

Certain indoor air pollutants can be absorbed through the skin. What you need to know

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Even though most of us will spend a [majority of our lives indoors](#), that doesn't mean we aren't still exposed to air pollution. Indoor air contains a wide array of pollutants including chemicals found in many common

household items, building materials and cleaning products.

These chemicals (known as [volatile organic compounds](#)) can occur in gaseous form, which means we can inhale them. But there's a sub-group of [volatile organic compounds](#), called [semi-volatile organic compounds](#). These can occur both in gas form and absorbed on [solid surfaces](#) (including all indoor surfaces, as well as dust).

Not only can these chemicals enter our body through inhalation, ingestion or by touching a surface containing these compounds, research shows they can also penetrate the skin directly from the air.

Once in our body, these chemicals may harm our health—potentially affecting the [respiratory system, nervous system, cognitive health](#) and the [hormonal system](#).

Skin exposure

There are many groups of semi-volatile organic compounds. One type you'll probably come across in your home are [phthalates](#). Phthalates are everywhere and our exposure to them is nearly continuous.

Phthalates are used as plasticizers, added to certain products so they're softer and more flexible. They can be found in certain types of plastics (such as food packaging or garden hoses), building materials (such as vinyl flooring) and personal care products (including shampoos and hair sprays).

Exposure to these chemicals has been linked to a variety of health problems, including [lower sperm quality](#), poorer [cardiovascular health](#) and altered [growth and development](#) in children.

Once phthalates enter the body, they're broken down over a few hours to

a few days. These breakdown products (metabolites) are then excreted through urine. But while phthalates may be quickly excreted by the body, most of us still have these chemicals in our body almost [all the time](#). This is because we are continuously exposed to these chemicals.

There are many ways we can be exposed to phthalates in our daily lives. While people might think they're only at risk if they inhale or ingest these chemicals, research shows skin absorption can have a major affect on [phthalate](#) levels in the body.

In [one study](#), six participants were exposed to air containing elevated levels of two phthalates in a controlled climate chamber. This was done using latex paint, formulated with a heavy dose of the target phthalates and applied to aluminum plates hanging in the chamber, thus introducing them in the air.

To separately measure the quantity of phthalates absorbed through inhalation versus through skin, the participants were exposed twice—once wearing a tight-fitting breathing hood (exposing them only through skin) and once without the hood (exposing them through both skin and inhalation). The participants only wore shorts in order to increase the exposed skin surface area.

Their diet and use of [personal care products](#) were restricted, as these can be a [major source of phthalate intake](#). Participants also collected their urine for several days after exposure. The quantity of phthalates absorbed by participants was estimated from the concentration of phthalate metabolites in their urine.

The participants had a substantial intake of phthalates even when only their skin was exposed. Their exposure was even higher after the test where both their skin and airways were exposed to the chemicals.

In the same study, an additional participant was put through the experiment to better understand how skin absorbs chemicals and whether clothing has a protective effect. The participant was exposed to the phthalates twice. He wore a breathing hood both times, to ensure that the skin was the only absorption route.

In the first experiment, he wore a set of clean clothes. In the second experiment, he wore a set of clothing which had been exposed to the chamber air several days prior. The results were then compared to the bare-skinned participants. The researchers found that the participant's phthalate exposure was reduced with clean clothes, but it was three to six times higher when wearing the contaminated clothes compared to the participants in the bare-skinned trial. This shows how clothing can also be a reservoir for pollutants.

In [a follow-up study](#), similar findings were obtained in nearly identical experiments using nicotine from cigarette smoke as the test chemical. More recently, [research in homes](#) has yielded similar results.

[Modeling studies](#) have also indicated that perfluoroalkyl and [polyfluoroalkyl substances](#) (PFAS), another type of commonly used semi-volatile organic compound, can also be absorbed through skin.

All these results highlight the potentially significant role skin absorption plays in air pollution exposure—and of the protective role clothing can have.

Health harm

The harm a chemical causes differs depending on [how it enters the body](#). Ingested chemicals pass through the intestines and liver before entering the blood. Inhaled chemicals first pass through the lungs where they may be [absorbed directly into the blood](#). Chemicals that penetrate the skin

can [also directly enter the bloodstream](#). You don't even need to have an [open wound](#), as the chemicals can be absorbed directly through the skin.

Even for similar exposure levels, the concentration of pollutants in the body differs depending on the exposure route. For example, [one study](#) modeled the concentration of a chemical called bisphenol-A in the liver and kidney from oral ingestion versus skin exposure. They found that the concentrations in the kidney and liver differed remarkably depending on the route of exposure.

Regardless, the longer you're exposed to these chemicals, the more likely it is that skin becomes a reservoir for them—eventually becoming a primary route of exposure. Fortunately, there are many things you can do to reduce your vulnerability to these chemicals:

1. [Use low-emission](#) building materials (such as paints and adhesives) where possible.
2. [Clean indoor surfaces](#) to remove any chemicals that might have been deposited on them (especially dusty surfaces).
3. [Wash clothing](#) and bedding regularly and wash [new clothes](#) before wearing them. This will help prevent [chemical absorption](#) by your skin.
4. [Air out your home regularly](#) (unless your home has a mechanical ventilation system). This will help reduce pollutant concentration in the air.
5. [Bathing](#) and [washing hands](#) after exposure can also help reduce skin absorption.

By improving [indoor air quality](#), you can lower your risk of exposure to multiple harmful pollutants.

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