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

Report No: 50-261/92-25

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

Docket No.: 50-261 License No.: DPR-23

Facility Name: H.B. Robinson

Inspection Conducted: August 24-28, 1992

Inspectors: MB Shymlock for — Sept 30, 92
G.T. MacDonald — Date Signed

Approved by: MB Shymlock — Sept 30, 92
Milton B. Shymlock — Date Signed
Plant Systems
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This special announced inspection was conducted to evaluate the plant and licensee response to the Loss of Offsite Power event on August 22, 1992. An assessment was also made of the plant's capability for restoring offsite power via backfeeding through the main and unit auxiliary transformers.

Results: On August 22, 1992 a moisture induced short circuit in the Startup Transformer (SUT) sudden pressure relay cable connector caused a spurious SUT sudden pressure relay fault signal which cleared the SUT. Following the fault signal a turbine runback, a turbine trip and a reactor trip occurred resulting in a loss of offsite power (LOSP). The single failure in a non-safety related instrument cable connection caused a plant trip and a challenge to plant safety systems.

The initial response to the event was good, plant safety systems functioned as expected and plant personnel stabilized the plant in natural circulation. The plant's emergency response was good with parallel recovery methods considered. Transmission maintenance

department response and rapid diagnosis of the cause of the fault signal was good. Plant recovery efforts after the transformer was repaired were not as good as the initial plant response.

During the review of the event response, one potential violation and three inspector follow up items were noted. The potential violation (paragraph 5.0) involved inadequate procedural guidance for operation of Startup to 4KV Bus 2 Breaker 52/12. The inspector followup items involved: control of work and modification of switchyard equipment (paragraph 4.0), SUT reliability improvements (paragraph 3.0), followup on procedures for backfeed under LOSP conditions with SUT unavailable (paragraph 6.0).

REPORT DETAIL

1. Persons Contacted

Licensee employees

R. Abbott, Senior Specialist Technical Support Electrical
*R. Barnett, Manager, Outage & Modifications
C. Baucom, Project Specialist Regulatory Compliance
*D. Billings, Senior Reactor Operator
*S. Billings, Technical Aide Regulatory Compliance
*B. Clark, Manager, Maintenance
*D. Crook, Senior Specialist Regulatory Compliance
*C. Dietz, Vice President, Robinson Nuclear Project Department
W. Flanagan, Manager, Operations
*J. Harrison, Manager, Regulatory Compliance
R. Lamb, Engineer, Nuclear Engineering Department
*A. McCauley, Manager, Electrical Subsystems
G. McKenzie, Manager,Transmission Maintenance Florence
T. McNamara, Engineer, Technical Support Electrical
R. Moore, Shift Supervisor, Operations
*J. Padgett, Manager, Environment and Radiological Control
*M. Page, Manager, Technical Support
J. Prim, Staff Engineer Transmission Maintenance Southern Division
*E. Shoemaker, Manager, Operations Programs
D. Stadler, Onsite Licensing Engineer
D. Tolman, Senior Engineer Technical Support Electrical
R. Wallace, Manager, Operations Coordinator

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, and technicians.

NRC Employees

*L. Garner, Senior Resident Inspector
*C. Ogle, Resident Inspector

* Attended exit interview

Acronyms and abbreviations used throughout this report are listed in the last paragraph.

2.0 Sequence of Events

On August 22, 1992 a moisture induced fault in the SUT sudden pressure relay cable caused a spurious sudden pressure fault which cleared the SUT. This de-energized 4KV Bus 3, 480 V Bus E2, and Instrument Bus 4. Subsequently a turbine runback, turbine trip and a reactor trip occurred. The following is a summary of the sequence of events, which was gathered from OSC and TSC logs, Shift Supervisor and Control Room logs, Scram Review Package, Plant Status logs, and personnel interviews.

August 22, 1992

10:07 a.m.	Loss of SUT giving loss of Bus E2 and Inst. Bus 4, B EDG started, Bus E2 loaded on B EDG per blackout sequencer.
10:09 a.m.	Reactor trip due to turbine trip, high level in A S/G.
10:10 a.m.	Turbine generator lockout relay energized; A EDG start; Loss of RCPs; LOSP; RCS on natural circulation.
10:18 a.m.	Manual Safety Injection, unable to keep Pressurizer level greater than 10%.
10:23 a.m.	Pressurizer level back on scale.
10:25 a.m.	Declared Unusual Event, Loss of Offsite Power.
10:41 a.m.	Reset Safety Injection.
10:55 a.m.	Relay crew and line crew dispatched to plant per load dispatcher.
10:58 a.m.	EDGs and safeguards equipment verified ok.
11:03 a.m.	Verified RCS on natural circulation.
11:10 a.m.	Activated offsite ERO.
12:13 p.m.	Marvin Page assumes duty of SEC.
12:15 p.m.	TSC/OSC activated.
01:02 p.m.	Charging pump powered from DS Bus.
01:15 p.m.	G. McKenzie indicated SUT investigation reveals SUT internals OK, problem is in cable; expect SUT back in 2 to 2 and a half hours.
01:48 p.m.	Consulted TSC staff, took deviation from EPP-021 to restore power to deepwell pumps in order to fill CST, NRC will be notified by TSC.
01:52 p.m.	Isolated SDAFW pump from CST to conserve water level in CST, SDAFW pump out of service.
01:55 p.m.	480 V Bus 3 energized from DS Diesel, deepwell pump running.
02:10 p.m.	480 V Bus 2B energized from DS Diesel.
02:35 p.m.	Recommendation to modify relay by TM; plant approval granted to go ahead with mod. and to provide the plant with a mod. status briefing at 03:15 p.m.
03:15 p.m.	Started filling CST at 150 gpm, waiting on relay, mod. based on drawings from other transformer.
04:55 p.m.	Going back to original configuration.
05:12 p.m.	Modification on relay abandoned.
05:39 p.m.	Shut SUT motor operated disconnects.
05:41 p.m.	SUT re-energized.

06:23 p.m. SDAFW pump back in standby.
07:56 p.m. 480 V Bus 2A energized via SP-1155.

August 22, 1992 cont.

08:08 p.m. PORV 455C lifted.
08:27 p.m. PORV 455C lifted.
08:49 p.m. PORV 455C lifted.
08:56 p.m. Spent fuel pit crane energized.
09:46 p.m. Spent fuel shipping cask in decon. area and unhooked.
10:46 p.m. Verify closed Breaker 52/12;did not close.
11:05 p.m. 4KV breaker 52/12 would not close from the RTGB - notified TSC for I&C assistance.
11:07 p.m. SDAFW started and stopped.
11:26 p.m. SDAFW started and stopped.
11:30 p.m. SDAFW started and stopped.
11:33 p.m. Generator lockout relay 86P reset.
11:34 p.m. Breaker 52/12 closed from RTGB.
11:52 p.m. Shut Breaker 52/15B and it immediately tripped.
11:54 p.m. Shut Breaker 52/15B and it immediately tripped.

August 23, 1992

12:14 a.m. Bus E-1 energized by offsite power.
12:17 a.m. A EDG shutdown.
12:24 a.m. Bus E-2 energized by offsite power.
12:28 a.m. B EDG shutdown.
12:55 a.m. DS Bus energized by offsite power.
01:20 a.m. I&C determined Breaker 52/15B under voltage relay fuse problem, replaced fuse and 52/15B closed and Breaker 52/12B opened.
01:24 a.m. Unusual event terminated.
02:35 a.m. TSC deactivated.

The initial response of the plant and personnel during the event was good. All plant safety systems functioned as expected and plant personnel stabilized the plant in natural circulation. The emergency response of the plant was good with parallel recovery paths considered.

The plant contacted the load dispatcher who contacted the transmission maintenance personnel and directed them to respond to the event. The transmission crew was put on standby status for possible transformer changeout. The plant OSC alerted the maintenance department that it might be necessary to bring offsite power back via backfeeding through the main and unit auxiliary transformers and told maintenance to make preparations for backfeeding. No procedures existed for backfeeding. The plant was prepared to restore offsite power following repairs to the SUT or to place the spare SUT in service if the transmission repair crew determined that the SUT was damaged beyond repair.

The transmission maintenance crew rapidly determined that the cause of the fault was a short circuit in the sudden pressure relay cable connector. The discussion of the cause of the fault signal and the corrective action is discussed in paragraph 3.0.

During the diagnosis of the cause of the SUT sudden pressure relay fault, TM personnel indicated that there was a modification which could be made to the circuit to increase reliability. Plant management granted permission and the modification was attempted then later abandoned when the modified circuit didn't perform as originally intended. See section 4.0 for a discussion of the attempted modification.

During the recovery phase of the event after repairs were complete to the SUT, the plant had difficulty operating breakers 52/12 and 52/15B. See paragraph 5.0 for a discussion of breaker operation during the recovery phase of the LOSP.

Paragraph 6.0 contains a discussion of the procedural readiness of the plant to recover from a LOSP. An evaluation of the plants capability of backfeeding offsite power via the main and auxiliary transformers is also included in paragraph 6.0. The licensee has initiated ACR 92-307 to review the event and response.

3.0 Startup Transformer Fault Evaluation

Transmission maintenance personnel performed an evaluation of the status of the SUT and obtained an output from the digital fault recorder. They rapidly determined that there had been no real fault to the transformer as there was no indication of abnormally high currents or voltage depressions from the recorder. Thus, it was determined to be a spurious trip signal. The examination of the transformer also gave no evidence of a fault, the overpressure relief device had not lifted, there was no evidence of physical damage, no oil leakage was noted and all parameters seemed normal. Upon further investigation they determined the cause to be a short circuit in the sudden pressure relay cable connector.

Review into the cause of the spurious trip discovered that moisture had accumulated in a junction box and travelled down the cable to the connector at the SUT sudden pressure relay. The junction box had been rotated such that the open drain hole was at the top of the box and had allowed the box to collect water. When transmission maintenance personnel opened the box water poured out of the box. The SUT sudden pressure relay has two sets of contacts, one normally open and one normally closed which are actuated simultaneously upon a sudden pressure increase inside the SUT. The SUT sudden pressure trip feature only utilizes the normally open contact set. The cable conductors from the normally open contact shorted together in the connector due to the moisture and generated a spurious false sudden pressure transformer trip signal. The sudden pressure trip signal energized a lockout relay which tripped the transformer supply and output breakers.

After replacing the cable the sudden pressure relay was tested and the transformer was checked and no faults were present. The transmission maintenance personnel inspected all the junction boxes on the main, auxiliary, and startup transformers and verified proper drain hole orientation. The licensee indicated that the cable replacement was a short term repair and that they had initiated ACR 92-331 to begin a review of long term corrective action. Transmission maintenance had submitted a request for engineering assistance to Raleigh (Corporate Engineering) to have a modification developed to utilize both sets of sudden pressure relay contacts in the trip circuit. The plant indicated that they will be performing an engineering evaluation of weatherproofing for specific equipment types and the main, auxiliary, and startup transformers will be included. The SUT reliability improvements have been identified as Inspector Followup Item 92-25-03.

4.0 Switchyard Work/Modification Control

Once the cause of the SUT fault signal had been determined TM suggested a modification to the sudden pressure trip circuit to utilize both relay contact sets to improve reliability. Plant management (Operations and Tech. Support) granted permission to implement the modification provided it could be completed within a specific time period and transmission maintenance was to provide a status briefing of modification progress during the time period.

The modification consisted of installing a resistor, wiring, and the normally closed contact in parallel with the 63FPX relay driven by the normally open contact. The modification was attempted utilizing the prints from the HB Robinson Autotransformer which utilized the two contact trip scheme. Transmission maintenance made the modification and tested the circuit only to find that a relay was missing from the scheme and that without the relay the circuit did not operate as desired. The modification was abandoned at this point and the circuit was returned to the original configuration; however, the resistor and one additional wire were left installed. The additional wire and resistor were removed on August 27,1992. Modifications with such weak controls are allowed under the current interface agreement "Customer/Supplier Agreement Between Florence Transmission Maintenance And Robinson Nuclear Project Department". The NRC inspector indicated concerns about the adequacy of the current agreement controls on work and modifications on important to safety equipment such as the SUT. The licensee indicated that they would perform a review of the agreement to determine if additional controls were needed. The control of work and modifications on switchyard equipment has been identified as Inspector Followup Item 92-25-02.

5.0 Breaker Operation During LOSP Recovery Phase

Upon re-energization of the SUT the licensee experienced difficulty in operating breaker 52/12, STARTUP TO 4KV BUS 2. During the recovery from the LOSP, the licensee had to prepare special procedures to restore power to specific loads needed for recovery. As a result temporary change T-4633 to procedure OP-603 was utilized to restore offsite power

from the SUT. This procedure was inadequate in that it did not provide guidance to the operator that the generator lockout relays 86P and 86BU must be reset prior to closing breaker 52/12.

The SUT clearance tagout was removed and the breaker racked in and its control power fuses were installed. The breaker did not close automatically as it should have done with the lockout signal still present nor did it close upon demand from the RTGB. Subsequently the breaker was racked out and the latch check switches were discovered out of position. The breaker was racked in and still would not operate. I&C was notified and the breaker was racked out and the latch check switches were manually tripped. The cause of the improperly positioned latch check switches was thought to be due to the rack in interlock being stuck in the mid position. The breaker was then racked in and the fuses installed and the breaker closed automatically.

Operations opened breaker 52/12 from the RTGB successfully and upon breaker opening the SDAFW pump auto started. An attempt followed to close 52/12 from the RTGB and it would not close. The fuses were pulled, the breaker was racked out, the spring discharged and the breaker was connected to the 4KV test stand. The breaker tested satisfactorily on the test stand. The breaker was racked in and when the fuses were installed the breaker closed automatically and the spring recharged. Operations reset the generator lockout relay 86P. The breaker was opened from the RTGB successfully and the SDAFW pump auto started. The breaker was then closed from the RTGB and with the lockout relay reset the breaker closed upon demand. Due to this procedural inadequacy it took 48 minutes to determine why the breaker would not close.

The breaker was allowed to close several times automatically instead of properly controlling the evolution from the RTGB. Also the breaker was unnecessarily cycled as was the SDAFW pump. This demonstrated a procedural inadequacy and a weakness in plant personnel's knowledge of 4KV breaker operations in this operational mode. The licensee initiated ACR 92-340 to review operation of breaker 52/12. This item has been identified as violation 92-25-01, "Inadequate procedural guidance for operation of 4Kv Breaker 52/12".

The licensee also experienced problems in operating 480 V breaker 52/15B which immediately tripped after the operators attempted to close the breaker. This occurred twice and I&C was then called to investigate. I&C determined that the breaker had an under-voltage relay fuse problem and replaced the fuse. Once the fuse was replaced no further problems were experienced with the breaker. The licensee initiated ACR 92-308 to review operation of breaker 52/15B.

6.0 Procedural Readiness For Recovery From An LOSP

The inspector evaluated the licensee's procedural readiness for coping with an LOSP as weak. An LOSP is an especially important event for H. B. Robinson since the plant has only one readily available source of offsite power. During the recovery from the event the plant had to write

special procedures to provide power to specific loads such as the deepwell pumps. A procedure already existed to provide power to the pressurizer heaters and this evolution was accomplished rapidly. Had additional procedural preparations been available for coping with an LOSP the event recovery time could have been much shorter.

The inspector walked through the procedure for backfeeding offsite power to the plant from the main and auxiliary transformers. The current procedure is not written to be performed with the SUT unavailable. The TS indicate that the backfeeding procedure is to be performed during cold shutdown, however use of the process during hot shutdown is allowed when it is required due to nuclear safety concerns. The plant has never performed the evolution under emergency conditions.

Should the plant be required to utilize the backfeed process to restore offsite power during an LOSP with the SUT unavailable the inspector judged that the time required to accomplish the evolution would be approximately ten hours. The breakdown of the required time is as follows:

Development of procedure - (4-6 hours)
Tagout clearance - (1 hour)
Remove generator links - (2 hours)
Jumper breaker interlocks - (1 hour)
Complete breaker alignment procedure - (1 hour)

Should a procedure be developed for backfeeding under LOSP conditions with the SUT unavailable the time required to restore offsite power via this method could be reduced to approximately 5 hours. During the exit meeting the inspector indicated that the NRC was requesting that the licensee develop a procedure for backfeeding under LOSP conditions and to respond with a schedule indicating when the procedure would be implemented. Followup on the development of backfeeding procedures under LOSP conditions with the SUT unavailable has been identified as Inspector Followup Item 92-25-04.

7.0 Exit Interview

The inspection scope and findings were summarized on August 28, 1992 with those persons identified in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection findings listed below and in the summary. Dissenting comments were not received from the licensee. Although reviewed during the inspection, proprietary information is not contained in this report.

Item Number	Description/Reference Paragraph
92-25-01	VIO - Inadequate Procedural Guidance For Operation of 4KV Breaker 52/12 (paragraph 5.0).
92-25-02	IFI - Control of Work and Modification on Switchyard Equipment (paragraph 4.0).
92-25-03	IFI- SUT Reliability Improvements (paragraph 3.0).
92-25-04	IFI - Followup on Procedures for Backfeed Under LOSP Conditions (paragraph 6.0).

8.0 Abbreviations and Acronyms

a.m.	Ante Meridiem
ACR	Adverse Condition Report
CFR	Code of Federal Regulations
CST	Condensate Storage Tank
DS	Dedicated Shutdown
EDG	Emergency Diesel Generator
EOP	Emergency Operating Procedure
EPP	End Path Procedure
ERO	Emergency Response Organization
GPM	Gallons Per Minute
I&C	Instrumentation and Controls
IFI	Inspector Followup Item
IR	Inspection Report
KV	Kilovolt
LOSP	Loss of Offsite Power
Mod.	Modification
NRC	Nuclear Regulatory Commission
OP	Operations Procedure
OSC	Operations Support Center
PM	Preventive Maintenance
p.m.	Post Meridiem
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RG	Regulatory Guide
RTGB	Reactor Turbine Generator Board
SDAFW	Steam Driven Auxiliary Feedwater
S/G	Steam Generator
SI	Safety Injection
SP	Special Procedure
SUT	Startup Transformer
TM	Transmission Maintenance
TS	Technical Specifications
TSC	Technical Support Center
VIO	Violation