
Strata Corporations

What is Third-Hand Smoke & How Long Does it Last?

Third-hand smoke (THS), a term first coined in 2009, refers to residual second-hand tobacco smoke contamination that persists in the indoor environment after smoking has stopped. Semi-volatile and volatile organic chemicals like nicotine and polycyclic aromatic hydrocarbons (carcinogens, also known as PAH) are oily or waxy and more likely to stick to surfaces than be removed by ventilation. Because they are volatile or semi-volatile, they are also looking for other constituents with which to bond, becoming new chemical species.

Like DDT, scientists are starting to think that these THS residues can persist in the environment for weeks, months or even years, remaining on surfaces and in dust where they later off-gas. For example, carpet has extremely high sorbency, absorbing 100x more nicotine per m² than stainless steel. You don't need to be a scientist to understand this--anyone who has lived in a place with carpeting where someone smoked knows how long it smells, and how difficult (if not impossible) it can be to get the smell out.

How long third-hand smoke persists in an indoor environment depends on:

- Number of cigarettes smoked;
- Volume of air (depends on layout of the home);
- Ventilation rate;
- Rate of emission of chemical constituents from sidestream and mainstream smoke;
- Furnishing level (material type and surface area);
- Sorbency (how likely something will be absorbed or adsorbed) of surfaces; and
- Rate of de-sorption and re-emission (off-gassing).

Very little is currently known about potential or actual health effects of exposure to THS. Not all constituents of THS have yet been identified, and it is premature to assess the health risks of exposure without evidence from clinical outcomes. However, while there is still much not known about THS, it is clear that there are significant chemical, toxicological and behavioural differences between it and second-hand smoke (SHS).

For example, one study from 2010 sought to demonstrate that nicotine residue from SHS, which readily sorbs (sticks) to indoor surfaces, can react with ambient nitrous acid (HONO) to form potent carcinogenic (cancer-causing) tobacco-specific nitrosamines (TSNAs). HONO, present in the indoor environment from unvented combustion appliances and from chemical reactions, is often found at higher levels than outside. Nicotine is the most abundant organic compound found in SHS, deposits almost entirely on indoor surfaces, and persists in the indoor environment for weeks to months. In laboratory experiments, vaporized nicotine was adsorbed onto cellulose as a model indoor material and then exposed to HONO for 3 hours.

The researchers found NNA {1-(N-methyl-N-nitrosamino)-1-(3-pyridinyl)-4-butanal}, a TSNA absent in fresh tobacco smoke, to be a major product, along with two others—NNK {4-(methylnitrosamino)-1-(3-pyridinyl)-1-butanone} and NNN {N-nitrosornicotine}. Moreover, given the low volatility of TSNAs and their ability to persist in the indoor environment, they represent a potential and unappreciated health hazard through skin exposure, dust inhalation, and for infants, ingestion. The study emphasized the need for more research in this area to better understand the health implications of these potent cancer-causing compounds that impregnate the various surfaces and furnishings of indoor environments.

It is premature to adopt public policies regarding potential THS health risks; however, it is noted that customer complaints regarding the smell of stale SHS have already triggered numerous voluntary smoke-free policies in hotels and car rental companies. A research agenda is needed to connect the research on risk assessment with research to reduce and prevent tobacco use and to reduce exposure to smoke pollutants and tobacco-related diseases.

Source: Non-Smokers' Rights Association