



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
REGION II  
SAM NUNN ATLANTA FEDERAL CENTER  
61 FORSYTH STREET, SW, SUITE 23T85  
ATLANTA, GEORGIA 30303-8931

February 3, 2000

SDP/EA 2000-22

Carolina Power & Light Company  
ATTN: Mr. James Scarola  
Vice President - Harris Plant  
Shearon Harris Nuclear Power Plant  
P. O. Box 165, Mail Code: Zone 1  
New Hill, NC 27562-0165

SUBJECT: FIRE PROTECTION INSPECTION (NRC INSPECTION REPORT NO.  
50-400/99-13)

Dear Mr. Scarola:

This refers to the inspection conducted onsite on November 1 - 5, 1999, at your Shearon Harris facility. Subsequent to the onsite inspection, your staff provided additional information to the inspectors for review. Our in office inspection of this additional information was completed on December 20, 1999. This was a Fire Protection Inspection which was performed in accordance with Inspection Procedure 71111.05 under the pilot plant study for the new inspection oversight process. The enclosed report presents the results of this inspection.

The inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas the inspection consisted of a selective examination of procedures and representative records, observations of activities, and interviews with personnel. The primary objective of this inspection was to assess the adequacy of the Harris fire protection program implementation with emphasis on verification that the post-fire safe shutdown capability and the fire protection features provided for maintaining one train of this capability free of fire damage. The results of this inspection (including the inspectors' review of the additional information provided) were discussed on December 20, 1999, with Mr. C. Burton and other members of your staff.

The inspectors identified three unresolved items: (1) the Thermo-Lag fire barrier between the B Train Switchgear Room/Auxiliary Control Panel (ACP) Room and the A Train Cable Spreading Room (CSR) has a tested fire rating of one hour and 48 minutes instead of the three-hour rating referenced in the Harris Plant Final Safety Analysis Report and the NRC Safety Evaluation Report; (2) the 10 CFR 50.59 evaluation performed by the licensee to justify the 40 percent reduction in margin of the Thermo-Lag fire barrier assembly rating requires further NRC review to determine the adequacy of the 10 CFR 50.59 evaluation and the acceptability of this reduction in the fire barrier assembly rating; and (3) the licensee's fire testing and acceptance criteria used to determine the fire resistive performance of the Hemyc/MT cable wrap fire barrier systems installed to separate safe shutdown functions within the same fire area requires further NRC review to determine its acceptability. Region II requested the Office of Nuclear Reactor Regulation's (NRR) assistance in Task Interface Agreement (TIA) 99-028, dated November 23,

1999, in evaluating the resolution to these items. We will inform you of the results of our evaluation.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Sincerely,

*Original Signed by Kerry D. Landis*

Kerry D. Landis, Chief  
Engineering Branch  
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Docket Nos. 50-400  
License Nos. NPF-63

Enclosure: NRC Inspection Report

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-400

License Nos.: NPF-63

Report Nos.: 50-400/99-13

Licensee: Carolina Power & Light Company (CP&L)

Facility: Shearon Harris Nuclear Power Plant, Unit 1

Location: 5413 Shearon Harris Road  
New Hill, NC 27562

Dates: November 1 - 5, 1999, onsite, Shearon Harris  
November 8 - December 20, 1999, in office, Region II

Inspectors: G. Hausman, Senior Reactor Inspector, Region III  
M. Thomas, Senior Reactor Inspector, Region II  
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Observer: P. Qualls, Fire Protection Engineer, Office of Nuclear Reactor  
Regulation

Approved By: Kerry D. Landis, Chief  
Engineering Branch  
Division of Reactor Safety

ENCLOSURE

## SUMMARY OF FINDINGS

### Shearon Harris Nuclear Power Plant, Unit 1 NRC Inspection Report 50-400/99-13

The report covers a one-week period of inspection onsite and additional review in the Region II Office. This inspection included a review and evaluation of the Shearon Harris fire protection program implementation, with emphasis on verification that the post-fire safe shutdown capability and the fire protection features provided for maintaining one train of this capability free of fire damage, have been correctly maintained within the licensing and design bases for Fire Areas 12-A-CR/CRC1, 1-A-SWGR-A, 1-A-SWGR-B, and 1-A-BAL-B. No findings were identified during this inspection.

The inspection identified the following unresolved items:

- Fire endurance testing demonstrated that the Thermo-Lag walls which serve as part of the fire area separation barriers between cable spreading rooms A and B and switchgear room B would provide a 1 hour and 48 minutes barrier for a 3-hour fire loading area with no automatic suppression and a fire brigade that had not practiced in the area for over seven years. The licensee performed an evaluation to justify the acceptability of the Thermo-Lag wall in lieu of the fire endurance test results. An unresolved item was identified for this issue pending further NRC review to determine the adequacy of the protection provided by the Thermo-Lag fire barrier assemblies within the Cable Spreading and Auxiliary Control Panel Rooms. (Section 1R05.2.2)
- Changes were made to the Updated Final Safety Analysis Report (UFSAR) under 10 CFR 50.59 to revise the fire rating of the Thermo-Lag fire barriers in the switchgear room, ACP room, and cable spreading rooms from 3-hour barriers as approved in the Safety Evaluation Report (SER), without prior Commission approval, that involved a change to the approved fire protection program. The change to the Thermo-Lag barrier fire rating represented a 40% degradation (derating) of the margin of fire resistance from that established in the approved fire protection program. This issue is identified as an unresolved item pending NRR's review and determination of the adequacy of the 10 CFR 50.59 evaluation to support the FSAR change of the fire barrier rating from 3-hours to that which is adequate for the hazard. (Section 1R05.2.3)
- The appropriate test methodology and acceptance criteria may not have been used to determine the fire resistive performance of the Hemyc/MT cable wrap fire barrier systems installed to separate safe shutdown functions within the same fire area. This issue was identified as an unresolved item pending NRR's review to determine whether the licensee's use of the Hemyc and Promatec "MT" fire barrier wrap systems as qualified one-hour and three-hour fire barriers is acceptable. (Section 1R05.2.4)

## REPORT DETAILS

### REACTOR SAFETY

#### CORNERSTONES: INITIATING EVENTS and MITIGATING SYSTEMS

#### 1R05 FIRE PROTECTION

##### INTRODUCTION

The objective of this Fire Protection Inspection was to perform a review of the licensee's fire protection program for selected risk significant plant fire areas with emphasis on post-fire safe shutdown capability and the fire protection features provided for ensuring that at least one post-fire safe shutdown success path is maintained free of fire damage.

#### 1. **Systems Required to Achieve and Maintain Post-Fire Safe Shutdown**

##### a. Inspection Scope

The inspectors reviewed the licensee's shutdown methodology documented in Calculations E-5524 and E-5525; and abnormal operating procedures (AOP) AOP-004 and AOP-036. These documents were reviewed to verify that the methodology had properly identified the components and systems necessary to achieve and maintain safe shutdown for the selected fire areas. This included verifying that: (1) the reactivity control function was capable of achieving and maintaining cold shutdown conditions; (2) the reactor coolant makeup function was capable of maintaining the reactor coolant level within the level indication in the pressurizer; (3) the reactor heat removal function was capable of achieving and maintaining decay heat removal; (4) the process monitoring equipment provided direct readings of the process variables for reactivity control, coolant makeup, and decay heat removal functions; and (5) the support system functions were capable of providing the services necessary to permit extended operation of the equipment used to accomplish safe shutdown functions. The risk significant fire areas selected for review included the following:

12-A-CR/CRC1	Main Control Room/Control Room Complex
1-A-SWGR-A	Switchgear Room A
1-A-SWGR-B	Switchgear Room B
1-A-BAL-B/Room 1-A-4-CHLR	Reactor Auxiliary Building Unit 1 Balance

##### b. Observations and Findings

There were no findings identified and documented during this inspection.

## 2. Fire Protection of Safe Shutdown Capability

### 2.1 Fire Barrier Enclosures - Thermo-Lag Walls

#### a. Inspection Scope

The inspectors reviewed the actions that Carolina Power & Light Company (CP&L) had taken to resolve the technical issues related to the fire-resistive performance of Thermo-Lag fire area enclosures (i.e., fire area walls). The team also reviewed installed fire area barrier enclosures, the plant licensing basis, supporting fire tests, and evaluations.

In 1991, the NRC found that Thermo-Lag fire barrier material did not perform to the manufacturer's specifications. NRC Bulletin 92-01, "Failure of Thermo-Lag 330 Fire Barrier Systems to Maintain Cabling in Wide Cable Trays and Small Conduits Free From Fire Damage," identified that testing demonstrated that the fire resistant capability of the material had been declared indeterminate and required licensees with Thermo-Lag barriers to consider these fire barriers to be degraded.

#### b. Observations and Findings

The Shearon Harris Facility has Thermo-Lag fire barrier enclosure installations as complete wall and floor sections that constitute a portion of fire area boundaries between cable spreading rooms (CSR) A and B and switchgear room "B" (fire areas 1-A--CSRA, 1-A-CSR B, and 1-A-SWGR-B). The Auxiliary Control Panel (ACP) room [fire zone 1-A-ACP] is contained within fire area 1-A-SWGR-B. As originally designed and installed, these Thermo-Lag fire barrier enclosures were intended to provide three hours of fire endurance capability, based on standard fire test exposures.

Automatic fire detection and suppression systems are provided in fire areas 1-A-CSRA and 1-A-CSR B. No automatic suppression coverage is provided within the Thermo-Lag fire barrier enclosures or fire area 1-A-SWGR-B including the ACP room. An automatic fire detection system is provided within the Thermo-Lag fire barrier enclosures in fire areas 1-A--CSRA and 1-A-CSR B. No fire detection capability was originally provided with the Thermo-Lag fire barrier enclosure located in the ACP room, however, ESR 97-00562 was issued to add an ionization type fire detector inside this enclosure.

The Thermo-Lag fire barrier enclosures in the cable spreading and ACP rooms are comprised of two general configurations. One configuration consists of a vertical wall extending full height from floor to ceiling in the ACP room and in CSRA. The other configuration consists of two-sided enclosures (one Thermo-Lag wall and one floor assembly) located in the overhead areas of the respective cable spreading and ACP rooms. The concrete walls and ceilings in the rooms form the remaining sides of these enclosures.

The licensee performed full-scale fire endurance tests to evaluate the performance capability of the installed Thermo-Lag enclosure configurations. The fire tests were performed on similar floor and wall designs. The tests involved a one hour test of a vertical wall element and three hour test of wall and floor elements. A one-hour test was performed on September 14, 1994 (Omega Point Project No. 14980-97261). The test was run for a one-hour rating period using American Society for Testing and Materials (ASTM) E-119 as the testing method and acceptance criteria. The assembly met the temperature rise limits as measured on the cold side of the wall. A solid-bore hose stream test was conducted upon completion of the fire test. At 60 seconds into the hose stream test, water leakage was discovered at the interface of panel to panel joints. The hose stream test was stopped. Note that ASTM E-119 requires the hose stream test to last a minimum of one minute (60 seconds) per each 100-square feet of test assembly area (i.e., 60 seconds for this test assembly to be considered a one-hour rated assembly). After the assembly sat for approximately 1½ hours, the testing laboratory conducted an after-the-fact additional 90 second hose stream test. The assembly remained unchanged with the additional leakage around a thermocouple. Due to these discrepancies the required hose stream test for a 1-hour rated assembly is considered to be indeterminate. Also note that ASTM E-119 requires a minimum 2-1/2 minutes (150-second hose stream test per each 100-sq. feet of assembly area) to qualify a three-hour fire barrier assembly.

Another full-scale test was performed on May 23, 1995 (Omega Point Project No. 14980-98207). The test articles included horizontal floor portions of two-sided enclosures and a vertical wall element that contained an upgrade to the penetration seal sleeves. This test was scheduled to run for a 3-hour rating period with no hose stream test at the end. The licensee had planned on using the hose stream test results from the test of September 4, 1994, as allowed, with restrictions by ASTM E-119. (See previous discussion involving the acceptability of the hose stream testing.) This Thermo-Lag fire testing demonstrated that the fire barrier walls that constitute a portion of fire area boundaries between the cable spreading rooms A and B and switchgear room "B", fire areas 1-A--CSRA, 1-A-CSR B, and 1-A-SWGR-B would provide a fire-resistive rating for 1-hour and 48 minutes. The horizontal Thermo-Lag floor fire barrier test assembly successfully satisfied the average allowable temperature rise and maximum allowable single thermocouple temperature rise test acceptance criteria of the specified test standard for the full three hours of fire exposure. However, the Thermo-Lag wall failed to qualify as a 3-hour rated fire barrier enclosure. At 1 hour and 48 minutes (1:48) into the test, the average allowable temperature rise of 250 °F was exceeded. At 2 hours and 3 minutes (2:03), the maximum allowable single thermocouple temperature rise exceeded the 325 °F maximum limit.

The inspectors reviewed the licensee's UFSAR fire hazards analysis loading calculations for the cable spreading rooms A, B, switchgear B room, and ACP room (fire areas 1-A--CSRA, 1-A-CSR B, 1-A-SWGR-B, and fire zone 1-A-ACP). UFSAR Section 9.5.1.3 discusses the licensee's fire protection practice of determining the fire severity of a plant area. The UFSAR stated that the relative fire hazard (severity) of an area may be considered "LOW, MODERATE, or HIGH" based on each additional increment of 80,000 BTU/sq. ft. of fire loading. Also, for each increment increase in fire severity loading an

additional 1-hour of fire resistance rating for the barriers is needed. The licensee identified three plant areas where the fire loading exceeded 240,000 BTU per square foot (3-hours of fire resistance). These areas were the cable spreading rooms A, B, and the ACP room. Based on the above, the inspectors determined that at least a 3-hour in-situ fire severity loading existed in the areas adjacent to and exposing the Thermo-Lag fire barrier enclosures.

Based on the fire endurance test results, the licensee prepared a 10 CFR 50.59 safety evaluation (97-255) to evaluate the acceptability of the failed 3-hour test for the Thermo-Lag wall. This safety evaluation was transmitted to the NRC in a letter dated August 29, 1997, (Serial No. HNP-97-170), in response to NRC GL 92-08, "Thermo-Lag 330-1 Fire Barriers." Also, in a letter dated December 4, 1997 (Serial No. HNP-97-211), the licensee transmitted a summary of the evaluation to incorporate the evaluation of ESR 95-00620, Revision 1, into the updated UFSAR (Amendment 48). The stated purpose of the evaluation was to determine the suitability of the existing Thermo-Lag enclosures as a fire barrier in the ACP room and CSRs. This involved revising the rating of the Thermo-Lag barriers in these areas from 3-hour rated to those which were suitable for the hazard. The evaluation included Calculations FP-0109, "Compartment Heat-up Analysis for Cable Spreading and ACP Rooms," Revision 0, and FP-0110, "Evaluation of Thermo-Lag Fire Barrier Enclosures Within the Cable Spreading and ACP Rooms," Revision 0. The purpose of these calculations was to assess room temperatures as a result of a postulated cable tray fire in the areas and assess the ability of the existing Thermo-Lag fire barrier enclosures to maintain acceptable temperatures on the unexposed side due to the postulated fire.

Harris Operating License NFP-63, Condition 4.2.F, "Fire Protection Program," specifies, in part, that Carolina Power and Light (CP&L) implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report (UFSAR) for the facility as amended and as approved in the Safety Evaluation Report (SER) dated November 1983 (and supplements 1 through 4), and the Safety Evaluation dated January 12, 1987.

Harris UFSAR Sections 9.5.1.2.2, "Barriers and Access," states that fire barriers with a minimum fire resistance rating of three hours are provided such that both redundant divisions or trains of safety-related systems are not subject to damage from a single fire to the extent possible in accordance with NRC position C.5.b.(2) of BTP CMEB 9.5-1 (NUREG-0800), July 1981. The Individual plant examination of external events (IPEEE) indicated that the ignition frequencies in these areas are significant. On the basis of the ignition frequencies and the combustible loading in these areas, the Thermo-Lag walls are considered to be important because they provide primary passive fire barrier separation between redundant trains of post-fire safe shutdown equipment. Under the conditions of a severe fire, there is a possibility that the Thermo-Lag wall could fail, and the redundant safe shutdown cables and equipment in both areas could be fire damaged.

The fire endurance testing demonstrated that the Thermo-Lag walls that serve as a portion of fire area separation barriers between the cable spreading rooms A and B and

switchgear room B would provide a fire rating of 1 hour and 48 minutes for thermal performance in lieu of the 3-hour requirements of the approved fire protection program. This rating, however, may be questionable, considering the failed hose stream testing performed on the 1-hour test assembly. In the case of the B train switchgear room fire area, the inspectors noted that there was no automatic fire suppression. This issue may be significant since the Thermo-Lag fire wall was not designed or rated to bound the in-situ fire loading and the lack of diverse fire protection (i.e., no automatic sprinklers installed in the B switchgear fire area). A significant amount of cables exists in the ACP room, which is part of the B switchgear room fire area. Therefore, the inspectors viewed this reduction in the fire rating for these Thermo-Lag walls as non-conservative and may contribute to an increase in risk due to fire. The licensee had performed an evaluation of the acceptability of the Thermo-Lag fire barrier wall which considered the fire endurance test results. The inspectors did not perform a detailed review of the evaluation during this inspection. Region II requested the Office of Nuclear Reactor Regulation's (NRR) to evaluate this issue in Task Interface Agreement (TIA) 99-028, dated November 23, 1999. This issue will be identified and tracked as unresolved item (URI) 50-400/99-13-01, Adequacy of Thermo-Lag Fire Barrier to Meet Plant Licensing Basis Requirements. This issue is unresolved pending further NRC review to determine the adequacy of the protection provided by the Thermo-Lag fire barrier assemblies within the Cable Spreading and ACP Rooms.

## 2.2 10 CFR 50.59 Evaluation for UFSAR Change

### a. Inspection Scope

The inspectors performed an independent technical review of the licensee's 10 CFR 50.59 evaluation 97-255 for ESR 95-00620 discussed above in Section 2.2 of this report. The change implemented by the licensee was evaluated in order to verify that the following requirements had been satisfied:

- . That the licensee obtained NRC approval prior to implementing changes to licensing bases that result in a more than minimal increase in risk.
- . That reduction in design margins for risk significant SSCs did not degrade the capability of the SSCs from performing their design functions.
- . That changes were made in accordance with the requirements of 10 CFR 50.59.

### b. Observations and Findings

The licensee's 10 CFR 50.59 evaluation 97-255 screen for ESR 95-00620 concluded that the fire barrier rating of the Thermo-Lag fire wall enclosures as established by actual fire testing was one hour and 48 minutes (1.8 hrs.), in lieu of the intended 3-hour fire endurance capability. The licensee's evaluation further determined that changes in the ratings of these fire area boundaries (which separated redundant divisions of safety-related equipment) did not require prior NRC review and approval. As such, the licensee changed the UFSAR to revise the rating of the Thermo-Lag fire barriers in the

switchgear room, ACP room, and cable spreading rooms from 3-hour barriers to one that was adequate for the hazard.

10 CFR 50.59 states that the licensee may make changes to the facility as described in the safety analysis report without prior Commission approval, unless the proposed change involves a change in the TS incorporated into the license or an unreviewed safety question. The NRC's response to question 8.4, "Future Changes," described in GL 86-10, stated that, if a future modification involves a change to a license condition or technical specification, a license amendment request must be submitted. When a modification not involving a technical specification or license condition is planned, the evaluation made in conformance with 10 CFR 50.59. If the evaluation finds that there is an impact that could result in the area either not being in conformance with Appendix R, or some other aspect of the approved fire protection program, or being outside the basis for an exemption that was granted for the area involved, the licensee must either make modifications to achieve conformance or justify and request exemption (or, for the post 1979 plants, approval) from the NRC. See also responses to Questions 8.1 and 8.2.

License Condition 2.C.4 to the Shearon Harris Operating License NPF-63 specifies that the licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the UFSAR for the facility as amended and as approved in the SER dated November 1983 (and supplements 1 through 4), and SER dated January 1987. The NRC based its approval of the Harris fire protection program on the licensee's commitment that it would meet Section C.5.a of BTP CMEB 9.5-1 as approved in Section 9.5.1.4 of the Harris SER, dated November 1983.

Changes were made to the UFSAR to revise the fire rating of the Thermo-Lag fire barriers in the switchgear room, ACP room, and cable spreading rooms from 3-hour barriers as approved in the SER, without prior Commission approval, that involved a change to an aspect of the approved fire protection program. The change to the Thermo-Lag barrier fire rating represented a 40% degradation (derating) of the margin of fire resistance from that established in the approved fire protection program. Region II requested NRR assistance in TIA 99-028 to evaluate this issue. This issue is identified as URI 50-400/99-13-02, Adequacy of the 10 CFR 50.59 for Changes Made to the UFSAR to Revise the Fire Rating of Selected Thermo-Lag Fire Barriers. This item is open pending NRR's review and determination of the adequacy of the 10 CFR 50.59 evaluation to support the FSAR change of the fire barrier rating from 3-hours to that which is adequate for the hazard.

## 2.3 Electrical Raceway Fire Barrier Systems Used to Protect Safe Shutdown Capability

### a. Inspection Scope

The inspectors reviewed the technical adequacy of the "Hemyc Wrap" and "MT Wrap" fire barrier material used to separate safe shutdown functions within the same fire area. This review included evaluation of the material's application as a fire barrier system for the protection of safe shutdown functions, and the fire endurance testing which substantiated the fire barrier systems' construction/installation attributes and their its

ability to perform as 1-hour and 3-hour rated fire barriers. The inspectors reviewed the following documents:

- CTP 1026, "Fire Qualification Test of 'Hemyc' Cable Wrap System-One Hour," June 1, 1982, Central Nuclear de Asco, Tarragona, Spain.
- CTP 1071, "Three Hour Fire Qualification Test of Promatec 'MT' Barrier Wrap System-Electrical Conduit Circuits," January 6, 1986, Southwest Research Institute, San Antonio, Texas, Project No. 01-8305-049.
- CTP 1100A, "Three Hour Fire Qualification Test of Promatec 'MT' Barrier Wrap System-Electrical Cable Tray Circuits," June 4, 1986, Southwest Research Institute, San Antonio, Texas, Project No. 01-8821-016.

b. Observations and Findings

Fire protection features required to satisfy General Design Criterion (GDC) 3, "Fire Protection," included features to ensure that one train of those systems necessary to achieve and maintain safe shutdown conditions be maintained free of fire damage. One means for complying with this requirement was to separate one safe shutdown train from its redundant train with fire-rated barriers. The level of fire resistance required, 1-hour or 3-hours, depended on the other fire protection features provided in the fire area of concern.

The NRC issued guidance on acceptable methods of satisfying the regulatory requirements of GDC 3 in Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guideline for Fire Protection for Nuclear Power Plants;" Appendix A to BTP APCS 9.5-1; BTP Chemical Engineering Branch (CMEB) 9.5-1 "Fire Protection for Nuclear Power Plants," July 1981; Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements," April 24, 1986; and Supplement 1 to GL 86-10, " Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used To Separate Redundant Safe Shutdown Trains Within the Same Fire Area," March 25, 1994.

Harris UFSAR Section 9.5.1.2.2.1, "Safe Shutdown Capability," states that where cable or equipment ... of redundant safe shutdown divisions of systems necessary to achieve and maintain cold shutdown conditions are located within the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant divisions is free of fire damage is provided: (a) Separation of cables and equipment and associated circuits of redundant safe shutdown divisions by a fire barrier having a 3-hour rating except as described in Section 9.5.1.2.4; (b) Separation of cables and equipment and associated circuits of redundant safe shutdown divisions by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards; (c) Enclosure of cables and equipment and associated circuits of redundant safe shutdown divisions by a fire barrier having a 1-hour rating.

During plant licensing, Shearon Harris SER Supplement 4, Section 9.5.1.1, "Fire Protection Program Requirements," incorporated the guidance of GL 86-10,

"Implementation of Fire Protection Requirements," dated April 24, 1986, into the UFSAR by reference.

In the BTPs and in GL 86-10, the NRC staff stated, in part, that the fire resistance rating of fire barriers should be established in accordance with National Fire Protection Association (NFPA) Standard 251, "Standard Methods of Fire Tests of Building Construction and Materials." A test specimen should represent the materials, workmanship, method of assembly, dimensions, and configuration for the fire rating desired. In GL 86-10, and its Supplement 1 the staff included guidance on fire test acceptance criteria and for evaluating deviations from tested configurations. The guidance in GL 86-10 did not change the requirement to separate one safe shutdown train from its redundant train with either a 1-hour or a 3-hour fire rated barrier.

Hemyc Wrap and MT cable wrap fire barrier systems were used at Harris to maintain one train of post-fire safe shutdown capability free of fire damage and to provide the needed assurance that one train of post-fire safe shutdown capability would be immediately available to perform their intended function. Both Hemyc and MT cable wrap systems are manufactured by Promatec Technologies, Inc..

The inspectors performed a review and evaluation of the Hemyc /MT cable wrap fire barrier systems' qualification testing documentation. Fire barrier test designation CTP-1026 for the Hemyc 1-hour rated fire wrap system and CTP-1071 for the MT 3-hour rated fire wrap system serve as the plants qualification bases for the cable wrap fire barrier systems.

The fire barrier acceptance criteria used for the Hemyc /MT cable wrap fire barrier systems was based on that reflected by American Nuclear Insurers (ANI) as specified in ANI Information Bulletin 5(79), "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class 1E Electrical Circuits," July 1979. The ANI test methodology, as specifically noted on the cover letters for the test reports provided to the inspectors by the licensee, stated that the tests reports were issued for insurance purposes only, and were not be considered the equivalent of rated fire barriers, where required. Additionally, in 1994, Supplement 1 to GL 86-10 addressed NRC concerns with the ANI test methodology. In lieu of monitoring the unexposed surface temperature of the fire barrier test specimen, the ANI test specifies that cables within the fire barrier test specimen be monitored for temperature and circuit integrity (pass a low voltage circuit integrity test) while the test specimen is subjected to a test fire that follows the standard time-temperature curve. If cable circuit integrity is maintained, the test is considered successful. The ANI test methodology does not specify the following GL 86-10 acceptance criteria:

- (1) The fire barrier design has withstood the fire endurance test without the passage of flame or the ignition of cotton waste on the unexposed side for a period of time equivalent to the fire-resistance rating required of the barrier.
- (2) Analysis of temperature levels recorded on the unexposed side of the fire barrier demonstrates that the maximum temperature rise does not exceed 139 °C [250 °F] above ambient temperature.

(3) The fire barrier remains intact and does not allow water to be projected beyond the unexposed surface during the hose stream test.

The NRC considers using the ANI monitoring approach nonconservative in that cable damage can occur without indication of excessive temperatures on the cables. This, linked with no loss of circuit integrity, would give indications of a successful test. Enclosure 1, "Interpretations of Appendix R," to GL 86-10, provided additional guidance with respect to the term "free of fire damage" as used in Appendix R. Interpretation 3, "Fire Damage," stated: "In promulgating Appendix R, the Commission has provided methods acceptable for assuring that necessary structures, systems, and components are free from fire damage (see Section III.G.2a, b, and c), that is, the structure, system or component under consideration is capable of performing its intended function during and after the postulated fire, as needed."

The licensee was unable to provide the inspectors with engineering evaluation documentation which demonstrated that the shutdown capability is protected. For example, the cables for redundant trains of safe shutdown related functions throughout the plant and both trains of onsite diesel generator power cables routed through fire zone 4-A-CHLR (where the offsite power bus ducts are also routed) are wrapped with cable wrap fire barrier systems. As a result, all power supplied to the 6.9kV Emergency Switchgear 1A-SA and 1B-SB is susceptible to total loss if a substantial fire were to occur in this fire zone and the cable wrap fire barrier system protecting the Emergency Diesel Generators 1A(1B) feeder cables were to fail. The licensee had not previously analyzed this condition for the effects on off-site power.

Additionally, the inspectors were unable to confirm that the licensee had established an acceptable design basis for the Hemyc/MT cable wrap fire barrier systems used to separate safe shutdown functions within the same fire area. The licensee stated that CP&L was currently implementing a comprehensive design basis program for fire protection systems and feature, including passive features such as penetrations seals and Hemyc/MT cable wrap fire barrier systems. As part of this effort, as-built plant configurations are to be validated against documented design basis requirements established by the fire endurance qualification testing documentation and evaluations completed for fire barrier conditions that vary from the tested configurations. It did not appear that an adequate design basis had been established for fire protection cable wrap fire barrier systems which incorporated the guidance of GL 86-10.

The inspectors concluded that the actual fire resistive performance of the Hemyc/MT cable wrap fire barrier systems installed to separate safe shutdown functions within the same fire area was indeterminate. There was uncertainty as to whether or not the ANI test method established a level of fire barrier performance equivalent to that established by the GL 86-10 acceptance criteria, and may not have provided reasonable assurance that the cables protected by the cable fire barrier systems would be capable of performing their intended post-fire safe shutdown function during and following a fire. Region II requested NRR's assistance in TIA 99-028 to evaluate this issue. This issue is identified as URI 50-400/99-13-03, Adequacy of Hemyc/MT Cable Wrap Fire Barrier Qualification Tests and Evaluations to Scope Installed Configurations. This item remains open pending NRR review to determine whether the licensee's use of the

Hemyc and Promatec "MT" fire barrier wrap systems as qualified one-hour and three-hour fire barriers is acceptable.

## 2.4 Fire Brigade Drill Program

### a. Inspection Scope

The inspectors reviewed the fire brigade drill program, observed a fire brigade response associated with an unannounced fire brigade drill, and reviewed selected audits of the fire protection program performed by the Harris Nuclear Assessment Section (HNAS).

### b. Observations and Findings

The inspectors witnessed an unannounced fire brigade drill (Serial NO. 99-D-07) for an operations shift, on November 3, 1999. The fire scenario, involved a simulated fire in the Battery Charger 1A-SB located in the B train 1B-SB Switchgear Room (Fire Area 1-A-SWGR-B). The brigade demonstrated good fire fighting tactics, the proper use of the pre-fire plan and fire fighting equipment, and adequate recovery operations. The fire brigade leader's direction and performance was also good. The fire brigade leader dispatched two fire brigade members to the 1-A-SWGR-A, Switchgear Room to inspect the area to ensure no fire existed that could affect A train safe shutdown equipment in this area. Control room activities in response to the drill were timely and in accordance with procedures.

The critique of this drill was effective in identifying a pre-fire plan area of improvement involving noting in the pre-fire plan the availability of fire hose stations in the Turbine Building for use when accessing the switchgear rooms. The licensee initiated Document Change Form (DCF) no. 1999P20294 to correct the identified pre-fire plan drawing inconsistency, which had no significant effect on fire brigade operation. The nominal fire brigade performance response time to place an effective fire suppression agent on the fire was about 18 minutes. The overall brigade drill performance was judged to have been satisfactory.

No findings were identified and documented in relation to the fire brigade drill performance.

The inspectors observed that the drill critique data for shift fire drills conducted during the past three-year period indicated that effective response by the fire brigade may have been somewhat reduced throughout several years. The inspectors reviewed selected HNAS assessment reports and noted that a number of issues had been identified concerning fire brigade drill performance deficiencies (Issue No. H-FP-97-01-11) and the quality and use of pre-fire plans (H-FP-98-01-W1 and H-FP-98-02-12). Also, the NRC identified a concern regarding the lack of fire brigade drills scheduled in the switchgear areas. Until recently, no fire drills had been scheduled within the switchgear areas in at least the past seven years. This concern was documented in CR 99-01973 and discussed in NRC inspection report 50-400/99-05.

## 3. **Post-fire Safe Shutdown Circuit Analysis**

a. Inspection Scope

Harris Updated Final Safety Analysis Report (UFSAR) Section 9.5.1 described the plant fire protection program. UFSAR Section 7.4.1 referred to the safe shutdown analysis for safe shutdown following a fire. The safe shutdown analysis documented the analysis of the plant against the criteria of Standard Review Plan (SRP) 9.5.1 (NUREG-0800) which contained the technical requirements of Branch Technical Position (BTP) Chemical Engineering Branch (CMEB) 9.5-1 "Fire Protection for Nuclear Power Plants," July 1981. CMEB 9.5-1, position C.5.b requires that one train of systems necessary to achieve and maintain hot shutdown conditions be maintained free of fire damage by separation and/or fire protection features which meet the requirements of positions C.5.b(2)(a), C.5.b(2)(b), or C.5.b(2)(c).

On a sample basis, the adequacy of separation provided for power and control cabling associated with redundant trains of equipment necessary to achieve and maintain safe shutdown was reviewed for fire areas 12-A-CR/CRC1, 1-A-SWGR-A, 1-A-SWGR-B, and 1-A-BAL-B. The inspectors focused on functions required to achieve and maintain hot shutdown conditions, and included: electrical power distribution; reactivity control; reactor coolant system inventory control; reactor pressure control; reactor heat removal; essential mechanical support; and essential environmental support functions. Specifically, the evaluation included power and control cables associated with components of the auxiliary feedwater (AFW), component cooling water (CCW), chemical and volume control (CVCS), emergency diesel generator (EDGS), emergency service water (ESW), safety injection (SIS) and residual heat removal (RHR) systems.

The evaluation of separation of required safe shutdown functions was based on a comparison of cable routing information retrieved from the plant's computerized cable and raceway function report C15; post-fire safe shutdown analyses documented in calculations E-5524, "Safe Shutdown Separation Analysis," Revision 2 and E-5525, Revision 1, "Safe Shutdown Analysis in Case of Fire," and conduit and cable tray routing drawings provided by the licensee. For the purpose of this review, an interaction was identified whenever cables of redundant shutdown paths and/or divisions were shown on the cable and raceway function report and cable tray routing drawings as being in the same fire area. Following their identification, the safe shutdown separation analyses methodology for providing an acceptable resolution was evaluated. This evaluation included a review of the post-fire safe shutdown analysis and supporting calculations to determine if the interactions had been properly identified and dispositioned.

b. Observations and Findings

For the sample of circuits reviewed, no findings were identified and documented during this inspection. The licensee initiated Engineering Service Request (ESR) 99-00415 to correct five inspector identified drawing inconsistencies, which had no significant effect on plant operation.

**4. Alternative Shutdown Capability**

a. Inspection Scope

The inspectors reviewed selected licensee calculations, AOPs, and surveillance procedures to verify the adequacy of the design and implementation of the alternative shutdown capability for selected plant fire areas. The inspectors also reviewed the licensee's alternative shutdown methodology to determine the identified components and systems necessary to achieve and maintain safe shutdown conditions. This included: (1) verifying that the methodology addressed achieving and maintaining hot and cold shutdown from outside the main control room (MCR) with off-site power available or not available; and (2) verifying that the transfer of control from the MCR to the alternative location had been demonstrated to not be affected by fire-induced circuit faults.

b. Observations and Findings

There were no findings identified and documented during this inspection.

**5. Operational Implementation of Alternative Shutdown Capability**

a. Inspection Scope

The inspectors reviewed the operational implementation of the alternative shutdown capability for Fire Areas 12-A-CR/CRC1 (Control Room/Control Room Complex) to verify that: (1) the training program for licensed personnel included alternative or dedicated safe shutdown capability; (2) personnel required to achieve and maintain the plant in hot shutdown following a fire using the alternative shutdown system could be provided from normal onsite staff, exclusive of the fire brigade; (3) adequate procedures for use of the alternative shutdown system existed and the operators could reasonably be expected to perform the procedures within applicable shutdown time requirements; (4) the licensee had incorporated the operability of alternative shutdown transfer and control functions into the plant technical specifications; and (5) the licensee periodically performed operability testing of the alternative shutdown instrumentation and transfer and control functions, including imposing appropriate compensatory measures during testing when the alternative shutdown capability may be declared inoperable.

b. Observations and Findings

There were no findings identified and documented during this inspection.

**6. Communications for Performance of Alternative Shutdown Capability**

a. Inspection Scope

The inspectors walked down the remote shutdown equipment identified in procedure AOP-036 in the in the switchgear rooms A and B and the ACP room and verified that sound-powered phone jacks were at the locations identified in the procedure. The inspectors' observations of the material condition of selected sound-powered phone stations found that the sound-powered phone jacks were in good condition, free of foreign material, and installed at the proper locations to support required shutdown actions identified in the AOP-036 procedure.

Observations and Findings

- b. There were no findings identified and documented during this inspection.

**7. Emergency Lighting for Performance of Alternative Shutdown Capability**

a. Inspection Scope

The inspectors reviewed the design and operation of the 8-hour battery powered emergency lighting and the ACP room dc emergency light systems.

The inspectors' reviewed emergency lighting drawings CPL 2165-S-sheets 1000-1006, "Emergency Lighting and Access/Egress Path Layout," and verified that the emergency lighting design drawings for the 8-hour battery powered emergency lighting system installed in switchgear rooms A and B and the ACP room were properly provided to allow access to safe shutdown equipment and performance of manual actions reflected in AOP-036 for these areas.

The inspectors walked down remote shutdown equipment identified in procedure AOP-036 in the switchgear rooms A and B and the ACP room and inspected approximately 25 lighting units designated on the emergency lighting drawings. The purpose of the walk down was to verify that the emergency lighting unit lamps were operational and the lighting heads were aimed to provide adequate illumination to perform the required shutdown actions denoted in the procedure.

The ACP room was not provided with 8-hour battery powered emergency lighting units. In the ACP room the plant dc emergency lighting system was used. The inspectors reviewed the cable routing for the dc emergency lighting system and verified that the cables were separated so that a single fire will not cause loss of the lighting capability in the ACP room.

b. Observations and Findings

There were no findings identified and documented during this inspection.

**V. MANAGEMENT MEETINGS**

**EXIT MEETING SUMMARY**

The lead inspector discussed the progress of the inspection with licensee representatives on a daily basis and presented the preliminary results to members of licensee management and staff during a pre-exit at the conclusion of the onsite inspection on November 5, 1999. Subsequent to the onsite inspection, the licensee provided additional information to the inspectors for review. After reviewing the additional information, the inspectors and Region II management held the formal exit by telephone with licensee management on December 20, 1999. The

licensee stated their belief that the three unresolved items are not findings. The inspectors asked the licensee whether any of the material examined during the inspection should be considered proprietary. No proprietary information was identified.

**PARTIAL LIST OF PERSONS CONTACTED**

**Licensee**

D. Alexander, Manager, Regulatory Affairs  
 C. Burton, Director, Site Operations  
 J. Eads, Supervisor, Licensing/Regulatory Affairs  
 R. Field, Manager, Nuclear Assessment Section  
 P. Fulford, Superintendent, Technical Services, Harris Engineering Support Section (HESS)  
 L. Garner, Supervisor, Maintenance  
 C. Georgeson, Safe Shutdown Engineer, HESS  
 B. Gerwe, Fire Protection Engineer, Robinson Engineering Support Section  
 W. Gregory, Operations Fire Protection Coordinator  
 W. Gurganious, Supervisor, Technical Training  
 S. Hardy, Principle Analyst, Nuclear Engineering Design  
 T. Hobbs, Manager, Operations  
 C. Jernigan, Superintendent, Shift Operations  
 D. McAfee, Fire Protection Program Manager, HESS  
 A. Morisi, Supervisor, Electrical/I&C Design, HESS  
 M. Munroe, Superintendent, Operations Support  
 S. Saunders, Supervisor, Emergency Core Cooling System, HESS  
 J. Scarola, Vice President, Harris Plant  
 R. Sims, Fire Protection Engineer, Brunswick Engineering Support Section  
 V. Stephenson, Superintendent, Mechanical Systems Engineering, HESS  
 M. Wallace, Senior Analyst, Licensing/Regulatory Programs

Other licensee employees contacted included engineers, operations personnel, maintenance personnel, and administrative personnel.

**NRC:**

J. Brady, Senior Resident Inspector  
 R. Hagar, Resident Inspector  
 P. Koltay, Office of Nuclear Reactor Regulation (NRR)  
 P. Qualls, (NRR)  
 V. McCree, Deputy Director, Division of Reactor Safety, Region II

**INSPECTION PROCEDURES USED**

IP 71111.05, Fire Protection

**ITEMS OPENED, CLOSED, OR DISCUSSED**Opened

50-400/99-13-01	URI	Adequacy of Thermo-Lag Fire Barrier to Meet Plant Licensing Basis Requirements (Section 2.1)
50-400/99-13-02	URI	Adequacy of the 10 CFR 50.59 for Changes Made to the UFSAR to Revise the Fire Rating of Selected Thermo-Lag Fire Barriers (Section 2.2)
50-400/99-13-03	URI	Adequacy of Hemyc/MT Cable Wrap Fire Barrier Qualification Tests and Evaluations to Scope Installed Configurations (Section 2.3)

**APPENDIX**

**LIST OF DOCUMENTS REVIEWED**

**PROCEDURES**

AOP-004, Remote Shutdown, Revision 18

AOP-036, Safe Shutdown Following a Major Fire, Revision 7

EPT-709T, Temporary Procedure for MCB to ACP Manual Transfer - Functional Test (Expires 12/31/95), Revision 0

FPP-001, Fire Protection Program Manual, Revision 19

OMM-002, Shift Turnover Package, Revision 17

OST-1813, Remote Shutdown System Operability 18 Month Interval Modes 5, 6, or Defueled, Revision 15

**CALCULATIONS**

Calculation E-5524, Safe Shutdown Separation Analysis, Revision 2

Calculation E-5525, Safe Shutdown Analysis in Case of Fire, Revision 2

**DRAWINGS**

CPL 2165-S, Emergency Lighting and Access/Egress Path Layout, Sheets 1000-1006

**ASSESSMENT REPORTS**

H-FP-98-01, Harris Fire Protection Assessment, dated January 29, 1998

H-FP-98-02, Harris Fire Protection, dated January 29, 1999