

THIRDHAND SMOKE Resource Center

What do we know about the health risks of thirdhand smoke?

Thirdhand smoke is the chemical residue from tobacco smoke. It is also called “tobacco smoke residue” or “stale tobacco smoke.” The chemicals in thirdhand smoke are toxic to humans, especially children. It can linger for years in dust and on household surfaces. It can also become embedded in carpets, furniture, clothes, and building materials. It is difficult and expensive to remove.

Secondhand smoke contains thousands of chemicals in the form of gases and very small and sticky particles. Many of these pollutants are known to cause cancer and heart disease and harm your lung and reproductive health. Thirdhand smoke contains a subset of these particles and gasses that can linger for years in carpets, walls, furniture, and other objects and materials.

People and pets come into contact with thirdhand smoke when their skin touches a surface where thirdhand smoke has collected. Someone can breathe in pollutants from thirdhand smoke gases and particles in the air, or by ingesting thirdhand smoke residue from objects they put in their mouth.

Five major lines of research demonstrate the impact of thirdhand smoke exposure on human health.

1) **Research on the effects of chemicals found in thirdhand smoke:**

Thirdhand smoke contains some of the same toxic chemicals as first- and secondhand smoke, including tobacco-specific nitrosamines, polycyclic aromatic hydrocarbons, heavy metals, nicotine, and ultrafine particles with a median diameter $<0.10 \mu\text{m}$. There is overwhelming evidence that exposure to this mixture of toxic chemicals and ultrafine particulate matter is harmful to human health. Some of these chemicals are listed by the WHO's International Agency for Research on Cancer. California law requires that more than 25 of the pollutants found in thirdhand smoke to be listed under Prop 65 because they are known to cause cancer, birth defects or other reproductive harm (<https://oehha.ca.gov/proposition-65>).



2) Research on the effect of thirdhand smoke exposure on human cells under controlled laboratory conditions:

Studies of human cells show that exposure to thirdhand smoke can directly damage DNA (e.g., DNA strand breaks), the genetic material found in nearly every cell in the human body that contains the instructions our cells need to develop, function, grow, and reproduce. Thirdhand smoke causes oxidative stress in human cells, interfering with their normal functioning and repair mechanisms. In the presence of thirdhand smoke chemicals, the ability of human cell to regenerate and repair themselves is impaired.

3) Research on the presence of thirdhand smoke and human exposure to thirdhand smoke in real-world field settings:

The presence and persistence of thirdhand smoke has been demonstrated in many different nonsmoking settings. They include: single-family homes, low-income multi-unit housing, high-end condominiums, homes of nonsmokers with smoking bans, homes of smokers after they stop smoking, homes after smokers moved out, nonsmoking rooms in hotels, public places, and public transportation. People living in these environments have been shown to be exposed to toxic constituents of thirdhand smoke. Evidence of exposure is based on the presence of thirdhand smoke biomarkers in the urine, blood, or saliva. Newborns, infants, children, and adult nonsmokers living in thirdhand smoke polluted environments have been shown to thirdhand smoke toxicants in their bodies.

4) Research on the effects of thirdhand smoke exposure conducted on animals under controlled laboratory conditions:

In 1953, one of the earliest animal studies on thirdhand smoke was conducted, showing that mice developed skin cancer when thirdhand smoke residue was applied to their skin. A more recent study showed that mice exposed to thirdhand smoke through their bedding material have the following symptoms:

- slow wound healing
- inflammation in lungs
- elevated levels of fat in liver
- high blood sugar levels
- increased blood clotting
- hyperactive behavior
- poor weight gain after birth
- elevated LDL (“bad”) cholesterol and low HDL (“good”) cholesterol levels



5) Research conducted on humans in laboratories and real-world field conditions:

Researchers at the University of California San Francisco studied the effects of thirdhand smoke exposure in healthy, non-smoking human volunteers in a laboratory setting. They established that after only three hours of exposure to thirdhand smoke, there was damage to the participants' lung cells.

Researchers from Cincinnati Children's Hospital and San Diego State University found that children exposed to thirdhand smoke were more likely to be diagnosed with pulmonary illness, viral/other infectious illness, and bacterial infection.

Summary

The evidence from laboratory experiments on human cells and animals, controlled studies on healthy humans, and real-world field studies in the community show that thirdhand smoke

- contains chemicals toxic to humans
- persists in the environment
- can cause harm to multiple organ systems in the human body.

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Sources

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