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U-602435  
L30-95(03 -28 )LP  
8G.120  
JGC-134-95  
March 28, 1995

Docket No. 50-461

Document Control Desk  
Nuclear Regulatory Commission  
Washington, D.C. 20555

Subject: Illinois Power's (IP) Response to the Nuclear  
Regulatory Commission's Follow-Up to the Request  
for Additional Information (RAI) Regarding Generic  
Letter 92-08, "Thermo-Lag 330-1 Fire Barriers"

Dear Sir:

This letter provides Illinois Power's (IP) response to the Nuclear Regulatory Commission's (NRC) RAI of December 28, 1994, which requested additional information regarding Generic Letter 92-08. In that letter, the NRC expressed concerns related to the quality assurance program of the Thermo-Lag manufacturer, Thermal Science, Incorporated, and the quality of Thermo-Lag materials. On the basis of the NRC's conclusion that some of the Thermo-Lag parameters cannot be verified by plant walk-downs or by comparison with installation procedures or records, the NRC requested extensive information regarding Thermo-Lag material properties and attributes that would require IP to perform disassembly and detailed examination of a representative sample of Thermo-Lag installed at Clinton Power Station (CPS).

As previously stated in IP's response (U-602250 dated February 9, 1994) to the NRC's RAI letter dated December 21, 1993, IP has eleven installations of Thermo-Lag in ten fire zones at CPS. Also in that letter, IP committed to implement hardware modifications in CPS fire zones CB-4, CB-5a, and CB-6d by the end of Refueling Outage No. 6 (currently scheduled to complete in December of 1996) and in CPS fire zone CB-1g by the end of Refueling Outage No. 7 (currently scheduled to complete in May of 1998). IP subsequently determined that these modifications would not rely on Thermo-Lag material to protect the safe shutdown capability in these fire zones. The compensatory measures described in IP letter U-602250 for these four installations will remain in place until the modifications are installed. Therefore, the information contained in this letter regarding the quality assurance of Thermo-Lag material and installation parameters is relevant only for the Thermo-Lag installed in CPS fire zones A-1a, C-2, CB-1e, CB-1f, D-8, and F-1p. ✓ ✓ ✓ ✓ ✓

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*Last time  
F-1p is discussed*

*AC-74*

As indicated in IP's letter U-602425, dated March 16, 1995, IP has prepared safety evaluations to address the protected components in fire zones A-1a, C-2, CB-1e, CB-1f, D-8, and F-1p in accordance with 10 CFR 50.59. These evaluations determined that no unreviewed safety questions exist. As shown in the safety evaluations, the fire endurance capability of the installed Thermo-Lag barrier is but one part of the defense-in-depth features of the CPS fire protection program. Collectively, these features ensure that safe shutdown capability would not be affected by a fire in one of these six fire zones. Therefore, minor variations in the quality or installation of the Thermo-Lag material would not have a significant impact on the capability to safely shutdown the plant. Consequently, the conclusions of the safety evaluations transmitted to the NRC on March 16, 1995 remain valid.

IP has determined that chemical composition testing of the Thermo-Lag material installed at CPS would be beneficial in that it would provide additional assurance that the results of the NEI generic fire endurance test program may be applied to CPS. Provided that the chemical composition results are consistent with the test data previously obtained by NEI under the generic fire endurance test program, IP concludes that additional material testing is neither warranted nor cost-beneficial.

Attachments 2 and 3 provide IP's response to the questions posed in the enclosure of the RAI, the details of the planned chemical composition testing, and the justification for not performing any other material testing or further verification of material or installation parameters.

Attachment 1 provides an affidavit supporting the facts set forth in this letter.

Sincerely yours,

  
J. G. Cook  
Vice President

WTD/csm

Attachments

cc: NRC Clinton Licensing Project Manager  
NRC Resident Office, V-690  
Regional Administrator, Region III, USNRC  
Illinois Department of Nuclear Safety  
Nuclear Energy Institute, Attn: Alex Marion

**References:**

1. NRC letter to IP, "Follow-Up to the Request for Additional Information Regarding Generic Letter 92-08, Issued Pursuant to 10 CFR 50.54(f), Clinton Power Station (TAC No. M85535)," dated December 28, 1994.
2. IP letter to the NRC, "Illinois Power's (IP) Safety Evaluations of Certain Installations of Thermo-Lag," dated March 16, 1995.
3. IP letter to the NRC, "Illinois Power's Response to the Nuclear Regulatory Commission's Follow-Up to the Request for Additional Information Regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers," dated December 16, 1994.
4. NRC letter to IP, "Follow-Up to the Request for Additional Information Regarding Generic Letter 92-08, Issued Pursuant to 10 CFR 50.54(f), in December 21, 1993 - Clinton Power Station (TAC No. M85535)," dated September 19, 1994.
5. IP letter to the NRC, "Illinois Power's Response to the Nuclear Regulatory Commission's Request for Additional Information Regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers," dated February 9, 1994.
6. NRC letter to IP, "Request for Additional Information Regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers" Pursuant to 10 CFR 50.54(f) - Clinton Power Station (TAC No. M85535)," dated December 21, 1993.

J. G. Cook, being first duly sworn, deposes and says: That he is Vice President of Illinois Power, that the response to the follow-up to Request for Additional Information (RAI) regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers" has been prepared under his supervision and direction, that he knows the contents thereof, and that to the best of his knowledge and belief said letter and the facts contained therein are true and correct.

Date: This 26 day of March 1995.

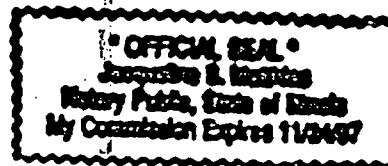
Signed: \_\_\_\_\_

J. G. Cook

STATE OF ILLINOIS

} SS.

DeWitt COUNTY



Subscribed and sworn to before me this 28<sup>th</sup> day of March 1995.

Jacqueline E. Mortimer  
(Notary Public)

### Thermo-Lag Material Properties

As a result of the nuclear industry's concerns, which were expressed by the Nuclear Energy Institute (NEI) regarding the extensive scope and resource burden imposed on the utilities by the latest NRC request, the NRC staff conducted a public meeting in Bethesda, Maryland, on March 14, 1995. In that meeting the NRC staff explained the considerations and bases for the December, 1994 50.54(f) letter and stated the NRC staff's expectations.

Illinois Power (IP) agrees with the NRC's position, stated at the meeting, that chemical analysis testing is necessary to ensure plant-specific barriers are represented by the generic configurations utilized in industry testing of Thermo-Lag material. IP will provide Thermo-Lag material samples taken from the plant installations that will not be relied upon as a result of planned hardware modifications and participate in the industry's chemical composition test program being coordinated by NEI. The intent of the program is for each participating utility to independently select samples and ship them to a common facility for pyrolysis gas chromatography testing consistent with ASTM D3452. Use of this test protocol will allow a comparison of new data from existing Thermo-Lag installations to chemical test data previously obtained by NEI under the generic fire endurance test program.

The December 28, 1994, NRC letter to IP contains the following quote from a previous (December 21, 1993) NRC letter:

"[B]ecause of questions about the uniformity of the Thermo-Lag fire barrier materials produced over time, NUMARC [now Nuclear Energy Institute] stated in its letter of July 29, 1993, that '[c]hemical analysis of Thermo-Lag materials provided for the program, as well as samples from utility stock, will be performed, and a test report prepared comparing the chemical compositions of the respective samples'."

Subsequent chemical analysis of various Thermo-Lag materials procured for the NEI fire endurance tests did not identify any uniformity concerns. Additionally, Thermo-Lag samples provided from utility warehouse stock were included in the NEI fire endurance tests with no difference in performance. This indicates that the date of manufacture is not a relevant parameter and validates the results of the NEI chemical composition tests.

As noted in the cover letter, the information contained in this letter regarding the Thermo-Lag material properties is relevant only for the Thermo-Lag installed in CPS fire zones A-1a, C-2, CB-1e, CB-1f, D-8, and F-1p. The following discussion corresponds to the specific requests for information contained in the first part of the enclosure to the 50.54(f) letter.

**1. a. Description of Specific Tests and Analyses**

- (1) **Chemical Composition:** CPS will participate in the chemical composition testing of the industry pool of samples which will be tested by one common test facility. The CPS sample selection methodology and schedule are provided in the response to sections 1.b and 1.c.
- (2) **Material Thickness:** The original purchase specification for CPS Thermo-Lag material required that all fire protection-related work be controlled by the contractor's quality assurance (QA) program, which was required to meet the requirements of 10 CFR 50, Appendix B, and ANSI N45.2-1971. The installation contractor and material supplier for CPS Thermo-Lag, Brand Industrial Services, Inc. (BISCO), did have such a program established and did comply with its program during the installation. Specifically, BISCO's QA program required that the Thermo-Lag 330-1 prefabricated panel thickness be 1/2 inch minimum (for 1-hour applications) or 1 inch minimum (for 3-hour applications). Material receipt inspection was performed by BISCO in accordance with their QA program, and is documented for all Thermo-Lag lot numbers on BISCO turnover documentation. Additionally, IP performed various QA surveillances of Thermo-Lag installations as they were completed. On the basis of the available installation documentation which shows the installed material thickness to be as specified for each of the CPS installations without reliance on the Thermo-Lag manufacturer's information, IP concludes that there is reasonable assurance that the material thickness conforms with IP specifications. Consequently, IP does not consider it necessary to conduct any further examinations or tests to verify material thickness.
- (3) **Material Weight and Density and (4) The Presence of Voids, Cracks and Delaminations:** IP does not consider it necessary to conduct any further examinations or tests to verify material weight, density, or the presence of voids, cracks, and delaminations for the following three reasons:
  - BISCO's installation procedures required that all joints and gaps be filled with trowel-grade Thermo-Lag material. Additionally, BISCO's inspection procedures required that all edges and joints in

the Thermo-Lag envelope be sealed with the appropriate thickness of material, and that no damage or openings in the envelope be evident. As documented in the BISCO turnover packages for CPS Thermo-Lag, where damage or openings in the envelope were found during QA inspection, the installation was repaired to a satisfactory condition in accordance with BISCO's installation procedures.

- Regular surveillances conducted by IP since 1987 on the Thermo-Lag fire barriers, in addition to an extensive walk-down and inspection of the barriers by IP in early 1994, have revealed that the Thermo-Lag installed at CPS is in excellent physical condition, with one minor exception discovered in late 1994. This exception is a small crack in the edge of a butt-joint on a cable tray in fire zone CB-1e. This joint will be repaired in accordance with BISCO's installation procedures. Compensatory measures, as discussed in letter U-602250, will remain in effect for fire zone CB-1e until the repair is completed.
  - As previously discussed, the safety evaluations performed in accordance with 10 CFR 50.59 for CPS fire zones A-1a, C-2, CB-1e, CB-1f, D-8 and F-1p have demonstrated that the defense-in-depth features of the CPS fire protection program provide assurance that safe shutdown of the plant is achievable in the event of fire in any of these six fire zones. While variations in material weight and density and the presence of voids, cracks, and delaminations could be postulated to impact the fire endurance capability of the fire barrier, such variations would not have a significant impact on the capability to safely shutdown the plant (as explained in the CPS safety evaluations) because acceptance of the installed Thermo-Lag is not based solely on its precise fire endurance capability.
- (5) **Fire Endurance Capabilities:** In assessing the fire endurance capability of Thermo-Lag installed on safe shutdown cables, IP prepared calculations using data extracted from the NEI and Texas Utilities Electric Company (TUE) fire tests. These calculations compared the CPS installations to the configurations of the industry test samples to ensure their applicability. As shown in the safety evaluations, the fire endurance capability of the installed Thermo-Lag barrier is but one part of the defense-in-depth features of the CPS fire protection program which collectively ensure that safe shutdown capability is not affected in the event of a fire in any of the six fire zones. Therefore, minor variations in the fire endurance capability

of the Thermo-Lag material installed in these six fire zones would not have a significant impact on the capability to safely shutdown the plant. Additionally, the use of the chemical composition data to be obtained by the tests discussed in item (1) will provide additional basis to confirm the applicability of the NEI and TUE test data, with respect to the fire endurance capabilities of the Thermo-Lag installed at CPS.

- (6) **Combustibility and (7) Flame Spread Rating:** Thermo-Lag's heat of combustion and lateral flame spread were tested by Underwriters Laboratories (UL) using test protocols of ASTM E1321 and ASTM E1354 respectively. These test results were provided in the "Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide" issued by the Nuclear Utility Management Resource Council (NUMARC). In calculating the fire loads in CPS fire zones, IP has accounted for the heat of combustion of Thermo-Lag. With regard to flame spread, IP's fire modeling calculations of the installations in which Thermo-Lag fire barrier is wrapped around safe shutdown cables concluded that the fixed and transient combustibles in each fire zone would not ignite the Thermo-Lag material. Since the CPS fireload calculations acknowledge the combustibility of Thermo-Lag and since the fire modeling calculations show that the ignition of Thermo-Lag is not credible, IP does not consider it necessary to conduct any further examinations or tests to verify Thermo-Lag combustibility and flame spread rating.
- (8) **Ampacity Derating:** As discussed in the safety evaluations transmitted to the NRC on March 16, 1995 the Thermo-Lag fire barriers installed at CPS do not adversely impact the current carrying capability of the protected cables. The reliance on Thermo-Lag for the remaining cables currently protected by Thermo-Lag will be eliminated by the hardware modifications scheduled to be implemented in Refueling Outages 6 and 7. Consequently, IP does not consider it necessary to conduct any further examinations or tests to verify Thermo-Lag ampacity derating.
- (9) **Mechanical Properties such as Tensile Strength, Compressive Strength, Shear Strength, and Flexural Strength:** These properties are related to the fire barrier seismic considerations and not to fire barrier performance. The Thermo-Lag fire barriers at CPS are not seismically qualified; however, like for piping insulation, the dead weight of the material was accounted for in the evaluation of the structural adequacy of the raceway hangers during a seismic event. The fire barriers are installed with stress skin, steel bands and tie wires in a configuration that gross failure of Thermo-Lag fire barriers during a seismic event is unlikely. For these reasons, IP does not consider it necessary to conduct any further



examinations or tests to verify Thermo-Lag mechanical properties such as tensile strength, compressive strength, shear strength, and flexural strength.

- b. **Sample Size:** This discussion applies to the chemical composition testing. The manufacturer's lot numbers for all Thermo-Lag material used on each commodity in each CPS installation are identified in the contractor's (BISCO's) turnover documentation. Additionally, each preformed panel and conduit preshape section installed in the field is usually marked with its lot number. The chemical composition testing discussed in item 1.a. (1) will be performed for Thermo-Lag 330-1 material installed at CPS. IP intends to obtain representative samples from ten percent of the approximately 85 Thermo-Lag 330-1 lot numbers installed at CPS and ship them to the test laboratory which will conduct the test for the industry. Lot numbers will be the only basis for sample selection, as the shape or form of the Thermo-Lag material has no bearing on its chemical composition. The time of manufacture and installation at CPS is not considered to be a significant variable since all of the CPS procurement and installation activities occurred within a relatively short time period, November 1985 to April 1986.
- c. **Schedule:** This discussion applies to the chemical composition testing. IP will ship the samples to the test laboratory by May 31, 1995. The schedule for the performance of the tests and results evaluation will be in accordance with the industry effort involving a number of participating utilities and the NEI.
- d. **Reporting of Tests and Analyses:** This discussion applies to the chemical composition testing. IP will provide to the NRC the requested supplemental report within 60 days of receipt of the evaluation of the chemical composition test results.

Important Barrier Installation Parameters

In Attachment 1 to letter U-602250 dated February 9, 1994, Illinois Power stated:

"In cases where the need for Thermo-Lag fire barriers will be eliminated through plant modifications, or the existing Thermo-Lag fire barrier is accepted as-is, the unknown parameters will not be evaluated. In cases where IP decides to upgrade the existing configuration, the necessary parameters will be obtained through destructive examinations, vendor sources, or further research of installation documentation. If it becomes unreasonably difficult to obtain the information by the above methods, IP will make a "worst-case" assumption for the unknown parameters. Finally, IP will consider the results of the NUMARC test program and Application Guide, and may either remove parameters from or add parameters to the list of important parameters depending upon the test results and Application Guide."

Subsequently, Illinois Power determined the following:

- The four hardware modifications as committed to the NRC in IP's response (U-602250 dated February 9, 1994) to the NRC's RAI letter dated December 21, 1993, will eliminate the reliance on Thermo-Lag material to protect safe shutdown capability in fire zones CB-4, CB-5a, CB-6d, and CB-1g. Additionally, the safety evaluations for fire zones A-1a, C-2, CB-1e, CB-1f, D-8, and F-1p have determined that no unreviewed safety questions exist relative to protection of safe shutdown capability in the event of fire. As shown in the safety evaluations, the fire endurance capability of the installed Thermo-Lag barrier is but one part of the defense-in-depth features of the CPS fire protection program. Collectively, these features ensure that the safe shutdown capability is not affected in the event of a fire in one of these six fire zones. Therefore, the above referenced statements regarding unknown parameters and efforts to obtain them are no longer applicable to CPS.
- IP's review of the NEI Application Guide and of NEI and TUE test data did not reveal any important parameters to be added. Neither were any of the parameters specifically removed from consideration when assessing fire endurance capability, due to the lack of specific information in the test data to ascertain a given parameter's influence on test results. Therefore, the above referenced statements regarding addition or removal of parameters of importance are no longer applicable to CPS.

As noted in the cover letter, the information contained in this letter regarding the quality assurance of Thermo-Lag installation parameters is relevant only for the Thermo-Lag installed in CPS fire zones A-1a, C-2, CB-1e, CB-1f, D-8, and F-1p. The following discussion corresponds to the specific requests for information contained in the second part of the enclosure to the 50.54(f) letter.

**2. a. Description of examinations and inspections**

From the time that Thermo-Lag material was first proposed for use at CPS until the present, Illinois Power has conducted various activities to verify, with reasonable assurance, the Thermo-Lag parameters of importance as identified by the NRC staff in the NRC's RAI of December 1993. Specific verification activities include:

- The original purchase specification for the Thermo-Lag material required that all fire protection-related work be controlled by the contractor's quality assurance (QA) program, which was required to meet the requirements of 10 CFR 50 Appendix B and ANSI N45.2-1971. BISCO did have such a program established and did comply with its program during the installation. Specifically, BISCO's QA program required the following:
  - a) material traceability of all Thermo-Lag by lot number, both in the construction documentation and on the material itself
  - b) certification of installation and inspection personnel
  - c) 100% inspection of each commodity section in each installation to verify that it conformed to the installation procedures and design details (as discussed in the following paragraph)
  - d) identification and resolution of installation problems in accordance with BISCO's corrective action (non-conformance) program
  - e) documentation of these activities (i.e., turnover packages)

Additionally, Illinois Power's QA program, which also meets the requirements of 10CFR50, Appendix B, and ANSI N45-2, required qualification of the contractor and inspection of the Thermo-Lag installations at time of turnover.

- The original purchase specification for CPS Thermo-Lag installation required the contractor to submit installation and inspection procedures for review and approval. BISCO's procedures and design details were reviewed and approved by IP's architect/engineer, Sargent & Lundy (S&L). Based in part on TSI Technical

Manuals 1130-83A and 20684, the BISCO procedures were revised to contain more detail than the TSI manuals. Specifically, the BISCO installation procedures and details identified:

- a) approved materials
- b) cleanliness and primer adhesion requirements
- c) minimum sizes for tie wire, banding, and anchors
- d) stress-skin orientation
- e) minimum spacing between tie wires or banding
- f) minimum thickness of prefabricated panel
- g) use of butt-joint or score-and-folded joints
- h) amount of precoating (prebuttering) for butt joints
- i) minimum thickness of preshaped conduit sections
- j) minimum anchor penetration, anchor spacing, and flange width for attachment to concrete
- k) minimum thickness of material to cover anchors
- l) minimum thickness and length of material for thermal shorts
- m) minimum overlap to cover penetration seal interface
- n) minimum thickness of material for in-tray firestops
- o) minimum depth of caulk-and-fiber for internal conduit seals
- p) requirement to fill gaps or joints as needed prior to completion

The actual thicknesses or measurements for the above parameters were not recorded in the Thermo-Lag turnover packages for CPS; however, BISCO installation and inspection personnel did verify and initial that the minimum requirements for these parameters had been satisfied.

- In response to the NRC's letter dated December 21, 1993, Illinois Power conducted extensive walk-downs of the installed Thermo-Lag material at CPS in early 1994 to gather information relative to the parameters of importance as identified by the NRC staff. Attachment 3 to U-602250 contains the results of these walk-downs. From these walk-downs IP did not find any indication of material or installation defects, and in all cases the installations were verified to conform to the BISCO installation procedures and design details.
- All information that IP has accumulated about the 24 Thermo-Lag installation parameters of importance as identified by the NRC staff in the RAI of December 1993 was presented in Attachment 3 of U-602250. In that attachment, IP stated that for several of the parameters, verification of the parameter would be impossible even upon dismantling or breaching the Thermo-Lag envelope. In such cases the indeterminate parameter was conservatively assumed to be "worst-case"

when assessing the fire endurance capability of the as-installed Thermo-Lag. As shown in the aforementioned safety evaluations performed in accordance with 10 CFR 50.59, the fire endurance capability for the installed Thermo-Lag barrier is but one part of the defense-in-depth fire protection features which ensure that safe shutdown ability is not affected in the event of a fire. As indicated in letter U-602425, dated March 16, 1995, these evaluations determined that no unreviewed safety questions exist. Because of the conservative assumptions made, the indeterminate nature of several of the installation parameters does not impact the conclusions of these safety evaluations.

In light of the activities discussed above, IP has determined that further efforts to verify these parameters are neither technically necessary nor cost-effective. Consequently, IP does not intend to conduct any further verification of installation parameters.

**2. b. Description of examination and inspection methodology**

As discussed in the above section, IP does not intend to conduct any further verification of installation parameters. For descriptions of the examinations and inspections conducted in the past, see the above section.

**2. c. Schedule for examination and inspection**

As discussed in the above section, IP does not intend to conduct any further verification of installation parameters; therefore, a schedule for such activities is not provided.

**2. d. Written supplemental report**

As discussed in the above section, IP does not intend to conduct any further verification of installation parameters; therefore, IP does not intend to submit a supplemental report.