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Mr. James M. Taylor
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Taylor:

As a follow-up to our telephone conversation back in December, I want to outline Florida Power & Light's (FPL) approach to resolution of the issues raised by NRC Bulletin 92-01 and Generic Letter 92-08 regarding the functionality of fire barriers at U.S. nuclear plants.

FPL has developed a performance-based approach using the combined results of fire modeling, NUMARC and/or other relevant fire barrier testing, probabilistic safety assessment, and planned plant modifications, where necessary, to demonstrate the continued ability of FPL nuclear plants to achieve and maintain safe shutdown conditions associated with a fire emergency. This approach uses a detailed engineering analysis, fire area by fire area, to evaluate whether the Turkey Point and St. Lucie plants meet the objectives of 10 CFR 50, Appendix R.

This approach, as described in greater detail in the attached outline, provides a sound technical basis for resolving the issues associated with Bulletin 92-01 and Generic Letter 92-08. Following your review of the attached, I suggest we meet together with our staffs to discuss this approach in further detail.

Please note that FPL's response to the 10 CFR 50.54(f) letter regarding this issue will be submitted in February 1994.

Very truly yours,

J. H. Goldberg
President
Nuclear Division

JHG/re

cc: S. D. Ebneter, Regional Administrator, USNRC, Region II

FPL APPROACH TO THERMO-LAG RESOLUTION

CONTENTS

FPL APPROACH TO THERMO-LAG RESOLUTION

EXECUTIVE SUMMARY

FPL's performance-based approach to Thermo-Lag resolution has three parts that will allow us to evaluate the acceptability of the Turkey Point and St. Lucie installed fire barrier configurations:

1) **RADIANT ENERGY SHIELDS:**

For the outdoor fire barrier installations, FPL proposes that the fire barriers be considered as radiant energy shields, i.e., barriers that effectively shield components from radiant heat flux. This approach is based on Section III.G.2(f) of Appendix R. The open plant layout and its heat dissipation characteristics lend themselves to such a consideration. Outdoor fire barriers will be compared to the NUMARC and/or other relevant test data.

2) **POSTULATED HAZARDS ANALYSES:**

The postulated hazards analyses (PHA) will be based on both fire modeling analyses and a traditional fire hazards evaluation.

a) FIRE MODELING: Indoor fire areas are analyzed by the FPL-developed, area-by-area, plant-specific fire model to assure that the plant-specific combustible loadings will not jeopardize the reduced fire barrier ratings derived from test results. This will ensure protection of at least one train of safe shutdown equipment.

b) TRADITIONAL FIRE HAZARDS EVALUATION: This evaluation will utilize the traditional methodology of estimating heat generation and heat removal per the NFPA Fire Protection Handbook as a check for consistency.

3) **PROBABILISTIC SAFETY ASSESSMENT:**

The Probabilistic Safety Assessment (PSA) for the indoor and outdoor fire areas will be used to further evaluate if the installed fire barriers provide adequate reactor safety.

Any configurations determined to be inadequate by the above analyses will be modified as appropriate.

INTRODUCTION

FPL has developed a performance-based approach that uses detailed engineering analyses to evaluate whether the Turkey Point and St. Lucie plants meet the objectives of 10 CFR 50, Appendix R. This approach uses area-by-area fire modeling, fire hazards analyses, industry-wide NUMARC and/or other relevant fire barrier testing, and probabilistic safety assessment. Appropriate plant modifications will be made, where necessary, to demonstrate the continued ability to achieve and maintain safe shutdown.

Prior to beginning an evaluation for the Turkey Point Units 3 & 4, FPL conducted a review of the Thermo-Lagged circuits. It has been determined that some of the Thermo-Lagged circuits at the Turkey Point Plant no longer require special protection because of the additional redundant equipment installed during the 1990-91 Dual Unit Emergency Power System (EPS) enhancement outage. Therefore, in each fire area, a reanalysis of the Thermo-Lagged circuits was performed to Appendix R safe shutdown requirements. All cables necessary to achieve and maintain safe shutdown were identified. By a systematic review of each circuit, a determination was then made of whether the Thermo-Lagged circuits are required. For the required Thermo-Lagged circuits, the FPL approach described below is utilized.

The output of the FPL approach including any required modifications will ensure that one train of systems necessary to achieve and maintain safe shutdown will remain free from fire damage. In this regard, the approach is consistent with the Appendix R objective and uses an alternate performance-based approach to the 1-hour and 3-hour rated fire barriers.

FPL APPROACH TO THERMO-LAG RESOLUTION

The FPL approach is depicted in Figure I. The steps that are followed depend on whether the Thermo-Lag is located outdoors or indoors. The outdoor Thermo-Lag installations are reviewed using the Radiant Energy Shield approach described below for the Turkey Point Units. The indoor fire areas for Turkey Point and St. Lucie will be analyzed by a plant-specific area-by-area fire model and fire hazards evaluation. This approach utilizes NUMARC and/or other relevant test data to establish the fire endurance capabilities. To provide further assurance that reactor safety is maintained, a probabilistic safety assessment of the fire areas containing Thermo-Lag will be performed.

RADIANT ENERGY SHIELDS FOR OUTDOOR AREAS

Radiant Energy shields are defined as those barriers which effectively shield components from radiant heat flux. Their use is permitted by Appendix R Section III.G.2.(f) inside containment. The FPL approach treats the Turkey Point outdoor area fire barriers as radiant energy shields. The bases for the radiant energy shield approach for the Turkey Point Plant outdoor areas are provided below.

The plant layout typically used in south Florida is open in the sense that the turbine building is an open deck structure. There is no closed turbine building with attendant walls and ceilings; therefore, hot gasses generated by a fire will not be trapped in equipment areas. The temperature drops off sharply outside the fire plume since a large heat sink (the atmosphere) is available to dissipate the energy. As a result of the open layout, the hot off-gas temperatures from a postulated transient fire would rapidly dissipate such that a stratified hot gas layer would not develop. The quantitative approach based on plume dynamics and the trapped hot gas layer at the ceilings of typical indoor areas is thus not applicable to the open outdoor areas. Typical outside fire area characteristics are conceptually depicted in Figure II.

In addition, Turkey Point outdoor areas contain a low amount of in-situ combustibles and there is no combustible storage in any areas which contain safe shutdown equipment or cables. It should be noted that the radiant energy shield methodology will not be applied for fire areas within 50 feet of large combustible loadings (turbine lube oil storage tanks, transformers, etc.). The use of transient combustibles in these outdoor areas is controlled and limited to special uses, such as changing oil in a condensate pump motor. Hot work in these areas is limited and controlled by procedure.

The radiant energy shield approach is considered acceptable for the outdoor areas because of the heat dissipating characteristics discussed above and the low amount of in-situ combustibles. Radiant energy shields are endorsed for use in containment in Section III.G.2(f) of Appendix R. The acceptable fire ratings of radiant energy shields for the Turkey Point outdoor configurations will be determined by NUMARC and/or other relevant fire barrier testing.

POSTULATED HAZARDS ANALYSES FOR INDOOR FIRE AREAS

An FPL team of qualified systems and fire protection engineers familiar with system requirements and interactions are performing calculations for the indoor fire areas of Turkey Point and St.Lucie.

(a) FIRE MODEL:

A typical indoor fire model developed for each fire area of the plant is shown in Figure III. The fire models are applied on a plant-specific basis to evaluate the as-installed fire barrier configurations. The FPL fire model is based on the EPRI Fire Induced Vulnerability Evaluation (FIVE) methodology, a conservative, NRC-approved technique that is being used industry-wide for analyses of Individual Plant Examinations for External Events (IPEEE). The FPL model centers on providing assurance that at least one train of the safe shutdown systems, as defined by Appendix R, is available. The flow chart of this process is shown in Figure IV.

The FPL model conservatively determines the effect of the actual in-situ plus transient fire loadings for each barrier location. The explicit safety factors inherent in the FPL approach which add to its conservatism, are:

- In-situ combustibles, including Thermo-Lag, are placed in the plume.
- The transient combustible utilized to initiate the fire is gasoline which has a higher BTU content than most combustibles typically found in FPL's plants.
- The transient is assumed to burn at full intensity from time zero to exhaustion of fuel.
- The influence of oxygen depletion on fires in unventilated spaces is neglected.

This analysis is a quantitative approach that incorporates a conservative evaluation of the fire plume dynamics and resulting hot gas layer at the ceiling. The resulting calculated room temperature as a function of time is lower than the ASTM E-119 temperature vs. time curve, ensuring that the 325^{0}F NRC pass/fail criterion for the protected raceway is not exceeded.

(b) TRADITIONAL FIRE HAZARDS EVALUATION:

A traditional fire hazards evaluation is also performed. This method utilizes information and methodologies provided in the NFPA Fire Protection Handbook. Fire Severity and Fire Loads are evaluated to the standard time-temperature curve to determine the fire barrier requirements.

The required fire ratings determined from (a) and (b) above will be compared to the fire ratings established by the current NUMARC and/or other relevant testing programs. It is expected that a

substantial portion of the results will show that the fire barrier ratings can accommodate the plant-specific fire loadings while maintaining high margins.

PROBABILISTIC SAFETY ASSESSMENT

To supplement the results of the deterministic efforts described above, FPL will apply probabilistic safety assessment (PSA) techniques to the EPRI FIVE fire model, developed for the IPEEE's. These techniques will be applied in order to further evaluate if the as-installed fire barriers provide adequate reactor safety. The PSA assumes failure of installed Thermo-Lagged cables and equipment, but allows credit for suppression systems, for proceduralized recovery actions, and for other equipment success paths that may be available. The PSA leads to calculated core damage frequencies on a fire zone by fire zone basis. Fire zones with installed Thermo-Lag will be ranked based on risk significance and modifications (i.e., reroute circuits, upgrade fire barriers, or add detection and suppression systems) will be considered as appropriate.

CURRENT PROGRESS

The following is the current status of the FPL effort started ten months ago. The fire model has been developed and verified for both plants. For Turkey Point Units 3 & 4, Thermo-lagged circuits in 21 indoor areas, 3 miscellaneous structure areas and 1 outdoor area were evaluated. Based on these circuit evaluations, FPL has concluded that there is a need for maintaining the existing Thermo-Lag fire barriers in about one-half of these areas. Preliminary Turkey Point fire model calculations show that the anticipated fire ratings of Thermo-Lag barriers based on testing are adequate for the hazards encountered. Similar fire model calculations will commence at the St. Lucie Units later this month. Most of the St. Lucie rooms are larger in size than at Turkey Point and therefore similar results are expected for St. Lucie.

SCHEDULE

Submittal of the FPL approach for NRC approval is scheduled for April, 1994. FPL envisions completing the on-going efforts for the Turkey Point Units and the St. Lucie Units, including the plant-specific PSA's, and identification of any necessary modifications, in the fourth quarter of 1994. FPL believes the time for resolution of the Thermo-Lag issue by this approach is less than the time required by other alternatives. The integrated schedule based on the FPL approach will be presented to the NRC in the February 1994 response to the 10 CFR Part 50.54(f) request dated December 20, 1993.

FIGURE I
FPL APPROACH TO THERMO-LAG RESOLUTION

ST. LUCIE UNITS 1 & 2
TURKEY POINT UNITS 3 & 4

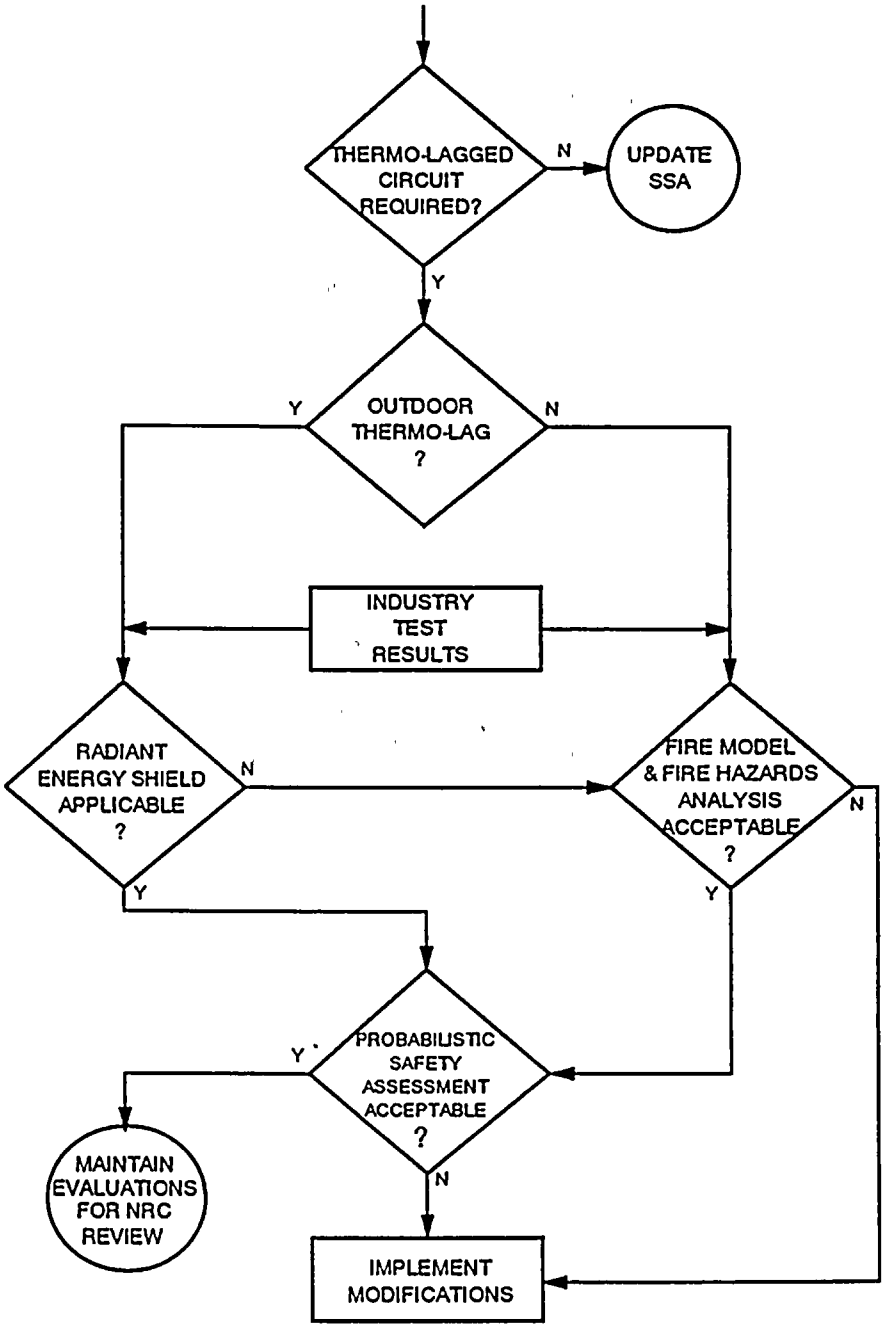

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FIGURE II - CHARACTERISTICS OF OUTDOOR FIRE AREAS

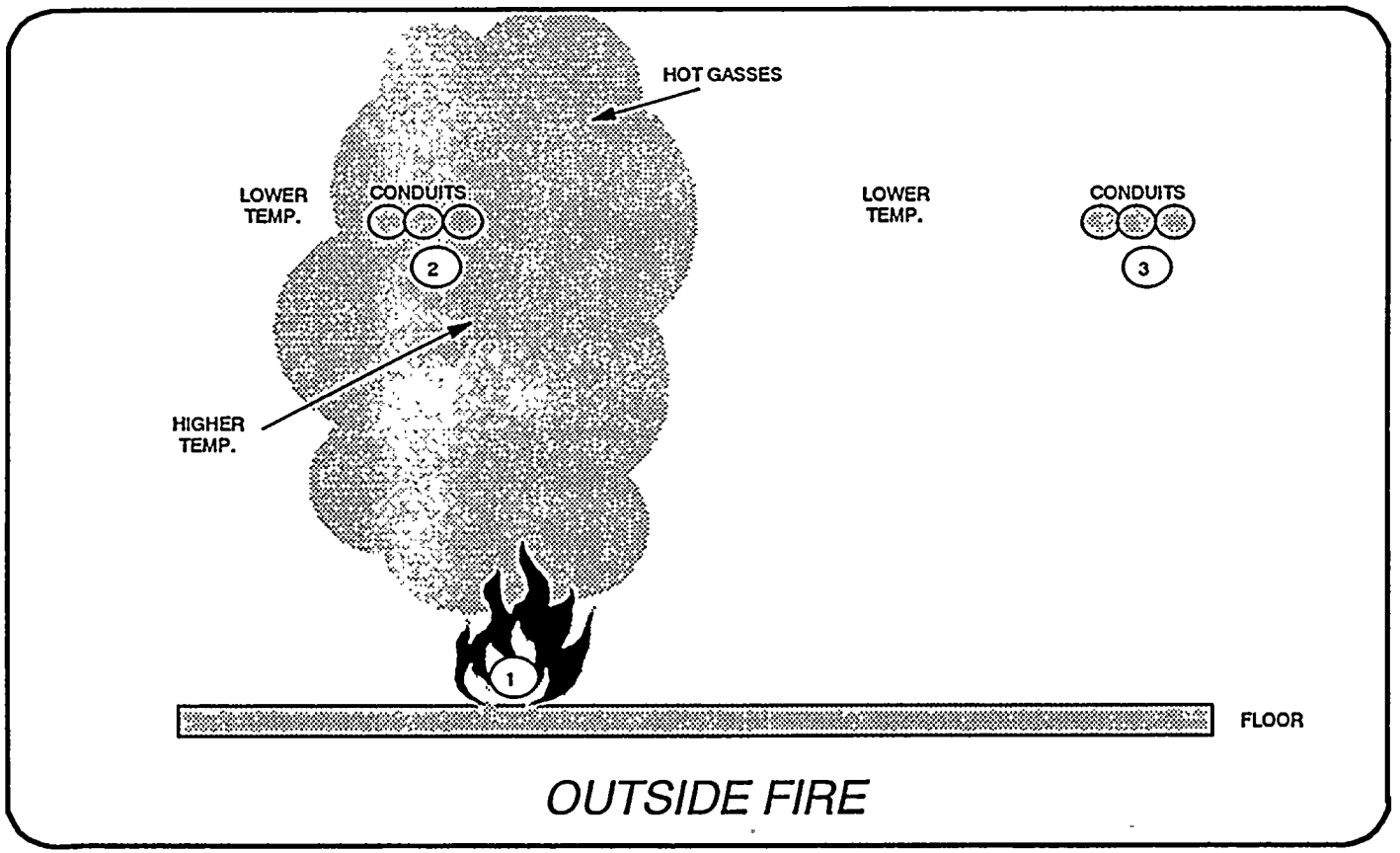

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FIGURE III - FIRE MODEL FOR INDOOR FIRE AREAS

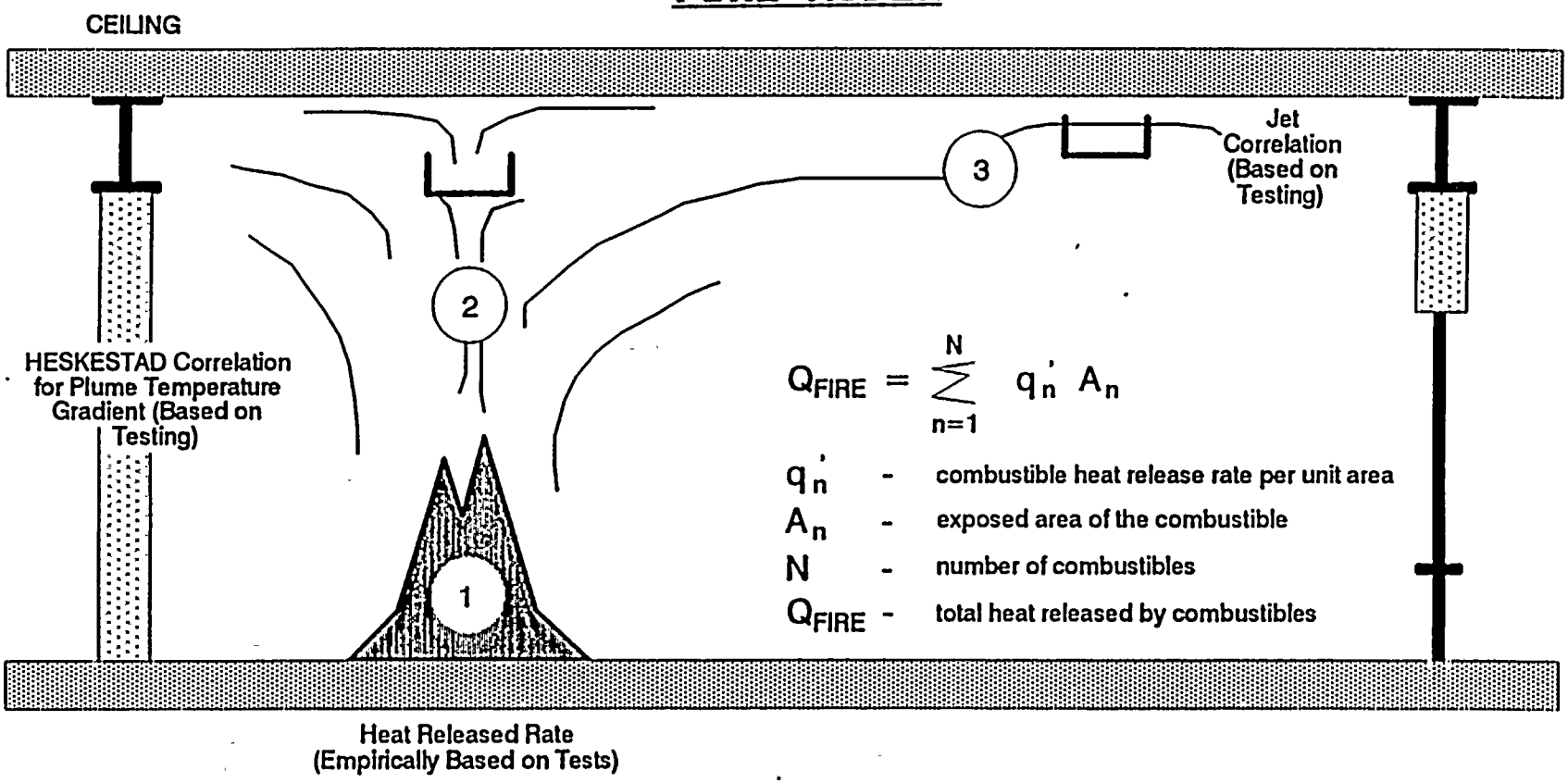

FIGURE IV - FIRE MODEL FLOW CHART