

## Rapid Fire Progress – Terminology

The first known reference, or use of the term 'FLASHOVER', was made in the 10th edition of the NFPA Handbook for Fire Protection in 1948 where a 'flashover point' was used to describe enclosure fires reaching a stage of development where all the combustible material in the area will flash into flame.

In 1961 US Fire Investigator [John Kennedy](#) wrote about the phenomenon of flashover, noting the ability of fire to leap across rooms or down corridors at 'express train speed'. The first scientific discussion of the phenomenon appeared in UK Fire Research note 663 (December 1967) where Dr Philip H Thomas referred to the term as 'the theory of a compartment fire's growth, up to the point where it became fully developed'. Customarily, this period of growth was said to culminate in flashover, although Thomas admitted his original definition was somewhat imprecise and accepted that the term could be used to mean different things in different contexts.

In RN 663 (1967) Thomas informed us that there can be more than one kind of 'flashover' and described flashovers resulting from both ventilation and fuel controlled scenarios.

Then in 1995, Walton and Dr Thomas further informed us through the SFPE Handbook that 'Flashover is not a precise term and that several definitions in the literature can be found. Although there appears several definitions, they all allude that flashover results in full total room surface involvement with sustained flaming.

The newly crafted **NFPA 921-2004** definition of flashover is: *“A transitional phase in the development of a compartment fire in which surfaces exposed to thermal radiation reach ignition temperature more or less simultaneously and fire spreads rapidly throughout the space resulting in full room involvement or total involvement of the compartment or enclosed area.”*

However, for firefighting purposes, the NFPA have recognized for over twenty years (in their annual reports concerning firefighter life losses) that there are several other forms of related phenomena or terms used, such as smoke explosion; flameover; backdraft; flash fire; etc and that many of these phenomena cannot be explained or directly attributed by on-scene firefighters.

Therefore, the NFPA reporting system has established the term 'Rapid Fire Progress' to cover all situations where some form of fire phenomena led to an extreme event of combustion causing sudden transition from a small fire to a large fire, even where flaming is not sustained. They further refer to various sudden or extreme fire phenomena as falling into one of three categories -

- Flashover
- Backdraft (Backdraught)
- Fire Gas Ignitions

From a CFBT fire instructor's standpoint, it is not necessarily the precise science behind each event that is important to the firefighter, but rather the actions (or non actions) that he/she might take to prevent or counter such forms of extreme fire behavior.

Despite what some authors are now suggesting, **Flashover still remains as an official term in 2007 with a current ISO definition** as follows - Flashover is a *'stage of fire transition to a state of total surface involvement in a fire of combustible materials within an enclosure'*

The main use of the term 'flashover' was always meant (and is used) to describe fire safety tests that develop to full room involvement. The term 'Rapid Fire Progress' used by the NFPA better describes the wider range of gaseous-phase combustion that firefighters are likely to encounter at structure fires.

Dr Thomas himself suggests (2005) that *"flashover" is now a problem word of which there seem to be several definitions. The fire services seem to stick to a gas phase definition, and yet the ISO and other definitions refer to fire spread and fuel surfaces. These are, to me, not alternatives but different types of flashover: the essence is "flash" and "over" – "overhead" and "over surfaces" are two varieties. ISO 13943 does refer to "transition", but it could be "slow" or "fast"*.

In the 1980s, however, there were further issues with some of the terminology and theories brought through the translation from Swedish to English. Swedish fire engineers had begun to redefine terms that had already been established by scientists and firefighters in the US and the UK several decades before, by using new terms, definitions and explanations for events associated with various rapid fire phenomena.

The original Swedish terminology related to the term 'flashover' has since been altered in its translation to conform with current European and North American accepted scientific definitions as follows:

- Swedish 'Lean Flashover' - is **ROLLOVER**
- Swedish 'Rich Flashover' - is **BACKDRAFT**
- Swedish 'Delayed Flashover' - is **SMOKE EXPLOSION**
- Swedish 'Hot Rich Flashover' - is **AUTO-IGNITION**
- US 'Black Fire' - See Article [HERE](#)

Some examples from current training texts based on Swedish translations into English (with corrections in Red) -

A '**lean flashover**' (accepted scientific terminology is **ROLLOVER**) is the ignition of the gas layer under the ceiling, leading to total involvement of the compartment. The fuel/air ratio is at the bottom region of the flammability range.

A **rich flashover** occurs when the flammable gases are ignited while at the upper region of the flammability range. This can happen in rooms where the fire subsided because of lack of oxygen. The ignition source can be a smoldering object, or the stirring up of embers by the air track. **The internationally accepted scientific definition of such an event is known as 'backdraft'.**

A **delayed flashover** occurs when the colder gray smoke cloud ignites after congregating outside of its room of origin. The results can be very unpredictable, and if the ignition occurs at the ideal mixture, the result can be a violent **smoke gas explosion**. **The internationally accepted scientific terms for this process are either smoke explosion or fire gas ignition depending on the severity of the combustion process.**

A **hot rich flashover** occurs when the hot smoke with flammable gas ratio above the upper limit of flammability range and temperature higher than the ignition temperature leaves the compartment. Upon dilution with air it spontaneously ignites and the resultant flame can propagate back into the compartment, resulting in an event similar to a rich flashover. **The internationally accepted definition of this process is known as auto-ignition which is another form of fire gas ignition.**

We must be very careful how we relate to events and use terminology associated with various forms of rapid fire phenomena. We must use a standard language.