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

Report No.: 50-400/91-15

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: June 3 - June 7, 1991

Inspector: M Glasman FOR 6/11/91
J. Tedrow, Senior Resident Inspector Date Signed

Accompanying Inspectors: M. Shannon, Resident Inspector
N. Merriweather, Reactor Inspector
M. Glasman, Project Engineer

Approved by: for 6/11/91
H. Christensen, Section Chief Date Signed
Division of Reactor Projects

SUMMARY

Scope:

This special inspection was conducted in the areas of plant operation, technical support, and maintenance to review the licensee's activities following a reactor trip which occurred on June 3, 1991, during which a reactor trip breaker failed to open as required.

Results:

Two apparent violations were identified: failure to adequately establish/implement plant procedures, paragraph 2; and failure to maintain two operable automatic reactor trip channels, paragraph 2.

Weaknesses were also identified in paragraph 2 concerning poor implementation of manufacturer's recommendations and reliance on craft experience instead of detailed procedural guidance.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*J. Collins, Manager, Operations
*C. Hinnant, General Manager, Harris Plant
*T. Morton, Manager, Maintenance
*J. Nevill, Manager, Technical Support
*C. Olexik, Manager, Regulatory Compliance
*R. Richey, Vice President, Harris Nuclear Project

Other licensee employees contacted included office, operations, engineering, maintenance, chemistry/radiation and corporate personnel.

*Attended exit interview

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

2. Review of Plant Operations (71707)

On June 3, 1991 at 3:33 p.m. the plant experienced a reactor trip caused by a spurious reactor coolant low flow signal. Although an operator verified that all of the control rods were on the bottom following the trip signal and that reactor power was decreasing, it was discovered that the "A" reactor trip breaker had failed to open. At twenty-two seconds into the event, the operator manually opened the "A" reactor trip breaker by using the reactor trip switch on the main control board.

A subsequent review of this event by the licensee found that the undervoltage output driver card had failed and therefore prevented the reactor trip signal from tripping the "A" reactor trip breaker. This failure maintained a 48 VDC signal to the reactor trip breaker undervoltage coil and also maintained a 48 VDC signal to the STA trip relay which prevented an automatic shunt trip from opening the breaker. The failed undervoltage output card was replaced and tested in accordance with procedure MST-I0001, Rev. 4, Train "A" Solid State Protection System Actuation Logic and Master Relay Test. After this action, the licensee commenced a reactor startup. The cause of the board failure was considered a random failure by the licensee.

The inspectors reviewed testing and maintenance history for this system and determined the following: On May 16, 1991, the "A" train of SSPS tested satisfactorily following performance of procedure MST-I0001. During the plant heatup on May 18, 1991, the "A" reactor trip breaker

failed to close on demand from the control room. Subsequent troubleshooting found that the "A" reactor trip breaker closing coil was defective and the control room "RTA" control switch, CS-92.1SAB, had intermittent switch contacts. The breaker closing coil and control switch were replaced on May 18, 1991. During interviews with the electricians who performed the troubleshooting of the "A" reactor trip breaker, the inspectors learned that various electrical jumpers and test equipment had been installed. These jumpers were installed to test the breaker while it was racked out of the breaker cubicle. To facilitate testing, one set of jumpers was installed to provide 48 VDC to the breaker undervoltage coil so that the breaker could be closed. This jumper was installed in the breaker cubicle on the "A" contacts which were supplied from the SSPS undervoltage output card. The electrician stated that visibility and physical clearances for installing the jumpers was limited. The licensee's investigation concluded that during the replacement of the control switch and breaker closing coil, electrical leads were accidentally grounded/shorted through the use of electrical jumpers. This caused the failure of a transistor on the undervoltage output card which resulted in the card maintaining 48 VDC output to the breaker undervoltage coil and shunt trip relay in the presence of the trip signal on 6/3/91. Following the maintenance activities on May 18, 1991, until the reactor trip on June 3, 1991, the "A" train of the reactor protection system was inoperable because of the failed undervoltage output card. Technical Specification 3.3.1 requires that the reactor trip system shall have two automatic trip channels operable when the reactor trip system breakers are closed and the control rod drive system is capable of rod withdrawal. The failure to maintain two operable automatic trip channels from May 18 until June 3, 1991 is considered to be an apparent violation.

Apparent violation (400/91-15-01): Failure to maintain two operable automatic reactor trip channels.

Administrative Procedure AP-24, Temporary Bypass, Jumper and Wire Removal Control, contains administrative controls for the use of electrical jumpers. This procedure contains a form (AP-024-1) to be completed when jumpers are employed in the maintenance process. Section 3.2.1 of the procedure requires that maintenance personnel ensure that operations personnel are properly notified and appropriate parts of form AP-024-1 are completed prior to placement or removal of any electrical jumper. This form also contains a section where appropriate testing after jumper removal can be listed. During the maintenance activities associated with the reactor trip breaker and control switch replacement on May 18, 1991, the operations staff was not informed that jumpers had been connected to SSPS outputs and form AP-24-1 was not completed documenting the various installed jumpers. Therefore, the operations staff was not aware of the extent of the activities performed and could not determine the post-maintenance test necessary upon completion of the work.

The inspectors noted a lack of detailed procedural guidance in the work package for troubleshooting and repairing the reactor trip breaker. A review of maintenance periodic test, MPT-E0005, Reactor Trip and Bypass Breakers, Westinghouse Model DS-416, found that this procedure had

recently been changed to provide external power supplies, 48 VDC and 125 VDC, for breaker operation during maintenance activities. The procedure detailed various procedural steps for connecting and disconnecting the power supplies. It was noted by the inspectors that this procedure was not used or referenced while performing corrective maintenance on the "A" reactor trip breaker. Reliance on the "skill of the craft" instead of detailed procedure guidance is considered to be a weakness. Implementation of procedure MPT-E0005 would have provided external power supplies and would not have required jumpers to be installed. This would have averted this event.

The testing performed following the breaker work on May 18, 1991, did not include a check of the SSPS system for potential damage. The work package only specified that the breaker be cycled to verify proper operation. Further review found that the specification appraisal system, which is used by operations personnel to identify post-maintenance testing, identified procedure MST-I0072, Train "A" 18 Month Manual Reactor Trip Solid State Protection System Actuation Logic & Master Relay Test, as a post-maintenance test that should be performed following maintenance on the reactor trip breaker. Plant personnel reviewed the testing requirements and concluded that the scope of work performed would not have affected the SSPS and therefore the testing was not required. Procedure PLP-400, Post-Maintenance Testing, was written by the licensee to ensure appropriate testing is performed following work to verify that affected equipment is capable of performing its intended function. The post-maintenance testing requirements were not adequate for the scope of the work performed.

The troubleshooting effort for the breaker problem also identified a problem with the closing contacts in the reactor trip/closing switch on the main control board. Maintenance personnel initiated a second work ticket to replace the switch (CS-92.1SAB). The switch was subsequently replaced. The computerized equipment data base system did not identify any testing requirements following switch replacement and therefore no post-maintenance testing was specified in the work package. The specification appraisal system likewise did not contain any required testing. Licensee personnel concluded that cycling the breaker from the control switch would be an adequate post-maintenance test and this test was subsequently satisfactorily completed. The inspector noted however, that cycling the breaker would not test all of the functions of the control switch. Consequently, post-maintenance testing of this work was considered to be inadequate. When informed of this finding, licensee personnel subsequently reviewed the testing performed and likewise concluded that the testing would not check both the shunt trip and undervoltage trip functions of the switch. The switch was declared inoperable and a plant shutdown commenced on June 8, 1991, to perform testing on the switch. Results of the test were satisfactory.

In conclusion, the licensee failed to properly implement various procedures that could have identified and prevented the event. The failure to properly implement procedures AP-24 and PLP-400 to adequately control jumpers and perform post-maintenance testing is considered to be an apparent violation of Technical Specification 6.8.1.

Apparent violation (400/91-15-02): Failure to properly implement plant procedures.

The inspectors reviewed NRC Information Notice 85-18, Failures of Undervoltage Output Circuit Boards in the Westinghouse-designed Solid State Protection System. This notice discussed previous failures at other sites which resulted in the loss of automatic reactor trip redundancy. The licensee's response to this notice was also reviewed in detail. The licensee tracked this item by an operational experience feedback report (OEF), OEF 85-053, dated March 21, 1985. In the report the onsite nuclear safety group recommended that two items be considered in the development of maintenance procedures. The first recommendation was to ensure that maintenance activities on the reactor protection system would not cause damage to SSPS circuitry. The second was to ensure that post-maintenance testing be performed following maintenance on circuits that electrically interfaced with the SSPS. An additional OEF item was generated to track the undervoltage card concern, OEF 85-186. This item was generated following receipt of Westinghouse Technical Bulletin NSID-TB-85-16, dated July 31, 1985, which recommended removal of the SSPS output driver card when performing maintenance, and replacement of the existing undervoltage output driver card with one designed to prevent undetected failures from external shorts. The onsite nuclear safety group evaluated the bulletin and its two recommendations and reached the following conclusions. With the concurrence of Maintenance, the removal of the undervoltage output driver card was not considered necessary. Maintenance personnel also stated that although a new card to prevent undetected failures may be worthwhile, card replacement was not necessary because post-maintenance testing would detect card failures. The undervoltage output card was not pulled during the maintenance activities which took place on 5/18/91 on the reactor trip breakers and no SSPS testing was performed following this maintenance. Although new undervoltage cards with the modification, a resistive link, had been received on site in August 1986, the cards were not installed in the SSPS.

The licensee failed to implement NRC Information Notice 85-18, Westinghouse Technical Bulletin NSID-TB-85-16, and Onsite Nuclear Safety recommendations documented in OEF 85-053 and OEF 85-186. Although these items were recommended in 1985, actions on the recommenda-tions had not been completed as of June 3, 1991. Failure to properly implement manufacturer's recommendations is considered to be a weakness. Following the undervoltage output card failure on June 3, 1991, an undervoltage output card incorporating the resistive link modification was installed in the "A" Train of SSPS. Previously, in April 1991, a modified undervoltage output card had been installed in the "B" Train of SSPS following the

failure of this card during unrelated maintenance, in response to Westinghouse Technical Bulletin 89-06. During this work, several SSPS cards were damaged accidentally.

3. Exit Interview (30703)

The inspectors met with licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on June 7, 1991. During this meeting, the inspectors summarized the scope and findings of the inspection as they are detailed in this report, with particular emphasis on the apparent violations addressed below. The licensee representatives acknowledged the inspector's comments and did not identify as proprietary any of the materials provided to or reviewed by the inspectors during this inspection.

Item Number	Description and Reference
400/91-15-01	Apparent VIO: Failure to maintain two operable automatic reactor trip channels. Paragraph 2.
400/91-15-02	Apparent VIO: Failure to properly implement plant procedures, paragraph 2.

4. Acronyms and Initialisms

AP	Adminstrative Procedure
MPT	Maintenance Periodic Test
MST	Maintenance Surveillance Test
OEF	Operational Experience Feedback
PLP	Plant Procedure
RTA	Reactor Trip A
SSPS	Solid State Protection System
STA	Shunt Trip Attachment
VDC	Volts Direct Current