

A-171F  
LER 1-90-6

BOOKETED  
11/14/91  
#312  
01545

LOSS OF OFFSITE POWER LEADS TO SITE AREA EMERGENCY  
OCT 20 P3:08

EVENT DATE: 3-20-90

OFFICE OF SECRETARY  
OF ENERGY  
REGULATORY & SERVICE  
COMMISSION

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 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 2B High 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 136 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.~~

a  
for the

The direct cause of <sup>this</sup> series of events was 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 was the intermittent actuation of the DG jacket water temperature switches.

was was

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

was

temperature

{ Unit 1 Diesel Generator (DG) and Unit 2 ~~DG~~ but DG1A tripped, ~~DG~~ 2E started

NUCLEAR REGULATORY COMMISSION

Docket No. 50-424/425-OLA-3 EXHIBIT NO. GRC II-171F  
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 CFR 50.73 (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 8 (Refueling) at 0% rated thermal power. The reactor had been shutdown on 2-23-90 for a 45 day scheduled refueling outage. The reactor core reload had been completed, the initial ~~pressurizing~~ tensioning the reactor vessel head studs was complete, and the outage team was awaiting permission from the control room to begin the final tensioning. Reactor Coolant System (RCS) level was being maintained at mid-loop ~~(100%)~~ with Train A Residual Heat Removal (RHR) pump in service for decay heat removal. The 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. ~~The~~ 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. RCS level was being maintained at mid-loop for 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 activities during this event.

## C. DESCRIPTION OF EVENT

On March 20, 1990, at approximately 0817 CST, a truck driver and security escort entered the protected area driving a fuel truck.

Although not a member of the plant operations staff, the driver was a Georgia Power Company employee belonging to a group under contract to perform various plant services. 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.

*Jordan's rally mission.*

The driver <sup>the</sup> who ~~generally backs into the switchyard to fuel the machines in this area, pulled straight in~~ 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 <sup>C</sup> phase 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 RAT 1A and the Unit 2 RAT ~~2B~~ <sup>High Side</sup> and Low Side breakers tripped causing a loss of offsite power, condition (LOSP) to the Unit 1 Train A Class 1E 4160 volt bus <sup>1AA02</sup>, the Unit 2 Train B Class 1E bus <sup>2BA03</sup>, and the 480 volt busses supplied by 1AA02 and 2BA03. The Unit 1 Train B Class 1E 4160 volt bus <sup>1BA03</sup> 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 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.

*response to this provided*

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 ~~under voltage~~ UV signal is a maintained signal at the sequencer. ~~When starting logic receives this signal and relay R-11, TDA and COL see it (activate shut-down) 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 <sup>up</sup>, a condition that existed until the UV signal was reset, ~~and relay TDA was energized~~. For this reason, DG1A did not re-start by itself after it tripped. *However,*

After the trip, operators were dispatched <sup>the</sup> 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 <sup>determine</sup> ~~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 TDA relay to deenergize and reset the permissive for 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~~ <sup>re-start</sup> ~~start~~ due to the starting logic being blocked, <sup>as described above.</sup> ~~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~~ *automatically*

*By* *was*

Foreman and vendor representative observed that the Jacket water pressure at the gauge was about 12-13 PSIG. The trip set point is 8 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 were lube oil pressure sensor malfunction and fuel oil level High/Low alarm.

operation  
replace  
with



~~Because of the equipment problems being experienced,~~ 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.

*which rendered the primary Emergency Notification Network (ENW) inoperative.*  
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. *after restoration of core cooling and one train of electrical power*

The SAE was downgraded to an Alert Emergency at 0915 CST. By 1200 CST, plant conditions had stabilized with ~~adequate power restored to Unit 1 and DHR 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.

*both trains of electrical power being supplied from offsite sources (2A7)*

*After discussions with the NRC and local government agencies,*

### D. CAUSE OF EVENT

#### Direct Causes:

1. 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.~~
2. 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

AC

INSERT

At 1040 CST, RAT 1B was energized to supply power to 4160 volt Bus 1AA03. DG 1A supplied power to 4160 volt bus 1AA02 until 1157 CST, at which time bus 1AA02 was tied to RAT 1B.

~~Root Causes:~~ Root Causes;

1. (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 these highways would have required a Class 1 license. The site environment was different, in addition, furthermore -~~ site safety rules, requiring a flagman for backing, vehicles when viewing is impaired, were violated.

*because the annunciators were reset ~~and~~ before the condition was fully evaluated.*

2. (b) The root cause for the failure of DG1A <sup>which is</sup> 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 was~~ *Therefore, it was*

*Not which caused*

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 ~~prevents~~ *achieve* the DG to ~~operate~~ *allows* 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 investigation, the trip conditions that were observed on the second DG trip on 3-20-90 ~~were essentially recreated by~~ *duplicated* 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.~~

*jacket water simulation could be jacket water temperature*  
Following the 3-20-90 event, all three switches were bench tested. Switch TS-19110 was found to have a setpoint of 187 degrees F, which was approximately 6 degrees below its previous setting. Switch TS-19111 was found to have a setpoint of 189 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.

*The most likely cause of the two trips was intermittent actuation of the jacket water temperature switches*

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 ~~the~~ Class 1E bus 1BA03 and <sup>the</sup> 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 ~~Residual Heat Removal~~ <sup>ORHR</sup> 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

~~The steam generator primary side mainway installation and closure of the containment equipment hatch were completed after re-establishing ORHR, 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:

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

provided that the phase to ground fault was cleared

- 2. 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 ~~RAIR 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

- 1 ~~20~~ Offsite truck driver license requirements will be changed to match state requirements by 6-1-90. (Have state 222)
- 1 ~~20~~ Sensitive and vulnerable areas inside the the protected area will be evaluated by 7-1-90 and appropriate barriers erected or controls established.
- 2 ~~20~~ 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 trips~~ <sup>are</sup> blocked upon LOSP. diesel engine
- 3 ~~20~~ DG operating procedures will be revised to include specific instructions for restarts following a DG trip during LOSP, <sup>by 7-1-90</sup> ~~by 7-1-90.~~ Care
- 4 ~~20~~ 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.
- 5 ~~20~~ 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 one or more valid failures have occurred~~ in the last 20 valid tests. Including the ~~two~~ two valid failures, there have been a total of four valid failures in 66 valid tests of DG1A.

With no more than of this event



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 - FI~~

~~Security System - IA~~

~~Component Cooling Water System - CC~~

~~Nuclear Service Cooling Water System - BC~~

Radiation Monitoring System - IL