

FAQ Number 08-0047 FAQ Revision 0

FAQ Title Spurious Operation Probability

Plant: ABWR Date: March 13, 2008

Contact: Dennis Henneke Phone: (910) 675-6780

Email: Dennis.Henneke@ge.com

Distribution: *(NEI Internal Use)*

805 TF  FPWG  RATF  RIRWG  BWROG  PWROG

---

**Purpose of FAQ:**

The purpose of this FAQ is to provide additional guidance on the determination of Circuit Failure Probabilities for components with multiple electrical cables within a fire area or compartment.

---

**Is this Interpretation of guidance?**  Yes / No

**Proposed new guidance not in NEI 04-02?**  Yes / No

---

**Details:**

**NEI 04-02 guidance needing interpretation (include section, paragraph, and line numbers as applicable):**

N/A

**Circumstances requiring guidance interpretation or new guidance:**

Lessons have been learned from pilot review of the Fire PRA Standard indicates confusing guidance within NUREG/CR-6850 (EPRI TR-1011989) on the determination of circuit failure probabilities (spurious operation probabilities) for components with multiple cables within a fire area.

**Detail contentious points if licensee and NRC have not reached consensus on the facts and circumstances:**

None.

**Potentially relevant existing FAQ numbers:**

---

**Response Section:**

**Proposed resolution of FAQ and the basis for the proposal:**

NUREG/CR-6850, page 10-7 provides guidance that if the cable failure mode can occur due to different cable mode interactions, the probability estimate is taken as a simple sum of the estimates. This guidance is repeated on the top of page 10-9, as follows: "When more than one cable can cause the component failure mode of concern, and those cables are within the same boundary of influence for the scenario (i.e, within the same fire area or fire compartment), the probability estimates associated with all affected cables should be considered when deriving a failure estimate for the component."

This guidance has been interpreted as summing the circuit failure probability for each cable in a fire area or compartment to determine the overall probability of spurious operation for a component. In most cases, the circuit failure probabilities for multiple cables should not be added, since a ground fault on the first cable (typically resulting in a blow fuse) would prevent spurious operation given damaged to a second cable. Therefore, in most cases, the circuit failure probability for a single cable should be used rather than adding the failure probability for each cable. The exception to this is as follows:

- Target Cables that are powered from a separate/alternate power supply, where a ground fault would not affect the primary circuit should be considered separately. These circuits referred to as either auxiliary or "off-scheme" circuits often times provide automatic operation of the component from an instrument/control circuit. Failure of these circuits would not, in general, prevent operation of the component through either operator action or by spurious operation of the circuit.

The following guidance is recommended for determination of the circuit failure probability for both initial screening and detailed FPRA analysis:

**Initial Circuit Failure Probability Determination:**

- 1) For components with no auxiliary or off-scheme circuits (powered from a separate power supply), the circuit failure probability is assigned based on the limiting (highest) circuit failure probability for the cables within the fire area/compartment.
- 2) For Components with auxiliary or off-scheme circuits, the circuit failure probability is based on the sum of the a) limiting (highest) circuit failure probability for the primary circuit and b) limiting (highest) circuit failure probability for the auxiliary/off-scheme circuit.

- 3) If circuit analysis has not been performed to determine if auxiliary or off-scheme circuits are present for the component, then the circuit failure probability is assigned based on a sum of the two highest circuit failure probabilities for the component cables.

### **Detailed FPRA Circuit Failure Probability Determination**

Once a detailed fire scenario analysis is performed, where detailed circuit routing has been determined, the location of each circuit can be accounted for in the FPRA. In this case, the cable initially damaged determines the circuit failure probability. If the primary and auxiliary/off-scheme circuit cable are contained within the same cable tray or are estimated to be damaged at the same time, the guidance above for initial circuit failure probability determination would apply. For other circuits, the following can be used:

- 1) If the primary circuit cable is damaged first, then the circuit failure probability is assigned based on the initial cable damaged.
- 2) If the auxiliary or off-scheme cable is damaged first, then the circuit failure probability for the component is determined from the sum of circuit failure probabilities for a) the initial auxiliary/off-scheme circuit cable damaged, and b) the initial primary circuit cable damaged.

Detailed circuit analysis and cable routing for the component should be performed to confirm application of the above guidance. When component circuits are determined to be unique, adjustments to the above guidance may be needed. For example, if spurious operation of a component requires circuit failures in two cables, then the model would need to be adjusted to account for damage to each of the various combinations of cables within the fire scenario. Another example would be if the component contained two independent auxiliary/off-scheme circuits, both powered from separate power supplies. In this example, the initial spurious operation probability assigned would be a sum of the three circuit failure probabilities, and the detailed analysis could include consideration for the location and damage time for each of the cables. Finally, if failure of the auxiliary/off-scheme circuit prevents spurious operation of the component, then the off-scheme circuit would be treated as if it was a primary circuit and the component circuit failure probability (initially assigned) would be based on the limiting circuit failure probability.

**If appropriate, provide proposed rewording of guidance for inclusion in the next**

**Revision:**

Revised NEI 04-02 per the above guidance.