

# HARRIS FIRE PROTECTION MEETING

3/21/01

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## Meeting Attendance

Purpose: *CPI/L/NAC Meeting*

Date: 3/21/01

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# Fire Barrier Meeting

- Background
- Brief History
- Technical Comments
- Fire Risk Aspects of the Issues
- Discussion

# Background

- CP&L Performed Joint Utility Fire Tests to Address Thermo-Lag Configurations
- CP&L Performed Engineering Analyses and Plant Upgrades to ensure the Thermo-Lag Barriers were Adequate for the Fire Hazards
- Engineering Analysis and Upgrades were completed in 1997
- FSAR Amendment Reflecting Barrier Evaluations submitted to NRC in 1997 as part of CP&L 's Annual FSAR Update

# Fire Barrier History

- November 1999 – First NRC Pilot Baseline Fire Protection Inspection
- April 2000 – Conference Call With NRR to Review URI Items
- July 2000 – CP&L Requests Technical Meeting
- August 1, 2000 – NRR Response to Task Interface Agreement (TIA) 99-028

# Fire Barrier History

- September 15, 2000 – CP&L Letter to Region II
- October 20, 2000 – CP&L Submits Fire Test Reports
- October 24, 2000 – NRR Provides Response to TIA 2000-16
- February 26, 2001 – NRR Provides Supplemental Response to TIA 2000-1

# Fire Barrier Technical Comments

# NRC TIA Response

## Conclusions

- Three Hour Fire Tests do not satisfy G.L. 86-10, Supplement 1 Acceptance Criteria
- Use of Thermo-Lag appears in conflict with General Design Criterion (GDC) 3, of Appendix A to 10 CFR Part 50
- Licensee did not demonstrate as-installed barriers are adequate for the hazard
- Licensee evaluation does not provide the NRC with adequate technical basis

# HNP Response

- Fire Tests were performed in accordance with ASTM E119 Industry Standard Fire Test Protocol for Barriers
- Use of Thermo-Lag as a Fire Barrier is Acceptable under GDC 3
- CP&L's Technical Evaluation and Safety Analysis provide basis that the barriers are adequate for hazard

# NRC TIA Response Technical Comments

- Fire Test Acceptability
- Combustibility of Thermo-Lag
- Toxicity of Thermo-Lag
- Fire Brigade Visual Inspection of Barrier
- Penetration Seal Performance
- Barrier Evaluation

# Fire Test Acceptability

- Fire Test Comments Identified in TIA Response
  - Fire Endurance Testing
    - G.L. 86-10, Supplement 1 Fire Test Criteria not met
  - Hose Stream Testing
    - No hose stream test was conducted for the 3 hour wall and ceiling configurations
    - No technical basis is provided for the Licensee's unique two-stage hose test procedure
  - Ignition of Cotton Waste
    - Use of negative/neutral pressure furnaces in lieu of positive pressure furnaces
  - Supplemental Support of Test Assembly
    - Supplemental support was provided during the conduct of the ceiling test

# Fire Test Acceptability

- **NRC Comment:** G.L. 86-10, Supplement 1  
Fire Test Criteria not met
- **HNP Response:** G.L. 86-10, Supplement 1  
refers to the guidance of NFPA 251 and  
ASTM E119 as acceptable test methods for  
demonstrating fire endurance performance.  
The HNP Licensing Basis for Fire Testing  
Barrier Configurations is ASTM E119

# Fire Test Acceptability

- **NRC Comment:** No hose stream test was conducted for the 3 hour wall and ceiling test
- **HNP Response:** HNP credits the following ASTM E119 Hose Stream Application Requirements
  - Three Hour Fire Wall Test
    - Requires either a 2½ minute hose stream application for a duplicate test configuration applied during a 1 hour fire test
    - or
    - A 2 ½ minute hose stream after a 3 hour fire test
  - Three Hour Ceiling Fire Test
    - No Hose Stream Application Required

# Fire Test Acceptability

- **NRC Comment:** No technical basis is provided for the Licensee's unique two-stage hose test procedure
- **HNP Response:**
  - Credit taken for hose stream performed on duplicate test configuration conducted under one hour fire test
    - Initial 1 minute hose stream performed for 1 hour fire test
    - A 90 minute delay occurred before second hose stream application
    - Final 1 ½ minute hose stream applied after delay

# Fire Test Acceptability

- **HNP Response (cont.):**
  - HNP evaluated this deviation and concluded the delay resulted in a more severe hose stream application based on
    - First 1 minute application resulted in significant initial cooling
    - Severe impact on charred material resulting in portions becoming dislodged
    - Trapped residual heat left in the assembly would have continued to adversely degrade the barrier material
    - The 90 minute delay allowed the Thermo-Lag material to absorb water and soften before second hose stream application

# Fire Test Acceptability

- Fire Endurance Test Results
  - One Hour Fire Wall Test
    - ASTM test requirements satisfied for a 1 hour wall fire test
  - Three Hour Wall Fire Test
    - ASTM E119 Structural Integrity testing requirements meet
    - ASTM E119 Average Temperature Rise requirements exceeded at 1 hour and 48 minutes (Fire Test continued for full three hour duration)
  - Three Hour Ceiling Fire Test
    - ASTM test requirements satisfied for a 3 hour ceiling fire test

# Fire Test Acceptability

- Conclusion
  - Hose Stream Application for 3 hour fire wall configuration evaluated as a conservative conduct of the hose stream test required by ASTM E119
  - No Hose Stream Application is required for a 3 hour ceiling fire test in accordance with ASTM E119
  - Therefore, the Hose Stream Applications for the 3 hour test satisfy ASTM E119 Requirements

# Fire Test Acceptability

- **NRC Comment:** Cotton waste acceptance criteria may not be adequate
- **HNP Response:** Cotton waste acceptance criteria in accordance with ASTM E-119
  - Credit for No Ignition of Cotton Waste
    - Fire Tests performed in accordance with ASTM E119
    - ASTM E119 does not require positive pressure furnace
    - ASTM E119 prescribes a cotton waste test as part of the overall fire test acceptance criteria
- Cotton Waste test passed in accordance with ASTM E119

# Fire Test Acceptability

- **NRC Comment:** Supplemental support was provided during the conduct of the ceiling test.
- **HNP Response:** Supplemental support of test assembly on unsupported side is acceptable based on plant configurations
  - Test configuration supported by furnace on three sides
  - Fourth side unsupported due to interface with adjacent test configuration
  - Deflection occurred during fire test
  - Actual plant configurations supported on all sides
  - Test Lab secured fourth edge similar to plant configuration

# Fire Test Acceptability

- Nationally Recognized Test Lab Evaluation Request
  - Omega Point Labs has conducted over 50 fire tests of Thermo-Lag configurations including the CP&L fire wall and ceiling tests
  - Omega Point Labs performed a review of the following TIA Response Fire Testing Comments
    - Hose Stream Requirements
    - The 90 minute delay between hose stream applications
    - Supplemental support of the ceiling test assembly

# Fire Test Acceptability

- Omega Point Lab's Evaluation Results
  - Found Hose Stream Applications for all 3 fire tests in accordance with ASTM E119 Requirements
  - Found 90 minute delay between hose stream applications to be more severe than a single 2 ½ minute application
  - Found the need for additional support during the Ceiling Fire Test to be acceptable based on actual plant configurations

# Fire Test Acceptability

- Conclusion
  - Fire Endurance Tests satisfy the requirements of ASTM E119
  - Hose stream applications satisfy the requirements of ASTM E119
  - Endorsement by Nationally Recognized Testing Lab

# Thermo-Lag Combustibility

- Thermo-Lag Combustibility Comments Identified in TIA Response
  - GDC 3 Applicability
  - Flame Spread Rate
  - Replacement of 1 hour Thermo-Lag fire barrier

# Thermo-Lag Combustibility

- **NRC Comment:** The licensee's evaluation does not address the apparent nonconformance with GDC-3
- **HNP Response:** The NRC has stated that the use of Thermo-Lag is acceptable to meet GDC-3. The plant Fire Hazards Analysis was updated to reflect the use of Thermo-Lag as a combustible material

# Thermo-Lag Combustibility

- GDC 3 Applicability
  - NRC addressed in Federal Register dated April 10, 1996 and concluded that such barriers can satisfy the requirements of 10 CFR 50.48 and GDC 3
  - Generic Letter 86-10, Supplement 1 also addressed that combustible fire barrier materials should be considered by the fire hazard analysis

# Thermo-Lag Combustibility

- **NRC Comment:** There is no justification for increased combustibility of topcoated Thermo-Lag in relation to the plant licensing basis.
- **HNP Response:** HNP Licensing Basis does not require Thermo-Lag to be considered a combustible except when topcoated. However, the plant Fire Hazards Analysis was updated to reflect the use of Thermo-Lag as a combustible material regardless of whether it is topcoated or not

# Thermo-Lag Combustibility

- HNP Licensing Basis is Flame Spread Rate of 25 or less is not considered combustible
- Based on Information Notice 95-32 Flame Spread Rate for Thermo-Lag varies from 25 to 37
- Majority of Thermo-Lag configurations fall into a flame spread of 25
- HNP included all applications of Thermo-Lag into Fire Hazard Analysis for Conservatism

# Thermo-Lag Combustibility

- **NRC Comment:** Questioned HNP replacement of 1 hour rated Thermo-Lag wall due to combustibility and not 3 hour barriers
- **HNP Response:** Partial Height 1 hour wall configuration is different than the full height 3 hour fire wall configurations and therefore was the only wall replaced

# Thermo-Lag Combustibility

- Partial height one hour rated wall between opposite train Motor Control Centers
- Concern for potential fire propagation up and over partial height wall
- Adequate accessibility to replace with alternative qualified one hour material
- These considerations are not applicable the the three hour configurations

# Thermo-Lag Combustibility

- Conclusion
  - Combustibility of Thermo-Lag does not preclude the use of the material as a fire barrier
  - Thermo-Lag barriers can satisfy the requirements of 10CFR50.48 and GDC 3

# Toxicity of Thermo-Lag

- **NRC Comment:** There is no evaluation of the toxic products of combustion on plant personnel who have to transit areas adjacent to the fire-affected area.
- **HNP Response:** Toxicity is not a concern for the following reasons
  - No safe shutdown manual actions are required in the fire areas or adjacent areas interfacing with the Thermo-Lag enclosures
  - Plant ventilation system for the Cable Spreading and Switchgear rooms contain smoke purge capability

# Fire Brigade Visual Inspection

- **NRC Comment:** Fire brigade will not be able to observe potential degradation due to smoke and heat generated by the burning combustibles in the compartment
- **HNP Response:** The fire brigade will be able to perform a visual observation of cold side of the barrier for fire degradation and apply a hose stream to cool the barrier if required

# Thermo-Lag Penetration Seals

- **NRC Comment:** There is a lack of testing and evaluation of the penetration seals installed in the Thermo-Lag barrier.
- **HNP Response:** Penetration seal baseline and upgrade testing was conducted during both wall tests. Results were evaluated and field configurations were upgraded as required.

# Thermo-Lag Penetration Seals

- HNP included penetration seal configurations in both the one and three hour fire tests
- Fire test results were evaluated
- Plant upgrades were performed based on fire test results
- Penetration seal upgrade configurations exceeded the Thermo-Lag wall thermal performance
- HNP has tested and evaluated the effects of penetration seals on the Thermo-Lag barriers

# Barrier Evaluation

- Barrier Evaluation Comments Identified in TIA Response
  - Non-Symmetry of fire barrier
  - Use of Raceway Acceptance Criteria
  - Adequacy of Barrier Evaluation

# Barrier Evaluation

- **NRC Comment:** One side of the barrier does not have Thermo-Lag coating covering tie bolts and washers
- **HNP Response:** Analysis evaluated the most conservative configuration, and is therefore, acceptable

# Barrier Evaluation

- Bolts required to secure the panels to the structural framing are protected with Thermo-Lag material
- Additional tie bolts were used to secure the panels to a metal lath for additional support
- One side of these tie-bolts was not protected with Thermo-Lag
- The impact of the unprotected bolt on the thermal performance of the barrier was evaluated

# Barrier Evaluation

- **NRC Comment:** The use of the acceptance criteria specified in G.L. 86-10 Supplement 1 is inappropriate for wall, floor, and ceiling assemblies. As stated in G.L. 86-10, Supplement 1 endurance testing criteria for these barriers are addressed in NFPA 251 and ASTM E119
- **HNP Response:** Fire testing was performed using ASTM E119, however no guidance exists related to the evaluation of barrier temperatures that exceed the criteria. Therefore as part of our evaluation, HNP utilized the raceway thermal performance criteria provided by G.L. 86-10 Supplement 1

# Barrier Evaluation

- **NRC Comment:** Existing analyses and evaluations do not adequately demonstrate that the Thermo-Lag barriers as installed will not adversely impact the ability of the plant to achieve and maintain safe shutdown in the event of a fire
- **HNP Response:** Barriers as installed are adequate for the hazard, and safe shutdown in the event of a fire is assured

# Barrier Evaluation

- HNP is licensed to BTP CMEB 9.5-1 as opposed to Appendix R.
- FSAR originally specified that the Cable Spreading Room fire area boundaries would have a fire rating of three hours.
- Plant FP License condition allows changes to the program without prior NRC concurrence if it can be demonstrated that it will not adversely impact the ability of the plant to achieve and maintain safe shutdown in the event of a fire.

# Barrier Evaluation

- Three tiered approach
  - Engineering evaluation in accordance with the guidance in G.L. 86-10
  - Room heat-up analysis in which it was demonstrated that a postulated fire would not produce room temperatures close to the ASTM E-119 Time/Temperature Curve, thus assuring an additional margin.
  - Heat transfer analysis in which the impact of the maximum average temperature experienced during the test would have on a raceway located a minimum of one-inch from the barrier.

# Barrier Evaluation

- Generic Letter 86-10 Evaluation
  - Review of Circuit Protection to Understand Potential Ignition Sources
  - IEEE 383 cable as primary fuel source
  - MCC/Switchgear as primarily ignition source
  - Field Verification of As-Installed Barrier Thickness
    - Field Thickness of 1.6” vs. Fire Test thickness of 1.5”
  - Engineering Evaluation of ASTM E119 Fire Test Results
    - Hose Stream Testing
    - Non-Symmetry of Barrier
    - Penetration Seal Performance

# Barrier Evaluation

- Evaluation of heat transfer to target cables
  - Utilized Actual Fire Test Cold Side Average Temperature
  - Analyzed As-installed Configurations
    - Minimum 1” air gap between Thermo-Lag wall and cable tray
    - Conservatively assumed no heat absorption or dissipation into concrete barriers
  - Performed Heat Transfer Analysis
  - Results indicated target raceway temperatures were less than 325 °F
  - Demonstrated that cable would be free of fire damage

# Barrier Evaluation

- Evaluation of Plant Specific Heat Release Rates
  - Postulated a conservative fire based on hazards in the area (i.e., IEEE 383 cable)
  - Developed realistic heat release rates and compared them to the standard ASTM Time Temperature Curve
  - Evaluation demonstrated that the expected area temperatures were well below (approximately 50% less) those required during the actual ASTM fire test

# Barrier Evaluation

- Summary
  - Performed significant fire testing to understand performance of the Thermo-Lag material
  - Analyzed potential ignition sources
  - Evaluated potential combustibles in the areas
  - Determined realistic heat release rates for the fire areas
  - Evaluated heat transfer to target cables based on plant configurations and fire test results

# Conclusion

- Integrated engineering evaluation concluded that the Thermo-Lag barriers were adequate for the hazards and would not adversely impact the ability to achieve and maintain safe shutdown
- HNP Licensing Condition allows licensee to make changes to the approved fire protection program
- The evaluation of the adequacy of the Thermo-Lag barriers is within our licensing basis

# Risk Determination

- Phase 2 risk determination
  - Loss of Offsite Power
  - Fire brigade credit
- Benefits from a more detailed risk analysis

# Significance Determination Process

- NRC analysis using Phase 2 SDP
  - “Preliminary White” finding
  - Two loss of offsite power scenarios white
  - Three or more “green” adjacent to white
- Phase 2 may Overstate Risk
  - No credit given for recovery of offsite power
  - No scrutable basis for reduced credit for fire brigade

# Loss of Offsite Power

- Credit should be given for the recovery of offsite power
  - Sufficient time exists
  - Recovery actions are contained in Operating Procedure OP-156.02
  - Training program
  - No environmental concerns
  - No special equipment needed

# Loss of Offsite Power

- Recovery of offsite power can easily be accomplished
- Results in the LOOP sequences being “Green” in Phase 2 analysis

# Fire Brigade Assessment

- Phase 2 provided reduced credit for Fire Brigade
  - No drills in safety related switchgear rooms for last 7 years
  - Station corrective action program issues
    - Quality and use of fire pre-plans
    - Drill performance critique trends
  - Coaching observed in a similar drill

# Fire Brigade Assessment

- Inspection report 99-13, for a drill in the “B” safety related switchgear room, stated
  - “..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.”

# Fire Brigade Assessment

- Issues cited pre-date observed performance drill
- 1996 – 1999; 142 drills with only 4 remediations
- 6 drills in non-safety related switchgear rooms  
1996 – 1999
- Coaching – Intervention to prevent the use of  
radios in the switchgear rooms
- 4 drills in safety related switchgear since 99  
inspection – no deficiencies

# Fire Brigade Assessment

- Based on observed brigade performance as documented in IR 99-13
  - Full credit for fire brigade effectiveness should be given
  - Phase 2 results are “Green”

# Phase 2 Conclusion

- Credit for offsite power recovery
- Full credit for Fire Brigade effectiveness
- Phase 2 results are “Green”

# Detailed Risk Analysis Considerations

- Testing and analysis results show
  - Barrier is adequate for 1.8 hours
  - Realistic temperatures, with air gap, lower than with deterministic test criteria
- Analysis shows no damage to protected cables for the duration of postulated fires

# Benefits from further analysis

- Increase in risk should be negligible, given no damage to protected cables for the duration of postulated fire events
  - High likelihood of Fire Brigade suppression of fire.
  - Recovery of offsite power
- Best estimate risk analysis should result in finding that is clearly “green”

# Conclusions

- Phase 2 worksheets conclude the risk is very low safety significance
- Qualitative risk analysis would support the risk is very low safety significance