

**FAQ Number** 18-0014 **FAQ Revision** 0 (Draft V7)

**FAQ Title** The time of Detection is Zero for the start of the Manual Non-Suppression Probability (NSP) Calculations

**Plant:** Various **Date:** March 13, 2019 (Received by NRC 4/3/2019)

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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.

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**Relevant NRC document(s):**

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

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**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 is artificially high most cases.

**Commented [CR1]:** This is true for most risk significant cases. If the fire is severe enough to progress to core damage, then control room equipment with control rom indication will be impacted



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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 an electrical cabinet, 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 where equipment affected by first target/ignition source affected by the fire would cause direct indication in the control room, aside from any fire detector actuation. Using  $T=0$  for detection time is only applicable for the current t-squared growth curve (characterized as fast growth 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.

Direct indication is valve position lights, annunciators, gauges, etc. For example, a transient fire damages a tray that contains a component cooling pump heat exchanger control cable. The fire causes the throttling valve to change state. This causes a reactor coolant pump seal high temperature alarm in the control room.  $T=0$  can be used as valve changing state has control room indication.

**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 curves is  $T=0$  if the first piece of equipment damaged by the fire would be indicated in the control room. This is equivalent to using the equation with the time to detection,  $T_{det}$ , set to zero ( $T_{det}=0$ ).

**Commented [MB8]:** The growth profile recommended in NUREG/CR-6850 is considered to be slow relative to other fire protection literature.

**Commented [CR9R8]:** Add your comment

**Commented [MB10]:** This is similar to the existing prompt detection credit in NUREG/CR-6850 for in-cabinet detection.

**Commented [CR11R10]:** As stated earlier, this is not used where incipient detection is credited.

