



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W.
 ATLANTA, GEORGIA 30323

Report No.: 50-400/89-27

Licensee: Carolina Power and Light Company
 P. O. Box 1551
 Raleigh, NC 27602

Docket No.: 50-400

License No.: NPF-63

Facility Name: Harris 1

Inspection Conducted: October 10-12, 1989

Inspectors: *T.E. Conlon for* 10/27/89
 A. Ruff, Team Leader Date Signed

J. Harris 10/26/89
 J. Harris Date Signed

T.E. Conlon for 10/27/89
 W. Miller Date Signed

Approved by: *T.E. Conlon* 10/27/89
 Thomas E. Conlon, Chief Date Signed
 Plant Systems Section
 Engineering Branch
 Division of Reactor Safety

SUMMARY

Scope:

This special announced inspection was conducted to investigate a fire that occurred at the Shearon Harris Nuclear Plant. The fire was due to an electrical fault and a subsequent fire that occurred at 2306 p.m. on October 9, 1989.

Results:

In the areas inspected, violations or deviations were not identified. Overall the fire fighting operations limited the fire damage to the points of origin and prevented the fire spread to adjacent equipment. This can be attributed to a sound brigade training program and the professionalism demonstrated by the fire brigade members. However, the decision to respond to the fire without self contained breathing apparatus, although not a factor in this fire is not considered a good practice. Corrective action should be taken to prevent future occurrence on this item.

8911010067 891026
 PDR ADCK 05000400
 Q PDC



REPORT DETAILS

1. Persons Contacted

Licensee Employees

H. Avinger, Senior Electrical Engineer
*G. Collins, Manager Operations
*G. Forehand, Manager, Quality Assurance/Quality Control
*C. Gibson, Director, Projects and Procedures
*J. Hammond, Manager, Onsite Nuclear Safety
K. Hefner, Senior Electrical Engineer
*C. Hinnant, Plant General Manager
*A. Howe, Senior Specialist Regulatory Compliance
*J. Morris, Senior Electrical Engineer
R. Rabuld, Senior Electrical Engineer
*R. Richey, Manager, Harris Nuclear Project
*J. Sipp, Manager, E and RC
*M. Stokes, Senior Specialist Fire Protection
*M. Wallace, Senior Specialist Regulatory Compliance
*E. Willex, Manager Outages and Modifications
*L. Woods, Engineering Supervisor Technical Support
*R. Zula, Project Engineer Technical Support

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, mechanics, security force members, technicians, and administrative personnel.

NRC Resident Inspectors

*J. Tedrow, Senior Resident Inspector
*M. Shannon, Resident Inspector

*Attended exit interview

2. Followup on Regional Request (92705)

a. On October 9, 1989, the plant was operating at 100 percent reactor power. At approximately 11:06 p.m., four loud bangs or explosions were heard followed by receipt of multiple annunciator alarms in the control room. Both the turbine and reactor tripped automatically. The trips were apparently caused by an electrical fault in the generator to the main station transformer distribution system. This fault caused excessive heat in the bus which ignited combustible components in the duct termination box at the transformer "B" and the grounding of the neutral transformer on the 286 elevation of the turbine building. The heat also ruptured the hydrogen seal of the generator. When the seal ruptured the hydrogen, normally maintained

at approximately 60 psi, was discharged out the ruptured seal to the south end of the generator on the 314 elevation, and to the area directly beneath the generator at the 286 elevation. This hydrogen gas provided additional fuel which was immediately ignited by the heat from the electrical fault.

Therefore, within seconds, there were at least three separate fires involving the main transformer B, area around the neutral transformer and exciter end of the generator.

The fire brigade responded to the fire at 11:11 p.m. Offsite assistance was also requested and was provided by the Holly Springs and Fuquay-Varina Fire Department.

b. Sequence of Events, October 9, 1989 and October 10, 1989.

<u>Approximate Time</u> <u>October 9, 1989</u>	<u>Events</u>
2303 PM	Four loud bangs or explosion noises heard. Turbine trip from generator lockout relay.
2306 PM	Reactor trip from turbine trip.
2309 PM	Auxiliary operator reported fire in "B" phase generator transformer. Fire brigade was dispatched South end of turbine building was evacuated.
2311 PM	Fire brigade was assembled in staging area on the Northwest corner of 261 elevation of turbine building. Auxiliary operators reported: arcing and sparks coming from 236 elevations of south end of turbine building.
2314 PM	Fire Technical Aid (Fire brigade member) arrived at B transformer. Manually tripped transformer deluge fire protection valve from manual actuation station in South end 261 elevation of turbine building. Both fire pumps started on pressure drop from activated deluge system. Fire brigade members arrived at transformer in full turnout gear except for self contained breathing apparatus.



Approximate Time
October 9, 1989
(cont'd)

Events

Two fire brigade members were dispatched to the 286 elevation of the turbine building to obtain foam fire fighting equipment and noted flame approximately eight feet long and four inches in diameter coming from the ceiling area.

Auxiliary operator advised control room of potential hydrogen gas fire in the ceiling of 286 elevation at southeast corner of turbine building.

2315 PM

Fire brigade members pulled three one and half inch fire hoses from standpipe hose station in south end of 286 foot elevation of turbine building.

Auxiliary operator isolated hydrogen to generator by closing valve at the hydrogen skid.

2318 PM

The fire brigade team leader responded to the 286 elevation south portion of turbine building to direct the fire fighting operations. The shift supervisor requested assistance from offsite via 911 emergency telephone system.

One fire brigade member checked the 314 elevation of the turbine building for fire spread and found a four foot wide by four foot long fire coming from the South end of the generator.

2319 PM

A one and half inch fire hose was pulled from the standpipe hose stations located on the west side of the 314 elevation of the turbine building.

2320 PM

Wade County Emergency Center dispatched a fire alarm to Holly Springs and Fuguay-Varnia Fire Departments.

Approximate Time
October 9, 1989
 (cont'd)

Events

2324 PM

The generator fire was extinguished. However, hose streams continued to discharge into the fire damaged generator for cooling and to prevent reignition.

2332 PM

Emergency Alert classification was declared.

2336 PM

Holy Springs Fire Department arrived at the fire scene with one pumper and nine fire fighters including the fire chief, and assisted the fire brigade at the 286 and 314 elevations of the turbine building. One additional one and a half inch hose was pulled from a standpipe hose station on the 314 elevation, water was directed to the fire area.

2341 PM

The Fuguay - Varnia Fire Department arrived at the fire scene with one pumper, one utility truck and nine fire fighters including the fire chief. They assisted the fire brigade members at each fire location. State and counties were notified of "Alarm Emergency Classifications."

2400 PM

Fire on 286 elevations of Turbine building was under control but still burning from hydrogen being released into fire area from the damaged hydrogen oil system.

October 10, 1989
 0004 AM

Emergency medical unit from Apex arrived on the fire scene.

0011 AM

NRC notified of alert classification.

0022 AM

NRC resident inspector arrived on site.



Approximate Time
October 9, 1989
(cont'd)

Events

0030 AM Fire fighting personnel were directed to move away from the 286 elevation fire areas as the hydrogen pressure decreased in generator. There was concerns that fire might enter the generator and explode. The hose nozzles were tied down and left unattended and were being discharged into the fire. The deluge valve to the transformer fire protection system was closed.

0040 AM Operators started to purge the generator with CO₂. Fire fighters were permitted to enter the fire area and continue fire fighting operations.

0059 AM Technical Support Center was activated.

0102 AM Fire on 314 elevation of the turbine building at generator was verified to be extinguished and all fire hoses were secured.

0103 AM Generator CO₂ pressures was at 2 psi.

0105 AM Transformer "B" still had small fire in duct termination box on top of generator. Fire brigade was prepared to discharge foam/water hose streams to extinguish the remaining fire.

0115 AM However, at 0115 AM foam was discharged into all three transformers oil collection pits by the fire fighters as a fire prevention measure.

0135 AM Fire fighter discharged one dry, chemical extinguisher into termination box on top of transformers. This extinguished the remaining fire..

0145 AM All fires were extinguished. Walkdown inspection initiated.

0242 AM Alert Terminated.

c. Sequence of Events.

The turbine building fire was extinguished at 12:45 a.m. on October 10 by water supplied from the turbine building fire protection hose stations. The fire was prevented from spreading to the transformer by manually activating the water spray fire protection system provided for the transformer. The fire in the duct termination box on top of the transformer was extinguished by means of a portable dry chemical extinguisher at 1:45 a.m. on October 10.

- d. The NRC inspectors reviewed the fire fighting operations performed and found these actions to be satisfactory. The decisions to request offsite assistance in the early stages of the fire was considered prudent since the normal five man plant fire brigade is only designed to combat a single fire and not to fight multiple fires which are burning at the same time. The prompt actions by the Fire Protection Technical Aid to manually activate the transformer deluge system reduced manual fire fighting requirements and provided appropriate protection for preventing the spread of this fire to the transformer. Overall, the fire fighting operators limited the fire damage to the points of origin and prevented the fire spread to adjacent plant equipment. This can be attributed to a sound fire brigade training program and the professionalism demonstrated by the fire brigade members. However, the decisions to respond to the fire without self contained breathing apparatus, although not a factor in this fire is not considered a good practice, and corrective action should be taken to prevent further occurrence on this item.

Following the fire the plant was maintained in hot shutdown, mode 3, and the licensee elected to enter the refueling outage which was originally scheduled to start on October 21, 1989.

- e. The NRC inspectors interviewed the fire chiefs from the responding offsite fire departments. The fire chiefs expressed their appreciation for the cooperation provided by the plant staff during the emergency events and the training provided to the fire fighters. The security access provided to fire department responding to this event was well organized and permitted rapid egress into the protected area by responding to the fire fighting personnel.
- f. Observations in the Electrical Area for Event of 10-9-89.

In accordance with CP&L's IBMDPROC08 - Relay Coordination-OS4, SHNPP's protective relay systems of the main generator, the main transformer and the unit auxiliary transformers, through the operation of generator lock out relays (86-G1A and 86-G1B) comprise a unified generator-power transformers protective relay system. The components of the system are, (1) Generator-main transformer protective relay system, including the relay protection of the isolated phase bus connection between the components, and (2) Unit auxiliary transformers 1A and 1B protective relay systems.

At SHNPP all electrical faults, with few exception within the boundaries of the above system, result in an immediate trip. The trips are actuated with the operation of either one of the generator lock out relays 86-G1A or 86-G1B. These trips refer to the practice of closing the turbine valves, opening of the high voltage generator breakers and removing excitation to the main generator.

The Sequence of Events (SOE) Recorder indicated that an electrical fault sensed by the Generator-Main Transformer protective relay system (87/GMT1) was the initiating event for the October 9th occurrence. The October 9th significant SOE through the reactor trip are shown below:

<u>Time</u>	<u>Description</u>
23:05:34.391	87/GMT1 Transformer Differential Relay picks up and sends a signal to 86 lockout relay--73 milliseconds later,
23:05:34.464	The first of three low DEH hydraulic pressure switch trips indicating the 86 lockout relay has picked up and the turbine is tripping. 81 milliseconds later,
23:05:34.545	Reactor trip breaker opens.

A licensee representative also stated that oscillograph traces show that the main transformer breakers opened within 4 cycles (66.6 milliseconds) of fault detection which also confirms that the 86 lockout relay had picked up. It appears that all safety systems functioned satisfactorily and as designed.

The licensee, his vendors, and consultants are in the process of doing further investigation, components are being opened and megger testing of the main generator was to commence late on October 12, 1989. The Iso-Phase vendor representatives were scheduled to be on site October 14, 1989.

The damage reported elsewhere in this report was visually observed and the root cause(s) for this event cannot be determined until a more detailed investigation is performed. The licensee's detailed investigation and the opening of components to determine the root cause(s) is still in process. The Licensee stated that a detailed report would be prepared and that a Licensee Event Report (LER) would be issued in 30 days.

As stated previously it appears that all safety systems functioned satisfactorily and as designed.

4. Exit Interview

The inspection scope and results were summarized on October 12, 1989, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results listed above.

5. Acronyms and Initialisms

SHNPP - Shearon Harris Nuclear Power Plant
SOE - Sequence of Events
LER - Licensee Event Report
CP&L - Carolina Power and Light Company