From: McKenzie Thomas , eII
To: Charlie Payne
Date: 5/1/03 5:36PM
Subject: St. Lucie TFPI Report 03-02

Attached is a draft of the report 50-335,389/2003-02 for your review. I should finish the report tomorrow.

Kenny

NN-14

May XX, 2003

Florida Power and Light Company
ATTN: Mr. J. A. Stall, Senior Vice President
Nuclear and Chief Nuclear Officer
P. O. Box 14000
Juno Beach, FL 33408-0420

SUBJECT: ST. LUCIE NUCLEAR PLANT - NRC TRIENNIAL FIRE PROTECTION INSPECTION REPORT 50-335/03-02 AND 50-389/03-02

Dear Mr. Stall:

On March 28, 2003, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your St. Lucie Nuclear Plant Units 1 and 2. The enclosed inspection report documents the inspection findings, which were discussed on March 28, 2003, with Mr. D. Jernigan and other members of your staff.

The inspection examined 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. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents a finding concerning silicon oil filled transformers in the B Switchgear Room which had not been considered or evaluated in the licensee's fire hazards analysis. Additionally, a finding was identified concerning the crediting of manual operator actions outside the main control room in lieu of physical protection of cables and equipment relied on to achieve safe shutdown during a fire, without prior NRC approval, for areas designated as 10 CFR 50 Appendix R, Section III.G.2. These findings involved violations of NRC requirements. These findings collectively have potential safety significance greater than very low significance. However, a safety significance determination has not been completed. These findings did not present an immediate safety concern. In addition, the report documents one NRC-identified finding of very low safety significance (Green), which was determined to involve a violation of NRC requirements. However, because of the very low safety significance and because it was entered into your corrective action program, the NRC is treating this as a non-cited violation (NCV) consistent with Section VI.A of the NRC Enforcement Policy. Additionally, two licensee identified violations which were determined to be of very low safety significance are listed in this report. If you contest any NCV in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN.: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at St. Lucie Nuclear Plant.

FP&L

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at

http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

Charles R. Ogle, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos. 50-335, 50-389
License Nos. DPR-67, NPF-16

Enclosure: Inspection Report 50-335, 389/03-02
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

FP&L

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos:	50-335, 50-389
License Nos:	DPR-67, NPF-16
Report No:	50-335/03-02, 50-389/03-02
Licensee:	Florida Power and Light Company (FPL)
Facility:	St. Lucie Nuclear Plant, Units 1 & 2
Location:	6351 South Ocean Drive Jensen Beach, FL 34957
Dates:	March 10-28, 2003
Inspectors:	R. Deem, Consultant, Brookhaven National Laboratory P. Fillion, Reactor Inspector F. Jape, Senior Project Inspector M. Thomas, Senior Reactor Inspector (Lead Inspector) S. Walker, Reactor Inspector G. Wiseman, Senior Reactor Inspector
Approved by:	Charles R. Ogle, Chief Engineering Branch 1 Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000335/2003-002, 05000389/2003-002; Florida Power and Light Company; 03/10 - 28/2003; St. Lucie Nuclear Plant, Units 1 and 2; Triennial Fire Protection.

The report covered a two-week period of inspection by regional inspectors and a consultant. Three Green non-cited violations (NCVs) and one unresolved item with potential safety significance greater than Green were identified. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG 1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Initiating Events

- TBD. The team identified a violation of 10 CFR 50.48 and the St. Lucie Nuclear Plant (PSL) Unit 2 Operating License Condition (OLC) 2.C.(20), Fire Protection. The fire hazards analysis (FHA) failed to consider and evaluate the combustibility of 380 gallons of transformer silicone dielectric insulating fluid in each of six transformers (installed in three Unit 2 fire areas) as contributors to fire loading and effects on safe shutdown (SSD) capability, as required by Fire Protection Program (FPP) commitments.

  This finding is greater than minor because it affected the objective of the initiating events cornerstone to limit the likelihood of those events that could upset plant stability and challenge critical safety functions relied upon for SSD during a fire. The six previously unidentified silicone oil-filled transformers represented an increase in the ignition frequency of the associated fire areas/zones. This finding is unresolved pending completion of a significance determination. Also, when assessed with other findings identified in this report, the significance could be greater than very low significance. (Section 1R05.02)

Cornerstone: Mitigating Systems

- TBD. A violation of 10 CFR 50, Appendix R, Section III.G.2, was identified for failure to ensure that one train of equipment necessary to achieve and maintain safe shutdown would be free of fire damage. Train A 480 volt (V) vital load center 2A5 and associated electrical cables were located in the Train B switchgear room (fire area C) without adequate spatial separation or fire barriers. This load center powered redundant equipment (via motor control center 2A6 which powered boric acid makeup pumps 2A and 2B) required for SSD in the event of a fire. In lieu of providing adequate physical protection for load center 2A5 and the associated electrical cables, manual operator actions outside the main control room (MCR) were relied on and credited, without prior NRC approval, for achieving and maintaining SSD.

This finding was greater than minor because fire damage to the unprotected cables could prevent operation of the equipment from the MCR and challenge the operators' ability to maintain adequate reactor coolant system (RCS) inventory and reactor coolant pump (RCP) seal flow for SSD during a fire in the B switchgear room.

- Green. A non-cited violation of 10 CFR 50, Appendix R, Section III.G.2 was identified concerning a lack of spacial separation or barriers to protect cables against fire damage in containment could result in spurious opening of the pressurizer power operated relief valve (PORV).

This finding is greater than minor because it affected the mitigating system cornerstone objective of equipment reliability, in that, spurious opening of the PORV during post-fire safe shutdown would adversely affect systems intended to maintain hot shutdown. The finding is of very low safety significance because the initiating event likelihood was relatively low, manual fire suppression capability remained unaffected and all mitigating systems except for the PORV and block valve were unaffected. (Section 4OA5)

B. Licensee-Identified Violations

One violation for which the significance has not been determined and two violations of very low safety significance, which were identified by the licensee and entered in the corrective action program, were reviewed by the inspection team. (Section 4OA7)

- TBD. Many local manual operator actions were used in lieu of the required physical protection of cables for equipment relied on for SSD during a fire, without obtaining prior NRC approval for these deviations from the approved fire protection program. This condition applied to numerous fire areas, including the areas selected for this inspection. This reliance on large numbers of local manual actions, in place of the required physical protection of cables, could potentially result in an increased risk of loss of equipment that was relied upon for SSD from a fire. (Section 1R05.05)

A violation of PSL Unit 2 (OLC) 2.C.(20) and the Fire Protection Program was identified. However, this finding is unresolved pending completion of a significance determination. The finding is greater than minor because it could potentially result in an increased risk of loss of equipment that was relied upon for SSD from a fire. (Section 1R05.XXXXX)

Other violations of very low safety significance, which were identified by the licensee, have been reviewed by the team. Corrective actions taken or planned by the licensee have been entered into the licensee's corrective action program. These violations and corrective action tracking numbers are listed in Section 4AO7.

REPORT DETAILS

1. **REACTOR SAFETY**
Cornerstones: Initiating Events, Mitigating Systems and Barrier Integrity

1R05 FIRE PROTECTION

01. Systems Required to Achieve and Maintain Post-Fire Safe Shutdown

a. Inspection Scope

The team evaluated the licensee's fire protection program against applicable requirements, including Operating License Condition (OLC) 2.C.20, Fire Protection; Title 10 of the Code of Federal Regulations Part 50 (10 CFR 50), Appendix R; 10 CFR 50.48; Appendix A to Branch Technical Position (BTP) Auxiliary Systems Branch (ASB) 9.5-1, Guidelines for Fire Protection for Nuclear Power Plants; related NRC Safety Evaluation Reports (SERs); the St. Lucie Updated Final Safety Analysis Report (UFSAR); and plant Technical Specifications (TS). The team evaluated all areas of this inspection, as documented below, against these requirements. The team reviewed the licensee's Individual Plant Examination for External Events (IPEEE) and performed in-plant walk downs to choose three risk-significant fire areas for detailed inspection and review. The three fire areas selected were:

- **Unit 2 Fire Area B - Cable Spreading Room (Fire Zone 52).** A fire in this area would involve alternate shutdown from outside the main control room (MCR).

- **Unit 2 Fire Area C - Train B Switchgear Room (Fire Zone 34) and Electrical Equipment Supply Fan Room (Fire Zone 48).** Fire Area C and the essential equipment and cables within were evaluated by the licensee with respect to the protection and separation criteria of 10 CFR 50, Appendix R, Section III.G.2, to assure that the ability to safely shut down the plant was not adversely effected by a single fire event. Safe shut down of Unit 2 from the MCR using Train A equipment was credited for a fire in this area.

- **Unit 2 Fire Area I - Fire Zone 51 West (Cable Loft), Fire Zone 21 (Personnel Rooms), Fire Zone 32 (PASS and Radiation Monitoring Room), Fire Zone 33I (Instrument Repair Shop), and Fire Zone 23 (Train B Electrical Penetration Room).** Fire Area I and the essential equipment and cables within were evaluated by the licensee with respect to the protection and separation criteria of 10 CFR 50, Appendix R Section III.G.2 to assure that the ability to safely shut down the plant was not effected by a single fire event. Safe shutdown from the MCR using Train A equipment was credited for a fire in this area.

The team reviewed the licensee's fire protection program documented in the St. Lucie

UFSAR (Appendix 9.5A, Fire Protection Program Report); safe shutdown analysis (SSA); fire hazards analysis (FHA); SSD essential equipment list; and system flow diagrams to identify the components and systems necessary to achieve and maintain safe shutdown conditions. The objective of this evaluation was to assure the safe shutdown equipment and post-fire safe shutdown analytical approach were consistent and satisfied the Appendix R reactor performance criteria for safe shutdown. For each of the selected fire areas, the team focused on the fire protection features, and on the systems and equipment necessary for the licensee to achieve and maintain safe shutdown conditions in the event of a fire in those fire areas. Systems and/or components selected for review included the pressurizer PORVs; boric acid makeup pumps 2A and 2B and gravity feed valves V-2508, V-2509; auxiliary feedwater (AFW); charging pumps and volume control tank discharge valve V-2501; shutdown cooling; heating, ventilation, and air conditioning (HVAC); atmospheric dump valves (ADVs); and component cooling water. This review also included verifying that manual valves operated during post fire safe shutdown were included in the licensee's maintenance program.

b. Findings

No findings of significance were identified.

.02 Fire Protection of Safe Shutdown Capability

a. Inspection Scope

For the selected fire areas, the team evaluated the frequency of fires or the potential for fires, the combustible fire load characteristics and potential fire severity, the separation of systems necessary to achieve SSD, and the separation of electrical components and circuits located within the same fire area to ensure that at least one train of redundant safe shutdown systems was free of fire damage. The team also inspected the fire protection features to confirm they were installed in accordance with the codes of record to satisfy the applicable separation and design requirements of 10 CFR 50, Appendix R, Section III.G, and Appendix A of BTP ASB 9.5-1. The team reviewed the following documents which establish the controls and practices to prevent fires and to control combustible fire loads and ignition sources to verify that the objectives established by the NRC-approved fire protection program (FPP) were satisfied:

- Updated Final Safety Analysis Report (UFSAR), Appendix 9.5A, Fire Protection Program Report
- Plant St. Lucie (PSL) Individual Plant Examination of External Events (IPEEE)
- Administrative Procedure 1800022, Fire Protection Plan
- Administrative Procedure 0010434, Plant Fire Protection Guidelines

- Electrical Maintenance Procedure 52.01, Periodic Maintenance of 4160 Volt Switchgear

The team toured the selected plant fire areas to observe whether the licensee had properly evaluated in-situ compartment fire loads and limited transient fire hazards in a manner consistent with the fire prevention and combustible hazards control procedures. In addition, the team reviewed fire protection inspection reports, and corrective action program condition reports (CRs) resulting from fire, smoke, sparks, arcing, and equipment overheating incidents for the years 2001-2002 to assess the effectiveness of the fire prevention program and to identify any maintenance or material condition problems related to fire incidents.

The team reviewed the fire brigade response procedures, training procedures, and drill program procedures. The team reviewed fire brigade initial training and continuing training course materials to verify appropriate training was being conducted for the station firefighting personnel. In addition, the team evaluated fire brigade drill training records for the operating shifts from August 2001- February 2003. The reviews were performed to determine whether fire brigade drills had been conducted in high fire risk plant areas and whether fire brigade personnel qualifications, drill response, and performance met the requirements of the licensee's approved fire protection program.

The team walked down the fire brigade staging and dress-out areas in the turbine buildings and fire brigade house to assess the condition of fire fighting and smoke control equipment. The team examined the fire brigade's personal protective equipment, self-contained breathing apparatuses (SCBAs), portable communications equipment, and various other fire brigade equipment to determine accessibility, material condition and operational readiness of equipment. Also, the availability of supplemental fire brigade SCBA breathing air tanks, and the capability for refill, was evaluated. Additionally, the team observed whether emergency exit lighting was provided for personnel evacuation pathways to the outside exits as identified in the National Fire Protection Association (NFPA) 101, Life Safety Code and Occupational Safety and Health Administration (OSHA) Part 1910, Occupational Safety and Health Standards. This review also included an examination of backup emergency lighting availability on pathways to and within the dress-out and staging areas to support fire brigade operations during a fire-induced power failure. The fire brigade self-contained breathing apparatuses were examined and assessed for adequacy.

Team members walked down the selected fire areas to compare the associated fire fighting pre-fire strategies and drawings with as-built plant conditions. This was done to verify that fire fighting pre-fire strategies and drawings were consistent with the fire protection features and potential fire conditions described in the UFSAR Fire Protection Program Report. Also, the team performed a review of drawings and engineering calculations for fire suppression caused flooding associated with the floor and equipment drain systems for the Train B Switchgear Room, Electrical Equipment Supply Fan Room, and Train B Electrical Penetration Room. The review focused on ensuring that those actions required for SSD would not be inhibited by fire suppression

activities or leakage from fire suppression systems.

The team reviewed design control procedures to verify that plant changes were adequately reviewed for the potential impact on the fire protection program, SSD equipment, and procedures as required by PSL Unit 2 Operating License Condition 2.C(20). Additionally, the team performed an independent technical review of the licensee's plant change documentation completed in support of 2002 temporary modification, TSA 2-02-006-3, that placed two exhaust fans on a fire damper opening between the cable spreading room and the Train B switchgear room. This TSA was evaluated in order to verify that modifications to the plant were performed consistent with plant design control procedures.

b. Findings

Inadequate Fire Hazards Analysis

Introduction: The team identified a Green non-cited violation (NCV) associated with failure to meet the fire protection program plan requirements. The team found that six silicone oil filled transformers installed in three Unit 2 fire zones [Fire Zone 37, Train A Switchgear Room; Fire Zone 34, Train B Switchgear Room; and Fire Zone 47, Turbine Building Switchgear Room] were not evaluated in the Fire Hazards Analysis (FHA) as contributors to fire loading and effects on SSD capability as required by fire protection program commitments.

Description: At PSL, the indoor medium voltage power transformers installed in Unit 1 were of the dry type. However, six of the indoor medium voltage power transformers in Unit 2 were cooled and insulated by a silicone-type fluid. The licensee provided the team with information from the transformer vendor which indicated that the transformer insulating fluid was Dow Corning (DC) 561, a dimethyl silicone insulating fluid. The team performed an independent technical review of the licensee's engineering calculations and maintenance documentation, transformer vendor technical information manual, insulating fluid manufacturer information, Underwriters Laboratory (UL) and Factory Mutual (FM) listing agencies' documentation, and Institute of Electrical and Electronics Engineers (IEEE) Standards.

The DC 561 technical manual described the DC 561 fluid as a silicone liquid that will burn, but was less flammable than paraffin-type insulating oils. The technical manual also stated that the DC 561 fluid had a flash point of 324 °C, a total heat release rate (HRR) of 140 kw/m^2 (per ASTM E 1354-90), and a fire point of 357 °C. In their Fire Hazard Analysis the licensee evaluated the adequacy of their fire area/zone and electrical raceway fire barrier system (ERFBS) enclosure barrier features based on the combustible hazard content and overall fire loading (analyzed fire duration) present within the associated area/zone. Based on the above, the team concluded that the transformer insulating fluid was a in-situ combustible liquid not accounted for nor evaluated in the PSL FHA. Additionally, the team noted that the licensee had conducted an UFSAR Combustible Loading Update evaluation in 1997. This evaluation was

documented in PSL-ENG-SEMS-97-070, but failed to identify that the transformers in fire zone 37 contained combustible silicone insulating fluid. Also a PSL Triennial Fire Protection Audit (documented in QA audit Report QSL-FP-01-07) conducted in 2001, reviewed the FHA but did not identify any fire loading discrepancies.

The team determined that the previously unidentified six silicone oil-filled transformers represented an increase in the ignition frequency of the associated fire areas/zones. Also, the additional in-situ combustible fire load and fire severity represented by the combustible transformer insulating fluid increased the likelihood of a sustained fire event from a catastrophic failure of an effected transformer that may upset plant stability and challenge critical safety functions during SSD operations.

The I-T-E Unit Substation Transformers Instruction Manual recommended that the dielectric insulating fluid be sampled annually and the dielectric strength of the fluid be tested to ensure that it is at 26 KV or better. The licensee determined that except for four tests conducted during the period 1990-1992, there were no records of the transformers' fluid being sampled and tested. This issue was entered into the corrective action program as CR 2003-0978 and will followed up by the NRC resident inspectors at PSL.

Analysis: The team determined that this finding was associated with the "protection against external factors" attribute and affected the objective of the initiating events cornerstone to limit the likelihood of those events that could upset plant stability and challenge critical safety functions relied upon for SSD from a fire, and is therefore greater than minor. The six previously unidentified silicone oil-filled transformers in Unit 2 represented an increase in the ignition frequency of the associated fire areas/zones. The finding was considered to have very low safety significance (Green) because it did not involve the impairment or degradation of NRC approved fire protection features and the overall SSD capabilities for the areas were evaluated by the licensee's SSA as adequate to ensure SSD capability. However, when assessed in combination with other findings identified in this report, the significance could be greater than very low significance.

Enforcement: 10 CFR 50.48 states, in part, "Each operating nuclear power plant must have a fire protection program that satisfies Criterion 3 of Appendix A to this part." PSL Unit 2 Operating License NPF-16, Condition 2.C.(4) specifies, in part, that the licensee implement and maintain in effect all provisions of the approved FPP as described in the UFSAR for the facility and as approved by the NRC letter dated July 17, 1984, and subsequent supplements. The approved FPP is maintained and documented in the PSL UFSAR, Appendix 9.5A, Fire Protection Program Report.

The Fire Protection Program Report stated, in part, that the PSL fire protection program implements the philosophy of defense-in-depth protection against fire hazards and effects of fire on safe shutdown equipment. The PSL fire protection program is guided by plant fire hazard analyses and by credible fire postulations. It further stated that the FHA performed for PSL Unit 2 considered potential fire hazards and their possible effect

on safe shutdown capability.

PSL administrative fire protection procedure, 1800022, Section 8.3 states that the FHA is an individual study of each plant's design, potential fire hazards in the plant, potential of those threats occurring, and the effect of postulated fires on safe shutdown capability. Further, Section 8.7.1.A of this procedure stated that in-situ combustible features were evaluated in the FHA as contributors to fire loading in the respective fire zones.

Contrary to the above, the FHA for fire zones 34, 37, and 47 was not adequate and did not meet FPP commitments. Specifically, 380 gallons of in-situ combustible transformer silicone dielectric insulating fluid in each of six transformers located in Unit 2 was not considered nor evaluated in the FHA as contributors to fire loading and possible effects on SSD capability. This condition was contrary to the requirements of the PSL FPP as outlined in UFSAR, Section 9.5A, and therefore did not meet the requirements as set forth in 10 CFR 50.48 and PSL OLC 2.C.(20).

Because the failure to evaluate in-situ combustible transformer silicone dielectric insulating fluid as a contributor to fire loading in the FHA is of very low safety significance and has been entered into the corrective action program as CR 2003-0637, this violation is being treated as an NCV in accordance with Section VI.A.1 of the NRC's Enforcement Policy. **This item is identified as NCV 50-389/03-02-0X, Failure to Evaluate In-situ Combustible Transformer Dielectric Insulating Fluid as a Contributor to Fire Loading in the FHA.**

.03 Post-Fire Safe Shutdown Circuit Analysis

a. Inspection Scope

The team reviewed how systems would be used to achieve inventory control, reactor coolant pump seal protection, core heat removal and reactor coolant system (RCS) pressure control during and following a postulated fire in the fire areas selected for review. Portions of the licensee's Appendix R Safe Shutdown Analysis Report which outlined equipment and components in the chosen fire areas, power sources, and their respective cable functions and system flow diagrams were reviewed. Control circuit schematics were analyzed to identify and evaluate cables important to safe shutdown. The team traced the routing of cables through fire areas selected for review by using cable schedule, and conduit and tray drawings. The team walked down these fire areas to compare the actual plant configuration to the layout indicated on the drawings. The team evaluated the above information to determine if the requirements for protection of control and power cables were met. The licensee's circuit breaker and fuse coordination study was reviewed for adequate electrical scheme protection of equipment necessary for safe shutdown. The following equipment and components were reviewed during the inspection:

- V1474 and V1475, Pressurizer PORVs
- V1476 and V1477, Pressurizer Isolation Block Valves

- MV-09-03 and MV-09-04, Feedwater Bypass Valves
- 2HVE-13B, Control Room Booster Fan
- V2501, VCT Discharge Outlet Valve
- MV-07 -04, Containment Spray Isolation Valve
- LP-208, Lighting Panel 208
- LP-209, Lighting Panel 209
- HCV-3625, Safety Injection Block Valve
- V3444, Shutdown Cooling Block Valve
- PI-1107/1108, Pressurizer Pressure for Hot Shutdown Panel
- LI-1104/1105, Pressurizer Level for Hot Shutdown Panel
- LI-9113 / 9123, Steam Generator Level for Hot Shutdown Panel
- SIAS Logic
- MCC 2A5/2A6 and relative feeds, 480 Volt Motor Control Center
- MCC 2B5/2B6 and relative feeds, 480 Volt Motor Control Center
- Load Center 2A5 480 Volt Switchgear

b. Findings

No findings of significance were identified.

04. Alternative Post-Fire Safe Shutdown Capability

a. Inspection Scope

The cable spreading room, which was one of two alternate shutdown (ASD) fire areas listed in the St. Lucie SSA for Unit 2, was selected for detailed inspection of post-fire SSD capability. Emphasis was placed on verification that hot and cold shutdown from outside the control room could be implemented; and that transfer of control from the main control room to the hot shutdown control panel (HSCP) and other equipment isolation locations could be accomplished within the performance goals stated in 10 CFR 50, Appendix R, Section III.L.3.

Electrical diagrams of power, control, and instrumentation cables required for ASD were analyzed for fire induced faults that could defeat operation from the MCR or the HSCP. The team reviewed the electrical isolation and protective fusing in the transfer circuits of components (e.g., motor operated valves) required for post-fire SSD at the HSCP to verify that the SSD components were physically and electrically separated from the fire area. The team also examined the electrical circuits for a sampling of components operable at the HSCP to ensure that a fire in the B Switchgear Room would not adversely affect safe shutdown capability from the MCR. The team's review was performed to verify that adequate isolation capability of equipment used for safe shutdown implementation was in place, accessible, and that the hot shutdown control panel was capable of controlling all the required equipment necessary to bring the unit to a safe shutdown condition. This also included a review to verify that the shutdown process met the performance goals of 10 CFR 50,Appendix R, Section III.L.3 and guidance in generic letter (GL) 86-10, by comparing it to the thermal hydraulic time line

analysis provided by the licensee.

b. Findings

No findings of significance were identified.

05. Operational Implementation of Post-Fire Safe Shutdown Capability

a. Inspection Scope

The team reviewed off normal operating procedure 2-ONP-100.02, Control Room Inaccessibility, Rev. 13B, the licensee's procedure for alternate safe shutdown, and procedure 2-ONP-100.01, Response to Fire, Rev. 9, the licensee's operating procedure for post-fire safe shutdown from the MCR. The review focused on ensuring that all required functions for post-fire safe shutdown and the corresponding equipment necessary to perform those functions were included in the procedures. The review also examined the consistency between the operations shutdown procedures and other procedure driven activities associated with post-fire safe shutdown (i.e., fire fighting activities).

b. Findings

The team noted that the licensee had identified that manual operator actions outside the MCR were credited and used in lieu of physical protection of cables and equipment relied on for SSD during a fire without obtaining prior NRC approval. Use of manual operator actions outside the MCR for 10 CFR 50, Appendix R, Section III.G.2 areas (Fire Area C and Fire Area I for this inspection) without prior NRC approval was not in accordance with the licensee's approved Fire Protection Program. The licensee identified this issue in CR **03-0153** prior to this inspection. *This finding is More Than Minor.* This finding will be Unresolved pending completion of the SDP to determine the risk associated with using manual operator actions in lieu physical protection. 10 CFR 50, Appendix R, Section III.G specified the need to identify equipment to achieve and maintain safe shutdown functions, and the protection requirements for that equipment. It also stated that one train of safe shutdown equipment should remain free of fire damage for non-alternate shutdown (III.G.2) designated fire areas. Two of the three fire areas inspected were so designated. In these areas, manual operator actions outside the MCR were being used and credited in the SSA to achieve safe shutdown. Determination of the licensing basis and required NRC exemption to use manual operations in lieu of protection for one shutdown train was addressed by another inspection team member. The inspection team was also concerned whether all potential spurious operations were properly accounted for in the shutdown procedures. Subsequent review of the licensee's procedures for these areas did demonstrate that manual actions required to mitigate spurious signals on both units were properly dispositioned.

06. Communications

a. Inspection Scope

The team reviewed plant communications to verify that adequate communications were available to support unit shutdown and fire brigade duties. This included verifying that site paging (PA), portable radios, and sound-powered phone systems were available consistent with the licensing basis. The team reviewed the licensee's communications features to assess whether they were properly evaluated in the licensee's SSA (protected from exposure fire damage) and properly integrated into the post-fire SSD procedures. The team also walked down sections of the post-fire SSD procedures to verify that adequate communications equipment would be available to support the SSD process. The team also reviewed the periodic testing of the site fire alarm and PA systems; maintenance checklists for the sound-powered phone circuits and amplifiers; and inventory surveillance of post-fire SSD operator equipment to assess whether the maintenance/surveillance test program for the communications systems was sufficient to verify proper operation of the systems.

b. Findings

No findings of significance were identified.

07. Emergency Lighting

a. Inspection Scope

The team reviewed licensee emergency lighting against the requirements of 10 CFR 50, Appendix R, Section III.J, to verify that eight hour emergency lighting coverage was provided in areas where manual operator actions were required during post-fire safe shutdown operations, including the ingress and egress routes. The team's review also included verifying that emergency lighting requirements were evaluated in the licensee's SSA and properly integrated into the Appendix R safe shutdown procedures as described in UFSAR Appendix 9.5A, Section 3.7. During plant walk downs of selected areas where operators performed local manual actions defined in the post-fire SSD procedures, the team inspected area emergency lighting units (ELUs) for operability and checked the aiming of lamp heads to determine if adequate illumination was available to correctly and safely perform the actions required by the procedures. The team also inspected emergency lighting features along access and egress pathways used during SSD activities for adequacy and personnel safety. The team checked the ELUs' battery power supplies to verify that they were rated with at least an 8-hour capacity. In addition, the team reviewed the manufacturer's information and the licensee's periodic maintenance tests to verify that the ELUs were being maintained and tested in accordance with the manufacturer's recommendations.

b. Findings

No findings of significance were identified.

08. Cold Shutdown Repairs

a. Inspection Scope

The team reviewed the licensee's SSA and existing plant procedures to determine if any repairs were necessary to achieve cold shutdown, and if needed, the equipment and procedures required to implement those repairs was available onsite.

b. Findings

No findings of significance were identified.

.09 Fire Barriers and Fire Area/Zone/Room Penetration Seals

a. Inspection Scope

The team walked down the selected fire zones/areas to evaluate the adequacy of the fire resistance of barrier enclosure walls, ceilings, floors, and cable protection. The team randomly selected several fire barrier features for detailed evaluation and inspection to verify proper installation and qualification. This evaluation included fire barrier penetration fire stop seals, fire doors, fire dampers, fire barrier partitions, and Thermo-Lag electrical raceway fire barrier system (ERFBS) enclosures to ensure that at least one train of SSD equipment would be maintained free of fire damage from a single fire.

The team observed the material condition and configuration of the selected fire barrier features and also reviewed construction details and supporting fire endurance tests for the installed fire barrier features. This review was performed to compared the observed fire barrier penetration seal and ERFBS configurations to the design drawings and tested configurations. The team also compared the penetration seal and ERFBS ratings with the ratings of the barriers in which they were installed.

The team reviewed licensing documentation, engineering evaluations of Generic Letter 86-10 fire barrier features, and NFPA code deviations to verify that the fire barrier installations met design requirements and license commitments. In addition, the team reviewed surveillance and maintenance procedures for selected fire barrier features to verify the fire barriers were being adequately maintained.

b. Findings

No findings of significance were identified.

.10 Fire Protection Systems, Features, and Equipment

a. Inspection Scope

The team reviewed flow diagrams, electrical schematic diagrams, periodic test procedures, engineering technical evaluations for NFPA code deviations, operational valve lineup procedures, and cable routing data for the power and control circuits of the electric motor-driven fire pumps and the fire protection water supply system yard mains. The review was performed to assess whether the common fire protection water delivery and supply components could be damaged or inhibited by fire-induced failures of electrical power supplies or control circuits and subsequent possible loss of fire water supply to the plant. Additionally, team members walked down the fire protection water supply system piping and actuation valves for the selected fire areas to assess the adequacy of the system material condition, consistency of the as-built configuration with engineering drawings, and operability of the system in accordance with applicable administrative procedures and NFPA standards.

The team walked down accessible portions of the fire detection and alarm systems in the selected fire areas to evaluate the engineering design and operation of the installed configurations. The team also reviewed engineering drawings for fire detector spacing and locations in the four selected fire areas for consistency with the licensee's fire protection plan, engineering evaluations for NFPA code deviations, and the requirements in NFPA 72A and 72D.

The team also walked down the selected fire zones/areas with automatic sprinkler suppression systems installed to verify the proper type, placement and spacing of the heads/nozzles and the lack of obstructions. The team examined vendor information, engineering evaluations for NFPA code deviations, and design calculations to verify that the required suppression system density for each protected area was available.

The team reviewed the manual suppression standpipe and fire hose system to verify the adequacy of their design, installation, and operation for the selected fire areas. The team examined design flow calculations and evaluations to verify that the required fire hose water flow and sprinkler system density for each protected area were available. The team checked a sample of manual fire hose lengths to determine whether they would reach the SSD equipment. Additionally, the team observed placement of the fire hoses and extinguishers to assess consistency with the fire fighting pre-plan drawings.

b. Findings

No findings of significance were identified.

4. Other Activities

4OA2 Problem Identification and Resolution

a. Inspection Scope

The team reviewed a sample of licensee audits, self-assessments, and plant condition

reports (CRs) to verify that items related to fire protection and safe shutdown were appropriately entered into the licensee's corrective action program in accordance with the licensee's quality assurance program and procedural requirements. The items selected were also reviewed for classification and appropriateness of the corrective actions taken or initiated to resolve the items.

The team reviewed the licensee's applicability evaluations and corrective actions for selected industry experience issues related to fire protection. The operating experience reports were reviewed to verify that the licensee's review and actions were appropriate. The reports are listed in the List of Documents Reviewed Section.

b. Findings

No findings of significance were identified

4OA3 Event Followup

.1 (Closed) LER 50-335, 389/00-01, Outside Design Bases Appendix R Hi-Lo Pressure Interface and Separation Issues.

On March 9, 2000, the licensee identified seven cases where the plant was not in compliance with 10 CFR 50, Appendix R, Sections III.G.2.d and III.G.2. f. The first case, involving the pressurizer PORVs, applied to Units 1 and 2, and is discussed in Section 4AO5 of this report. The other six cases apply to Unit 2 only, and are discussed as follows.

Shutdown cooling valves

Shutdown cooling valves V3652 and V3481 could spuriously open due to fire induced cable-to-cable short circuits. The location of vulnerability was a pull box (JB-2031) in the annulus region of containment. The valves are motor operated type valves which are de-energized by procedure during normal plant operation. The problem however is that the power cables for both these valves were routed through a pull box together with other three-phase power cables. Therefore, the potential existed for fire induced cable to cable short circuiting which could inadvertently energize the motors to open these valves. Both valves would have to open to have a problem. Opening of these valves directly connects the RCS to piping that is not rated for RCS normal operating pressure. Should the valves open when the RCS is at operating pressure, a pressure relief valve would open and RCS coolant would flow from the RCS to the containment sump. This situation is essentially a large break LOCA. Valve V3545 is a normally open motor operated valve in series with V3652 and V3481. Theoretically, V3545 could be closed by the operator to stop the outflow, but the cables for V3545 could have been damaged by the same fire. The licensee resolved the problem by installing new power cables using armored cable. This precluded the possibility of cable to cable short circuits. Inspectors confirmed implementation of the modification through review of plant modification PCM01028.

The reported condition was a violation of Appendix R requirements of more than minor significance because it could adversely affect the equipment reliability objective of the cornerstones of mitigating systems and barrier integrity as described above. Using techniques described in NRC Procedure 0609, Appendix F, the inspectors determined that the finding was of very low safety significance (Green). Specifically the SDP worksheet for large break LOCA was evaluated. The conclusion was supported primarily by the negligible probability of the initiating event occurring and the fact that cables for mitigating systems for LOCA are located outside containment. The enforcement considerations for this violation are given in Section 4OA7.

Pressurizer pressure instrumentation affected by tray-conduit interaction

Lack of 20-foot separation or a radiant heat shield between a cable tray and two conduits in containment meant that a fire which could start in the cable tray due to cable self ignition could result in damage to a number of pressurizer pressure instrumentation loops. PT-1105, PT-1106 and PT-1107 are in cable tray L2224; and PT-1103, PT-1104 and PT-1108 are in conduits 25018Y and 23091A. PT-1107 and PT-1108 were the instruments specified in the post-fire shutdown procedure. These instruments also provide input to alarms, automatically initiate automatic actions, provide permissives, computer inputs, input to calculations and indications of pressure at various locations. The inspector reviewed the consequences and ramifications of instruments failing either high or low. Also reviewed, was which pressurizer pressure instrumentations remain unaffected by the fire. This information was analyzed by the inspector, and it was concluded that the affected instrumentation would not lead to any transient nor to change in core damage frequency. The finding is therefore of very low safety significance. As corrective action, conduits 25018Y and 23091A were protected by a radiant heat shield for twenty feet either side of the tray L2224 by plant modification PCM99104, Supplement 1. The licensee reports the fact that both channels of pressurizer pressure instruments specified in the post-fire shutdown procedure could have been affected by one fire represents a violation of 10 CFR 50, Appendix R, Section III, G, 2. Refer to Section 4OA7 of this report for enforcement aspects.

Pressurizer level instrumentation affected by tray-conduit interaction

Lack of 20-foot separation or a radiant heat shield between a cable tray and two conduits in containment meant that a fire which could start in the cable tray due to cable self ignition could result in damage to all pressurizer level instrumentation loops. LT-1110X and LT-1105 are in tray L2213; and LT-1110Y and LT-1104 are in conduits 23320D and 23090A. LT-1110X & Y were specified in the post-fire shutdown procedure. It was determined that the failure mode for a short-circuit between the twisted pair or open circuit caused by fire exposure of the signal wires was level fails low. Level failing low initiates several automatic actions some of which tend to cause level to rise and some of which cause level to fall. The de-energization of pressurizer heaters dominates the situation and results in falling level. This leads to a reactor trip with safety injection on low pressurizer pressure. When the safety injection pumps start,

the level will rise. Since the operator cannot see level, he may not turn off the safety injection pumps. So it follows that the pressurizer will go solid. The post-fire safe shutdown procedure directs the operator to place the PORVs in override due to concerns about spurious opening. Therefore, rising level and concomitant pressure rise would be relieved by the safety relief valves. To obtain the risk significance of the fire induced failure of pressurizer level instrumentation, the SDP worksheet for stuck open relief valve was evaluated. The results indicated the finding was of very low safety significance (Green) for the same reasons mentioned in Section 4AO5.1 which deals with spurious opening of PORVs. The licensee reports the fact that both channels of pressurizer level instruments specified in the post-fire shutdown procedure could have been affected by one fire represents a violation of 10 CFR 50, Appendix R, Section III, G, 2. Refer to Section 4OA7 of this report for enforcement aspects.

Pressurizer level instrumentation affected by conduit to conduit interaction

Lack of 20-foot separation or a radiant heat shield between two conduits in containment containing cables for redundant channels of pressurizer level instrumentation meant that the separation requirements of Appendix R were not met. The location of the interaction is in the annulus area at an elevation where there are no ignition sources other than the cables themselves. It is not considered credible that low voltage, low energy, instrumentation circuits could self-induce cable ignition, and even if such occurred within a conduit, the fire would not affect another conduit. The reported problem was a violation of Appendix R requirements with regard to separation of cables. The inspectors determined that, given the particular configuration at issue, it could not credibly adversely affect any cornerstone. The licensee corrected the separation problem by installing a radiant heat shield on one of the conduits per plant modification PCM99104, Supplement 1. This licensee identified issue constitutes a violation of minor significance that is not subject to enforcement action in accordance with Section IV of the NRC's Enforcement Policy.

Circuits related to automatic pressurizer pressure control affected by conduit to conduit interaction

Lack of separation or a radiant heat shield between certain conduits in containment related to automatic pressurizer pressure control meant that the separation requirements of Appendix R were not met. The circuits involved were for the PORV and the auxiliary spray isolation valves. The concern was that, if one fire could affect both these circuits, two diverse subsystems designed to reduce pressure when necessary may not function. There are other ways to reduce pressure, but the above mentioned ones were the systems designated in the post-fire shutdown procedure for this function. The location of the interaction is in the annulus area at an elevation where there are no ignition sources other than the cables themselves. It is not considered credible that a fire starting within one conduit would expand to affect other nearby conduits. The reported problem was a violation of Appendix R requirements with regard to separation of cables. The inspectors determined that, given the particular configuration at issue, it could not credibly adversely affect any cornerstone. The

licensee corrected the separation problem by installing a radiant heat shield on a sufficient number of the conduits per plant modification PCM99104, Supplement 2. This licensee identified issue constitutes a violation of minor significance that is not subject to enforcement action in accordance with Section IV of the NRC's Enforcement Policy.

Radiant heat shields not installed per Appendix R accepted deviation

Inside containment in the area between the containment wall and the bioshield four groups of cable trays are installed. There are five trays in each group. These trays run horizontally along the circumference of the containment to carry cables from the penetration area to their various ultimate destinations in the containment. Train B cables are in trays near the containment wall, and Train A cables are in trays near the bioshield. There is at least seven foot horizontal separation between these two sets of trays in the area of interest. Both the Train A set and the Train B set consists of a group running above the 45-foot elevation grating and a group running above the 23-foot elevation grating. Examples of cable trays involved are instrumentation trays L2223 (Train A) and L2224 (Train B); or control trays C2223 (Train A) and C2224 (Train B). According to the safety evaluation report each of the four groups should have had a radiant heat shield installed directly below the group. This is actually an accepted deviation, or exemption, from the requirement to have a heat shield between the redundant cables. The licensee reported in the LER that the radiant heat shields below the groups at the 45-foot elevation were not installed. The missing radiant heat shields have now been installed per PCM01028.

The inspector evaluated the risk significance of the lack of radiant heat shield below the 45-foot elevation groups of trays. The conclusion of this evaluation was that the problem was of very low safety significance (Green). Some of the dominant factors considered were:

- Fire brigade capability for a fire in containment was not impaired.

- In-situ ignition sources were negligible, and transient ignition sources and combustibles are not present during normal plant operation.

- Only the top tray in each group contains power cables (480 volt) carrying sufficient energy capable of self ignition of IEEE 383 flame tested cable. Most of the power cables in containment are not energized during normal plant operation. These trays are solid metallic bottom and cover type trays. This construction inherently limits the spread of internal tray fire, and effectively provides a shield limiting the radiant heat energy.

- The "target" cable trays have a minimum spatial separation of 15 feet vertical and 7 feet horizontal from the potentially burning cable tray. The target trays have solid metallic bottoms. Radiant energy flowing between source and target is blocked to a great extent by intervening HVAC ducts, large pipes, tanks and building steel. Hot gas layer is not a factor in the part of containment under consideration.

- The target cables would be instrumentation cables, and various scenarios involving damage to these same instrumentation cables discussed in relation to other findings within this report Section were shown to be of very low safety significance.

- A very similar configuration in the Unit 1 containment was analyzed by the licensee and reviewed by the NRC in great detail, and found to be an acceptable configuration from the fire protection viewpoint. The Unit 1 study had a safety factor of at least two, which provides margin to account for geometry and other unknown differences between the two units.

Failure to adhere to the configuration of cable trays and radiant heat shields described in an exception to 10 CFR 50, Appendix R, Section III.G.2 represents a licensee identified violation. Refer to Section 4AO7 of this report for enforcement aspects.

.2 (Closed) LER 50-335/00-04, Pressurizer Level Instrumentation Conduit Separation Outside Appendix R Design Bases

Lack of 20-foot separation or a radiant heat shield between a cable tray and a conduit in Unit 1 containment meant that a fire which could start in the cable tray due to cable self ignition could result in damage to all pressurizer level instrumentation. The discussion of risk significance and requirements for this issue would be identical to the discussion of essentially the same issue on Unit 2 in Section .1 above under the heading: Pressurizer level instrumentation affected by tray-conduit interaction. Refer to Section 4AO7 of this report for enforcement aspects.

4OA5 Other Activities

.1 (Closed) URI 335,389/99-08-03, PORV Cabling May Not be Protected from Hot-Shorts Inside Containment

Introduction: A Green NCV was identified for failure to comply with 10 CFR 50, Appendix R, Section III, G, 2.d and f, related to spurious opening of the pressurizer PORV.

Description: During conduct of an inspection in the area of fire protection (NRC Inspection Report 50-335, 389/99-08, dated January 31, 2000) the inspectors identified the possibility that the PORV cables inside containment were not protected from fire induced cable to cable short circuits. The issue was identified through review of the licensee's analysis. However, the analysis referred to a study which showed that the cable to cable short circuit leading to spurious opening of the PORV was not credible. Since the study could not be located at the time of the inspection, an unresolved item was initiated to track this issue. Subsequently LER 50-335, 389/00-01 reported that the pressurizer PORVs could open due to fire induced short circuits that could occur in a cable tray in containment. In addition, cables for the associated block valve were routed in the same cable tray. This meant the block valve may not be available to counter the

spurious opening of the PORV. Cables for one PORV and its block valve were in a tray near the containment wall and cables for the other set were in a tray near the bioshield. The condition applied to both units.

The licensee resolved the problem by installing new PORV cables using armored cable. This precluded the possibility of cable to cable short circuits. The potential for spurious opening due to spurious pressure signal had already been offset by having the operator place the control switch in override in response to a fire in containment. Inspectors confirmed the modification was implemented through review of plant modification package PCM00059 (Unit 1) and PCM99104, Rev 4 (Unit 2).

LER 00-01 mentioned above also reported licensee identified findings in the area of Appendix R. In addition, Unit 1 LER 00-04 reported similar problems. Refer to Section 4OA3 for discussion of these findings.

Analysis: The finding was a performance deficiency because it represented a violation of Appendix R requirements. It was considered greater than minor because it could adversely affect the cornerstones of mitigating systems and barrier integrity. It affects mitigating systems in the sense that systems designated for post-fire shutdown would be adversely affected by an open PORV during the early stages of post-fire shutdown. It affects the cornerstone of barrier integrity in the sense that a spuriously open PORV represents a breach of the RCS pressure boundary which is one of the barriers. Using techniques described in NRC Procedure 0609, Appendix F, the inspectors determined that the finding was of very low safety significance (Green). Specifically, the SDP worksheet for stuck open relief valve was evaluated. A key factor leading to this conclusion was that the initiating event likelihood was relatively low. It was less likely than the likelihood for stuck open PORV due to non-fire induced causes. Manual suppression of fires in the containment was in the normal state because the plant had fire detectors, a fire plan and there were no automatic valves in the water source that could be affected by the fire. Even though no credit could be given for the block valve, other mitigating systems were unaffected. This was primarily due to the fact that the associated cables were all outside containment.

Enforcement: Because this violation of 10 CFR 50, Appendix R, Section III, G.2.d. and f, is of very low safety significance, has been entered into the CAP (CR00-0386) and the problem has been corrected through a plant modification it is being treated as an NCV, consistent with Section VI.A of the NRC Enforcement Policy. The number and title of this NCV are: NCV 50-335, 389/03-02-01, Failure to Meet 10 CFR 50, Appendix R, Section III, G, 2, for Protection of the PORV Cables in Containment.

4OA6 Meetings

On March 28, 2003, the team presented the inspection results to Mr. D. Jernigan and other members of your staff, who acknowledged the findings. The team confirmed that proprietary information is included in this report.

4OA7 Licensee-Identified Violations

The following findings of very low safety significance (Green) were identified by the licensee and are violations of NRC requirements which meet the criteria of Section VI of the NRC Enforcement Policy, NUREG-1600, for being dispositioned as NCVs.

- 10 CFR 50, Appendix R, Fire Protection Program, Section III, Specific Requirements, Subpart G, Fire protection of safe shutdown capability, requires that for cables, that could prevent operation or cause maloperation due to hot shorts, open circuits or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions and located inside noninerted containments, one of the following fire protection means shall be provided:

  1. Separation of cables of redundant trains by a horizontal distance of more than 20-feet with no intervening combustibles or fire hazards; or

  2. Separation of cables of redundant trains by a non-combustible radiant energy shield.

  Contrary to this, since the requirement became effective, the required fire protection was not provided for the following redundant cables:

  1. Shutdown cooling valves V3652 and V3481 on Unit 2.

  2. Pressurizer pressure instrumentation PT-1107 and PT-1108 on Unit 2

  3. Pressurizer level instrumentation LT-1110X and LT-1110Y on Units 1 & 2

  4. Cables contained in cable trays L2223 (Train A) and L2224 (Train B)

  These findings have been entered into the CAP (CR 99-1963, Rev. 2, and CR 00-0386), corrected by plant modifications, and are of very low safety significance for reasons given in Sections 4AO3.1 and .2.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

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