A-171 I

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DEPARTMENT: NSAC EXT. NO. 3105

VOGTLE ELECTRIC GENERATING PLANT
NUCLEAR OPERATIONS
ROUTE 2, BOX 1600
WAYNESBORO, GEORGIA 30830

SPECIAL INSTRUCTIONS: _____

NUCLEAR REGULATORY COMMISSION
Docket No. 50-424/425-OLA-3 EXHIBIT NO. GPC II-171 I
In the matter of Georgia Power Co. et al., Vogtle Units 1 & 2
☐ Staff ☒ Applicant ☐ Intervenor ☐ Other
☒ Identified ☒ Received ☐ Rejected Reporter SD
Date 09-06-95 Witness Webb

16

92 PROJECT 057612

LER 1-90-c

LOSS OF OFFSITE POWER LEADS TO SITE AREA EMERGENCY

EVENT DATE: 3-20-90

ABSTRACT

On 3-20-90, Unit 1 was in a refueling outage and Unit 2 was operating at 100% power. At 0820 CST, the driver of a fuel truck in the switchyard backed into a support for the phase "C" insulator for the Unit 1 Reserve Auxiliary Transformer (RAT) 1A. The insulator and line fell to the ground, causing a phase to ground fault. Both Unit 1 RAT 1A and Unit 2 RAT 2B High Side and Low Side breakers tripped, causing a loss of offsite power condition (LOSP). Unit 1 Diesel Generator (DG) 1A and Unit 2 DG 2B started, but DG1A tripped, causing a loss of residual heat removal (RHR) to the reactor core since the Unit 1 Train B RAT and DG were out of service for maintenance. A Site Area Emergency (SAE) was declared and the site Emergency Plan was implemented. The core heated up from 90 degrees F to 136 degrees F before the DG was emergency started at 0856 CST and RHR was restored. At 0915 CST, the SAE was downgraded to an Alert after onsite power was restored.

The direct cause of this series of events was a cognitive personnel error. The truck driver failed to use proper backing procedures and hit a support, causing the phase to ground fault and LOSP. The most probable cause of the DG1A trip was the intermittent actuation of the DG jacket water temperature switches.

Corrective actions include strengthening policies for control of vehicles, extensive testing of the DG and replacement of suspect DG temperature switches.

The driver, checked the welding machine that was in the area and found that it did not need fuel. He returned to the fuel truck and was in the process of backing out of the area when he hit a support holding the phase "C" insulator for the RAT 1A. The insulator and line fell to the ground, causing a phase to ground fault, and the transformer tripped.

At 0820 CST, both Unit 1 RAT 1A and the Unit 2 RAT 2B High Side and Low Side breakers tripped causing a loss of offsite power condition (LOSP) to the Unit 1 Train A Class 1E 4160 volt buss 1AA02, the Unit 2 Train B Class 1E buss 2BA03, and the 480 volt busses supplied by 1AA02 and 2BA03. The Unit 1 Train B Class 1E 4160 volt buss 1BA03 also lost power since RAT 1A was feeding both Trains of Class 1E 4160 volt busses. The loss of power caused the associated ESF Actuation System Sequencers to send a start signal to one Unit 1 and one Unit 2 Diesel Generators. DG1A and DG2B started and sequenced the loads to their respective busses. Further description of the Unit 2 response to this event is provided in LER 50-425/1990-002.

One minute and twenty seconds after the DG1A engine started and sequenced the loads to the Class 1E bus, the engine tripped. This again caused an undervoltage (UV) condition to class 1E bus 1AA02. The UV signal is a maintained signal at the sequencer. However, since DG1A was coasting down from the trip, the shutdown logic did not allow the DG fuel racks or starting air solenoids to open and start the engine. This caused the engine starting logic to lockup, a condition that existed until the UV signal was reset. For this reason, DG1A did not re-start by itself after it tripped.

After the trip, operators were dispatched to the engine control panel to investigate the cause of the trip. According to the operators, several annunciators were lit. Without fully evaluating the condition, the operators reset the annunciators. During this time, a Shift Supervisor (SS) and a Plant Equipment Operator (PEO) went to the sequencer panel to determine if any problems were present on the 1A sequencer. The SS quickly pushed the UV reset button, then reset the sequencer by deenergizing and energizing the power supply to the sequencer. This caused the air solenoid to energize for another 5 seconds which caused the engine to start. This happened 19 minutes after the DG tripped the first time. The engine started and the sequencer sequenced the loads as designed. After 1 minute and 10 seconds, the breaker and the engine tripped a second time. It did not automatically re-start due to the starting logic being blocked as described above. By this time, operators, a maintenance foreman and the diesel generator vendor representative were in the DG room. The initial report was that the jacket water pressure trip was the cause of the trip. The maintenance foreman and vendor representative observed that the jacket water pressure at the gauge was about 12-13 PSIG. The trip set point is 6 PSIG and the alarm setpoint is 8 PSIG. Also, the control room observed a lube oil sensor malfunction alarm.

Fifteen minutes after the second DG1A trip, DG1A was started from the engine control panel using the emergency start breakglass button. The engine started and loads were manually loaded. When the DG is started in emergency mode, all the trips except four are bypassed. However, all alarms will be annunciated. During the emergency run, no trip alarms were noticed by the personnel either at the control room or at the engine control panel. The only alarms noted by the control room operator assigned for DG operation were lube oil pressure sensor malfunction and fuel oil level High/Low alarm.

At 1040 CST, RAT 1B was energized to supply power to the 4160 volt buss 1BA03. DG1A supplied power to the 4160 volt buss 1AA02 until 1157 CST, at which time the 1AA02 buss was tied to RAT 1B.

A Site Area Emergency was declared at 0840 CST, due to a loss of all off-site and on-site AC power for more than 15 minutes. The Emergency Director signed the notification form used to inform off-site government agencies of the emergency at 0848 CST and notifications began at 0857 CST. Due to the loss of power, which rendered the primary Emergency Notification Network (ENN) inoperable, and some mis-communication, the initial notification was not received by all agencies until 0935 CST. Subsequent notifications were made without difficulty.

The Emergency Director instructed personnel to complete various tasks for restoring containment and RCS integrity. All work was accomplished and maintenance personnel exited containment by 1050 CST.

The SAE was downgraded to an Alert Emergency at 0915 CST after restoration of core cooling and one train of electrical power. By 1200 CST, plant conditions had stabilized with both trains of electrical power being supplied from off-site sources (RAT 1B) After discussions with the NRC and local government agencies, the emergency was terminated at 1247 CST and all agencies were notified by 1256 CST.

D. CAUSE OF EVENT

Direct Causes:

1) The direct cause of the loss of offsite class 1E AC power was the fuel truck hitting a pole supporting a 230kV line for RAT 1A.

2) The direct cause of the loss of onsite class 1E AC power was the failure of the operable DG, DG1A, to start and load the LOSP loads on bus 1AA02.

Root Causes

1) The truck driver met all current site training and qualification requirements, including holding a Class 2 Georgia driver's license. However, site safety rules, which require a flagman for backing vehicles when viewing is impaired, were violated.

2) The root cause for the failure of DG1A has not been conclusively determined. There is no record of the trips that were annunciated after the first trip because the annunciators were reset before the condition was fully evaluated. Therefore, the cause of the first trip can only be postulated, but it was most likely the same as that which caused the second trip. The second trip occurred at the end of the timed sequence of the group 2 block logic. This logic allows the DG to achieve operating conditions before the trips become active. The block logic timed out and the trip occurred at about 70 seconds. The annunciators observed at the second trip included jacket water high temperature along with other active trips. In conducting an investigation, the trip conditions that were observed on the second DG trip on 3-20-90 could be duplicated by venting 2 out of 3 jacket water temperature sensors, simulating a tripped condition. The simulation duplicated both the annunciators and the 70 sec. trip time. The most likely cause of the DG trips was intermittent actuation of jacket water temperature switches.

   Following the 3-20-90 event, all three jacket water temperature switches were bench tested. Switch TS-19110 was found to have a setpoint of 197 degrees F, which was approximately 6 degrees below its previous setting. Switch TS-19111 was found to have a setpoint of 199 degrees F, which was approximately the same as the original setting. Switch TS-19112 was found to have a setpoint of 186 degrees F, which was approximately 17 degrees F below the previous setting and was re-adjusted. Switch TS-19112 also had a small leak which was judged to be acceptable to support diagnostic engine tests and was reinstalled. The switches were recalibrated with the manufacturer's assistance to ensure a consistent calibration technique.

   During the subsequent test run of the DG on 3-30-90, one of the switches (TS-19111) tripped and would not reset. This appeared to be an intermittent failure because it subsequently reset. This switch and the leaking switch (TS-19112) were replaced with new switches. All subsequent testing was conducted with no additional problems.

A test of the jacket water system temperature transient during engine starts was conducted. The purpose of this test was to determine the actual jacket water temperature at the switch locations with the engine in a normal standby lineup, and then followed by a series of starts without air rolling the engine to replicate the starts of 3-20-90. The test showed that jacket water temperature at the switch location decreased from a standby temperature of 163 degrees F to approximately 156 degrees F and remained steady.

Numerous sensor calibrations (including jacket water temperatures), special pneumatic leak testing, and multiple engine starts and runs were performed under various conditions. Since 3-20-90, DG1A and DG1B have been started several times and no failures or problems have occurred during any of these starts. In addition, an undervoltage start test without air roll was conducted on 4-6-90 and DG1A started and loaded properly.

Based on the above facts, it is concluded that the jacket water high temperature switches were the most probable cause of both trips on 3-20-90.

4. ANALYSIS OF EVENT

The loss of offsite power to Class 1E buss 1BA03 and the failure of DG1A to start and operate successfully, coupled with DG1B and RAT 1B being out of service for maintenance, resulted in Unit 1 being without AC power to both Class 1E busses. With both Class 1E busses deenergized, the RHR System could not perform its required safety function. Based on a noted rate of rise in the RCS temperature of 16 degrees F, measured at the core exit thermocouples over a fifteen minute period, the RCS water would not have been expected to begin boiling until approximately 1 hour and 50 minutes after the beginning of the event.

Restoration of RHR and closure of the containment equipment hatch were completed well within the estimated 1 hour and 50 minutes for the projected onset of boiling in the RCS. A review of information obtained from the Process and Effluent Radiation Monitoring System (PERMS) and grab sample analysis indicated all normal values. As a result of this event, no increase in radioactive releases to either the containment or the environment occurred.

Additional systems were either available or could have been made available to ensure the continued safe operation of the plant:

1) The maintenance on RAT 1B was completed and the RAT was returned to service approximately 2 hours into the event.

2) Offsite power was available to non-1E equipment through the generator step-up transformers which were being used to "back-feed" the Unit Auxiliary Transformers (UAT) and supply the non-1E busses. Provided that the phase to ground fault was cleared, Class 1E busses 1AA02 and 1BA03 could have been powered by feeding through non-1E bus 1NA01.

3) The Refueling Water Storage Tank could have been used to manually establish gravity feed to the RCS to maintain a supply of cooling water to the reactor.

Consequently, neither plant safety nor the health and safety of the public was adversely affected by this event. A more detailed assessment of this event and an assessment of potentially more severe circumstances will be performed and included in a supplemental LER.

F. CORRECTIVE ACTIONS

1)

a)A management policy on control and operation of vehicles has been established.

b)Temporary barricades have been erected which directs authorization for control of switchyard traffic to the SS.

2)

a)The Loss of Off-site Power (LOSP) diesel start and trip logic has been modified so that an automatic "emergency" start will occur upon LOSP. Therefore, non-essential diesel engine trips are blocked upon LOSP. The Unit 2 DG's will be modified by 4-30-90.

b)The DG1A test frequency will be increased to once every 7 days in accordance with Technical Specification Table 4.8-1. This frequency will be continued until 7 consecutive valid tests are completed with no more than one valid failure in the last 20 valid tests. Including the two valid failures of this event, there have been a total of four valid failures in 66 valid tests of DG1A.

c)Operators are being trained prior to their next shift to ensure that they understand that an emergency reset will override the high jacket water temperature trip.

3)

Further corrective actions will be addressed in a supplemental LER.

G. ADDITIONAL INFORMATION

1. Failed Components:
   Jacket Water High Temperature Switches manufactured by California Controls Company.
   Model # A-3500-W3

2. Previous Similar Events:
   None

3. Energy Industry Identification System Code:

   Reactor Coolant System - AB
   Residual Heat Removal System - BP
   Diesel Generator Lube Oil System - LA
   Diesel Generator Starting Air System - LC
   Diesel Generator Cooling Water System - LB
   Diesel Generator Power Supply System - EK
   Safety Injection System - BQ
   13.8 kV Power System - EA
   4160 volt non-1E power system - EA
   4160 volt Class 1E power system - EB
   Chemical and Volume Control System - CB
   Containment Building - NH
   480 volt Class 1E Power System - ED
   Engineered Safety Features Actuation System - JE
   Radiation Monitoring System - IL