April 15, 1994

Mr. Paul Gunter, Director
Reactor Watchdog Group
Nuclear Information and Resource Service
1424 16th Street NW, Suite 601
Washington, DC 20036

Dear Mr. Gunter:

I am responding to the technical issues regarding Thermo-Lag fire barriers that you identified in your memorandum of February 25, 1994, to Mr. Leo Norton, U.S. Nuclear Regulatory Commission (NRC), Office of the Inspector General. We reviewed your correspondence for safety issues and technical information that were not previously noted or that are not within the scope of the NRC staff review of Thermo-Lag fire barriers. You did not identify any new technical or safety issues, nor did you submit any new information.

We agree that the combustibility, ampacity derating, and seismic issues remain open. The combustion toxicity and hose stream testing issues, however, are closed. The status of each of these issues is documented in the Thermo-Lag Action Plan. Our comments on the five technical issues are enclosed.

Please contact Mr. Steven West, Chief, Special Projects Section, Office of Nuclear Reactor Regulation, if you have any questions. He can be reached at 301-504-1220.

Sincerely,
Original Signed By
WILLIAM T. RUSSELL
William T. Russell, Director
Office of Nuclear Reactor Regulation

Enclosure:
1. NRR Comments
2. Generic Letter 86-10, Supplement 1
3. Thermo-Lag Action Plan, January 14, 1994

DISTRIBUTION
See next page

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RETURN TO REGULATORY CENTRAL FILES

ENCLOSURE 1

OFFICE OF NUCLEAR REACTOR REGULATION COMMENTS ON
CORRESPONDENCE OF FEBRUARY 25, 1994 FROM P. GUNTER, NIRS
TO L. NORTON, NRC OFFICE OF THE INSPECTOR GENERAL

Combustibility

In your correspondence, you stated that the combustibility of Thermo-Lag fire barrier material remains an open issue. The NRC staff agrees that this is so. The following status information is from Part II of the Thermo-Lag Action Plan of January 14, 1994:

> "The staff conducted combustibility tests of Thermo-Lag material and issued the results to industry by Information Notice 92-82. Further review of Thermo-Lag combustibility is included in the NUMARC [Nuclear Management and Resources Council] test program (Part I). The staff will provide its final position on Thermo-Lag combustibility in GL 92-08, Supplement 1 (Part I)."

The combustibility issue is also shown as an open issue in the Gantt charts attached to the Thermo-Lag Action Plan (Part I, under "NUMARC PROGRAM"). The staff is presently reviewing the issue of combustibility. Information submitted in response to the request for additional information that the NRC staff issued pursuant to 10 CFR 50.54(f) will also be used in the review of the combustibility issue. For example, data on the amounts and configurations of Thermo-Lag fire barriers will be used.

In your letter, you also addressed combustibility in the context of the Florida Power & Light (FPL) proposal to use a performance-based approach to resolve the Thermo-Lag issues at its Turkey Point and St. Lucie facilities. You asserted that the FPL proposal "ignores that Thermo-Lag constitutes an installed fire load." At a public meeting on March 10, 1993, FPL informed the NRC staff that the fire hazards evaluation element of its proposed approach considers all in situ combustibles, including Thermo-Lag. This is reflected on Slide 7 of FPL's presentation materials. You received a copy of these materials following the presentation. The NRC staff cannot make a final judgment regarding the combustibility issue with respect to the FPL facilities at this time, but will consider the issue in its review of the FPL submittal.

In their responses to NRC Bulletin 92-01, Supplement 1, "Failure of Thermo-Lag 330-1 Fire Barrier System To Perform Its Specified Fire Endurance Function," all licensees of operating plants that use Thermo-Lag fire barriers affirmed that compensatory measures are in place consistent with plant technical specifications or license conditions for an inoperable fire barrier. The NRC staff has evaluated such compensatory measures as fire watches, and found that they continue to adequately protect the public health and safety. So long as the compensatory measures remain in place, there is no undue risk to the public health and safety. The NRC staff has concluded, therefore, that the combustibility questions do not pose a threat to the public health and safety.

Combustion Toxicity

In your correspondence, you asserted that the issue of toxicity of Thermo-Lag combustion products remains open in so far as the NRC staff did not explain the discrepancy in the results of tests the NRC staff conducted at the National Institute of Standards and Technology (NIST) and information you submitted concerning tests conducted at Southwest Research Institute (SwRI). You did not raise any new safety issues and did not provide any new technical information regarding the toxicity of Thermo-Lag combustion products. The NRC staff previously addressed and closed this issue as summarized below.

In the final director's decision of May 23, 1993, provided to NIRS in response to a petition filed on behalf of NIRS with the NRC pursuant to Section 2.206 of Title 10 of the Code of Federal Regulations (10 CFR § 2.206), the NRC staff stated that the Thermo-Lag toxicity issue was raised in part by the SwRI test report and provided its technical evaluation of the issue and its bases for not pursuing detailed explanations of the differences between the SwRI and NIST test results. The NRC staff review of the SwRI test report raised questions about the development of the test results— specifically, questions regarding the protocol, procedures, and quality controls used in the conduct of the test. Moreover, the NRC staff did not have reasonable assurance that it could verify the pedigree of the Thermo-Lag materials tested by SwRI, which it believes were provided to SwRI by a competitor of Thermal Science, Incorporated (TSI), the manufacturer of Thermo-Lag. Rather than expending resources trying to resolve these questions, the NRC staff decided to concentrate its efforts on a direct and independent assessment of the fundamental issue— whether or not Thermo-Lag combustion products present unique nuclear power plant concerns. Using Thermo-Lag materials with known pedigrees, the NRC staff, in conjunction with NIST, conducted an independent toxicological evaluation of the combustion products of Thermo-Lag fire barrier material. On the basis of this evaluation, the NRC staff determined that the products of Thermo-Lag combustion are no more toxic than other materials, such as cable insulation, that are also installed in nuclear power plants. The NRC staff also had NIST subject six Thermo-Lag samples of different forms and vintage of Thermo-Lag material to a detailed chemical analysis to characterize the chemical composition of the materials. The analysis revealed the same elemental profile and similar composition and behavior for all six samples, indicating that there had been no changes in the formulation of Thermo-Lag over the years.

As a result of these evaluations, the NRC staff concluded that the thermal decomposition of Thermo-Lag under fire conditions does not introduce unique concerns regarding either the composition or quantity of toxic materials produced as a result of a fire that burns other typical in-plant combustibles. In addition, the NRC staff noted that the toxicity levels evaluated did not suggest that precautions above and beyond those that would normally be taken during an in-plant fire should be considered.

Our review of the SwRI test report revealed that SwRI deviated from the specified test protocol. Therefore, the NIST and SwRI tests were not conducted in an identical fashion. A comparison of the results of dissimilar tests is inappropriate and would provide little or no basis for assessing the

toxicological hazard of Thermo-Lag combustion products. Moreover, because NIST is the nationally recognized authority for establishing the standards by which to conduct toxicological tests, the NRC staff has the highest confidence in the results of the NIST tests. Given the high level of confidence in NIST's ability to conduct toxicity tests, the confidence that the NIST test results and toxicity evaluation were adequate to assess the toxicological hazard of Thermo-Lag combustion products within the context of typical nuclear power plant configurations, and the unanswered questions with the SwRI tests, the NRC staff concluded that the NIST tests provided adequate information to evaluate and close the toxicity issue.

In response to your correspondence of February 25, 1994, the NRC staff reviewed its previous evaluations of Thermo-Lag toxicity and concluded that there are no technical bases for reopening the toxicity issue for further review or for conducting additional review of the SwRI test results. The NRC staff further concluded that you did not raise any new safety issues, did not submit any new technical information, and did not provide a basis for why the SwRI test results should call into question the results of the NIST test or the NRC staff's previous evaluation. Therefore, this issue remains closed.

Ampacity Derating

In your correspondence, you stated that the issue of ampacity derating remains open with regard to the effects of TSI underestimating the ampacity figure for Thermo-Lag installation on conduits and cable trays. Overall, the NRC staff agrees that the technical issue of ampacity derating is an open issue. The status of the specific ampacity derating tasks under NRC staff review are given under Part I of the Gantt Charts attached to the Thermo-Lag Action Plan of January 14, 1994.

The NRC staff is pursuing the ampacity derating questions and has already issued the following generic communications that address the ampacity derating factors provided to industry by TSI: Information Notice 92-46, "Thermo-Lag Fire Barrier Material Special Review Team Final Report Findings, Current Fire Endurance Tests, and Ampacity Calculation Errors," June 23, 1992; Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers," December 17, 1992; and Information Notice 94-22, "Fire Endurance and Ampacity Derating Test Results for 3-Hour Fire-Rated Thermo-Lag 330-1 Fire Barriers," March 16, 1994. The NRC staff is also reviewing the results of ampacity derating tests performed by Texas Utilities Electric Company for Comanche Peak Steam Electric Station and by Tennessee Valley Authority for Watts Bar Nuclear Plant. The Nuclear Energy Institute (formerly the Nuclear Management and Resources Council) is also planning ampacity derating tests as part of the industry response to the Thermo-Lag issues.

In the partial director's decision of February 1, 1993, provided to NIRS in response to a petition filed on behalf of NIRS with the NRC pursuant to 10 CFR § 2.206, the NRC staff concluded that the ampacity derating issue is not an immediate safety concern but rather an aging issue to be resolved over a long term. As stated in the partial director's decision, the NRC staff determined that the ampacity derating factor resulting from Thermo-Lag insulating properties represents only one of many variables used by licensees

to determine the design ampacity for cable systems and that sufficient margin exists in this area to preclude any immediate safety concerns. The staff based its determination on the following evaluation.

For actual installations, various derating factors are typically applied to the Insulated Cable Engineers Association (ICEA) ampacity values provided for each cable size. In general it can be expected that the cables typically used in actual installations have higher current-carrying capacity than the ICEA ampacity values. Also, cables are sized on the basis of full-load current plus a 25-percent margin to account for starting current requirements of the load. Given the short duration of typical equipment starts, this margin is available to compensate for any errors in ampacity derating. Further, use of a cable size larger than normal may be required as a result of voltage drop considerations for long circuit lengths. In typical applications, this also provides additional current-carrying capacity. Given these conservatisms inherent in the design ampacity of cable systems and, in addition, the fact that most power cables required for safe shutdown are not normally energized, but are typically operated during surveillance testing for short time periods, the NRC staff has judged it unlikely that cables could ignite as a result of Thermo-Lag ampacity derating errors. In addition, on the basis of these conservatisms and the currently available information on existing plants, ampacity design, and operating history, the NRC staff believes that the ampacity derating issue is not an immediate safety issue but rather an aging issue to be resolved over the long term.

You did not send any new information in your correspondence that calls into question this ampacity derating evaluation. However, in response to your correspondence, the NRC staff reviewed the evaluation. On the basis of this review, the NRC staff affirmed that the ampacity derating issue is not an immediate safety concern and that the current NRC staff and industry efforts are adequate to ensure thorough and timely review.

Seismic Issues

In your correspondence, you stated that the seismic issue remains open. Pending the design of Thermo-Lag fire barrier upgrades, which could affect seismic performance, the NRC staff agrees that this is an open issue. The seismic issue is tracked under Part I of the Gantt Charts attached to the Thermo-Lag Action Plan of January 14, 1994. However, in the partial director's decision of February 1, 1993, provided to NIRS in response to a petition filed on behalf of NIRS with the NRC pursuant to 10 CFR § 2.206, the NRC staff provided its generic evaluation of the seismic issues. On the basis of this evaluation, the NRC concluded that Thermo-Lag material may crumble and crack during a seismic event, but that this behavior would not shatter raceways or sever cables required for safe shutdown. Later, in NUREG-0797, Supplement 26, "Supplemental Safety Evaluation Report Related to the Operation of Comanche Peak Steam Electric Station, Unit 2," of February 1993, the staff provided a plant-specific evaluation of the same issues and concluded that the Thermo-Lag material installed at Comanche Peak Unit 2 would not have a damaging effect on other seismic features under the maximum postulated seismic event.

With the exception of certain manual fire fighting hose stations, NRC guidelines and requirements do not specify that fire protection systems be designed to withstand design-basis seismic events (safe shutdown earthquake or operating basis earthquake). The plant fire brigade would use hose stations to protect safe shutdown capability in the event of a fire concurrent with a seismic event. In addition, Section V(a)(2) of Appendix A to 10 CFR Part 100, "Seismic and Geologic Siting Criteria for Nuclear Power Plants," states: "If vibratory ground motion exceeding that of the operating basis earthquake occurs, shutdown of the nuclear power plant will be required. Prior to resuming operations, the licensee will be required to demonstrate to the Commission that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public." The plant walkdowns and inspections conducted by the licensee to verify that no functional damage has occurred should reveal any fire barrier damage. Before restart, licensees could repair the barriers or implement compensatory measures for the barriers in accordance with plant procedures or technical specifications until permanent repairs could be made.

Hose Stream Testing

In your memorandum, you stated that hose stream testing remains an open issue. Supplement 1 to Generic Letter (GL) 86-10, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Safe Shutdown Functions Within the Same Fire Area," was issued on March 25, 1994. This GL supplement presents final staff guidance for hose stream testing. Issuance of this GL supplement completes the NRC staff review of hose stream testing. You did not raise any safety issues and did not submit any new technical information concerning hose stream testing. The NRC staff technical review of hose stream testing is closed.

In your correspondence, you also sought information on the staff position on hose stream testing criteria. The NRC staff interpreted your questions to be a request for information regarding how the staff developed the hose stream testing criteria for raceway fire barriers specified in Supplement 1 to GL 86-10 and for penetration seals.

On November 18, 1992, the NRC staff met with representatives from NUMARC, now the Nuclear Energy Institute (NEI), to discuss fire barrier testing acceptance criteria for fire barrier systems used to separate safe shutdown functions within the same fire area. The NRC staff handed out its proposed position on fire endurance testing (later designated "proposed Supplement 1 to GL 86-10") at this public meeting, and subsequently placed the proposed position in the NRC public document room along with the meeting minutes. On July 23, 1993, the NRC published proposed Supplement 1 to GL 86-10 in the Federal Register and invited comments. The comment period expired on August 23, 1993. The information you requested is captured in the NRC staff response to the comments that it received on hose stream testing. The following discussion, which is taken directly from the staff response to the comments, addresses the origin of the hose stream test criteria, the final hose stream test methodologies and criteria, and the technical bases for the criteria. The technical bases apply to fire barrier systems used to separate safe shutdown functions within the same fire area and to penetration seals.

Generic Letter 86-10, "Implementation of Fire Protection Requirements," established that Chapter 7 of National Fire Protection Association (NFPA) Standard 251, "Standard Methods of Fire Tests of Building Construction and Materials," provided the basis for the staff position for qualification testing of raceway fire barriers. This position is not changed by Supplement 1 to GL 86-10.

NFPA 251, Chapter 7, "Fire Test Acceptance Criteria for Nonbearing Partition Walls," allows the hose stream tests for a nonbearing wall to be performed on a duplicate test specimen after the specimen has been exposed to the standard test fire for a period equal to one-half of the fire resistance rating desired, but for not more than 1-hour (e.g., after a 30-minute fire exposure to qualify a 1-hour fire barrier and after a 1-hour fire exposure to qualify a 3-hour fire barrier). After the fire exposure, the test specimen is subjected to a solid hose stream test. The NRC staff position accepts this hose stream test method.

The staff also accepts the application of the hose stream test after the completion of the full fire endurance test period. If this method is used, one of the following hose stream test options can be applied:

- A solid hose stream applied at random to all exposed surfaces of the test specimen through a 2½-inch national standard playpipe with a 1⅛-inch orifice at a pressure of 30 psi at a distance of 20 feet from the specimen. The duration of the hose stream application is 1 minute for a 1-hour barrier and 2½ minutes for a 3-hour barrier; or

- A fog hose stream applied at random to all exposed surfaces of the test specimen through a 1½-inch fog nozzle set at a discharge angle of 30 degrees with a nozzle pressure of 75 psi and a minimum discharge of 75 gpm with the tip of the nozzle at a maximum of 5 feet from the test specimen. The duration of the hose stream application is 5 minutes for both 1-hour and 3-hour barriers); or

- A fog hose stream applied at random to all exposed surfaces of the test specimen through a 1½-inch fog nozzle set at a discharge angle of 15 degrees with a nozzle pressure of 75 psi and a minimum discharge of 75 gpm with the tip of the nozzle at a maximum of 10 feet from the test specimen. The duration of the hose stream application is 5 minutes for both 1-hour and 3-hour barriers.

NRC staff guidance in NUREG-0800, Standard Review Plan (SRP), Section 9.5.1, "Fire Protection For Nuclear Power Plants," specifies these hose stream methods for fire barrier penetration seal fire endurance tests. Therefore, the application of these hose stream test options to fire barriers systems used to separate safe shutdown functions within the same fire area is consistent with existing staff guidance. Furthermore, the staff believes that a fog hose stream test (after a full-duration fire test) satisfies the same fire safety objectives for fire barrier penetration tests as raceway fire barrier systems.

The staff accepts a fog hose stream test (after the full duration fire test) based on the following considerations:

(1) Nuclear power plant fire protection programs are based on the defense-in-depth concept, in which fires are prevented through administrative control of transient combustibles and ignition sources. Installed plant fire protection features also provide fire separation between safe shutdown trains and enable the plant staff to rapidly detect, control, and suppress fires that occur despite the prevention efforts.

(2) The staff recognizes the fire-resistive construction of nuclear power facilities, the defense in depth of the fire protection program, and the low combustible fire loads in nuclear power plants. Thus, the staff does not expect significant fire-related structural challenges (e.g., collapse of cable trays) to the integrity of the raceway fire barriers before the fire is controlled and suppressed by either automatic fire suppression systems or the in-plant fire brigade.

(3) In-plant fire brigades apply water through fog streams to control fires in areas with energized electrical equipment (most areas with raceway fire barriers).

(4) The pressures and the discharge rates from fog stream hose streams provide sufficient cooling and eroding effects to evaluate the fragility of the barrier system after the full-duration fire exposure.

03/21/94
New date approved
by Margo Bridgers
SW.

ACTION

EDO Principal Correspondence Control

04/11/94
~~03/31/94~~

FROM: DUE: ~~03/23/94~~ EDO CONTROL: 0009820
DOC DT: 03/01/94
FINAL REPLY:

Paul Gunter
Nuclear Information and Resource Service
(Referred by OIG)

TO:

Leo Norton, OIG

FOR SIGNATURE OF : ** GRN **

~~Russell~~ ~~Executive Director~~

DESC: Russell

STATUS OF THERMO-LAG 330-)

ROUTING:

Taylor
Milhoan
Thompson
Blaha
Beckjord

DATE: 03/02/94

ASSIGNED TO: CONTACT:

NRR Russell

SPECIAL INSTRUCTIONS OR REMARKS:

TICKET REISSUED 3/16/94 TO REFLECT SPECIFIC INSTRUCTIONS FROM THE CHAIRMAN.
PREPARE EDO RESPONSE.
DISCUSS WITH EDO. CHAIRMAN DESIRES EACH ISSUE TO BE TREATED SERIOUSLY.

ACTION
DUE TO NRR DIRECTOR'S OFF.
BY March 28

NRR RECEIVED: March 16
NRR ACTION: DSSA:VIRGILIO

EDO Should Concur

NRR ROUTING: WR/FJM
AT
LR
DC
FG
NRR MAIL ROOM

ACB