Why control smoke?

Proving the case for the priority of smoke control in life saving building design

You'll often hear comments or read articles from people in our industry along the lines of "it's not heat or flames that kill and injure in a fire, it's smoke." It's a natural enough assumption and it boosts the importance of our work in smoke control, but those people very rarely cite their sources.

Even the Wikipedia page on the subject of smoke inhalation quotes "some 50–80% of fire deaths are the result of smoke inhalation injuries, including burns to the respiratory system." But their link-out reference is something called emedicinehealth.com which is festooned with banner ads and states these figures as facts without any qualification.

Well we like to dig a little deeper here at Adexsi. First, to the common sense argument for prioritising smoke management above everything else in a fire situation:

Fire is hot and can spread quickly, but it needs to build up sufficient heat, across a sufficiently conductive medium, to do so.

Smoke, on the other hand, is also hot, yet can travel as quickly as air. Within seconds it can completely obscure vision making escape extremely difficult, and almost as quickly it can be breathed it causing serious injury.

But do the facts back up this common assertion? Let's take a look.

The dangers of hot smoke

The NPFA (National Fire Protection Association) in the USA has a chart that explains how harmful smoke can be to people in fire situations:

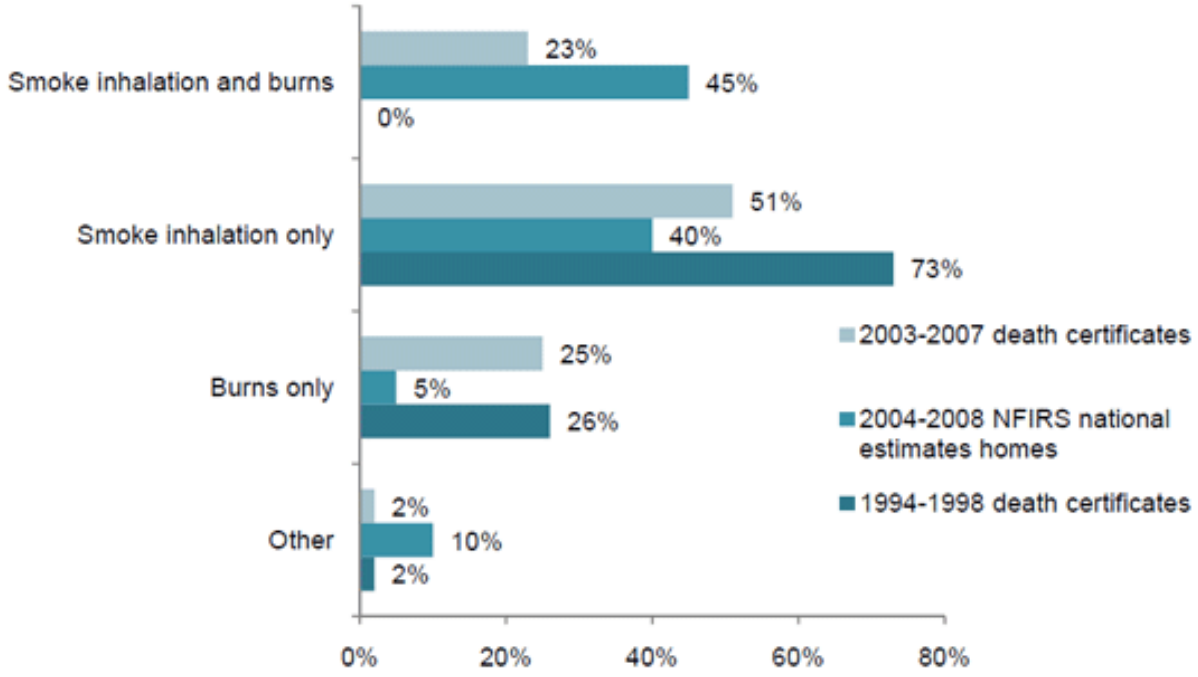
When oxygen levels are at...	...a person experiences:
21 percent	Normal outside air
17 percent	Impaired judgment and coordination
12 percent	Headache, dizziness, nausea, fatigue
9 percent	Unconsciousness
6 percent	Respiratory arrest, cardiac arrest, death

A report from Michigan State University in 2015 states “Even one breath of this very hot air can be lethal. Inhaling superheated gases can burn your respiratory tract whether or not the gases present are toxic. Those who suffer burns are at even greater risk as burn victims often have injuries to their lungs from inhaling hot smoke. Over 50 percent of people with severe burns and smoke inhalation die.”

Just the facts

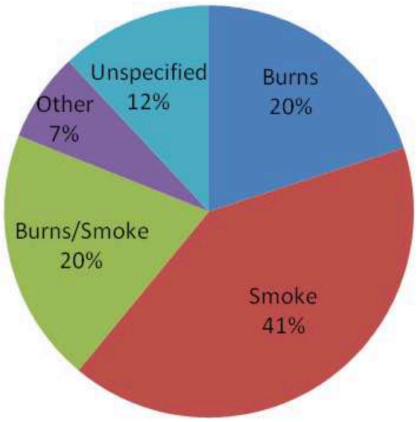
The NFPA undertook a study in 2011 into precisely the figures reflecting deaths within fires, looking specifically at the ratio of flame-related injuries to smoke-related injuries as the cause of death.

Figure A. Shares of Fire Deaths by Smoke Inhalation or Burns



The study’s introduction starts with “Death certificates show a 2-to-1 ratio of smoke inhalation to burns for fire deaths overall, while fire incident reports show an 8-to-1 ratio for home fire deaths” implying that residential buildings are especially vulnerable to the effects of smoke as a hazard when a fire breaks out.

A University of Leeds paper from 2016, titled “What Kills People in a Fire? Heat or Smoke?” looks at fire toxicity in terms of smoke being a complex hazard that gets more dangerous as its constituent parts are more polluting to a human. In other words, smoke is hazardous but moreso when it’s carrying toxic gases from the source of the fire.



This chart is from fire and rescue services figures in the UK from January 2015 - 41% of the fatalities died from smoke inhalation and 46% of injuries (excluding first aid and precautionary checkups) were caused by smoke inhalation.

The UK and USA have both seen fire deaths in general decrease over the years as greater legislation leads to improved building design and fire safety protocols being in place, although recent media reports state that over the past year in the UK fire-related deaths are actually up 26% - reportedly due to the reduced numbers of fire fighters on account of austerity measures.

Conclusion

We can see from the above studies that hot smoke is incredibly dangerous, especially if it comes from burning materials that contain hazardous toxins. We can also see that our previous common sense assertions appear to be backed up by statistics from the UK and the USA.

It all just goes to highlight the incredible importance of managing smoke when a fire breaks out. That means a properly-specced, professionally-installed and well maintained by experts in their field, as mandated by appropriate regulations and legislation.