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June 9, 1984
5211-84-2141

Office of Nuclear Reactor Regulation
Attn: John F. Stolz, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Stolz:

Three Mile Island Nuclear Station, Unit I, (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
TMI-1 Fire Proof Cable Test Program - Test Reports

- References:
- 1) Underwriters Laboratories Inc. Report File R10925-1,
"Report on Fire Resistant Cables", dated April 10, 1984
 - 2) GPUN Letter 5211-83-324, dated November 30, 1983.
 - 3) NRC Letter, from John F. Stolz to GPU Nuclear Corporation,
"TMI-1 Fireproof Cable Test Program", dated March 15, 1984.

GPU Nuclear Corporation sponsored the development and testing of a fireproof cable by the Rockbestos Company. The intent of the program was to develop a fire-rated cable as an alternative to installation of one hour fire barriers to meet the requirements of 10 CFR 50, Appendix R. Fire-rated cable represents a practical alternative for providing levels of fire protection equivalent to the methods listed in 10 CFR 50, Appendix R, Section III.G.

Enclosed is a copy of the independent test report, "Report on Fire Resistant Cables". by Underwriters Laboratories Inc., (Reference 1) for your review and evaluation.

The test program was submitted to the NRC by Reference 2. The comments in Reference 3 were discussed with GPUN prior to the initial testing on February 21, 1984 and are described in Attachment 1. GPUN believed many of the concerns expressed in Reference 3 have been addressed by one of the following:

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- 1) The methods by which the testing was performed (e.g., distributed flame during the oven exposure; additional fire hose exposures).
- 2) The subsection of sheathed fireproof cables to mechanical stresses during the full scale testing.
- 3) Performance of a small scale test using 450 V AC to simulate the actual voltage stress conditions.

It should be noted that the full scale test period was extended from the planned 80 hours to 94 hours.

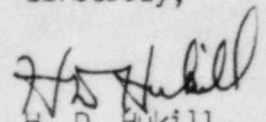
In addition, the Rockbestos cable was tested by VTEC Laboratories on January 16 and 17, 1984, for performance at high voltage after a one hour exposure fire and water hose stream test. A copy of this test report is also enclosed for your review.

Based on the testing to date, the Rockbestos Company is developing engineering data which will allow designers to properly size each application of fireproof cable to provide acceptable circuit performance during a one hour fire exposure (ASTM E-119). GPUN will provide a specific exemption request for each application of fireproof cable at TMI-1. The use of fireproof cables in lieu of one hour fire barriers or radiant energy heat shields at TMI-1 will be subject to the following guidelines:

- 1) Fireproof cables may be used for safe shutdown circuits inside containment in lieu of radiant energy heat shields.
- 2) Fireproof cables may be used for safe shutdown circuits in lieu of protection of such circuits by one hour fire barriers in locations protected with fixed automatic fire suppression and detection systems.
- 3) Locations for the use of fireproof cables for safe shutdown circuits in lieu of one hour fire barriers for protection of such circuits will be as follows: a) circuits which will be required only during hot shutdown and cooldown; b) circuits required for hot shutdown, cooldown and cold shutdown for which one train can be repaired within 72 hours. All other circuits required during cold shutdown will be rerouted, protected with fire barriers or repaired within 72 hours.

It is requested that the NRC review the report enclosed as GPUN is proceeding with the design modification based on the guidelines discussed above.

Sincerely,


H. D. Hukill,
Director, TMI-1

HDH/MI/mle
Attachment (1)
Enclosures (2)

cc: J. Van Vliet
D. Kubicki
V. Benaroya

Attachment 1

GPUN response to NRC comments listed in NRC letter dated March 15, 1984, entitled "TMI-1 Fire Proof Cable Test Program".

Comment #1: The test program gives no consideration to the effects of collapsing cable trays or other debris that might be generated during an actual fire in the plant. This consideration is the same, of course, as for one hour enclosures and cable wraps. Under postulated fire conditions in the plant, temperatures would rise to such a levels that cable trays, HVAC ducts, lighting fixtures and other such physical features could be damaged to the point of collapse. If such features were located in the proximity of the fire rated cable, collapsing debris would likely cause significant damage and might affect continued cable operability. This would have to be considered for each use on a case-by-case basis.

Response: The supports for tray and conduit in the test configuration were fireproofed to prevent their collapse, as the prime purpose of the test was to evaluate cable performance under fire conditions in trays and in conduit.

However, this concern will be addressed in the following manner:

- a. In areas which are protected by area wide automatic fire suppression systems, an exemption from the requirement to fireproof supports for cable raceways containing the proposed cable as well as any services whose collapse could cause failure of the proposed cable will be requested. The exemption will take credit for the ability of the aforementioned suppression system to extinguish any postulated fire promptly, thus preventing temperatures in the area from rising to the point where failure of any supports can occur. This should permit use of the proposed cable in existing trays (if physically possible) and will not place restrictions on the routing of any new conduits intended to contain rerouted circuits.
- b). In areas which are not protected by area wide automatic suppression systems, it is expected that any safe shutdown circuits in cable trays will be rerouted to new conduit. Rockbestos cable will be run in the conduit, or standard cables will be run and the conduit protected by one hour fire barriers consistent with the criteria outlined in the cover letter for this attachment. New conduit will be routed as close as possible to the ceiling or wall in order to eliminate the potential for any collapsing debris to affect the rerouted conduit. In addition, GPUN is currently developing design details for conduit supports which, when analyzed, will be capable of retaining their structural integrity without the benefit of fireproofing.

This analysis will serve as the basis for an exemption from the requirement to fireproof supports for rerouted conduit containing the proposed cable in areas not protected by area wide automatic suppression system.

GPUN does not expect any exemptions will be required for utilizing the proposed cable in the Reactor Building. A request will be made to qualify the proposed cable as equivalent to radiant energy heat shields for use inside containment. Radiant energy heat shields are not one hour fire barriers, and as such, the cable raceways to which they are applied need not be additionally protected by fireproofing their supports. Therefore, no exemption requests will be required for unprotected steel supports inside containment.

Comment #2: The test program will not establish that the cable is "free of fire damage" per Appendix R. In fact, significant physical transformation/damage is likely to occur as a result of a fire. Consequently, fire rate cables will not literally comply with Section III.G.1.a of Appendix R.

Also, since the cable is not enclosed in a physical barrier which limits temperature rise on the non-fire-exposed side to not more than 250° F above ambient and otherwise protects the cable from the harmful effects of a fire, the tested cable will not literally comply with Section III.G.2.c of Appendix R, which pertains to fire barriers.

Response: There was no intent to establish the fact that the proposed cable was "free from fire damage". GPUN agrees that the fire rated cables do not literally comply with the requirements of Appendix R. The results of February 21, 1984, test demonstrated that the intended functional capability of the cables during and after fire exposure were met, thus representing an equivalent level of fire protection, and hence should be acceptable under the exemption process.

Comment #3: In the proposed application, the cable would be enveloped in flame, it is not clear that the first hour of the ASTM E-119 time vs temperature curve is conservative for this condition.

Response: GPUN believes that the qualification of fire rated cable must be against an acceptable industry standard. The test simulated fire conditions by utilizing the time vs. temperature curve as outlined in the ASTM E-119 test which is the same exposure to which cable raceway envelope systems have been exposed. The NRC recognized the ASTM E-119 Time vs Temperature curve as the basis for qualifying rated fire barriers; therefore, the test cable need not be exposed to more stringent fire exposure over a one hour time frame.

It should be noted, however, that during the actual test other cables in the tray were ignited thus causing a more severe fire condition than the ASTM E-119 time vs temperature curve. The performance of the Rockbestos cable was satisfactory.

Comment #4: During the tests the conductors are energized at 100 V AC; however, the cable will be used at higher voltages. Therefore, the test does not simulate the voltage stress, particularly the voltage transients of the actual installation due to switching and motor starting.

Response: Although the full scale test on February 21, 1984, was not run at rated voltage due to safety considerations, two (2) tests run before and after the full scale test in ASTM ovens demonstrated the test cable's ability to operate at well above rated voltage at the peak temperature. The results of these ancillary tests are contained in test report prepared by VTEC Laboratories and are also covered on page 32 of the U.L. test report.

Comment #5: The performance characteristics of the cable that are necessary for successful operation are not specified. The cable ratings are not specified.

Response: Additional cable data is included in the test report. Full cable specifications are being developed by Rockbestos and will be available to perform the necessary work.

Comment #6: "Wet short" post-fire conditions are not simulated; however, in the installation the damaged cables may be immersed in water for significant periods of time.

Response: The initial hose stream test which was required to last for 1-1/2 minutes continued on and off for approximately 45 minutes because of the violence and persistence of the fire in the cable tray caused by the fuel loading cables. Seventeen days after the test (400 hours), the cables were subjected to another hose stream application (note that cable in conduit is not impacted by the hose stream; this concern applies only to exposed cable in tray). The cables were then subjected to an AC hi-post test, during which they all supported 1000 volts AC with a combined charging/leakage current of less than 1 milliamper.

Comment #7: The thermal expansion forces under real fire conditions are not simulated.

Response: Thermal expansion forces under fire conditions will be addressed as follows;

- a. Where the proposed cable is routed in cable tray or conduit in locations protected by area wide fire suppression systems, thermal expansion will be addressed in exemption requests, but considered negligible since credit is taken for automatic suppression preventing a significant temperature rise as discussed previously.
- b. Where the proposed cable is routed in conduit in locations not protected by area wide automatic suppression (will not be run in cable trays in these areas), the design of supports not requiring fireproofing and the spacing of these supports as well as conduit runs, will account for thermal expansion forces. This will also serve as the basis for an exemption request from the requirement to fireproof supports in these areas.

Comment #8: The post fire mechanical forces due to firefighting and recovery operations are not simulated.

Response: Laboratory testing cannot accurately emulate post fire mechanical forces. However, the test did demonstrate that the cable can withstand considerable physical abuse since some of the cable trays did fail. In addition the cables were subject to repeated hose stream forces, which were required. Procedures will be developed for post-fire recovery based on the actual applications of the cable.

Comment #9: No post test assessment of the cables operability is included.

Response: The cable was tested for 94 hours during this mock up, though Appendix R allows repairs of cold shutdown equipment within 72 hours. The guidelines for the test as stated in this letter will assure operability of equipment until the necessary repairs of cold shutdown equipment can be performed. GPUN plans to replace the damaged circuitry prior to returning the plant to service should a fire occur.