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

Report No.: 50-261/89-07

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: February 11 - March 10, 1989

Inspector: H C Dance / for 4/6/89
L. W. Garner, Senior Resident Inspector Date Signed

H C Dance / for 4/6/89
K. R. Jury, Resident Inspector Date Signed

Approved by: H C Dance 4/6/89
H. C. Dance, Section Chief Date Signed
Division of Reactor Projects

SUMMARY

Scope: This routine announced inspection was conducted in the areas of operational safety verification, surveillance observation, maintenance observation, ESF system walkdown, onsite followup of events at operating power reactors, and onsite review committee.

Results: The unit experienced a high steam flow coincident with Low Tavg SI induced reactor trip from 30% power due to a personnel error. While troubleshooting a EH power supply an I & C technician inadvertently connected a current meter into the control circuit. The resultant short circuit closed two governor valves, thereby, initiating the transient.

A violation was identified concerning procedure usage. Procedure steps were signed off certifying that safety related valves operated properly before the post-maintenance tests were actually performed, paragraph 4.

An operator was observed manipulating a valve without first verifying valve identification, resulting in the wrong valve being manipulated. This poor practice is discussed in paragraph 3.

The licensee demonstrated a conservative approach to safety, in that, plant operation has been voluntarily limited to 9 months as a result of the A loop hot leg RTD thermowell cracking issue described in paragraph 6.

REPORT DETAILS

1. Licensee Employees Contacted

R. Barnett, Maintenance Supervisor, Electrical
C. Bethea, Manager, Training
R. Chambers, Engineering Supervisor, Performance
*D. Crook, Senior Specialist, Regulatory Compliance
*J. Curley, Director, Regulatory Compliance
*C. Dietz, Manager, Robinson Nuclear Project Department
R. Femal, Shift Foreman, Operations
W. Flanagan, Manager, Design Engineering
W. Gainey, Support Supervisor, Operations
*E. Harris, Director, Onsite Nuclear Safety
R. Johnson, Manager, Control and Administration
D. Knight, Shift Foreman, Operations
D. McCaskill, Shift Foreman, Operations
R. Moore, Shift Foreman, Operations
*R. Morgan, Plant General Manager
D. Nelson, Maintenance Supervisor, Mechanical
M. Page, Acting Manager, Technical Support
D. Quick, Manager, Maintenance
D. Seagle, Shift Foreman, Operations
J. Sheppard, Manager, Operations
R. Steele, Acting Operating Supervisor, Operations
*H. Young, Director, Quality Assurance/Quality Control

Other licensee employees contacted included technicians, operators, mechanics, security force members, and office personnel.

*Attended exit interview on March 12, 1989.

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

2. Operational Safety Verification (71707)

The inspectors observed licensee activities to confirm that the facility was being operated safely, in conformance with regulatory requirements, and that the licensee management control system was effectively discharging its responsibilities for continued safe operation. These activities were confirmed by: direct observations, tours of the facility, interviews and discussions with licensee management and personnel, independent verifications of safety system status and limiting conditions for operation, and reviews of facility records.

Periodically, the inspectors reviewed shift logs, operations records, data sheets, instrument traces, and records of equipment malfunctions to verify operability of safety-related equipment and compliance with TS. Specific items reviewed include control room logs, maintenance work requests, auxiliary logs, operating orders, standing orders, jumper logs, and equipment tagout records. Through periodic observations of work in progress and discussions with operations staff members, the inspectors verified that the staff was knowledgeable of plant conditions; responded properly to alarm conditions; adhered to procedures and applicable administrative controls; and was aware of equipment out of service, surveillance testing, and maintenance activities in progress. The inspectors routinely observed shift changes to verify that continuity of system status was maintained and that proper control room staffing existed. The inspectors also observed that access to the control room was controlled and operations personnel were carrying out their assigned duties in an attentive and professional manner. The control room was observed to be free of unnecessary distractions. The inspectors performed channel checks, reviewed component status and safety related parameters, including SPDS information, to verify conformance with the TS.

During this reporting interval, the inspectors verified compliance with selected LCOs. This verification was accomplished by direct observation of monitoring instrumentation, valve positions, switch positions, and review of completed logs and records.

Plant tours were conducted to verify the operability of standby equipment; assess the general condition of plant equipment; and verify that radiological controls, fire protection controls, and equipment tag out procedures were properly implemented. These tours verified the following: the absence of unusual fluid leaks; the lack of visual degradation of pipe, conduit and seismic supports; the proper positions and indications of important valves and circuit breakers; the lack of conditions of which could invalidate EQ; the operability of safety-related instrumentation; the calibration of safety-related and control instrumentation including area radiation monitors, friskers and portal monitors; the operability of fire suppression and fire fighting equipment; and the operability of emergency lighting equipment. The inspectors also verified that housekeeping was adequate and areas were free of unnecessary fire hazards and combustible materials.

In the course of the monthly activities, the inspectors included a review of the licensee's physical security and radiological control programs. The inspectors verified by general observation and perimeter walkdowns that measures taken to assure the physical protection of the facility met current requirements. The inspectors randomly verified that radiological controls were being adhered to by station personnel.

No violations or deviations were identified within the areas inspected.

3. Monthly Surveillance Observation (61726)

The inspectors observed certain surveillance related activities of safety-related systems and components to ascertain that these activities were conducted in accordance with license requirements. For the surveillance test procedures listed below, the inspectors determined that precautions and LCOs were met, the tests were completed at the required frequency, the tests conformed to TS requirements, the required administrative approvals and tagouts were obtained prior to initiating the tests, the testing was accomplished by qualified personnel in accordance with an approved test procedure, and the required test instrumentation was properly calibrated. Upon completion of the testing, the inspectors observed that the recorded test data was accurate, complete and met TS requirements, and that test discrepancies were properly rectified. The inspectors independently verified that the systems were properly returned to service. Specifically, the inspectors witnessed/reviewed portions of the following test activities:

a. OST-202 (revision 16) Steam Driven Auxiliary Feedwater System Component Test

The test implements surveillance requirements of ASME Section XI and TS 4.8. The inspectors witnessed the performance of section 7.2 which tests the SDAFW pump. The test was performed in order to declare the SDAFW pump operable after adjustments of the Masoneilan pressure controller were completed. The adjustments were necessary as the required flow rate had not been obtained during the performance of OST-206. The inspectors verified that the acceptance criteria concerning pump speed, differential pressure, vibration, and feed-steam differential pressure were met.

b. OST-206 (revision 9) Steam Driven Auxiliary Feedwater Pump Flow Test

The procedure implements test requirements of ASME Section XI. On February 24, 1989, the SDAFW pump developed approximately 300 gpm instead of the anticipated 600 gpm during the test performance.

During troubleshooting activities, the operator was observed to manipulate an instrument air valve without first reading the valve tag. This resulted in manipulation of the air regulator valve to the Masoneilan pressure controller instead of the controller's air isolation valve. This had no safety significance in that the SDAFW pump was already inoperable. However, the inspectors have observed a tendency by operations personnel to not alway verify valve identification prior to operating valves. This is considered a poor work practice. The inspectors acknowledge that there is no requirement to verify a valve tag prior to operating equipment. However, the licensee is required to identify equipment in some manner and

implement procedures adequately. In the context of equipment identification established by the licensee (i.e., valve tags), the failure to habitually use the established system (i.e., read valve tags) is considered a weakness. This issue was discussed with the Operations Manager. The inspectors observed adjustment of the pressure controller by I&C, and the subsequent successful completion of OST-206.

No violations or deviations were identified within the areas inspected.

4. Monthly Maintenance Observation (62703)

The inspectors observed several maintenance related activities of safety-related systems and components to ascertain that these activities were conducted in accordance with approved procedures, TS, and appropriate industry codes and standards. The inspectors determined that these activities did not violate LCOs, and that redundant components were operable. The inspectors also determined that activities were accomplished by qualified personnel using approved procedures, appropriate ignition and fire prevention controls were implemented, and the affected equipment was properly tested before being returned to service. In particular, the inspectors observed/ reviewed the following maintenance activities:

- CM-111 (revision 5); Limitorque Limit Switch and Torque Switch Maintenance
- WR/JO 89-ACUM1; Weld repair of A SWBP PI-1601A pressure indicator sensing line.
- WR/JO 89-ACXW1; Repair of B EDG air compressor.

On February 15, 1989, while reviewing implementation of CM-111 associated with WR/JO 89-ACMK1 and 89-ACML1, the inspectors identified a procedure usage problem. The WRs involved inspection of V2-14A (89-ACMK1) and V2-14C (89-ACML1), the SDAFW pump discharge valves to S/Gs A and C, respectively. Step 7.6.4 of CM-111 requires verification of proper motor operator function when the valves are electrically cycled fully open and closed. This verification is to be initialed on the associated attachment 8.1. The inspectors identified that this verification was initialed as having been completed before the valve operators were completely reassembled.

Upon discussion of this situation with the maintenance personnel performing the work, the inspectors were told that they had every intention of completing the procedure, and that they had just signed the verification step in advance. This situation is identified as a violation: Initialing Procedure Steps Prior to Performing Work (89-07-01).

One violation was identified within the areas inspected.

5. ESF System Walkdown (71710)

The inspectors performed a field walkdown of parts of the CS and the SI sub-systems shown on drawings 5379-1082 sheets 1, 2 and 3, and the MDAFW sub-system shown on drawing G-190197 sheet 4. Specifically, the inspectors examined the system components located in the CS tank room, the SI pump room, the CCW room, and the MDAFW pump room. Items examined included pumps, valves, piping, pipe supports, instrument tubing and their supports, and valve tagging. The inspectors verified that all major valves were in their correct position, manual valves were locked as required, instrumentation was valved into service, and power was available to MOVs as indicated by the RTGB indicators and MCC breaker positions. No conditions which could render these sub-systems incapable of performing the safety function were observed.

No violations or deviations were identified within the areas inspected.

6. Onsite Followup of Events at Operating Power Reactors (93702)

a. Failure of the A Loop RTD Hot Leg Thermowells

On February 9, 1989, while at rated temperature and pressure in preparation for taking the reactor critical after refueling number 12, the licensee observed an abnormal downscale indication on the A loop TAVG instrument. On February 11, the licensee discovered that a small plume of steam was being emitted from one of the loop A hot leg RTD thermowells. The reactor system was returned to cold shutdown and the thermowell was removed. Liquid penetrative examination at the Harris Energy and Environmental Center revealed a 200 degree crack at the transition area between the threaded area and the shank of the thermowell. Subsequent destructive testing revealed that the crack was a fatique failure at a stress riser. The cracking resulted from stresses due to high flow induced vibrations and amplified by a very small radius of curvature in the transition area (approximately 5 mils radii). Removal of the other two A loop hot leg RTD thermowells revealed non-throughwall cracking. In one instance the crack was in the same location as the one discussed above. The radius of curvature was found to be 15 mils. The specified radius of curvature was 30 plus or minus 10 mils. The other thermowell was cracked in between the first and second threads. In this instance the crack initiated at a manufacturing defect. In summary, the cracking was attributed to higher than anticipated flow induced stresses, compounded with either stress risers due to either a small radius of curvature or a manufacturing flaw.

The licensee has performed a safety analysis which indicates that total failure of a hot leg RTD thermowell (i.e., complete separation) is bound by existing analysis for loose parts and would not result in

coolant inventory loss in excess of the normal makeup capability. The largest leak from one completely severed thermowell is limited to that which would occur from a one fourth inch diameter hole. One charging pump can make up the leakage from a three-eighths inch diameter hole. Consequently, failure of the three A loop hot leg RTD thermowells would not render the safeguards system inoperable.

The licensee, with the assistance of Westinghouse (the RTD Thermowell supplier) and Weed Instrument Company (the RTD manufacturer), modified the design of the replacement A loop hot leg RTD thermowells. The changes included a shorter thermowell (i.e., a 3.5 inch instead of 4.5 inch emersion depth); increased transition area radius of curvature (machining); increased compressive stresses in the transition area (shot peening); and reduced thermowell to coolant pipe wall gap (chrome plating). Reduction of the gap limits the allowable deflection of the thermowell. This limits the amplitude of vibration and hence limits the maximum stress in the transition area. The licensee's engineering department performed calculations which demonstrated a useful life for the replacement RTD thermowells of 9 months. These calculations conseratively assumed that the vibration amplitude could be as large as 16 mils, the thermowell to coolant pipe wall gap. The licensee has authorized plant operation for up to nine months while a permanent solution is found. The licensee is pursuing redesign of the A loop hot leg RTD thermowells and development of more realistic analytical models. This issue is identified as an IFI: Review Permanent Solution to RTD Thermowell Cracking Phenomena (89-07-02).

The unit was placed on line at 9:47 a.m., on February 25, 1989. Subsequent inspection and channel checks of the RTGB TAVG indicators have revealed no unusual indications from the A loop hot leg RTDs.

b. Reactor Trip and NOUE

On February 27, 1989, at 4:17 p.m., the unit experienced a SI signal reactor trip from 30% full power. The plant was brought to stable conditions in accordance with EOP PATH-1 and end path procedure EPP-7, revision 6, SI Termination. All ESF systems performed as expected. Plant Emergency Procedure, PEP-101, revision 8, Initial Emergency Actions, describes conditions requiring entry into emergency classification. Item 1.b of PEP-101, Attachment 9.1 requires an unusual event be declared for an "Automatic (non-spurious) S-signal"; where an S-signal is a SI signal. The licensee declared a NOUE at 4:22 p.m., and after the plant was stabilized, the NOUE was terminated at 4:51 p.m.

The inspectors entered the control room approximately 15 minutes after the trip. The inspectors verified that timely notifications were made to the state and to the NRC. The inspectors also witnessed

successful completion of EPP-7. A post scram review determined that the trip had occurred as a result of a personnel error. While troubleshooting an EH power supply trouble alarm, an I&C technician inadvertently shorted out part of the control circuit during the installation of a meter into the circuit. The meter can serve as either a voltmeter or ammeter depending upon a switch position. The technician had intended to measure voltage, but had the meter set to the ammeter mode. The resultant shorting of the circuit caused two of the turbine governor valves to go closed. The subsequent loss of load caused three steam dumps to open. The I&C technician, sensing something was amiss because of relay actuations, proceeded to remove the meter from the circuit. This action caused the two governor valves to reopen. With the three steams dumps also open, a high steam flow and over cooling of the primary resulted (i.e., TAVG decreased rapidly). The resultant high steam flow coincident with low TAVG, conditions indictative of a steam line break, initiated the SI signal and reactor trip.

The inspectors reviewed the draft post trip review report and have no further concerns at this time. The EH power supply was repaired and the unit was returned to service on February 28, 1989.

No violations or deviations were identified within the areas inspected.

7. Onsite Review Committee (40700)

The inspectors evaluated certain activities of the PNSC to determine whether the onsite review functions were conducted in accordance with TS and other regulatory requirements. In particular, the inspectors attended the special PNSC meetings on February 18 and 22, 1989, concerning the RTD thermowell replacements prior to plant startup. In addition, the inspectors also attended the monthly scheduled PNSC meeting on February 15, it was ascertained that provisions of the TS dealing with membership, review process, frequency, and qualifications were satisfied.

No violations or deviations were identified within the areas inspected.

8. Exit Interview (30703)

The inspection scope and findings were summarized on March 12, 1989, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection findings listed below and those addressed in the report summary. Dissenting comments were not received from the licensee. Proprietary information is not contained in this report.

Item Number	Status	Description/Reference Paragraph
89-07-01	Open	VIO - Initialing Procedure Step Prior to Performing Work, paragraph 4.
88-07-02	Open	IFI - Review Permanent Solution For RTD Thermowell Cracking Issue, paragraph 6.

9. Acronyms and Initialisms

AFW	Auxiliary Feedwater
ASME	American Society of Mechanical Engineers
CCW	Component Cooling Water
CM	Corrective Maintenance
CS	Containment Spray
EDG	Emergency Diesel Generator
EH	Electro-hydraulic
EOP	Emergency Operating Procedures
EPP	End Path Procedures
EQ	Environmental Qualifications
ESF	Engineered Safety Feature
I&C	Instrumentation & Control
IFI	Inspector Followup Item
LCO	Limiting Condition for Operation
MCC	Motor Control Center
MDAFW	Motor Driven Auxiliary Feedwater
MOV	Motor Operated Valve
MST	Maintenance Surveillance Test
NOUE	Notice of Unusual Event
NRC	Nuclear Regulatory Commission
OST	Operations Surveillance Test
PEP	Plant Emergency Procedure
PNSC	Plant Nuclear Safety Committee
RCA	Radiation Control Area
RTD	Resistence Temperature Detector
RTGB	Reactor Turbine Generator Board
RWP	Radiation Work Permit
SDAFW	System Driven Auxiliary Feedwater
S/G	Steam Generator
SI	Safety Injection
SPDS	Safety Parameter Display System
SW	Service Water
SWBP	Service Water Booster Pump
TAVG	Temperature, Average
TS	Technical Specification
VIO	Violation
WR	Work Request
WR/JO	Work Request/Job Order