FAQ Number	**18-0014**
FAQ Revision	**0 (Draft V8)**
FAQ Title	**The Time of Detection is Zero for Equipment with Control Room Indication for the Start of the Manual Non-Suppression Probability (NSP) Calculations**

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Purpose of FAQ:

This FAQ provides an interpretation of when to begin crediting the empirically based manual Non-Suppression Probability (NSP) curves for cases where the fire damaged equipment is indicated in the MCR to align with the data used to develop the curves in alignment with NUREG-2230.

Relevant NRC document(s):

NUREG/CR-6850
NUREG/CR-6850 Supplement 1 (FAQ 08-0050)
NUREG 2169
NUREG-2230

Details:

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

See list of relevant NRC documents

Circumstances requiring interpretation or new guidance:

The guidance in NUREG/CR-6850 Appendix P implicitly and through example directs that the detection time be subtracted from the overall time until target damage when developing the manual non-suppression probability. Although NUREG/CR-6850 Supplement 1 (FAQ 08-0050) and NUREG 2169 remove the brigade response time from the NUREG/CR-6850 approach for

crediting manual suppression, the subtraction term for the detection time remains. As a result, the risk associated with the manual non-suppression probability can be artificially high.

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

None.

Potentially relevant existing FAQ numbers:

FAQ 08-0050, "Manual Non-Suppression Probability"

Response Section:

Proposed resolution of FAQ and the basis for the proposal:

The manual non-suppression probability (NSP) curves by nature of the data collection process are developed from the point at which the fire is detected. Once a fire event is logged in a Nuclear power plant, it is detected (i.e. the NSP curve begins). The recommended timeline should be in the same context as NUREG/CR-6850 and NUREG-2230 where T=0 is also defined as when the growth curve starts.

NUREG-2169 used the Updated Fire Events Database (EPRI 1025284) in the development of the NSP curves. Although detection of a fire precedes control or extinguishment, the exact time to detection cannot be known without knowing exactly when the fire starts. The given assumption in NUREG/CR-6850 and NUREG-2230 is that T=0 is when growth begins. In NUREG-2230, it is recognized that there is better than a 99% chance (per Section 5.3.4) that with control room indication and the possibility of plant personnel detection that detection occurs at T=0.

Incipient detectors are excluded from the approach in this FAQ since these detectors are not traditional fire detectors and the vast majority of fires are not detected using incipient detectors.

Detection (T=0), in the context of this FAQ, is considered the point at which operations logs that something has happened. This does not mean that it is initially known that a fire has occurred. The investigation time to confirm a fire has occurred (e.g. equipment operator sent to equipment location) would be included in the NSP curve development. Therefore , T=0 corresponds both growth and the suppression curve development. The fire will be controlled or extinguished within x amount of time from detection at the confidence calculated using the NSP curves.

Due to the empirical nature of the data collection, any delays in the response due to embedded confirmations or procedural delays would be reflected in the response time of the data.

This FAQ only applies to the Electrical fires NSP in Table 5-1 or the Bin 15 Interruptible and Growth NSP Curves in NUREG-2230 Table 7-3. The case in which the time to detection equals 0 with respect to applying the NSP curve is:

When the fire is detected by a plant equipment failure that is indicated directly in the control room, the time to detection (T_{det}) is inherently included in the manual response time curves since the time from fire initiation to detection is generally assumed negligible and thus the HRR t-squared growth profile does not begin in the PRA model until detection
This timeline illustrates the sequence of events:

- Time = -y Fire Starts
- Time = 0 Fire is Detected (i.e. operations logged the event)
  Fire Growth Curve Begins (for the specific case above)
- Time = x Fire is controlled or extinguished

In Fire PRA, the NSP curves are used to prevent damage beyond the initial zone-of-influence (ZOI) of the fire source. For high-energy-arcing faults (HEAF) events, the initial ZOI for target damage is applied at T=0.

For example, if the fire source is a motor, the fire might be in the incipient stage for an extended period. Detection can occur due to equipment damage manifesting through main control board indication changes. In this case, the timeclock for controlling the fire from expanding beyond the initial ZOI begins when initially logged by operations (i.e. detected).

Thus, this approach will only be applied to fire scenarios electrical related fires where there is direct indication in the control room, aside from any fire detector actuation. This is to say the ignition source involves equipment or components that are specifically monitored in the main control room. This would include alarms or line-of-sight indicators continuously monitored by the reactor operator. Using T=0 for detection time is only applicable for the current t-squared growth curve (characterized as growth fires in future research [but considered slow growth in traditional fire protection]). If growth curves other than the t-squared growth at T=0 are considered, then using T=0 as the detection time is not appropriate.

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

The following are proposed revisions to NUREG 2169:

The start of the t-squared growth curves and manual NSP electrical related curves is T=0 if equipment has direct control room indication. This is equivalent to using the equation with the time to detection, $T_{det,}$ set to zero (T_{det}=0).

Thus, if control room indication is not available, then the T_{det}, must be calculated using the fire detection models. The time to detection, T_{det} , for automatic suppression systems must be calculated regardless of whether or not control room indication is available for the first piece of equipment damaged by the fire. Setting T_{det}=0 is only applicable to the empirically based manual electrical related NSP curves for this particular case.

As this approach is essentially a data change, use of this FAQ would be considered an update (not an upgrade).