November 8, 1993

Mr. Rubin Feldman
President
Thermal Science, Inc.
2200 Cassens Drive
St. Louis, MO 63026

Dear Mr. Feldman:

The NRC staff is conducting a review to ascertain potential safety hazards in response to various concerns whether ampacity derating testing and seismic analyses have been conducted for Thermo-Lag 330-660, the Flexi-Blanket System. To assist us in our review, please provide responses to the enclosed questions. A response within 30 days after the date of this letter would be appreciated.

If you require clarification of the questions, please call Ronaldo Jenkins at 301-504-2985.

Sincerely,
Original Signed by
Carl H. Berlinger

Carl H. Berlinger, Chief
Electrical Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

Enclosure:
As stated

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ENCLOSURE

I. GENERAL QUESTIONS

A. To the best of your knowledge, which NRC licensees use the Thermo-Lag 330 Flexi-Blanket fire barrier material or system to meet NRC fire protection requirements or guidelines?

B. In the TSI Bid Document 618 (attached) dated June 25, 1986 for Northeast Utilities Service Company (Millstone Units 1 and 2) you stated in Section 5.2 regarding the ampacity derating for Thermo-Lag 330-660 material that "we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1 Subliming Material, that this material will produce similar test results to ... THERMO-LAG 330-1". Provide copies of all documentation you have to support this statement.

II. AMPACITY DERATING

A. What are the ampacity derating values for the 1-hour and 3-hour (if applicable) Thermo-Lag 330-660 Flexi-Blanket fire barrier systems?

B. What standards and test methods were used to qualify the fire barrier systems for use in nuclear power reactors to meet NRC requirements and guidelines? What specific acceptance criteria have been applied?

C. Provide all test reports that document the ampacity derating characteristics of the fire barrier.

III. SEISMIC ANALYSES

A. Provide the material properties of the fire barrier, i.e., density, tensile strength, compressive strength, modulus of elasticity, weight, etc. at 70 °F and higher temperatures.

B. Provide information on seismic tests and analyses, if any, performed for the barrier to demonstrate their integrity during and after seismic events.

IV. FIRE RESISTANCE

A. Identify all the fire barrier system applications where Thermo-Lag 330-660 Flexi-Blanket fire barrier material may have been used.

B. Provide all the pertinent 1- and 3-hour fire endurance test reports that support the use of Thermo-Lag 330-660 Flexi-Blanket fire barrier material.

25 June 1986

Mr. W. C. Mihal, Manager-Purchases
Northeast Utilities Service Company
P O Box 1928
Hartford, Connecticut 06144-1928

Attention: Mr. J. E. Kmietek

Reference: Inquiry No. JEK-620
Request for Quotation

Subject: TSI's Bid Document 618

Dear Mr. Kmietek:

TSI is pleased to submit its proposal for the supply of the Three Hour Fire Rated Design of the THERMO-LAG 330 Fire Barrier System Materials and Field Service Engineering required to install these materials at Northeast Utilities Millstone Units 1 and 2 located in Waterford, Connecticut.

TSI proposes the use of a combination of the THERMO-LAG 330-1 semi-rigid fire barrier system (prefabricated panels and preshaped conduits sections) and the THERMO-LAG 330-660 Flexi-Blanket System, in order to provide the most efficient, cost effective method of installation. The THERMO-LAG 330-1 semi-rigid system is recommended for the vast majority of the areas to be protected, due primarily to the substantial installed cost savings of the one layered prefabricated system. There are selected areas where the THERMO-LAG 330-660 Flexi-Blanket System would prove to be a more efficient system, such as bare cables in bundles in areas under the manway.

Our Bid Document is submitted in two parts. Part I is comprised of the technical qualifications of the THERMO-LAG 330 Fire Barrier System Materials in accordance with your Specification No. SP-ME-586. The detailed technical documentation as required by your Specification is contained in the enclosed copy of TSI's Technical Note 618-A entitled "THERMO-LAG 330 Fire Barrier System, Technical Documentation."

Part II is comprised of budgetary cost information for the THERMO-LAG 330 Fire Barrier System Materials and our rates for a full time Field Service Engineer to provide the requested technical assistance. TSI can ship the quantities of materials quoted therein in accordance with a delivery schedule to be agreed upon at the time of contract execution.

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
Telex: Domestic 44-2384 • Overseas 209901 • Telecopier (314) 349-1207

If TSI is awarded the contract to supply the THERMO-LAG 330 Fire Barrier System Materials to Millstone Units 1 and 2, we will provide - on a no charge basis - a Field Service Engineer for a period of one (1) week to assist the facility in determining the most efficient THERMO-LAG 330 Fire Barrier System Design for each area to be wrapped and the total quantity of materials required.

In addition, TSI's Field Service Engineer will also conduct material installation training classes to fulfill both TSI and the American Nuclear Insurers requirement. Additional Field Service Engineering required by Northeast Utilities will be at the rates delineated in Part II of this Bid Document.

TSI will require a minimum of two (2) weeks advance written notice prior to dispatching its Field Service Engineer to the jobsite. A Certificate of Insurance will be sent to Northeast Utilities Service Company prior to the start of work by our Field Service Engineer.

This proposal is valid for a period of ninety (90) days from this date and is subject to the execution of a mutually acceptable written contract between our two companies.

We appreciate this opportunity to be of service to your Company and look forward to your favorable consideration.

Yours truly,

M. E. Grau
Contracts Administrator

MEG/ms
Enclosures

TSI BID DOCUMENT 618

FOR THE SUPPLY OF THE

THERMO-LAG 330 FIRE BARRIER SYSTEM

PREPARED FOR

NORTHEAST UTILITIES

MILLSTONE UNITS 1 AND 2

JUNE 1986

THERMAL SCIENCE, INC. • 2200 CASSENS DR. • ST. LOUIS, MO 63026 • (314) 349-1233
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PART I

TECHNICAL QUALIFICATIONS

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PART I

TECHNICAL QUALIFICATIONS

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TSI BID DOCUMENT 618

PART I

TECHNICAL QUALIFICATIONS

PART I

TECHNICAL QUALIFICATIONS

1.0 SCOPE OF WORK

The work to be performed under this proposal consists of supplying the fire barrier system materials and technical assistance required to install the three hour fire rated designs of THERMO-LAG 330 Fire Barrier System. The work performed shall satisfy the requirements of 10CFR50 Appendix R, and the American Nuclear Insurers (ANI) for preservation of safe hot shutdown capabilities. The THERMO-LAG 330 Fire Barrier System will be manufactured and supplied in accordance with all applicable sections of TSI's Level II Nuclear Quality Assurance Program Manual (NQAPM) and Quality Control Operating Procedures Manual (QCOPM).

2.0 GENERAL REQUIREMENTS

The following paragraphs set forth the nature and extent of work to be performed by TSI under this proposal.

2.1 Work to be Provided

TSI will perform the following work in carrying out the provisions of Specification No. SP-ME-586:

1. Provide the required three hour fire rated THERMO-LAG 330 Fire Barrier System.
2. Provide on-site technical assistance during the installations of the fire barrier materials.
3. Train and qualify the installers of the fire barrier system materials.

4. Furnish all required documentation as delineated in paragraphs 3.3, 3.6, 3.7, 3.9 and 3.10 of Specification SP-ME-586 which includes fire endurance and ampacity test reports, analysis and/or tests verifying the ability of the fire barrier to satisfactorily withstand seismic events, unit weight information, radiation resistance test and other environmental conditions.

5. Provide ANI Acceptance Certificates for the three hour fire endurance test report and TSI's Installation Procedures Manual.

6. Furnish standard installation procedures manual for the fire barrier system.

7. Provide a Certificate of Insurance for TSI's Field Service Engineer after contract award and prior to dispatching him to the jobsite.

2.2 Work To Be Done By Others

1. Furnish all installation labor and supervision for the installation the fire barrier system materials in accordance with TSI's installation procedures.

2. Furnish quality assurance and quality control surveillance.

3. Furnish all finish protective coating of exposed ferrous material.

4. Provide normal construction tools and equipment required for the installation of the fire barrier system materials including scaffolding, ladders and staging.

5. Provide for onsite receiving, storage and handling of the fire barrier system materials.

6. Furnish required water, electricity and compressed air.

7. Furnish office space, telephone, and pertinent equipment and supplies required by TSI's Field Service Engineer.

8. Provide for cleanup of the work area.

3.0 MATERIALS

The THERMO-LAG 330 Fire Barrier System is comprised of the following materials:

3.1 THERMO-LAG Stress Skin Type 330-69

This material provides the strong mechanical base for the THERMO-LAG 330-1 Subliming Material. It is comprised of an open weave, self stiffened steel mesh and is used to provide an enclosure over cable trays, conduits, etc. It is used in the fabrication of THERMO-LAG Prefabricated Panels and Preshaped Conduit Sections.

3.2 THERMO-LAG 330-1 Subliming Material

This material provides the required level of fire resistance. It is a water based, subliming, thermally activated fire resistive material which volatilizes at fixed temperatures, exhibits a small volume increase through the formation of a multi-cellular matrix and blocks heat to protect the substrate material to which it is applied. This material is supplied in a spray or trowel grade. They are identically the same material except that the trowel grade is supplied in a thicker consistency, suitable for troweling or caulking type applications. This material is used in the fabrication of the THERMO-LAG Prefabricated Panels and Preshaped Conduit Sections.

3.3 THERMO-LAG 330-660 Subliming Material

This is a water based, subliming, thermally activated fire resistive material which volatilizes at fixed temperatures, exhibits a small volume increase through the formation of a multi-cellular matrix and blocks heat to protect the substrate material to which it is applied. This material is used in the fabrication of the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material.

3.4 THERMO-LAG 351-2 Primer

This highly efficient corrosion inhibiting primer is applied to properly prepared steel surfaces prior to the application of the THERMO-LAG 330-1 Subliming Material. It is applied at a spread rate of circa 200 sq. ft. per gallon.

3.5 THERMO-LAG 350 Two Part Topcoat

This material provides excellent protection against water flow and climatic variations, chemical attack and physical abuse. It is applied at a spread rate of circa 50 sq. ft. per gallon.

The above materials do not contain any halogens and are asbestos free, and are rated as non-combustible with a flame spread, fuel contributed and smoke developed of less than 25.

4.0 DESCRIPTION OF INTENDED USE

The THERMO-LAG 330 Fire Barrier System is designed to protect conduits, cable trays, junction boxes, etc. containing electrical cables, and their supports or ductwork against high intensity fires for one and three hour time periods. As a result, the protected raceway cables are expected to continue to function without interruption for these time periods. The THERMO-LAG 330 Fire Barrier System designs provide for normal maintenance and operation of the protected entities without undue restraint.

The THERMO-LAG 330 Fire Barrier System should not constitute a hazard to adjacent systems or components by becoming a missile during seismic events, nor should they structurally or physically fail in such a manner as to damage or render inoperable safety related equipment, clog drains or sulfage during anticipated containment spray activation or DBA's.

5.0 TESTS AND APPROVALS

The THERMO-LAG 330 Fire Barrier System has been thoroughly tested for installation in nuclear power generating plants. These tests and their results are described briefly in the following paragraphs.

5.1 Fire Endurance Tests
(Reference Para. 3.3 of Specification SP-ME-586)

One and three hour ASTM E119 type fire endurance tests, followed by water hose stream tests, were conducted on test articles protected with the THERMO-LAG 330 Fire Barrier System by an independent test laboratory. These test articles consisted of cable trays, conduits and their structural supports, condulets, pullboxes and air drops, which contained various arrangements of "generic"

power, instrument and control cabling. The tests were conducted in accordance with the prerequisites of ANI's Bulletin #5(79) "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class 1E Electrical Circuits", and the American Society for Testing Materials Standard "E119 - Standard Method of Fire Tests of Building Construction and Materials". The results obtained are discussed in the following paragraphs. Copies of the above reports and ANI acceptance forms are contained in Section 1 of TSI's Technical Note 618-A, enclosed.

One Hour Fire Barrier

A one hour fire resistance rating was obtained using a 0.500" minimum dry film thickness of the THERMO-LAG 330 Fire Barrier System. The test articles were exposed to the standard ASTM E119 time/temperature environment for a minimum of 60 minutes, followed by a 2½ minute minimum water hose stream test, with no loss of circuit integrity in any of the test circuits monitored. The THERMO-LAG 330 Fire Barrier System met all the one hour ASTM E119 fire endurance and water hose stream test requirements in all aspects.

Three Hour Fire Barrier

A three hour fire resistance rating was obtained using a 1.00" minimum dry film thickness of the THERMO-LAG Prefabricated Panel and Preshaped Conduit Sections, and 1.250" (five wraps - each 0.250") minimum dry film thickness of the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material designs of the THERMO-LAG 330 Fire Barrier System. 330 Fire Barrier System. The test articles were exposed to the standard ASTM E119 time/temperature environment for a minimum of three (3) hours, followed by a 2½ minute minimum water hose stream test, with no loss of circuit integrity in any of the test circuits monitored. The THERMO-LAG 330 Fire Barrier System met all the three hour ASTM E119 fire endurance and water hose stream test requirements in all aspects.

In both the one and three hour fire endurance tests, the electrical cables were not damaged as a result of their exposure to the fire endurance tests. Examination of the test articles at the conclusion of all tests indicated that the cables were all intact and free of heat or fire damage.

5.2 Ampacity Derating Tests and Analysis
(Reference Para. 3.6 of Specification SP-ME-586)

TSI has conducted ampacity derating tests and analysis in accordance with IPCEA Publication Number WC51-1975, on "generic" power cables installed in both conduit and tray raceway systems protected with one and three hour Prefabricated Panel and Preshaped Conduit Section designs of the THERMO-LAG 330 Fire Barrier System Designs. This is summarized in the following tests:

Raceway Type	Fire Barrier Rating	Percent Derating
Ladder Tray	1 Hour	12.50
Ladder Tray	3 Hour	20.55
Conduit	1 Hour	7.47
Conduit	3 Hour	9.72

The ampacity derating percentage is independent of conductor size, and is applicable to all IEEE-383 type cables, since derating is a function of wrap thermal conductivity, wrap emissivity, wrap thickness, area of wrap, cable jacket temperature and ambient temperature. This implies that the derating percentage determined by test for THERMO-LAG 330 Fire Barrier System Materials can be used for similar types of cables to those tested. Copies of the ampacity derating tests for the One and Three Hour Fire Barrier System designs are contained in Section 2 of TSI's Technical Note 618-A.

TSI has not conducted ampacity derating tests on the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material. However, we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1 Subliming Material, that this material will produce similar test results to those of the THERMO-LAG 330-1 Subliming Material. If these tests are required, TSI would be pleased to discuss the arrangements for such tests in further detail with Northeast Utilities.

5.3 Environmental Conditions
(Reference Para. 3.7 of Specification SP-ME-586)

Accelerated weathering and thermal cycling tests were performed on THERMO-LAG 330 Fire Barrier System materials by the Underwriters Laboratories, the U.S. Army Ballistics Research Center, Aberdeen Proving Ground, Maryland and at TSI. Based on these tests, the THERMO-LAG 330 Fire Barrier System can be expected to have a service life of at least 40 years. A copy of the above test report is contained in Section 3 of TSI's Technical Note 618-A.

A radiation resistance test was performed on the THERMO-LAG 330 Fire Barrier System in which the fire barrier material was subjected to a simulated

$$2 \times 10^8 \text{ Rads}$$

total 40 years integrated dose. The test results showed no degradation in the fire resistance properties after this radiation exposure. A copy of the radiation resistance test report is also enclosed in Section 3.

In addition, the THERMO-LAG 330 Fire Barrier System materials have been individually tested for all test parameters of IEEE Standard 382-1972. This is the standard which is applicable to plant design for containment LOCA environmental conditions.

The IEEE 382-1972 requirements list a maximum temperature of 300F occurring from 0 to 30 minutes, and a maximum of 60 psig over the same period. The THERMO-LAG 330-1 Subliming Materials have been tested to 400F. At 400F, the THERMO-LAG 330-1 Subliming Material is not expected to crack, flake or break up. The sublimation temperature of the active ingredients is circa 650F. The binder pyrolizes at approximately 800F. The major balance of the materials are inert. The 60 psig pressure will equalize on the inside and outside of the THERMO-LAG 330 Fire Barrier System and will not effect the THERMO-LAG 330-1 Subliming material properties.

It is recognized that the incipient pressure shock during a LOCA condition may occur over a 5 to 15 milli-second period of time. THERMO-LAG 330-1 Subliming Material has been exposed to "over pressure" exceeding these rates during the qualification testing performed by the Ballistics Research Laboratory at Aberdeen Proving Ground, Maryland. During this test program, the THERMO-LAG 330-1 Subliming Material exposed to the exhaust of a torch jet having a surface pressure of circa 150 psig at 2000F, at an initiated period of less than 10 milli-seconds. Data supporting this is shown in BRL's Interim Memorandum Report No. 459 which is also enclosed in Section 3 of TSI's Technical Note 618-A.

The THERMO-LAG 330 Fire Barrier System and attachments are resistant to any degradation when subjected to the following chemical spray, wetting and pressure transient:

> Chemical spray consisting of Borated water of 2270 ppm. This is a Boron (B) solution with sodium hydroxide used to adjust the pH to 10.5 +/- 1.5

TSI has not conducted environmental or radiation resistance testing on the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material. However, we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1 Subliming Material, that this material will produce similar test results to those of the THERMO-LAG 330-1 Subliming Material. TSI would be pleased to discuss this further with Northeast Utilities.

5.4 Seismic Qualifications
(Reference Para. 3.10 of Specification SP-ME-586)

The THERMO-LAG 330 Fire Barrier System is designed to withstand a safe shutdown earthquake condition (SSE) with horizontal ground acceleration of 2.25g's and operating basis earthquake (OBE) with horizontal ground acceleration of 7 g's. Analyses were performed by Dr. Phillip Gould of Washington University in St. Louis, Missouri, which pertains to cable trays and conduits. Copies of these analyses are contained in Section 4 of TSI's Technical Note 618-A.

TSI has not performed any seismic analyses on the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material. However, we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1 Subliming Material, that this material will produce similar results to those of the THERMO-LAG 330-1 Subliming Material. However, if required, TSI would be pleased to discuss the performance of seismic analyses with Northeast Utilities.

6.0 INSTALLATION, DESIGN AND CONSTRUCTION FEATURES (Reference Para. 3.11 of Specification SP-ME-586)

6.1 Installation

The THERMO-LAG 330 Fire Barrier System will be installed in accordance with the procedures contained in TSI's Technical Note 20684 "THERMO-LAG 330 Fire Barrier System, Installation Procedures Manual, Power Generating Plant Applications, Revision V". Typical installation drawings are contained therein. A copy of this procedure is contained in Section 5 of TSI's Technical Note 618-A.

6.2 Design and Construction Features

One and three hour levels of fire protection can be obtained by the use of proven and tested ready access designs of the THERMO-LAG 330 Fire Barrier System. These systems are discussed in more detail in the following paragraphs.

6.2.1 THERMO-LAG Prefabricated Panels

The THERMO-LAG Prefabricated Panel design is used for the protection of cable trays, junction boxes, ventilation ducts, etc. These panels are fastened to the entity to be protected with with approved stainless steel banding or tie wires. These bands or tie wires permit quick non-destructive access for maintenance or repair.

The one hour design consists of an inner layer of THERMO-LAG Skin Type 330-69 and an outer layer of 0.500 inch minimum dry film thickness of THERMO-LAG 330-1 Subliming Material.

The three hour design consists of an inner layer of THERMO-LAG Stress Skin Type 330-69, a 1.00 inch minimum dry film thickness of the THERMO-LAG 330-1 Subliming Material, and an outer layer of THERMO-LAG Stress Skin Type 330-69.

THERMO-LAG 330-1 Subliming Trowel Grade Material is used to seal the edges and butt joints during the installation of the THERMO-LAG Prefabricated Panels.

6.2.2 THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier

This design utilities THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material. It is a subliming, high temperature, heat blocking, flexible, thermal barrier. It is reinforced on both sides with a low density, fiberglass cloth, further implemented by a heat blocking thermal catalizer. The Flexi-Blanket Material is mounted on the entity to be protected and then joined together using approved stainless steel tie wires or banding material. The use of the tie wires or banding material facilitates the removal of the fire barrier for inspection or repair of the cables. The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material is available in nominal 4 foot by 6½ foot sheets.

This material is applied in two (2) 0.250 inch wrapped layers to provide one hours fire resistance and five (5) 0.250 inch wrapped layers to provide three hours fire resistance.

THERMO-LAG 330-1 Subliming Trowel Grade Material is used to seal the edges and butt joints during the installation of the THERMO-LAG 330-660 Flexi-Blanket.

6.2.3 THERMO-LAG Preshaped Conduit Fire Barrier

This design utilizes THERMO-LAG Preshaped Conduit Sections which are scored and formed into two (2) half moon sections. These two sections are then mounted on the conduit, air drop cables, etc., and joined together using approved stainless steel tie wires or banding material. The use of the tie wires or banding material facilitates the removal of the fire barrier for inspection or repair of the cables. The Preshaped Conduit Sections are available in nominal three (3) foot lengths and range in diameters from 3/4 inch to 6 inches, although larger sizes can be made available upon request.

The one hour design consists of an inner layer of THERMO-LAG Stress Skin Type 330-69 and an outer layer of 0.500 inch minimum dry film thickness of THERMO-LAG 330-1 Subliming Material.

The three hour design consists of an inner layer of THERMO-LAG Stress Skin Type 330-69, a 1.00 inch minimum dry film thickness of the THERMO-LAG 330-1 Subliming Material, and an outer layer of THERMO-LAG Stress Skin Type 330-69.

THERMO-LAG 330-1 Subliming Trowel Grade Material is used to seal the edges and butt joints during the installation of the THERMO-LAG Preshaped Conduit Sections.

6.3 Other Design Features
(Reference Para. 3.9 of Specification SP-ME-586)

The maximum unit weights for the one and three hour configurations in lbs/ft are shown on the Appendix A entitled: "THERMO-LAG 330 Fire Barrier System, Maximum Unit Weights, One and Three Hour Configurations."

7.0 TSI'S QUALITY ASSURANCE QUALIFICATIONS

TSI has an Nuclear Quality Assurance Program Manual (NQAPM) and Quality Control Operating Procedures Manual (QCOPM) which meets the requirements for nuclear power generating plant operations. TSI's Quality Assurance Manager reports through an independent chain of authority directly to the President, and has complete autonomy from Engineering and Manufacturing.

All phases of the manufacture of the THERMO-LAG 330 Fire Barrier System materials, from purchase of raw materials, through product manufacture, inspection, tests, storage and shipping are carefully governed by QA procedures.

An "Informational Copy" of TSI's Level II Nuclear Quality Assurance Program and Quality Control Operating Procedures Manual is submitted with this Bid Document.

8.0 EXCEPTIONS TO SPECIFICATION NO. SP-ME-586
(Reference Para. 7.0 of Specification SP-ME-586)

TSI takes exception to the following paragraphs delineated in the above referenced Specification:

8.1 Paragraph 3.3 - "Acceptance Forms"

The THERMO-LAG 330 Fire Barrier System Designs have been accepted by the American Nuclear Insurers as evidenced by their acceptance forms for the one and three hour fire endurance/water hose stream tests and TSI's Technical Note 20684, Revision 5. Individual material components of the THERMO-LAG 330 Fire Barrier System have been tested and approved (classified) by the Underwriters Laboratories or Factory Mutual. However, TSI has not submitted these designs for acceptance testing to the Underwriters Laboratories or Factory Mutual and therefore, can not provided acceptance forms from these testing agencies.

8.2 Paragraph 4.0 - "Test and Inspections" - Subparagraph 4.1

Since TSI considers all of its manufacturing and processes Proprietary and Company Confidential, a Confidentiality Agreement must be signed by a officer of Northeast Utilities prior to granting the Owner's Representative limited access to TSI's manufacturing facilities. At no time will TSI permit the Owner's Representative "free or unescorted access" to its plant.

8.3 Paragraph 6.0 "Guarantee" - Subparagraph 6.2

This paragraph should be deleted and TSI's warranty inserted, a copy of which is enclosed herein as Appendix B.

8.4 Paragraph 9.3 "Audits"

TSI requires a minimum of one month's advance written notice prior to scheduling an audit of its facilities.

8.5 THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material
Reference Paragraphs 3.6, 3.7, 3.10

The THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material has sucessfully passed both one and three hour fire endurance and water hose stream tests, in accordance with applicable procedures delineated in ANI's Bulletin #5(79) with no loss of circuit integrity. Copies of these test reports as well as ANI Acceptance Forms are contained in TSI's Technical Note 618-A.

However, TSI has not performed any ampacity derating tests, environmental, radiation resistance or seismic analyses on the THERMO-LAG 330-660 Flexi-Blanket Thermal Barrier Material. However, we believe that based on the formulation, composition and similarity of the material to the THERMO-LAG 330-1 Subliming Material, that this material will produce similar results to those of the THERMO-LAG 330-1 Subliming Material. However, if required, TSI would be pleased to discuss the performance of these tests further with Northeast Utilities.

TSI BID DOCUMENT 618

PART II

PRICE QUOTATION

PART II

PRICE QUOTATION

1.0 UNIT PRICES

The following are the applicable unit prices for the THERMO-LAG 330 Fire Barrier System Materials and are provided to Northeast Utilities for budgetary cost purposes. These prices are quoted FOB - TSI's Plant in St. Louis, Mo. and should be used in determining the cost of materials required for this project.

A) THERMO-LAG Prefabricated Panels

One Hour Fire Barrier — $33.80/Ft2
(0.500" Nominal Thickness Panels)
Size: 4' x 6½' = 26 Ft2/Panel

Three Hour Fire Barrier — 67.65/Ft2
(1.00" Nominal Thickness Panels)
Size: 4' x 6½' = 26 Ft2/Panel

B) THERMO-LAG 330-660 Flexi-Blanket — 35.31/Ft2
(0.250" Nominal Thickness)
Size: 4' x 6½' = 26 Ft2/Panel

C) THERMO-LAG Preshaped Conduit Sections

Nominal Conduit Diameter	Unit Price/Ln Ft	
	One Hour Fire Barrier	Three Hour Fire Barrier
3/4 Inch	$52.50/LF	$105.00/LF
1 Inch	52.50/LF	105.00/LF
2 Inch	53.21/LF	106.41/LF
3 Inch	53.57/LF	107.13/LF
4 Inch	53.93/LF	107.86/LF
6 Inch	$65.50/LF	131.00/LF

D)	THERMO-LAG 330-1 Subliming Trowel Grade Material Packaged: 50 Net Lbs/Pail	4.93/LB
E)	THERMO-LAG 351-2 Primer Packaged: 5 Gallons/Pail	43.73/Gallon
F)	THERMO-LAG 350 Two Part Spill Resistant Topcoat Packaged: 5 Gallon Kit	65.73/Gallon
G)	18 Ga. Stainless Steel Banding Material 0.5 x 0.020"x 100 Ft Rolls	68.00/Roll
H)	Stainless Steel Banding Clips Packaged: 1000/Box	138.00/M

Please note that inasmuch as all prefabricated items are custom made, TSI reserves the right to ship and bill the Customer for all overages (circa 10%) of prefabricated items ordered.

2.0 DELIVERY AND SCHEDULING

TSI can ship your material requirements in accordance with a delivery schedule to be agreed upon at the time of contract execution.

3.0 FIELD SERVICE ENGINEERING

If TSI is awarded the contract to supply the THERMO-LAG 330 Fire Barrier System Materials to Millstone Units 1 and 2, we will provide - on a no charge basis - a Field Service Engineer for a period of one (1) week to assist the facility in determining the most efficient THERMO-LAG 330 Fire Barrier System Design for each area to be wrapped and the total quantity of materials required.

TSI's Field Service Engineer will also conduct material installation training classes to fulfill both TSI and the American Nuclear Insurers requirement.

If additional Field Service Engineering is required beyond the one week referenced above, TSI will require a Purchase Order from Northeast Utilities for this service. Our rates are as follows:

A. Travel Pay

Engineer	$434.40/Day Portal to Portal Basis

B. Onsite Labor Rate

Engineer	
Straight Time Rate	$434.40/Day Maximum 8 Hours Day/5 Days Per Week
Overtime Rate	81.45/Hour (Hours over 40 & Saturdays)
Doubletime	108.60/Hour (Sundays & Holidays)

TSI shall be reimbursed for remuneration paid to its personnel (including taxes and administrative costs) for any work performed on holidays. The holidays to be observed by TSI's personnel will be the same holidays that are observed by Northeast Utilities personnel.

TSI shall also be reimbursed for all cost of travel and subsistence (portal to portal) which includes, but is not limited to:

C.	Food	$30.00/Day/Man
D.	Transportation	To be Billed on a Net/Net Basis, and includes, but is not limited to, round trip coach air fare, car rental, and all other related expenses.
E.	Lodging	To be Billed on a Net/Net Basis, and includes, but is not limited to, hotels and all other related expenses.

F. Miscellaneous Expenses — To be Billed on a Net/Net Basis, and includes, but is not limited to, telephone, telegrams, hand tools or other similar items required for the training of personnel, and all other related expenses.

The rates quoted above for Field Service Engineering are predicated on the personnel assigned by TSI to this project being onsite for the duration of the time intervals specified in any ensuing contract between our two companies.

TSI requires at least two (2) weeks advance written notice prior to dispatching its Field Service Engineer(s) to the jobsite.

4.0 TERMS

4.1 Terms of Payment

1. Material Invoices - 20% of the invoice total is due and payable net fifteen (15) days from date of invoice. The 80% balance is due and payable net fifteen (15) days thereafter. No discounts are allowed.

2. All invoices for TSI's Field Service Personnel will be submitted on a weekly basis and are due and payable net thirty (30) days from date of invoice - No discounts allowed.

3. All material shipments are made FOB - TSI's plant in St. Louis, Missouri.

4. All past due invoices are subject to a charge equal to the prime interest rate being imposed by the Mercantile Bank N.A. in St. Louis, Missouri in effect at that time. All shipments are placed on "hold" until past due and interest invoices are paid.

5. TSI is not licensed to collect sales or use taxes.

4.2 Terms and Conditions of Sales

All orders are subject to TSI's Terms and Conditions of Sales, a copy of which is contained in Appendix B.

5.0 VALIDITY

The unit prices and field service engineering rates quoted herein are valid for a period of ninety (90) days from this date and are subject to the execution of a mutually acceptable written contract between our two companies.

6.0 MATERIAL RECOMMENDATIONS

TSI proposes the use of a combination of the THERMO-LAG 330-1 semi-rigid fire barrier system (prefabricated panels and preshaped conduits sections) and the THERMO-LAG 330-660 Flexi-Blanket System, in order to provide the most efficient, cost effective method of installation. The THERMO-LAG 330-1 semi-rigid system is recommended for the vast majority of the areas to be protected, due primarily to the substantial installed cost savings of the one layered prefabricated system. There are selected areas where the THERMO-LAG 330-660 Flexi-Blanket System would prove to be a more efficient system, such as bare cables in bundles in areas under the manway.

If TSI is awarded the contract to supply the THERMO-LAG 330 Fire Barrier System Materials to Millstone Units 1 and 2, we will provide - on a no charge basis - a Field Service Engineer for a period of one (1) week to assist the facility in determining the most efficient THERMO-LAG 330 Fire Barrier System Design for each area to be wrapped and the total quantity of materials required.

TSI will require a minimum of two (2) weeks advance written notice prior to dispatching its Field Service Engineer to the jobsite.