

**FAQ Title Alternative Methodology to NUREG/CR-6850 for Maintaining FPRA Ignition Frequencies Weighting Factors**

Plant: \_\_\_\_\_ Date: June 9, 2016  
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**Purpose of FAQ:**

This FAQ proposes an alternative method to NUREG/CR-6850 for maintaining Fire PRA ignition source fire frequencies and establish a framework for maintenance of cable loading weighting factors.

In the event of a change in the number of ignition sources in a plant, current guidance provided by NUREG/CR-6850 requires the recalculation of ignition source frequencies. The formula yielding the ignition frequency for a given ignition source includes a weighting factor,  $W_{IS,J,L}$ . This weighting factor is the ratio of the count of the ignition source in question, divided by the total count of ignition sources of the same type in the same generic plant location. See NUREG/CR-6850, section 6.3.1 for more details.

The guidance in this FAQ would eliminate the need to recalculate the NUREG/CR-6850 Task 6 results and the individual fire scenario frequencies for Task 11 if the count of ignition sources changes. This change provides a more pragmatic approach for evaluating the addition or removal of ignition sources.

Application of the proposed method would address the following adverse effects that may be encountered when updating a Fire PRA:

1. The reduction of calculated risk in relatively high-risk fire scenarios resulting from the addition of ignition sources in low-risk locations.
2. The increase of calculated risk in relatively high-risk fire scenarios resulting from the elimination of ignition sources.

As risk models mature and are utilized in evaluating risk informed plant change evaluations (e.g. the use of NFPA-805 self-approval models), consideration for the risk implications of adding or removing of equipment will increase. Therefore, it is expected that the location chosen for the addition of new ignition sources be separated from risk sensitive targets. In these cases, were the guidance in NUREG/CR-6850 to be used, the increase in the number of countable ignition sources (i.e. all ignition source types other than transients and large system ignition sources) would decrease the frequency applied to other, potentially higher risk scenarios, with the same ignition source types. Therefore, the inclusion of a new ignition source would produce the undesired effect of artificially reducing calculated plant risk elsewhere in the model. Conversely, the removal of an ignition source from the analysis would redistribute ignition frequency to the remaining scenarios resulting in an increase of the plant fire risk in those scenarios.

Furthermore, the current method from NUREG/CR-6850 imposes a burdensome process for maintaining cable loading weighting factors when implementing modifications that add or remove cables. With regard to changes in combustible cable loading, risk insights from the Fire PRA models are generally only impacted by large-scale modifications that include a significant change in combustible cable loading. Therefore, this FAQ establishes a framework to treat a change in cable loading as resulting in a negligible change in ignition frequency, thereby eliminating the burden of maintaining cable loading information.

In summary, the process proposed by this FAQ would maintain constant ignition source and cable loading weighting factors. However, it is recognized that during specific PRA model updates, a rebase line of the weighting factors might be desirable. Therefore, the intent of this FAQ is to provide an alternative approach to NUREG/CR-6850 to pragmatically enhance the application of the Fire PRA models and reduce unnecessary model updates.

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**Relevant NRC document(s):**

NUREG/CR-6850, Section 6.5.7

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**Details:****NRC document needing interpretation (include document number and title, section, paragraph, and line numbers as applicable):**

NUREG/CR-6850, Section 6.5.7

**Circumstances requiring interpretation or new guidance:**

Adding and removing ignition sources produces an undesired effect when redistributing the ignition frequencies for evaluating the effect on plant risk increases and decreases in risk informed change evaluations.

Adding or removing cables within a plant location is generally immaterial to the existing transient fire ignition frequencies. This FAQ would establish a basis for not updating the cable loading factors when evaluating modifications that add or remove cables within a compartment.

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

N/A

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N/A

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

The proposed approach would be a deviation from NUREG/CR-6850 Section 6.5.7: Ignition Source Weighting Factors.

The ignition source weighing factor,  $W_{IS,J,L}$ , for countable items is calculated as the number of ignition sources within a given compartment divided by the total number of ignition sources in the generic plant location.

After initially establishing a weighting factor in accordance with NUREG/CR-6850 Section 6.5.7.1, the proposed method would permit subsequent calculations to use a constant denominator (i.e. the total number of ignition sources in the generic plant location would remain unchanged). This method would effectively yield a static weighting factor for use in evaluating the addition or elimination of plant ignition sources. Upon the addition or elimination of an ignition source, the static weighting factor would be used and applied to the ignition source in question. This would eliminate the requirement of the analyst to recalculate an updated weighting factor based on a revised total ignition source count and apply it to all impacted scenarios in the analysis.

The proposed method is predicated on the assumption that the initial weighting factor calculation sufficiently establishes a plant-specific ignition frequency on a per-component basis. Therefore, the subsequent addition or elimination of ignition sources would have no effect on the frequencies currently applied to the existing ignition source scenarios and the ensuing change in calculated plant risk would produce illogical risk insights.

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

The proposed method would provide the following as an acceptable optional approach to ignition frequency changes.

-Establish a total ignition source count in accordance with guidance in NUREG/CR-6850 for developing the Fire PRA model (i.e. no change to the current method). An accepted revision of the Fire PRA (i.e. the current model of record), may be used as the basis for the "initial" ignition source count.

-Establish a per count ignition frequency for each countable item in a given plant generic location. For example, 100 pumps (bin 21 of NUREG/CR-6850) located within the generic location 'L' would result in a calculated weighting factor of  $1/100 = 0.01$  for each pump in location L. Multiply this weighting factor by the appropriate bin total frequency from the latest approved data, yielding a frequency for a single pump ignition source.

-Any subsequently added ignition sources should use the per-source calculated frequency for scenario development. Any subsequently eliminated ignition sources should simply be removed from the Fire PRA with no consequential impact on any of the remaining fire scenarios. Therefore, neither the addition nor elimination of ignition sources should impact the ignition frequencies for other fire scenarios.

-The same approach is applicable to the cable fire frequency weighting factor,  $W_{Cable,i}$ , for cable fires caused by welding and cutting (Bins 5, 11, and 31) and for cable run fires (Bin 12). That weighting factor should remain static and should continue to be used in the model to evaluate modifications when cables are added or removed from the analysis. In the event a plant modification substantially changes the numerator of the weighting factor for a PAU (using the same metric originally used to establish the weighting factor) then an update of the fire frequency for that tray should occur. Otherwise, no change is necessary. In this context, "significant" is defined as a 5% change.

When new generic ignition frequency data becomes available, then an update with this data should be performed consistent with the licensee's maintenance and upgrade process. Currently, prior to the development of industry-wide, component-based fire ignition frequencies, new generic ignition frequency data will be applied during the update on a plant wide basis and the ignition source frequency distributed equally among all components corresponding to the bin. Fire frequencies throughout the plant should be calculated with current counts of components and current cable loading when a periodic update is performed.