Attachment 6

Guidance for the Identification of Targets and Their Ignition and Damage Criteria

The identification of nearest ignition and damage targets will most often involve the identification of cables as both ignition and damage targets. Often the same cable will represent both targets. For cables, the ignition and damage criteria will be assumed to be the same. Heat flux and temperature criteria for damage and/or ignition are identified below:

Table A6.1 - Screening Criteria for the Assessment of the Ignition and Damage Potential of Electrical Cables

Cable Type	Radiant Heating Criteria	Temperature Criteria
Thermoplastic	6 kW/m^2 (0.5 BTU/ft^2s)	205°C (400°F)
Thermoset	11 kW/m^2 (1.0 BTU/ft^2s)	330°C (625°F)

Additional rules for application in the target identification task are:

Cables in conduit will be considered potential damage targets, but not ignition targets. Cables in conduit will not contribute to fire growth and spread. The conduit will be given no credit for delaying the onset of thermal damage.

Cables coated by a fire-retardant coating will be considered as both thermal damage and fire spread targets. For the purposes of the Phase 2 analysis, no credit will be given to the coating for delaying or preventing the onset of damage and/or ignition.

In identifying damage targets, do not include components directly within or associated with the fire ignition source itself. The fire ignition source will inherently be assumed to be damaged given any fire involving itself as the source so further evaluation of the components as damage targets is unnecessary.

> Example: for an electrical panel fire, all equipment and components within the panel will be assumed to fail. Per the counting guidance, a panel will be defined as a distinct vertical section in this context.
>
> Example: Given a self-ignited cable fire, all cables in the initiating raceway will be assumed to fail immediately on fire ignition (time zero).

Mixed Cable Insulation/Jacket Type Configurations

There are cables that are formulated with a thermoset insulation and a thermoplastic jacket, and potentially, *vise-versa*. Armored cables may have a bare metal armor exposed, or may have either a thermoset or thermoplastic covering over the metallic armor. For such cases, some special consideration is needed.

In the SDP process, the analysis does not distinguish between ignition and damage behaviors. Ignition of a cable is taken as an indication of imminent failure. In the assessment of whether to treat a cable as a thermoset or thermoplastic, the weakest link will dominate. For example, a cable with a thermoset insulation and a thermoplastic jacket will be treated using the failure criteria of a thermoplastic cable to reflect the reduced resistance to ignition of the jacket material. A cable with a thermoplastic insulation and a thermoset jacket will also be treated as a thermoplastic due to the likelihood of melting of the insulation material.

The following table provides a decision matrix for the selection of which failure/ignition property set to apply to a given cable.

Table A6.2 - Cable Properties Selection Decision Matrix		
Cable Construction / Configuration		**Ignition/Damage Parameter Set to be Used**
Insulation Type	**Jacket/Covering Type**	
TS	TS	TS
TS	TP	TP
TP	TS	TP
TP	TP	TP
Armored - TS	TS, or No Cover	TS
Armored - TS	TP Cover	TP
Armored - TP	TS, TP, or No Cover	TP

TS = Thermoset TP = Thermoplastic

<u>Targets other than electrical cables</u> may also be vulnerable to fire damage. Large, strictly mechanic components (e.g., pipes, check valves, structural supports, tanks, etc.) are not considered vulnerable to fire damage for the purposes of SDP Phase 2 analyses. Should an issue related to potential fire-induced failures of such elements (e.g., fire-induced collapse of a structure or structural supports) be deemed relevant, the analyst should consult NRC HQ staff for guidance.

For the majority of plant components, electrical cables servicing the equipment (power, control, and/or instrument cables) will be the most vulnerable aspect of the component. Hence, failure of the cables will represent the predominant failure mode for the component. In these cases, the failure criteria for the component will be based on failure of the cables servicing the component as already described. This approach applies to any electrical or electro-mechanical component with a thermal mass that exceeds that of a short segment of cable. Such components would include motors, pumps, fans, most valves, transformers, electro-mechanical relays, switchgear, breakers, mechanical switches, hand switches on a control board, etc.

The only case where damage criteria other than those applied to cables should be considered is solid state devices and printed circuit based components (e.g., circuit cards, electronic relays, computers, electronic signal conditioning equipment, digital instrumentation and control circuits, electronic displays, etc.). Electronic devices are generally vulnerable to failure at temperatures much lower than those that may cause cable failures. If a scenario should arise involving solid state control components as a potentially risk-important thermal damage target, the failure criteria to be applied in screening are 0.25 BTU/ft^{2}s and 150°F, unless information is available to indicate the components are qualified for continuous operation at a higher temperature. The criteria for ignition of the components will assume properties similar to thermoplastic cables (0.5 BTU/ft^{2}s and 400°F).

For cables, damage and ignition thresholds are treated as equal. Unlike cables, for the electronic components, failure of the component will not be taken as indication of the ignition of the component. For electronic components, the ignition temperatures far exceed the damage temperatures. If electronic components are important as secondary combustibles (i.e., as a specific path for fire spread to another critical target), *the ignition criteria established for thermoplastic cables (as described previously) should be used* to characterize the ignition behavior of solid state devices and printed circuit cards.

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