

# There is no such thing as extreme fire behaviour

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Fire is a process of combustion and it is driven by laws of nature. Such laws describe how various phenomena in nature are related and affect each other. Amongst such laws, relevant in the case of fire in buildings, are

- The first law of thermodynamics, which states that energy cannot be destroyed or created, only transformed
- Newton's general law of gravitation
- Bernoulli's law, describing the relation between pressure and flow, and
- The general gas law, describing the relation between pressure, volume, temperature and mass.

That we do not always understand these fundamental laws and how they affect the behaviour of a fire, do not make the fire extreme in any way. The fire simply follows the conditions given, whether we know them or not. There is no "magic" about fires. The fire is not a living being or any kind of phenomena with a life of its own. The fire requires certain conditions and it is controlled and influenced by some basic laws and conditions. Our ignorance about this does not make the behaviour of a fire extreme in any way.

A fire can be described by that fuel evaporates and possibly decomposes (it pyrolyzes). The gaseous (and possibly pyrolyzed) fuel reacts with oxygen in the air and produces a wide range of simple and complex products of combustion. In many cases, some of the fuel remains more or less unaffected by the combustion process (but can react some time later). Meanwhile, energy is released of which some is used to keep the process going which means that the process is self-sustaining, something that is very significant for a fire. Emissions of heat and light are other significant characteristics of fire. Note that a very large part of the energy delivered from the fire, is emitted in the form of radiation outside the visible spectrum – although we cannot not see flames the fire (or other hot surfaces, objects or particles) might very well radiate.

How a fire develops is determined, amongst other things, by the surroundings and the presence and type of combustible material. The heat developed by the fire is spread through radiation, conduction and convection. It is worth noting that fire gases, objects and construction elements that initially is heated by the fire, in turn, spreads heat by radiation, conduction and convection, thus further affecting the development of fire (and various parts of a building). As the surroundings and the presence and type of combustible materials are not always known, makes the fire and its development difficult to assess and predict. But even if the course of the fire was unexpected, we never experienced anything like this before, the outcome of the fire was more or less unpredictable (as a result from lack of knowledge) or if the course of the fire otherwise was difficult to determine in advance, does not make the fire extreme in any way. From a physical-chemical point of view, the development of a fire always is expected and in some sense predictable, as it follows the conditions given and the laws of nature. However, the consequences of a fire can be severe and the risks during a fire in a building are often high, simply because the circumstances and the factors influencing the fire behaviour are not known.

To understand fire behaviour one must have knowledge of a number of basic thermal properties of the fuel as well as of the surroundings. Among these properties are heat of combustion, heat of evaporation, ignition temperature, vapor pressure, specific heat capacity, thermal conductivity and geometry of the building.

And even if our knowledge regarding these properties is good, it is not always possible to pre-determine or assess development of fires. We can not always retrospectively explain or understand why something happened. But this is not the same as the development of the fire was extreme in any way. The fire is still behaving as expected, from a physical-chemical perspective.

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