NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

02-REQ-001-262-2-02 Revision 4

TITLE: EMERGENCY AC POWER SYSTEMS

	SIGNATURE	DATE
PREPARER		2/1/90
TRAINING SUPPORT SUPERVISOR	for JAC	2-1-90
TRAINING AREA SUPERVISOR		2/1/90
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Summary of Pages

Effective Date: 2/1/90

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Date	Pages
February 1990	1 - 15

THIS LESSON PLAN IS A GENERAL REWRITE

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION: _____ _____

DATA ENTRY: _____ _____

RECORDS: _____ _____

I. TRAINING DESCRIPTION

A. Title of Lesson: Emergency AC Power Systems

B. Lesson Description: Provide a review for Licensed Operators of the Emergency AC Power Systems.

C. Estimate of the Duration of the Lesson: 2 - 3 hours

D. Method of Evaluation and Grade Format and Standard of Evaluation: Open reference written exam $\geq$ 80%.

E. Method and Setting of Instruction: Classroom Lecture

F. Prerequisites:

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

G. References:

1. N2-OP-72, "Standby and Emergency A.C. Distribution System"
2. Tech Spec 3/4.8.1, 8.2, 8.3, Electrical Power Systems
3. ESK-5ENS21, SWG101 UV and Load Sequencing
4. ESK-5EGP01, ACB 101-1
5. MFR Drawing G5-553-133, Standby Diesel Engine Control

II. REQUIREMENTS

1. AP-9 "Administration of Training"
2. NTP-11, "Licensed Operator Retraining and Continuing Training"

III. TRAINING MATERIALS

A. Instructor:

1. Lesson Plan, Emergency AC Power Systems
2. Transparency Package
3. T/S 3/4.8.1 - 8.3, Electrical Power Systems
4. ESK-5ENS21, SWG101 UV and Load Sequencing
5. ESK-5EGP01, ACB 101-1
6. MFR Drawing G5-553-133, Standby Diesel Engine Control
7. N2-OP-72, "Standby and Emergency A.C. Distribution System"

B. Trainee:

1. N2-OP-72, "Standby and Emergency A.C. Distribution System"
2. Tech Spec 3/4.8.1 - 8.3, Electrical Power Systems
3. ESK-5ENS21, SWG101 UV and Load Sequencing
4. ESK-5EGP01, ACB 101-1

IV. EXAM AND MASTER ANSWER KEYS

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

V. LEARNING OBJECTIVES

A. Terminal Objectives

TO-1.0 2000040501 Perform actions for an emergency electrical system failure.

TO-2.0 2000350501 Perform the actions required for a loss of offsite power.

TO-3.0 2620140101 Transfer the load from a UPS to maintenance source and shut down the UPS.

TO-4.0 2629060401 Re-energize stub buses after a loss of offsite power.

TO-5.0 2629140101 Place a UPS in service from a deenergized condition.

TO-6.0 2629200101 Transfer emergency bus feed from reserve station transformer to aux boiler transformer.

TO-7.0 3410180303 Apply Tech Spec directions for safety limits, LCOs and limiting safety system settings (SRO Only).

TO-8.0 3449150503 Direct actions required for a loss of electrical power (SRO Only).

B. Enabling Objectives

EO-1.0 State the purpose of the Emergency AC Power System (EACPS).

EO-2.0 State the normal and alternate power sources for the Emergency AC Power System.

EO-3.0 Using a diagram of the EACPS, state the normal and alternate sources of power through major components to major loads for each Division.

EO-4.0 List the major motor loads supplied by each division of the EACPS.

EO-5.0 Explain the purpose and operation of the emergency Uninterruptible Power Supplies. (Include in your discussion, normal and alternate sources.)

EO-6.0 List and describe, including time sequencing, the automatic actions of the EACPS, as a result of one or both of the following events:

a. Loss of Coolant Accident
b. Loss of Off-site Power

EO-7.0 Explain the operation of the following components:

a. LOCA Bypass Switch
b. Sync Selector Switch
c. 43 LS Switch
d. Appendix R disconnects

EO-8.0 Given N2-OP-72, Standby and Emergency AC Distribution System, identify the appropriate actions and/or locate information related to:

a. Start-Up
b. Normal Operations
c. Shutdown
d. Off-Normal Operations
e. Procedures for correcting alarm conditions
f. Precautions

EO-9.0 Given any condition of relevant plant parameters and system component operability, determine whether any Technical Specification LCO's apply.

EO-10.0 (SRO Only) Given a set of relevant plant conditions and any combination of inoperable components in the system:

a. Determine the applicable Technical Specification LCO(s).

b. Identify the Corrective Action(s), including surveillance testing, necessary to satisfy the LCO(s).

c. Assess the consequences of inoperable system components relative to system operation.

VI. LESSON CONTENT

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
I. INTRODUCTION		
A. Greet class	Completed required paperwork	
B. System Purpose Function of the Emergency AC Power System is to provide a source of AC Power to all class 1E safety related loads.		EO-1
II. DISTRIBUTION	Show Figure 1	EO-2/3
A. Station Transformers	Review the major loads each division supplies.	EO-4
1. Reserve A (2RTX-XSR1A) is the normal supply for Bus 100 and 102.		
2. Reserve B (2RTX-XSR1B) is the normal supply for Bus 103 and the backup supply to Bus 102.	Note: Backup supply to Bus 102 is a cubicle only interlock.	
3. The Aux. Boiler transformer (2ABS-X1) can be used to supply Bus 101 or 103.		
4. The reserve station service transformers are designed to carry the max. load on buses 101 and 102 or 103 and 102, plus one stub bus load.		
5. The Aux. Boiler transformer is sized to carry only a partial load of bus 101 or 103.		
B. Diesel Generators		
1. Each division has its own diesel generator.		
2. In the event of a loss of voltage or sustained degraded voltage from the Resv. Transformer the Emergency Diesel Generator will automatically start.		EO-6

3. When the generator attains rated speed, voltage and frequency the generator output breaker will shut.

NOTE: T/S require the output breaker to shut ≤ 10 seconds.

4. On a LOCA all diesels will start and run unloaded ready to pick up loads in the event of a loop.

EO-6

Q: What are the LOCA start signals for the DG's.

A: Div. I/II High DW Press and L1
Div. III High DW Press and L2

   a. Division I and II LOCA start signals
      1) High Drywell Pressure 1.68 psig
      2) Reactor Vessel Level 1 (17.8")
   b. Division III LOCA start signal
      1) High Drywell Pressure 1.68 psig
      2) Reactor Vessel Level 2 (108.8")

C. Control Power

1. Each divisional bus has 2 DC Control Power Buses supplied by its associated divisional Emergency DC Power System.
2. One DC Bus supplies control power to the main breakers.
3. The other DC Bus supplies control power to the feeder breakers.
4. Emergency load centers receive DC control power from their respective divisional DC buses.
5. MCC Loads for each respective division
   a. Emergency motor loads (1/2-50 Hp)

NOTE: a. 2BYS*BAT2A for 2ENS*SWG101 via 2BYS*SWG002A.
b. 2BYS*BAT2 for 2ENS*SWG103 via 2BYS*SWG002B.
c. 2BYS*BAT2C for 2ENS*SWG102 via 2CEC*IPNL414.

b. Motor operated valves 1/6 Hp up.

c. Heaters and miscellaneous loads. (MCC201 feeds all Division III 600V to 120V distribution panels.)

D. 600V Distribution

1. There are 2 600V load centers
   2EJS*US1 (Div. I)
   2EJS*US3 (Div. II)

2. Load centers are indoor metal-enclosed type with drawout circuit breakers.

3. 600V Loads
   a. Emergency motor loads (50-200 Hp)
   b. Other emergency loads (60-150 KW)
   c. Emergency MCC's
   d. and 600V power distribution panels.

E. Uninterruptible Power Supply (UPS) System EO-5

1. Provides Normal 120 or 208V AC, 3 phase
   or Normal 120V AC, 1 phase,
   or Emergency 120V AC, 1 phase

2. Power Distribution
   a. Each UPS System has a normal AC source and a bypass (not-filtered) AC source, fed from 600V AC, and a 125V DC backup source.

b. If the normal AC supply is lost, 125V DC is used to power the UPS loads through the inverter.

c. In case of inverter trouble, the system automatically transfers to the alternate source. The transfer is conducted by a make before break static transfer switch.

3. The plant emergency UPS System consists of two (2) 25kVA, 120V, 1 phase buses (2VBA*UPS2A and UPS2B) and their distribution panels. They supply the Div. I and II DG Control Panels 2VBS*PNL101A and 2VBS*PNL301A.

a. Power supplies:

UPS2A: Norm-2EJS*PNL100A
Alt -2LAC*PNL100A
B/U -2BYS*SWG002A

UPS2B: Norm-2EJS*PNL300B
Alt -2LAC*PNL300B
B/U -2BYS*SWG002B

III. LOAD SHEDDING AND SEQUENCING

EO-6

A. Load shedding is provided for Div. I and II switchgear to allow a controlled loading of the diesel generator.

Using ESK5ENS21 explain the sequence of events.

B. Load shedding will initiate on a loss of voltage or sustained degraded voltage.

C. Load shedding performs the following functions:

1. Trips offsite power supply breakers.
2. Starts the standby diesel.
3. Permits closure of the diesel generator breaker when at rated speed and voltage.
4. Sheds the following 4.16kv loads:
   a. RHS pumps
   b. CSL pump
   c. Service water pumps
   d. Spent fuel pool cooling pump
   e. Trips stub bus supply breaker (ACB 101-11 and/or 103-8)
5. Starts load sequencing

Q: What loads are shed from the bus when load shedding initiates.
A: RHS pumps, CSL pump, SW pumps, SFPC pump, stub buses

D. Load sequencing starts when the generator output breaker shuts at time T = 0.

<u>With a LOCA signal present</u>

1. T = 1 RHR Pump A/B starts.
2. T = 6 LPCS Pump/RHR Pump C starts.

<u>With or without a LOCA signal</u>

3. Attempts to start Div. I/II red flagged service water pumps
   a. A and B at T = 32 seconds
   b. C and D at T = 37 seconds
   c. E and F at T = 42 seconds

4. Attempts to start Div. I/II green flagged service water pumps if there is not a pump running in that division.
   a. A and B at T = 48 seconds
   b. C and D at T = 54 seconds
   c. E and F at T = 61 seconds
5. You cannot operate a SW pump with the control switch until after 70 seconds has timed out.
   a. Once a SW pump has started the remaining pumps are automatically locked out.

Q: How long after load sequencing starts until you can manually operate a SW pump?

A: 70 seconds

E. Division III is transferred to its emergency diesel upon a loss of or sustained undervoltage condition.
   1. No load shedding or sequencing is required in Div. III.

IV. CONTROLS

EO-7

A. Control Switches are provided on Panel 852 for the alternate and preferred bus supply breakers.
B. Synchronizing switches are provided for synchronizing the reserve station transformers and auxiliary boiler transformer to the buses.
C. Controls are provided for paralleling the emergency diesel to the emergency bus.

D. LOCA Bypass Switch

1. ON position will disable the diesel generator auto start on a LOCA signal and will prevent ECCS components from starting.

E. Synch. Emergency Diesel Generator to bus switch allows synchronizing the DG to the emergency bus.

1. In the ON position it will defeat a LOCA/LOOP start (Div. I and II)

Use MFR Drawing G5-553-133, Sheet 1 to show why this occurs.

F. Manual Bus De-energization

1. When Div. I (II) supply breaker is manually opened (breaker green flagged) the emergency diesel will start, but will not close in on the bus.

Use 5EGP01 to show why this occurs.

2. When Div. III supply breaker is manually opened the Div. III diesel generator will start and close in on the bus.

G. 43 LS Switch

1. Located at the switchgear.

Use ESK 5ENS21 to show the effect of placing this switch on.

2. In the ON position will prevent:

a. Undervoltage start of the emergency diesel which will prevent load shedding/ sequencing.

H. Appendix R disconnect switches

1. When the Appendix R disconnect switches are activated the following breakers may be operated locally using the test switch for breaker control.
   a. ACB-101-1 (103-14)
   b. ACB-101-14, ACB-101-2 (103-1, 103-13)
   c. ACB-101-13, ACB-101-10 (103-2, 103-4)
   d. ACB 101-11 (103-8)
2. Appendix R switches will also disable the DG start and associated ECCS component starts on a LOCA signal.

Show this using ESK5ENS21 Sh. 1 & 2

V. INTERLOCKS

A. Div. I Supply

1. Normally closed breaker 101-13 is interlocked with breaker 101-10 so that if a breaker is in that cubicle 101-13 will not close.

Show Figure 1 and discuss the interlocks.

B. Supply breakers to Div. II and III are interlocked in the same manner as Div. I.

C. US1 and US3 supply breakers are interlocked so that both cannot be closed at the same time.

D. Kirk keys are used on Div. I/II MCC's to prevent both sources from supplying the A and C (B and D) buses simultaneously.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
VI. SYSTEM OPERATION		
A. Normal Mode of Operation	Show Figure 1 with all breakers in their normal position.	
B. Synchronizing of two (2) power sources on a 4160V bus is performed by the operator.		
1. Synchronizing can be performed between the diesel generator for that bus and either the reserve station service transformer or the auxiliary boiler transformer.		
C. Loss of Offsite Power	Note: Previously discussed	
VII. SYSTEM INTERRELATIONS		
A. DC Power System Provides power to protective relaying control and breaker control.		
B. AC Electrical Distribution System Provides power to the Emergency AC System during normal operation.		
C. Standby Diesel Generator System Provides power to the Emergency AC System during a loss of normal AC power.		
VIII. PROCEDURE REVIEW		EO-8
A. Review N2-OP-72 with emphasis on Precautions and Off Normals.	Note: Instructor may review any other portions of the procedure that the class may desire.	

IX. TECHNICAL SPECIFICATIONS EO-9/10

A. Review the following Tech Specs including bases:

1. 3/4.8.1 AC Sources
2. 3/4.8.2 DC Sources
3. 3/4/8.3 Onsite Power Distribution System

X. RELATED PLANT EVENTS

Refer to Attachment 2.

XI. WRAP-UP

Review the System Learning Objectives.

ATTACHMENT 1

LIST OF FIGURES

ATTACHMENT 2

1. Nine Mile Point 2 LER 88-036, Rev. 01

Update on failure of a transfer switch contact to return to normal results in an inoperable diesel generator and a violation of tech specs.

On July 28, 1988 while at approximately rated thermal power, it was discovered that Unit 2 had not been in compliance with its Technical Specifications (TS). From July 21, 1988 to July 28, 1988 the appropriate TS action statements were not performed for continued operation with one diesel generator inoperable. The diesel was inoperable due to its associated cooling water valve being inoperable. Operations personnel were not aware of this situation until performance of a diesel generator surveillance test. The immediate cause was the failure of a contact on a remote shutdown panel transfer switch to return to its normal position. The most probable root cause of this event has been determined to be a programmatic deficiency. A possible contributing cause was an installation deficiency. Immediate corrective actions were to restore the mispositioned contact to its normal position, perform the TS required surveillance test and declare the diesel generator operable. Additional corrective actions consisted of the Electrical Maintenance Department reworking the associated terminal lugs, as required, to the correct installation configuration and verifying no further impediment to proper switch operation, posting of caution signs on the remote shutdown panels and issuing a Lessons Learned.

2. Nine Mile Point 2 LER 88-050

Engineered safety feature results from opening of a feeder breaker to an emergency switchgear due to personnel error.

On September 20, 1988 at 1438 hours Unit 2 was operating at 63% of rated thermal power when the Division 1 Service Water System's "Loss of Off-Site Power" logic actuated. The Division 1 Diesel Generator (EGS) had been operating in parallel with normal off-site site power to the

Division 1 Emergency Switchgear. At the conclusion of the test, the licensed operator in the control room inadvertently opened the off-site power breaker instead of the EGS output breaker. This resulted in the expected Service Water System (SWP) automatic actions due to the initiation of SWP "Loss of off-site immediate corrective action was to reclose the Division 1 Switchgear normal off-site logic power breaker and to restore the SWP System to its normal line up. To prevent recurrence, a training modification recommendation has been issued to incorporate the Institute of Nuclear Power Operations "Self Verification Work Practice" in simulator training.

3. Nine Mile Point 2 LER 86-022

Division I, II, III Diesel Generators Inoperable.

On December 22, 1986, the three standby diesel generators (DG) at Unit 2 (NMP2) were declared inoperable as a result of simultaneous draining of each DG Day Tank during a Chemistry Surveillance Test. The reactor was at 0% power, with the mode switch in "shutdown". Additionally, plant operations were in compliance with NMP2 Technical Specification, Section 3.8.1.2 Action Statement "A". No transients occurred while the standby DG's were inoperable. Corrective actions taken Chemistry Surveillance Procedure N2-CSP-8 revised. The parties involved have been counseled on event severity and consequences. A letter has been written to the Chemistry Technicians re-enforcing the need to communicate any identified procedural deficiencies to supervision. A letter has been written to operators to ensure adequate assessment of procedure prior to authorization by the control room supervision. As of January 19, 1987 the control room will not allow any surveillance or a maintenance procedures to be run without plant impact statements.