ENCLOSURE

Safety Evaluation Report
GE Topical Report, NEDO-10466A Addendum 1
Power Generation Control Complex

Introduction

In Revision 2 of NEDO-10466A dated March 1978, General Electric recommended that a Halon 1301 fire extinguishing system would be required to protect the PGCC. The system would provide a 20 percent concentration of Halon 1301 for a soak time for 20 minutes for deep seated fires. The staff found it acceptable.

By letter dated February 28, 1985, General Electric submitted Addendum 1 to NEDO-10466A. General Electric requested deviations that would reduce the Halon 1301 concentration to be provided to protect the PGCC and the amount of soak time required. For PGCC's with 80 percent or greater Tefzel cable, General Electric requested that the concentration and soak time of Halon 1301 be changed to be surface burning fire concentration and soak time, i.e., 6 percent for 10 minutes.

Discussion/Evaluation

Based on testing and research performed on cable insulation since 1978, General Electric has reevaluated deep seated fires occurring in the PGCC. General Electric indicates that Figure 4.2 of NEDO-10466, Revision 2, Appendix F, shows that the rate and degree of burning of the Tefzel cable used in the PGCC essentially corresponds with that of the ignition source. Because of this, the key to limiting the severity of burning of Tefzel is in the capability of extinguishing the ignition source. If the ignition source is extinguished, the fire in the Tefzel will self-extinguish, almost simultaneously. Tefzel is a thermoplastic material, which means that as its temperature is raised it will melt before it burns, that is, the auto ignition temperature is higher than its melting temperature. This characteristic of melting before it burns ensures that burning can occur only at its surface as a liquid.

8508150408 850812
PDR TOPRP EMVGENE
C PDR

The surface burning characteristic of Tefzel have been substantiated in every fire test conducted by General Electric.

After reviewing the test results in Appendix F of NEDO-10466A, we agree with General Electric that Tefzel cable will exhibit surface burning characteristics and not deep seated. Therefore, the amount of Halon 1301 required to extinguish Tefzel cable fires should be based on surface burning fires in accordance with NFPA 12A, i.e., 6 percent for 10 minutes.

Based on the burning characteristics of Tefzel cable, fire test results in non-Tefzel cables, and NFPA for acceptance, for non-Tefzel cable we find that an automatic Halon 1301 extinguishing system with an adequate amount of Halon 1301 to achieve a 6 percent concentration for a 10 minute soak time will extinguish cable fires in PGCC's enclosures which contain 80 percent or greater by weight Tefzel cabling.

Conclusion

Based on our evaluation, we conclude that an automatic Halon 1301 extinguishing system with an adequate amount of Halon 1301 to achieve a 6 percent concentration for a 10 minute soak time will be acceptable for PGCC's which contain 80 percent or greater by weight Tefzel cabling. Therefore, we find General Electric's request for deviation from NEDO-10466A acceptable.

GENERAL ELECTRIC

NUCLEAR ENERGY BUSINESS OPERATIONS
GENERAL ELECTRIC COMPANY • 175 CURTNER AVENUE • SAN JOSE, CALIFORNIA 95125
MC 682, (408) 925-3392

MFN- 29-85

February 28, 1985

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: C. O. Thomas, Chief
Standardization & Special Projects Branch

Gentlemen:

SUBJECT: POWER GENERATION CONTROL COMPLEX (PGCC) FIRE SUPPRESSION LICENSING TOPICAL REPORT ADDENDUM 1

The purpose of this letter is to transmit a special report which documents in Addendum 1 to NEDO-10466 an additional Halon concentration and soak time option for the PGCC's fire suppression system.

We request a review and safety evaluation report (SER) for referencing and licensing actions by Utility applicants, i.e. Illinois Power Company, Gulf States Utilities, etc. This fire suppression option has been discussed by John Stang, NRC, Ed Maxwell, GE, and various Utility representatives. We request an expedited review schedule, i.e. two to four weeks after receipt of this letter.

Under separate correspondence to William O. Miller, NRC, we have provided the $150.00 application fee.

Please contact R. D. Hickman on (408) 925-4584 should you have any questions.

Very truly yours,

H. C. Pfefferlen
Manager
BWR Licensing Programs

HCP:csc/I02213

Attachments

cc: L. S. Gifford, w/Att
G. G. Sherwood, w/o Att
D. Moran (NRC), w/Att
D. C. Scaletti (NRC), w/o Att

8504120376 1p

SPECIAL REPORT MFN- 29-85

NEDO-10466 ADDENDUM 1

FEBRUARY 1985

8503131320 app

NEDO-10466
ADDENDUM 1
CLASS I
FEBRUARY 1985

LICENSING TOPICAL REPORT

POWER GENERATION CONTROL COMPLEX DESIGN CRITERIA AND SAFETY EVALUATION (ADDENDUM 1)

J. E. MAXWELL

GENERAL ELECTRIC

PGCC FIRE SUPPRESSION CONCENTRATION AND SOAK TIME REQUIREMENTS

REQUEST

For the GESSAR II design, General Electric requests approval to define an additional Halon concentration and soak time option for the fire suppression system within the PGCC. This option would apply to PGCC floor sections which predominantly contain combustible loadings of cable insulation which only burns on the surface and in the flaming mode.

This request is being made on the basis that GESSAR II, Section 9A.4.2.5, references NEDO-10466-A for the fire suppression provisions for the PGCC floor sections. Section 4.1.6.11 of NEDO-10466-A contains only requirements for suppression for combustible loadings of cable insulation which is capable of burning in a deep-seated mode. The GESSAR II design, however, primarily utilizes all Tefzel cable insulation, which burns only on the surface and in the flaming mode. It is appropriate to define a suppression option compatible with surface burning.

We specifically request that for PGCC floor sections containing more than 80% by weight of Tefzel insulation, the required concentration of Halon 1301 to be 6% and the required soak time be 10 minutes.

Applicants choosing this option must provide automatic initiation of the initial discharge of the Halon. Discharge may be initiated by either or both of the product of combustion or rate of temperature rise detectors. It is the responsibility of each applicant to choose the specific wiring methods to be utilized.

JUSTIFICATION

Our justification for classifying Tefzel as a surface burning material, recommending a 6% concentration and a 10 minute soaking time for the Halon 1301 and including up to 20% non-Tefzel insulated cable in the fill is as follows:

Tefzel as a Surface Burning Material

Tefzel is a thermoplastic material, which means that as its temperature is raised it will melt before it burns, that is, the auto ignition temperature is higher than its melting temperature. This characteristic of melting before it burns ensures that burning can occur only at its surface as a liquid.

The surface burning characteristic of a thermoplastic contrasts with that of a thermosetting plastic, such as cross-linked polyethylene, which auto-ignites and burns before it melts. Because of this basic characteristic, a fire in a thermal setting material progresses from surface burning to deep-seated as the material is consumed.

The surface burning characteristic of Tefzel as it melts and burns has been substantiated in every fire test conducted by General Electric. Note of it having occurred was reported in the PGCC fire test report, NEDO-10466-A Appendix F. It was also noted in the fire test report contained in the TVA STRIDE Fire Hazard Analysis Report submitted to the NRC in May 1977.

Halon 1301 Concentration of 6% for 10 Minutes

NFPA 12A-1972, Section 2420, recommends 5% for 10 minutes as being adequate to completely extinguish a surface fire.

Figure 4.2 of NEDO-10466-A, Appendix F, indicates that the rate and degree of burning of the Tefzel essentially corresponds with that of the ignition source. Because of this, the key to limiting the severity of burning of Tefzel is in the capability of extinguishing the ignition source. If the ignition source is extinguished, the fire in the Tefzel will self-extinguish, almost simultaneously.

If an ignition source fire is of sufficient magnitude that a 6% concentration of Halon 1301 for 10 minutes within the PGCC is not adequate to suppress the fire, the fire would have to be of such magnitude that it would be an area fire. Alternate capability in the form of redundant remote shutdown capability and fire suppression equipment have been provided to make the plant tolerant of area fires in the control room.

Twenty Percent Non-Tefzel Cable

Due to special requirements, some of the ducts and a few PGCC floor sections may have up to 20% of their cables insulated with materials, usually cross-linked polyethylene, other than Tefzel. A 6% concentration of Halon 1301 for 10 minutes is adequate for these floor sections because:

1. Although the peak temperatures will be elevated above the Tefzel only case (Figure 4.2 of NEDO-10466-A, Appendix F), they will be below those experienced for the 100% non-Tefzel cases shown in Figure 4.2. This will always be true for two reasons:

    a. Tefzel does not appreciably increase the severity of the fire above that of the introduced ignition source.

    b. The actual cross-sectional area of non-Tefzel cable insulation will be less than the cross-sectional areas for the non-Tefzel cases for the fire test.

2. Any fire suppression introduced into the duct within 6 minutes of ignition of the fire would almost immediately extinguish both the ignition source and the surface burning of the cable insulation (first peak on the curves of Figure 4.2). Initiation of the deep-seated mode of burning (second hump on the curves in Figure 4.2) for the non-Tefzel insulated cables would be prevented.

3. If discharge of the Halon is delayed 6 minutes or more, the 10 minute soak time would envelope the time required to reach the maximum deep-seated burning rate, which occurred approximately 5 minutes after the ignition source had burned out during the fire test. The action of the Halon would therefore ensure that the burning curve would tail down at a much faster rate than experienced in the fire test.

4. The net effect of items 1 thru 3, above, is that the maximum insulation temperatures for cables in the adjacent cable ducts will be less than those shown on Figure 4.3 of the fire test report. In other words, the maximum insulation temperature for the cables in the cable duct adjacent to the duct containing the fire will be less than 176°C. This is less than the 250°C which was deemed to be an acceptable basis for passing the fire test. Cables would not be damaged in a duct adjacent to a duct containing a fire.

SUGGESTED ADDITION TO NEDO-10466-A *

Optionally, if the cable insulation for a control room is primarily Tefzel, the applicant may choose to provide automatic injection of the Halon in a quantity sufficient to maintain a 6% concentration for 10 minutes. This option may be chosen on an individual floor section basis, but a qualifying floor section must not contain more than 20% by weight of non-Tefzel insulation. Automatic initiation of the injection of the suppressant may be from the product of combustion detectors, the rate of temperature rise detectors or a cross-zoned combination of the two types of detectors. The choice of the specific method of wiring the detectors is the responsibility of the applicant.

* To be added at the end of Section 4.2.6.10

JEM: rm/A013016*-1
1/30/85

from one area to another. Cables in the control room should be kept to the minimum necessary for plant operation.

Cables in underfloor and ceiling spaces should meet the separation criteria given in Regulatory Guide 1.75. Air handling functions should be ducted separately from cable runs in such spaces; i.e., if cables are routed in underfloor or ceiling spaces these should not be used as air plenums for ventilation of the control room. Fully enclosed electrical raceways in such underfloor and ceiling spaces, if over one square foot in cross-sectional area, should have automatic fire suppression inside. Area automatic fire suppression should be provided for underfloor and ceiling spaces if used for cable runs unless all cable is run in 4-inch or smaller steel conduit or if the cables are in fully enclosed raceways internally protected by automatic fire suppression.

(See Section C.6.b of Reference 7, Regulatory Guide 1.120)

4.1.6.11 Computer rooms for computers performing safety-related functions which are not part of the control room complex should be separated from other areas of the plant by barriers having a minimum fire resistance rating of three hours and protected by automatic detection and fixed suppression. Computers that are part of the control room complex but not in the control room should be separated and protected as described in Section C.6.b. Computer cabinets located in the control room should be protected as other control room equipment and cable runs therein. Non-safety-related outside the control room complex computers should be separated from safety-related areas by minimum three-hour rated fire barriers and be protected as needed to prevent fire and smoke damage to safety-related equipment.

(See Section C.6.d of Reference 7, Regulatory Guide 1.120)

cables. The fire tests performed on a floor section demonstrated that the separation requirements of Regulatory Guide 1.75 were met (See Appendix F). The qualification test proved that the limited air flow in a normally configured floor section (all floor plates installed) does not allow a fire to burn and in a degraded configuration (two floor plates removed) the fire does not propagate along the cables. Continuity of cables and dielectric strength of cables in the adjacent raceway (non-fire raceway) were also maintained with a substantial safety margin.

A piping manifold and nozzles for a fixed manual Halon 1301 fire suppression system (as required by the NRC for the PGCC floor sections) is provided for suppressant injection. This Halon suppression is an additional precaution to control potential fires in concealed areas. The suppressant will be supplied by the customer to a percent and holding time to extinguish a potential floor section fire. The NRC requirement at this time is based on a deep-seated fire and their requirement is 20% concentration for 20 minutes.

Optionally, if the cable insulation for a control room is primarily Tefzel, the applicant may choose to provide automatic injection of the Halon in a quantity sufficient to maintain a 6% concentration for 10 minutes. This option may be chosen on an individual floor section basis, but a qualifying floor section must not contain more than 20% by weight of non-Tefzel insulation. Automatic initiation of the injection of the suppressant may be from the product of combustion detectors, the rate of temperature rise detectors or a cross-zoned combination of the two types of detectors. The choice of the specific method of wiring the detectors is the responsibility of the applicant.

4.2.6.11 Since the computer panels are also mounted on floor sections, the concerns of this guideline apply. These panels do not perform safety-related functions and therefore are treated the same as any other non safety-related panels in the control room. Channel separation is maintained in the routing of computer cables.

Table 4-1
COLOR CODING OF CABLE MARKERS

Separation Category	Marker Color	Lettering	Lettering Color
Division I	Yellow	Div I	Black
Division I Associated	Yellow	Div I A	Black
Division II	Blue	Div II	White
Division II Associated	Blue	Div II A	White
Division III	Green	Div III	White
Division III Associated	Green	Div III A	White
Division IV	Orange	Div IV	Black
Division IV Associated	Orange	Div IV A	Black
Non-Divisional	White	ND	Black

The markers are made of colored tape with the letters (1/8-inch characters) printed on it in a repeating pattern. The tape markers are 3/4-inch wide and long enough to go around the cable. The cables are marked 1 foot from each end and at approximately 5-foot intervals.