



April 7, 2000

L-2000-83
10 CFR 50.4

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: St. Lucie Unit 1
Docket No. 50-335
Thermo-Lag 330-1 Summary Report
Generic Letter 92-08 and NRC Confirming Order Corrective Actions

By Florida Power & Light Company (FPL) letters L-97-19 and L-98-134 dated March 17, 1997 and June 3, 1998, respectively, FPL committed to complete the Thermo-Lag 330-1 modifications on St Lucie Unit 1 by December 31, 1998. There were three exceptions to this commitment as discussed in FPL letter L-98-134 and NRC Confirming Order dated July 13, 1998.

1. The proposed corrective action for the Thermo-Lag wall separating the St. Lucie Unit 1 cable spreading room and 'B' switchgear room would not be completed by December 31, 1998. As discussed in L-98-134, FPL committed to complete the proposed corrective actions during the St. Lucie Unit 1 1999 refueling outage (SL1-16). These actions were completed during the St. Lucie Unit 1 outage SL1-16 in the Fall of 1999.
2. Thermo-Lag ampacity derating methodology issues, which were still under NRC review, were not to be resolved by December 31, 1998. Schedules for any corrective actions related to ampacity derating were to be determined separately and were not part of the order. Subsequently, the NRC closed the ampacity derating portion of GL 92-08 for St. Lucie Plant by NRC letter dated March 26, 1999.
3. The resolution of any new Thermo-Lag corrective actions resulting from the pilot fire protection functional inspection (FPFI) conducted at St. Lucie during March 1998 were not considered part of the confirming order since FPL had neither received nor responded to the inspection report. Such issues and any corrective actions were to be scheduled and resolved as part of that inspection.

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FPL has completed the corrective actions for St. Lucie Unit 1 committed in the FPL responses to NRC GL 92-08 and the Unit 1 Thermo-Lag Confirming Order dated July 13, 1998. FPL previously notified the NRC of the completion of the NRC GL 92-08 corrective actions for St. Lucie Unit 2 by FPL letter L-98-165 on June 23, 1998.

A summary report describing the corrective actions for St. Lucie Unit 1 is attached.

Please contact us if there are any questions about this submittal.

Very truly yours,



Rajiv S. Kundalkar
Vice President
St. Lucie Plant

RSK/GRM

Attachment

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

St. Lucie Unit 1

Thermo-Lag 330-1 Fire Barrier Summary Report



Florida Power & Light Company
St. Lucie Plant
March 2000

1.0 LICENSING AND DESIGN BASIS REQUIREMENTS

As indicated in FPL Letter L-97-19 dated March 19, 1997 and/or L-98-134 dated June 3, 1998, then subsequently reflected in NRC Confirmatory Order Modifying License (TAC No. M85608), Florida Power & Light committed to complete all modifications required to resolve St. Lucie Unit 1 Thermo-Lag related issues by the end of the calendar year 1998 with the following exceptions: 1) outage related work, 2) ampacity derating concerns and 3) new Thermo-Lag corrective actions resulting from the pilot fire protection functional inspection (FPFI). The outage related modification discussed in L-98-134 was the replacement of the Thermo-Lag wall separating the cable spread room and the "B" switchgear room with a non Thermo-Lag wall, which FPL agreed to complete final implementation by end of the St. Lucie Unit 1 1999 refueling outage (SL1-16). In addition, a commitment was made to complete closeout documentation and submit a final summary report 180 days after all modifications were implemented.

2.0 ORIGINAL THERMO-LAG APPLICATIONS

Thermo-Lag 330-1 has been used at St. Lucie Unit 1 to achieve compliance with 10 CFR 50, Appendix R requirements for the separation of redundant safe shutdown components and circuits. The original application of Thermo-Lag consisted of 1-hour and 3-hour fire barrier conduit protection, 3-hour fire area boundary walls and ceilings, and containment radiant energy shields. The 1-hour and 3-hour protection installations for conduit consisted of one-half inch (minimum) thickness and one inch (minimum) thickness of Thermo-Lag 330-1 preformed sections tie-wired or banded to the conduit, respectively. The 3-hour fire rated walls and ceilings consisted of two "back to back" one half inch thick (minimum) Thermo-Lag 330-1 prefabricated panels mounted to a steel framework or a one inch thick prefabricated panel mounted to a steel framework. The radiant energy shields consisted of wall barriers constructed of one inch thick Thermo-Lag 330-1 panels.

3.0 UPGRADED THERMO-LAG APPLICATIONS

The upgraded Thermo-Lag installations at St. Lucie constitute 1-hour and 3-hour fire rated conduit barrier installations and fire rated walls and ceilings. Containment Thermo-Lag radiant energy shields were replaced with radiant energy shields of stainless steel sheet metal construction. Upgrades to the Thermo-Lag conduit barriers were performed to meet the critical attributes of the NEI Application Guide based upon acceptable qualification testing in accordance with the requirements of Generic Letter 86-10, Supplement 1. The Engineering specification was revised to provide the design criteria and installation guidance necessary to assure that Thermo-Lag fire barrier system upgrades were performed with the proper control over the materials and installation process.

In general, the modifications for Thermo-Lag conduit fire barriers included the following:

- 1) Verification of a properly installed base layer. In instances where the existing Thermo-Lag 330-1 barrier was improperly installed, repair or replacement of the base layer was performed.
- 2) Upgrades for the 1-hour barriers included the reinforcement of seams and joints through the addition of stress skin and tie wires, and the addition of a one-quarter inch (minimum) thickness Thermo-Lag 330-1 overlay for conduits smaller than three inches in diameter.
- 3) Upgrades for 3-hour barriers required the reinforcement of the baseline material at conduit and support interfaces with the use of wire mesh or stress skin. In addition, the upgrades included the application of layers of one-quarter inch (minimum) thickness Thermo-Lag 770-1 Mat over the existing base layer. The number of layers required was dependent upon the size of the conduit and the percentage of cable fill. Finally, the upgrades included the application of a Thermo-Lag 770-1 trowel grade finish coat.

In general, the modifications associated with the Thermo-Lag fire area wall/ceiling upgrades included the following:

- 1) Inspection of the existing configuration to verify critical attributes, identification of unsupported seams/joints, and other installation deficiencies.
- 2) Reinforcement of Thermo-Lag panels at unsupported seams/joints, penetrations, and intervening items.
- 3) Additional reinforcement of horizontal Thermo-Lag panels.

4.0 THERMO-LAG REDUCTION EFFORTS

Thermo-Lag reduction efforts included engineering analyses to eliminate the reliance on Thermo-Lag as a fire barrier as much as practical. The following methodology was used:

- 1) Analysis evaluated the need for Thermo-Lag protection of each essential circuit based upon its function and the availability of redundant circuits.
- 2) The requirement for protection was eliminated where equipment redundancy existed in another fire area or a redundant circuit was protected in the same fire area.
- 3) The preferred method of protection of essential circuits was to reroute the circuits through a separate fire area and utilization of the existing fire rated walls/ceilings to provide separation. Where feasible, the essential circuit was rerouted.
- 4) Thermo-Lag inside the reactor containment building was replaced with stainless steel sheet metal. This Thermo-Lag was originally used as a radiant energy shield.

5.0 SUMMARY OF MODIFICATIONS

Provided below is a summary table listing approximate quantities (linear feet or square feet) of the final Thermo-Lag barrier material utilized at St. Lucie Unit 1 and a brief description of the plant change modifications (PC/M) implemented to resolve Thermo-Lag related issues.

5.1 Final Thermo-Lag Quantities

Barrier Type	1-Hr	3-Hr	3-Hr (1)
Trays	None	None	N/A
Conduits	320 ft.	8 ft.	N/A
Walls, Floors, & Ceilings	N/A	N/A	3100 ft²
Radiant Energy Shields	None	None	None

Notes: (1) 3-Hour fire rating as described in PC/M 97-040

5.2 Design Modification Package Summary

5.2.1 Conduit/Cable Reroutes

PC/M 97-034, Conduit Reroutes For Thermo-Lag Reduction

- 1) Relocated conduits protected with Thermo-Lag 330-1 fire barrier systems from 19.50' elevation to 43.00' elevation. Affected conduits are routed in Fire Zone A/77 ("A" electrical cable penetration room), Fire Zone C/55W (common hallway), and Fire Zone C/78 ("B" electrical cable penetration room). The conduits rerouted by this package contained cables for the 125 volt positive and negative power feed from battery 1A to 125 volt dc test panel 1A, 125 volt dc power from bus 1A to static inverter 1A, 120 volt ac power from Inverter 1A to instrument bus transfer panel 1A, 120 volt ac power from instrument bus transfer panel 1A to instrument bus 1MA and power and control cable for power operated relief valve (PORV) V-1402 and V-1404.
- 2) Relocated cables for charging pump B in Fire Zone N/36A (charging pump access hallway) and Fire Zone N/75 (charging pump B cubicle).
- 3) Relocated control cables and the remote contactors for PORV V-1402 and V-1404 out of the electrical penetration room to provide protection of the PORVs from spurious actuation and prevent having to protect the PORV block valves. This provided for a design consistent with the high-low pressure interface requirements of the UFSAR.
- 4) The Safe Shutdown Analysis was revised to reflect updated information for conduits previously protected for safe shutdown capabilities.

PC/M 97-061, New Fire Area "D" – 1B Electrical Penetration Room

- 1) Added new fire damper, FDPR 25-131, and associated limit switch to a duct penetrating the west wall of 1B electrical penetration room and qualified the walls/ceiling of 1B electrical penetration room as 3-hour rated barriers.
- 2) Created a new fire area changing previously defined Fire Area/Fire Zone C/78 (1B electrical penetration room) to D/78 to eliminate the concern for spurious actuation of PORV V-1404 due to multiple electrical failures in the 1B electrical switchgear room and 1B electrical penetration room.
- 3) The Safe Shutdown Analysis, fire hazards analysis, corrective action reports (CAR), and plant drawings were revised to reflect updated information.

PC/M 97-030, Charging Pump 1A Conduit Reroutes and ICW Intake E-Lights

- 1) Relocated control cable associated with charging pump 1A suction pressure switch previously located in Fire Zone N/36A (charging pump area common access hallway) to an embedded conduit eliminating the need of a Thermo-Lag fire barrier for this cable.
- 2) The Safe Shutdown Analysis was revised to reflect updated information.

PC/M 99-011, Cable Spreading Room (CSR) Thermo-Lag Wall Circuits

- 1) Relocated four (4) safe shutdown cables that were previously routed in a cable tray riser area that was bound by Thermo-Lag wall in the CSR. These cables were relocated because the wall that separated them from the CSR was removed during the implementation of PC/M 99-029, resulting in a train A/B separation concern. To maintain required safe shutdown functions, these cables were routed directly from elevation 19.50' to "B" switchgear room.
- 2) The Safe Shutdown Analysis was revised to reflect updated information.

5.2.2 Radiant Energy Shields

PC/M 97-039, Replacement of Radiant Energy Shields

This plant modification replaced the 1 inch thick Thermo-Lag wall panels utilized as a radiant energy barrier between redundant circuits required for safe shutdown inside the containment building. Thermo-Lag wall panels were replaced with 16 gauge stainless steel sheet metal. The sheet metal was secured by bolting to the existing structural members that supported the Thermo-Lag wall materials.

5.2.3 Conduit Upgrades

PC/M 97-041, Thermo-Lag Conduit Fire Barrier Upgrades

This design package provided for the upgrade and/or installation of approximately 320 linear feet of Thermo-Lag protected conduits to the requirements of Engineering Specification MN-3.21, *Installation and Inspection Guidelines for Thermo-Lag Fire Barrier Material*. This specification identifies the general requirements for installing 1-hour and 3-hour Thermo-Lag fire barriers, as well as, approved methods for upgrading existing Thermo-Lag fire barriers to qualified 1-hour and 3-hour fire resistant barriers. The technical requirements of this specification are based upon the acceptable fire testing and analysis performed under the Nuclear Energy Institute, *NEI Application Guide For Evaluation of Thermo-Lag 330-1 Fire Barrier Systems*.

5.2.4 Wall Modifications

PC/M 97-038, Fire Zone 57B Thermo-Lag Wall and Ceiling Replacement

This design package removed the existing Thermo-Lag fire barrier material from the walls and ceiling of the "B" inverter room and replaced it with an ASTM E119 3-hour rated fire barrier constructed from sheet metal and ceramic fiber. The general design consists of 14-26 gauge stainless steel sheet metal bolted to both sides of structural steel framing. The cavity between the sheet steel is filled with ceramic board or fiber having a weight density of 8 lbs/ft³. Commodities that penetrate the barrier are protected, as determined by the type of commodity, to thwart heat conduction through the wall assembly. Additionally, based on inaccessibility after this design package is implemented, three conduits in the cable spread room were inspected/upgraded to the requirements to be set forth in PC/M 97-041 *Thermo-Lag Conduit Fire Barrier Upgrades*.

PC/M 97-040, Unit 1 Thermo-Lag Wall Upgrades

This design package upgraded the existing Thermo-Lag 330-1 walls to permit for use as 3-hour fire rated barriers. The Thermo-Lag walls were originally designed as 3-hour fire rated barriers; however, subsequent fire endurance testing demonstrated that the ASTM E119 temperature criterion was exceeded at 1-hour and 48 minutes. The fire testing did demonstrate that the other test criteria for a 3-hour rated barrier were met. Specifically, no ignition of cotton waste for the full test duration, no visible flame for the full test duration, and a successful hose stream test. Additionally, thermocouples located at approximately 1 inch from the wall on the cold side did not exceed 130 degrees Fahrenheit. Acceptability of these walls as fire area boundaries was documented in a fire hazards analysis, using the criteria outlined in Generic Letter 86-10 and demonstrated that the upgraded walls are equivalent 3-hour fire barriers for the barrier configuration and safe shutdown circuit orientation associated with the field conditions. Included in this evaluation was confirmation that no redundant essential

circuits are in proximity of the wall so as to be impacted by the elevated cold side temperatures. The modifications implemented by this PC/M generally include reinforcement of the Thermo-Lag panels at the seams, additional bolting/attachment of the Thermo-Lag panels to the structural frames, and Thermo-Lag upgrades to the penetrations in the walls. A total of approximately 3100 square feet of Thermo-Lag walls were upgraded.

PC/M 98-036, Cable Spread Room/"A" Switchgear Room Thermo-Lag Blockout Replacement

This design package removes Thermo-Lag panels from HVAC Penetration No. 430-BW162-2 located in Block Wall No. 162 and closes the penetration with concrete. The wall is a 12-inch thick reinforced concrete filled block wall that functions as a 3-hour fire barrier separating the CSR (B/57) and the "A" switchgear room (A/60). Filling the penetration with concrete restores the fire rating of the barrier to 3-hour as defined in ASTM E119.

PC/M 98-091, Fire Damper FDPR-25-121 Standoff Thermo-Lag Removal

This design package removes the Thermo-Lag panels installed on the standoff for fire damper FDPR-25-121 and replaces them with a non-combustible ASTM E-119 3-hour rated fire barrier ("Durasteel"). Fire dampers are required to prevent flames from propagating from one side of a fire barrier to the other. Since Thermo-Lag is a combustible material, its use in a fire damper installation could permit the propagation of fire to the unexposed side of the damper. Removal of the Thermo-Lag material and replacement with a 3-hour fire rated non-combustible material assures the subject fire damper will provide the required 3-hour fire resistance.

PC/M 99-029, Cable Spread Room To "B" Switchgear Room Thermo-Lag Wall Replacement

This design package removed the existing Thermo-Lag fire barrier material from the wall between CSR (FZ B/57) and the "B" switchgear room (C/56) and replaced it with an ASTM E119 3-hour rated fire barrier constructed of sheet metal and ceramic fiber. The general design consists of 14 - 20 gauge stainless steel sheet metal bolted to both sides of structural steel framing. The cavity between the sheet steel is filled with ceramic fiber having a weight of 8 lb/ft³. Commodities that penetrate the barrier are protected, as determined by the type of commodity, to thwart heat conduction through the wall assembly.

6.0 OTHER RELATED THERMO-LAG ISSUES

6.1 Combustibility

Combustible loading calculations were performed for the final Thermo-Lag quantities installed in each fire area/zone. A fire hazards analysis was then performed to document the acceptability of this increased combustible loading for each affected fire area, and a 10 CFR 50.59 Safety Evaluation including an UFSAR Change Package was issued.

In order to comply with 10 CFR 50 Appendix R Section III.G.2.f which requires radiant energy shields to be constructed of non-combustible material, the Thermo-Lag panels used as radiant energy shields inside containment were replaced with panels constructed of stainless steel sheet metal.

6.2 Seismic Qualification

Thermo-Lag does not perform a safety related function; however, since the material is installed on safety related equipment and in areas containing safety related equipment, it must be capable of maintaining gross structural integrity such that it does not adversely interact with safety related systems during a design basis seismic event (i.e., seismic II/I consideration). St. Lucie has taken into consideration this design requirement in the implementation of Thermo-Lag modifications, and has also reviewed the data provided by NRC Information Notice (IN) 95-49 and 95-49 Supplement 1. In conclusion, the St. Lucie Unit 1 Thermo-Lag installations have been determined to meet applicable seismic design requirements.

6.3 Ampacity

The effect of Thermo-Lag 330-1 and 770-1 fire barrier material on cable ampacity has been evaluated. Adequate design margin has been demonstrated to exist by calculation and utilization of the recent Florida Power Corporation (FPC) derating test data for Crystal River.

By letters L-96-28, L-96-335 and L-98-17 5dated February 12, 1996, December 19, 1996, and June 26, 1998, respectively, FPL responded to NRC Requests for Additional Information (RAI). The RAIs were dated October 6, 1995, November 6, 1996, and April 23, 1998. In a letter dated March 26, 1999, the NRC concluded that there are no outstanding ampacity derating issues as identified in Generic Letter 92-08 for St. Lucie.