

# Cheap sewer pipe repairs can push toxic fumes into homes and schools—here's how to lower the risk

January 23 2023, by Andrew J. Whelton

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With many CIPP repairs, this isn't just steam. Credit: Andrew Whelton/Purdue University

Across the U.S., children and adults are increasingly exposed to harmful chemicals from a source few people are even aware of.

It begins on a street outside a home or school, where a worker in a manhole is repairing a sewer [pipe](#). The contractor inserts a [resin-soaked](#)

[sleeve](#) into the buried pipe, then heats it, transforming the [resin](#) into a hard plastic pipe.

This is one of the [cheapest](#), [most common](#) pipe repair methods, but it comes with a serious risk: Heating the resin generates harmful fumes that can travel [through the sewer lines](#) and into surrounding buildings, sometimes several blocks away.

These chemicals have [made hundreds of people ill](#), forced building evacuations and even led to hospitalizations. [Playgrounds](#), [day care centers](#) and schools in several states have been affected, including in [Colorado](#), [Connecticut](#), [Massachusetts](#), [Michigan](#), [Pennsylvania](#), [Washington](#) and [Wisconsin](#).

With the 2022 [Bipartisan Infrastructure Law](#) now sending hundreds of millions of dollars [into communities across the U.S.](#) to fix broken pipes, the number of children and adults at risk of exposure will likely increase.

For more than a decade, my colleagues and I have worked to [understand and reduce the risks](#) of this innovative pipe repair technique. In two new studies, in the [Journal of Environmental Health](#) and [Environmental Science and Technology Letters](#), we show that workers, and even bystanders, including children, lack adequate protection.

Our research also shows the technology can be used safely if companies take appropriate action.

## **Fixing aging pipes with harmful chemicals**

As U.S. water infrastructure ages, communities nationwide are grappling with thousands of broken sewer pipes in their [1.3 million-mile](#) inventory.



With this sewer pipe repair method, the chemical waste is blown into the air and can enter buildings through buried sewer pipes, plumbing, foundation cracks, windows, doors and HVAC units. Credit: [Andrew Whelton/Purdue University](#)

The new law [provides US\\$11 billion](#) for sewer fixes, about [one-fifth of the EPA's estimate](#) of the need.

The least expensive repair method is called [cured-in-place pipe, or CIPP](#). It avoids the need to dig up and replace pipes. Instead, contractors insert [a resin-saturated sleeve](#) in the manhole and through the buried pipe. The resin is then "cooked," [typically with steam or hot water](#), and

transformed into a hard plastic.

One challenge is that the resin [safety data sheets](#) do not disclose all of the [chemicals](#), and some entirely new [ones](#) are [created](#) during heating.

Chemical plumes rising from nearby manholes and contractor exhaust pipes are also [not just "steam."](#) These plumes contain highly concentrated [chemical](#) mixtures, uncooked resin, particulates and [nanoplastics](#) that can harm [human health](#). When we examined the heating process in the lab, we found that as much as [9% of the resin](#) was emitted into the air.

CIPP production is known to discharge about 40 chemicals. Some [cause](#) nausea, headaches and eye and nasal irritation. They can also lead to vomiting, breathing difficulties and other effects.

Styrene, the most frequently documented chemical, is acutely toxic, and ["reasonably anticipated" to cause cancer](#), according to the National Research Council. Chemicals other than styrene can be responsible for [plume toxicity](#).

## **CIPP-associated illnesses in nearby buildings**

So far, chemical exposures have been reported in at least [32 states and seven countries](#). In addition to schools, this process has contaminated [homes](#), [restaurants](#), [medical facilities](#) and [other businesses](#). Companies have been cited for exposing their workers to [unsafe levels of styrene](#).

The earliest U.S. incident we know about was in 1993 at an [animal shelter in Austin, Texas](#). Seven people were overcome by fumes and transported to a hospital. In 2001, fumes entered a hospital in [Tampa, Florida](#), causing employee breathing problems. Since then, [hundreds more](#) people are known to have been exposed, and the numbers are

likely much higher.



The blue cured-in-place pipe, or CIPP, can be seen inside this damaged storm sewer pipe. The CIPP was created by steam cooking the resin into the hard plastic. Credit: Andrew Whelton/Purdue University

In our experience, exposures are rarely made public. Municipalities have

encouraged people [affected by the fumes](#) to only contact the CIPP contractor and pipe owner. In some cases, people were told the exposures were always harmless.

Chemicals [can enter buildings](#) through sinks, toilets, foundation cracks, doors, windows and HVAC systems. The chemicals can even enter buildings that have water-filled plumbing traps. Anticipating this risk, bystanders have been told to [cover their toilets](#) and [close all windows and doors](#).

Wind can help dilute outdoor chemical levels. However, [concentrated plumes](#) can rush through buried pipes into nearby buildings. Bathroom [vent fans](#) may sometimes increase the indoor chemical levels. Levels that should prompt firefighters to [wear respirators](#) have been found in the buried pipes.

The [highest levels](#) have been found during and [after the heating process](#).

Hand-held air testing devices commonly used by some firefighters and contractors [do not accurately identify](#) specific chemical levels. An [earlier study](#) showed the styrene levels were sometimes wrong by a thousandfold.

## **How to protect public health**

With the wave of infrastructure projects coming, it's clear that controls are needed to lower the risk that people will be harmed.

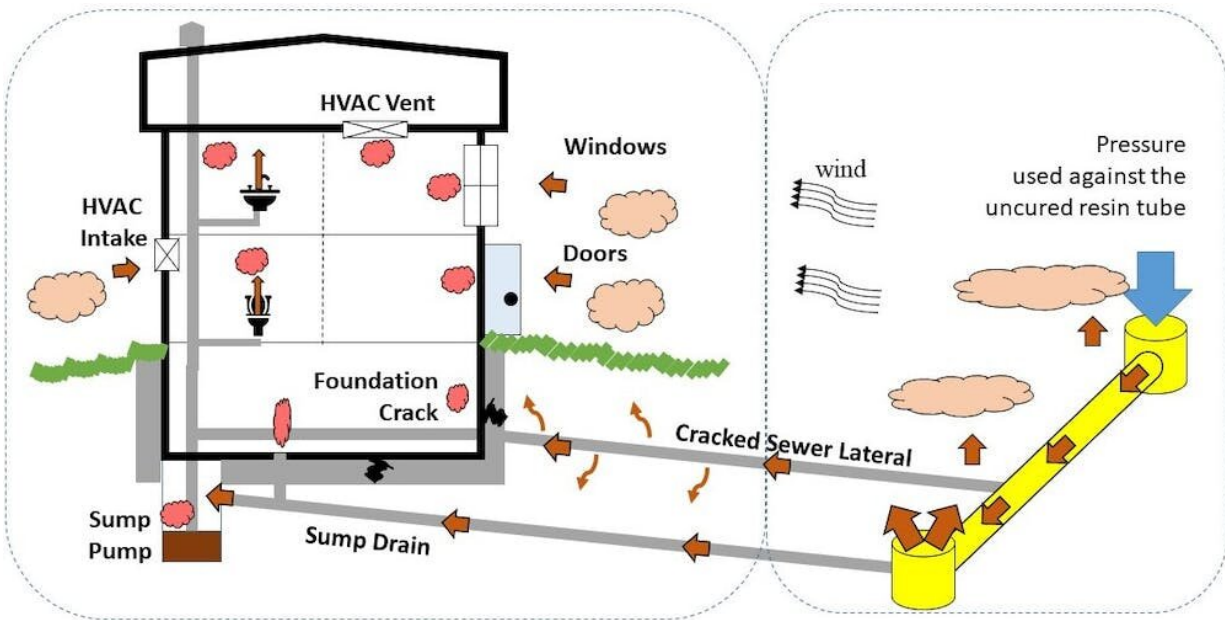
Our research points to several actions that residents, companies and health officials can take to keep communities safe.

We advise residents to:

- Close all windows and doors, fill plumbing traps with water and leave the building during pipe-curing operations, especially when children are in the building.
- Report unusual odors or illnesses to health officials or call 911. Seek medical advice from health officials, not the contractors or pipe owners. Evacuate buildings when fumes enter.

Companies can minimize risks too. They can:

- Stop the cooking process when fumes leave the worksite to lessen the spread of contamination and exposures.
- Use resins that release [less](#) air pollution than standard resins.
- Ask [federal agencies](#) to evaluate hand-held air testing device use.
- Capture and treat air pollution from the process. While this has not yet been done at scale, it is straightforward and would be a fraction of the overall project cost. This waste will be [hazardous](#) because of [its toxicity](#).



Fumes generated during sewer line repair, on the right, can enter nearby homes, schools and other buildings. Credit: Andrew Whelton/Purdue University

Public health and environmental agencies should also get engaged. Federal agencies [know](#) that the practice poses health [risks](#) and can be [fatal](#) to [workers](#). [California](#) and [Florida](#) recognize in safety documentation that bystanders could be harmed. But, so far, few steps have been taken to protect workers' and bystanders' health.

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