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2-130A

GEORGIA POWER
POWER GENERATION DEPARTMENT
VOGTLE ELECTRIC GENERATING PLANT
TRAINING LESSON PLAN

TITLE:	LOSS OF ALL AC POWER	NUMBER:	LO-LP-37031-06-C
PROGRAM:	LICENSED OPERATOR	REVISION:	6
SME:	L. RAY	DATE:	12/13/89
APPROVED:	Lloyd a Hunt	DATE:	12/14/89

INSTRUCTOR GUIDELINES:

I. LESSON FORMAT

A. Verbal lecture with visual aids

II. MATERIALS

A. Overhead projector

B. Transparencies

C. White board with markers

III. EVALUATION

A. Written or oral exam in conjunction with other lesson plans

IV. REMARKS

A. This lesson plan meets the training commitments made in FSAR Question 730.1 NUMARC Position on Station Blackout.

B. Ensure students have latest revision of EOP

C. Performance-based instructional units (IUs) are attached to the lesson plan as student handouts. After the lecture on Loss of All AC Power, the student should be given adequate self-study time for the IUs. The instructor should direct self-study activities and be available to answer questions that may arise concerning the IU material. After self-study, the student will perform, simulate, observe, or discuss (as identified on the cluster signoff criteria list) the task covered in the instructional unit in the presence of an evaluator.

I PURPOSE STATEMENT

Following completion of this lesson, the student will possess those knowledges systematically identified for the performance of the LOSS OF ALL AC POWER tasks.

II LIST OF OBJECTIVES

1. Define "loss of all AC power" condition. Explain its immediate implications for operation of plant equipment.

2. State why the RCP is a primary concern during a loss of all AC condition.

3. Assuming a fixed leak size, state the impact of not starting asecondary side depressurization (plant cooldown) on the following parameters:
   a. RCP seal leakage
   b. RCS coolant mass
   c. time to core uncovering

4. Describe the effect of a leak, concurrent with a loss of all AC power, on the following parameters:
   a. pressurizer level
   b. containment pressure
   c. time to core uncovering

5. State the special concerns regarding the following items should the operator begin the secondary side depressurization:
   a. return to critical condition
   b. introduction of non-condensible gases

6. State from memory the immediate operator actions of EOP 19100.

7. State the bases for "Loss of All AC Power" procedure.

8. Using EOP 19100 as a guide, briefly describe how each step is accomplished.

9. Given a NOTE or CAUTION statement from the EOP, state the bases for that NOTE or CAUTION statement.

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REFERENCES:

1. PLANT VOGTLE PROCEDURES

   19100-1 LOSS OF ALL AC POWER
   19101-1 LOSS OF ALL AC POWER RECOVERY WITHOUT SI REQUIRED
   19102-1 LOSS OF ALL AC POWER RECOVERY WITH SI REQUIRED

2. WOG EMERGENCY RESPONSE GUIDELINE: ECA 0.0 LOSS OF ALL AC POWER

3. COMMITMENTS AND OTHERS

   FSAR QUESTION 730.1 UNREVIEWED SAFETY QUESTION STATION BLACKOUT
   NUMARC POSITION ON STATION BLACKOUT

4. TRANSPARENCIES

   LO-TP-37031-001 OBJECTIVES
   LO-TP-37031-002 RCP SEAL LEAK WITH AND WITHOUT SECONDARY DEPRESSURIZATION
   LO-TP-37031-003 PRESSURIZER RESPONSE TO LOSS OF ALL AC
   LO-TP-37031-004 MAJOR ACTION CATEGORIES FOR ECA-00

5. STUDENT HANDOUTS

   LO-HO-37031-001 LOSS OF ALL AC POWER

6. INSTRUCTIONAL UNITS

   LO-IU-37031-001 RESPOND TO LOSS OF ALL AC POWER
   LO-IU-37031-002 RECOVER FROM LOSS OF ALL AC POWER WITH SI REQUIRED

I. INTRODUCTION

A. This lesson will give the student a general knowledge of ECA 0.0 "Loss of All AC Power"

II. PRESENTATION

A. General Information

1. Definition of loss of all AC power

a. Loss of grid power (RATS) and subsequent failure of events preventing the emergency diesels from energizing the emergency buses

1) Immediate consequences to plant safety

2) If power cannot be restored, cause

a) Core uncovering

III. LESSON OUTLINE:

NOTES

I. INTRODUCTION

A. This lesson will give the student a general knowledge of ECA 0.0 "Loss of All AC Power." — Cover objectives LO-TP-37031-001

II. PRESENTATION

A. General Information

1. Definition of loss of all AC power

a. Loss of grid power (RATS) and some combination of events preventing the emergency diesels from energizing the emergency AC buses — Objective 1

1) Immediate consequences to plant equipment if not accompanied by some other event (LOCA, S/G TR) are not severe

2) If power cannot be restored, consequences to plant and public safety can potentially be extreme

a) Core uncovering

2. Basis

a. The object of ECA 0.0 is to provide guidance to respond to a loss of all AC power in order to mitigate deterioration of RCS conditions while AC power is not available — Objective 7

3. ECA usage

a. Guidance provided in other EOP's not applicable following loss of all AC

1) Other EOP's written on the premise that at least one AC emergency bus energized

b. ECA 0.0 has priority over all other guidelines

1) Steps include actions that monitor and maintain critical safety functions

B. Plant Response to Loss of Power

1. Chief concern to loss of RCS Fluid through RCS — Objective 2

III. LESSON OUTLINE:

NOTES

seals with no makeup capability

2. Without cooling seal situation degrades over time. May increase to 300 gpm or more

3. Loss of RCS inventory if maintained would eventually uncover core

4. Large (300 gpm) leak with and without secondary depressurization — Objective 3 LO-TP-37031-C-002

   a. Note process of transient - drop of RCS pressure until saturated condition at 30 min.

   b. Figure 3 assumes secondary steam pressure is held by S/G safeties. Figure 4 assumes 100°/hr cooldown is begun

   c. Note differences in where RCS pressure stabilized; 1200# vs 600#

   d. Note resulting difference in leak rate

   e. Note drop in pressurizer level

      *Depends on leak rate

   f. Since leak rate can be affected by depressurizing the S/G this will increase the time to core uncovery

5. Restrictions on use of operator imposed cooldown — Objective 5

   a. Return to critical condition due to moderator temperature coefficient

      1) Without charging pump power you can't borate

      2) Can drop pressure to force accumulator injection to add negative reactivity. However, circumstances may prevent depressurization by this amount

      3) Problem aided by factors of xenon buildup

      4) Severity of this concern is determined by fuel burnup conditions

   b. Introduction of non-condensible gases

1) Will be unable to isolate accumulators without ESF bus power, also can't vent them

2) Must be controlled by controlling steam release rate from S/G's

6. Seal leakage is analyzed as break in RCS cold leg at pump discharge — Objective 4

a. Pressurizer level decreases at rate consistent with leak rate

1) Without cooldown - pressurizer level charge best indication of leak rate

b. Containment pressure will increase slightly

1) Worst case effects are moderate

2) Heat removal from containment are via passive means

3) Maximum pressure increase would be approx. 3 psi

c. Time to core uncovering

1) Dependent on

a) Leak rate

b) Cooldown

2) Leak rate decreases as pressure decreases

3) Cooldown allows more mass to stay in RCS

C. Major Action Categories of ECA 0.0

1. Perform immediate actions

2. Restore AC power

3. Maintain plant conditions for optimal recovery

4. Evaluate energized AC emergency bus

5. Select recovery guideline after AC power restoration

III. LESSON OUTLINE:

NOTES

D. Operator Actions

LO-TP-37031-C-004

1. 19100 contains immediate actions similar to first steps of 19000

   a. First four steps, RNO's included (operators must memorize)

Objective 6

2. Monitor CSFSTs while in 19100 but do not transition to FRPs

3. Procedure 19100 actions (use 19100 as a guide)

Objective 8
Note: ensure students know how to perform each step procedure

   a. Perform immediate actions verifying RCS isolation and secondary heat sink availability (Steps 1-4)

   b. Restore AC power - optimal recovery is always to do whatever you can to get AC power back ASAP (Steps 5-7)

   c. Maintain plant conditions for optimal recovery. That is, depressurize the secondary (Steps 8-22)

      1) Step 16 is a judgement point; SS must guess at expected outage duration

         a) If short, hold ground and wait

         b) If long, begin depressurization

      2) May require local actions to release steam via ARVs. Hard to coordinate cooldown rate with control room

      3) While power is off motor breakers are opened and automatic loading defeated to permit operator control on restoration of power

      4) Operational loop is repeated until power is restored

   d. Evaluate energized bus (Step 23-26)

      *Verify selected equipment status

   e. Select recovery guideline (Step 27)

      1) Use 19101 if criteria for SI initiation do not exist

III. LESSON OUTLINE:

NOTES

2) Use 19102 if RCS conditions are reasonably normal but SI initiation is required

- RCS subcooling less than 24°F or
- Pressurizer level less than 9%, or
- ECCS equipment have already been actuated

4. Caution statements of 19100-C (not previously covered) — Objective 9

a. Three cautions before Step 6

1) When power is restored to any AC emergency bus, recovery actions should continue starting with Step 24

2) If an SI signal exists or if an SI signal is actuated during this procedure, it should be reset to permit manual loading of equipment on an AC emergency bus

3) Two NSCW pumps should be available to automatically load on its AC emergency bus to provide diesel generator cooling

a) To minimize the deterioration of plant conditions, recovery actions are started as soon as power is restored. Step 24 is entered from any step after caution

b) Loss of all AC power philosophy is to defeat automatic loading of AC emergency bus

c) If diesels start, cooling water is supplied immediately to prevent loss of diesel

b. Caution before Step 11

1) A faulted or ruptured SG that is isolated should remain isolated. Steam supply to the TDAFW pump must be maintained from at least one SG

III. LESSON OUTLINE:

NOTES

a) First part reminds operator to keep faulted/ruptured SG isolated to maximize operator control of secondary pressure and minimize radioactive releases

c. Caution before Step 16

Note before Step 16: Need to control S/G depress so that TDAFW pump capacity will not be exceeded

1) To prevent injection of accumulator nitrogen into the RCS, SG pressure should not be lowered to less than 165 psig

a) Ensures that accumulator nitrogen will not impede natural circulation

2) SG narrow range level should be maintained greater than 5% (27% for adverse containment) in at least one intact SG. If level cannot be maintained, SG depressurization should be stopped until level is restored in at least one SG

a) Maintains secondary heat sink at all times

d. Caution before Step 25

1) The loads placed on the energized AC emergency bus should not exceed the capacity of the power source

a) As equipment is manually loaded on bus operator must not overload diesel and cause further loss of bus

E. Recovery Without SI Required (19101 ECA 0.1)

1. Entered only from transition out of 19100-C, Step 27

a. Major action categories

1) Start normal operation equipment as necessary

2) Establish RCPs seal cooling

III. LESSON OUTLINE:

NOTES

3) Stabilize plant with normal operational systems

2. Recovery action plan

a. Check the status of the following

1) RCP seals and thermal barriers isolated

2) CIA not actuated

3) Verify valve alignment and load NSCW, ACCW, CCP, and containment fan coolers

Note: ensure students know <u>how</u> to perform each step of procedure

b. Establish charging

c. Check ECCS flow not required

d. Increase pressurizer level to $\geq$ 19%

e. Stabilize secondary (SG level, pressure, and AFW flow)

f. Place ECCS pump handswitches to auto

g. Establish RCP seal flow

h. Establish letdown

i. Stabilize and control pressurizer level and pressure

j. Verify:

1) Natural circulation

2) SDM

k. Maintain plant conditions stable

l. Continue attempts to restore off-site power to all AC buses and at least one RCP

3. Transition out of procedure

a. Occurs when off-site power is finally restored

1) If RCP started, go to appropriate procedure

2) If no RCP started, go to "Natural

III. LESSON OUTLINE:

NOTES

Circulation Cooldown" - 19002-1

4. Caution statement of 19101-1 (not previously covered)

Objective 9 (cont'd)

a. Caution statement before Step 7

1) If SG narrow range level lowers to less than 5% (27% for adverse containment) and AFW flow is less than 570 gpm, the MDAFW pumps should be manually loaded on the AC emergency bus to supply water to the SGs

a) Informs operator under what conditions a MD AFW pump should be started

b. Caution statement before Step 10

1) RCP thermal barrier cooling should be established slowly to minimize potential steam flashing of the ACCW system

2) RCS seal injection should be established slowly to minimize RCP thermal stresses and potential seal failures

3) As a part of subsequent recovery actions, RCPs should not be started prior to a status evaluation

a) By minimizing the amount of steam formed, any steam introduced into the ACCW system will be condensed thereby preventing system binding or water hammer

b) Prevent further damage to RCP seals and shafts

c) Starting a RCP has the potential for aggravating and damage and increasing the RCS leakage above upper unit est in background document

F. Recovery with SI Required

1. Entry from either 19100 or 19101, following

Note: ensure students know <u>how</u> to perform each step

III. LESSON OUTLINE:

NOTES

restoration of emergency power — of procedure

2. Major action categories

   a. Start safeguards equipment as necessary

   b. Establish RCP seal cooling

3. Recovery action plan

   a. Check requirement for transfer to cold leg recirculation (RWST greater than 39%)

   b. Start SIP

   c. Align CCP for SI flow, start when RCP seal injection valves are isolated

   d. Manually load CCW, RHR, ACCW pumps and four containment coolers

   e. Stabilize SG level (NR level 5%-50%,

   f. Check containment spray necessary (containment pressure greater than 21.5 psig)

   g. Establish RCP seal cooling

   h. Go to 19010-1, E-1 "Loss of Reactor or Secondary Coolant"

4. Caution statement of 19102-1 (not previously covered) — Objective 9 (cont'd)

   a. Loading of energized AC emergency bus should be sequenced with a delay between each component loaded to prevent exceeding the capacity of the DG

      1) By allowing the starting current to decay and minimizing the load on the bus will insure that the operable diesel continues to supply the bus

III. SUMMARY

A. Review Objectives

1. DEFINE "LOSSOF ALL AC POWER" CONDITION. EXPLAIN ITS IMMEDIATE IMPLICATIONS FOR OPERATION OF PLANT EQUIPMENT.

III. LESSON OUTLINE:

NOTES

Loss of grid power (RATS) and some combination of events preventing the emergency diesels from energizing the emergency AC buses

Immediate implications (w/o accident) are not severe, long-term can be extreme

2. STATE WHY THE ACP IS A PRIMARY CONCERN DURING A LOSS OF ALL AC CONDITION.

Failure of RCP seals causing loss of RCS fluid with no makeup capability

3. ASSUMING A FIXED LEAK SIZE, STATE THE IMPACT OF NOT STARTING A SECONDARY SIDE DEPRESSURIZATION (PLANT COOLDOWN) ON THE FOLLOWING PARAMETERS:

RCP SEAL LEAKAGE

RCS COOLANT MASS

TIME TO CORE UNCOVERING

Seal leakage - as long as RCS pressure is high leak rate will continue, possible getting larger

Coolant mass - mass loss will occur faster

Time to core uncovery - will be shorter

4. DESCRIBE THE EFFECT OF A LEAK, CONCURRENT WITH A LOSS OF ALL AC POWER, ON THE FOLLOWING PARAMETERS:

PRESSURIZER LEVEL - continue to decrease

CONTAINMENT PRESSURE - slight increase

TIME TO CORE UNCOVERY - dependent on leak rate

5. STATE THE SPECIAL CONCERNS REGARDING THE FOLLOWING ITEMS SHOULD THE OPERATOR BEGIN THE SECONDARY SIDE DEPRESSURIZATION:

RETURN TO CRITICAL CONDITION - unable to establish SDM so must monitor reactivity added by MTC

INTRODUCTION OF NON-CONDENSIBLE GASES - unable to isolate injection accumulators could if

III. LESSON OUTLINE:

NOTES

introduce N_2 if pressure drops low enough

6. STATE FROM MEMORY THE IMMEDIATE OPERATOR ACTIONS OF EOP 19100

   Reference EOP 19100-1, Steps 1 - 4

7. STATE THE BASES FOR "LOSS OF ALL AC POWER" PROCEDURE

   Provide guidance to respond to loss of all AC power in order to mitigate deterioration of RCS conditions while AC power is not available

8. USING EOP 19100 AS A GUIDE, BRIEFLY DESCRIBE HOW EACH STEP IS ACCOMPLISHED.

   Reference EOP 19100-1

9. GIVEN THE CAUTION STATEMENT FROM THE EOP, STATE THE BASES FOR THAT CAUTION STATEMENT.

   Reference Section II.D.4, II.E.4, and II.F.4. of lesson plan