

Chemicals in spray polyurethane foam: How can something so toxic be considered green?



Margaret Badore
Design / Green Architecture
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Spray polyurethane foam is widely promoted as a green building material for its ability to improve energy efficiency. It insulates better per inch than fiberglass or cellulose, which can mean major energy saving on heating and cooling. However, energy efficiency isn't the only consideration when it comes to sustainable building. A closer look at spray foam's chemical makeup reveals a number of substances that are known to be hazardous.

Spray polyurethane foam consists of two liquid chemical components, referred to as "Side A" and "Side B," that are mixed at the site of installation. Side A is mostly made up of isocyanates, while Side B usually contains polyol, flame retardants and amine catalysts. These chemicals create hazardous fumes during the application, which is why installers and nearby workers should wear personal protective gear during this process. Once the foam has fully expanded and dried, manufacturers say it is inert. If the chemicals are not properly mixed, they may not react fully and can remain toxic.



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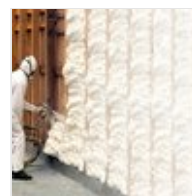
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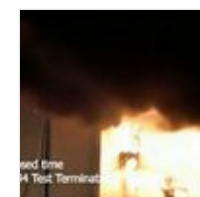
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FLAME RETARDANTS MAY
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documented, but risks associated with Side B are less well understood. David
associated with spray foam installation since 2010. Although Marlow was
unavailable for interview, the Public Affairs office at the CDC was able to
provide information about his ongoing research via email. These field studies
aim to determine the extent of exposure to all the chemical components of
spray foam, determine a better understanding of curing rates and establish safe
reentry times, and develop engineering controls to reduce the risk of exposure.

In addition to the dangers associated with installation, these chemicals can
potentially remain unreacted in the form of dust or shavings. The
[Environmental Protection Agency warns](#): "Cutting or trimming the foam as it
hardens (tack-free phase) may generate dust that may contain unreacted
isocyanates and other chemicals." This is also a concern during the process of
removing foam.

Isocyanates

Isocyanates, such as methylene diphenyl diisocyanate (MDI), are found in the
"Side A" of the spray foam mix. Isocyanates are also found in paints, varnishes
and other types of foam. They are a known cause of occupational asthma.
According to Dr. Yuh-Chin T. Huang, a professor at Duke University Medical
Center, isocyanate-induced asthma is similar to other types of asthma, but
instead of being triggered by exercise, it is triggered by exposure. Once
someone has become sensitized, re-exposure can cause intense asthma attacks.

Homeowner Keri Rimel says she and her husband have both become extremely
sensitive to isocyanates and other chemical smells following exposure during
spray foam installation. "He still to this day can walk into any restaurant, home
or office and he can immediately tell if there's spray foam in a building," said
Rimel of her husband.

[According to the CDC](#), direct contact with isocyanates can also cause a rash if it
comes in contact with the skin.

Amine catalysts

Amine catalysts are one of the Side B chemicals that the CDC is researching, in
an effort to understand the levels of exposure during installation. "Amine
catalysts in [spray polyurethane foam] may be sensitizers and irritants that can
cause blurry vision (halo effect)," they write.

According to a [report published by the Consumer Product Safety Commission](#),
amine catalysts can also irritate the eyes at even low concentrations and if
ingested "may result in severe irritation, ulceration, or burns of the mouth,
throat, esophagus, and gastrointestinal tract."

Polyol

Also found in side B, polyols are alcohols that serve as catalysts. Polyols are
usually made from adipic acid and ethylene glycol or propylene oxide. Some
polyols are made from soy, but [according to the Pharos Project](#), an organization
that advocates for building material transparency, the soy-based material
makes up just 10 percent of the final insulation.

Ethylene glycol, a chemical used to produce polyol in some spray foam, can in
cases of acute exposure (such as swallowing) cause vomiting, convulsions and
affect the central nervous system. [According to the EPA](#), exposure by inhalation
can cause irritation in the upper respiratory system and studies in animals have
shown kidney failure.

Flame retardants

[Flame retardants](#) are added to Side B to pass flammability tests in building
codes. The main fire retardants used in spray foam are
hexabromocyclododecane (HBCD or HBCDD) and tris(1-chloro-2-propyl)
phosphate (TCPP).

According to the Centers for Disease Control, "flame retardants, such as
halogenated compounds, are persistent bio accumulative and toxic chemicals."
Bioaccumulation means that a chemical builds up in the body faster than it can
be flushed out, so there can be a risk of chronic poisoning even if the level of



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A paper by [Vytenis Babrauskas](#) published in the journal [Building Research & Information](#) says that, "flame retardants whose primary use is in building insulation are found at increasing levels in household dust, human body fluids and in the environment." The paper also cites several other studies that show these chemicals are associated with endocrine disruption and are potentially carcinogenic.

The chemical question mark

In a [post for the CDC](#), [Marlow describes](#) the components of Side B as "a chemical question mark." He described the need for "real world sampling."

In addition to those listed above, there may be other chemicals used in spray foam that are undisclosed, and are protected trade secrets. This is particularly troubling for homeowners who want to have their air tested, because they won't know which tests to have done. "You have to tell the person testing what you're looking for," says Terry Pierson Curtis, an indoor air quality specialist. "The problem a lot of times is trying to figure out what you're looking for."

NEXT: Spray Polyurethane foam manufacturer may face class-action lawsuit

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