as evaluated by the program instructor's observation and oral response to questioning.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- describe xenon reactivity effects on a reactor startup.
2)- discuss how the operator can vary charging and letdown flow.
3)- recall the technical specifications which apply to reactor startups.
4)- explain the operator actions if criticality occurs outside ECC limits.
5)- manipulate the chemical and volume control system to compensate for changes in core xenon concentrations.

References

1. Virgil C. Summer Training Simulator GOP-3, GOP-4, SOP-102, SOP-403, and STP 123.002.
2. Virgil C. Summer Phase III Training Material
3. Technical Specifications
4. South Carolina Electric & Gas Company Phase II Training Material
5. Precautions, Limitations, and Setpoints Document

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES
I. INTRODUCTION A. UNIT TERMINAL OBJECTIVE: The student will be able to satisfactorily explain and analyze xenon transient effects on reactor startups as evaluated by the program instructor's observation and students oral response to questioning. B. OPERATIONS PLAN: Perform plant startup from hot standby to full power during xenon transient with simple malfunctions. C. MALFUNCTIONS SCHEDULED - CRF-4 Dropped rod (one) - CVC-17 Charging pump trip - CVC-7 Loss of normal letdown STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT II. REVIEW (Optional) A. Review . reactor theory homework B. Present overview of simulator operations - Reactor startup at peak xenon - Continue secondary startup - Turbine loading C. Review CVCS - Letdown o Valve and pump interlocks o VCT level program - Operation of o PCV -145	

LESSON OUTLINE	NOTES AND REFERENCES

- c TV -143
- o TV -144
- o LCV-115A

- Charging
  - o Pumps
  - o Flow paths
  - o Seal injection
  - o Operation of
    - + FV-122
    - + HV-186
- Excess letdown
- BCMS
  - o Operation
  - o Accuracy
  - o Sample points
- Procedures
  - o CVCS Malfunction SOP-102

Note to Instructors: In the above discussions, ensure that the indications and operator actions for the following are covered:

- LCV-115A failure
- PV -145 failure
- FV -122 failure

- o Loss of Seal Water
- o Loss of Normal Letdown

D. Review RCP Seal System

- Injection and leakoff flow path
- Types of individual seals
- Seal pressure requirements
- Seal precautions

LESSON OUTLINE	NOTES AND REFERENCES
E. Xenon transient during startup - Xe buildup - Xe decay - Xe peak	
III. PROCEDURE	
A. Set up plant in IC Set for HZP and conduct a shift turnover - Shift - Initial conditions: Hot standby, about 4 hours after a reactor trip from 180 days of continuous operation; T_{avg} = 557°F, P = 2235 psig, ARI - Load dispatch orders: 100 percent by the end of the shift	
B. Scheduled STPs - STP 123.002 Service Water System Pump Test	
C. Perform a reactor startup - Students calculate ECC - Discuss Xe transient due to reactor trip and the effects of Xe burnout after power is achieved - Increase power to 10^{-8} amps	
D. Increase power to 2 percent	
E. Startup secondary plant - Start additional condensate pump; one main feed pump - Maintain S/G level with main feedwater bypass valves - Secure, realign emergency feedwater - Warm, roll main turbine	

LESSON OUTLINE	NOTES AND REFERENCES
- Increase reactor power to 12-15 percent	
- Synchronize generator to 5 percent	
F. Load generator to 100 percent	
- Increase load to 10 percent	
- Initiate malfunction CVC-7, loss of normal letdown	Evaluate using a copy of Attachment I; SOP-102
- Increase load to 15 percent	
- Clear CVC-7	
- Increase load to 20 percent	
o Rods in Auto > 15 percent	
o Steam dumps in T_{avg} mode	
- Increase load to 50 percent	
o Condensate, FW booster, and feedwater pumps	
o P-8	
o Perform calorimetric	
o Perform Service Water System Pump Test	STP-123.002
o Initiate malfunction CRF-4, one dropped rod at ~ 40 percent power	Attachment I SOP-403
+ Recognition	
+ Corrective action	
+ Clear malfunction	
- Increase load to 75 percent	
o AT ~ 65 percent power initiate malfunction CVC-17, charging pump trip	Attachment I SOP-102
+ Recognition	
+ Corrective action	
+ Tech specs	
+ Clear malfunction	
o Perform calorimetric at 75 percent	

LESSON OUTLINE	NOTES AND REFERENCES
- Increase load to 90 percent o Borate/dilute for ΔI o Rods in manual at 90 percent - Increase load to 100 percent G. Final condition: 100 percent power H. Students conduct shift turnover to instructor. Check for knowledge of current situation. IV. CRITIQUE A. Review overall operations and conduct. B. Review malfunction response.	

DAY 9

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

NORMAL OPERATIONS WITH MINOR MALFUNCTIONS

Power Operations and Turbine Trip Recovery

Overview

Occasionally during nuclear plant operation, conditions will arise which result in automatic shutdown of the unit. The automatic actions will place the nuclear plant in a safe condition. However, proper operator response is required to place the plant in a stable shutdown condition.

This unit will provide a review of plant and system response to a turbine trip and subsequent recovery. It will discuss proper operator actions following a unit trip along with subsequent requirements and actions in returning the plant to operation.

Terminal Objective

The student will be able to describe nuclear plant response to a turbine trip including precautions and requirements for plant recovery and return to power. Evaluation will be performed by the program instructor's observation and student's oral response to questions.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- describe automatic actions which occur following a turbine trip.
2)- describe, in general terms, the operator actions required to place the unit in a stable condition following a turbine trip.
3)- describe the precautions for performing a plant startup.
4)- describe ECC requirements for reactor startup following a trip.
5)- describe the sequence of events during a reactor startup.
6)- describe reactor plant response upon return to power operation in relation to boron and xenon concentrations.
7)- perform a turbine trip recovery, applying the appropriate off-normal or emergency procedures.

References

1. Virgil C. Summer Phase III Training Materials
2. Technical Specifications
3. South Carolina Electric & Gas Company Phase II Training Materials
4. Precautions, Limitations, and Setpoints Document
5. Virgil C. Summer Training Simulator SOP-102, SOP-118, SOP-214, SOP-403, SOP-404, and STP-105.004.

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe nuclear plant response to a reactor trip including precautions and requirements for plant recovery and return to power. Evaluation will be performed by the program instructor's observation and student's oral response to questions.

B. OPERATIONS PLAN:

Perform plant unloading from 50 percent to 25 percent with simple malfunctions.

C. MALFUNCTIONS SCHEDULED

- Selected meter failure
- CCW-1 letdown heat exchanger tube leak
- CRF-7 stuck rod
- TUR-1 inadvertent turbine trip

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions can also be used.

STATE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

II. REVIEW (Optional)

A. Review reactor theory homework

B. Present overview of simulator operations

- Plant unloading from 50 percent to 25 percent
- Turbine trip
- Hot standby
- RCD, SDM, ECC

LESSON OUTLINE	NOTES AND REFERENCES

- Reactor startup
- Turbine loading

C. Discuss system response and operation following a turbine trip
- Reactor trip
- Main Steam System
  - o Steam valves
  - o Atmospheric reliefs, safeties
  - o Extraction steam check valves
- Steam dumps
  - o T_{avg}, pressure control
- Feedwater System
  - o Feedwater isolation
  - o Feedwater pumps
- Emergency feedwater
  - o Auto start
  - o Flow control
  - o Operator actions
- Reactor coolant system and pressurizer, factors which help limit pressure excursion
  - o Control heaters off
  - o Pressurizer sprays
  - o PORV
  - o Safeties

D. Review xenon transient following reactor trip and return to power

E. Discuss turbine trip in SOP-214
- Symptoms
- Automatic action
- Immediate action
- Subsequent action

LESSON OUTLINE	NOTES AND REFERENCES
F. Discuss CCW off normals in SOP-18 - Symptoms - Automatic actions - Immediate actions - Followup actions	
G. Discuss rod control off normals in SOP-403 - Symptoms - Automatic actions - Immediate actions - Followup actions	
H. Discuss IR NIS off normals in SOP-404 - Symptoms - Automatic actions - Immediate actions - Followup actions	
I. Review ECC requirements - Data for calculation - Time requirements	
J. Review startup precautions	
K. Discuss Technical Specifications 6.6 through 6.9	
III. PROCEDURE	
A. Put plant in IC set (later) and conduct shift turnover - Shift - Plant status: 50 percent, equilibrium xenon - Load dispatch orders: 25 percent at end of shift	
B. Scheduled STPs - STP-105.004 RHR pump test	
C. Have students conduct plant unloading IAW GOP-4	

LESSON OUTLINE	NOTES AND REFERENCES
D. Fail selected meter(s) for each operator and allow him to detect and determine meter vice instrument failure E. Return meter to service after detected F. Initiate CRF-7, stuck rod - Discuss effects on ΔI - Ensure students consult procedures - Evaluate response - Clear malfunction G. Initiate CCW-1, letdown heat exchanger tube leak - Discuss effects on continued plant operation - Ensure students notify auxiliary operator - Evaluate response H. Initiate TUR-1, inadvertent turbine trip - Discuss plant response - Evaluate response I. Recover from trip and perform a reactor startup J. Initiate NIS-4, IR under compensation - Discuss effects on operation - Evaluate response K. Continue to POAH and begin secondary plant startup L. Discuss effects of xenon transient on startup	

LESSON OUTLINE	NOTES AND REFERENCES
M. Continue loading as time permits	
N. Perform RHR pump test	STP-105.004
IV. CRITIQUE	1 Hour
A. Review overall operations.	
B. Review malfunction response	

DAY 10

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

PLANT TRANSIENT RESPONSE

Load Rejection Transients and
Accident Assessment and Identification

Overview

During power operations a control room operator can be confronted with various degrees of load rejections. The operator should be able to determine the degree of change in system parameters following various degrees of change in load. In addition to these transients, abnormal conditions sometimes occur which the control room operator will have to detect and evaluate. The seriousness of each event will largely depend upon the type of malfunction. However, the actions of the operator can significantly affect the consequences of that malfunction. The operator is relied upon to detect, identify and follow the correct emergency or abnormal procedure which provides guidelines for operation in returning the plant to a safe and stable condition.

This unit will accomplish two goals:

1. It will provide the student with the experience of plant operation during load rejection under a wide range of initial conditions, thus improving his ability to detect, evaluate and respond to this type of transient.

2. This unit will present the student with the various procedures available to enable him to identify and respond to various accident conditions. In addition, it will allow the students the opportunity to apply these procedures to actual accident or abnormal conditions and increase his awareness of plant response and control room atmoshphere during accident conditions.

Terminal Objective

When the student completes this unit he will be able to predict expected plant parameter changes during varying degrees of load rejection. The student will be capable of detecting load changes and discussing system transient analysis associated with the major parameters. The student will discuss plant technical specifications applying to systems and operations covered during this unit.

The student will also be able to adequately explain the different types of procedures available in the control room and be able to correctly use the applicable procedure during an accident or abnormal condition as evaluated by the program instructor's personal observation and questioning.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1) discuss automatic control system response to a 10 percent load step change.
2) discuss plant response to a 50 percent load rejection.
3) explain plant parameter changes during load changes.
4) discuss plant response during load rejections when automatic control systems are in manual.
5) respond properly to a load rejection following the appropriate plant procedures.
6) describe the ba ic sections of the Emergency Procedures.
7) demonstrate an .bility to use the Control Room procedures during accident or abnormal conditions.
8) identify the major accidents using the indications on the Main Control Board.

References

1. Virgil C. Summer Simulator EOPs.
2. Virgil C. Summer Phase III Training Material
3. Virgil C. Summer Phase III Training Material.
4. Technical Specifications.

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
I. INTRODUCTION A. UNIT TERMINAL OBJECTIVE: When the student completes this unit he will be able to predict the expected plant parameter change during varying degrees of load rejection. The student will be able to detect load changes and discuss the system transient analysis associated with the major parameters. The student will discuss plant technical specifications that apply to system and operations covered during this unit. - Explain the different types of procedures available in the control room and be able to correctly use the applicable procedure during an accident or abnormal condition as evaluated by the program instructor's personal observation and questioning. B. OPERATIONS PLAN: - Allow the students to maintain reactivity balance during 100 percent power peak Xe burnout. Initiate 10 percent step changes to demonstrate response without auto rod control or steam dumps. Perform the same with 50 percent load rejection. - Allow the students the opportunity to experience the major accidents from an observer viewpoint. Report any accident as you feel necessary and have students follow the emergency procedures. Slow simulator speed to help students observe more indications during the accident.	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

C. MALFUNCTIONS SCHEDULED:

- CVC-1 Boric acid flow transducer failure
- RCS-5 LOCA (large)
- RCS-2 S/G tube break
- MSS-3 Steam break inside containment
- FWM-8 Feed break inside containment

STATE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions can also be used.

II. REVIEW (Optional)

A. Present overview of simulator operations

- Load rejection transients
  - o 100 percent power peak xenon burnout
  - o Transient response 10 percent step
    - + Without auto rod control
    - + Without steam dumps
  - o Transient response 50 percent rejection
    - + With auto rod control and steam dumps
    - + Without auto rod control
    - + Without steam dumps
- Accident identification/assessment
  - o Observe plant response
  - o Procedure use

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
o Observe major accidents + LOCA + Tube break + Steam break + Feed break NOTE: The above presentation is to be evaluated by the instructor based upon the students knowledge of the diagram, effectiveness of his communication method, and ability to explain system interrelations. B. Discuss plant response during the following: - 10 percent step reduction without auto rod control o Steam dump o Makeup system o Nuclear power response o Reactivity effects o ΔI limits - 10 percent step reduction without steam dumps o Rod Control o Makeup system o Nuclear power response o Reactivity effects o ΔI limits - 50 percent load rejection o Steam dumps o Rod control	

LESSON OUTLINE	NOTES AND REFERENCES
o Makeup system o ΔI limits o Nuclear power response - 50 percent load rejection without auto rod control o Steam dumps o Reactivity effects o Nuclear power response - 50 percent load rejection without steam dumps o Rod control o Reactivity effects o Nuclear power response C. Discuss procedures concerning load-rejection D. Discuss Emergency Operating Procedure EOP-1. - Purpose - Symtoms - Automatic actions - Immediate operator actions - Follow up action E. Discuss the Technical Specification 3/4.5	
III. PROCEDURE A. Set up plant in IC Set (later) and conduct a shift turnover - Shift - Initial conditions: 100 percent power B. Scheduled STPs NONE C. With the plant at 100 percent power, perform a 10 percent step load rejection with and without auto rod control.	

LESSON OUTLINE	NOTES AND REFERENCES
- Trend the following parameters o T_{avg} o PZR level o PZR pressure o S/G level (1) o S/G pressure (1) o ΔT (1) - Once the plant has stabilized, review the transient with the students using the trend results	
D. Reinitialize and perform a 10 percent step load rejection without steam dumps. Trend and review transient as per step C	
E. Reinitialize and perform a 50 percent load rejection trend and review the transient as per step C	
F. Reinitialize and perform a 50 percent load rejection without rod control. Trend and review the transient as per step C	
G. Reinitialize and perform a 50 percent load rejection without steam dumps trend and review the transient as per step C	
H. Reinitialize and explain plant conditions and objectives to students - System lineups - Plant parameters - Operational status - Power history	
I. Allow students to utilize makeup system to maintain ΔI limits	
J. During a boration initiate CVC-1 boric acid flow transducer failure - Discuss method of continued boration of desired quantity	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
- Evaluate response using a copy of Attachment I. K. Reinitialize at 100 percent. L. Initiate DBA RCS-5, discuss: - Indications - ECCS response - Procedure application - Operator actions M. Reinitialize and, if desired, repeat RCS-5 at reduced simulator speed or smaller break N. Reinitialize and initiate RCS-2 leak rate = 660 gpm and ramp of long enough time to observe indications prior to trip. Discuss: - Indications - Procedure application - Operator actions - Plant response O. Reinitialize and initiate MSS-3 steam break inside containment, again with a ramp time long enough for evaluation prior to the trip. Discuss: - Plant response - Indications - Procedure application - Operator actions P. Reinitialize initiate FWM-8 and discuss: - Indications - Plant response - Procedure application - Operator actions	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
Q. Reinitialize and repeat any of the major casualties or minor malfunctions with no operator actions and observe plant response	
V. CRITIQUE	1 Hour
A. Review overall operations.	
B. Review malfunction response.	

DAY 11

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Reactor Startup to Power, Malfunctions

Overview

The proper operation of a nuclear power plant is dependent upon many electrical, electronic, and mechanical support systems. A failure of any particular instrument or device will probably have an effect on some system and subsequently affect plant operation. The consequences of a failure will largely depend upon the type of failure and the system(s) affected. However, the operator will provide a significant contribution to subsequent plant operation. An astute and knowledgeable operator should be capable of diagnosing the failure and taking appropriate action as specified in operation procedures and technical specifications.

This unit is designed to give the prospective control room operator experience in dealing with plant malfunctions. These are conditions which pose no immediate hazard to plant operation or safety. However, without operator action, they could develop into a serious condition involving possible plant trip.

In addition, during this unit, one student will receive a startup examination. This is an examination performed by the program instructor and conducted in accordance with the guidelines adopted for the final certification startup exam.

Terminal Objective

The student will be able to identify system malfunctions that affect nuclear instrumentation and control of reactor operations. The operator will be able to utilize proper system abnormal operating procedures to place the plant in a safe condition. The operator will develop a philosophy of operations which will enable him to combat any unsafe plant condition.

Enabling Objectives

Upon completion of this unit the student shall be able to:

1)- identify plant malfunctions through use of alarm and control board indication.

2)- recall the proper immediate operator actions for the particular plant problem and refer to the appropriate abnormal operating procedure for appropriate subsequent operator actions.

3)- recall any technical specifications limitations associated with the particular plant failure and apply these limitations to subsequent plant operations.

4)- develop a basic plan outlining an operator philosophy in dealing with minor plant problems and systems malfunctions.

5)- perform a safe reactor startup as evaluated by the program instructor.

References

1. Virgil C. Summer Training Simulator SOP-102, SOP-405, SOP-403, EOP-10, STP-102.003, STP-125.002.
2. Technical Specifications
3. NIS System diagrams

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to recognize, diagnose and respond correctly to various plant malfunctions. This ability will be evaluated by instructor observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Conduct a control board misalignment if desired. Perform a Reactor Startup Evaluation of one student. Terminate evaluation once 2 percent power has been attained. Conduct normal plant loading towards 100 percent power. Conduct the scheduled malfunctions.

C. MALFUNCTIONS SCHEDULED:

- NIS-1 - Source range channel failure
- CRF-8 - T reference failure (rod control)
- CND-2 - Hotwell level transmitter failure
- CVC-3 - Makeup control failure in all modes
- CVC-17 - Loss of charging pump
- TUR-6 - EHC first-stage pressure transmitter failure
- FWM-6 - FW booster pump trip

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
PRESENTATION	
II. REVIEW (Optional)	
A. Review homework assignment	
B. Present overview of simulator operations	
- Reactor startup evaluation	
- Normal plant loading towards 100 percent	
- Selected malfunctions	
C. Review SOP-405 Nuclear Instrumentation System malfunction	
- Review Tech Specs 3/4.3	
D. Review SOP-403, EOP-10 Rod Control System Malfunctions	
- Review Tech Specs 3/4 1.3, 3/4.2	
E. Review SOP-102 CVCS Malfunction	
- Review Tech Specs 3/4.5.2, 3/4.5.3	
III. PROCEDURE	
A. Initialize at (Later)	
Conduct a shift turnover and explain plant conditions and objectives to students	
- System lineups	
- Plant parameters	
- Operational status	
- Power history	
B. Scheduled STPs	
- STP-102.003 IR range analog channel test	
- STP-125.002 diesel generator operability test	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
C. Continue plant loading towards 100 percent power, discussing boration/dilution requirements	
- Perform an IR analog channel test	STP-102.003
- Perform a diesel generator oper. test	STP-125.002
D. Initiate CVC-3, makeup control failure discuss:	
- Effect on plant operation	
- Continue operations with Makeup System in manual, or clear malfunctions to simulate repairs as desired.	
E. Once Rod Control is in auto, initiate CRF-8. T reference failure (rod control) discuss:	
- Input to rod control	
- Effect on plant operation	
- Clear malfunction upon request for repair	
F. Continue plant loading, initiate CND-2 hotwell level transmitter failure, discuss:	
- Manual control of level - makeup and reject	
- Clear malfunction upon request for repair	
G. Continue plant loading, ensure EHC is in first-stage pressure feedback. Initiate TUR-6 EHC first-stage pressure transmitter failure, discuss:	
- EHC response i.e., cause for possible load change	
- Clear malfunction upon request for repair	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
H. Continue plant loading, initiate FWM-6 FW booster pump trip, discuss: - Effect on plant capability - Clear malfunction upon request for repair	
I. Initiate CVC-17 loss of charging pump, select operating charging pump, discuss: - Technical Specifications - Effects on PZR level, letdown temperatures, seal flow and VCT level.	
J. Student conduct shift turnover to instructor	
IV. CRITIQUE	
A. Review overall operations conduct.	
B. Review malfunction responses	

DAY 12

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Reactor Startup to Power, Malfunctions

Overview

The operation of a nuclear power plant normally involves maintaining steady state conditions. On those occasions when the plant deviates from normal operation, the operators will have to react to correct the problems and bring the plant back to a stable condition. This unit is designed to teach the operator how to properly react to various malfunctions during varying plant conditions to bring the plant back to a safe and stable condition.

Also during this unit, one student will receive a startup examination. This is an examination performd by the program instructor and conducted following the same guidelines as the final certification startup exam.

Terminal Objective

The student will be able to identify control system failures and take proper action to return the plant to a safe condition.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- discuss Rod Control Abnormal Operating Procedures.

2)- review any technical specifications applicable to movable control assemblies.

3)- perform a safe reactor startup as evaluated by the program instructor.

References

1. Rod Control Abnormal Operating Procedures, STP-105.004
2. SCE & G Phase III training material
2. Technical Specification on movable control assemblies.

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to recognize, diagnose and respond correctly to various plant malfunctions. This ability will be evaluated by instructor observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Conduct a control board misalignment if desired. Perform a reactor startup evaluation of one student. Terminate evaluation once 2 percent power has been attained. Conduct plant loading towards 100 percent power from a point where the generator is ready to synchronize to the grid. Conduct the scheduled malfunctions.

C. MALFUNCTIONS SCHEDULED:

- NIS-6 - Noisy source range channel (on startup)
- FWM-5 - Main feedwater pump speed malfunction
- CRF-7 - Stuck rod
- FWM-9 - Tube leak in feedwater heater
- RCS-9 - Faulty primary RTD
- TUR-1 - Inadvertant turbine trip

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

LESSON OUTLINE	NOTES AND REFERENCES
II. REVIEW (Optional) A. Review homework B Present an overview of simulator operations - Reactor startup evaluation - Normal plant loading towards 100 percent - Selected malfunctions C. Review failure of control bank(s) to move procedure (EOP-10). - Re-review Tech Spec 3/4.1.3 D. Review Rod Position Indication Malfunction Procedure (SOP-403). E. Review Turbine Trip Procedure (SOP-214).	
III. PROCEDURE A. Initialize at (Later) and perform a shift turnover. Explain plant conditions and objectives to students: - System lineups - Plant parameters - Operational status - Power history B. STPs scheduled - STP 105.004 RHR pump test C. Continue plant loading towards 100 percent power, discussing boration/dilution requirements - Perform RHR pump test D. Initiate FWM-5, main feedwater pump speed, discuss: - Effect on plant operation i.e., power capability of emergency feedwater, and one main feed pump	STP-105.004

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
- Clear malfunction upon request for repair	
E. Initiate CRF-7, stuck rod, discuss:	
- Tech Spec implications, i.e., shutdown margin determination, continuation of operator	
- Clear malfunction upon attempt to realign the rod	
F. Initiate FWM-9, tube leak in feedwater heater, discuss:	
- Isolation of the heater	
- Effect on plant operation	
- Continue operation with heater isolation	
G. Initiate RCS-9, faulty primary RTD, discuss:	
- Effect on plant operation	
- Tripping of bistables	
H. Initiate TUR-1 inadvertant turbine trip, discuss:	
- Proper plant response, i.e., P-8	
- Proper operator response with respect to Rx trip	
I. Students conduct shift turnover to instructor	
IV. CRITIQUE	
A. Review overall operation conduct.	
B. Review malfunction responses	

DAY 13

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Reactor Startup to Power, Malfunctions

Overview

The Nuclear Steam Supply System for a typical Pressurized Water Reactor (PWR) is designed to operate properly with little or no operator assistance. Normal plant conditions are maintained by automatic systems and controls. Unsafe conditions, when detected, cause alarms and other indications to initiate a sequence of events culminated by an operator taking the necessary actions to correct the problem or to safely shutdown the plant. Reliability is guaranteed through necessary and proper training in this response oriented technique.

This unit is designed to train the prospective plant operator to respond properly and in a timely manner to minor plant malfunctions. These malfunctions are defined to be conditions which pose no immediate hazard to plant operation or safety. However, with no operator action, they could develop into a serious condition involving possible plant trip.

During this unit, one student will receive a startup examination

Terminal Objective

The student will be able to identify various system malfunctions and be able to take the proper actions to maintain proper plant performance at all times.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- discuss the loss of Feedwater System Abnormal Operating Procedure.
2)- analyze plant conditions to identify malfunctions through the use of alarms and control board indications.
3)- recall related technical specifications.
4)- perform a safe reactor startup as evaluated by the program instructor.

References

1. Abnormal Operating Procedures, STP-133.001, STP-125.002
2. System diagrams for Main Feedwater System
3. SCE & G Phase III training material

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to recognize, diagnose and respond correctly to various plant malfunctions. This ability will be evaluated by instructor observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Perform a Reactor Startup Evaluation of one student. Terminate evaluation once 2 percent power has been attained. Conduct normal plant loading towards 100 percent power. Conduct the scheduled malfunctions.

C. MALFUNCTIONS SCHEDULED:

- NIS-5 - Failure of source range high voltage to disconnect
- MSS-5 - Steam dump control valves fail
- PRS-1 - Pressurizer pressure channel failure
- FWM-1 - Trip of main feedwater pump
- MSS-7 - Steam generator relief valve opens
- PRS-3 - Pressurizer spray valve failure

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
II. REVIEW (Optional) A. Review homework assignment - Present an overview of simulator operations - Normal plant loading towards 100 percent - Selected malfunctions B. Review EOP-02 loss of secondary coolant without SI C. Review SOP-210 loss of one feedwater pump D. Review SOP-210 loss of feedwater system	
III. PROCEDURE: A. Initialize at (Later) and perform a shift turnover. Explain plant conditions and objectives to students: - System lineups - Plant parameters - Operational status - Power history B. STPs scheduled - STP -133.001 Axial Flux Difference Calculation - STP -125.002 Diesel Generator Operability test C. Continue plant loading towards 100 percent power, discussing boration/dilution requirements - Perform a Diesel Generator Operability test D. Initiate MSS-5, steam dump control valve fails, discuss: - Indications of problem	STP-125.002

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
- Effects on plant - Clear malfunctions upon request for repair	
E. Initiate PRS-1, pressurizer pressure channel failure, discuss: - Failure's effect on pressure control - Bistables associated with failure - Clear malfunction upon request for repair	
F. Continue plant loading, initiate MSS-7 steam generator relief valve opens (100 percent), discuss: - Indications of problem - Isolation capabilities - Effect of continued operation i.e., safety related - Clear malfunction some time after repairs are requested	
G. Perform an Axial Flux Difference Calculation	STP-133.001
H. Continue plant loading, initiate PRS-3 pressurizer spray valve failure (with manual control), discuss: - Indications of problem - Isolation (if possible) or reduction of flow if no manual operation - Ability to continue operation - Clear malfunction upon request for repair	
I. Continue plant loading, at approximately 75 percent, initiate FWM-1 trip of main feedwater pump, discuss:	

LESSON OUTLINE	NOTES AND REFERENCES
- Effect on operations, i.e., turbine runback, steam dump actuation, control rod response - Clear malfunction upon request for investigation and repair J. Students conduct shift turnover to instructor. IV. CRITIQUE A. Review overall operation conduct. B. Review malfunction responses	

DAY 14

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Load Follow Operation With Malfunctions

Overview

Power changes because of load follow operations in a PWR causes problems with xenon oscillations and the effect on maintaining ΔI within its operating band. Day 14 and 15 are designed to give the student experience of plant operations during load follow operations.

During this session the student will decrease load from 100%. While power is being decreased, xenon is being produced and the operator will have to compensate for the xenon buildup. The operator will have to respond to minor plant malfunctions. These malfunctions are defined to be conditions which pose no immediate hazzard to the plant operation or safety. However, with no operator action they could develop into serious conditions involving possible plant trip.

At the end of this day, a SNAP of the final conditions will be taken for Day 15.

Terminal Objective

The student will be able to change power and maintain ΔI within its limits while maintaining proper plant performance.

Enabling Objectives

Demonstrate the actions to decrease power as xenon builds in.

Discuss the applications of Technical Specifications in regards to ΔI limits.

Demonstrate the ability of controlling ΔI without control rods movement.

INSTRUCTOR'S GUIDE

LESSON OUTLINE | NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to maintain ΔI within limits during load follow operation with various malfunctions.

B. OPERATIONS PLAN:

Conduct load follow operations. On request from dispatcher, ramp generator output from 930 MWe to 450 MWe over a two hour period. Maintain 450 MWe until load increase requested from dispatcher (to be continued during Day 15).

C. MALFUNCTIONS SCHEDULED:

RCS-11 Accumulator Leakage

RCS-12 Reactor Vessel Flange Leakage

MSS-12 Steam Header Pressure Transmitter Failure

FWM-2 Condensate Pump Trip

CRF-11 Power Cabinet Urgent Failure

CVC-16 Charging Flow Control Valve Failure

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STP Schedule:

None.

II. PROCEDURE:

A. Initialize at 100% and perform a shift turnover and explain plant conditions and objectives to students.

- System Lineups
- Plant Paramaters
- Operational Status
- Power History

LESSON OUTLINE | NOTES AND REFERENCES

B. Dispatcher ask for a 450MW decrease in power over a two hour period. Ensure operators are aware of iodine sampling requirements.

C. As load decreases, initiate FWM2 (condensate pump trip) with reactor power at >95%.
- Discuss Operation of Condensate System
- Discuss Condensate Pump Trips
- Clear Malfunction on Request

D. Initiate RCS-11 (Accumulator Leakge)
Discuss:
- Technical Specifications
- SOP's
- Operators Drain to Limit
- Possible Dilution Problem

E. Initiate RCS-12 <10 gpm leakage (Reactor Vessel Flange Leakage)
Discuss Technical Specifications.
Perform Leak Rate Calculation.

F. Initiate CRF-11 (Power Cabinet Urgent Failure)
Discuss ways to control power without rod motion.

G. Initiate MSS-12 (Steam Header Pressure Transmitter Failure). Suggest failing low with ramp.
Discuss effect on speed control. Operators should take manual control of speed controller.
Clear when repaired.

H. Initiate CVC-16 (charging flow control valve failure).
Operator can take manual control of FCV-122 and maintain PZR level.

I. At end of Day write SNAP to be used in Day 15.

LESSON OUTLINE	NOTES AND REFERENCES
III. Critique A. Review overall operations conduct. B. Review malfunction responses with students.	

DAY 15

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Plant Load Follow Operations with Malfunctions

Overview

This is a continuation of Day 14. During this training session the load follow operations will continue with the problems of maintaining ΔI within limits. Because of the time it takes for xenon to peak after power manipulation this session consists of 2 days.

Terminal Objective

The student will be able to change power and maintain ΔI within the limits set forth by the operating curves.

Enabling Objectives

Demonstrate the actions to decrease power as xenon builds in.
Discuss the applications of Technical Specifications in regards to ΔI limits.
Demonstrate the ability of controlling ΔI without control rods movement.

INSTRUCTOR'S GUIDE

LESSON OUTLINE | NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE

The student will be able to maintain ΔI within limits during load follow operation.

B. OPERATIONS PLAN

Continue with load follow operations from Day 14. Increase generator load from 450 MWe per dispatcher instructions with various malfunctions.

C. MALFUNCTIONS SCHEDULED

CRF-2 Auto Rod Speed Failure

CCW-8 Seal Water Heat Exchanger Leak

FWM-15 FW Control Valve Position Failure

EPS-6 Diesel Generator Trip

PRS-3 Pressurizer Spray Valve Sticks

EPS-13 Generator Breaker Fails to Trip

D. STP SCHEDULED

STP-125.002 - Diesel Generator Operability Test

II. PROCEDURE

A. Initiate in SNAP written at end of Day 14.

Review:

- Plant Conditions
- Power History
- Operational Status

B. Perform STP-125.002. During STP initiate EPS-6 (diesel generator trip).

Discuss:

- Technical Specifications
- Requirement to Verify Other Diesel
- Operability
- Clear when Repaired

LESSON OUTLINE | NOTES AND REFERENCES

C. Initiate CCW-8 (seal water heat exchanger) Discuss the possibility of cromates in the RCS clear when repaired.

D. Dispatcher ask for load increase to 930 MWe over two hour perid.

E. As load increases, initiate FWM-15 (FW control valve position failure). Suggest failing valve position "as is" with manual control allowed.

F. Initiate CRF-2 (auto rod speed failure) with speed failed to 72 steps per minute.

G. Near end of session, initiate EPS-13 (generator breaker fails to trip) and then initiate PRS-3 (pressurizer spray valve failure). Evaluate operator actions with regard to spray valve sticking open and on reactor trip.

Discuss:

- Immediate actions of EOP-5
- Possibility of reducing power to <38% and securing RCP.

III. CRITIQUE

A. Review overall operations conduct.

B. Review malfunction responses.

DAY 16

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Power Operations, Malfunctions
RCP Trip and Recovery, Accident Analysis Part 1

Overview

The American Nuclear Society has divided nuclear plant operations into four conditions. Up to this point in training the prospective operator has mainly concentrated on Condition I - Normal Operation and Operational Transients. It is becoming increasingly more important for an operator to experience operation in the other three conditions. These conditions deal with faults of increasing severity which have not been emphasized during the past operator training courses. Because of the importance placed upon an operator's ability to recognize and properly respond to fault conditions, this unit will stress the Condition II type faults and the design analyses behind them. The prospective operator will experience Condition II faults of increasing severity, thus enhancing his ability to correctly handle the same category faults during actual operation.

Terminal Objective

The student will be able to discuss typical Condition II faults including immediate operator actions required and follow the appropriate procedures to perform subsequent operator actions maintaining nuclear plant safety at all times.

Enabling Objectives

Upon completion of this unit the student shall be able to:

1)- discuss types of faults included in Condition II operation.

2)- identify Condition II faults from Main Control Board (MCB) annunciators and indications.

3)- demonstrate the use of Abnormal and Emergency Procedures in response to Condition II faults.

4)- relate fault conditions to technical specification limits.

References

1. Virgil C. Summer Training Simulator
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications
6. Abnormal Operating Procedures
7. STP 102.002

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to recognize, diagnose, and respond correctly to various plant malfunctions. This ability will be evaluated by instructor observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Commence plant unloading from 100 percent to <50 percent power. Conduct the scheduled malfunctions.

C. MALFUNCTIONS SCHEDULED:

1. CVC-1 - Boric acid flow transducer failure
2. PCS-3 - Steam generator level control failure
3. CRF-1 - Rods fail to move
4. NIS-7 - Power range detector failure
5. MSS-4 - Steamline break outside the reactor building

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

II REVIEW (Optional)

A. Review homework assignment

B. Present an overview of simulator operations:

- Plant unloading from 100 percent to <50 percent
- Selected malfunctions

C. Review EOP-10, misalignment of full length rods, with respect to a Condition II fault and analysis, i.e., RCCA misalignment.

D. Review EOP-10 dropped rod

- Re-review Tech Specs 3/4.1.3

E. Review Reactor Coolant Makeup Control System malfunction, with respect to a Condition II fault and analysis, i.e., uncontrolled boron dilution.

- Review Tech Specs 3/4.1.2

F. Re-review EOP-2, loss of secondary coolant

G. Review SOP-101, RCP Trip, with respect to a Condition II fault and analysis, i.e., partial loss of RCS flow and startup of inactive RCP.

III PROCEDURE

A. Initialize at (Later), perform a shift turnover, and explain plant conditions and objectives to students:

- System lineups
- Plant parameters
- Operational status
- Power history

B. STPs scheduled

- STP 102.002 NIS power range heat balance

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
C. Commence plant unloading towards 50 percent. - Have students perform heat balance before commencing downpower STP 102.002 D. Initiate CVC-1, boric acid flow transducer fails high, discuss: - Inability to borate, i.e., how extensive? - Alternate means to borate - Clear malfunction when problem is located and request for repair is made E. Initiate PCS-3, steam generator level control failure, discuss: - Manual control and load follow problems - Clear malfunctions upon request for repair F. Initiate CRF-1, rods fail to move, (manual control allowed) discuss: - Means to control T_{avg} if no manual rod motion - Tech Spec requirements - Clear malfunction upon request for repair G. Initiate NIS-7, power range detector failure, discuss: - Effect on protection - Purpose of various switch manipulations taking place at NIS panels - Required bistable tripping - Clear malfunction upon request for repair	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
H. Initiate MSS-12, main steam header steam leak, discuss: - Identification difficulties - Isolable versus non-isolable - Means to minimize energy release - Continue plant shutdown/cooldown to the end of the period	
I. Students conduct a shift turnover to instructor	
IV CRITIQUE	
A. Review overall operations conduct.	
B. Review malfunction responses	

DAY 17

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Power Operations, Malfunctions
Small RCS Leak

Overview

In the nuclear power industry there have been several utilities that have experienced small amounts of leakage from the Reactor Coolant System (RCS). To prepare the operator to properly identify and isolate such a leak, the student will be exposed to several types of RCS leaks and will be required to identify and take proper corrective actions by following the Abnormal Operating Procedures for an RCS leak.

Terminal Objective

The student will be able to discuss and describe indications of RCS leakage along with operator actions required to place the plant in a safe and stable condition.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- discuss the Reactor Coolant System Abnormal Operating Procedure for reactor coolant leakage.

2)- describe indications of a small RCS leak.

3)- recall RCS leakage technical specifications limits and their bases.

References

1. Virgil C. Summer Training Simulator
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications
6. Abnormal Operating Procedures
7. STP 114.002

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to recognize, diagnose and respond correctly to various plant malfunctions. This ability will be evaluated by instructor observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Commence plant loading from 20 percent to 100 percent power. Conduct the scheduled malfunctions.

C. MALFUNCTIONS SCHEDULED:

1. PCS-8 - Failure of reactor trip switch
2. MSS-6 - Steam generator isolation valve closes
3. CVC-17 - Loss of charging pump
4. RCS-3 - RCP Trip
5. CRF-4 - Dropped full length rod
6. RCS-6 - Leak
7. PCS-4 - Unstable steam generator level controller

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

II. REVIEW (Optional)

A. Review homework assignment.

B. Re-review SOP-403, Dropped Rod (evaluate student response)

LESSON OUTLINE	NOTES AND REFERENCES
C. Re-review SOP-102, loss of charging (evaluate student response) D. Review EOP-6, emergency boration - Re-review Tech Specs 3/4.5 - Stress when emergency boration is required E. Review EOP-12, Reactor Coolant System - Excessive Coolant Leakage - Review Tech Specs 3/4.4.6 III. PROCEDURE A. Initialize at (Later) and perform a shift turnover and explain plant conditions and objectives to students: - System lineups - Plant parameters - Operational status - Power history B. STPs scheduled - STP 114.002 Operability Leak Test C. Commence plant loading towards 100 percent. D. Initiate PCS-8, failure of reactor trip switch E. Initiate CVC-17, loss of charging pump, following a shift to a CCP, discuss: - Tech specs associated with ECCS - CCW operating in both trains prior to start - Seal injection - Clear malfunction upon request for repair F. Initiate CRF-4, dropped full length rod, discuss: - Causes and plant limitations - Related tech specs	

LESSON OUTLINE	NOTES AND REFERENCES
- Urgent/nonurgent failures and alarm reset - Allow recovery of rod by procedure Ensure malfunction is cleared prior to attempting rod recovery G. Initiate PCS-4, unstable steam generator level controller, discuss: - Manual control and load change relationships - Elements of level control - Clear malfunction upon request for repair H. Initiate MSS-6, steam generator isolation valve closes, discuss: - Indications - Effect on plant operations at low versus high power levels, i.e., reason for plant trip - If plant trips, backup prior to malfunction and continue plant loading - If plant does not trip, clear malfunction, reopen the MSIV, and continue plant loading I. Initiate RCS-3, RCP Trip, discuss: - Effect on plant operations at low versus high power levels - If plant does not trip, clear malfunction, restart pump, and continue plant loading J. Initialize at (Later) and explain plant conditions	

LESSON OUTLINE	NOTES AND REFERENCES
- System lineups - Plant parameters - Operational status - Power history K. Have students perform an Operational Leak Test STP 114.002 L. Initiate RCS-6, LOCA (small), ramp leak rate up to allow leak rate determination and location identification - Determine proper procedure, i.e. within CCP capabilities M. Students conduct shift turnover to instructor IV. CRITIQUE A. Review overall operations conduct. B. Review malfunction responses	

DAY 18

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Power Operations, Malfunctions
Small Steam Generator (S/G) Tube Leak

Overview

Identification of nuclear plant faults, as evidenced in the past few units, requires the use of several interrelated indications. This unit is a continuation of the same type of faults. One indication or annunciator will be a symptom of the problem, but the identification of the specific problem requires operator awareness and knowledge of system interrelations. A steam generator (S/G) tube leak is one fault which will be identified by the association of several different indications. Although it may seem unrealistic to discuss a particular fault immediately prior to experiencing it, the discussion and application will complement one another such that the result will be a student familiar with a particular problem and the proper response such that he can properly react to the fault.

Terminal Objective

The student will be able to discuss indications of steam generator tube leakage along with operator actions required to place the plant in a stable condition. In addition he will be able to identify this type of fault as a control room operator and use the proper procedure as guidance in further plant operations.

Enabling Objectives

Upon completion of this unit the student shall be able to:

1)- describe indications of a steam generator tube leak.

2)- identify the particular steam generator involved.

3)- describe operator actions in response to a steam generator tube leak.

4)- demonstrate an ability to perform actions as a control room operator during a steam generator tube leak.

References

1. Virgil C. Summer Training Simulator
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications
6. Abnormal Operating Procedures
7. STP - 204.001

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES

INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to recognize, diagnose and respond correctly to various plant malfunctions. This ability will be evaluated by instructor observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Commence plant loading towards 20 to 100 percent power. Conduct the scheduled malfunctions.

C. MALFUNCTIONS SCHEDULED:

1. TUR-12 - First stage pressure transmitter failure
2. CVC-1 - Boric acid flow transmitter failure
3. PRS-2 - Pressurizer level channel failure
4. CVC-4 - RCP #1 seal leak
5. CVC-8 - Leak inside containment
6. RCS-2 - Steam generator tube leak (small)

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

II. REVIEW (Optional)

A. Review homework assignment

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
B. Review EOP-03, steam generator tube leak - Review tech specs C. Re-review Reactor Coolant Makeup Control System malfunction (evaluate student response) D. Re-review SOP-101, reactor coolant pump - off normal procedure (evaluate student response) E. Re-review EOP-12, reactor coolant system - excessive coolant leakage (evaluate student response) III. PROCEDURE A. Initialize at (Later) and perform a shift turnover. Explain plant conditions and objectives to students: - System lineups - Plant parameters - Operational status - Power history B. STPs scheduled - STP 204.001 Hot Channel Factor test C. Commence plant loading towards 100 percent D. Initiate TUR-12, first stage pressure transmitter failure, discuss: - Effect on all associated systems, i.e., P-13, P-7, C-5, C-7, auto rod control - Clear malfunction after proper bistables have tripped and request for repair has been made E. Initiate CVC-1, Boric Acid Flow Transmitter Failure, discuss: - Investigation as to cause	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
- Limitations that this problem imposes clear malfunction upon request for repair F. Initiate PRS-2, pressurizer level channel failure, discuss: - Manual manipulations of pressurizer level in response to load changes - Limitations imposed upon operator - Allow for a period of manual operation, then clear malfunction upon request for repair G. Initiate CVC-4, RCP #1 seal leak, discuss: - Use of indications to determine cause - Orderly shutdown - Upon determination of steps to be followed, terminate malfunction and backup to a point prior to the seal leak. Continue plant loading towards 100 percent. H. Initiate CVC-8, leak inside the reactor building (letdown line), discuss: - Source of leak and possible isolation - Significance of loss of letdown, i.e., load follow, plant chemistry, etc. - Terminate malfunction when proper action has been started. I. Re-initialize at (Later) explain plant conditions - System lineups - Plant parameters - Operational status - Power history	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
J. Have students perform a Hot Channel Factor STP 204.001 Test	
K. Initiate RCS-2 steam generator tube leak, discuss: - First indications versus determining indications, i.e., radiation alarms in conjunction with flow changes, and apparent difficulties - Leak-rate determination - Proper procedure (EOP-12) - Carry out malfunction as long as time allows	
L Students conduct shift turnover to instructor	
CRITIQUE	
A. Review overall operations conduct.	
B. Review malfunction responses	

DAY 19

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Power Operations, Malfunctions
Loss of Site Power and Recovery, Establish Natural Circulation

Overview

The casualty training presented in weeks one, two, and three has concentrated on minor malfunctions for which the operator could usually take corrective action and continue plant operation. Although it is unlikely for a major accident to occur in a nuclear plant, the possibility does exist. Therefore, operators have to be knowledgeable of accident conditions, responses and procedures in order to place the plant in as safe and stable a condition as possible without causing further damage or public hazard.

A loss of site power requires the control room operator to verify a safe shutdown condition and actuation of all required emergency components. In addition the operator will have to establish conditions which enhance natural circulation and monitor core conditions to ensure that core heat removal is adequate.

Terminal Objective

Upon completion of this unit the student will be able to describe the symptoms and automatic actions during a loss of site power (blackout). The student will also be able to perform and justify the immediate operator action required of a control room operator for a loss of site power and other plant malfunctions. Successful completion of this unit will be based on satisfactory evaluation by the program instructor based on observation and the student's oral responses to questions.

Enabling Objectives

Upon completion of this unit the student will be able to:

1)- list the symptoms or indications associated with a loss of site power (blackout).

2)- describe plant response to a station blackout (loss of site power) including all automatic actions that will occur.

3)- list the immediate operator actions required following a loss of site power (blackout).

4)- demonstrate an ability to perform the immediate actions during control room operations.

5)- perform the subsequent operator actions while using the applicable procedures for a loss of site power (blackout).

6)- discuss conditions which enhance natural circulation.

References

1. Virgil C. Summer Training Simulator EOP-4, SOP-306, STP 102.003
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES

INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe the symptoms and automatic actions during a loss of site power. The student will also be able to perform and justify the immediate action required of a control room operator for a loss of site power and other plant malfunctions. Successful completion of this unit will be based on satisfactory evaluation by the program instructor based on observation and the student's oral responses to questions.

B. OPERATIONS PLAN:

Initiate at 100 percent power equilibrium conditions and complete a shift turnover. Initiate minor malfunctions as scheduled. Have the load dispatcher inform the control room of a severe weather watch involving the possibilities of tornados. Initiate a station blackout. Respond to the blackout including observation and discussion of natural circulation flow in the RCS. Continue with subsequent plant recovery as time permits.

C. MALFUNCTIONS SCHEDULED:

1. NIS-3 Power range channel failure
2. FWM-21 HP feed heater bypass valve
3. CRF-9 DRPI loss of voltage
4. FWM-3 Emergency feedwater pump trip
5. PRS-4 PZR PORV failure
6. FWM-4 Feed flow transmitter failure

LESSON OUTLINE	NOTES AND REFERENCES
7. EPS-1 station blackout NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous sessions may also be used. STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	
II. REVIEW (Optional) A. Review thermodynamics homework B. Present a basic overview of simulator operations. - Power operation at 100 percent with minor malfunctions and a station blackout. C. Discuss emergency procedures for station blackout (EOP-4) - Ask the students to list the symptoms, automatic actions, and immediate operator actions. - Discuss the subsequent operator actions to place the plant in a more stable condition. D. Discuss the mechanism, indications, and plant conditions related to natural circulation flow. - This review should include a discussion of plant design to promote natural circulation flow along with the various parameters which should be observed: o Pzr pressure	

LESSON OUTLINE	NOTES AND REFERENCES
o Pzr level o Wide range temperature recorders o In-core thermocouples o S/G pressure o S/G level E. Review the following technical specifications - S/G safety valves emphasizing necessary actions if one or more valves are inoperable. - Review specification 3.0.4 - Emergency Feedwater System - Condensate storage tank F. Discuss the following emergency and system procedure - Diesel Generator Procedures SOP 306 III. PROCEDURE A. Set up the plant in (LATER) and conduct a shift turnover emphasizing the current conditions - steady state 100 percent power; no testing in progress. - Power history - Systems status - Tests/evolutions in progress - Equipment inoperability B. STPs scheduled - STP 102.003 I.R. Analog Channel Operability Test C. Initiate a power range channel failure (NIS-3), such that the channel fails to a minimum output. - Have the students explain how the channel signal is utilized in Rod Control, SGWLC and Rx Protection.	

LESSON OUTLINE	NOTES AND REFERENCES
- Review tech specs limitations for PR channel failures - Discuss differences in indication between a channel failure and a detector failure. - Trip the associated bistables and initiate repairs. D. Intiate a HP feed heater bypass valve failure (FWM-21), due to a failed control switch. (bypass fails open) - Review the Feedwater Heater System - Discuss any reduced plant efficiency and indications on the MCB. - Review the concept of Rx Turbine power mismatch. E. Clear the HP Heater malfunction when requested to reposition the valve locally. F. Initiate a RPI loss of voltage (CRF-9), due to failed power supply to Group B. - Review RPI system to include non-urgent failure alarm, Data B failure, and General Warning lights. - Discuss RPI system accuracy after a failure - Review tech specs limitations for continued operation - When (If) requested to switch power supplies, clear the malfunction. Otherwise continue plant operations with the failure as allowed by tech specs.	

LESSON OUTLINE	NOTES AND REFERENCES
G. Initiate a PORV failure (PRS-4), such that the selected valve fails open without interlock to 100 percent position. - Students should isolate the faulty valve; if not the plant will trip and SI will occur. - Operator action will depend on immediate actions - Discuss tech specs limitations on continued operations.	
H. Continue plant operations at 100 percent power.	
I. Initiate a feed flow transmitter failure (FWM-4). Fail the transmitter used for SGWLC to a high flow value. - Operators should take manual control of S/G level or switch to an alternate feed channel. If not, a low-low S/G level should result. - Review the inputs to and operation of SGWLC. - Review any tech specs limitations - Trip the selected bistables and continue plant operations	
J. Initiate a emerg. feed pump trip (FWM-3) malfunction due to loss of elect. power.	
K. Have students perform an I.R. range channel test STP STP-102.003	
L. Initiate a Station Blackout (EPS-1), due to inclement weather. - When the loss of site power occurs, a generator trip - turbine trip - Rx trip results.	

LESSON OUTLINE	NOTES AND REFERENCES
- Discuss blackout recovery actions - Review vital loads which should start on a blackout. M. When (If) emerg. feed pump failure is noticed and local help is requested, clear the malfunction to simulate reclosing the pump breaker locally. - Review Emerg. Feed System drawing N. Continue subsequent recovery actions from the blackout as time permits. - Discuss and calculate a shutdown margin. - Review tech specs for electrical power system. Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems, procedures, tech specs, etc. The sessions should be representative of the final audit operational exam. O. Students conduct shift turnover to instructor CRITIQUE A. Review overall operations conduct. B. Review malfunction responses	

1. What automatic actions occur upon a loss of site power (blackout)?

2. List the immediate operator actions required for a loss of site power (blackout).

3. Describe the plant conditions that enhance natural circulation.

4. Describe indications of natural circulation being established.

5. What is the design bases for the capacity of the condensate storage tank?

6. Describe a method of cooldown if the Emergency Feedwater System was not available.

7. Describe the operability requirements for the S/G safety valves in various modes.

8. What signals will automatically start the emergency feedwater pumps?

9. Why does feedwater isolation occur on P-4 and low T_{avg} signals?

DAY 20

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

PLANT CASUALTY TRAINING

Power Operations, Malfunctions
Pressurizer Steam Space Leak, Accident Analysis Review Part 2

Overview

Since the occurrence of the Three Mile Island Incident, a significant amount of attention has been focused on pressurizer (PZR) steam space leaks. The control board indications of a steam space leak differ from those of a water piping leak and therefore warrant special consideration and training. This unit concentrates on the unique indications of this type of accident and allows the student to evaluate and respond to it. In addition, other Condition III type faults and their analyses will be discussed.

Terminal Objective

The student will be able to describe the symptoms and automatic actions during a pressurizer steam space leak. The student will be able to perform and justify the immediate operator actions required of a control room operator for a small Reactor Coolant System (RCS) leak and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral responses to questions.

Enabling Objectives

Upon completion of this unit the student will be able to:

1)- discuss the symptoms of a pressurizer steam space leak.

2)- describe operator actions for a small loss of coolant accident.

3)- describe what is meant by Condition III faults.

4)- list the types of faults considered to be Condition III faults.

5)- perform the subsequent operator actions while using the applicable procedure(s) for small loss of coolant accident.

References

1. Virgil C. Summer Training Simulator EOP-1, EOP-2, EOP-5, EOP-12, SOP-404, SOP-403, STP 108.001
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe the symptoms and automatic actions during a pressurizer steam leak. The student will also be able to perform and justify the immediate operator actions required of a control room operator for a small RCS leak and other plant malfunctions. Successful completion of this unit will be based on satisfactory evaluation by the program instructor based on observation and the student's oral responses to questions.

B. OPERATIONS PLAN:

Initiate minor malfunctions as scheduled. Eventually a plant and Rx shutdown will be required due to a Pzr steam space leak. Continue with plant cooldown as time permits.

C. MALFUNCTIONS SCHEDULED:

1. CRF-7 Stuck rod
2. NIS-8 Source range high voltage failure
3. NIS-7 Power range detector failure
4. PRS-1 Pzr pressure channel failure
5. MSS-5 Steam dump control failure
6. FWM-1 Main feedwater pump trip
7. MSS-7 S/G relief failure
8. RCS-6 RCS leak

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous sessions may be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

LESSON OUTLINE	NOTES AND REFERENCES
REVIEW (Optional) A. Review thermodynamics homework B. Present a basic overview simulator operations. - Power operations at 100 percent with minor malfunctions and a small RCS leak. C. Discuss emergency procedures for immediate action and diagnostics (EOP-1) and loss of primary reactor coolant (EOP-12) - Ask the students to list the symptoms, automatic actions, and immediate operator actions for each emergency. - Discuss the subsequent operator actions to place the plant in a more stable condition. D. Discuss Condition III - Infrequent Faults - Review each Condition III fault emphasizing any applicable emergency or off-normal operator actions: o Minor steam system piping failure (EOP-2) o Complete loss of forced reactor coolant flow (EOP-4) o Rod cluster control assembly misalignment (SOP-403) o Improper fuel loading and operation o Small break loss of coolant accidents (EOP-12) o Radioactive gas waste system leak o Radioactive release due to liquid tank failure	

LESSON OUTLINE	NOTES AND REFERENCES
o Spent fuel cask drop accidents E. For each event in item D above, discuss any applicable tech specs sections: - Movable Control Assemblies Group Height - Design Features Section 5.3 Reactor Core - Reactor Coolant System Leakage Section - Refueling Operations Section Crane Travel-Spent Fuel Storage Pit Building. F. Review the aspects of a Pressurizer steam space leak to include the following: - Indications to the Operators - System Design o Isolable PORVs o RTDs for safety valve/PORV leakage o Acoustic leak monitor - Ability to maintain plant pressure and continue plant operations - Effects on level indication of a level standpipe/condensing pot leak. - Overall review of leak rate determination and subsequent plant shutdown if tech specs limits are exceeded. PROCEDURES A. Set up the plant in (Later) and conduct a shift turnover emphasizing the current conditions - steady state 100 percent power; no testing in progress. - Power history - Systems status - Tests/evolutions in progress - Equipment inoperability B. STPs scheduled - STP-108.001 Quadrant Power Tilt Ratio	

LESSON OUTLINE	NOTES AND REFERENCES
C. Initiate a stuck rod malfunction due to mechanical failure (CRF-7) in a shutdown bank.	
D. Initiate a source range high voltage failure (NIS-8). - Select the source range channel chosen for the audio count rate circuit. Failure of HV power supply. NOTE: In the event of a reactor trip, the stuck rod should initiate an immediate boration action from the operators if noticed and the source range failure will result in a loss of power indications once the source range instruments reenergize (~ 15 minutes after the trip).	
E. Initiate a power range detector failure (NIS-7) such that the lower detector fails to a high value. - Student should take manual rod control to terminate rod insertion. Review Inst. Failure Response Manual - Review Rod Control System inputs - Perform followup actions of AOP-15 NIS Malfunction - Review methods of monitoring power in the affected quadrant of the core. - Trip the associated bistables and initiate repairs - Discuss power range detector current compartor circuit Quadrant Power Tilt.	
F. Initiate a pressurizer pressure channel failure (PRS-1) such that the controlling pressure channel fails high.	

LESSON OUTLINE	NOTES AND REFERENCES

NOTE: A pressure channel low failure will result in a OTΔT Rx Trip. If students trip bistables for this failure an inadvertent OTΔT Rx Trip will result.

- Students should respond to take manual control of Pzr sprays and heaters to stop the pressure decrease or select an alternate controlling channel.
- Discuss Pzr pressure control system/PORV interlocks
- Review Inst. Failure Response Manual for failed channel.
- Review tech specs limitations for pressure channel failures.

  NOTE: Operators cannot meet tech specs limitations for minimum operable channels unless in Surveillance Testing. Therefore plant shutdown is required; if bistables are tripped with 1 hour, a plant trip will result.
- If a trip occurs, follow Rx Trip procedure and discuss stuck rod and NIS failure. Then reset to 100 percent power.

G. Commence plant shutdown in accordance with normal procedures.

H. Repair the NIS lower detector; complete functional testing, then stop the power decrease.

- Reset bistables for power range
- Trip selected bistables for failed pressure transmitter.
- Continue plant operations - increase power toward 100 percent slowly.

LESSON OUTLINE	NOTES AND REFERENCES
I. Have student perform a Quadrant Power Tilt Ratio	STP-108.001
J. Initiate a steam dump control failure (MSS-5) such that the cooldown valves (Group 1) ramp open. Failure is due to a failure of I/P converter for selected group of valves. - Increased steam demand should cause power increase - Students should terminate system operation by taking manual control or turning the system off. - Discuss limitations on Rx power output, S/G swell, Pzr response to transient. - Continue operations with the system off. - Discuss effect on load rejection capabilities with the steam dump system inoperable.	
K. Initiate a feedwater pump trip (FWM-1) due to a failure in the pump trip circuit. - Students should perform immediate and subsequent actions of SOP-210 (loss of main feedwater) - The Rx may trip from S/G low low level. If so, follow EOP-5; discuss stuck rod and SR failures. Reset at previous power level and continue power increase. - If no trip occurs, ensure operators return Steam Dump System to normal after the transient, discuss Steam Dump System operation.	

LESSON OUTLINE	NOTES AND REFERENCES
- Investigate MFP trip; restart the pump and start restoring power to 100 percent. - Review ΔI and RIL relative to Rod Control response to insert control rods. L. Initiate a S/G relief valve failure without manual control. (MSS-7) - Students should have the valve isolated locally - Discuss tech specs limitations for relief valves and/or S/G safety valves. M. Initiate a RCS leak (RCS-6). The leak size is variable. Recommend a value < 40 gpm to start. - Students should respond to decreased pressure and level and reactor building rad monitors - Observe proper actions for EOP-12 loss of reactor coolant without S.I. Start additional charging pumps - Monitor for leak location; calculate leak rate - Review tech specs limitations N. Commence plant shutdown in accordance with normal procedures. - As shutdown continues, slowly increase the size of the leak to > 200 gpm. - Discuss methods of determining leak size and location. O. Students should trip the Rx and proceed according to EOP-1 (Safety Injection Actuation).	

LESSON OUTLINE	NOTES AND REFERENCES
P. Proceed with EOP-1 to stabilize plant conditions as time allows.	
Q. If no previous Rx trip, discuss stuck rod and Source Range failures. Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems, procedures, tech specs, etc. The sessions should be representative of the final audit operational exam.	
R. Students conduct shift turnover to instructor	
IV. CRITIQUE	
A. Review overall operations conduct.	
B. Review malfunction responses	

DAY 21

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

MAJOR PLANT CASUALTY TRAINING

Loss of Secondary Coolant Inside the reactor building, Accident Analysis Review - Part 3

Overview

In previous units, faults of increasing severity have been discussed. The remaining accident events to be considered are those included in Condition IV Events - Limiting Faults. These are the most drastic events. Although not expected to occur, these accidents are postulated because their consequences include the potential for radioactive material release. It is the Condition IV accident which the plant is designed to protect. The plant's protection and safeguards systems will automatically provide initial safe shutdown; however, the operator is relied upon to correctly diagnose the accident and perform the required actions specified in the emergency procedures.

This unit is designed to review the accidents in the Condition IV category and allow students to experience selected faults as control room operators.

Terminal Objective

Upon completion of this unit, the student will be able to describe the symptoms and automatic actions during a loss of secondary coolant (inside the reactor building) and other Condition IV events. The student will also be able to perform and justify the immediate operator actions required of a control room operator for a loss of secondary coolant accident and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral response to questions.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- describe what is meant by Condition IV events.
2)- list faults included in the Condition IV category.
3)- describe indications of a feedline break inside the reactor building.
4)- discuss assumptions used in the feedwater break analysis.
5)- describe operator actions for a loss of secondary coolant.
6)- describe plant response to a steam line rupture.
7)- describe the major indication differences between steam and feed breaks inside the reactor building.
8)- perform the subsequent operator actions while using the applicable procedures for a loss of secondary coolant.

References

1. Virgil C. Summer Training Simulator
2. SCE&G Phase III Training Material
3. SCE&G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe the symptoms and automatic actions during a loss of secondary coolant (inside the reactor building). The student will be able to perform and justify the immediate operator actions required of a control room operator for a loss of secondary coolant accident and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Initiate at 80 percent power during xenon transient and complete a shift turnover. Initiate minor malfunctions as scheduled. Major accidents will include a steam break and a feed break inside the reactor building, with each event involving safety injection system actuation. Discuss emergency plans with students for each major accident.

C. MALFUNCTIONS SCHEDULED:

1. CRF-10 DRPI open or shorted coil
2. PRS-6 Failure of PZR backup heaters
3. CVC-2 VCT divert valve control failure
4. MSS-3 Steam break inside containment
5. FWM-4 Feedwater flow transmitter failure

LESSON OUTLINE	NOTES AND REFERENCES
6. CRF-8 T_{ref} failure 7. RCS-8 RTD failure (T_H-control) 8. FWM-8 Feedline break inside containment 9. FWM-3 Emergency feed pump trip NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used. STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	
II. REVIEW (Optional) A. Review thermodynamics homework. B. Present a basic overview of simulator operations. - Increasing load from 50 percent during a xenon transient with minor malfunctions and Loss of Secondary Coolant Accidents. C. Discuss Condition IV events - Review each Condition IV fault emphasizing any applicable emergency for off-normal operator actions: o Major steam system piping failure (EOP-2) o Feedwater system pipe break (EOP-2) o RCP shaft seizure (SOP-101)	

LESSON OUTLINE	NOTES AND REFERENCES
o RCP shaft break (SOP-101) o Rod ejection accidents o Steam Generator Tube Failure (EOP-3) o Large Break Loss of Coolant Accident (EOP-1) o Refueling Emergency (EOP-7) - Emphasize the ability to diagnose plant conditions/indications and identify the various faults. D. For each event in item 4 above, discuss any applicable Tech Specs sections: This review should encompass the Tech Specs sections for Rx Protection Systems and ESF Instrumentation 3/4.3.1 and 3/4.3.2. E. Review overall indications and plant response to the following: - Steam Break Inside the reactor building - Feed Break Inside the reactor building F. Review (EOP-1) for Accident Diagnostics and immediate operator actions. G. Discuss Loss of Secondary Coolant Procedure (EOP-2) - Ask the students to list the immediate operator actions for this emergency procedure. H. Review steamline and feedline isolation signals and their bases. Review Tech Specs 3/4.7.1. - Steamline Isolations o High 2 Containment Pressure o Low steamline pressure	

LESSON OUTLINE	NOTES AND REFERENCES
o High Steam Pressure Rate - Decreasing - Feedline Isolation o S/G High Level Override P-14 - Feedwater Isolation o Rx Trip with Low T_{avg} signal o P-14 III. PROCEDURE A. Set up plant in (Later) (50 percent power during xenon transient). B. Conduct a shift turnover emphasizing the current conditions 50 percent power during a xenon transient; no testing in progress. - Power History - System Status - Test/Evolutions in Progress - Equipment Inoperability NOTE: The instructor may initiate with equipment inoperable as long as applicable surveillance requirements are being met for continued plant operations. C. Initiate plant loading toward 100 percent power D. Initiate a DRPI open or sorted coil (CRF-10) in Data A. - Discuss DRPI system alarm o Nonurgent failure o General warning - Discuss system accuracy with failure - Review Technical Specifications limitations for continued operations Section 3/4.1.3	

LESSON OUTLINE	NOTES AND REFERENCES
- Clear malfunction ~5 minutes after request for repair. E. Initiate a failure of Pzr backup heaters (PRS-6). - Discuss Pzr pressure control system response. - Operators should take proper action to stabilize plant pressure - Initiate repairs and continue operations F. Initiate a failure of VCT divert valve such that valve fails to HUT. - Students should take manual control of VCT divert valve. - Alternative actions are to isolate normal charging and letdown, reduce charging flow to minimum and establish excess letdown. - Discuss CVCS flowpaths/flow balance/excess letdown system - Discuss the ability to dilute/borate in this condition G. Continue plant loading; initiate a steamline break inside the reactor building (MSS-3) Recommend 6 x 10^6 lb/Hr over a 30 minute ramp. - Observe operator actions; diagnostics - When students are in subsequent actions of EOP-2 freeze the conditions and critique the evolution. H. Reinitialize at 50 percent power or a backup SNAP >50 percent power if desired to maintain previous plant conditions.	

LESSON OUTLINE	NOTES AND REFERENCES
NOTE: Remove the steamline break if inserted with time delay. I. Continue plant loading; initiate a feedwater flow transmitter failure (FWM-4) such that a feed valve fails closed in automatic. (Manual control is available). - Proper operator response should restore S/G level in manual control. - If S/G level trip occurs, follow EOP-5 then reset in Backup and repeat the failure. - Discuss indications of failure o Loop ΔT decrease o Steam flow increase due to increased steam pressure. o T_{avg} increase - control rod insertion. - Review S/G swell and shrink. J. Continue plant operations in manual S/G control; initiate a failure low (CRF-8). - Operators should respond to control rod insertion and switch to manual rod control - Continue operations in manual rod control K. Continue plant loading; initiate a RTD failure such that loop 3 T_H RTD fails low (RCS-8). - Discuss indications of failure (T_{avg}, ΔT analysis) - Discuss affects on Rod Control, Pzr Level Control, RIL circuitry (ΔT)	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
- Review Tech Specs operability requirements - Trip selected bistables and initiate repairs L. Initiate an Emergency Feed Pump Failure (FWM-3) due to a feed breaker failure. (Motor Pump Failure) - This failure should be noticed during subsequent SI and corrective action taken to cross-connect the motor driven pump headers or attempt to start the pump locally. M. Continue plant loading; initiate a feedline break inside the reactor building (FWM-8); break is downstream of check valve inside the reactor building. Leak rate of 6×10^6 lb/hr and a ramp of 30 minutes are recommended. - Observe operator actions; diagnostics - When students are in subsequent actions of EOP-2, discuss overall operations - Review Emergency Feed Pump operability requirements (Tech Specs) N. Continue subsequent actions as time permits. O. Students conduct shift turnover to instructor. Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems.	

LESSON OUTLINE	NOTES AND REFERENCES
procedures, Tech Specs, etc. The sessions should be representative of the final audit operational exam.	
IV. CRITIQUE	
A. Review overall operations conduct.	
B. Review malfunctions responses.	

DAY 22

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

MAJOR PLANT CASUALTY TRAINING

Loss of Secondary Coolant Outside the Reactor Building

Overview

Day 21 discussed, in detail, a loss of secondary coolant inside the reactor building. To fully develop this analysis the same basic accident occurring at different locations outside the reactor building must also be discussed. Several control room indications and operator actions will differ depending on the break location. This unit is designed to enhance the prospective operator's ability to identify, locate, and respond to a loss of secondary coolant.

Terminal Objective

Upon completion of this unit, the student will be able to describe the symptoms and automatic action during a secondary steam break. The student will also be able to perform and justify the immediate operator actions required of a control room operator for a loss of secondary coolant and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observations and the student's oral response to questions.

Enabling Objectives

Upon completion of this unit the student will be able to:

1)- describe indications for feedwater breaks in the following locations:
   - immediately downstream of flow transmitter
   - immediately upstream of flow transmitter
   - common feedwater header
   - discharge of feedwater pump
2)- describe indication of a steam line break outside the reactor building.
3)- list the immediate actions required of the control room operators for a loss of secondary coolant accident.
4)- diagnose feedwater and steamline break accidents as a control room operator.
5)- perform the required immediate and subsequent actions as a control room operator for a loss of secondary coolant.

References

1. Virgil C. Summer Training Simulator EOP-1, EOP-2, SOP-211
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe the symptoms and automatic actions during a secondary system break. The student will also be able to perform and justify the immediate operator actions required of a control room operator for a loss of secondary coolant and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral responses to questions.

B. OPERATIONS PLAN:

Initiate at 15 percent load and complete a shift turnover. Initiate minor malfunctions as scheduled. Have the operators continue plant loading toward 100 percent. Major accidents will include a steam break and feed break outside containment. If additional time remains, other steam/feed break drills can be initiated at the discretion of the instructor. Discuss emergency plans for each major accident.

C. MALFUNCTIONS SCHEDULED:

1. EPS-6 Diesel generator failure
2. EPS-5 Loss of ESF bus
3. FWM-9 H.P. feedwater heater tube leak
4. CRF-7 Stuck rod
5. NIS-4 IR gamma compensation
6. FWM-4 Feed flow transmitter failure
7. PCS-3 S/G level control failure
8. PCS-6 Inadvertent phase A isolation
9. CCW-4 Loss of CCW to letdown H/X

LESSON OUTLINE	NOTES AND REFERENCES
10. CND-1 Loss of condenser vacuum 11. CVC-8 Letdown line leak inside the reactor building 12. MSS-4 Steam break outside the reactor building NOTE: In addition to the above listed malfunctions, any of the malfunction scheduled on previous simulator sessions may also be used. STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	
II. REVIEW (Optional) A. Review Day 22 thermodynamics homework B. Present a basic overview of Day 22 simulator operations. - Increasing load from 15 percent with minor malfunctions and loss of secondary coolant accidents. C. Review Feedwater System - Components - Flow path - S/G level control - Feed pump speed control o Bases for programmed ΔP - Operation of system - System procedures D. Discuss feed line break accidents at various locations: - Have the students list the appropriate indications to determine the following break locations. o Between feed flow transmitter and feed isolation valve	

LESSON OUTLINE	NOTES AND REFERENCES
o Between feed reg. valve and flow transmitter o In the common feedwater line before branching to feed reg. valves o Between feed pump discharge and feed discharge check valve. o In H.P. feedwater heaters E. Review Emergency Feedwater System - Components - Flow paths (Have a student draw the system) - Flow control - normal system lineup SOP-211 - Sources of water - System response to a feed line break F. Discuss indications for steamline breaks outside the reactor building. - Compare or contrast these indications with those for a feedline break outside the reactor building. G. Review the emergency procedure for a Loss of Secondary Coolant (EOP-2), and Accident Diagnostics (EOP-1). III. PROCEDURE A. Set up the plant in (Later) 15 percent load during a normal startup and conduct a shift turnover emphasizing the current conditions - 15 percent load during a normal plant startup, no testing in progress. - Power history - Systems status - Tests/evolutions in progress - Equipment inoperability	

LESSON OUTLINE	NOTES AND REFERENCES
NOTE: The instructor may initiate with equipment inoperable as long as applicable surveillance requirements are being met for continued plant operations. B. STPs scheduled - STP 202.001 Target Axial Flux Difference Measurement C. Continue plant loading toward 100 percent power in accordance with normal procedures. D. Initiate a diesel generator failure (EPS-6) on DG A due to mechanical failure. E. Initiate a ESF bus trip (EPS-5) on bus 1DA due to a failure in the supply breakers mechanical latching mechanism. - Discuss DG failure; students should attempt to restore power to the bus. - Upon request, clear the DG malfunction to allow the bus to be restored to power. - Discuss reports; tech specs requirements for loss of power supply to ESF Bus; DG failure. - Clear ESF bus supply failure and restore affected equipment to normal status. F. Continue plant loading toward 100 percent; initiate an H.P. feedwater heater tube leak (FWM-9). - Select the maximum break size with minimum ramp time. - Observe proper immediate actions/ diagnostics - Start to restore plant conditions	

LESSON OUTLINE	NOTES AND REFERENCES
G. Reinitialize at 50 percent load (Later) and continue plant loading toward 100 percent.	
H. Have students perform a Target Axial Flux Difference Measurement	STP 202.001
I. Initiate a stuck rod malfunction (CRF-7) due to mechanical failure.	
J. Initiate an intermediate range gamma compensation failure (NIS-4 on IR N35 with a + 10^{-10} amps value.	
- These failures will be noticed only during any subsequent plant trip. IR under compensation will result in a failure of the SR to reenergize. Operators should immediately borate for the stuck rod if the Rx trips.	
K. Continue plant loading; initiate a feedwater flow transmitter failure (FWM-4).	
- Select the flow transmitter being used for SGWLC to fail low with minimum ramp time.	
- Review SGWLC system operation.	
- Operators should take manual control to stabilize conditions and select an alternate channel for control.	
- Initiate repairs to the failed channel.	
L. Initiate a S/G level control failure (PCS-3) such that level input to the control system fails "as is".	
- Affected S/G level will change during load change until an alternate level channel is selected.	
- Discuss level input to SGWLC system.	
- Trip selected bistables; initiate repairs.	

LESSON OUTLINE	NOTES AND REFERENCES
M. Continue plant loading; initiate an inadvertent containment Phase A isolation signal in one train during periodic SI system testing (PCS-6). - Once the operators have identified the problem, clear the malfunction and restore systems to normal lineup: CVCS, blowdown, reactor building ventilation. - Review containment Phase A signal generation and systems affected. - Review tech specs limitations.	
N. Initiate a simultaneous loss of CCW to Letdown HTX (CCW-4) and loss of condenser vacuum (CND-1). - Loss of CCW failure should be in automatic control only. - Loss of condenser vacuum should be caused by a slow leak on the steam seal unloading valve. Recommend a 10 percent failure on the unloading valve. - Operators should take manual control of CCW to the letdown HTX to restore temperatures to normal. - Discuss effect of increased flow of CCW to the letdown H/X to other system components. - Upon request or announcement for Local Action for loss of condenser vacuum, clear the malfunction. - Allow vacuum to stabilize; discuss vacuum pump and gland seal steam system operation.	

LESSON OUTLINE	NOTES AND REFERENCES

- Discuss other possible causes for low vacuum; e.g. low C.W flow, high C.W. temp, leaks on valves (vacuum breaker).

O. Continue to increase load; initiate a small CVCS letdown leak inside the reactor building CVC-8. Recommend a small leak in order to evaluate leak rate and diagnosis.
- Students may not identify the leak location, but should commence an orderly plant shutdown.
- Review tech specs leadage requirements and definitions.

P. Commence shutdown; initiate a steamline break outside the reactor building; recommend a 30 minute ramp to 2 x 10^6 lbm/hr.
- Observe diagnosis, manual SI if applicable.
- Once the plant is stabilized; main steam lines are isolated and subsequent actions are being performed; affected S/G is boiled dry:
  - o Discuss differences between feed break and steam break
  - o Discuss core protection provided by ECCS.
  - o Review the emergency procedures and the students overall performance.

Q. Students conduct shift turnover to instructor.

LESSON OUTLINE	NOTES AND REFERENCES
Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems, procedures, tech specs, etc. The sessions should be representative of the final audit operational exam.	
IV. CRITIQUE	
A. Review overall operations conduct.	
B. Review malfunction responses	

DAY 23

SOUTH CAROLINE ELECTRIC & GAS

PHASE III PROGRAM

MAJOR PLANT CASUALTY TRAINING

Loss of Coolant Accident - Inadequate Core Cooling

Overview

The next major nuclear plant fault that must be discussed in detail and actually performed is a loss of primary coolant accident (LOCA). Although this particular accident and small Reactor Coolant System (RCS) leaks have been previously observed, the required actions for . loss of coolant accident have not been performed. During this unit, the Emergency Core Cooling Systems (ECCS) and operator actions during a loss of coolant accident will be discussed.

Terminal Objective

Upon completion of this unit, the student will be able to describe the symptoms and automatic actions during a loss of coolant accident (LOCA) including systems used and mechanisms of heat removal. The students will also be able to perform and justify the immediate operator actions required of a control room operator for a LOCA and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observations and the student's oral response to questions.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- list indications of a loss of reactor coolant accident.
2)- distinguish between primary and secondary loss of coolant accidents.
3)- describe operator immediate actions for a LOCA.
4)- demonstrate an ability to perform immediate and subsequent actions as a control room operator during a LOCA.
5)- describe ECCS flow paths, flow rates, and injection pressures for each ECC system.
6)- describe the basic steps required to shift ECCS from injection mode to recirculation mode.
7)- discuss conditions that enhance natural circulation.
8)- discuss the problems associated with inadequate core cooling and how to combat those problems.

References

1. Virgil C. Summer Training Simulator EOP-1, SOP-115
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe the symptoms and automatic actions during a loss of coolant accident (LOCA). The students will also be able to perform and justify the immediate operator actions required of a control room operator for a LOCA and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Initiate at 100 percent power and complete a shift turnover. Initiate minor malfunctions as scheduled. The objective of this unit is to have the students identify and carry out the emergency procedure for a large LOCA including shiftover to recirculation mode of operation. Discuss emergency plans for each major accident.

C. MALFUNCTIONS SCHEDULED:

1. NIS-4 Int. Range Gamma Compensation
2. NIS-3 Power Range Channel Failure
3. CND-2 Hotwell Level Transmitter Failure
4. RCS-5 Large LOCA (DBA)
5. FWM-3 Em. Feed Pump Trip
6. RCS-5 Large LOCA (DBA)
7. RHR-1 RHR Pump Trip

LESSON OUTLINE	NOTES AND REFERENCES

NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used.

STATE THE NEED TO ASK QUESTIONS AS THEY ARISE

STATE BASIC PRESENTATION FORMAT

II. REVIEW (Optional)

A. Review Thermodynamics Homework

B. Present a basic overview of simulator operations.

- Operations at 100 percent power with minor plant malfunctions
- Large LOCA event carried out through recirculation mode (1.5 - 2 hours).
- As time permits, additional operations with malfunctions.

C. Review ECCS

- Have the students draw the systems on the board for use in further discussion and critique the drawing.
- Review the following:
  - o System flow paths for:
    - + Injection mode
    - + Cold Leg recirculation mode
    - + Hot leg recirculation mode
  - o Flow rates at varying system pressures

LESSON OUTLINE	NOTES AND REFERENCES
o Technical Specifications and Bases Section 3/4.5 + Accumulators + ECCS Subsystems $T_{avg} \geq 177°C$ + ECCS Subsystems $T_{avg} < 177°C$ + Boron Injection System + RWST	
D. Review Safety Injection Actuation (EOP-1) - Review Immediate Actions of EOP-1 - Outline on the board a general sequence of events involved in subsequent operator actions: o Precautions and Notes o Verify sump level indication o Regulate Emerg. Feed Flow o Isolate PORV's o Terminate SI (Precautions) + RCS Pressure > 2000 psig + Pzr level > 50 percent of span + RCS subcooling > 50°F + Sufficient water level in at least one S/G. o If SI terminated, plant recovery follows with orderly plant cooldown o For legitimate SI, proceed to cold leg recirculation + Notes, Precautions + Automatic Shiftover to cont. recirculation sump + Realignment of ECCS suction flow paths to RHR	

LESSON OUTLINE	NOTES AND REFERENCES

- o Initiation of reactor building spray recirculation
- o At ≤ 24 Hours, switchover to hot leg recirculation mode.

NOTE: The instructor should review these procedures in detail using the system drawing and asking questions about various steps in the procedure: e.g. Why shift to hot leg recirculation mode?

E. Review RHR Loss of Flow Off-Normal Procedure SOP-115.

F. Review Loss of Emergency Feedwater Off-Normal Procedure.

G. Discuss the G-module review self-evaluation. Handout copies for students to fill out and return to the instructor.

III. PROCEDURE

A. Set up the plant in (LATER) (100 percent power, Equilibrium Xenon).

B. Conduct a shift turnover emphasizing the current conditions - 100 percent load, equilibrium Xenon, Power Range functional testing in progress by Instrument Maintenance personnel.

*Turbine Driven Emerg. Feed Pump O.O.S due to oil leaks.

- Power History
- Systems Status
- Tests/Evolutions in Progress
- Equipment Inoperability

LESSON OUTLINE	NOTES AND REFERENCES
NOTE: The instructor may initiate with equipment inoperable as long as applicable surveillance requirements are being met for continued plant operations.	
C. Initiate an Int. Range gamma compensation problem on channel N36 (NIS-4). - Recommend over-compensation with a value of ($\sim 10^{8}$ amps) - Students should observe the problem and check Tech Specs. - Continued operation allowed; initiate repairs	
D. When repairs are requested, clear the malfunction and then undercompensate the same channel with a $+10^{-10}$ amps value - for subsequent plant trip.	
E. Initiate a Power Range channel failure (NIS-3), such that channel N44 fails to 200 percent value due to a summing amp output failure. - Observe student's response - Discuss Instrument Failure Reference Manual (IFRM) - Review Rod Control System inputs - Trip selected bistables and consult Tech Specs for operational limitations - Review overpower rod stop ckt. - Discuss methods of monitoring quadrant power.	
F. Continue operations at 100 percent power.	

LESSON OUTLINE	NOTES AND REFERENCES
G. Initiate a Hotwell Level Transmitter Failure (CND-2), such that the level transmitter fails to 0 percent. - Upon manual action to control hotwell level, clear the malfunction. - Discuss the design and operation of the Hotwell Level Control System - Discuss adverse effects of high or low hotwell level. H. Initiate a trip of emergency feed pump (FWM-3). I. Initiate a Large LOCA (DBA) in Loop 1 (RCS-5). This evolution should take 1.5 - 2 hours. - When requested to restore Emerg. Feedwater, clear FWM-3. - Carry out the immediate and subsequent actions to the point of waiting for shiftover to hot leg recirculation. - Simulate time lapse of 24 hours and shift to hot leg recirculation mode. - Discuss procedures, notes, and precautions as you handle this accident. - Discuss loss of all emergency feedwater system and alternate methods of feeding S/G's or providing cooling for the RCS. - Use system drawings/CRT's for emphasis during system realignment. - Discuss undercompensated IR when SR fails to reset.	

LESSON OUTLINE	NOTES AND REFERENCES
J. Reinitialize at 100 percent power; stabilize plant conditions instructor can backup. K. Initiate a RHR Pump Trip (or fail to start) (RHR-1). L. Initiate a large LOCA (RCS-5). - Operator should carry out immediate actions including ensuring Rx Trip. - Discuss loss of RHR train affect on ECCS functional capabilities. - Review ECCS criteria from 10CFR50. o Peak clad temp. 2200°F o Max H_2 generation < 1 percent o Max clad oxidation < 17 percent o Coolable core geometry o Long term cooling M. Students conduct shift turnover to instructor. Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems, procedures, Tech Specs, etc. The sessions should be representative of the final audit operational exam. IV CRITIQUE A. Review overall operations conduct. B. Review malfunction responses with Attachemnt I.	

DAY 24

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

MAJOR PLANT CASUALTY TRAINING

Steam Generator Tube Rupture

Overview

During normal operations, several nuclear plants have experienced varying degrees of steam generator (S/G) tube failure up to an actual rupture. A tube rupture alone represents a serious problem, however the consequences of that rupture depend significantly upon actions performed by the operators. Because of the frequency of occurrence and importance of the operator actions, it becomes imperative for operators to receive training in both discussion and implementation of tube rupture procedures and actions. This unit is designed to provide the prospective operator with a thorough discussion of the procedures supplemented by operations during a steam generator tube rupture.

Terminal Objective

The student will be able to identify a steam generator tube rupture and describe the symptoms and automatic actions of this event. The student will also be able to perform and justify the immediate operator actions required of a control room operator for a S/G Tube Rupture and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral response to questions.

Enabling Objectives

Upon completion of this unit, the student will be able to:

1)- list indications of a steam generator tube rupture.

2)- describe how an operator can identify and verify the affected S/G.

3)- describe operator actions required for a tube rupture.

4)- explain the bases for each of the required operator actions.

5)- demonstrate an ability to perform the required immediate actions as control room operator during S/G tube rupture.

6)- perform the subsequent operator actions while using the applicable procedures for a steam generator tube rupture.

References

1. Virgil C. Summer Training Simulator EOP-1, EOP-3
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to describe the symptoms and automatic actions during a S/G Tube Rupture. The student will also be able to perform and justify the immediate operator actions required of a control room operator for a S/G Tube Rupture and other plant malfunctions. Successful completion of this unit will be based on a satisfactory evaluation by the program instructor based on observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Initiate at 50 percent power and complete a shift turnover. Initiate minor malfunctions as scheduled.

The objective of this unit is to gain familiarity in handling S/G Tube Rupture events. The session will provid the opportunity to utilize emergency and subsequent actions for a S/G Tube Rupture event. Discuss emergency plans for each major accident.

C. MALFUNCTIONS SCHEDULED:

1. MSS-8 Stuck steam dump valve
2. CND-4 Circulation Water Pump trip
3. CVC-2 VCT Divert Valve control failure

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
4. RCS-2 S/G Tube Rupture 5. PCS-5 Inadvertent SI actuation 6. FWM-1 Main Feed Pump Trip 7. CVC-4 RCP Number 1 Seal Failure 8. MSS-7 S/G Relief Valve Failure 9. RCS-2 S/G Tube Leak NOTE: In addition to the above listed malfunctions, any of the malfunctions scheduled on previous simulator sessions may also be used. STATE THE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	
. REVIEW (Optional) A. Review Thermodynamics Homework B. Present a basic overview of simulator operations. - Power operations at 50 percent power with minor malfunctions and S/G Tube Rupture. - S/G Tube Leak and Diagnosis Plant Shutdown C. Discuss a S/G Tube Rupture Accident - Possible causes o S/G Chemistry Control o Continuous Blowdown o Condensate Demineralizers (Copper in secondary systems) o Tube Denting, etc,	

LESSON OUTLINE	NOTES AND REFERENCES
- Plant response o LOCA o Rx Trip and SI o Required operator actions to isolate the affected S/G o Minimizing airborne releases o Condenser Off-gas system - Analysis o Tech Specs Bases for S/G Activity Sec. 3/4.7.1 o Tech Specs on S/G's and Bases Sec. 3/4.4.5 o S/G Pressure/Temperature Limitations Sec. 3/4.7.2 - Emergency Procedure (EOP-1) o Diagnostics (EOP-1) - RCS Leak from S/G Tube o EOP-03 D. Discuss the Inadvertent SI Abnormal Procedure III. PROCEDURE A. Set up the plant in (Later) (50 percent power, Equilibrium Xenon) B. Conduct a shift turnover emphasizing the current conditions - steady state equilibrium Xenon for 50 percent power, no testing in progress. - Power History - Systems Status - Tests/Evolutions in Progress - Equipment Inoperability (if desired by instructor)	

LESSON OUTLINE	NOTES AND REFERENCES
NOTE: The instructor may initiate with equipment inoperable as long as applicable surveillance requirements are being met for continued plant operations.	
C. Commence load increase toward 100 percent; initiate a stuck steam dump valve (MSS-8) due to mechanical failure. - Isolate valve (LOA) upon request. - Discuss steam dump systems operation and indications.	
D. Continue load increase; initiate a Circulation Water Pump trip (CND-4) once plant load is above 80 percent. Associated condenser shell pressure will increase. - Discuss circ. water system requirements - Discuss steam dump valve failure when noticed. - Initiate repairs on CW Pump breaker.	
E. Initiate a failure of VCT Divert valve with full flow to RHUT (CVC-2) due to a failed I/P converter. - Review VCT Level control system - Review Boron Recycle System-capacity of RHUT - Observe operator's awareness of excessive auto makeup system operation - Initiate repairs; clear malfunction or take manual control of system.	
F. Clear the Circ. Water Pump malfunction; continue load increase.	

LESSON OUTLINE	NOTES AND REFERENCES
G. Initiate a S/G Tube Rupture (RCS-2); recommend max leak rate with minimum ramp time. - Observe proper operations in accordance with EOP-1. - Continue the transient until RCS T_{avg} is below 507°C and RCS pressure is below the S/G safety valve setpoints. - Freeze and discuss the overall event.	
H. Reinitialize at 100 percent power with all malfunctions cleared. Conduct a shift turnover of plant conditions.	
I. Initiate an inadvertent SI actuation (PCS-5), due to an accidental short circuit in Train B. - Operators should respond to Rx trip - Discuss indication that an operator can utilize to determine an inadvertent SI from a legitimate plant transient. o Pzr Pressure o Reactor Building Parameters o S/G Parameters - Reset SI signal and stop affected equipment - Discuss EOP-1 recovery from spurious SI	
J. Reinitialize at 100 percent power; initiate a MFP trip (FWM-1) due to a failure in the pump trip circuit. - Once plant conditions are stabilized, discuss what things can cause a MFP trip.	

LESSON OUTLINE	NOTES AND REFERENCES
- Discuss administrative requirements for reports, etc. K. Repair the MFP (clear malfunction), and continue operation. L. Continue plant operation; initiate a RCP No. 1 seal failure (CVC-4). Recommend the max value. - Isolate affected No. 1 seal - Commence plant shutdown - Discuss RCP seal construction and operation, evaluation of seal performance. M. Initiate a S/G Tube Leak on A S/G (RCS-2). Shortly after the leak is noticed, initiate a failure of the S/G Relief valve on A S/G (MSS-7). - Recommend a small leak rate (< 100 gpm to allow unit shutdown). - Discuss release of activity through failed relief valve - Follow EOP-03 as time permits. - Discuss Radiological Problems and Actions N. Continue plant shutdown following EOP-03 as time allows. O. Students conduct shift turnover to instructor Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems, procedures, Tech	

LESSON OUTLINE	NOTES AND REFERENCES
Specs, etc. The sessions should be representative of the final audit operational exam.	
IV. CRITIQUE	
A. Review overall operations conduct	
B. Review malfunction responses	

Review Questions

1. What actions could be taken for a stuck open S/G relief valve during a S/G tube break? Safety valve?

2. What advantage/disadvantage could be gained by stopping the Reactor Coolant Pump (RCP) in the loop with a S/G tube rupture?

3. Describe how the S/G is isolated following a tube break.

4. What is the basis for the rapid 50°F cooldown of Reactor Coolant System (RCS)?

5. Describe what actions the operator will perform to implement the Station Emergency Plan.

6. What limits are imposed on secondary system activity? Explain the bases for these limits.

7. What is the maximum allowed S/G tube leakage permitted by Technical Specification?

8. What radiation monitors are used to detect S/G tube leakage?

9. Do any of the radiation monitors in question no. 8 above have automatic functions? Describe these functions.

10. What actions are necessary in order to sample S/G's following a S/G tube rupture assuming all radiation monitors function properly? Explain.

DAY 25

SOUTH CAROLINA ELECTRIC & GAS

PHASE III PROGRAM

MAJOR PLANT CASUALTY TRAINING

Integrated Power Operations

Overview

During the South Carolina Electric & Gas Training Program for Phase III the student has been subjected to approximately 100 plant malfunctions and a wide assortment of discussion topics. At this point in the plant operator's training, the operator should feel relatively competent and knowledgeable regarding plant routine operations and casualties. From this point on, specific scheduled malfunctions will not be discussed prior to the simulator operations period.

This unit includes time for a review of any topic deemed necessary by the program instructor. Simulator operations with malfunctions selected by the program instructor will be administered based upon individual/class needs.

Terminal Objective

The student will be able to maintain nuclear plant safety during normal and casualty plant operation while fulfilling the duties and responsibilities of a control room operator. Satisfactory completion of this unit will be determined by the instructor based on observation and the student's oral response to questions.

Enabling Objectives

Upon completion of this unit, the student shall be able to:

1)- perform functions as a control room operator during Nuclear Steam Supply System (NSSS) and secondary plant faults.
2)- describe how any NSSS fault affects plant safety.
3)- describe how any secondary plant fault affects plant safety.
4)- recall technical specifications related to NSSS and secondary plant faults.
5)- recall operator actions for a plant fire.
6)- recall operator actions for control room inaccessibility.

References

1. Virgil C. Summer Training Simulator
2. SCE & G Phase II Training Material
3. SCE & G Phase III Training Material
4. Westinghouse Phase III Training Material
5. Technical Specifications

INSTRUCTOR'S GUIDE

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

I. INTRODUCTION

A. UNIT TERMINAL OBJECTIVE:

The student will be able to maintain nuclear plant safety during normal and casualty plant operation while fulfilling the duties and responsibilities of a control room operator. Satisfactory completion of this unit will be determined by the instructor based on observation and the student's oral response to questions.

B. OPERATIONS PLAN:

Initialize at power and conduct a shift turnover - follow the scheduled malfunction scenarios. Conduct this session in the same manner as a final operational audit exam with as many questions as possible to all the operators. Review Radiological Emergency Response and Implementation Plans as applicable.

C. MALFUNCTIONS SCHEDULED:

NOTE: These scenarios can be run in any order. Additional malfunctions can be added or conditions modified at the instructor's discretion.

1. RCS-2 & CND-1 - S/G Tube Rupture with Loss of Vacuum
2. CRF-8 - T_{ref} Failure Low
   TUR-7 - Stator Water Cooling Trouble
   CVC-7 - Loss of Normal Letdown
   TUR-1 & PCS-8 - Inadvertent Turbine Trip with Failure of Manual Rx Trip Switch

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
3. RMS-2 & CCW-1 - Failed Rad Monitor in CCW with Letdown Hx Leak TUR-2 - Turbine Vibration MSS-8 - Stuck Open Steam Dump Valve 4. RCS-6 - RCS Leak (Small LOCA) RMS-3 - Area Monitor Failure (Item No. 10) RMS-2 Process Radiation Monitor Failure (Item No. 13) STATE NEED TO ASK QUESTIONS AS THEY ARISE STATE BASIC PRESENTATION FORMAT	
II. REVIEW (Optional) A. Review Day 25 Thermodynamics Homework B. Present a basic overview of Day 25 simulator operations - C Module self-evaluation sheets - Power Operations with selected malfunctions and transients C. Discuss the Emergency Procedures for Control Room Inaccessibility and Fire - Ask the students to list the immediate actions for control room inaccessibility - Review the organization and procedure for the Fire Emergency Procedure o Organization and Responsibilities o How to Report a Fire o Actions to be Taken During a Fire o Fire in a Radiation Area	

LESSON OUTLINE	NOTES AND REFERENCES
D. Discuss the Fire Suppression Tech. Specs. Section 3/4.7.9 - Fire Suppression Water System - Spray and/or Sprinkler Systems - Low Pressure CO_2 Systems - High Pressure CO_2 Systems - Halon Systems - Fire Hose Stations - Penetration Fire Barriers III. PROCEDURE Note to Instructors: The following combinations of events are intended to provide multiple failures for operator diagnosis and response. These events were intended to be performed at power (50 percent - 100 percent) with power being changed. System parameters being outside their normal band may complicate the diagnostic process and therefore power changes are desirable. Otherwise initial conditions and sequence of events are at the discretion of the instructor. A. Set up the plant at power (Later) is recommended for peak Xenon burnout at 50 percent power. B. Conduct a shift turnover emphasizing the current conditions and the following: - Power History - Systems Status - Tests/Evolutions in Progress - Equipment Inoperability *Recommend that various equipment is made inoperable as appropriate.	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

C. Scenario #1 - S/G Tube Rupture with Loss of Vacuum

- At power (25-100 percent), initiate a S/G Tube Rupture in B S/G (RCS-2) of 3500 gpm with minimum ramp time. Simultaneously initiate a loss of condenser vacuum (CND-1.)
- Observe operator response
  - o EOP-0 immediate actions and diagnostics
  - o Stop RCP's below 1500 psig if necessary; natural circulation
  - o Proceed to EOP-1 Procedure
  - o Stabilize RCS conditions
  - o Attempt to determine faulty S/G
  - o Stop emergency feed flow to faulty S/G
  - o Stop RCP in affected loop
  - o Cooldown using three atmospheric relief valves
  - o Reset SI - stop selected pumps
  - o Restore pressurizer level
  - o When T_{avg} reaches 507°F reduce plant pressure
  - o Reset Phase A Isolation
  - o Equalize Primary and Secondary pressures
- Stop the evolution and conduct a short critique

D. Rotate operators; reinitialize at power (Recommend (Later) 25 percent power); conduct a shift turnover.

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES
E. Scenario #2 - Minor malfunctions with Turbine Trip, Failure of Rx Trip Switch and Loss of Condenser Vacuum - Increase plant load toward 100 percent - Initiate a T_{ref} Failure (CRF-8) to 500°F o Operators should take manual rod control o Discuss followup course of action - Initiate a Stator Water Cooling Trouble (TUR-7) event such that the temperature control valve fails to a full divert position. o Observe Generator Panel Trouble alarm on CBP o Stator water return and supply temperature on CBP increase o Review System - when asked to take local action, clear the malfunction - Initiate CVC-7, Loss of Normal Letdown o Observe operators reaction to loss of letdown flow o Valve failure is due to loss of air (broken air line) o Initiate repairs; reduce charging; establish excess letdown o After some operating period, clear the malfunction to simulate repair completion. - Initiate an Inadvertent Turbine Trip (TUR-1) after failing the Rx Trip Switch (PCS-8)	

LESSON OUTLINE	NOTES AND REFERENCES
o Initiate a loss of condenser vacuum (CND-1) o Operators should attempt to trip the Rx by any method + If they deenergize Rod Drive MG sets, rods will drop + If not, T_{avg} increase will shutdown the Rx to low power and operators should borate to complete the shutdown o Loss of vacuum will result in a loss of secondary heat sink to condenser o Observe operation to atmospheric reliefs/safeties - When plant conditions are stabilized, stop the evolution and conduct short critique F. Rotate operators; reinitialize at 25 percent load (Later); conduct a shift turnover. G. Scenario #3 - Small RCS Leak, Rad Monitor Failures, Turbine Vibration (Trip) with stuck open steam dump valve. - Increase plant load toward 100 percent - Initiate Rad Monitor Failure in CCW (RMS-2) RCS activity will not cause any rad monitor alarms upon system leakage - Initiate a Letdown Hx Leak (CCW-1) of 100 percent o Rad Monitor System monitoring the letdown line will see the reduced activity and cause a rad monitor failed low alarm	

INSTRUCTOR'S LESSON PLAN

LESSON OUTLINE	NOTES AND REFERENCES

- o Comp Cooling Surge Tank level will increase
- Initiate a Turbine Vibration problem (TUR-2) such that #2 bearing exceeds 12 mils in <5 minutes.
- Initiate a stuck open steam dump cooldown valve (MSS-8) to the 100 percent position.
  - o When the turbine trip occurs, excessive cooldown should result, causing pressurizer pressure and level to decrease.
  - o Operators may respond to failure as a LOCA rather than a cooldown - steam break type accident
  - o Observe diagnosis and operator response
  - o If operator response is improper, stop the drill and critique the plant conditions
  - o If operators find the stuck valve and request isolation locally, terminate the drill, discuss plant conditions and critique the operators performance.

H. Rotate operators; reinitialize at power (recommend 100 percent power, Later); conduct a shift turnover.

I. Scenario #5 - Small LOCA with Failed Rad Monitor System

INSTRUCTOR'S LESSON PLAN

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- Initiate a Small LOCA (RCS-6) with Area Monitor Failure (RMS-3) Item No. 10 and Process Monitor Failure (RMS-2) Item No. 13
  - o Recommend a gradually increasing leak rate from 10 gpm and a short ramp time to minimize duration
  - o No rad monitor indication inside the reactor building; so could be a steam/feed leak except
  - o T_{avg} remains essentially constant
  - o Observe operator actions to diagnose conditions as time permits
  - o Terminate drill before end of shift and critique

J. Students conduct shift turnover to instructor

Note to Instructors: The simulator session should be conducted with as many questions as possible being asked of the operators regarding plant systems, procedures, Tech Specs, etc. The sessions should be representative of the final audit operational exam.

IV. CRITIQUE

A. Review overall operations conduct.

B. Review malfunction responses