

NEDO-10466
ADDENDUM 1
CLASS I
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LICENSING TOPICAL REPORT

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

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NEDO-10466
POWER GENERATION CONTROL COMPLEX DESIGN CRITERIA AND SAFETY EVALUATION (ADDENDUM 1)

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*