

RES & EPRI Team Response to FAQ 07-0031
NUREG/CR-6850, EPRI TR-1011989
“Clarification of Miscellaneous Ignition Source Binning Issues”

Final Revision 0 – 10/11/2007

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Background

The purpose of this document is to respond to Frequently Asked Question (FAQ) 07-0031 of the NFPA-805 pilot process. This FAQ requests clarification of the guidance provided for the counting of electric motors, pumps, ventilation subsystems, and transformers. The general intent of the suggested changes was to ensure a higher level of consistency between four specific fire ignition source bins associated with electrical equipment (motors, pumps, ventilation subsystems, and transformers). The proposed changes would also establish new criteria for eliminating certain motors and transformers from the counting process based on size (e.g., the associated component electrical power limits) or function.

The FAQ as posed to the team (FAQ 07-0031, Revision 0, May 17, 2007) is attached to this document for reference. The following sections provide the team’s response for each of the four fire ignition source bins discussed in the FAQ.

Bin 14: Electric Motors

For Bin 14, Electric Motors (Plant-Wide Components), the team agrees that some clarification is warranted. In particular, the intent of this bin was always to exclude motors associated with equipment counted in other bins, and this can be clarified. The team also agrees that use of a more consistent wording scheme would help to avoid confusion. Hence, we will shift to an “include/exclude” phrasing.

The team also agrees that some expansion of the exclusionary provisions for certain types of motors is appropriate. However, the team does not agree to the exclusion of all MOV motors as suggested by the FAQ. In particular, the team would agree to the exclusion of totally enclosed motors, including totally enclosed MOV drive motors, because the nature of the motor housing would prevent the extension of flames outside the motor casing. However, other motors (e.g., ventilated motors) do present the potential for fire spread outside the motor and should continue to be considered regardless of the motor application. Furthermore, the fire event database includes a small number of fire events involving MOV drive motors. MOV drive motors that are not totally enclosed should be treated similar to other general-use electric motors.

The original guidance provided in Section 6.5.6 of the methodology for Bin 14 (page 6-16) can be clarified as follows:

“Bin 14 – Electric Motors (Plant-Wide Components): Electric motors associated with various plant equipment such as elevators, valves, etc., with the following clarifications:

- This bin *includes* any electric motor with a rating greater than 5 hp unless the motor meets one (or both) of the two exclusionary provisions immediately below. The bin *excludes* motors with a rating of 5 hp or less regardless of motor application.
- This bin *excludes* electric motors that are attached to equipment already identified and counted in other bins (i.e., reactor coolant pumps, air compressors, dryers, pumps, RPS MG sets, and ventilation subsystems). That is, motors associated with a piece of equipment counted as a part of another ignition source bin are not counted separately as motors, but rather, are considered an integral part of the larger equipment item (the pump, the compressor, etc.).
- This bin *excludes* any motors, including MOV drive motors, which are totally enclosed regardless of the motor size. A totally enclosed motor is defined by the National Electrical Manufacturers Association (NEMA) as “a motor designed without air openings so there is no free exchange of air between the inside and outside of the enclosure but not necessarily air or water tight” (Reference: NEMA MG 2-201, Rev. 1, 2007, "Safety Standard and Guide for Selection, Installation, and Use of Electric Motors and Generators"). Specifically, motors meeting the following NEMA classifications are *excluded* from the motor counting process and are not considered as ignition sources: totally enclosed machines; totally enclosed nonventilated; totally enclosed fan-cooled; totally enclosed pipe-ventilated; totally enclosed water-cooled; and explosion-proof.”

Bin 21 - Pumps

For Bin 21, Pumps (Plant-Wide Components), the team agrees that some clarification is appropriate. In particular, clarifying that the intent is to also exclude pumps associated with smaller (5 hp or less) hydraulic actuators is appropriate. The guidance relative to Bin 21 as provided in Section 6.5.6 is clarified as follows:

“*Bin 21 – Pumps (Plant-Wide Components) and large hydraulic valves:* For this methodology, it is assumed that above a certain size, fire ignition is the same for all pumps. Pumps with a rating of 5 hp or less are assumed to have little or no significant contribution to risk. The number of larger pumps (>5 hp) in all plant locations defined as “Plant-Wide” should be estimated.

- This bin *excludes* small sampling pumps.
- This bin *excludes* pumps with a rating of 5 hp or less. This bin *includes* pumps rated greater than 5 hp.

- This bin *excludes* pumps associated with hydraulic actuators where the pump is rated 5 hp or less. The bin *includes* pumps associated with larger hydraulic actuators where the pump is rated greater than 5 hp.

Bin 23 - Transformers

As originally written, Bin 23, Transformers (Plant-Wide Components), did not establish a lower limit for the inclusion/exclusion of transformers. The FAQ suggests that this bin only include transformers with a power rating above 45 kVA. In general, the team agrees that a lower limit on the counting of dry-type transformers is appropriate and would be consistent with the guidance for other electrical equipment bins. Furthermore, upon review, the team agrees that 45 kVA is a reasonable bound at or below which dry-type transformers would not represent significant fire hazards.

The team's assessment is based primarily on a review of the combustible content of smaller transformers. Dry transformers with a rating of 45 kVA or less are expected to have insufficient content of combustible material to produce a challenging fire as defined in Chapter 6 of NUREG/CR-6850, EPRI TR-1011989. In the event of an insulation breakdown, significant electrical energy could be released (i.e., arcing inside the transformer). However, given the small amount of combustible materials within the transformer (mainly the varnish used to coat the windings), it is expected that a significant fire escaping the transformer's housing is very unlikely. A potentially challenging fire is defined as one with the potential to spread beyond the bounds of the initiating component or to represent a direct threat to other plant equipment or cables. Small dry transformers would not appear to hold this potential.

Note that the original wording of the ignition source bin in Chapter 6 of NUREG/CR-6850, EPRI TR-1011989 had already excluded "small lighting transformers." The revision discussed immediately above will now exclude transformers with a rating of 45 kVA or less and will supersede the prior guidance. In order to avoid confusion and potential conflicts, the original wording associated with the exclusion of "small lighting transformers" has been deleted from the revised bin description provided below. The 45 kVA criterion applies to any dry-type transformers including lighting transformers.

The team does, however, conclude that the same arguments would not apply to oil-filled transformers. These transformers should be included in the count regardless of the power rating. Any oil-filled transformer has a sufficient combustible content (i.e., the oil) to represent a potentially challenging fire in the event of transformer failure. In practice smaller, indoor-type transformers are generally not of an oil-filled design. The guidance relative to Bin 23 as provided in Section 6.5.6 is modified and clarified as follows:

"Bin 23 – Transformers (Plant-Wide Components): This bin nominally includes any indoor transformer that is not an integral part of a larger component. In particular, all dry-type transformers with a rating greater than 45 kVA and all oil-filled transformers are included in this bin. Examples of transformers accounted for in this bin include: 4160V/480V station service transformers attached to AC

load centers; low-voltage regulators; and 480V/208-120V auxiliary service transformers. The large yard transformers are not part of this bin. The number of indoor transformers should be estimated with the following clarifications:

- This bin *excludes* control power transformers and other small transformers, which are subcomponents in electrical equipment. These small transformers are assumed to be an integral part of the larger component.
- This bin *includes* all indoor, oil-filled transformers regardless of size.
- This bin *excludes* dry-type transformers with a rating of 45 kVA or less. The bin *includes* all indoor dry-type transformers with a rating greater than 45 kVA.
- This bin *includes* wall-mounted transformers, unless they satisfy the 45 kVA exclusionary criteria immediately above.”

Bin 26 - Ventilation Subsystems

For Bin 26, Ventilation Subsystems (Plant-Wide Components), the team agrees that some clarification is appropriate. In particular, the team’s original intent was to exclude ventilation subsystems with very small motors consistent with Bin 14. In this case, the modification is simply a re-wording of the existing guidance to make it more consistent with the other related bins. The guidance relative to Bin 26 as provided in Section 6.5.6 is clarified as follows:

“Bin 26 – Ventilation Subsystems (Plant-Wide Components): This bin includes components such as air conditioning units, chillers, fan motors, air filters, dampers, etc. A fan motor and compressor housed in the same component are counted as one component. The total number of ventilation subsystems should be estimated with the following clarification:

- This bin excludes ventilation subsystems (e.g., fans, filter banks, or compressors) driven by an electric motor rated 5 hp or less. The bin *includes* any ventilation subsystem with an electric motor greater than 5 hp.”

Attachment: FAQ 07-0031, Revision 0, as presented to the Requantification Study team for response.