

# Vytenis Babrauskas

I am an internationally known fire scientist. I am also the author of the single-largest book on fire science ever written by a single author (*Electrical Fires and Explosions*), along with the second-largest book on fire science ever written by a single author (*Ignition Handbook*). I worked for a long time as a research scientist at the National Institute of Standards and Technology (NIST). At NIST, I invented the Cone Calorimeter and large-scale, oxygen-consumption heat release rate calorimeter. These have become the de facto standard instruments for quantifying how fast products and materials burn.

I have researched flame retardant (FR) chemicals ever since the 1970s. More recently, I also studied the harm to health and the environment which can come from heedless use of FR chemicals. During the 1970s and 1980s, it used to be thought that FR chemicals might do some (fire safety) good, and won't do any harm, thus their use proliferated. In subsequent decades, we have learned about profound dangers to health and the environment that may accrue from the use of organohalogen FR chemicals, but also from several other chemical classes of FR compounds. What has been tragically unfortunate, is that the loadings of FR chemicals put into various electrical, electronic, and consumer goods have tended to be insufficient to significantly improve the fire safety of these products, yet sufficient to cause alarming consequences for health and environment.

My research has indicated that, qualitatively, the potential fire safety effectiveness of an FR chemical can be viewed as the ratio of FR loading, divided by the volume of impinging flame. In other words, moderate loadings of FR chemicals can suffice to prevent ignition from small flames, but even large loadings (which would make the plastics be no longer functionally viable) will not prevent ignition, or improve the fire safety in situations where the flames involved are large.

The above considerations indicate FR chemicals are likely to have a positive fire safety advantage only situations where the reasonable expectation is that the ignition source will necessarily be very small. In practice, the only common product class where this is likely to prevail is electronic circuit boards.

In view of the above, it is my considered opinion that organohalogen FR chemicals (or any other classes of FR chemicals which present a potential danger of health or environmental harm) should not be added to any electrical, electronic, or consumer products, except for circuit boards.