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Meeting Title: Brief on Status of Staff Efforts to Resolve Thermo-Lag Fire Barrier Issues

Meeting Date: 7/30/92 Open X Closed ____

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Title: BRIEFING ON STATUS OF STAFF EFFORTS TO RESOLVE Thermo-Lag FIRE BARRIER ISSUES

Location: ROCKVILLE, MARYLAND

Date: JULY 30, 1992

Pages: 76 PAGES

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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BRIEFING ON STATUS OF STAFF EFFORTS
TO RESOLVE Thermo-Lag FIRE BARRIER ISSUES

- - - -

PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Thursday, July 30, 1992

The Commission met in open session, pursuant to notice, at 2:00 p.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner
JAMES R. CURTISS, Commissioner
E. GAIL de PLANQUE, Commissioner

STAFF SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

WILLIAM C. PARLER, General Counsel

JAMES TAYLOR, Executive Director for Operations

THOMAS MURLEY, Director, NRR

FRANK MIRAGLIA, Deputy Director, NRR

ASHOK THADANI, Director, Division of Systems Technology, NRR

WILLIAM RUSSELL, Associate Director for Inspections and Technology Assessment

PATRICK MADDEN, Senior Fire Protection Engineer, NRR

P-R-O-C-E-E-D-I-N-G-S

2:00 p.m.

CHAIRMAN SELIN: Good afternoon, ladies and gentlemen.

This afternoon we will be hearing a briefing on the status of the staff's efforts to resolve the health and safety aspects of the Thermo-Lag fire barrier issues. Let me emphasize the focus today will be on the safety factors. We should avoid discussion of issues currently under investigation by either of our investigative offices.

I think a brief summary of this issue is in order. Thermo-Lag is used in many plants to satisfy the electrical fire protection requirements for the safe shutdown as specified in Appendix R to 10 CFR Part 50. As a result of installation problems, failure of fire barriers and perhaps other questions that might come up today, during tests at River Bend, NRR formed a special review team in June 1991. The special review team was tasked with examining operating experience and allegations concerning Thermo-Lag. The special review team issued a report in April of this year and concluded the first resistance ratings of Thermo-Lag fire barriers to be indeterminate, although it is the review team's belief

that the barriers will provide some level of fire protection.

Last month, in June, the staff was notified of the failure of fire barrier tests at Comanche Peak. It has prompted the staff to issue NRC bulletin 9201 on June 24th, 1992. The bulletin requested licensees first to identify which plant areas contain Thermo-Lag fire barrier systems installed on small conduits or wide cable trays; second, to implement compensatory measures such as fire watches; and third, to respond to the NRC within 30 days informing the staff of the actions they may have taken.

The staff is here today to brief the Commission on its view of the health and safety questions as they now stand and to give us some insight as to what actions they are contemplating.

Commissioners?

Mr. Taylor, would you please proceed.

MR. TAYLOR: Good afternoon. With me at the table, starting from my far left, Pat Madden, Ashok Thadani, Doctor Murley, Frank Miraglia and Bill Russell, all from the Office of Nuclear Reactor Regulation.

Mr. Chairman, you mentioned briefly the

investigative work through the task force that is a cooperative effort between the Inspector General and the Office of Investigations. I would like to note that during the full course of their work, as they began their investigative work, they did agree to provide to the staff any information that could bear on the health and safety and protection issues related to their investigations and as it was developed. They have been doing that. The staff, Mr. Miraglia and I at numbers of sessions, and others, have been appropriately informed of that information. I think it's important to tell you that.

With that opening thought, Frank Miraglia, who has headed the special team review of this, will continue the briefing.

MR. MIRAGLIA: Thank you, Mr. Taylor.

(Slide) May I have slide 2, please?

This is an overview of the discussions that I plan to cover in today's presentation. The shutdown improvements in our regulation is as a result of the Browns Ferry fire, some background on the concerns that were raised regarding Thermo-Lag barriers, our activities to look into those concerns, the results of some recent testing regarding this material, the status of NRC actions to date and our

future plans.

Slide 2, please. Three, please.

(Slide) The 1975 Browns Ferry fire resulted in NRC taking substantive actions to improve protection for safe shutdown functions. The concept of defense in depth that is embedded in our safety regulations is also a part of the fire protection programs. The programs at these facilities rely on a defense in depth and that it includes fire prevention activities, the ability to detect, control and suppress a fire, and separation of redundant safe shutdown functions.

(Slide) Slide 4, please.

With respect to safe shutdown functions, the methods used for protecting these functions are the use of fire barrier materials. The barriers are of two types, a three hour barrier or a one hour fire resistant barrier that is also supported by an automatic fire detection and suppression capability. The protection afforded by a one hour or three hour barrier as defined here is considered to be equivalent.

(Slide) Slide 5, please.

The Thermo-Lag fire barrier system is available from Thermal Science Incorporated, St.

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The Thermo-Lag fire barrier system is available from Thermal Science Incorporated, St.

Louis, Missouri, and it provides barriers of one hour and three hour ratings. As many as 51 stations and over 80 plants use Thermo-Lag to satisfy NRC's requirements in protecting safe shutdown capability.

COMMISSIONER REMICK: Frank, I assume from that that there are alternative materials used by others then.

MR. MIRAGLIA: Yes, sir. There are some plants that have no Thermo-Lag installed.

COMMISSIONER REMICK: Does anybody use just the 20 foot separation?

MR. MIRAGLIA: I couldn't say whether there's one plant that meets all of Appendix R using separation only.

MR. TAYLOR: Where that's available --

MR. MIRAGLIA: That's the preferred alternative and if they have it available, they'll use it.

It's used to protect raceways, cable trays and the like. It's been used as fire walls to separate fire areas, and as enclosures for redundant safe shutdown equipment.

(Slide) Can I have slide 6?

I'll try to go through this briefly. The Chairman's statement was a succinct presentation of

much of this background. Site specific problems were discovered at River Bend with respect to Thermo-Lag material and they sent it on the methodology and the installation of that material. The LERs dealing with specifics of these concerns were filed in March of '87, April of '89 and March of '90. In October of '89, the River Bend station conducted a 30 inch cable tray test. That was nominally protected by a three hour barrier and the test -- there was a test failure in less than one hour.

In February of 1991, the staff received allegations regarding the performance of Thermo-Lag material and in May of that year, NRC conducted a visit to the site to determine the background and the facts of the installation and techniques used at River Bend station.

In June of this year, a special review team was established in which I was the manager in charge and two staff supported that effort and that was Mr. Loren Plisco and Steven West. The special review team interacted, as Mr. Taylor had said, with the ongoing OI/IG investigative task force and our team was charged with reviewing the health and safety implications of the concerns identified to date.

In the October through December time frame

-- and there's a typo on this slide. That should be December 19th, '91 -- the special review team conducted site visits to five plants, WMP 2, Callaway, Comanche Peak, Perry and River Bend Station. The focus of these site visits was to look at procedures and the installation processes for installing the Thermo-Lag material, to look at the designs and to field the installation techniques that have been used to install the material in the field.

In addition in December of 1991, we conducted a vendor inspection of TSI's facilities in St. Louis. The results of that inspection were published in a March report and indicated QA non-conformance concerns in the implementation of their quality assurance program for the manufacture of this material and also identified concerns regarding the controls of the qualification testing in that the test specimen configurations were not adequately detailed in reports, the construction of that test specimen were not clearly defined in some cases and the role of the independent test laboratory, ITL, used as the third party audit in these test reports, was not clearly identified.

As a result of the special review team effort, we prepared a final report and also drafted

a generic letter that would discuss the concerns that we've identified to date.

COMMISSIONER REMICK: Frank, before leaving that slide, near the top, on April 1989, it says, "Removal of ribs and stress skin." Can you explain what that means?

MR. MIRAGLIA: Yes. A little later in the presentation Mr. Madden was going to pass out some samples. It may be appropriate to do right now --

COMMISSIONER REMICK: Any time.

MR. MIRAGLIA: -- Pat.

MR. MADDEN: The structural ribs -- these are the structural ribs and the stress skin is the stuff that looks like a wire mesh.

COMMISSIONER REMICK: What is meant by removal of that?

MR. MADDEN: They pulled it off and they smoothed the -- took the rib right out of the assembly and smoothed it so it would be a flat board otherwise.

MR. MIRAGLIA: And this was counter to the installation recommendations and the concern relative to the River Bend material was that the material wasn't installed as directed and the concern was the performance material issue or was it installation issue? You couldn't distinguish.

COMMISSIONER REMICK: I see. I assume that results in sagging of the material then over time or with heat? Is that --

MR. MADDEN: Yes. When I get into some of the fire test results, I'll raise those questions.

MR. MIRAGLIA: We also have some pictures that will show specimens at various points in the test program.

(Slide) Slide 7, please.

I'd like to summarize the perspective this special review team had as a result of its effort. We concluded that the fire endurance performance of the fire barrier system, Thermo-Lag, was indeterminate. This was based upon a review --

CHAIRMAN SELIN: Before you say what it's based on, would you care to say that in English?

COMMISSIONER ROGERS: Say what it means.

CHAIRMAN SELIN: What do you mean it's indeterminate?

MR. MIRAGLIA: If I can finish what I -- I'm going to try and expand on that thought to give you the basis for that statement and a conclusion and different words that will perhaps answer your question.

CHAIRMAN SELIN: Okay.

MR. MIRAGLIA: Forty test reports were reviewed and we identified various concerns in a review of these qualification test reports having to deal with compliance to NRC requirements, the conduct of tests in terms of meeting the ASTM standards for thermocouple placement, methods of assuring that the acceptance criteria was met and therefore we concluded that based on a review of those test reports that many of the guidelines and criteria may not have been met in the conduct of that test based on a review of the report and therefore may not provide a basis for saying a material is qualified to the fire rating that was expected.

CHAIRMAN SELIN: That was very important. When you say it's indeterminate, you mean that -- is it the case that you mean the tests that the manufacturer performed do not answer the questions that they're supposed to answer or do you mean that we ran a lot of tests and we just can't draw a conclusion?

MR. MIRAGLIA: This is a review of the previous test reports, and so we were reviewing a report of a test. We raised sufficient questions relative to the conduct of that test to say, not being able to reconstruct and have accurate answers to this

question, we could not come to a definitive conclusion.

CHAIRMAN SELIN: So this is quite a negative statement about the test regime that's been reviewed, that these tests were submitted as making a point and upon investigation they just don't make the point.

MR. MIRAGLIA: That was our conclusion.

CHAIRMAN SELIN: And it still leaves us up in the air about what the facts were about the material as opposed to the testing regime itself. Is that correct?

MR. MIRAGLIA: Yes.

CHAIRMAN SELIN: Okay.

MR. MIRAGLIA: The Thermo-Lag fire barrier was also considered to provide some level of protection based upon some of the test data and some information was available. It would perform to some degree. We couldn't definitively conclude that it would perform for the rated one hour or three hour periods.

We deemed the safety significance of this issue to be low and that goes back to finding of the defense in depth of the fire protection system relative to the other features of having detections,

suppression, control of the fire hazards and generally low fire loadings in the facility. We'll discuss that a little bit more later.

The generic letter was proposed to deal with the issues identified to that point.

CHAIRMAN SELIN: But before we get off this, Mr. Miraglia, again I have two ways of interpreting. One is that the significance is low in the sense that the role played by the insulation isn't very important. Second, no, it is important but there are ways of compensating for it. While we are determining the adequacy in the short-term, there are measures that can be taken. But whether or not this insulation works properly is, in fact, a very important issue.

MR. MIRAGLIA: Yes, sir.

CHAIRMAN SELIN: Is one or the other a proper --

MR. MIRAGLIA: The latter. It is an important issue. We have to come to resolution of the issue. The barrier does play a role. There are compensatory measures.

CHAIRMAN SELIN: But given compensatory measures, the short-term immediately effect in your opinion is --

MR. MIRAGLIA: That it's low and we have time to resolve the matter in a disciplined kind of way.

(Slide) The generic letter, on slide 8, please, raised four principal concerns. The fire endurance tests that were reviewed by the special review team, and we didn't review them all, we reviewed approximately 40 reports and had questions on many of those reports and the special review team report outlines some of the concerns with respect to the reports reviewed. We were unable to evaluate the deviations or answer the questions where it perceived to have a deviation from acceptance criteria to come to a conclusion. Therefore, the generic letter was requesting a review of qualification test reports to determine whether the qualification test reports available to support the configuration installed in the facility were indeed consistent and in compliance with the requirements of the regulations.

CHAIRMAN SELIN: Let me stop you for a moment. Are we talking about the manufacturer's test to determine whether if installed properly it's an effective insulation, or are we talking about each facility trying to tell us how close they are to the manufacturer's recommended installation? Some of

both?

MR. MIRAGLIA: Some of both. In some instances, the vendor provided qualification reports to either the architectural engineer, who was acting as a contractor for the licensee, and that was used as the basis for qualification. In some instances, the utilities -- there were other tests also used to qualify the material. We've looked at about 40 of tests of that. The bulk of them were vendor reports.

CHAIRMAN SELIN: But from what you said earlier, did I understand correctly to say that we do not feel comfortable that even if installed according to the manufacturer's rules that it's an effective insulator based on the test results that were given to us?

MR. MIRAGLIA: That would be a question that we would have as to whether the test adequately was conducted in accordance with the regulations and provided an answer to that question.

CHAIRMAN SELIN: You said it wasn't adequately conducted, if I understood you correctly.

MR. MIRAGLIA: We would not be able to conclude that it was.

CHAIRMAN SELIN: Okay.

MR. MIRAGLIA: In addition, in the five

visits that the special review team conducted, we saw applications of this material in configurations that were extrapolations from test configurations. That was a concern to us. 86-10, which was a generic letter, indicated that qualification tests for the materials, if you were using in an application that was beyond the tested configuration, there had to be an engineering evaluation to support the use of that qualification test for the test in the facility. An example would be if a test was for, say, a 12 inch cable tray and they were using it in a configuration that was above 12 inch. What's the basis of saying that that test provided an adequate basis for the installed configuration. So, that was a concern that was raised by the special review team and that was also an issue that was to be addressed in response to the draft generic letter.

Certainly there have been deficiencies in the installation of the material and the inspection process, the quality control processes in looking at the installation of this material. Indeed, if the installation procedures were wrong, it affects the performance of the material. So, that was a concern as well.

CHAIRMAN SELIN: Have there been

deficiencies that we know of in the manufacture of the material or in the quality control on the manufacture and what's been delivered?

MR. MIRAGLIA: The inspection process here is the QC of the installation.

CHAIRMAN SELIN: I see. So, we don't have an opinion at this point as to the fabrication of the material itself?

MR. MIRAGLIA: The vendor inspection report found some concerns with respect to that in the vendor but they were not what I would call major concerns.

CHAIRMAN SELIN: Okay.

MR. MIRAGLIA: In addition, in the review of the issues, another issue known as the ampacity derating design basis was uncovered. Power cables and cable trays will generate heat. In order for the design of a cable tray to decide how many cables and power cables could be in the cable tray, one has to consider what the heat load within that cable tray is. When one has to enclose that cable tray for fire protection rapid, that increases the heat in the thermal loading and therefore in the design of the tray, if it is going to be protected from fire, that has to be considered. The number of ampacity tests

had been run for this facility, for this material, and there was a range of results for the barriers that had been reported.

CHAIRMAN SELIN: Ampacity is the capacity to carry amperes, to carry current --

MR. MIRAGLIA: Right.

CHAIRMAN SELIN: -- in specific configurations?

MR. MIRAGLIA: Yes. It's a tested configuration in saying, "Given that, how much would you have to derate the loading in that tray in terms of capacity to carry amperage because of internal heat generation?"

MR. RUSSELL: But you need to point out that this is an issue for aging of the insulation resistance on the cable. It's not a near-term issue. You may shorten the life of the cable by breakdown of the insulation resistance due to heating with time.

MR. MIRAGLIA: It's not a near-term issue, as Bill says. It results in perhaps higher operating temperatures if you haven't used the appropriate derating factor which would shorten the design life. So, we don't see it as a near-term issue. But again, what we have to decide and get a better handle on is what is the correct value and what values were used.

There were a range of values reported and it wasn't really clear as to what design values we used by each licensee. The generic letter would say, "What value did you use? This is the range of values out there." It's conceivable that they still may have not overloaded a tray, even if they had to have made adjustments. So, it had to be looked at and examined and a conscious decision be made relative to the design of the cable trays with respect to this issue. That was a matter within the context of the generic letter.

COMMISSIONER ROGERS: Just roughly speaking, how much of a temperature rise would you expect when you've enclosed a cable tray versus just operating in the open air?

MR. MIRAGLIA: I'm not quite sure I can answer that. I can give you the ampacity derating factors for a one hour --

COMMISSIONER ROGERS: Yes. That's not what I --

MR. RUSSELL: We've had one instance. It was at the Brunswick station where they had some temporary cables which were wrapped with fire insulation resistant material and that resulted in causing an actual fire. So, the temperatures can

conceivably get to be high enough that you would have a fire. However, given that this material has been installed for some time and we do not see that circumstance, that's why we say it's a longer term problem with degradation of cable insulation, cable life.

COMMISSIONER ROGERS: Well, yes. That's one thing you'd worry about, but I don't know how the requirements are that are placed on the Thermo-Lag, but you are talking, I know, in your slides here you said that you assumed a 75 degree ambient and a 250 degree temperature rise on top of that. So, it had to withstand 325 degrees. Now, if that 75 degrees is much lower than an actual use, the tests really should take that into account and the outside of the thermal lag ought to be subjected to a correspondingly higher temperature. Now, I don't know how big an effect that --

MR. MIRAGLIA: I think that predicate would say that the tray was designed properly such that it wouldn't be causing that much of a --

MR. RUSSELL: Let me also characterize that the material involved in the Brunswick situation was a wrap for temporary cables. I was just using that to illustrate that there is quite a bit of

heating within cables and you are essentially insulating the cables.

COMMISSIONER ROGERS: We might be talking about another 25 degrees.

DOCTOR THADANI: Commissioner, perhaps Ralph Architzel can address that question.

MR. ARCHITZEL: I just wanted to -- Ralph Architzel, plant assistance -- explain that the test established certain conditions to rise in open air to 90 degrees from a 40 degree ambient and then enclose it and see for the same enclosure, rise it again to 90 degrees with the enclosure, how much less current does it take to do that and that's your ampacity derating. All that it's doing is giving you a factor that says when these cables are in this enclosure, you load this many cables in there and you take that much current.

COMMISSIONER ROGERS: No, I understand. That isn't my point. My point is that when you enclose it, what is the operating temperature of those cables enclosed? We even derated. How different is it from what you assume to be your ambient temperature for your tests of the Thermo-Lag?

MR. MIRAGLIA: Based on Ralph's explanation, it sounds like what it says, is that the

maximum ambient would be 90 degrees.

DOCTOR THADANI: I think Paul was going to follow up on that.

MR. GILL: I'm Paul Gill. To answer your question, the tests that were conducted were based on 40 degree ambient and 90 degree rise. I mean 90 degree total temperature or 50 degree rise. However, in some of the tests that I've looked at, the final temperature did vary from 90, maybe went up to 91 degrees. That's where the tests were based on. However, in actual installation, if you were to carry the same current, the temperature could rise beyond that. We don't exactly have that data unless you go out in the field and measure that. It's all based on an ambient of 40 and a rise of 50 degrees.

DOCTOR MURLEY: I don't think we've answered your question. We'll try to frame that --

COMMISSIONER ROGERS: My question is a different question.

DOCTOR MURLEY: I understand your question. We'll try to get back to you on that.

COMMISSIONER REMICK: It leads me to ask another question. Was the ampacity rating dependent on the type of cable tray? Some are solid and some are, let's say, webbed or perforated. Does it depend

on the type of cable tray that the ampacity rating or not?

MR. RUSSELL: The ampacity is a derating for the cable because you have insulated it. So, the factor, if it's applied, if you've done the initial analysis correctly for the cable loading and the current loading in that tray, whether it's enclosed or open, you have some analysis that supports that that loading in that tray is acceptable. If you now insulate it, how much do you have to derate the current flow through it in order to keep the same life of cable? So, it's a sensitivity study that we're testing.

COMMISSIONER REMICK: Thanks, but you're confusing me. I thought this was an ampacity rating for the cable tray, the amount of cables you could put in there and not a derating of an individual cable.

COMMISSIONER ROGERS: I don't know if it's the individual cable, how much each cable is allowed to carry and derated because it's enclosed rather than operating in the open air.

COMMISSIONER REMICK: Another approach would be that you wouldn't derate an individual cable, but you would derate the capacity of the cable tray to handle a number of cables so that you wouldn't

exceed the heat. I thought it was --

MR. RUSSELL: I think it can be technically either way.

COMMISSIONER REMICK: Well, my point is--

MR. RUSSELL: We're talking about our existing trays with existing cables in them --

COMMISSIONER REMICK: Right.

MR. RUSSELL: And you're insulating it and that has either the effect of raising the temperature which would degrade the insulation life and so you want to keep that temperature low so that you're not shortening the life of the cable.

COMMISSIONER REMICK: No, I understand this is now in either case--

MR. RUSSELL: You can't do much about changing the current flow in the cables that are already installed. They're physically there.

COMMISSIONER REMICK: In either case it seems though that that derating would be dependent on the type of tray you're using. If the bottom of the tray is a wire mesh for example, it's going to be easier to dissipate the heat than an enclosed one. My question is is that taken into account or not? I'm just curious.

MR. RUSSELL: We'll get the specific

information and provide it.

COMMISSIONER REMICK: I think we have it. Okay.

DOCTOR MURLEY: Why don't we supply that.

COMMISSIONER REMICK: Okay. Fine. Good.

MR. MIRAGLIA: (Slide) Slide 9, please.

Slides 9 and 10 represent a listing of the qualification acceptance criteria for fire barriers. Appendix R of our regulations, particularly Section III.G.1.a, requires the safe shutdown capability, the protection of at least one fire train -- one train free from fire damage. That's usually done by barriers as indicated and those barriers would be relied upon to protect the system for one hour or three hours. The one hour, again, would be supported by detection and suppression, fire protection devices as well.

The cable tray fire barriers must meet the requirements of an ASTM standard E-119. The other standard that's represented in parentheses, National Fire Protection Association Standard 251, is equivalent to the ASTM E-119. Both standards have been articulated as acceptable criteria in branch technical position 9.5.1.

The SRP for the review of this material

defines the fire barriers as those rated by approved laboratory and meet the fire resistant ratings established by NFPA 251. The NFPA 251 standard is silent on cable tray applications. However, we've designated the use of the non-load bearing wall standard as the appropriate one in our review of this issue and that's indicated in General Letter 86-10.

(Slide) Slide 10 lists some of the requirements with respect to the barrier in terms of passage of flame and transmission of heat. The standard does indicate 250 degrees above ambient. In General Letter 86-10, we articulated that 325 would be an acceptable standard from the perspective of the NRC regulations and that's 250 plus an ambient of 75 and that was the derivation of the 325. If a material tested meets the 325, it's a clear go. It's acceptable. If it exceeds the 325, one has to have further justification and analysis to support the reasons why it's acceptable above that standard.

Generic Letter 86-10 said justification could be based upon temperatures less than the ignition temperature for the cables. Ignition temperatures of cables run in the order of 450 to 650 degrees fahrenheit.

COMMISSIONER REMICK: What kind of a flame

is used?

MR. MIRAGLIA: There is a standard, the time temperature curve. We have some slides later on that give an idea of what the thermal loadings are, but there's also a temperature, certain time temperature and that's also specified in the ASTM E-119.

There was a substantive review in the 1984 to '86 time frame about fire protection requirements. Appendix R was issued. There was branch technical positions and there were evolving criterion standards. In the '84 to '86 time period, there was a review, there was a special review group that examined the acceptance criteria and the requirements and criteria that had been specified that would provide a basis for meeting the Commission's regulations.

The bottom line of that group was that there was sufficient guidance and acceptance criteria. It should be collected in one place in an SRP and that there ought to be a generic letter that articulates what's in that SRP and we're directed to conduct workshops and that generic letter provided interpretations and question and answers that came out of that workshop. So, 86-10 was supposed to be the end of any concerns relative to what the acceptance

criteria were for meeting various fire protection requirements.

The review team felt that the acceptance criteria has been articulated by the NRC in the conduct of that review, but the questions raised in looking at this Thermo-Lag issue does indicate that perhaps licensees have not consistently implemented this criteria, nor has the NRC consistently implemented this criteria. In fact, the review of the test reports that we went back to look at, not all of which had been submitted to the staff, some were docketed and some were not.

The questions we raised raised question in our mind relative to the depth and scope of our review of these qualification testing initially. This is an issue that the special review team identified that were programmatic aspects that needed to be examined. We'll discuss later in the presentation what of our action plan does include a look back by the staff into the licensing and inspection programs that we had conducted to date as well.

There have been a number of recent tests of fire barriers, Thermo-Lag fire barrier by Thermal Sciences, by Texas Utilities and we've also conducted some very small scale tests at the National Institute

of Standards Technology. The tests that we're going to discuss have been observed, were witnessed by NRC staff. Mr. Madden, most if not all, has witnessed most if not all of these tests. So, the actions that we've taken to date are based upon our understanding of those tests. The findings are preliminary in that we don't have detailed documented test reports and we've designated the findings as preliminary and that should be understood at this time.

With that, I'd like for Pat to summarize briefly the recent fire testing activities.

MR. MADDEN: (Slide) Yes. If I can slide 11, but first I'll pass out some samples of this material you may or may not be aware of so we can get straight on the terminology.

This is a trial grade material which is used to prebutt the joints and join the boards together. This second panel, the first panel I passed around was a one hour panel and this one -- be careful with this one. It's a three hour panel. But we wanted to show you the depth and the thickness of the two different materials used for one hour and three hour.

COMMISSIONER ROGERS: It's got a big void in it. Is that from lay-up or is that from

manufacturing?

MR. MADDEN: That's from manufacturing.

That's the one hour panel after it's been exposed to a fire. As you can see, it intumesces or grows in thickness. It changes chemically and it builds up a char layer which in turn insulates the cables. That's part of the importance of the material, is to hold the char layer in place.

COMMISSIONER REMICK: Are there gaseous releases when it's fired?

MR. MADDEN: Yes, there are gaseous releases.

COMMISSIONER REMICK: Are they toxic?

MR. MADDEN: The toxicity of the gaseous releases, if you were to do a comparison, would be about the same toxicity as Douglas fir wood as it burns or combusts. So, smoke from the fire will get you too.

If I can go on into these tests we did on June 9th witness Thermal Science, their test which was a one hour configuration, an enhanced configuration at Omega Point Labs in San Antonio, Texas. It's from our understanding that when we reviewed the test specimen that the seams and the joints were all enhanced with this wire mesh on the

outside, with trowel grade material over it. That enhanced configuration is not currently installed in any of the plants currently. And we had some indeterminate concerns over that test and the fact that earlier Frank showed you the criteria of the hose stream test, that the hose stream should not penetrate the barrier at the end of the test when subjected. That assembly was penetrated by the hose stream significantly.

COMMISSIONER REMICK: Are there specs for that type of test also laid out on --

MR. MADDEN: NFPA 251 is the standard.

COMMISSIONER REMICK: But it's specified--

MR. MADDEN: Yes.

MR. MIRAGLIA: The standard 251, as I indicated, doesn't specifically consider cable trays. It's for non-bearing walls.

MR. MADDEN: Yes.

MR. MIRAGLIA: The standard was directed at non-bearing walls.

MR. MADDEN: When this stuff was originated, that was the closest standard that the staff had to use that could apply to the testing of this material.

CHAIRMAN SELIN: Have you finished

answering Commissioner Remick's question?

MR. MADDEN: Yes.

CHAIRMAN SELIN: Let me see if I understood what you said. Number one is material that was subjected to this test on June 9th was not the same material that has been delivered and installed in plants.

MR. MADDEN: It's the same material as the one hour panel but the seams and the joints have been enhanced by a different installation procedure.

CHAIRMAN SELIN: So, it's not the material as delivered and installed in any plant.

MR. MADDEN: It's the material as installed but it's not the same installation process that is installed in the plant.

MR. MIRAGLIA: The basic barrier material, Thermo-Lag, is the same. The enhancement has been in the installation procedure that put the test configuration together. Most of the facilities out there today in constructing a cable tray barrier would have butted the joints together and they would be prebutted with the trowel grade that would cure and there would be bands at some specified distance according to the material installation procedures.

This test configuration that Pat is

talking about actually had some stress skin pu[illegible] - those seams and then the trowel grade material put over that.

CHAIRMAN SELIN: I'm not trying to figure out whether the problem is with TSI or the utilities at this point. I'm just saying that the material that was tested had characteristics which were superior to material as installed in the plants.

MR. MIRAGLIA: That's correct, yes.

CHAIRMAN SELIN: Okay. And so, for that reason, your conclusion is that doesn't tell us whether the material as installed will withstand the --

MR. MIRAGLIA: As currently installed. That's right.

CHAIRMAN SELIN: Furthermore, even with this material on it, it failed the hose stream.

MR. MIRAGLIA: And we have some additional questions relative to that that we'd like to explore in detail.

CHAIRMAN SELIN: So, that's beyond being indeterminate. That's saying that even in this case it failed the hose stream test and therefore the material as installed in the plants probably also failed the hose stream test. Yes? No?

MR. MIRAGLIA: I think what we're going to find is that a number of the -- one of the issues that we have to address is the applicability and the conduct of the hose stream test and how it was conducted. The standard does provide acceptance criteria that was directed, as I indicated, for freestanding non-bearing walls. Then the issue then comes there is flexibility within the standard to change that test procedure with the approval of the permitting authority. We have not -- they may present arguments along those lines, but we haven't heard those. That's why we're not prejudging the outcome of that.

COMMISSIONER ROGERS: I don't know whether this is the right place to ask the question or not, but I take it that what we've done in setting up our requirements is that we've adopted this national standard that has several parts to it, one of which is the hose stream test, and that in adopting that did we really look at each element of that and decide whether that was particularly appropriate for its use in nuclear power plant or did we just adopt a standard? My guess is we just adopted the standard as it was.

For example, would you expect that hose

stream insult to the insulation to, in fact, be likely to take place in a nuclear power plant?

MR. MADDEN: If manual fire fighting were to occur by the fire brigade, it's a possibility.

CHAIRMAN SELIN: Please continue, Mr. Madden.

MR. MADDEN: On June 17th through 24th, 1992, we went to Omega Point again to witness some tests that were being done by TU Electric for their Comanche Peak facility. These were one hour tests of plant-specific applications of Thermo-Lag material.

(Slide) If I can have the first picture slide, then I'll -- I guess it's slide 13.

We witnessed the one hour test of the conduit configuration and that conduit configuration consisted of a three-quarter, one inch and a five inch conduit assembly coming into connection with the junction box in the center. Based on that test, there was some difficulty or temperature increases associated with the conduits, the three-quarter and the one inch, that the conduit temperature got to 694 degrees. This slide shows the assembly that was tested prior to go into the furnace. You can see the configuration, two conduits, a junction box, five inch conduit and a three-quarter inch and one inch conduit.

COMMISSIONER CURTISS: Just to clarify here, are these tests that we're looking at in these series of pictures, was the material installed in accordance with the instructions in these tests?

MR. MADDEN: In accordance with the installation procedure that Comanche Peak had developed from the vendor's information.

COMMISSIONER CURTISS: And was that consistent with the way the vendor recommended that the material be installed?

MR. MADDEN: Yes, sir.

COMMISSIONER CURTISS: So the answer to my question is these tests involve materials that were installed in accordance with the way the vendor recommended the material to be installed?

MR. MADDEN: Yes, sir.

COMMISSIONER CURTISS: Okay.

COMMISSIONER REMICK: Incidentally, seeing that plus a reminder from Commissioner Rogers that this is a wrap around the entire thing, I withdraw my question about mesh bottom versus solid bottom trays. I forgot that it was a complete enclosure. I was thinking only of a top enclosure.

MR. MADDEN: So, that was the assembly. (Slide) If we can go on with the next

color photograph, when subjected into the furnace through the viewing port the furnace actually brings the temperature up to somewhere around 1,700 degrees at the end of the one hour exposure. The increase in temperature is quick over the first five minutes of the exposure, otherwise the temperature comes up very rapidly inside the furnace and then it levels off and is almost constant all the way through the rest of the test.

(Slide) Next photograph, slide 14.

There was a question earlier about does this material off-gas and, yes, it does off-gas and some of the off-gassing is volatile and there is a flammability concern or question that we do have on the material which we are currently reviewing.

Once the specimen is subjected to the actual fire test, a hose stream test -- and I'll show you the hose stream on this configuration -- it's taken out of the furnace and then it's subjected to the hose stream and at that point then, after the hose stream, it's evaluated for the hose stream, ability of the hose stream to breach the barrier.

(Slide) Next photograph, slide 15.

This is what the barrier assembly looked like after being subjected to the hose stream test.

COMMISSIONER REMICK: Could you interpret that for me? I'm not quite sure --

MR. MADDEN: Okay.

COMMISSIONER REMICK: -- what I should see.

MR. MADDEN: We can go back to that photograph. You can see some of the material has been dislodged from the assembly or from the conduits by the hose stream. If you took a literal interpretation of the Standard, the Standard says that that stuff should remain intact and not allow that barrier to be breached by that hose stream.

(Slide) Next photograph, please.

That's just another shot of the assembly after the hose stream test.

(Slide) If I can have the first cable picture up there, I'll explain what we're going to look at.

When the assembly -- the next day, the following day, we went ahead and disassembled the assembly and pulled out the cables. We were suspect of the three-quarter inch and the one inch because of the temperature rise on the unexposed surface of the material. Three-quarter inch unexposed surface temperature got to 694 degrees and the one inch was

at 698 degrees. We had the cables pulled and I believe this is the one inch conduit and we found a section that was blackened as such.

(Slide) Next photograph.

When we started looking at the cables, the jacket was very brittle and of course charred and we had some questions of the ability in the small conduits of this material to actually protect the cable within the conduit.

COMMISSIONER REMICK: Now, remind me. We are looking at cable that was in a small conduit going into a junction box? Is that right?

MR. MADDEN: Yes, sir. That was the one inch. Now, the three-quarter inch had two similar hot spots on it.

COMMISSIONER REMICK: Okay.

MR. MADDEN: The following test witnessed was a 12 inch wide cable tray. Based on examination of cables we did not find any damage to those cables, but we still have some questions considering the tray supports, the hose stream test, and the internal temperature rise of the envelope.

(Slide) A 30 inch tray we witnessed, if I could have the next photograph of the 30 inch assembly. This was the 30 inch assembly. Some of the

support questions that we have with regard to the assemblies with TU is that during the test of this material they protected the supports and in plant configurations the supports are not protected.

(Slide) Next photograph.

During the fire exposure, there are these steel bands that bond the material to the cable tray. Well, the first thing that happens within like five minutes or so of the test, the steel bands start to expand and as they expand they let loose and no longer at the bottom are responsible for holding the material. The actual material is being held by the trowel grade material and the tightness on the corners.

(Slide) Next photograph.

At about 17 minutes or so into this test we saw a joint which -- and you can see the piece of material kind of hanging down there, a joint starting to open up, and we kept watching that joint.

(Slide) Next photograph.

This was a full shot of the whole joint and it's bowed in the center allowing hot gases from the fire to actually expose the cable at that point.

The 30 inch tray, the unexposed surface, the temperature got to 723 degrees and the cable

temperature was somewhere around 578 at the time of failure of the cables and the test was terminated at 42 minutes. So, the utility did not do a hose stream test. We wanted to examine the failure. A hose stream test didn't make any sense.

(Slide) Next photograph.

This was a breach in the barrier on one of the seams on the side.

(Slide) If I can have the next photograph, we'll show you the actual joint that failed. That's the picture of the joint failure.

We witnessed several other tests associated with TU. One was a 32 inch wide cable tray, enhanced design similar to the TSI test done on June 9th. And then also what we call a "cable tray fire stop" where you terminate your wrap. Another tray may come into a T piece and you have to terminate. So, we witnessed that fire test.

COMMISSIONER CURTISS: In the earlier slide, slide 12, you noted that some of these tests failed, some of them were indeterminate. I think I know the layman's definition of the distinction between the two. From a regulatory standpoint, what is the difference in terms of a test that fails versus one that's indeterminate? Does it suggest a different

action on our part?

MR. MADDEN: Well, the failure actually was related to cable damage. When we call it a hard fast failure, it's that the actual cables were damaged by the fire and the regulation requires that the cables be free from fire damage.

COMMISSIONER CURTISS: We're looking for proof positive that the cables will survive?

MR. MADDEN: Right.

COMMISSIONER CURTISS: So in either case, failed or indeterminate, that comes up short?

MR. MADDEN: In some cases, yes, sir.

DOCTOR THADANI: Yes.

COMMISSIONER CURTISS: Okay.

MR. MADDEN: We've done -- and I apologize that some of these pictures did not get -- we have done some series of tests at NIST and I just got the pictures yesterday, as a matter of fact, and I'm going to show you some of the pictures that highlight some of the testing that we're doing just on material or panels with no joints or just the panels themselves and no special configuration enhancements whatsoever other than we're placing the panel on a horizontal plane and testing it in a furnace.

(Slide) If I can have the first

photograph, this is a one hour panel test. We've thermocoupled it in five locations. We've also put a device on there to measure deflection of the panel during the fire test. It's a small-scale furnace which will model the ASTM E-119 curve. Like I said, there's no seams in this panel.

(Slide) If I can have the next picture, this will show an overview of the furnace arrangement and how small-scale the actual furnace is. The specimen was basically exposed to a two by two fire or two feet by two feet. The specimen was exposed to the atmosphere of the furnace.

Next --

CHAIRMAN SELIN: What are we to make of the fact that it's such a small-scale furnace? Is that significant?

MR. MADDEN: Well, actually what we're doing is just attacking the material itself. We're not attacking the structural stability of the material and that's what I'm trying to communicate here. It doesn't seem to be a -- with this furnace arrangement, the structural stability of the material is not in question because it's not a wide span, for example.

CHAIRMAN SELIN: Okay.

COMMISSIONER ROGERS: On this furnace or

any of these furnaces, are they specified in the code as to what that furnace's characteristics are supposed to be?

MR. MADDEN: The full-scale test, the furnace characteristics are specified in the code, yes.

COMMISSIONER ROGERS: What are they? Do you know what they are off-hand?

MR. MADDEN: Well, it's supposed to have a dimension of ten by ten or 100 square feet of exposed gas surface and any specimen that you would place in there should be -- if you were doing a wall, for example, you should have I think a nine by nine wall assembly attached to the furnace and exposed to the actual fire.

COMMISSIONER ROGERS: What about -- Commissioner Remick asked a little bit about the flame test. What is the nature of the combustion area? How well is that specified in these tests?

MR. MADDEN: The furnace gas is usually specified. The thermocouples that drive the furnace are specified. And I think some of the construction techniques as far as heat losses out of the furnace are also specified.

COMMISSIONER ROGERS: And the temperature

rise inside the furnace?

MR. MADDEN: Is also specified.

MR. MIRAGLIA: Time and temperature.

MR. MADDEN: Right.

COMMISSIONER REMICK: Are those tied in any way to some type of fire? Wood fire, oil fire, hydrogen fire or anything? How does it relate back to a practical possibility of fires? Is there any relationship?

MR. MADDEN: Yes. They're all based on some early NBS testing that was performed and they derived or determined the actual curves based on full-scale fires in buildings and generated that over -- you know, if you wanted to resist fire or have a structure for, let's say, a concrete or a block wall to resist fire from propagating from one structure to another structure, this is the potential heat curve.

COMMISSIONER REMICK: What I was getting at, what type of fire?

MR. MADDEN: Ordinary combustibles.

COMMISSIONER REMICK: Ordinary combustibles, not necessarily -- what I'm thinking of is a hydrogen fire in --

MR. MADDEN: No.

COMMISSIONER REMICK: -- the turbine

generator area or something like that.

MR. MADDEN: No.

COMMISSIONER REMICK: It's not that hot?

MR. MADDEN: No.

COMMISSIONER REMICK: All right.

MR. MADDEN: (Slide) If I can have the next photograph, on July 14th NIST ran a shake-down test for us on one panel to make sure that the furnace was tracking properly in accordance with the curve, that their computer program was working properly and the actual furnace was working properly. It appeared that the furnace and everything at the end of the test -- they didn't thermocouple the first sample that we used completely, but at the end of the first test they saw these results about 40 minutes, that the material started glowing red and the furnace was tracking properly to the ASTM curve. And they kind of set that sample aside and we said, "well, you know, this was a shake down test of the furnace. Let's see what happens on the actual test now that we've got all the bugs out of it." So I just wanted to highlight that glowing portion, because we did see similarities the following day when we did the actual test.

(Slide) If I can have the next slide, which is of the actual test, within that test at 22

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minutes all five thermocouples reached or exceeded 325 degrees and at 40 minutes the surface temperature of the material was at 572 degrees. Within 46 minutes into the test of a one hour test, we had burn through of the panels, of the panel, so at that point the temperature of the surface went up significantly.

CHAIRMAN SELIN: If I followed your argument, you're saying this is a more -- less rigorous test of the materials than the previous one, because you've taken out the physical buckling and stretching.

MR. MADDEN: Right.

CHAIRMAN SELIN: You have a very small piece, so the physical strain at the surface should not be an issue.

MR. MADDEN: Right.

CHAIRMAN SELIN: It's just a question --

MR. MADDEN: Material properties.

CHAIRMAN SELIN: -- of the thermal --

MR. MADDEN: Thermal dynamics of the material.

CHAIRMAN SELIN: Okay.

MR. MADDEN: (Slide) If I can get the next slide, we did a -- this is at the end of one hour, the actual surface of the material and what it

looked like, fully blackened. It started out originally white, as you saw. There were burn holes, I think four actual burn-throughs of the material.

CHAIRMAN SELIN: It's clear, if I might just use the time effectively, that there's serious problems with the material at least as installed in the current places.

MR. MADDEN: It seems to be configuration-dependent. Horizontal surfaces do not work as well as vertical surfaces.

CHAIRMAN SELIN: What I really want to make sure there's enough time for the Commission to go into is the actions that --

MR. MADDEN: Yes, sir.

CHAIRMAN SELIN: -- these steps. Clearly, one is uncomfortable about relying on the barriers. How uncomfortable can be determined, so let's make sure we have enough time to discuss what --

MR. MADDEN: I have one more, just one more, the three hour panel.

The three hour panel when we tested it in the same configuration, the surface temperature at two hours and two minutes exceeded the 325 and the surface temperature was at 403 degrees at three hours. That panel seemed to perform a little bit better than the

one hour panel.

CHAIRMAN SELIN: I forgot. What's the difference between a one hour and a three hour panel?

MR. MADDEN: Thickness, sir.

CHAIRMAN SELIN: Just thickness. Same material?

MR. MADDEN: Same material.

MR. MIRAGLIA: And it has the stress material on both surfaces.

MR. MADDEN: And that's basically the presentation I wanted to make.

MR. MIRAGLIA: As a result of the fire testing that we observed, we took certain actions. Certainly the performance of the material is very, very configuration dependent and in certain conditions it does compromise the fire protection defense in depth.

(Slide) I'm on slide 21.

As a result of the results that we saw during the Texas Utility test, the staff put out Bulletin 9201, as was indicated, and that required utilities that had this material installed in small conduits and cable trays larger than 14 inches, I believe the bulletin said, is to examine the areas to protect it in safe shut-down and to provide adequate

compensatory measures.

The result of this bulletin has resulted in the establishment of compensatory fire watches in most instances. There have been instances where the utilities have, in lieu of fire watches such as in high radiation areas and inside containment, used closed-circuit TV, but there is compensatory measure in these areas. The basis for that action was the results of the test from Texas Utility.

The 12 inch cable tray test, while we do have some questions, did perform and provide protection in the one hour barrier sense, and so the focus of the bulletin were those for where the configurations tested were deemed to be failures and that's where the action is directed and those bulletin responses are being received today.

CHAIRMAN SELIN: You lost me, Mr. Miraglia. Are you saying -- I hope you're not saying that where the results are indeterminate we assume that the barrier was okay and it's only where it failed that we -- what are you saying?

MR. MIRAGLIA: The indeterminate test, the 12 inch cable tray test at Texas Utility that we deemed to be indeterminate, the barriers did provide one hour protection. We do have questions as to

whether the temperature rise met the criteria and there are some questions regarding hose stream testing. The utility has deemed that to be a successful test based on the criteria it's testing to, and we're still dialoging on that.

We believe that, while it's indeterminate in the sense of saying it complies with all aspects of our regulations, it does appear to perform adequate fire protection in performing a one hour -- as performing as a one hour barrier.

CHAIRMAN SELIN: Are you suggesting that you're not concerned about the temperature runs or are you taking compensatory measures about the temperature runs? I mean, the barrier didn't fail, but it didn't keep the temperature within the --

MR. MIRAGLIA: Well, in addition, the temperature rise exceeded 325, but the standard is that if it exceeds 325 how high did it get and was there still continuity within the circuits that it was protecting, and the answers to those questions were yes.

MR. MADDEN: If I can interject, we did examine the cables after the 12 inch cable test and there was no visible damage to the cables.

CHAIRMAN SELIN: I see.

MR. MIRAGLIA: The "indeterminate" is that we have some questions about all aspects of the criteria. But I think in terms of the test, it did demonstrate one hour fire protection, a one hour barrier with the test fire.

CHAIRMAN SELIN: Okay.

MR. MIRAGLIA: (Slide) Slide 22.

I think the compensatory measures do provide early detection and notification of fire conditions and it does minimize the conditions which can challenge the limited endurance of the barriers of the test. On that basis, we feel that with the compensatory measures and the defense in depth, there's an adequate level of fire protection for these configurations.

(Slide) Slide 23.

Additional considerations in this determination is the test fire ratings are shown here are one hour. A one hour test is exposed to a fire of 80,000 BTUs per square foot. A three hour barrier is 240,000 BTUs per square foot. This is the test--what the test fire would develop. Typical loadings within the nuclear power plant are shown here. So, the test fire is for fire loadings higher than typically seen in nuclear power plants. The barriers

do provide some resistance, as shown by the tests. Compensatory measures enhance the fire prevention detection control and suppression and based on the defense in depth program we feel that with the compensatory measures and the information we have to date that the overall level of fire safety is reasonable.

COMMISSIONER REMICK: Just out of curiosity, if we added the turbine building around the generator and the possibility of a hydrogen fire there, I assume that it would be higher than a diesel generator. I assume that's based on oil.

MR. MIRAGLIA: That's probably correct. The turbine generators in most of the areas are outside of the fire protection envelope for most plants.

Pat, would you like to --

MR. MADDEN: Yes. There's very little safe shutdown related equipment in the turbine hall. So, the turbine, in most cases, is not really a concern.

COMMISSIONER REMICK: Old plants also?

MR. MADDEN: There's a few. I said most.

MR. TAYLOR: That's being looked at.

COMMISSIONER REMICK: The reason it's

fresh in my mind, having just a couple of weeks ago visited Vandellos 1 in Spain and that fire, it certainly brought home the importance of separation and all those things we talk about in environmental qualification.

DOCTOR THADANI: Commissioner Remick, we are looking at that event that happened at Vandellos to see if there are lessons to be learned for us.

COMMISSIONER REMICK: Okay.

MR. MIRAGLIA: (Slide) Slide 24, please.

I'd like to summarize the actions that the staff has taken to date in response to the concerns raised about Thermo-Lag and also to outline the future actions. There have been four information notices issued to the industry. The first one shortly after the special review team was put in place. It was issued in August of 1971 and it was -- I'm sorry, '91. It was relating the River Bend station test results and concerns raised in that experience.

In December of '91, additional information notice 91-79 was issued and that outlined the concerns about installation deficiencies, following the procedures, the importance of installing this material properly.

In June of 1992, we issued information

notice 92-46 which was the special review team report and a summary of information to date. Early this week, I believe, we issued an information notice that summarized the results of the NIST test that Mr. Madden described to you. The June notice also provided a summary of the TU tests that were described today.

We've completed a special review team report. We did draft a generic letter. That draft generic letter was discussed at a public meeting with NUMARC in February. The thrust of that meeting was to elicit NUMARC's aid in coordinating industry's response to the concerns raised by the special team review.

CHAIRMAN SELIN: Are there any activities that would have -- activities of short-term safety significance that would have been kicked off had that letter been issued that have not been kicked off because the letter is still under discussion?

MR. MIRAGLIA: No, sir. I think the compensatory measures are a result of the testing. That was important. The testing pushed the compensatory measures and we had concerns. I think the testing confirmed some of the findings of the special review team that there were perhaps

performance issues with the material installation questions and that perhaps additional qualification testing needed to be done for a specific configuration installed in facilities.

As I said, we met with NUMARC. NUMARC indicated that they would put a group together to work with us. They indicated that based upon the draft letter alone they didn't have sufficient technical basis to fully understand some of those issues and as a result of that from March through May the staff released special review team trip reports. We provided the test reports that the -- the list of the test reports that the special review team did review and eventually published and provided in May the special review team report that was appended to the June information notice.

Since that time, the special review team report was provided to the staff and the staff has developed an action plan to coordinate future staff actions. There is principally four elements in this staff action plan and that's to continue to identify, coordinate and resolve the technical issues with the industry. That's an ongoing activity. Mr. Russell has been in connection with NUMARC and we're talking about a meeting with early August to further continue

the discussions.

NRC testing of Thermo-Lag fire barrier material is proceeding. As Mr. Madden indicated, we've done these small-scale tests. We have several more small-scale tests planned and we're preparing some large-scale configurations to test. That planning process has been in place. That was instituted back under the auspices of the special review team and it has been continued.

In addition, as I said earlier, there were some concerns as to whether the industry and the staff had informally and consistently been implementing all of the acceptance criteria specified in the standards. As a result of that, the special review teams indicated that an assessment of our fire protection program should be considered. That is a distinct element of the action plan. That would look at the types of reviews, qualification tests that have been done.

The principal focus right now would be to resolve those questions and issues in the context of resolving the Thermo-Lag issues. But we're not going to stop just there. We're going to look at the entire program. All of those activities will provide additional input and development to improvements in

our inspection program aimed at assuring that the Thermo-Lag resolutions are appropriately applied. And also that any lessons learned are factored back into the inspection program.

That concludes the staff presentation. In summary, there are concerns. It is an important issue that needs to be dealt with. There are certain regulatory issues that certainly have to be dealt with in the context of resolving this issue. We've acted based upon the test data that we received to date. Compensatory measures have been put in place for those configurations where we have concern and we're going to continue to work with the industry in resolving this issue. The development of the generic letter is proceeding and will be put through the Agency's process for CRGR review and the like.

CHAIRMAN SELIN: I'd like to share some impressions, if I might. First of all, I am impressed by the thoroughness and professionalism of the staff once this program got started. Clearly, each test raises a lot of questions. You followed up with these questions in excess, but there's a long way to go.

MR. MIRAGLIA: That's correct.

CHAIRMAN SELIN: Related to that, if we had designed a test case to prove the benefits of

standardization, I don't think we could have done better. But there's a lot of work to be out there because each plant has done something differently. They have a different configuration, a different installation. So, we're faced with two kinds of uncertainties. One is every place you lift a stone you find more uncertainty. So, there are lots of questions about the test program that the manufacturer had, the installation procedures, the thoroughness with which the licensees followed up on the installations. We have science questions, technical questions, operations questions, insulation questions and just sort of basic uncertainties.

As I hear you go through these programs, and it's very clear you appreciate the depth and breadth of what's going on, it means it's going to be a long time before we have confidence that the insulation as installed carries out the job that it's supposed to carry out. You're also clearly going to have to go back and take a look at some of these test programs to make sure that the testing is really for what we want. For instance, the rules say 325 degrees. You find almost twice that rise. It didn't seem to affect the cables because there's a safety relationship with that number.

MR. MIRAGLIA: That's correct.

CHAIRMAN SELIN: So, even the. here's a lot of work. We're relying on compensatory measures to keep these plants safe while these questions go on. It's true, as you said at the beginning, that we have a defense in depth philosophy. On the one hand, that implies that we're not completely dependent on, say, the insulation or things that can compensate. On the other hand, we're not going to allow this compensation to go on indefinitely because it means in the long run we wouldn't have much depth.

MR. MIRAGLIA: That's correct.

CHAIRMAN SELIN: Now, are you comfortable that you've taken the steps that there will not be a kind of fatigue that comes in as this program grinds on, as we find that each question raises two more questions, that fire watches and things like that will be satisfactory for what could be really quite a long time and not just a short, acute time saving area?

MR. MIRAGLIA: To quote a great American, Yogi Berra, it's deja vu all over again in your initial implementation of Appendix R for operating plants. Compensatory measures, many utilities did not have barriers installed. There were tolling requirements within that regulation, by time such and

such these requirements had to be met. Those requirements were met in large part, for long periods of time, by compensatory measures such as fire watches. So, we're back to the early implementation of Appendix R in some respects.

CHAIRMAN SELIN: Well, you're better than that.

MR. MIRAGLIA: In terms of long-term fire watches within facilities, it's in a smaller amount of areas. There is a fire protection program. That's in place and there's an infrastructure that perhaps wasn't even there at the earlier time. But in the context of long-term compensatory measures such as those that we're relying on, as you pointed out, Mr. Chairman, chey will perhaps be in place for awhile. We've had that type of experience. In cases where the fire watches were not diligent, there have been enforcement actions and in some cases escalated enforcement actions.

So, there are the tools for trying to maintain that diligence. The fire protection program does require training of these individuals and also a quality control assurance program and oversight of these kinds of things. So, we've had that experience before. We may be in it for awhile. It's going to

take time to resolve these issues. I think it's in our best interest and the industry's best interest to work and focus on this thing to resolve it as soon as possible.

CHAIRMAN SELIN: Mr. Russell?

MR. RUSSELL: I'd like to characterize two elements that we have in the action plan that I think are important at this point. One is the programmatic review. I think the concerns over the review of test reports that were submitted or looking at test reports in the field as it relates to Thermo-Lag may also be a concern for testing for other types of material. That is explicitly a part of the staff's action plan to get its arms around the scope potentially of this problem. We expect to complete that portion of the review fairly quickly and intend to have our own programmatic internal review completed by January.

The second element relates to the comments on acceptance criteria. A key element in this action plan which is in phase one of the plan is to develop better definitive guidance for what would be acceptable to the regulator for this application, whether it is some temperature greater than 325, whether it's application specific, and to identify those cases where we would want to see and review the

specifics because it may be a close call or others which may be clearly acceptable and would not require prior NRC review. Those two elements we are giving priority to in our plan that we have that's been approved within NRR.

CHAIRMAN SELIN: I sincerely hope that the licensees and NUMARC and everybody understands that these compensatory measures are deadly serious, and I choose these words very carefully. The longer it takes to get the generic letter done and the testing done, the longer these unusual measures, expensive, time-consuming measures will have to be relied on. And that's in nobody's interest, but it may take awhile. Our inspection program will have to treat these as fire barriers, if you will. But these are not just easy measures to get over a difficult situation.

I'm impressed more than I'd expected with the thoroughness of the testing work, but I'm more impressed also with the amount of time that the industry, the licensees may be faced with these compensatory measures. They're clearly not going to be cleared up overnight.

MR. TAYLOR: That's why we looked to the industry working on this subject pretty hard with the

staff. That's really what this is about.

CHAIRMAN SELIN: Commissioner Rogers?

COMMISSIONER ROGERS: Yes. I'd like to take a little different tack here. I think it is deja vu all over again in some ways. I don't have any concern really that the staff won't very assiduously pursue all issues here with respect to the fire protection. But I think that what I'm concerned about is because of the sensitivity of this kind of an issue, and we're all concerned about fire, that we also look very carefully at what we come up with here as it effects the overall safety of the plant. It's very easy to get carried away. We know that in some instances improving fire protection has made it more difficult to maintain systems and inspect systems, and perhaps has, in fact, degraded overall safety even though it's improved fire safety. I would sound a little different note here, that in this assessment of our fire protection program that we pay particular attention to the impact that whatever we do on the overall safety of the plant not imply the fire safety of the plant, which we're all concerned about. I'm not trying to minimize that, but I think it's very easy to forget when you're pursuing one particular objective that you may be degrading other important

aspects of the plant. I would just sound that note again.

DOCTOR MURLEY: That's a very good point. We're face here though with a specific weakness and a specific material.

COMMISSIONER ROGERS: Oh, absolutely.

DOCTOR MURLEY: And its application and we have to deal with that. Your point is well taken, that we shouldn't go overboard with another kind of requirement on top of this.

DOCTOR THADANI: If I may just make a comment, Commissioner Rogers. In fact, we have in our action plan explicitly called out that that be considered. Safety significance the elements we're talking about and that's in the overall context. That's laid out in the action plan.

COMMISSIONER ROGERS: Good.

The question of these compensatory actions though, how do they -- is there a concern about the need for some specific exemptions to pursue those as deviations from Appendix R? Do we have to explicitly give an exemption that allows a deviation from the specific requirements of Appendix R?

MR. MIRAGLIA: In the implementation of Appendix R or within the context of the licensing to

the facility, it's either within the tech specs or the fire protection plan for the facility. It does recognize that certain barriers could be degraded and it does call for certain actions consistent with their tech specs or within the context of their fire protection plan. It does say if these barriers or these systems are degraded, these are the compensatory measures that one puts in place. So, it was contemplated in the initial formulation to the program.

Some relief in terms of the compensatory measures, as I indicated, may say fire watches. In some instances, utilities have said, "This is a high radiation area. Because of the radiation and safety concern, I don't want to mount a fire watch. I cannot institute that fire watch at this period of time. I'd like to modify my tech spec program to say rather than fire watch in this area closed circuit TV." We have been working with the utilities that have those unique instances to modify the tech specs or they've been making the changes consistent with their fire protection programs.

COMMISSIONER ROGERS: The Bulletin 92-01, that hasn't been out more than about a month, but have you gotten anything back on that that is particularly

useful in the way of responses?

MR. MIRAGLIA: As I said, I think the 30 day period from the date of the bulletin was last Friday. The latest count that we had, which was probably just before we came down here, shows about 20 to 25 utilities. So, that's about half of the sites that have this material have responded. The bulk of those responses indicate that they have mounted compensatory measures, fire watches, and in some instances they've indicated that they have provided closed circuit TV for certain areas.

So, they are responding to the bulletin and mounting the compensatory measures, have not provided additional insights relative to some of the concerns raised, although it's very, very early. The responses haven't been fully reviewed.

COMMISSIONER ROGERS: Thank you.

COMMISSIONER CURTISS I just have two or three specific questions, really no general observations to make. Have the licensees been asked to determine or are they going through the process of evaluating whether they have installed the material in accordance with the vendor's instructions?

MR. MIRAGLIA: That is an element that was in the draft generic letter. So, the issue has been

out there. In addition, there were information notices to the effect of the importance of the installation procedures. So, as a result of the bulletin, the answer is no, but the issue is out there and the industry is aware of the concerns relative to the importance of installation procedures.

COMMISSIONER CURTISS: Okay. Then the only questions that I have at this point rest on the premise that the material was installed correctly. If you -- based upon the tests that you've done and the information that you have, are there specific configurations, and again assuming proper installation of the material in accordance with the vendor instructions, where the configuration you know today would be unacceptable?

MR. MIRAGLIA: I think those configurations that are identified in the bulletin, we're saying large cable trays based on the information to date, and small conduits, we have concerns about those and that's why we've asked for compensatory measures in those instances.

COMMISSIONER CURTISS: And for those configurations, I guess the question now is what to do with respect to the configuration if we've determined that it's unacceptable. Compensatory

measures obviously fill the gap, but some action needs to be taken to address those situations.

MR. MIRAGLIA: Yes, sir. And there's testing. Texas Utilities has done some testing with enhanced installation techniques and the like to try to demonstrate that suitable performance can be shown for those configurations.

COMMISSIONER CURTISS: Okay. On the other end of the spectrum, are there specific configurations, and again assuming proper installation, that you've found that would be acceptable that are not problematic?

MR. MIRAGLIA: That we could say at this time clearly meet all acceptance criteria that are specified in the regulations, I guess we would say no. However, based on the questions --

MR. RUSSELL: We have questions essentially on all the testing to date.

COMMISSIONER CURTISS: All configurations. Okay. I don't have any other questions.

CHAIRMAN SELIN: Commissioner Remick?

COMMISSIONER REMICK: Do we have any knowledge or concerns about this material and its application over periods of time? In other words, aging effects. I'm thinking particularly of the joint

seal material and so forth. Do we have any knowledge of how that years later, even if properly installed, whether it stands up to just aging effects?

MR. MIRAGLIA: That has not been identified as a concern. Most fire protection programs have some surveillance kinds of measures requiring inspection of systems and the like. I'm not quite sure what that would involve for barrier material. Maybe Ashok or Pat could elaborate on that.

MR. RUSSELL: I'd like to add I'm not able to answer the question on aging. I'm more concerned about the effects of damage by working on equipment in the area, people standing on lagging insulation, breaking it, damaging it because the seams and the gaps --

COMMISSIONER REMICK: I was including that in my concept of aging.

MR. RUSSELL: -- are very much of concern, as we saw with essentially new installations going through the test. If someone is standing on it, hitting it with the tool or device, the physical deterioration of the barrier would be of concern.

COMMISSIONER REMICK: Yes. Okay. I think I know the answer to this question, but do we have any case of an actual fire in one of our plants where this

material has actually be tested and demonstrated that it did or did not meet the requirements?

MR. MADDEN: An actual fire in the plant? No.

COMMISSIONER REMICK: Yes. Okay. One, I want to add to the Chairman's comments, applaud the staff for the effort that you have underway. In doing that, I certainly agree with Commissioner Rogers' observation. At the same time, I must say that if there's anybody doubts the urgency of moving ahead, I suggest that you recommend to them that they go see the Vandellos plant in Spain. It certainly brought home to me, as I said, the importance of separation of safety functions and equipment qualification.

For those who might not be familiar with that, that was a simple case of a turbine throwing a blade, vibrating, as a result some hydrogen lines and oil lines break, a hydrogen fire which set the oil on fire. The oil went down around the condenser area. They had some rubber expansion joints which burned out, so they ended up with an internal flood on which the burning oil spread throughout the building. There were safety systems that were wiped out. In fact, it's just purely through luck that it didn't wipe out all the blowers for that gas reactor which could have

led to reactor safety questions.

So, it brought home to me the things that you fellows have been working on for years, the importance of some of those things. If anybody doubts the importance of what can be done to cabling by oil fires and so forth, why it's pretty shocking to see. You might suggest they go see that.

DOCTOR MURLEY: If I may comment on that. Bill Russell and I and Jack Martin and some of our staff did spend a day touring that plant I guess about two years ago. Since we've come back, we have been looking and have been sensitive to the kinds of failure modes. The oil floated on top of the fire and carried the fire through various parts of the plant that were undreamed of.

COMMISSIONER REMICK: That's right.

DOCTOR MURLEY: So, we are very sensitive to that.

COMMISSIONER REMICK: Yes. Good.

MR. RUSSELL: In fact, we have initiated a study of that fire as it relates to implications with respect to what actions we've taken under Appendix R and I think the most important lesson learned is the need for the responsiveness of the fire brigade for big fires in what I will characterize as

the portions of the plant which may not be defined within the scope of Appendix R for safe shutdown of one train, but which if out of control could potentially migrate or go to other areas.

COMMISSIONER REMICK: Absolutely.

CHAIRMAN SELIN: Commissioner?

COMMISSIONER de PLANQUE: I have just one question. In terms of future testing, are you at the point where you're able to define the whole suite of tests that you intend to do or is that going to be an iterative process as you get results?

MR. MIRAGLIA: I think with respect to the NRC program, we're looking at -- the focus is on logic configurations because it does appear to be configuration dependent, particularly when there is large unsupported sections and segments of this material and that's our focus right now. In addition, we hope that the industry working in concert could cover the array of the multiple configurations. As the Chairman pointed out, these plants are not standardized. Can we cover the array of configurations out there in an efficient and effective way?

MR. RUSSELL: I think the answer also somewhat depends upon the results of the tests. In

addition, I would characterize the programmatic look-back that I suggested. There may be other materials where we have similar questionable results that may indicate a need for some testing and we should have a feel for that so that there may be a reason to expand the scope.

COMMISSIONER de PLANQUE: Okay. Thank you.

CHAIRMAN SELIN: I'd like to thank you very much.

I also would like to make one other observation. That is I am impressed, not favorably, with the number of parties who are scurrying for cover when this comes up. There are a lot of contractors, vendors, et cetera, that will be involved in this and I would admonish all of them to cooperate fully and try to get the safety questions settled. The question of who shot Cock Robin we can worry about later.

There's a letter in front of us from Leonard Bickwit on behalf of Thermal Science which basically -- you know, it's a fine thing of saying it's all somebody else's fault. That's not the question right now. The question is what is the safety situation and what can be done about it. I'm sure there will be plenty of situations later on where

we could find that this party or that party could have avoided some of these risks if they've taken strong steps. But the reliance on these compensatory measures, I certainly feel much more comfortable having gone through the session about them, but this is not a satisfactory long-term solution.

I would just use this as an opportunity to talk to all the parties who are involved, each licensee, each vendor, each testing organization, to ask for as much cooperation as possible to try to find out what the facts are and not whose fault it is. I'm sure there's fault for everybody to go around.

Thank you. A very good, very professional, very thorough presentation. Thank you very much.

(Whereupon, at 3:38 p.m., the above-entitled matter was concluded.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON STATUS OF STAFF EFFORTS TO RESOLVE Thermo-Lag FIRE BARRIER ISSUES

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: JULY 30, 1992

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: Peter Lynch

THERMO-LAG 330
FIRE BARRIER SYSTEMS

TECHNICAL ISSUES
AND
NRC ACTIONS

COMMISSION BRIEFING
JULY 30, 1992

OVERVIEW

- BROWNS FERRY FIRE - SAFE SHUTDOWN IMPROVEMENTS
- HISTORY OF THERMO-LAG FIRE BARRIERS
  PROBLEMS
- NRC ACTIVITIES
- RECENT THERMO-LAG TESTING
- STATUS
  NRC ACTIONS
  FUTURE PLANS

BACKGROUND
FIRE BARRIER SEPARATION

1975 BROWNS FERRY FIRE RESULTED IN THE NRC TAKING ACTIONS TO IMPROVE FIRE PROTECTION FOR SAFE SHUTDOWN FUNCTIONS

NRC'S "DEFENSE–IN–DEPTH" FIRE PROTECTION PROGRAM RELIES ON PROTECTING SAFE SHUTDOWN FUNCTIONS BY CREATING A BALANCE IN .....

- FIRE PREVENTION ACTIVITIES;
- ABILITY TO RAPIDLY DETECT, CONTROL, AND SUPPRESS A FIRE; AND
- FIRE SEPARATION OF REDUNDANT SAFE SHUTDOWN FUNCTIONS

WEAKNESSES IN ANY ONE AREA CAN BE COMPENSATED BY ENHANCING THE PROTECTION CAPABILITIES OF THE REMAINING AREAS

SAFE SHUTDOWN FUNCTIONS SEPARATION/PROTECTION METHODS

METHODS (USING FIRE BARRIERS) FOR PROTECTING SAFE SHUTDOWN FUNCTIONS FROM FIRE:

- SEPARATION OF FUNCTIONS BY A 3–HOUR FIRE RESISTIVE BARRIER; OR

- SEPARATION OF FUNCTIONS BY A 1–HOUR FIRE RESISTIVE BARRIER WITH AUTOMATIC FIRE DETECTION AND SUPPRESSION CAPABILITY INSTALLED IN THE AREA OF CONCERN.

THERMO-LAG 330
FIRE BARRIER SYSTEMS

THERMO–LAG FIRE BARRIER SYSTEMS (1 AND 3 HOUR) USED.....

- TO PROTECT ELECTRICAL RACEWAY (CABLE TRAYS, CONDUITS, JUNCTION BOXES, etc.)
- AS FIRE WALLS AND CEILINGS TO SEPARATE FIRE AREAS
- AS ENCLOSURES TO SEPARATE EQUIPMENT FROM THE REDUNDANT SAFE SHUTDOWN TRAIN

HISTORY

* RIVER BEND LICENSEE EVENT REPORTS
  MARCH 1987 - FIRE BARRIER CONSTRUCTION DEFICIENCIES
  APRIL 1989 - REMOVAL OF RIBS AND STRESS SKIN
  MARCH 1990 - HOLES, CRACKS, UNFILLED SEAMS

* OCTOBER 1989 - RBS SwRI 3-hr TEST
  30" CABLE TRAY FAILURE < 1 HOUR

* FEBRUARY 1991 - ALLEGATIONS RECEIVED

* MAY 1991 - NRC SITE VISIT TO RBS

* JUNE 1991 - SPECIAL REVIEW TEAM ESTABLISHED

* OCTOBER-DECEMBER 1992 - SRT SITE VISITS: 5 PLANTS

* DECEMBER 1991 - TSI VENDOR INSPECTION

* FEBRUARY 1992 - SRT FINAL REPORT/DRAFT GENERIC LTR

SPECIAL REVIEW TEAM PERSPECTIVE

NRC/NRR SPECIAL REVIEW TEAM CONCLUDED THAT THE FIRE ENDURANCE PERFORMANCE OF THERMO–LAG FIRE BARRIER SYSTEMS WAS INDETERMINATE.

THERMO-LAG FIRE BARRIERS PROVIDE SOME LEVEL OF FIRE PROTECTION. SAFETY SIGNIFICANCE LOW CONSIDERING THE ADEQUACY OF REMAINING PLANT FIRE PROTECTION FEATURES (e.g., FIRE BRIGADE, AUTOMATIC FIRE DETECTION AND SUPPRESSION, CONTROL OF FIRE HAZARDS, AND GENERALLY LOW FIRE LOADINGS).

GENERIC LETTER PROPOSED TO DEAL WITH ISSUES

GENERIC LETTER ISSUES

* FIRE ENDURANCE TESTING AND APPLICATION OF TEST RESULTS

* DEFICIENCIES IN THE INSTALLATION AND QC INSPECTION PROCESS

* AMPACITY DERATING DESIGN BASIS

CABLE TRAY FIRE BARRIER QUALIFICATION ACCEPTANCE CRITERIA

APPENDIX R, SECTION III.G.1.a, FIRE PROTECTION OF SAFE SHUTDOWN CAPABILITY, REQUIRES ONE TRAIN FREE OF FIRE DAMAGE

FIRE BARRIERS RELIED UPON TO PROTECT SHUTDOWN RELATED SYSTEMS HAVE A FIRE RATING OF 1– OR 3- HOURS

CABLE TRAY FIRE BARRIERS SHALL MEET RQMTS OF ASTM E-119, (NFPA 251) INCLUDING HOSE STREAM TEST (APPENDIX A TO BTP APCSB 9.5.1, SECTION 3.D.3(d))

SRP 9.5.1 DEFINES FIRE BARRIERS AS THOSE RATED BY APPROVING LABORATORIES; FIRE RESISTANCE RATINGS ESTABLISHED PER TEST PROCEDURES OF NFPA 251 (see note)

SILENT ON CABLE TRAY APPLICATION - USE NON-LOAD BEARING WALL (GL86-10, 3.2.1)

CABLE TRAY FIRE BARRIER QUALIFICATION ACCEPTANCE CRITERIA (CONT.)

NFPA 251 REQUIRES:

– NO PASSAGE OF FLAME THROUGH THE BARRIER

– TRANSMISSION OF HEAT THROUGH THE BARRIER TO THE UNEXPOSED SURFACE OF THE BARRIER SHALL NOT EXCEED 250 F ABOVE AMBIENT, AND

– HOSE STREAM TEST; THE BARRIER IS CONSIDERED TO FAIL IF THE STREAM CREATES AN OPENING AND ALLOWS WATER TO PENETRATE THE BARRIER.

NRC GENERIC LETTER 86–10, RESPONSE TO QUESTION 3.2.1 FOR CABLE TRAY FIRE BARRIER COLD SIDE TEMPERATURE CRITERIA, IDENTIFIES NFPA 251 CRITERIA AS BEING ACCEPTABLE TO DEMONSTRATE FIRE RATINGS

- 325 F DERIVES FROM 75 F AMBIENT PLUS 250 F RISE

- MEET 325 F CRITERIA OR PROVIDE JUSTIFICATION

- JUSTIFICATION CAN BE BASED ON TEMP SUFFICIENT < IGNITION TEMP

RECENT THERMO-LAG FIRE TESTING ACTIVITIES

JUNE 9, 1992

THERMAL SCIENCE, INC.

1 HOUR TEST OF ENHANCED 36 INCH TRAY
(INDETERMINATE – HOSE STREAM, TEMPERATURE)

JUNE 17–24, 1992

TU ELECTRIC (COMANCHE PEAK)

1 HOUR TESTS OF PLANT SPECIFIC APPLICATIONS

CONDUIT CONFIGURATION (3/4–, 1– AND 5–INCH)
(FAILED – THERMAL DAMAGE TO CABLES, 3/4 & 1 INCH)
(INDETERMINATE – CONDUIT SUPPORTS, HOSE STREAM, TEMPERATURE)

12–INCH WIDE CABLE TRAY
(INDETERMINATE – TRAY SUPPORTS, HOSE STREAM, TEMPERATURE)

RECENT THERMO-LAG FIRE TESTING ACTIVITIES - CONT.

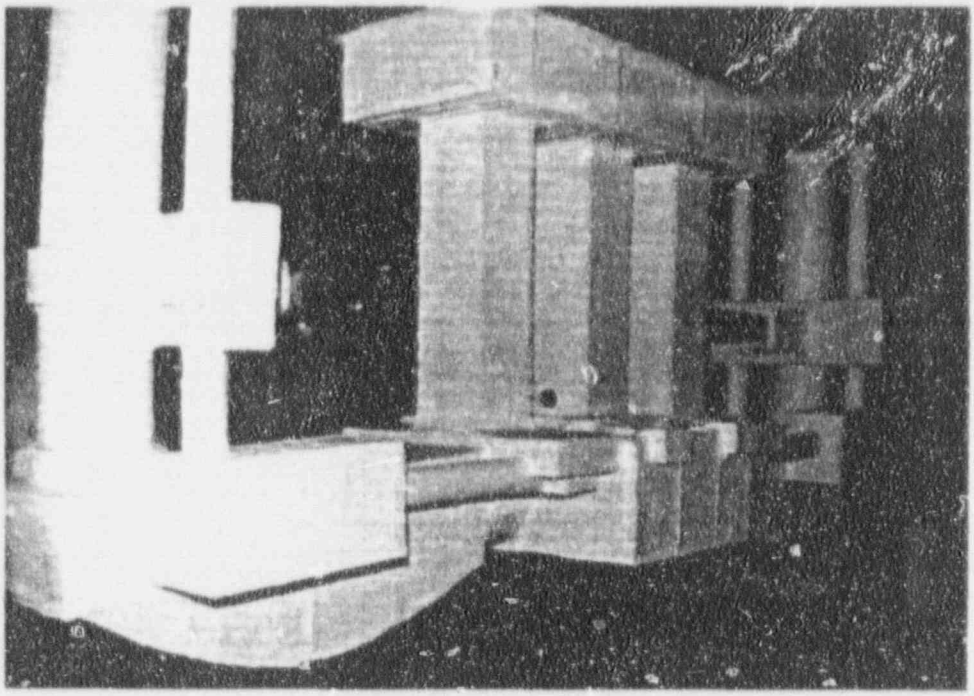
TU ELECTRIC TESTING CONTINUED

1 HOUR TESTS OF PLANT SPECIFIC APPLICATIONS

30–INCH WIDE TRAY
(FAILED – FAILURE OF JOINT AND SEAM, FIRE DAMAGE TO CABLES)

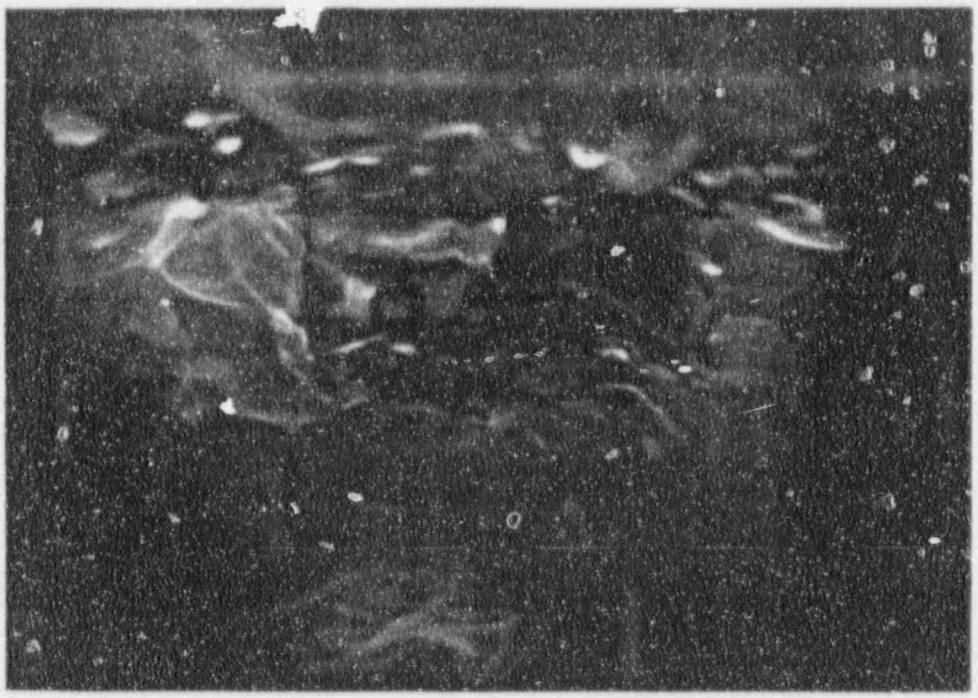
36–INCH WIDE CABLE TRAY (ENHANCED DESIGN)
(INDETERMINATE – TRAY SUPPORTS, HOSE STREAM, TEMPERATURE)

CABLE TRAY FIRE STOP
(INDETERMINATE – TEMPERATURE RISE, TEST CONFIGURATION - VERTICAL RUN, HOSE STREAM)

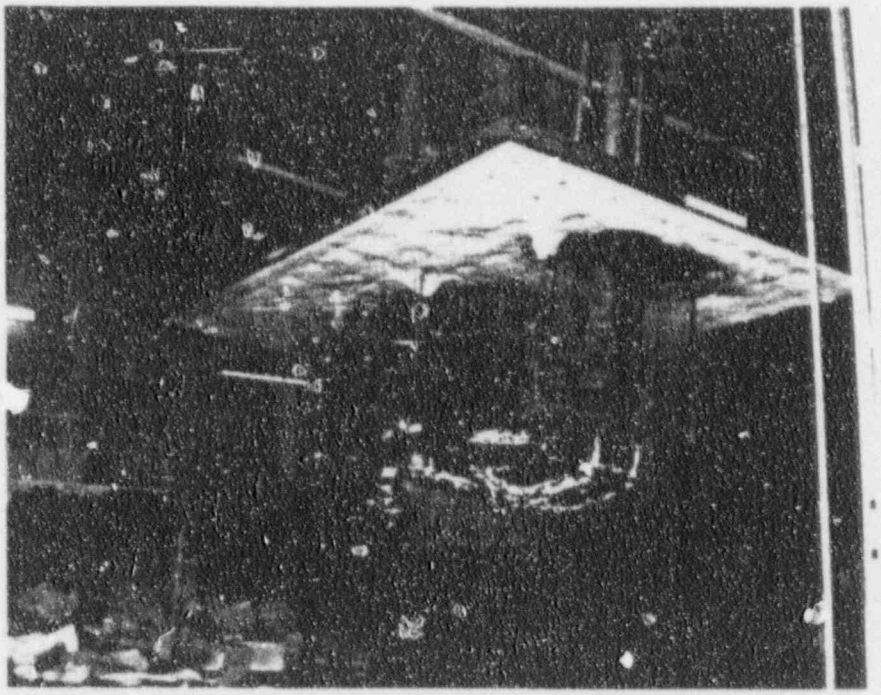


Multi-conduit assembly prior to fire endurance testing.

Multi-conduit assembly "on fire".

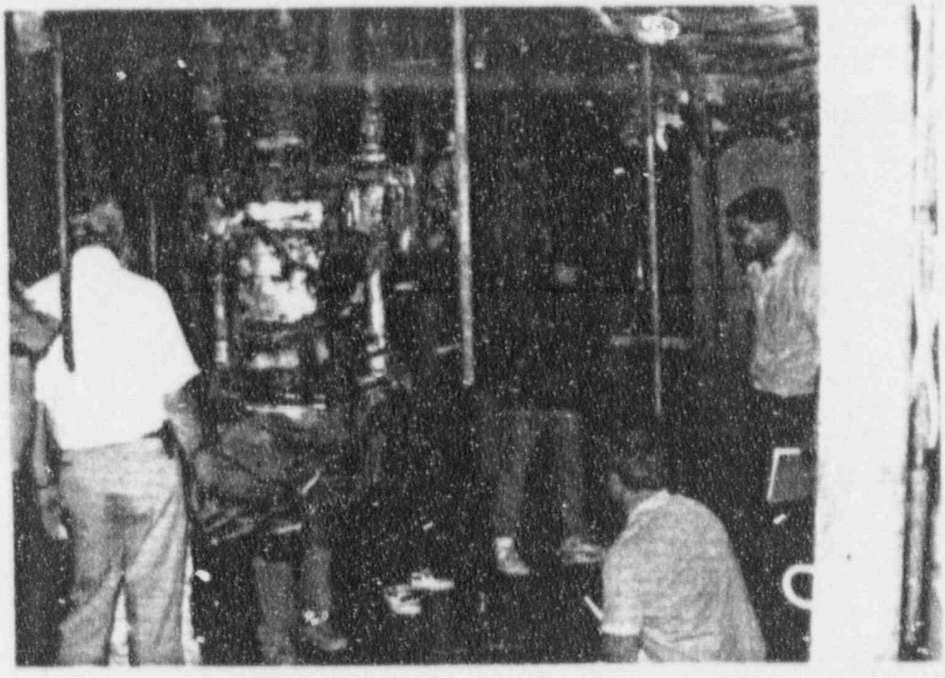


Combustibility of Thermo-Lag - Junction box burning.

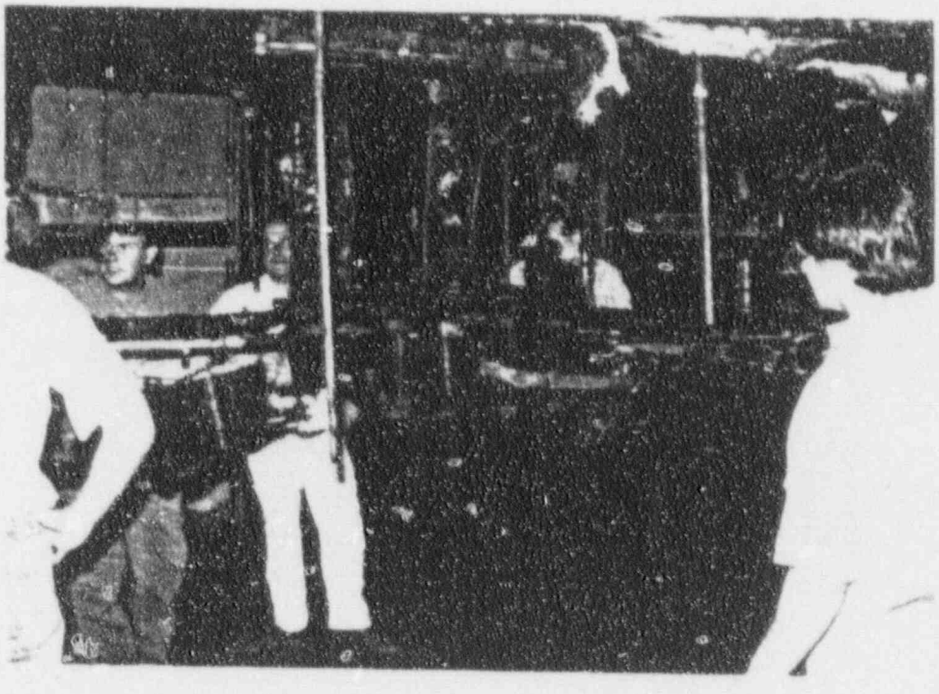


Multi-conduit assembly still burning.

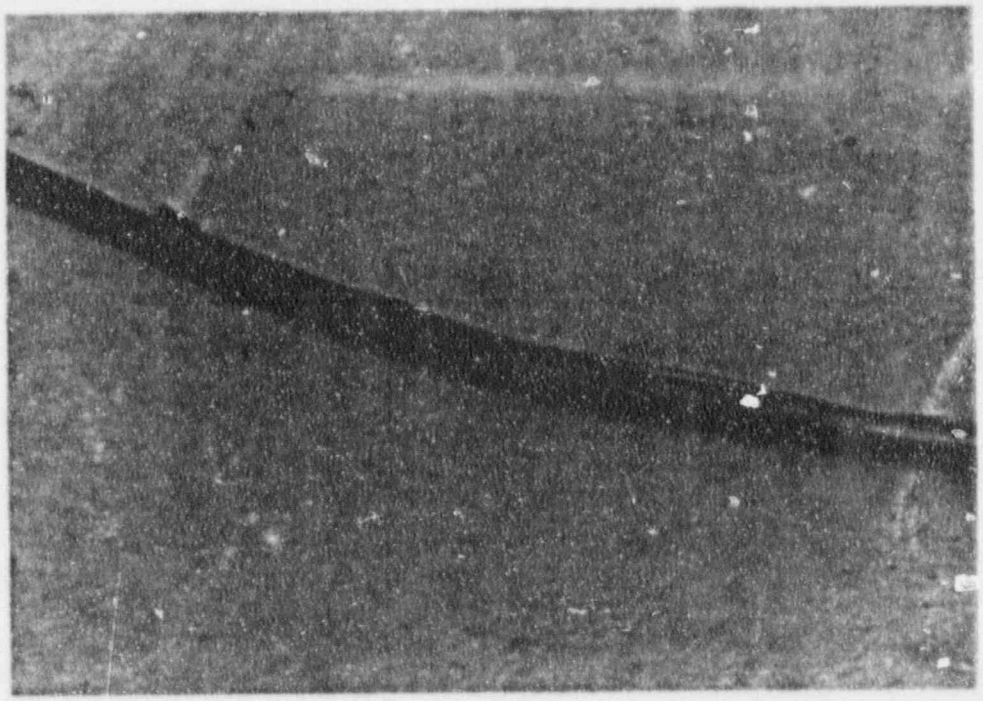
Prior to water hose stream test.



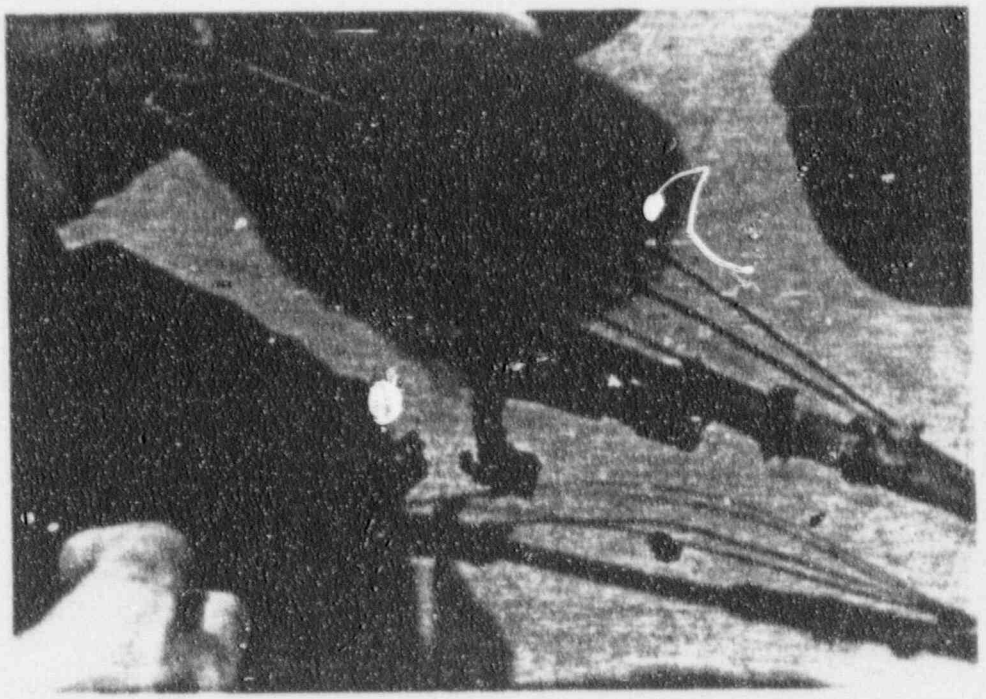
Multi-conduit assembly after water hose stream test.



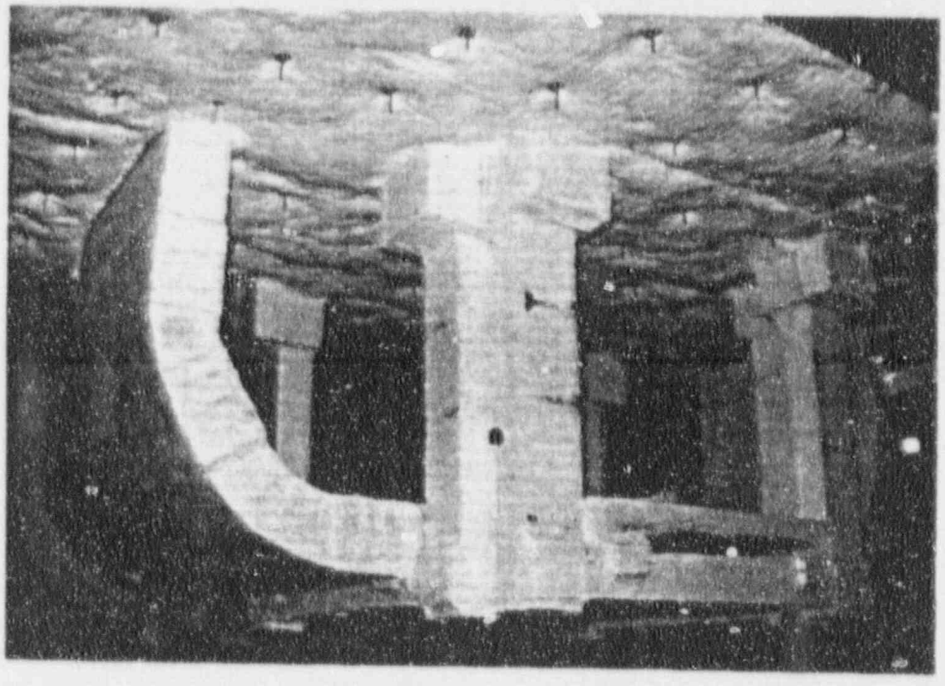
Visual damage to Thermo-Lag. Seams, joints, structural integrity, etc.



3/4" conduit cable thermal degradation.



Cable "brittleness".

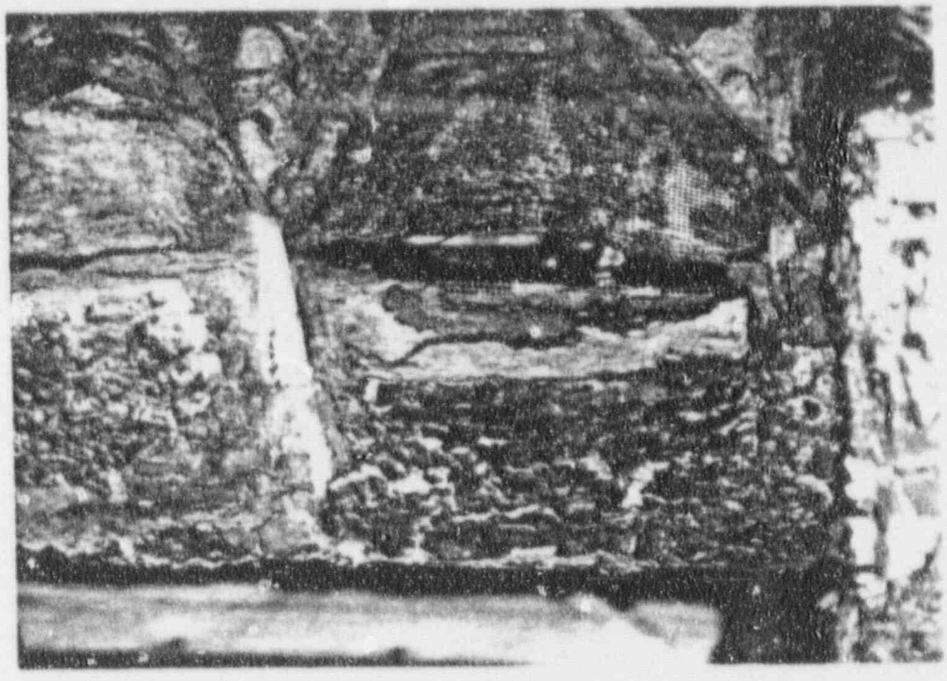


30" cable tray.

Cable tray during fire endurance testing.

Thermo-Lag fire barrier initial failure at joint.

30" cable tray failure at seam.



After fire test (no hose stream test performed)

seam damage.

Joint next to support failed. Temperature rise inside

cable tray in excess of 781° F.

RECENT THERMO-LAG FIRE TESTING ACTIVITIES - CONT.

JULY 15 AND 17, 1992

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

1–HOUR PANEL TEST
(FAILED – SURFACE TEMP. GREATER THAN 325 F IN 22 MINUTES, SURFACE TEMP. 572 F IN 40 MINUTES, BURN THROUGH IN 46 MINUTES)

3–HOUR PANEL TEST
(FAILED – SURFACE TEMP. GREATER THAN 325 F IN 2 HOURS AND 20 MINUTES, SURFACE TEMP 403 F AT 3–HOURS)

RECENT NRC ACTIONS

RECENT FIRE ENDURANCE TESTING CONFIRMED THAT CERTAIN THERMO-LAG FIRE BARRIER CONFIGURATIONS COMPROMISE THE FIRE PROTECTION "DEFENSE-IN-DEPTH" FUNCTION.

NRC BULLETIN 92-01, "FAILURE OF THERMO-LAG 330 FIRE BARRIER SYSTEM TO MAINTAIN CABLING IN WIDE TRAYS AND SMALL CONDUITS FREE FROM FIRE DAMAGE," ISSUED JUNE 24, 1992

THIS HAS RESULTED IN THE NEED TO ESTABLISH COMPENSATORY MEASURES (e.g., FIRE WATCHES)

COMPENSATORY MEASURES

COMPENSATORY MEASURE FUNCTIONS ARE TO .....

- MINIMIZE FIRE HAZARD CONDITIONS WHICH CAN CHALLENGE THE LIMITED FIRE ENDURANCE ABILITY OF THE BARRIER; AND

- PROVIDE EARLY DETECTION, NOTIFICATION, AND VERIFICATION OF A FIRE CONDITION.

CONTINUED PLANT OPERATION WITH THERMO-LAG FIRE BARRIERS

FIRE HAZARD ANALYSIS DEMONSTRATE LOW COMBUSTIBLE LOADINGS FOR MOST FIRE AREAS

FIRE RATING	LOADING (BTU's/SQ FT)
1-HOUR	80,000
3-HOUR	240,000

TYPICAL PLANT LOADINGS;	(BTU's/SQ FT)
BATTERY ROOM	32000
SWITCHGEAR ROOM	24000
DIESEL GENERATOR ROOM	112000

BARRIERS PROVIDE SOME RESISTANCE

COMPENSATORY MEASURES ENHANCE FIRE PREVENTION, DETECTION, CONTROL, AND SUPPRESSION

FIRE PROTECTION PROGRAM IS BASED ON DEFENSE-IN-DEPTH APPROACH - THE OVERALL PROGRAM PROVIDES REASONABLE LEVEL OF FIRE SAFETY

STAFF ACTIONS
THERMO-LAG

- ISSUED FOUR INFORMATION NOTICES TO INDUSTRY
- COMPLETED SPECIAL REVIEW TEAM REPORT
- DRAFTED A GENERIC LETTER
- ISSUED A BULLETIN
- DEVELOPED ACTION PLAN TO COORDINATE FUTURE STAFF ACTIONS

  1. IDENTIFICATION, COORDINATION, AND RESOLUTION OF TECHNICAL ISSUES WITH INDUSTRY
  2. NRC TESTING OF THERMO–LAG FIRE BARRIER MATERIAL
  3. DEVELOPMENT AND IMPLEMENTATION OF A COMPREHENSIVE INSPECTION PROGRAM
  4. DST ASSESSMENT OF NRC'S FIRE PROTECTION PROGRAM

Statement of Leonard Bickwit, Jr. on Behalf
of Thermal Science, Inc.

The position of Thermal Science, Inc. on the recent developments regarding Thermo-Lag 330 remains the same as it has been throughout the current controversy. The company has no reservations whatever that its material will perform its functions safely and effectively if properly installed and if used in configurations for which it was tested when supplied to the company's customers. The company has never represented that the material will work in every possible configuration. The company wishes to underscore once again that it will work in tested configurations if properly installed.

Nothing in the recent tests suggests a contrary conclusion. The Comanche Peak tests of previously tested configurations again established the effectiveness of the material. The test failures at Comanche Peak were of configurations that had not been previously tested. Those test results did not conflict with the company's expectations regarding the material or with any representations of the company concerning those expectations. The company has not yet received the data from the Gaithersburg tests, but its reaction to what it has learned through the media is that the tests do not in any way alter the company's position with regard to its material.

In sum, Thermo-Lag is a product that has performed effectively over the years in a wide range of commercial applications, and the company is entirely comfortable that it

will continue to do so under the conditions it is designed for. The company will continue to cooperate with the NRC and the industry to resolve the current controversy.

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July 30, 1992