07-192-91

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

NON-LICENSED OPERATOR

02-NLO-001-262-2-01 Revision 0 *

TITLE: NORMAL AC DISTRIBUTION

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Summary of Pages

(Effective Date: _____)

Number of Pages: 27

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May 1991	1 - 27

* THIS LESSON PLAN SUPERSEDES ALL REVISIONS TO 02-NLO-001-262-2-01-0

TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION _____

DATA ENTRY _____

RECORDS: _____

363

I. TRAINING DESCRIPTION

A. Title of Lesson: Normal AC Distribution

B. Lesson Description: Provide non-licensed operators with knowledge of the Normal AC Electrical Distribution system including purpose, general description, detailed description, instrumentation, controls and interlocks, basic operation interrelations, operating and surveillance procedures.

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

D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written exam, passing grade of 80% or greater

E. Method and Setting of Instruction: This lecture/facilitated discussion should be conducted in the classroom

F. Prerequisites:

1. Instructor:
   a. Certified In Accordance with NTP-16
2. Trainee:
   a. In Accordance with NTP-12

G. References:

1. N2-OP-68 "Main Generator, Exciter, Main Transformer, 345KV Yard"
2. N2-OP-70 "Station Electrical Feed and 115 KV Switch Yard"
3. N2-OP-71, "13.8 KV/4160V/ 600V A.C. Power Distribution"
4. N2-OP-75, "Station Lighting system"
5. Technical specifications 3/4.8 1 through 4
6. USAR chapter 8.3.1 "AC Power System"
7. NMPC drawing #12177 - BE - 1AC (Locations of MCC's & switchgear equipment)
8. 2CEC * PNL 852
9. Niagara Mohawk Accident Prevention Rules ("green book")
10. AP-3.2, Industrial Health and Safety
11. N2-ODI-5.08, Operator Good Practices
12. SER 11-90
13. SOER 90-1
14. LER 88-14

II. REQUIREMENTS

A. Requirements for class:

1. INPO NLO Guidelines
2. NTP-12

III. TRAINING MATERIALS

A. Instructor Materials:

1. Whiteboard, markers, erasers
2. Transparencies
3. Overhead Projector
4. Working Copy of this Lesson Plan
5. Scientific Calculator (*)
6. Handouts, worksheets w/answer keys (*)
7. Student Text
8. Films
9. Flipchart (*)
10. TR
11. Trainee Course Evaluations

B. Trainee Materials:

1. Text and drawings
2. Pens, pencils, paper
3. Binders (*)

IV. EXAM AND MASTER ANSWER KEYS

A. Exams and answer keys will be on permanent file with the Dedicated Clerk.

V. LEARNING OBJECTIVES

Upon completion of this lesson the trainee will be able to demonstrate the knowledge to:

A. Terminal Objectives:

TO-1.0 Perform lineups of the AC Electrical distribution system

TO-2.0 Monitor the AC electrical distribution system

TO-3.0 Perform switchyard checks

TO-4.0 Operate the "Kirk Key" Interlock system

B. Enabling Objectives:

EO-1.0 Explain the purpose and function of the Plant Normal AC Electrical Distribution system.

EO-2.0 List the major components of the Normal AC Electrical Distribution system.

EO-3.0 Given a list of major components of the Normal AC Electrical Distribution system, describe the purpose and function of the major components.

EO-4.0 Given a switchgear designation state whether the switchgear is normal, emergency or lighting and state the switchgear voltage. (examples: NPS, ENS, etc.)

EO-5.0 For the precautions and limitations listed in OP-70, 71, 72, 73A & B, 74A & B, and 75 explain the basis for each precaution and limitation.

EO-6.0 Regarding the Normal AC Electrical Distribution system, 1)-locate the correct drawing and 2)-use drawings to perform the following:

a. Identify electrical and mechanical components
b. Trace the flowpath of electricity
c. Identify interlocks and setpoints
d. Describe system operation
e. Locate information about specific components
f. Identify system interrelations

EO-7.0 Regarding the Normal AC Electrical Distribution system, determine and use the correct Procedure to identify the actions and/or locate information related to NLO duties for the following:

a. startup
b. normal operation

c. shutdown

d. off normal operation

e. correcting alarm conditions

EO-8.0 List the systems that interrelate with the Normal AC Electrical Distribution system and describe that interrelationship.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
I. INTRODUCTION	Preliminary Activities	
A. Student Learning Objectives	1. Introduce self to trainees (if unfamiliar). 2. Circulate Training Record. 3. Discuss method of evaluation/ acceptable performance. 4. Pass out copies of Course Evaluation Forms. 5. Show TP of Learning Objectives - Discuss Learning Objectives	
B. System Purpose		
1. The electrical power system provides sources of power for the normal auxiliary and service loads during all plant conditions	These conditions are startup, shut-down, and any emergencies	EO-1.0
2. The electric power system consists of the OFF-Site AC Power System, the On-Site Ac Power System and the DC Power System.	The on site Ac and DC systems are divided into two distinct categories: emergency or safety-related and normal or non safety related. This lesson covers the Normal AC system.	
C. General Description		EO-2.0
Normal AC Dist Flowpath:		
1. Main generator to main & normal station service transformers (NSST's)		

2. Main transformers to Scriba Substation.
3. NSST's to 13.8 KV switchgear which feed the 4160V and 600V switchgear
4. Aux. Boiler transformer - takes power from Scriba Substation and feeds Aux. Boiler and is an alternate for emergency AC switchgear
5. Reserve Station Transformers (2) backup to the Normal 13.8 KV buses and normal supply to the emergency AC buses

II. DETAILED DESCRIPTION

A. Offsite and Yard distribution

1. There are 3 sets of lines in the transformer yard.

Show TP-1 and 2 (Syracuse "grid drawings") EO-3.0

a. Scriba line # 23 - comes from the main generator via the main transformers and goes out to Scriba Substation 345 KV buses

Point out on TP - Syracuse "grid drawings"

Term that you may hear in future: Bus A and B - are just designations in Scriba Substation for the north and south 345 KV buses respectfully.
Point out on TP -

b. Line #5 and #6 come from scriba sub-station and feed 115KV to the Reserve station transformers and through a "center" bus in NMP2 transformer yard either incoming line #5 or #6 can feed the Auxiliary Boiler transformer

2RTX-XSR1A and B

Terms for future reference: lines #5 and #6 feed east and west buses in NMP2 yard

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
2. Reserve Station Service Transformers	Pass out copy of BE-1AC to point out	EO-3.0
a. 2RTX-XSR1A	location of the following transformers	
1) Feeds Div. I of the On-Site Emerg. AC Power System, 4.16 KV through a tertiary winding.	This power goes through 2NNS-SWG016 before going to Div. I	
2) Backup power source for plant Normal AC Power System, 13.8 KV. (2NPS-SWG001,002, 003)	NOTE: This is A transformer B transformer cannot feed SWG 2 (Aux. Boiler)	
b. 2RTX-XSR1B		
1) Feeds Div. II of the On-Site Emerg. AC Power System, 4.16 KV through a tertiary winding.	This power goes through 2NNS-SWG017	
2) Backup power source for plant Normal On-Site AC Power System, 13.8 KV. (2NPS-SWG001,003)	Ask students: Does anyone know what tertiary means? Answer: Tertiary is a third winding which is normally at lower voltage than the primary or secondary windings.	
c. 2RTX-XSR1A and - XSR1B are capable of carrying the plant at 100 percent power and during plant startup. Transformers are three phase, 60Hz, 115 KV primary, 13.8 KV resistance grounded secondary, with a 4.16 KV tertiary winding. Transformer 1A is capable of carrying the auxiliary boiler loads on the 13.8 KV winding. (Resistance ground is shorted through 2RTX-SW001 for this lineup.)	This is necessary only for running the aux. boiler and must be removed if A transformer is used to feed the normal 13.8 KV buses (2NPS-SWG0013)	

1) Automatic load tap changing (LTC) mechanisms can be set to maintain 13.8 KV at the non-safety related switchgear buses under varying Off-Site voltage and transformer secondary loading conditions	This is controlled in the Control Room. Do not confuse with the local tap changer.
a) 115 KV Off-Site system voltage may fluctuate between 120.75 KV to 109.25KV (±5%)	Ask students: What does a tap changer do? Answer: changes the number of turns being used in the primary or secondary of the transformer.
b) LTC's are operated in manual normally by procedure from P852 in the Control Room.	
2) Secondary winding has a load tap changer which shall only be operated under de-energized conditions	This is as per manufacturer direction and operating experience.
3) Each transformer is furnished with two (2) separately controlled banks of cooling equipment. Each bank contains seven (7) fans for forced air cooling thorough an oil to air heat exchanger and a pump for forced circulation of the insulating oil. One cooling bank is designed to provide 70% of the rated transformer cooling capacity.	Show TP of Figure 4 Instructor should stress the normal operation of transformer fans and pumps since various WR's have been written by operators who misunderstood the normal operation of the transformer cooling system.

The fans and pumps for the cooling banks are started and stopped automatically by a winding temperature relay. Transfer switches permit the selection of either cooling bank to operate continuously or in the standby mode.

3. Aux. Boiler Transformer, 2ABS-X1
   a. Primary winding - 115 KV Wye Secondary winding - 13.8 KV Wye — EO-3.0
   b. Feeds Aux. Boiler and associated loads, 13.8KV. (2NPS-SWG002)
   c. Backup source for Div. I or II of the On-Site Emergency AC Power System, 4.16 KV — Is fed through 2NNS-SWG018
   d. Sized to supply two electric boilers at 13.8 KV and either Div. I or II of the emergency power system at 4.16 KV.
   e. When the Aux. Boiler bus is fed from 2RTX-XSR1A it is solidly grounded neutral by 2RTX-SW001 to match 13.8 KV Aux. Boiler bus.
      1) Under this condition 2NPS-SWG001, or SWG003 cannot be connected to 2RTX-XSR1A, since normal 13.8KV system is resistance grounded.

f. The transformer is furnished with two (2) separately controlled banks of cooling equipment. One bank contains seven (7) fans for forced air cooling through an oil to air heat exchanger, the insulating oil flows by natural circulation. The other cooling bank contains four (4) fans for forced air cooling through an oil to air heat exchanger, the insulating oil flows by natural circulation. The fans for the cooling banks are started and stopped automatically by a winding temperature relay. Transfer switches permit the selection of either cooling bank to operate in the lead mode with the other in standby mode or continuously.

g. Transformer has a no-load tap changing mechanism.

4. Generator Step-up Transformer

EO-3.0

a. 2MTX-XM1A, 1B, 1C, 1D steps up the generator voltage of 25 KV to 345 KV for interconnection to the NMPC grid at Scriba Substation. Three of these single phase units are connected to form a grounded three phase high voltage network. One is used as a spare.

1) Each transformer is furnished with two (2) separately controlled banks of cooling equipment. Each bank contains five (5) fans for forced air cooling through an oil to air heat exchanger and a pump for forced circulation of the insulating oil. One cooling bank is designed to provide 70% of the rated transformer cooling capacity. The second cooling bank is started and stopped automatically by a winding temperature relay. Transfer switches permit the selection of either cooling bank to operate continuously or in the standby mode.

Spare can be connected to any of 3 phases but requires moving bus bars in bus ducts and transmission lines in the yard to accomplish this.

5. Normal Station Service Transformer

EO-3.0

a. 2STX-XSN1 steps down the 25 KV generator output to 13.8 KV for the plant normal power distribution system. The secondary consists of two sets of windings (one for each bus) which are resistance grounded.

b. Sized to carry all plant non-safety related loads through 2NPS-SWG001,-SWG003.

c. Other - disconnects and bushings and circuit switchers

d. The transformer is furnished with two (2) separately controlled banks of cooling equipment. Within each cooling bank there are two (2) separate paths for cooling flow. Within each cooling through an oil to air heat exchanger and a pump for forced circulation of the insulating oil. One cooling bank is designed to provide 70% of the rated transformer cooling capacity. The second cooling bank is started and stopped automatically by a winding temperature relay. Transfer switches permit the selection of either cooling bank to operate continuously or in the standby mode.

B. In-Plant Normal AC Power System (2NPS-SWG001 through SWG005) EO-3.0

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
1. Purpose - The In-Plant Normal or Non-safety Related AC Power System feeds all non-safety related loads. It is normally energized from the unit generator. In case of loss of power from its normal source, the system is energized from Off-Site power sources. A 345KV Transmission facility connects the Unit 2 generator to the Scriba Substation and the Niagara Mohawk grid. The Normal Station Service Transformer steps down the 25 KV output of the Unit generator to 13.8 KV for the plant Normal On-Site AC Power System.	Loads include but not limited to: 1. Main condensate and feedwater system. 2. Reactor recirculation system. 3. Condensate makeup and return system. 4. Component cooling water system. 5. Plant cooling and ventilation system. 6. Service water system (non-safety portion). 7. Circulating water system. 8. Reactor water cleanup system. 9. Other non-safety related auxiliary systems.	
	Show TP Panel Distribution drawing	EO-6.0
2. Switchgear designations. The 3 letter system designation has some very important information in it.	These are a NMP standard	EO-4.0
	Show TP letter designations	
a. The first letter		
E - emergency (standby)	(safety related)	
N - normal	(non-safety related)	
W - welding	(lighting can be 600VAC distribution or 208/120	
L - lighting	VAC lighting dist. panels)	
Y - yard		

b. The second letter stands for voltage:

X - 345KV AC System

U - 115KV AC System

P - 13.8 KV AC System — Not applicable to welding (WPS stands for welding power supply).

N - 4160 V AC System

J - 600 V AC Unit Substation

H - 600 V AC Motor Control Center

A - AC — Used in lighting designation

c. The third letter is normally an S - which stands for switchgear, substation or system the third letter in lighting systems stands for the associated building. This letter could also be C for control L - for relaying etc. as used in the yard.

Examples: C - Control Room

R - Reactor Building — From above designations ask students randomly what the following stands for: EPS, LAR, NNS, ENS, LAT, YUC

3. Five non-safety related 13.8 KV buses — EO-3.0

a. 2NPS-SWG001, - SWG003 supply: — Point out these switchgear on TP - 3 tell trainees that this drawing is laid out like panel 852.

1) All 13.8 KV non-safety related motors (>2500 hp)

2) All non-safety related 4.16 KV buses

3) 600V normal load centers

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
b. 2NPS-SWG001 also feeds 2EPS*SWG001, *SWG002	(This is the function of 13.8KV buses)	
c. 2NPS-SWG003 also feeds 2EPS-*SWG003, *SWG004		
d. 2NPS-SWG002 fed through the Aux. Boiler Transformer to feed the Aux. Boiler and can be an alternate supply to the emergency AC Buses	Point this out on TP as discussed earlier in the transformer yard section.	
e. 2NPS-SWG004 and 2NPS-SWG005 supply 15 Hz power to 2RCS*P1A and 2RCS*P1B respectively. These switchgear receive 4160 V 15 Hz power from the RCS MG's	Ask students: Why are these switch gear labeled NPS if voltage is 4160 VAC? (see student text Figure 3A) Answer: When recirc pumps are running on fast speed 13.8 KV can be on one side of these breakers.	
4. 4 safety related buses (2EPS*SWG001-004) a. 13.8KV 2EPS*SWG001, *SWG002 feed RRC pump 2RCS-P1A fast speed. b. 13.8KV 2EPS*SWG003, *SWG004 feed RRC pump 2RCS-P1B fast speed. c. The safety function is to downshift the recirculation pumps to slow speed when required.		EO-3.0
5. Normal 4.16KV distribution 2NNS-SWG011 through 2NNS-SWG018 2NNS-SWG011 through 15 are all normally fed from 2ATX-XS1 and 3.	Point out connections and Locations on Distribution drawing TP - 3 and location drawing BE-1AC	EO-3.0

a. 2NNS-SWG011, -SWG012, and SWG013 supply 4.16KV non-class 1E motor loads. 2NNS-SWG011 and -SWG013 also feed the Reactor Recirculation LFMG motors.

b. Bus 2NNS-SWG012 normally connected to bus 2NNS-SWG011, but can also be supplied by 2NNS-SWG013.

Other loads supplied by SWG-11, 12 and 13 are pumps in the following systems CCS, CNM, HSL, FPW and CCP (A pumps)

c. 2NNS-SWG014 and -SWG015 known as "stub buses", feed selected redundant normal 4.16KV motor loads (250 to 2500 hp) and the 600V load center transformers for load centers 2NJS-US5 and -US6.

4160 load - RDS pumps CCP (B and C pumps and NJS transformers for US5 and 6.

1) Can be manually connected to associated Emerg. Diesel Generator buses, 2ENS*SWG101 and *SWG103, upon loss of normal 13.8 KV power and no LOCA condition.

As mentioned earlier the 13.8 KV normal bus feeds SWG 14 & 15 through ATX-XS 1 and 3 respectfully.

2) Physically separated and electrically isolated to prevent interference with the safety function of the emergency distribution system.

d. 2NNS-SWG016, -SWG017, -SWG018

1) Interconnect 4.16 KV tertiary windings of 2RTX-XSR1A and -XSR1B, and 2ABS-X1, to the 4.16 KV emerg. buses, 2ENS*SWG101, *SWG102 and *SWG103.

tertiary - third

(small single breaker switch gear on switch south side of normal switch-gear 261' elevation)

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
6. Normal 600V Distribution System		EO -3.0
a. 2NJS-US1 through 2NJS-US4 and 2NJS-US7 through 2NJS-US10	Point out locations on BE-1AC	
1) Feed non-safety related loads (50 to 200 HP)		
2) Fed from the normal 13.8 KV switchgear buses.		
3) Double ended, split bus design (NOTE: US-7 only has an A and B bus).		
4) Associated MCC's carry loads 1/6 to 50 HP in size.		
b. 2NJS-US5 and 2NJS-US6	These use are also referred to as "stub buses"	
1) Feed selected plant loads such as the Uninterruptible Power Supply.		
2) Fed from 4.16 KV stub buses. (US5- from SWG-014, US-6 from SWG-015)	Covered in detail in UPS lesson material	
7. Uninterruptible Power Supply (UPS)	Some of these loads are:	EO -3.0
a. Provides normal and emergency power to all plant service loads, instrumentation, and control loads which require UPS.	RPS logic trip channel loads and ISC logic; selected non-safety instrumentation and control; lighting and computer loads	
8. Station Lighting (Four Subsystems)		EO -3.0
a. Normal lighting subsystem		
1) Power originates from 600V load center		

b. Essential Lighting Subsystem
   1) Fed from two UPS units, (UPS-1C & 1D)

c. Emergency Lighting Subsystem
   1) In emergency modes of operation, Emergency lighting subsystem is fed from the emergency diesel generator sets.

d. Engress Lighting Subsystem
   1) Branch of the Essential lighting. Provides lighting to various plant exit doors, walkways and roadways.

III. INSTRUMENTATION, CONTROLS AND INTERLOCKS (Control Room)

Good info. for the Control Room Operator or NLO pursing Control Room operator job.

A. Instruments and Indications
   1. Current XFMRs, Potential XFMR's and watt meters measure bus current flow, voltage, and electrical power.
   2. Frequency and VAR indication also present on PNL-852.
   3. Status Lights
      a. Red (closed)

Red means flow

      b. Green (tripped)
      c. Blue indicates the load tap changer transfer switches are in local position for 2RTX-XSR1A, 2RTX-XSR1B, and 2STX-XNS1.

B. Controls

Located on electrical control panel 852

For major buses (13.8 KV to 600 VAC)

C. System Interlocks

1. 115 KV System

a. CKT Switches YUC-MDS3-5 can be operated as long as no electrical fault exists on the respective service transformers.

(also called circuit switches 18, 28 and 38)

b. YUL-MDS1 & 2 can be operated if no other power source is supplying the bus and its respective RSS XFMR CKT switcher is not closed.

c. YUL-MDS10 and 20 can only be operated when no power exists on at least one side of the switch.

2. 13.8 KV System

a. 2NPS-SWG001 and 003 has protective relays for bus undervoltage and overcurrent.

b. ACB1-3 and 3-14 can be closed if sync permissive satisfied, supply XFMR has adequate voltage and no fault, and there are no bus electrical faults. ACB1-3 and 3-14 will trip on unit electrical fault, main generator fault, or bus electrical fault.

c. Alternate supply breaker (ACB-1 and 3-1) can be closed when adequate voltage exists on alternate XFMR, sync permissive is satisfied, there are no electrical faults on the bus, reserve XFMR, or normal XFMR, and normal supply breakers (ACB1-3 and 3-14) are open.

d. ACB-1 and 3-1 will trip from the control switch, on a bus or reserve XFMR fault, or if the neutral grounding switch is closed.

e. 2NPS-SWG002 has protective relays for overcurrent, the normal supply breaker ACB2-5 can be manually closed if alternate XFMR, or 115 KV XFMR trip. ACB2-5 will trip on a bus or XFMR fault.

3. 4.16 KV System

a. Buses have protective relays, breaker control interlocks, and lockouts for overcurrent and undervoltage.

b. Supply breakers for buses 2NNS-SWG011-013 can be manually closed only if any one of the three other supply breakers are open with the remaining pair closed.

c. Supply breakers for buses 2NNS-SWG014 and 015 interlocked such that only one breaker may be closed at a time.

4. Kirk Key

a. Interlock System on MCC's allowing power to normally be supplied to the A and C bus and B bus is fed from separate supply. To rearrange this lineup, due to the Kirk Key interlocks the buses must be deenergized, keys moved to breaker you want to turn on then power is restored. EO-5.0

IV. PRECAUTIONS AND LIMITATIONS

A. The following precautions are found in section D of the applicable procedures. N2-OP-68, 70, 71 and 75

1. Main transformers, Reserve station service transformers (1A and 1B) and Auxiliary Boiler Transformer are all supplied with "de-energized" tap changers. This is the design manufacturer's direction and also has been proven with the Aux. Boiler transformer that the transformer must be de-energized prior to changing the taps. EO-7.0

2. Personnel clear and equipment operable prior to startup. This is a major safety concern which should be like "common sense" whenever starting up any equipment.

3. The following safety equipment is required when working in or around switchyards
   a. hard hat
   b. safety glasses
   c. safety shoes

   Not anything more than in the plant it is just highlighted as a reminder that there are safety hazards in the switchyard. As discussed in the "Niagara Mohawk Accident Prevention Rules" (possibility of falling objects.)

4. Check following on RTX1A, 1B and ABS-X1
   a. Liquid temperature <80°C

	b. Winding temperature <80°C	
	c. Liquid level in tank and bushing normal	"equipment operable" as stated above.
5.	Before racking <u>in</u> any breakers their associated control switch should be in "Pull-to-Lock" and control power fuses must be removed.	(OP-71 ODI-5.11)
6.	Before closing a MCC breaker the associated breaker control switch must be in "Pull-to-Lock" where applicable.	These precautions both are to prevent the load from starting while you are racking or closing the breaker. <u>Caution</u> - some MCC breaker's associated load's have auto start/ closure etc. which may cause the starter to energize as soon as the breaker is closed. Therefore as stated in SGO 88-6 minimum personal protective equipment is gloves hard hat and safety glasses for operating breakers.
7.	Reserve transformer "A" neutral switch 2RTX-SW001 must be open for normal operation is closed when supplying <u>only</u> the aux. boilers.	
8.	Do not parallel Div. I and II diesel generators, at the same time, to SWG018.	Maintain divisional separation.
9.	<u>After</u> installing breakers in switchgear verify that spring charging motor circuits are energized.	(Trip and close fuses or toggle switch on)

	After closing breakers, verify that springs are charged.	This is to insure that the breaker closing springs are ready for the next needed closure
	10. All equipment operations shall be monitored and controlled in accordance with Rad. Protection procedures	"ALARA"
V.	SYSTEM OPERATION	
	A. Normal Operations	
	1. RTX XFMR 1A and Aux. Boiler XFMR are normally powered from Scriba Line #5 RTX XFMR 1B is normally supplied from Scriba line #6.	In other words the only MDS or circuit switch open is MDS20 in the 115 KV yard.
	a. RTX XFMR 1A can supply 2NPS-SWG001 or an alternate supply to 2NPS-SWG003, or it can supply 2NPS-SWG002 (only with switch 2RTX-SW001 in connected position). Also supplies power to 4.16 KV emergency buses 2ENS*SWG101 and 102 via 2NNS-SWG016.	
	b. RTX XFMR 1B is in standby to supply 2NPS-SWG003 and an alternate supply to 2NPS-SWG001. 4.16 KV supplies emergency bus 2ENS*SWG103 via 2NNS-SWG017. It can also feed power to emergency bus 2ENS*SWG102 if required.	

c. Aux. boiler XFMR supplies 13.8 KV to the two electrode boilers, and is the alternate 4.16 KV to emergency buses 2ENS*SWG101 or 103 via 2NNS-SWG018.

2. During normal operation with main generator on the line, 13.8 KV buses 2NPS-SWG001 and 003 are powered from the main generator through the STX XFMR. 13.8 KV to 2NPS-SWG002 is still supplied from aux. boiler XFMR.

a. Normal load and motor control center 600V supply breakers are closed to energize normal load center buses A and B. Bus C energized by tie circuit breakers connecting buses A and C. (NOTE: US-7 only has A and B bus)

b. See Table 12 for available UPS power supplies.

B. Infrequent Operation

1. Following a generator trip, the supply breakers from the normal station service transformer to 2NPS-SWG001 and SWG003 automatically open and the supply breakers from the reserve station service transformers (1A and B) close simultaneously

so that power is not interrupted to normal station loads. The auto fast transfer is attempted whenever a generator primary lockout or high speed protective relay is actuated. If the fast transfer is not completed within six cycles, fast transfer is blocked and slow transfer is attempted after all motor loads are shed.

Review LER 88-14 with trainees.

V. SYSTEM INTERRELATIONS — EO-8.0

A. Normal AC distribution interconnects with all systems receiving power to loads from associated switchgear.

B. DC power system provides power to protective relaying control.

C. Site transmission system interconnects NMP-2 with other utilities, and major load centers at 345 KV and 115 KV.

D. On-Site Emergency Power Distribution is normally energized from the Off-Site Power System via the RSS XFMR's.

VI. RELATED PLANT EVENTS

A. Using the modified case study format, discuss the events described in SOER 90-1, Ground Faults on AC Electrical Distribution Systems. — SOER 90-1

After reading the event description use a guided class discussion to determine:

1. Probable root cause

2. Recommended corrective actions (as if you were the licensee)
3. Relevance to NMP2 (i.e. Is the event described, a concern at NMP2?)
4. Actions that can be taken to prevent this event from happening at NMP2.

INSTRUCTOR NOTE

1. Use of OEA response to SOER 90-1 may be useful for the discussion of items 3 and 4 above. File Code NMP72128
2. Discuss with students the difference between low resistance grounded systems and high resistance grounded systems (Unit 2 uses a low resistance grounded system). The type of grounded system used is based upon the method used to connect the three-phase electrical system to components. With a low resistance grounded system a WYE type connection system is used. With high resistance grounded system, a DELTA type connection is used.
3. Discuss with the students the items listed under RECOMMENDATION 4 in the OEA response to SOER 90-1. File Code NMP72128

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
B. Using the modified case study format, discuss the events described in SER 11-90, Main Transformer Damage and Fires Caused by Static Electrification.	After reading the event description use a guided class discussion to determine: 1. Probable root cause 2. Recommended corrective actions (as if you were the licensee) 3. Relevance to NMP2 (i.e. Is the event described, a concern at NMP2?) 4. Actions that can be taken to prevent this event from happening at NMP2.	SER 11-90
	INSTRUCTOR NOTE Use of OEA response to SER 11-90 may be useful for the discussion of items 3 and 4 above.	File Code NMP74724

VII. SYSTEM HISTORY

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

VIII. WRAP-UP

A. Review the Student Learning Objectives.