A-171D JGA Commer

4-12-90-A

GPC EXHIBIT II-171-D
WEBB EX. C.4

DOCKETED
USNRC

'95 OCT 20 P3:06

OFFICE OF SECRETARY
DOCKETING & SERVICE

LER 1-90-6

LOSS OF OFFSITE POWER LEADS TO SITE AREA EMERGENCY

EVENT DATE: 3-20-90

ABSTRACT

On 3-20-90, Unit 1 was in a re-fueling outage and Unit 2 was operating at 100% power. At 0820 CST, a fuel truck in the switchyard backed into the support holding 'C' phase 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 1B Hi Side and Low Side breakers tripped, causing a loss of offsite power condition (LOSP). Both units' emergency Diesel Generators (DG's) started, but the Unit 1 DG 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 to 138 degrees F before the DG was emergency started at 0856 CST and RHR restored. At 0915 CST, the SAE was downgraded to an Alert after onsite power was restored.

The direct cause of these series of events is a cognitive personnel error. The truck driver failed to use proper backing procedures in the switchyard and hit a support, causing the phase to ground fault and LOSP. The most probable cause of the DG1A trip is 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 switches.

NUCLEAR REGULATORY COMMISSION
Docket No. 50-424/425-OLA-3 EXHIBIT NO. GPC II-171D
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

A. REQUIREMENT FOR REPORT

This event is reportable per: a) 10 CFR50.73 (a)(2)(iv), because an unplanned Engineered Safety Feature (ESF) actuation occurred when the ESF Actuation System Sequencer started, and b) Technical Specification 4.8.1.1.3, because a diesel generator failure occurred. Additionally, this report is a summary of the Site Area Emergency event.

B. UNIT STATUS AT TIME OF EVENT

Unit 1 was in Mode 6 (Refueling) at 0% rated thermal power. The reactor ~~was~~ has been shutdown on 2-23-90 for a 45 day scheduled re-fueling outage. The reactor core reload had been completed, the initial pass to tension the reactor vessel head studs was complete, and the outage team was waiting permission from the control room to begin the final tensioning. Reactor Coolant System (RCS) level was being maintained at mid-loop (187'-11") with Train A Residual Heat Removal (RHR) pump in service for decay heat removal. RCS temperature was being maintained at approximately 90 degrees F.

Due to the refueling outage maintenance activities in progress, some equipment was out of service and several systems were in abnormal configurations. The Train B Diesel Generator (DG1B) was out of service for a required 36 month maintenance inspection. The Train B Reserve Auxiliary Transformer (RAT 1B) had been removed from service for an oil change. 1BA03, the Train B Class 1E 4160 Volt switchgear, was being powered from the Train A RAT (1A) through its alternate supply breaker. All Non-1E switchgear was being powered from the Unit Auxiliary Transformer (UAT). All Steam Generator (S/G) Nozzle Dams had been removed, but only S/G's #1 and #4 had their primary manways secured. Maintenance personnel were in the process of restoring the primary manways on S/G's #2 and #3. ~~It was necessary to maintain the~~ RCS level being maintained at mid-loop for the valve repairs and the S/G manway restorations. In addition, the pressurizer manway was removed to provide a RCS vent path.

~~Additionally, the Emergency~~ Response Facility (ERF) computer was not capable of providing reliable historical data to the ERF facilities during this event.

C. DESCRIPTION OF EVENT

On March 20, 1990, at approximately 0817 CST, a contractor truck driver and security escort entered the protected area driving a fuel truck. The driver's duties were to refuel air compressors and welding machines staged around the site for the outage on Unit 1. He had had these duties for the past three weeks.

The driver, who generally backs into the switchyard to fuel the machines in this area, pulled straight in. He 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 when he hit a support holding "C" phase insulator for the Unit 1 RAT 1A. The insulator and line fell to the ground, causing a phase to ground fault, and the transformer tripped.

At 0820CST, both RAT 1A and the Unit 2 RAT 1B Hi 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. Unit 2 was in a normal and sent a start signal to Unit 1 and Unit 2 Diesel Generators. DG1A and DG2B started and sequenced the loads to their respective busses. Further description of the Unit 2 event is described 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 under voltage (UV) condition to class 1E bus 1AA02. The additional UV signal is a maintained signal at the sequencer. DG1A starting logic receives this signal and relays R-4A, TD2A and SOL-202-1A (activate shut-downs) energize. 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 lock-up, a condition that existed until the UV signal was reset and relay TD2A deenergized. 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. On the generator panel, the voltage balance relay was also found to be actuated. During this time, a Shift Supervisor (SS) and Plant Equipment Operator (PEO) went to the sequencer panel to find out if any problems were present on 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 TD2A relay to deenergize and meet the permissive for starting 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 start back due to the starting logic being blocked as described above. At 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 annunciators were 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 run were lube oil pressure sensor malfunction and fuel oil level High/Low alarm.

DG1A ran until 1157 CST, supplying power to the 1AA02 4160 volt buss. At 1040 CST, RAT 1B was energized to supply power to the 1BA03, 4160 volt, Class 1E Train B buss. At 1157 CST, the 1AA02 buss was tied to RAT 1B.

Because of the equipment problem being experienced a

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 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 the following tasks prior to leaving containment:

a) 1HV-8808D reassembly and bonnet bolts tightened. This is the SI Accumulator #4 isolation valve.
b) Complete installation of Steam Generators #2 and #3 manways.
c) Close the equipment hatch and reinstall the interlocks on the personnel air lock.

All work was accomplished and maintenance personnel exited containment by 1050 CST.

The SAE was downgraded to an Alert Emergency at 0915 CST. By 1200 CST, plant conditions had stabilized with off-site power restored to Unit 1 and RHR established for core cooling. The Emergency Director initiated a conference call with local government agencies to discuss termination of the emergency. This was also discussed with the NRC. Agreement was reached with all parties that the emergency would be terminated. The emergency was terminated at 1247 CST and agencies were notified by 1256 CST.

3. CAUSE OF EVENT

3.1 Direct Causes

a) The direct cause of the loss of off-site class 1E AC power was the fuel truck hitting a pole supporting a 230kV line for RAT 1A, which caused the loss of off-site power.
b) The direct cause of the loss of on-site class 1E power was the failure of the operable DG, DG1A, to start and load the LOSP loads on bus 1AA02.

3.2 Root Causes

a) The truck driver met all current site training and qualification requirements, including holding a Class 2 Georgia driver's license. However, to drive the same truck on state highways would have required a Class 4 license. The site requirement was therefore, inadequate. Furthermore, site safety rules requiring a flagman for backing vehicles when viewing is impaired were violated.

b) 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. The cause of the first trip can therefore only be postulated, but most likely has the same root cause as the second trip. The second trip occurred at the end of the timed sequence of the group 2 block logic. This logic provides for the DG to come up to 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. It is believed that the jacket water trip is the most likely cause of the second trip. In conducting an investigative test plan, the trip conditions that were observed on the second DG trip on 3/20/90 were essentially recreated by venting 2 out of 3 temperature sensors, simulating a tripped condition. The recreation duplicated both the annunciators and the 70 sec. trip time. This most likely cause assumes an intermittent actuation of jacket water temperature switches.

Following the 3-20-90 event, all three 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 has been started 18 times, and DG1B has been started 19 times. 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, ~~we have~~ 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 the Class 1E buss 1BA03 and 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 de-energized, the Residual Heat Removal (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.

The steam generator primary side manway installation and closure of the containment equipment hatch were completed after re-establishing RHR, both well within the estimated 1 hour 50 minutes prior to 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 significant 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:

a) The maintenance on RAT 1B was completed and the RAT returned to service approximately 2 hours into the event.
b) 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. Class 1E busses 1AA02 and 1BA03 could have been powered by feeding through Non-1E bus 1NA01.
c) The Refueling Water Storage Tank could have been used to manually establish gravity feed through the RHR and/or Chemical and Volume Control System (CVCS), and Safety Injection (SI) 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

a)
1)Onsite truck driver license requirements will be changed to match state requirements by 7-1-90.
2)Sensitive and vulnerable areas inside the the protected area will be evaluated by 7-1-90 and appropriate barriers erected or controls established.

b)
1)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.
2)DG operating procedures will be revised to include specific instructions for restarts following a DG trip during LOSP by 7-1-90.
3)Operator guidance on recording pertinent alarms and indications is being developed in order to assist in investigations of future plant events and will be in place by 5-1-90.
4)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 and and one or less valid failures have occurred in the last 20 valid tests. Including these two valid failures, there have been a total of four valid failures in 66 valid tests of DG1A.

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
   Administration Building - MA
   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
   Plant Page System - FJ
   Security System - IA
   Component Cooling Water System - CC
   Nuclear Service Cooling Water System - BS
   Radiation Monitoring System - IL