

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



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Docket No.: 50-285

MEMORANDUM FOR: Gus Lainas, Assistant Director  
for Operating Reactors  
Division of Licensing.

FROM: William V. Johnston, Assistant Director  
Materials, Chemical & Environmental Technology  
Division of Engineering

SUBJECT: THREE MILE ISLAND 1 - FIRE PROOF CABLE TEST PROGRAM  
REVIEW (TAC #53363)

By letter dated November 30, 1983, the licensee proposed a test program on fire-rated cable. The results of the test program will subsequently be used to justify, in part, specific exemptions from the requirements of Section III.G of Appendix R to 10CFR50, pertaining to the installation of a one-hour fire barrier.

The licensee requested our comments on the test program and clarification of the requirements that the protected division be "free of damage" after a postulated fire.

Our evaluation of this information is attached. Based on our evaluation, we have a number of comments and recommendations on the test program.

*William V. Johnston*

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Enclosure:  
As Stated

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CHEMICAL ENGINEERING BRANCH/FIRE PROTECTION SECTION  
TMI-1 FIRE PROOF CABLE DEVELOPMENT AND TEST PROGRAM  
DOCKET NO. 50-285

Introduction

By letter dated November 30, 1983, the licensee requested that we review and comment on a draft copy of "Fire Proof Cable Development and Test Program" (to comply with the requirements of Appendix R to 10CFR50), dated 11/2/83. The results of the test program will subsequently be used, in part, to justify exemptions from the requirements of Section III.G of Appendix R, pertaining to the installation of a one-hour fire barrier.

Discussion

Section III.G of Appendix R stipulates that fire protection features provided for systems important to safe shutdown shall be capable of limiting fire damage so that: "one train of systems necessary to achieve and maintain hot shutdown conditions...is free of fire damage." Free of fire damage in this context means that the system or component is essentially unchanged. It is a state that the system would have been in if it had not been subjected to the damaging effects of a fire or fire fighting activities, including heat, other products of combustion and the fire suppressant. Intuitively, this implies that the system be capable of continuous successful performance during and immediately after a fire. Moreover, it should have the capability of continued successful performance for an indefinite period of time subsequent to the fire event so that there is reasonable assurance that safe shutdown conditions can be achieved and maintained.

Section III.G of Appendix R presents several fire protection configurations which will provide us with reasonable assurance that one shutdown division

will remain free of fire damage. One such configuration includes the installation of a one-hour fire rated barrier around one shutdown division. In lieu of providing such a barrier around one division of shutdown-related cable, the proposed fire test would demonstrate that fire rated cable can withstand test fire conditions and can remain functional for up to 80 hours.

#### Evaluation

The cable under development is designated as Rochester FWR-1 and FWRS-1. The insulation is a proprietary combination of inorganic materials which have been demonstrated to survive at least 1 hour under the temperature conditions as described by ASTM E-119. The jacket is a polymer which had demonstrated ability to survive a postulated LOCA.

The licensee intends to use this cable in lieu of the proposed 1 hour fire barrier in a location where:

- (a) Fire detection and suppression system protects the area, or
- (b) Where damaged redundant cable can be replaced in 72 hours.

Raceway and cable configurations, representative of what is to be installed in the plant, will be exposed to the standard ASTM E-119 time-temperature curve for a minimum of one hour. The cable tray/conduit configuration will be subjected to a hose stream test. Circuit integrity and operability will be demonstrated for 80 hours.

We have the following comments on the test program:

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. Under postulated fire conditions in the plant, temperatures would rise to such a level 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.

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 rated 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.

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-temperature curve is conservative for this condition.
4. During the tests the conductors are energized at 110V 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.

5. The performance characteristics of the cable that are necessary for successful operation are not specified. The cable ratings are not specified.
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.
7. The thermal expansion forces under real fire conditions are not simulated.
8. The post fire mechanical forces due to firefighting and recovery operations are not simulated.
9. No post test assessment of the cables operability is included.

#### Conclusion

The test program does not demonstrate that the cables will comply with the requirements of Appendix R. Therefore, these cables will not be acceptable in lieu of a one hour barrier in all locations.

If the ratings of the cable are specified and the tests program produces acceptable results, these cables may be considered under the exemption process for certain locations in conjunction with other fire protection.