Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

JUL 09 1993

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Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) - RESULTS OF QUALIFICATION TESTING FOR THERMO-LAG 330 FIRE BARRIERS (TAC M63648).

References: 1. TVA letter to NRC dated October 16, 1992, Watts Bar Nuclear Plant (WBN)- Thermo-Lag Fire Barrier Issues - Conduit Fire Test Program (TAC M63648).

2. TVA letter to NRC dated February 10, 1993, Watts Bar Nuclear Plant (WBN) - Response to NRC Request for Additional Information - Conduit Fire Barrier Fire Endurance Testing Program (TAC M63648).

3. TVA letter to NRC dated April 16, 1993, Watts Bar Nuclear Plant (WBN) - Response to Generic Letter (GL) 92-08 - Thermo-lag 330-1 Fire Barriers.

The purpose of this letter is to provide the results of qualification testing for Thermo-Lag 330 fire barriers. Reference 1 described TVA's plan to qualify Thermo-Lag 330 fire barrier material for use to protect safe shutdown circuits in conduit at WBN. Reference 2 responded to an NRC request for additional information regarding the intended qualification test program. Reference 3 committed to have the results of Thermo-Lag testing available for NRC review when testing has been completed. The testing has now been completed. Enclosure 1 provides a summary description of the test program results and intended application of Thermo-Lag 330 at WBN. Enclosures 2 through 8 provide the relevant test reports.

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The testing described in the enclosed reports qualifies Thermo-Lag 330 for use as a one-hour fire barrier on conduit. Test reports are enclosed documenting six fire exposure tests conducted for TVA at Omega Point Laboratories (Enclosures 2-7). Qualification is based on maintaining the temperature rise inside the enclosure below acceptance criteria (250 degrees F average rise, 325 degrees F maximum). Accordingly, no testing of cable functionality at elevated temperature was performed since such testing was only required if temperature rises exceeded this criteria (Reference 1).

Test reports are enclosed documenting ampacity derating tests conducted in TVA's Central Laboratories (Enclosure 8). Ampacity testing was conducted to determine correction factors for the conduit configurations intended for use at WBN.

TVA did not test Thermo-Lag applications on cable trays. TVA will rely upon testing conducted by Texas Utilities (TU) for Comanche Peak 2, and accepted by NRC for that application, for any Thermo-Lag 330 installations on cable trays at WBN.

This letter makes no commitments. More detailed information, including TVA's general engineering specification (installation procedure), design standard, and WBN design drawings are available for NRC review at the WBN site or the TVA Rockville Licensing Office. If you have any questions, please contact P. L. Pace at (615) 365-1824.

Very truly yours,

W. J. Museler

William J. Museler

Enclosure
cc (w/o Enclosures 2 - 8):
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ENCLOSURE 1

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2

RESULTS OF QUALIFICATION TESTING FOR THERMO-Lag 330 ELECTRICAL

RACEWAY FIRE BARRIER SYSTEMS -- SUMMARY

Concerns were raised during 1992 regarding the acceptability of Thermo-Lag 330 for use as a fire barrier around electrical raceways in nuclear power plants. As a result of these concerns, TVA embarked on a technical program to test Thermo-Lag 330 for intended WBN applications and thereby to demonstrate the qualification of the material for intended service.

Texas Utilities (TU) was concurrently involved in similar testing to support application of Thermo-Lag at Comanche Peak 2. TVA determined that the TU tests of cable tray enclosures met TVA acceptance criteria for limiting temperature rise on the cold side of the barrier. TVA further determined that the TU design for installing Thermo-Lag 330 barriers on cable trays could be implemented at WBN. Accordingly, TVA decided to utilize the TU design for Thermo-Lag 330 protective enclosures around cable trays and to rely on the TU tests as qualification for this application (specific TU tests to be relied upon are listed in Appendix 1). TVA's test program was, therefore, limited to conduits and related structures (i.e., junction boxes, air drops, and intervening steel supports) since TVA installation practices for applying Thermo-Lag 330 to conduit differ from TU's.

On October 7, 1992, TVA met with NRC to present our position on fire testing and ampacity derating testing for Thermo-Lag Electrical Raceway Fire Barrier Systems (ERFBS). TVA explained intended testing methodologies and acceptance criteria. This information was subsequently documented by letter dated October 16, 1992. Further information was provided in response to NRC questions by letter dated February 10, 1993. Beginning in late Fall 1992 and continuing through Summer 1993, TVA conducted a series of full-scale fire exposure tests and ampacity derating tests. The results of these tests are summarized below.

Fire Exposure Tests

A series of full scale fire exposure tests was conducted at Omega Point Laboratories. Test decks were designed and Thermo-Lag was installed by TVA personnel to represent typical configurations to be installed at WBN. Except for the 3/8 inch Thermo-Lag, tested material used in these test decks was obtained from WBN stores. The 3/8 inch material had not been previously procured for WBN but was procured from TSI as a potential upgrade. The Thermo-Lag used in the tests is representative of the material to be installed at the plant. Test methodology and acceptance criteria were based on UL Subject 1724, "Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems," as described in TVA's letter to NRC dated October 16, 1992. Tests were conducted by an independent testing laboratory, Omega Point Laboratories. NRC personnel observed aspects of the testing, including installation of Thermo-Lag and conduct of the fire exposure tests.

Six of the TVA fire tests (Appendix 1) form the basis for the installation of Thermo-Lag 330 one-hour ERFBS on conduits, junction boxes, air drops, and intervening steel supports. The cold-side temperature remained below acceptance criteria for each of these tests, except for the specimen utilizing a single, nominal 5/8 inch protective layer on 3-inch conduit. This configuration will not be installed at WBN. Table 1 shows the acceptable configurations for TVA installations.

Table 1

Thermo-Lag 330 Conduit System Designs

Conduit size (Inches)	Nominal Thermo-Lag Thickness (Inches) 5/8	5/8 + 3/8	3/8 + 3/8
3/4		X	
1		X	
1-1/2		X	
2		X	X
2-1/2		X	X
3	X*	X	X
4	X		
5	X		

* Requires cable qualification, since cold-side temperatures exceeded acceptance criteria. This configuration will not be used at WBN.

Ampacity Testing

Ampacity derating tests of Thermo-Lag protected conduits were conducted at TVA Central Laboratory Services. The tests were performed in accordance with the latest version of draft IEEE Standard P848, "Procedure for the Determination of the Ampacity Derating of Fire Protected Cables." One-inch and four-inch conduits were tested as specified by the Standard to be representative of all conduit sizes. Each conduit size was tested in a base configuration (uncovered) and covered with each of the Thermo-Lag thickness combinations listed in Table 1 above (i.e., 5/8, 5/8 + 3/8, and 3/8 + 3/8).

As described above, the Thermo-Lag used in the tests was obtained from WBN stores or TSI and is representative of the material to be installed at the plant. Conduit used for the tests was obtained from WBN stores and is representative of materials installed or intended for installation in the plant. Construction of test configurations was performed by the same TVA personnel who performed this function for the fire exposure tests utilizing designs intended for use at WBN.

In addition to the derating factors obtained from testing, calculated values were developed based on the thermodynamic properties of the materials involved. Correction factors were defined to conservatively envelope the test results and the calculated derate values. The correction factors specified for use at WBN are presented in Table 2.

Table 2

Thermo-Lag 330 Ampacity Correction Factors

Thermo-Lag Thickness	Correction Factor
5/8	0.93
3/8 + 3/8	0.93
5/8 + 3/8	0.92

Ampacity correction factors were not determined by TVA for cable tray configurations. TVA will use the ampacity derate values derived by TU for the TU-developed cable tray protective system designs to be used at WBN.

TVA will also use the derate determined by TU for air drops despite differences between the TVA and TU air drop design. The TU design utilizes three layers of Thermo-Lag 660 Flexi-blanket. TVA's design utilizes standard Thermo-Lag 330 preformed conduit sections installed on the bare cables as it would be on conduit. The interior of the preformed sections are pre-buttered with trowelable-grade Thermo-Lag prior to installation. This step ensures better contact between the cables and the fire barrier than is achievable with the Flexi-Blanket design. In addition, the TVA design will eliminate air pockets which may exist between the individual wraps of Flexi-Blanket. The result is significantly better thermal conductivity for the TVA design. Nevertheless, TVA will use a correction factor of 0.682 for air drops, as derived by TU, since specific tests were not conducted for the TVA air drop configuration. The better thermal conductivity inherent in the TVA design should require significantly less derate, making use of the value derived from TU tests conservative.

Appendix 1

Fire Tests Relied on for Thermo-Lag 330 Qualification

1. TVA Fire Test

   Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (1 in. and 5 in. conduit configurations and 2 in. air drop configurations). Project No. 11210-94554C, Omega Point Laboratories, January 22, 1993 (T49 930625 851).

2. TVA Fire Test

   Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (1 in. and 5 in. conduit configurations and 2 in. air drop configurations). Project No. 11210-94554a, Omega Point Laboratories, January 25, 1993 (T49 930625 850).

3. TVA Fire Test

   Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (3 in., 2 in., 1 in. & 4 in. conduit configurations). Project No. 11210-94943a, Omega Point Laboratories, April 25, 1993 (T49 930630 821).

4. TVA Fire Test

   Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (3 in. steel, 3 in. aluminum, and 1 1/2 inch steel configurations and generic 2 in. and 4 in. tube steel support members). Project No. 11210-94943b, Omega Point Laboratories, April 30, 1993 (T49 930630 822).

5. TVA Fire Test

   Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (1 in., 2 in., 3 in., and 5 in. conduits and five junction boxes of varying sizes). Project No. 11210-94943d, Omega Point Laboratories, May 10, 1993 (T49 930630 823).

6. TVA Fire Test

   Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (large junction box and three 4 in. conduit sections). Project no. 11210-94943e, Omega Point Laboratories, May 10, 1993 (T49 930630 824).

7. TU Fire Test

Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (30 inch tray). Project No. 12340-943671, Omega Point Laboratories, December 16, 1992 (T25 930805 877).

8. TU Fire Test

Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (24 inch tray with tee). Project No. 12340-94367h, Omega Point Laboratories, December 16, 1992 (T25 930805 878).

9. TU Fire Test

Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (12 inch tray). Project No. 12340-943671, Omega Point Laboratories, December 9, 1992 (T25 930605 879).

10. TU Fire Test

Fire Endurance Test of a Thermo-Lag 330 Fire Protective Envelope (30 inch tray with tee). Project No. 12340-94367m, Omega Point Laboratories, December 16, 1992 (T25 930605 880).