

## 1.0 Introduction

The guidance provided in NUREG/CR-6850 Appendix H, Section H.2 include damage criteria for solid-state control components. The discussion provided in NUREG/CR-6850 Appendix S, Section S.2 refer to this criteria in the context of sensitive electronics. However, in the absence of clarification or a definition of what is to be considered solid-state control components or sensitive electronics, inconsistent application of the guidance can be expected to occur. The damage criteria provided in Section H.2 is substantially lower than that which would otherwise be used in the FPRA. A clarification and definition of terms used in NUREG/CR-6850 is needed.

This issue was recently included in an RAI associated with the transition of a licensee's Fire Protection Program from 10 CFR 50.48(b) to 10 CFR 50.48(c). An excerpt from this RAI is provided below.

*... for determining heat damage to "sensitive" electronics is described ... Clarify that electronics (i.e., computers, digital converters, digital amplifiers, digital communications equipment, electrical devices that contains a semiconductor or an integrated circuit board as a key element<sup>1</sup>) that could be damaged by heat from a fire ... were assessed.*

<sup>1</sup> IEEE Standard 142-2007, "Recommended Practice for Grounding of Industrial and Commercial Power Systems" defines "electronic equipment" in a generic sense, as referring to "all analog and digital semiconductor-based equipment, including data processing, telecommunications, process measurement and control, and other related electronic equipment and systems."

The current guidance uses varying terms to describe the types of components for which a lower damage threshold is applicable. For the purposes of this FAQ, the term 'sensitive electronics' will be used to refer to all instances where the lower damage threshold provided in Section H.2 would be applicable.

## 2.0 Proposed Definition

The following is proposed as supplemental guidance to define "sensitive electronics". Because the guidance will require the application of some judgment, cases that do not represent sensitive electronics are also provided.

- Electro-mechanical devices are not considered sensitive electronics.
- Solid State components applied in power applications such as those that would exist in battery chargers, variable frequency drives, inverters, etc., are not considered sensitive electronics.
- The presence of a component containing semiconductor materials, an integrated circuit board, or a solid-state component by itself is not sufficient to deem the component sensitive electronics.
- Sensitive electronics is not intended to include discrete solid state components such as diodes, transistors, resistors, capacitors, or single-inline or dual inline integrated circuits employing through-hole soldering or sockets.

- Integrated circuits employing any of the variants of pin-grid arrays should be treated as sensitive electronics unless they satisfy at least one of the criteria listed below in Section 3.

### **3.0 Relief Criteria**

The guidance in Section 2.0 provides a framework for defining what should be treated as sensitive electronics. However, cases can arise where specific testing or other considerations would allow components meeting the guidance in Section 2.0 to be excluded from treatment as sensitive electronics.

- Environmental qualification testing of a component to an ambient temperature of 65 °C or higher is sufficient to deem the component as not being sensitive electronics up to and including the qualification temperature regardless of whether the component satisfies any of the remaining criteria.
- Environmental qualification testing of a component to an ambient temperature of 50 °C but less than 65 °C is a sufficient basis to treat the component using the damage threshold for thermoplastic cables as specified in Table H-1.

Sensitive electronic components that are mounted inside a control cabinet such that the cabinet walls, top, front and back doors shield the component from the radiant energy of an exposure fire may be considered qualified up to the damage threshold for thermoplastic cables, provided that:

- The ambient temperature in the area has not been significantly raised as a result of fire conditions (i.e. a descending hot gas layer that would directly impact the temperature in the cabinet)
- The component is not mounted on the surface of the cabinet (front or back wall/door) where it would be exposed to the convective and/or radiant energy of an exposure fire.