

Staff response on Fire PRA FAQ 14-0007 fire PRA FAQ on transient frequency
Dated 10/19/2016

The positions by staff and industry are presented in reverse chronological order in this package. The staff's 10/19/2016 response to industry discussion points from the 4/13/2016 public fire PRA FAQ meeting (ADAMs ML16132A218) are directly below. Industry points discussed in the 4/13/2016 public meeting follow this staff response and begin on page 4. Earlier NRC points located at the back of this package were presented and discussed during 11/17/2015 public fire PRA FAQ meeting (ADAMs ML15341A347) and begin on page 7.

The red font in current staff response indicates additional points by NRC or confirmation of its original position from 11/17/2015, and considers discussions in the 4/13/2016 public meeting. Note that the staff agrees in concept with fire PRA FAQ 14-0007 which divides PAUs into TISRs to adjust transient frequency within the PAU. However, the staff disagrees with industry's proposal to weight the influence factors by floor area and to allow PAU transient frequency to vary whenever applying a TISR. The staff feels that there is a success path for this method which would accomplish industry's goal to divide PAUs in TISRs, and would accomplish NRC's goals to eliminate floor area weighting and maintain PAU frequency. The staff is willing to discuss this alternate FAQ path with industry in the next fire PRA FAQ meeting.

Issue #1: Requirements for Identifying a TISR in the plant for frequency reduction in the PRA

The staff agrees with industry's position from 4/13/16 that more robust visual cues, such as physical barriers, are not necessary in order to credit with this method a reduced transient fire frequency for a transient free area. The description of influence factors in FAQ 12-0064 captures violations and performance monitoring.

Issue #2: Dividing PAUs into TISRs.

The staff agrees that different plant conditions within certain PAUs support the division of PAUs into TISRs. A TISR should be limited by definition to a subset of a PAU, rather than the entire PAU. Although not in question, a fire ignition frequency should be applied to a PAU or TISR unless prohibited by operation or design as directed in NUREG/CR-6850.

The staff is maintaining its position on this issue.

Issue #3: Use of weighting factors from FAQ 64 for this FAQ

The staff accepts industry's proposal from 4/13/16 to revise the influence factors as necessary for TISRs.

Issue #4: Weighting influence factors by floor area

The staff disagrees with industry's proposal to apply floor area to the calculation of influence factors.

From a review of transient influence factors from NUREG/CR-6850, guidance for influence factors are not meant to be scaled by floor area. For example, maintenance is based on low, medium, high, or very high number of work orders for the typical PAU, and are not scaled by floor size. That is, according to the guidance, a low number of work orders for a small room does not receive the same influence factor as a high number of work orders for a large room.

Also, according to the guidance, should a room have both open and closed containers of combustible/flammable materials, the high for open containers is used regardless of the closed containers being present. Furthermore, if no combustible/flammable materials are stored in one section of a PAU, but in another part are stored in closed containers, then the worst category, medium, is used for the PAU. Thus, no averaging is to be applied in either one of these transient fire influence categories. Applying a scaled influence factor introduces a new level of subjectivism beyond the existing guidance.

Should the influence factor be significantly different over different parts of a PAU, then the PAU should be divided into different TISRs. Averaging the presence of transients over the TISR or PAU is not the way towards more realism. Averaging would underestimate the risk from transients in that portion of the PAU containing frequent transients.

The staff is maintaining its position on this issue.

Issue #5: Adjusting frequency to a PAU through a TISR addition

The staff agrees in part with industry's approach in this area.

In particular, an assigned PAU fire frequency could be changed if the licensee makes a change to the plant that would affect the frequency. For instance, if a transient free zone is assigned to the plant after the PAU analysis which assumed no transient free zone was done, then the PAU frequency could change. Should the PAU frequency change, then the remainder of the PAU frequencies for the remainder of the location would be affected.

However, if no plant change is made after the assignment of the PAU frequencies, then the PAU frequency must be preserved. That is, the PAU frequency after the breakup into TSIRs must be forced to maintain the original frequency. In other words, each TSIR will have its own frequency, but scaled as the PAU frequency will be forced to be the same as originally.

The staff is maintaining its position on this issue.

Issue #6: This question was not considered by the FAQ.

Both industry and the staff agree that, for certain locations of cables, scenarios involving those cables will need to be developed for multiple TISRs. The staff notes that not only can targets be potentially impacted by transient fires from multiple TISRs, but a single transient fire can potentially affect targets in multiple TISRs. See NRC and industry positions which follow.

Comment: Impact of use of scenario ZOI in substantiating insights

The staff was using the term ZOI incorrectly in its November 2015 discussion points. We understand that the relevant floor area is determined by the portion of the floor where the location of transients can affect the cables of concern.

Industry Response given above items and discussion during public meeting on 11/17/15

1. Visual cues required to model a TISR as a transient free zone
 - a. Plants use varying types of visual cues to indicate an area is a transient free zone
 - b. The visual cues used in a particular area depend on the configuration of the area (size of area, access points to area, type of area (e.g. a main walkway))
 - c. There were concerns raised by the NRC at the previous public meeting that more robust visual cues, such as physical barriers, would be required to model the area as a transient free zone
 - d. FAQ 12-0064 includes guidance for the assignment of influence factor ranking levels that include a review of the effectiveness of the performance monitoring program
 - e. As the effectiveness of the plant's administrative controls on transient combustibles are included in the assignment of the influence factors there is a mechanism in place to determine if a more robust visual cue, such as a physical barrier, would be required to credit the reduced influence factor rankings for a transient combustible free TISR
 - f. Industry would like to know if the NRC agrees with this position so that we can update the FAQ words appropriately
2. Use of the term TISR for a PAU that is not subdivided
 - a. The intent was to make the transient influence factor methodology less confusing by using a single category of plant subdivision
 - b. However, this is not a critical aspect to the FAQ
 - c. We will include in the next FAQ draft revision changes that identify that influence factors be assigned to PAUs unless the PAU is subdivided into TISRs
3. The use of "compartment" terminology in Table 6-3 in FAQ 12-0064
 - a. The use of compartment appears to be applicable to either PAUs or TISRs as written
 - b. However, the description for "Storage – Very Low" should be revised to replace "fire area" with the term "compartment"
 - c. There are other instances in which "location" or "area" are used instead of compartment; these can be revised in FAQ 14-0007 so that the table is more consistent
 - d. Industry will plan to revise Table 6-3 based on the items listed above in the next revision to FAQ 14-007 if NRC agrees
4. Use of Floor Area
 - a. During the Public Meeting on 11/17/15 the use of floor area was discussed

- b. Industry presented their position that the use of floor area when distributing transient ignition frequency would help to promote greater consistency when comparing fire scenario frequencies for transient fires located in different PAUs
 - c. Another concern raised by NRC was that the most limiting aspect of a PAU should be considered when assigning the influence factors in the current methodology and that trying to assign an “average” influence factor for a PAU would not be correct
 - d. The industry agreed that assigning an “average” influence factor is not ideal but that assigning a conservative influence factor may also be incorrect if only a small portion of the PAU warrants the higher classification as this would be conservative for the rest of the PAU and potentially non-conservative for the remaining PAUs in the Transient Generic Location
 - e. Enhancing the methodology to promote subdivision of PAUs into TISRs when the characteristics of the PAU are not constant within the PAU will address the concern that an inappropriate influence factor is assigned to a location in the plant
 - f. Industry would like confirmation that the NRC agrees that floor area is appropriate to add as an additional influence factor (in a manner similar to the cable loading factor for cable fires due to welding and cutting)
5. Changing the PAU frequency by subdividing into TISRs
- a. The concern that the PAU frequency should not change when subdividing into TISRs
 - b. Industry agrees that in general the amount of frequency allocated to a PAU should only change due to changes in how the plant is built or operated that may occur over time
 - c. However, given that the ability to subdivide PAUs was not available when the transient frequency calculations were initially performed, the PAU frequency allocation should not be considered static
 - d. It should also be recognized that changes to how the plant is built or operated in one PAU impacts the allocation of frequency to other PAUs in the same Transient Generic Location under the current methodology (as well as the proposed enhancement)
 - e. The proposed enhancements to the methodology may actually reduce the amount that a change in a PAU impacts other PAUs as the size of the location that is subject to the plant change will be a factor.
 - f. Industry would like confirmation that the NRC agrees that the PAU frequencies may change when implementing the enhancements to the methodologies or when other plant modifications are implemented
6. Targets impacted by two TISRs
- a. The observation that multiple scenarios (or a single scenario with multiple transient ignition sources contributing to the scenario frequency) would be required to fail targets that were within the ZOI for transients in multiple TISRs is correct
 - b. This situation often occurs for fixed ignition sources of different types or sizes in close proximity
7. Impact of use of scenario ZOI

- a. The example calculations provided by Industry to support the FAQ did not reference a ZOI, but rather the size of the floor for which a transient fire could be located and impact the same target set
- b. There is a relationship between the ZOI and the applicable floor area as the ZOI distance impacts the size of the foot print in which a transient fire may be postulated to damage the target set
- c. Targets sets that run for long distances horizontally will have a larger floor area footprint than a target set that only runs vertically in the room as there are more locations the transient could be placed and damage the same target set
- d. Industry would like confirmation that NRC agrees that the ZOI and the applicable floor area are related but are not the same and thus that changes to the TISR floor area ratio of 0.5 would also need to be made to the original ratio of 0.0625 to reflect a change to the transient fire scenario footprint (currently 100 ft² within the TISR or PAU respectively)

NRC Position on industry's FAQ 14-0007 on Transient Fire Frequency
(Discussed during November 17, 2015 public fire PRA FAQ meeting)

Issue #1: Requirements for Identifying a TISR in the plant for frequency reduction in the PRA

One type of TISR which is proposed as having a lower frequency is a transient free zone. Transient free zones for frequency reduction may currently only be marked on the floor. To credit a reduced frequency within a PAU through the TISR approach, a stronger visual cue more than a marked floor is necessary. Similar to the treatment for a protected train, a visual cue, e.g. a pylon/rope or pylon/chain, or a temporary barrier such as a gated, cross-link fence, must supplement the marked floor to qualify the TISR for a reduced frequency in the PRA. Appropriate signage indicating a transient free zone should be displayed also.

Issue #2: Dividing PAUs into TISRs.

The staff agrees that different plant conditions within certain PAUs support the division of PAUs into TISRs. A TISR should be limited by definition to a subset of a PAU, rather than the entire PAU. Although not in question, a fire ignition frequency should be applied to a PAU or TISR unless prohibited by operation or design as directed in NUREG/CR-6850.

Issue #3: Use of weighting factors from FAQ 64 for this FAQ

The description of weighting factors in FAQ 64, which is the latest description, regularly refers to compartments, aka PAUs. The staff questions whether the description of these influence factors need to be adjusted for this FAQ. For example, should the reference be made to TISRs in any of these cases where compartment is used in the description? Or is "compartment" still the correct reference? Also, it should be noted in this FAQ that the constraints on the use of influence factor ratings from violations as described in FAQ 64 applies to this FAQ as well.

Issue #4: Weighting influence factors by floor area

The staff disagrees with industry's proposal to apply floor area to the calculation of influence factors.

From a review of transient influence factors from NUREG/CR-6850, guidance for influence factors are not meant to be scaled by floor area. For example, maintenance is based on low, medium, high, or very high number of work orders for the typical PAU, and are not scaled by floor size. That is, according to the guidance, a low number of work orders for a small room does not receive the same influence factor as a high number of work orders for a large room.

Also, according to the guidance, should a room have both open and closed containers of combustible/flammable materials, the high for open containers is used regardless of the closed containers being present. Furthermore, if no combustible/flammable materials are stored in one section of a PAU, but in another part are stored in closed containers, then the worst category,

medium, is used for the PAU. Thus, no averaging is to be applied in either one of these transient fire influence categories. Applying a scaled influence factor introduces a new level of subjectivism beyond the existing guidance.

Should the influence factor be significantly different over different parts of a PAU, then the PAU should be divided into different TISRs. Averaging the presence of transients over the TISR or PAU is not the way towards more realism. Averaging would underestimate the risk from transients in that portion of the PAU containing frequent transients.

Issue #5: Adjusting frequency to a PAU through a TISR addition

The staff agrees in part with industry's approach in this area.

In particular, an assigned PAU fire frequency could be changed if the licensee makes a change to the plant that would affect the frequency. For instance, if a transient free zone is assigned to the plant after the PAU analysis which assumed no transient free zone was done, then the PAU frequency could change. Should the PAU frequency change, then the remainder of the PAU frequencies for the remainder of the location would be affected.

However, if no plant change is made after the assignment of the PAU frequencies, then the PAU frequency must be preserved. That is, the PAU frequency after the breakup into TISRs must be forced to maintain the original frequency. In other words, each TISR will have its own frequency, but scaled as the PAU frequency will be forced to be the same as originally.

Issue #6: This question was not considered by the FAQ.

What if there are cables in the overhead within the ZOI from fires on each side of the TISR? Compartments don't have this problem as the PAU essentially constrains the effect of the fire. However, for the TISR approach, the analyst would have to develop scenarios from both TISRs and assign both scenarios to the overall CDF/LERF. Each scenario would have different fire frequencies based on the particular TISR.

Comment: Impact of use of scenario ZOI in substantiating insights

It's worth noting that assuming 0.5 for the ZOI over the TFZ area in industry's Table 6 (Scenario Data, TISR Ratio) makes the results of the partitioned PAU D seem out of line in the Table 7B on TISR Based Scenario Frequencies without floor area. However, if the 0.5 which represents the ZOI over the TISR area is changed to 0.25 or 0.1 (comparable to the other ZOI to TISR area ratios), then the TFZ scenario frequency experiences a much larger decrease from the partitioning of PAU D (10% decrease in TFZ scenario frequency for 0.5 in industry's example, 55% decrease when using 0.25 instead of 0.5, 82% decrease when using 0.1 instead of 0.5) and is in line with what is expected. The lesson here is that the ZOI is a key variable in

determining the scenario frequency. Thus the approach without integrating floor area into the weighting factors provides frequencies consistent with expectations.

Conclusion:

The staff agrees with the resolution of PAUs into TISRs as warranted. Several concerns/questions remain in its implementation as described above.

First of all, for those TISRs warranting a frequency reduction, more than a marked floor is necessary. Precautions such as those taken for the protected train are necessary for the PRA to use a reduced frequency for the TISR representing a transient free zone.

Secondly, given the existing guidance for influence factors, floor areas should not be integrated into the influence factors. Such a change is unwarranted.

Next, the staff agrees that the frequency of an existing PAU can be changed to reflect a plant change. However, absent a plant change, the PAU frequency should remain the same.

Finally, the staff has identified other concerns and comments above.