50-390

August 20, 1993

Mr. Steve P. Nowlen
Nuclear Energy Technology
Organization 6449
Sandia National Laboratories
Albuquerque, New Mexico 87185

Dear Mr. Nowlen:

Enclosed are documents which may be required for your use on an upcoming task order under JCN J-2018 and, subsequently, to successfully perform the work. The documents relate to the ampacity derating test program results of Thermo-Lag protected cable systems as directed by Tennessee Valley Authority (TVA) for Watts Bar Nuclear Plant as well as a copy of Generic Letter 92-08.

This letter is not an authorization to begin work on this task order. Rather, it provides information which may be used to perform the work once a task order is authorized. The authorization to begin work on the upcoming task order will be provided in a letter signed by the NRC Division Director after agreement is reached on the acceptability of your proposal.

If you have any questions, please call me. Thank you for your assistance.

Sincerely,

Original signed by

Ronaldo Jenkins
Electrical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

Enclosures:
1. Memorandum from William J. Museler, TVA to U.S. NRC dated June 9, 1993 entitled "Watts Bar Nuclear Plant (WBN) - Results of Qualification Testing for Thermo-Lag 330 Fire Barriers (TAC M63648)," including test reports
2. U.S. NRC Generic Letter 92-08, dated December 17, 1992, "Thermo-Lag 330-1 Fire Barriers"

DISTRIBUTION w/enclosures
JTWiggins, NRR
CHBerlinger, NRR
PGill, NRR
RJenkins, NRR
BGrenier, NRR
Official Contract File (7 D26)
PDR
Central Files
EELB R/F

Document Name: G:\SHARED\NOWLEN81.LTR

Pred.

EELB:DE:NRR
RVJenkins:nkw
08/16/93

NRC FILE CENTER COPY

DF03

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

JUL 0 9 1993

William J. Museler
Site Vice President
Watts Bar Nuclear Plant

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

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 make 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.

JUL 09 1993

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,

William J. Museler

Enclosure
cc (w/o Enclosures 2 - 8):
NRC Resident Inspector
Watts Bar Nuclear Plant
P.O. Box 700
Spring City, Tennessee 37381

Mr. P. S. Tam, Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852

U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

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. 12340-94367i, 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).

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

December 17, 1992

TO: ALL HOLDERS OF OPERATING LICENSES OR CONSTRUCTION PERMITS FOR NUCLEAR POWER REACTORS

SUBJECT: THERMO-LAG 330-1 FIRE BARRIERS (GENERIC LETTER 92-08)

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter (GL) to obtain additional information needed from licensees to verify that Thermo-Lag 330-1 fire barrier systems manufactured by Thermal Science, Incorporated (TSI, the vendor), St. Louis, Missouri, comply with the NRC's requirements. Many licensees use Thermo-Lag 330-1 fire barriers to satisfy the NRC's fire protection requirements for safe shutdown capability. Some licensees also use Thermo-Lag 330-1 barriers to create physical independence between the circuits and electric equipment in and associated with the Class 1E power system, the protection system, systems actuated or controlled by the protection system, and auxiliary or supporting systems that must be operable for the protection system and the systems it actuates to perform their safety-related functions.

BACKGROUND

The NRC began a review of Thermo-Lag 330-1 fire barrier system fire endurance and ampacity derating test reports, installation procedures, and as-built configurations after receiving reports from Gulf States Utilities (GSU) about failed qualification fire tests and installation problems. The staff issued the results of the NRC's initial review in NRC Information Notice (IN) 92-46, "Thermo-Lag Fire Barrier Material Special Review Team Findings, Current Fire Endurance Tests, and Ampacity Calculation Errors," June 23, 1992. The special review team report enclosed with IN 92-46 included the technical bases for this generic letter. The NRC staff found the following regarding Thermo-Lag 330-1 barriers: incomplete or indeterminate fire test results, questionable ampacity derating test results and a wide range of documented ampacity derating factors, some barrier installations that are not constructed in accordance with the vendor recommended installation procedures, incomplete installation procedures, and as-built fire barrier configurations that may not be qualified by a valid fire endurance test or evaluated in accordance with the guidance previously provided by the staff in GL 86-10, "Implementation of Fire Protection Requirements," April 24, 1986.

Texas Utilities Electric Company (TU Electric) later conducted a series of full-scale fire endurance tests to qualify the Thermo-Lag 330-1 electrical raceway fire barrier configurations installed at its Comanche Peak Steam Electric Station. The NRC also conducted a series of small-scale fire tests of 1-hour and 3-hour Thermo-Lag prefabricated panels at the National Institute of Standards and Technology to assess the fire performance of the panels. The results of these fire tests raised additional concerns about the ability of

Thermo-Lag 330-1 fire barriers to provide fire protection according to their specified fire-resistance ratings.

The staff issued the results of the TU Electric and NRC fire tests in Bulletins 92-01, "Failure of Thermo-Lag 330 Fire Barrier System to Maintain Cabling in Wide Cable Trays and Small Conduits Free from Fire Damage," June 24, 1992, and 92-01, Supplement 1, "Failure of Thermo-Lag 330-1 Fire Barrier System to Perform its Specified Fire Endurance Function," August 28, 1992. In the bulletin and its supplement, the NRC notified the licensees of apparent failures of Thermo-Lag 330-1 fire barriers and materials during fire endurance testing. The bulletin and its supplement requested that each licensee determine which plant areas use 1-hour or 3-hour prefabricated Thermo-Lag 330-1 panels or conduit shapes for raceway, wall, ceiling, or equipment enclosure fire barriers; determine the plant areas that use these materials to protect or separate safe shutdown capability; and implement, in accordance with plant procedures, compensatory measures until the fire barriers can be declared operable. The bulletin required that each licensee inform the NRC in writing whether or not the above requested actions were taken and describe the measures being taken to ensure or restore fire barrier operability.

AREAS OF CONCERN

The NRC has three principal areas of concern: the fire endurance capability of Thermo-Lag 330-1 barriers, the ampacity derating of cables enclosed in Thermo-Lag 330-1 barriers, and the evaluation and application of the results of tests conducted to determine the fire endurance ratings and the ampacity derating factors of Thermo-Lag 330-1 barriers.

The NRC is concerned that the Thermo-Lag 330-1 fire barrier systems may not provide the level of fire endurance intended by licensees and, therefore, that licensees that use Thermo-Lag 330-1 fire barriers may not be meeting the requirements of Section 50.48, "Fire protection," and General Design Criterion (GDC) 3, "Fire protection," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50).

Cables routed in electrical raceways are derated to ensure that systems have sufficient capacity and capability to perform their intended safety functions. Cables routed in raceways enclosed in fire barriers require additional derating because of the insulating effect of the fire barrier materials. Cable derating calculations that are based on inaccurate or nonconservative derating factors could result in installation of undersized cables or raceway overfilling. This could cause operating temperatures to exceed design limits within the raceways thereby reducing the expected design life of the cables. The NRC is concerned that because of the wide range of ampacity derating factors documented for Thermo-Lag 330-1 materials, some licensees may not have adequately accounted for the insulating effects of the Thermo-Lag material in their derating analyses and, therefore, may not be meeting the requirements of GDC 17, "Electric power systems." This concern applies where Thermo-Lag 330-1 barriers are used either to protect safe shutdown capability from fire or to achieve physical independence of electrical systems.

The NRC is also concerned that some licensees have not adequately reviewed and evaluated the fire endurance test results and ampacity derating test results used as the licensing basis for their Thermo-Lag 330-1 barriers to determine the validity of the tests and the applicability of the test results to their plant designs.

The NRC is requiring information needed to verify compliance with 10 CFR 50.48, GDC 3, and GDC 17, and associated license conditions under the provisions of 10 CFR 50.54(f) where Thermo-Lag 330-1 barriers are used.

FIRE ENDURANCE CAPABILITY

The NRC's Qualification Requirements and Guidance for Fire Barriers

Section 50.48 of 10 CFR requires that each operating nuclear power plant have a fire protection plan that satisfies GDC 3. GDC 3 requires that structures, systems, and components important to safety be designed and located to minimize, in a manner consistent with other safety requirements, the probability and effects of fires. Fire protection features required to satisfy GDC 3 include features to ensure that one train of those systems necessary to achieve and maintain shutdown conditions be maintained free of fire damage.[1] One means of complying with this requirement is to separate one safe shutdown train from its redundant train with fire-rated barriers. The level of fire resistance required of the barriers, 1 hour or 3 hours, depends on the other fire protection features provided in the fire area.

The NRC issued guidance on acceptable methods of satisfying the regulatory requirements of GDC 3 in Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants;" Appendix A to BTP APCSB 9.5-1; BTP Chemical Engineering Branch (CMEB) 9.5-1, "Fire Protection For Nuclear Power Plants," July 1981; and GL 86-10. In the BTPs and in GL 86-10, the staff stated that the fire resistance ratings of fire barriers should be established in accordance with National Fire Protection Association (NFPA) Standard 251, "Standard Methods of Fire Tests of Building Construction and Materials," by subjecting a test specimen that represents the materials, workmanship, method of assembly, dimensions, and configuration for which a fire rating is desired to a "standard fire exposure" at a nationally recognized laboratory.[2] In GL 86-10, the staff included guidance on fire test acceptance criteria and for evaluating deviations from tested configurations.

---

[1] See Appendix R to 10 CFR Part 50, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979."

[2] American Society for Testing and Materials (ASTM) Standard E119 was adopted by the National Fire Protection Association (NFPA) as NFPA Standard 251.

Fire Endurance Testing and the Evaluation and Application of Fire Test Results

On October 26, 1989, the Southwest Research Institute (SwRI) performed a 3-hour fire endurance test of a cable tray and support protected by a Thermo-Lag 330-1 fire barrier for GSU. SwRI found that temperatures within the test assembly exceeded the NRC's acceptance criteria within 60 minutes and that the test assembly collapsed in less than 90 minutes. These test results raised concerns about the adequacy of Thermo-Lag 330-1 cable tray enclosures. The staff informed the licensees of these test results in NRC IN 91-47, "Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test," August 6, 1991. NRC IN 92-46 contains the staff's evaluation of this fire test.

While conducting its review, the NRC staff found that many fire endurance tests have been conducted on electrical raceways protected with Thermo-Lag 330-1 fire barrier systems. The staff reviewed about forty 1-hour and 3-hour fire endurance test reports from various testing facilities and found that testing methods and procedures used during some of the qualification tests did not meet the NRC's guidance and deviated from good engineering practices. In NFPA 251, the NFPA advised that the test conditions should be evaluated carefully because variations from the construction of the test specimen or from the conditions in which it is tested may substantially change the performance characteristics of the assembly. The test reports reviewed did not contain sufficient details of the construction methods used for the test specimens, did not contain details of the materials used, and did not contain dimensioned drawings. Most of the test configurations were atypical of the as-built field configurations observed by the staff.

The NRC recognized that fire endurance testing of every as-built fire barrier configuration is not possible. In GL 86-10, the NRC issued guidance for reviewing deviations from tested fire barrier configurations. While reviewing the Thermo-Lag 330-1 fire barriers, the NRC staff found several instances in which licensees installed fire barrier configurations that may not have been qualified by fire endurance testing or may not have been reviewed in accordance with the guidance in GL 86-10. For example, when the NRC conducted its initial review, some licensees could not justify their practice of extrapolating test results from small barrier enclosures to significantly larger enclosures or installing barriers using procedures and materials that were different from those tested. The NRC visited five sites after issuing IN 91-47 and also found several licensees that had constructed fire walls, partitions, and vaults using Thermo-Lag 330-1 as a component. These licensees could not provide qualification test reports or justify deviations from tested configurations to demonstrate the acceptability of these fire barriers. The staff informed the licensees of these issues in IN 91-79, "Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Materials," December 6, 1991.

The staff is concerned that some licensees have not adequately reviewed applicable fire endurance test results to determine if the tests are valid and if the test results apply to their plant designs.

Deficiencies in the Fire Barrier Installation and Inspection Procedures

While conducting site visits after issuing IN 91-47, the NRC staff observed that the vendor had revised its recommended installation procedures without notifying the licensees, that the vendor installation procedures are incomplete, that a number of field installations were not constructed in accordance with the vendor recommended installation procedures, that some installations did not appear to be qualified by fire endurance testing, and that some installations deviated from the tested configurations without justification. In IN 91-79, the NRC staff discussed installation problems resulting from incomplete TSI installation procedures, inadequate licensee installation procedures, installer errors, incomplete or incorrect design documents, and inadequate quality control oversight. In IN 91-79, the staff also listed the installation details in which it found differences between the field installations, the tested configurations, and the vendor installation procedures. These details are not repeated here.

AMPACITY DERATING

NRC Requirements and Guidance for Ampacity Derating

GDC 17 requires that onsite electric power systems be provided to permit the functioning of structures, systems, and components important to safety. The onsite electrical power system is required to have sufficient capacity and capability to ensure that vital functions are maintained. The Institute of Electrical and Electronics Engineers (IEEE) Standard 279, "Criteria for Protection Systems for Nuclear Power Generating Stations," includes guidance on acceptable methods of satisfying GDC 17. IEEE states that the quality of protection system components shall be achieved by specifying requirements known to promote high quality, such as the requirements for the derating of components, and that the quality shall be consistent with minimum maintenance requirements and low failure rates. Furthermore, IEEE 279 states that type test data or reasonable engineering extrapolation based on test data shall be made available to verify that protection system equipment continually meets the performance requirements determined to be necessary for achieving the system requirements.

In Regulatory Guide (RG) 1.75, "Physical Independence of Electric Systems," the NRC staff gave guidance for complying with IEEE Standard 279 and GDC 17 for the physical independence of the circuits and electric equipment comprising or associated with the Class 1E power system, the protection system, systems actuated or controlled by the protection systems, and auxiliary or supporting systems that must be operable for the protection system and the systems it actuates to perform their safety-related functions. Some licensees use Thermo-Lag 330-1 barriers to achieve physical independence of electrical systems in accordance with RG 1.75. The staff's concerns about ampacity derating apply to Thermo-Lag 330-1 barriers installed to achieve physical independence of electric systems and to those installed to protect safe shutdown capability from fire.

Ampacity Derating Tests and the Application of Ampacity Derating Test Results

Cables enclosed in electrical raceways protected with fire barrier materials are derated because of the insulating effect of the fire barrier material. Other factors that affect ampacity derating include cable fill, cable loading, cable type, raceway construction, and ambient temperature. The National Electrical Code, Insulated Cable Engineers Association (ICEA) publications, and other industry standards provide general ampacity derating factors for open air installations, but do not include derating factors for fire barrier systems. Although a national standard ampacity derating test method has not been established, ampacity derating factors for raceways enclosed with fire barrier material have been determined for specific installation configurations by testing.

The vendor has documented a wide range of ampacity derating factors that were determined by testing. For example, between 1981 and 1985, the vendor provided test reports to licensees that document ampacity derating factors for cable trays that range from 5.3 to 12.48 percent for 1-hour barriers and from 16.15 to 20.55 percent for 3-hour barriers. On October 2, 1986, TSI informed the NRC and its customers by Mailgram that, while conducting a special services investigation in September 1986 at the Underwriters Laboratories, Incorporated (UL), it found that the ampacity derating factors for Thermo-Lag 330-1 barriers were greater than previous tests indicated (28.04 percent for 1-hour barriers and 31.15 percent for 3-hour barriers). However, the cable fill and tray configuration for each test differed from those tested previously. The NRC learned that UL performed duplicate cable tray baseline tests using a longer stabilization period (4 hours instead of 15 minutes) after the final current adjustment and obtained a higher baseline current, which yielded higher derating factors (36.1 percent for 1-hour barriers and 38.9 percent for 3-hour barriers). UL gave these test results to the vendor, but they were not submitted to the NRC or to licensees. While reviewing tests which had been conducted at SwRI in 1986, the staff learned that the ampacity derating factor for the tested configuration was 37.4 percent for a 1-hour Thermo-Lag 330-1 barrier. The test procedures and test configurations differed for each of the aforementioned tests. Therefore, the results from these different ampacity tests may not be directly comparable to each other.

The staff is concerned that the ampacity derating factors derived from the UL tests for similar Thermo-Lag 330-1 barrier designs are inconsistent with one another because of differing stabilization times, which calls into question the validity of the ampacity derating tests. While reviewing Industrial Testing Laboratories (ITL) test reports, the NRC staff noticed that ambient temperature and maximum cable temperature were allowed to vary widely for some tests (48 °C instead of 40 °C for ambient temperature and 94.4 °C instead of 90 °C for maximum cable temperature). ITL then used an ICEA procedure to calculate the ampacity derating factors by adjusting the tested current to 40 °C ambient and 90 °C cable temperature. Those tests may not be valid because the ambient and maximum cable temperatures were not maintained within specified limits in some tests. In IN 92-46, the NRC informed licensees that a licensee also discovered a mathematical error in the calculation of the ampacity derating factor as published in an ITL test report. A preliminary assessment of the use of lower-than-actual ampacity derating factors indicates

that Thermo-Lag 330-1 barrier installations may allow cables to reach temperatures that exceed their ratings, which could accelerate cable aging.

The staff is also concerned that some licensees have not adequately reviewed the results of ampacity derating tests to determine if the tests are valid and if the test results apply to their plant designs. The staff ampacity derating concerns apply to the use of Thermo-Lag 330-1 on electrical raceways both as fire barriers to protect the safe shutdown capability and as barriers to create physical independence between electrical systems.

ACTIONS REQUESTED

NRC regulations require that safe shutdown equipment be protected from fire, that onsite electric power systems have sufficient capacity and capability to ensure that vital functions are maintained, and that certain circuits and electric equipment be physically independent. The NRC has found test assemblies that failed qualification fire tests, fire test results that are incomplete and indeterminate, installation problems, questionable ampacity derating tests, and differences between reported ampacity derating factors. The NRC also found that some licensees have not adequately evaluated the results of tests for fire endurance and ampacity derating. Therefore, licensees are requested to confirm (1) that the Thermo-Lag 330-1 barrier systems have been qualified by representative fire endurance tests, (2) that the ampacity derating factors have been derived by valid tests, and (3) that these qualified barriers have been installed with appropriate procedures and quality controls to ensure that they comply with the NRC's requirements.

The staff is continuing to review technical issues associated with Thermo-Lag 330-1 barriers. The NRC staff will evaluate other fire barrier materials and systems used by the licensees to satisfy the NRC's requirements. If the staff finds concerns, it will address them through appropriate communications. This generic letter does not request actions for barrier materials and systems other than the Thermo-Lag 330-1 fire barrier system. However, the staff expects that the recipients of this generic letter will review the information to determine if it applies to other barrier materials and systems used at their facilities and consider actions, as appropriate, to avoid similar problems.

REPORTING REQUIREMENTS

All addressees are required, pursuant to Section 182(a) of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), to submit a written report within 120 days from the date of this generic letter. In this written report, the licensee shall address the following items. Where applicable, the written report can reference previous responses to Bulletin 92-01 and Supplement 1 to Bulletin 92-01 in its response to this generic letter.

1. State whether Thermo-Lag 330-1 barriers are relied upon (a) to meet 10 CFR 50.48, to achieve physical independence of electrical systems, (b) to meet a condition of a plant's operating license, or (c) to satisfy a licensing commitment. If applicable, state that Thermo-Lag 330-1 is not used at the facility. This generic letter applies to all 1-hour and all 3-hour Thermo-Lag 330-1 materials and

barrier systems assembled by any assembly method such as by assembling preformed panels and conduit shapes, as well as spray, trowel and brush-on applications.

2. If Thermo-Lag 330-1 barriers are used at the facility,

   (a) State whether or not the licensee has qualified the Thermo-Lag 330-1 fire barriers by conducting fire endurance tests in accordance with the NRC's requirements and guidance or licensing commitments.

   (b) State (1) whether or not the fire barrier configurations installed in the plant represent the materials, workmanship, methods of assembly, dimensions, and configurations of the qualification test assembly configurations; and (2) whether or not the licensee has evaluated any deviations from the tested configurations.

   (c) State (1) whether or not the as-built Thermo-Lag 330-1 barrier configurations are consistent with the barrier configurations used during the ampacity derating tests relied upon by the licensee for the ampacity derating factors used for all raceways protected by Thermo-Lag 330-1 (for fire protection of safe shutdown capability or to achieve physical independence of electrical systems) and (2) whether or not the ampacity derating test results relied upon by the licensee are correct and applicable to the plant design.

3. With respect to any answer to items 2(a), 2(b), or 2(c) above in the negative, (a) describe all corrective actions needed and include a schedule by which such actions shall be completed and (b) describe all compensatory measures taken in accordance with the technical specifications or administrative controls. When corrective actions have been completed, confirm in writing their completion.

4. List all Thermo-Lag 330-1 barriers for which answers to item 2 cannot be provided in the response due within 120 days from the date of this generic letter, and include a schedule by which such answers shall be provided.

The licensee should retain all documentation of any reviews performed to satisfy the reporting requirements for future NRC audits or inspections.

If the addressee cannot submit the information required or meet the reporting deadline, it shall include in the response due within 120 days from the date of this generic letter, a justification, a description of any proposed alternative approaches, and a schedule under which responses and proposed actions will be completed. The NRC encourages licensees to work together to develop acceptable generic solutions to the problems addressed in this generic letter.

The written reports required shall be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 under oath or affirmation. A copy of the report shall also be submitted to the appropriate regional administrator.

BACKFIT DISCUSSION

The types of barriers addressed in this generic letter are currently installed at many operating power reactor sites and are required to meet either a condition of a plant's operating license or NRC requirements such as Section III.G of Appendix R to 10 CFR Part 50. The information required by this generic letter is necessary to verify licensees' compliance with their current licensing bases. There is no new staff position reflected in this generic letter. Therefore, any actions taken by licensees concomitant with responding to this generic letter are necessary to bring licensees into compliance with existing NRC rules and regulations, and are not the result of any new staff requirement or position. Accordingly, this generic letter is being issued as a compliance backfit under the terms of 10 CFR Section 50.109(a)(4).

The staff evaluated this generic letter in accordance with the charter of Committee to Review Generic Requirements (CRGR) and will place that evaluation in the NRC's public document room with the minutes of the October 6, 1992, meeting of the CRGR.

REQUEST FOR VOLUNTARY SUBMITTAL OF IMPACT DATA

This request is covered by Office of Management and Budget Clearance Number 3150-0011, which expires June 30, 1994. The estimated average number of burden hours is 300 person-hours for each addressee's response, including the time required to assess the requirements for information, search data sources, gather and analyze the data, and prepare the required letters. This estimated average number of burden hours pertains only to the identified response-related matters and does not include the time to implement the actions required to comply with the applicable regulations, license conditions, or commitments. Comments on the accuracy of this estimate and suggestions to reduce the burden may be directed to Ronald Minsk, Office of Information and Regulatory Affairs (3150-0011), NEOB-3019, Office of Management and Budget, Washington, D.C. 20503, and to the U.S. Nuclear Regulatory Commission, Information and Records Management Branch, Division of Information Support Services, Office of Information and Resources Management, Washington, D.C. 20555.

Although not required, the following information would assist the NRC in evaluating the cost of complying with this generic letter:

1. The licensee staff time and costs to perform requested inspections, corrective actions, and associated testing;

2. the licensee staff time and costs to prepare the required reports and documentation;

3. the additional short-term costs incurred as a result of the inspection findings such as the costs of the corrective actions or the costs of down time; and

4. an estimate of the additional long-term costs that will be incurred in the future to implement commitments such as the estimated costs of conducting future inspections or increased maintenance.

If you have any questions about this matter, please contact the technical contact or the lead project manager listed below.

Sincerely,

James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosure:
List of Recently Issued Generic Letters

TECHNICAL CONTACT: Steven West, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Mail Stop 9 A2, Washington, D.C. 20555, telephone (301) 504-1220

LEAD PROJECT MANAGER: Armando Masciantonio, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Mail Stop 13 D18, Washington, D.C. 20555, telephone (301) 504-1337

ENCLOSURE

LIST OF RECENTLY ISSUED GENERIC LETTERS

Generic Letter No.	Subject	Date of Issuance	Issued To
92-07	OFFICE OF NUCLEAR REACTOR REGULATION REORGANIZATION	10/10/92	ALL HOLDERS OF OPERATING LICENSES OR CONSTRUCTION PERMITS FOR NPRs
83-28 SUPPLEMENT 1	REQUIRED ACTIONS BASED ON GENERIC IMPLICATIONS OF SALEM ATWS EVENTS	10/07/92	ALL LIGHT-WATER REACTOR LICENSEES AND APPLICANTS
92-06	OPERATOR LICENSING NATIONAL EXAMINATION SCHEDULE	09/06/92	ALL POWER REACTOR LICENSEES AND APPLICANTS FOR AN OPERATING LICENSE
92-05	NRC WORKSHOP ON THE SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE (SALP) PROGRAM	09/04/92	ALL HOLDERS OF OP LICENSES OR CONST. PERMITS FOR NUCLEAR PWR REACTORS
92-04	RESOLUTION OF THE ISSUES RELATED TO REACTOR VESSEL WATER LEVEL INSTRUMENTATION IN BWRs PURSUANT TO 10CFR50.54(F)	08/19/92	ALL BWR LICENSEES FOF OPERATING REACTORS
90-02 SUPPLEMENT 1	ALTERNATIVE REQUIREMENTS FOR FUEL ASSEMBLIES IN THE DESIGN FEATURES SECTION OF TECHNICAL SPECIFICATIONS	07/31/92	ALL LWR LICENSEES AND APPLICANTS
87-02 SUPPLEMENT 1	SAFETY EVALUATION REPORT NO. 2 ON SQUG GENERIC IMPLEMENTATION PROCEDURE, REVISION 2.	05/22/92	ALL USI A-46 LICENSEES WHO ARE SQUG MEMBERS
92-03	COMPILATION OF THE CURRENT LICENSING BASIS: REQUEST FOR VOLUNTARY PARTICIPATION IN PILOT PROGRAM	03/19/92	ALL NUCLEAR POWER PLANT APPLICANTS AND LICENSEES
92-01 REVISION 1	REACTOR VESSEL STRUCTURAL INTEGRITY, 10CFR50.54(f)	03/06/92	ALL HOLDERS OF OP LICENSES OR CONST. PERMITS FOR NUCLEAR PWR PLANTS (EXCEPT YANKEE ATOMIC FOR YANKEE NUC PWR STA.)