2-1500

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GEORGIA POWER
POWER GENERATION DEPARTMENT
VOGTLE ELECTRIC GENERATING PLANT

INSTRUCTIONAL UNIT

TITLE:	RECOVER FROM LOSS OF ALL AC POWER WITH SI REQUIRED	NUMBER:	LO-IU-37031-002
PROGRAM:	LICENSED OPERATOR	REVISION:	1
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REFERENCES:

LO-IU-37031-002-01: Recover From Loss of All AC Power with SI Required

PERFORMANCE OBJECTIVE

Given that ac emergency power has been restored following a loss of all ac power and a recovery using safety injection is required, use the engineered safeguards systems to recover plant conditions.

Preparation for cooldown and depressurization must be completed. All communication and activities must be performed in accordance with current, approved procedures.

INFORMATION

This instructional unit addresses licensed operator actions necessary to recover from a loss of all ac power with safety injection required.

After ac emergency power has been restored following a loss of all ac power, two different techniques are available to recover plant conditions. The technique used to recover plant conditions primarily depends upon how much RCS conditions deteriorated during the loss of all ac power event. If RCS subcooling and pressurizer level are adequate and ECCS equipment has not aligned for safety injection, normal operational equipment can be used to recover plant conditions. This technique is addressed in Procedure 19101. If either RCS subcooling or pressurizer level have been lost, or if ECCS equipment has aligned for safety injection, engineered safeguards systems must be used to recover plant conditions. This technique is addressed in Procedure 19102. Entry to Procedure 19102 occurs from step 27 of Procedure 19100 or from steps 5 and 19 of Procedure 19101 when any of the following conditions exist:

- RCS subcooling is 24 degrees F or less (38% adverse containment)
- Pressurizer level is 9% or less (36% for adverse containment)

Procedure 19102 is also entered from step 27 of Procedure 19100 if ECCS equipment has aligned to the injection phase upon ac power restoration. A variety of plant conditions could exist when Procedure 19102 is entered. Assuming that Procedure 19102 is entered from Procedure 19100, the following nominal conditions should exist:

- The reactor should be subcritical.
- The steam generator pressures should be above the depressurization limit of Procedure 19100 and stable at the values existing when the ac power was restored.
- The TDAFW pump should be maintaining steam generator inventory.
- The NSCW system should be operating.
- Required small equipment should be loaded onto the energized ac emergency bus.

One or more of these nominal conditions may not exist if the loss of all ac power was accompanied by a LOCA or SGTR.

Recovering from a Loss of All AC Power with SI Required

NOTE: The CSF status trees should be monitored for information only until procedure step 9 has been completed. Because Procedure 19102-1 is entered for loss of all ac power events in which RCS conditions may have experienced significant deterioration, one or more CSF challenges (red or orange conditions) may exist. Steps 1-9 of Procedure 19102 address the critical safety function set as a whole and should be performed before any function recovery procedure is implemented to deal with a specific CSF. Steps 1-9 take into consideration the unique circumstances that accompany a loss of all ac power when starting the safeguards equipment.

PROCEDURE STEP 1 (19102)

ACTION: Verify that the RWST level is greater than 39 percent.

INTENT: This step ensures adequate RWST inventory for recovery in the safety injection mode. If the RWST level is less than 39 percent, use Procedure 19013, "Transfer to Cold Leg Recirculation" (discussed in other training material). After cold leg recirculation is established, go to step 6 of this procedure.

PROCEDURE STEP 2 (19102)

ACTION: Start one SI pump.

INTENT: Start the SI pump in the train that is energized. An SI pump should be started before the other ECCS pumps because this pump will inject as soon as it is started if RCS pressure is below the pump shutoff head (no valve alignment required). In addition, the SI pump can provide greater flow than a charging pump. If the secondary depressurization was performed in Procedure 19100, RCS pressure should be below the shutoff head of the SI pumps.

PROCEDURE STEP 3 (19102)

ACTION: Shift the CCP suction from the VCT to the RWST.

INTENT: Because the SI signal was reset, these valves would not automatically position. Do not manually initiate safety injection to

automatically align the valves because this might strip the energized ac emergency bus or cause failure of the bus, especially if power has been restored by a temporary power supply.

PROCEDURE STEP 4 (19102)

ACTION: Determine whether a CCP should be started.

INTENT: Do not start a CCP before the RCP seal injection isolation valves are closed. This protects the RCPs from damage caused by the introduction of cold seal injection water to a hot RCP seal area.

PROCEDURE STEP 5 (19102)

ACTION: Manually align the charging pump flow through the BIT.

INTENT: With the CCP suction aligned to the RWST, alternate miniflow (which recirculates to the RWST) should be established. Open the BIT isolation valves to establish flow through the BIT. Shut the charging line isolation valves. In this situation, it is preferable to inject ECCS flow to all 4 loops through the BIT, rather than to an individual loop to which normal charging flow is aligned.

PROCEDURE STEP 6 (19102)

ACTION: Verify that the RCP thermal barriers are isolated.

INTENT: The RCP thermal barriers should be isolated before loading an ACCW pump onto the ac emergency bus. When ACCW flow is initiated, a rapid cooling of the water in the seal package area of the RCP will occur and cause seal failure. In addition, the stagnant ACCW water in the thermal barrier heat exchanger may have flashed to steam after ACCW flow was lost. Restarting the ACCW pumps without having flow to the thermal barrier isolated can result in an excessive pressure and temperature transient on the ACCW system and components.

PROCEDURE STEP 7 (19012)

CAUTION: When placing loads on a bus powered from a diesel generator, wait until the starting current and voltage drop off; have an operator monitor the meters to prevent tripping the diesel generators.

ACTION: Manually load specific safeguards equipment onto the energized ac emergency bus.

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INTENT: The CCW pumps are loaded to provide cooling to the RHR heat exchangers and the SFP heat exchanger. The ACCW pump will provide cooling to the RCP motors, the letdown heat exchangers, and the drain tank heat exchanger. If pressure is low enough (possibly because of a large leak), the RHR pump may be necessary to restore RCS inventory. A containment fan cooler is loaded in the emergency mode to begin recovery of containment environmental conditions.

NOTE: Steps 1-7 should be performed on the other ac emergency bus when it is energized.

PROCEDURE STEP 8 (19102)

CAUTION: If the CST level decreases below 15 percent, inadequate suction pressure may cause an AFW pump trip.

CAUTION: If the steam generator narrow range level lowers in subsequent steps to less than 5 percent (27 percent for adverse containment), and the AFW flow is less than 570 gpm, manually load the MDAFW pumps onto the ac emergency bus to supply water to the steam generators.

NOTE: As long as MDAFW pump operation is not required, maintain the pump switches in the PULL-TO-LOCK position to prevent an inadvertent start of these pumps.

ACTION: Maintain the steam generator narrow range levels between 5 percent (27 percent for adverse containment) and 50 percent.

INTENT: This ensures adequate steam generator inventory or feed flow for secondary heat sink requirements. The AFW flow must be controlled to maintain the steam generator narrow range levels. Depending upon the status of the energized ac emergency bus, you may load the motor-driven AFW pump onto the bus and remove the turbine-driven pump from service as part of the subsequent recovery actions.

PROCEDURE STEP 9 (19102)

ACTION: Return the containment spray pumps to standby.

INTENT: Following a loss of all ac power, containment pressure is not anticipated to increase above the containment spray actuation setpoint. The loss of all ac power analysis in the Westinghouse Owner's Group background document for Procedure 19100 shows that the containment pressure stays under approximately 21.5 psig. If containment pressure rises above this set point, the containment spray pumps are permitted to automatically

start on the energized ac emergency bus to provide containment cooling. Manually initiate containment spray if necessary.

NOTE: After step 9 is performed, the FRPs may be implemented to address CSF challenges. Safeguards equipment has either been loaded onto the energized ac emergency bus, returned to the standby status, or maintained in the PULL-TO-LOCK position, depending upon the plant status. Because one ac emergency bus is energized and loaded consistent with the premise of the FRPs, their guidance is now applicable.

PROCEDURE STEP 10 (19102)

CAUTION: Establish RCP thermal barrier cooling slowly to minimize the introduction of steam into the ACCW system. Do not establish RCP thermal barrier cooling to any RCP with excessive seal leakage. After a loss of all ac power event, the hot reactor coolant leaking through the RCP seals will have raised the temperature of the seals and thermal barriers. Establishing ACCW flow to the thermal barriers after ac power has been restored may cause flashing of the ACCW in the thermal barriers. If the ACCW flow is established slowly, the impact of the steam formation (and the seal cooling rate) will be minimized. Any steam introduced into the circulating loops of the ACCW system can be condensed. Introducing a large volume of steam could bind portions of the ACCW system or cause a water hammer.

CAUTION: Establish RCP seal cooling slowly. The rapid introduction of cold seal injection water into hot RCP seals will result in thermal stresses that may damage the RCP seals and shafts.

CAUTION: Evaluate the status of the RCP seals before starting any RCP. The loss of RCP seal cooling that accompanies a loss of all ac power event can damage the RCP seals. Starting an RCP may aggravate any damage and significantly increase the reactor coolant leakage through the RCP seals, possibly exceeding the upper limit established in the background document for Procedure 19100 (300 gpm). After exiting this procedure, do not start the RCPs unless an extreme (red) or severe (orange) CSF challenge is diagnosed. Under a CSF challenge, RCP damage is an acceptable consequence if an RCP start is required to to mitigate an inadequate core cooling condition.

ACTION: Establish RCP seal cooling.

INTENT: To prevent further degradation of the RCP seals caused by continued leakage of hot reactor coolant through the seals, seal cooling should be re-established as soon as possible. Because RCP seal cooling should be established slowly to avoid RCP damage from excessive thermal

stresses, step 10 is intended to begin the necessary actions to restore RCP seal cooling. Proceed to step 11 to continue the recovery while the actions in step 10 are being completed.

The design ACCW flow rate for RCP thermal barrier cooling is based on removing heat from the reactor coolant leaking through the RCP seals at a design leak rate. If seal degradation has occurred and seal leak rates have exceeded the design leak rate, the design ACCW flow to the RCP thermal barriers may not be adequate to remove reactor coolant heat. Under these conditions, establishing ACCW flow to the RCP thermal barriers may form a significant amount of steam in the ACCW system. If it is determined that one RCP is exhibiting excessive RCP seal leakage, do not establish ACCW flow to that RCP unless absolutely necessary. Should it be necessary, HV-1975 seal return header isolation valve may be locally operated. To locally operate this valve you must go to its location (South Main Steam Valve Room Upper, Level A), engage the clutch and turn the handwheel to open the valve.

PROCEDURE STEP 11 (19102)

ACTION: Transfer to Procedure 19010.

INTENT: Procedure 19102 was entered because the pressurizer level and/or the RCS subcooling were lost. The deterioration of RCS conditions may be the result of a LOCA or a steam generator tube rupture coincident with the loss of all ac power. Once the safeguards equipment has been started, transfer to Procedure 19010 to diagnose the problem and to identify the correct recovery procedure. If symptoms of these concurrent events do not exist and the SI termination criteria are satisfied, Procedure 19010 will direct you to Procedure 19011 to terminate the safety injection.

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PERFORMANCE GUIDE

The following actions are required to recover from a loss of all ac power with safety injections required.

- Verify that the RWST level is greater than 39 percent. (procedure step 1)
- Start one SI pump. (procedure step 2)
- Shift the CCP suction from the VCT to the RWST. (procedure step 3)
- Determine whether a CCP should be started. (procedure step 4)
- Manually align the charging pump flow through the BIT. (procedure step 5)
- Verify that the RCP thermal barriers are isolated. (procedure step 6)
- Manually load specific safeguards equipment onto the energized ac emergency bus. (procedure step 7)
- Maintain the steam generator narrow range levels between 5 percent (27 percent for adverse containment) and 50 percent. (procedure step 8)
- Return the containment spray pumps to standby. (procedure step 9)
- Establish RCP seal cooling. (procedure step 10)
- Transfer to Procedure 19010. (procedure step 11)

SELF-TEST

Answer the following questions as completely as possible.

1. The technique used to recover plant conditions following a loss of all ac power primarily depends upon how much RCS conditions deteriorated during the loss of all ac power event.

   a. True
   b. False

2. Assume that you enter Procedure 19102 from Procedure 19100 after restoring ac emergency power following a loss of all ac power without a LOCA or SGTR. Indicate which of the following conditions should exist. Circle "Y" if the condition should exist and "N" if the condition will probably not exist.

a. Y N Reactor - subcritical
b. Y N Steam generator pressures - above the depressurization limit of Procedure 19100 and stable at the values existing when the ac power was restored.
c. Y N The MDAFW pump - maintaining steam generator inventory
d. Y N The NSCW system - operating.
e. Y N Required small equipment - loaded onto the energized ac emergency bus.

3. You are recovering from a loss of all ac power with SI required. State:

   a. which ECCS pump you start before the others.

   b. why you start this pump before the others.

4. Which of the following would be the MOST LIKELY immediate result of establishing RCP thermal barrier cooling too quickly in Procedure 19102?

   a. Introduce steam into the ACCW system.
   b. Thermally shock the RCP shafts.
   c. Significantly increase the RCS leakage through the RCP seals, possibly exceeding the Westinghouse guideline upper limit.
   d. Return to subcriticality.

ANSWERS

1. a. True
2. a. Y
   b. Y
   c. N (TDAFW)
   d. Y
   e. Y
3. a. SI pump
   b. Because the SI pump will inject as soon as it is started if RCS pressure is below the pump shutoff head (no valve alignment required) and the SI pump can provide greater flow than a charging pump.
4. a. Introduce steam into the ACCW system.

TASK PRACTICE

1. Review Procedure 19102. Be sure that you understand all notes, and steps associated with recovering from a loss of ac power with SI required.

2. Take this instructional unit and Procedure 19102 to the control room or simulator. Be sure that you can locate all instrumentation associated with recovering from a loss of ac power with SI required.

3. In the control room or simulator, simulate recovering from a loss of ac power with SI required. If possible, have a fellow trainee evaluate your performance using Procedure 19102 and this instructional unit.

FEEDBACK ON TASK PRACTICE

1. If you have any questions about the notes, cautions, or steps in Procedure 19102, ask your instructor.

2. You should have been able to locate all instrumentation associated with recovering from a loss of ac power with SI required. If you had any diffisulty, ask your instructor for help.

3. You should have simulated the steps necessary to recover from a loss of ac power with SI required. If you had any difficulty, re-read the pertinent sections of this instructional unit and the procedure. Resolve any questions with your instructor.