

Frequently Asked Questions - NSF Rapid CIPP Study 2 (Worker, Public Safety, and Chemical Air Emissions)

General Questions

Why was the study conducted?

The study published in the *Journal of Hazardous Materials* was conducted to determine what materials can be released into the air by the cured-in-place-pipe (CIPP) process used to repair sanitary sewer and storm sewer pipes and how chemical emission monitoring and CIPP liner analysis should be conducted.

Where can I obtain the files for this study?

Go to the *Journal of Hazardous Materials* website [<https://doi.org/10.1016/j.jhazmat.2019.02.097>] and download the following three groups of files:

1. A PDF "Manuscript" file,
2. A PDF "Supporting Material" file that contains a list of CIPP air incidents and other materials,
3. Four (4) videos in .mp4 format (est. 30 MB total)

What is CIPP?

Today, the cured-in-place-pipe or CIPP process is used to repair about water pipes in the U.S. It is used for repairing sanitary sewer, storm sewer, and drinking water pipes. The CIPP process is also used to repair pipes outside the U.S.

The CIPP process involves chemically manufacturing a new plastic pipe inside an existing damaged pipe. If the damaged pipe is not repaired, it may fail and will ultimately need to be replaced. An advantage of the CIPP technology is that a new plastic pipe is created without the need for digging up the damaged pipe. CIPP repairs can be less expensive compared to other alternatives. The CIPP process was invented in the 1970s.

Who funded this study?

This project was primarily funded by the National Science Foundation RAPID response grant program: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1624183. The National Science Foundation supports basic research that helps transform the future. Funds were also provided by public donations sought through crowdfunding. Purdue University also provided financial support and some data supported by the Federal Highway Administration was also included.

Who was involved?

The study was carried-out by Purdue University professors, graduate and undergraduate students. Team members included civil, environmental, and materials engineers, and pulmonary toxicologists. The team received assistance from Purdue University industrial hygienists and engineering staff. Air monitoring was conducted in Sacramento, California.

Have there been incidents where chemicals released by CIPP installation processes have caused health impacts?

When this study was published the authors had documented *more than 100* air chemical contamination incidents that have occurred. This incident list can be found in the "Supporting Material" PDF file of the newly published study. Building evacuations, reports of illness, fire department responses have been documented.

The purpose of the newly released study was not to determine the short- or long-term human health impacts caused by CIPP chemical exposure. Multiple lines of evidence however suggest health impacts are possible. Our prior air

monitoring study can be found here: <http://www.doi.org/10.1021/acs.estlett.7b00237>. Other organizations have conducted their own worker and public health studies and reported impacts or the potential for exceedances of allowable chemical exposure levels. These organizations include the US National Institute of Occupational Safety and Health (NIOSH), US Occupational Safety and Health Administration (OSHA), US Agency for Toxic Substances and Disease Registry (ATSDR), as well as Public Health England, the Centre for Radiation, Chemical and Environmental Hazards, The Netherlands National Institute for Public Health and the Environment (RIVM), Finland Occupational Safety Agency, Swedish Institute of Environmental Medicine, among others. Reports for these organizations are cited in our new study.

Did you ask workers if they had experienced health impacts?

No, the Purdue team did not discuss health impacts with the CIPP workers. Based on the new study, the Purdue team again strongly recommends that an independent worker health study be conducted. All CIPP companies can request FREE worker safety study from the NIOSH (please see resources tab). This is a confidential testing of worksites and advice about how to better protect workers is provided.

How do I donate to help the Purdue team continue their CIPP research?

Thank you for visiting this page. This new study would not have been possible without support from many individuals, including concerned citizens, some of whom contacted us asking for help after believing they were exposed to CIPP chemicals. Please go to <http://Giving.Purdue.edu/WaterPipeSafety> and consider donating whatever amount you believe this new study provides to you and the public. Funds would be used for supporting air testing supplies, to publicly distribute results, and other activities.

Was the study reviewed by experts in the field before publication?

Yes. Before publication, the study (or manuscript) was subjected to peer-review by the Elsevier journal *Journal of Hazardous Materials*. First, the manuscript was submitted to the journal for consideration. There was no guarantee that the manuscript would be published by the journal. Next, the manuscript was reviewed by three experts in the field chosen by the journal who looked at the study's originality and scientific importance of the topic, the quality of the work performed, and the appropriateness for the journal. Based on their recommendations and the consideration of the journal Editor, the manuscript was accepted for publication. Publication of this study was not guaranteed and the Purdue researchers do not know who the persons were that provided feedback. This anonymity is common and important so that the experts can provide honest feedback. *Journal of Hazardous Materials* is a well-respected peer-reviewed journal (i.e., impact factor of 6.4). Questions about the peer-review process should be directed to the *Journal of Hazardous Materials* and Elsevier.

What Can I Do?

CIPP Companies

Re-evaluate worksite safety practices and personal protective equipment (PPE) considering the recent discoveries. This would include workplace monitoring to fully characterize the materials emitted and materials workers have been and are exposed to. Do not assume the material safety data sheet (SDS) explains all the chemicals you could expose your workers to during CIPP manufacture. Do not permit chemicals to migrate outside the CIPP. Do not provide medical advice to persons who claim to be chemically exposed. Report all interactions with persons who complain about odors or illness IMMEDIATELY to health departments. If a building becomes or is suspected to have been contaminated, IMMEDIATELY contact the fire department and health department. Provide residents nearby health department contact information to report problems. Direct any persons that contact you about odors or health complaints to the health department.

Members of the Public

Find out if CIPP technology has been, is being, or planned to be used in your community. Utilities and municipal governments responsible for sanitary sewer, storm water, and drinking water pipes are the most likely organizations that would approve its use. State transportation agencies also sometimes use CIPP for stormwater culvert repairs.

Contact your elected officials and ask that the health department oversee CIPP construction projects and document and track odor and illness complaints.

If you believe you are being exposed to CIPP chemicals, IMMEDIATELY seek medical attention. IMMEDIATELY contact the fire department if you believe chemicals have entered your building or property where you believe the chemical exposures are taking place. Consider evacuating that area. A way to determine to what chemicals and amounts you have been exposed is to sample and chemically test the air when the incident occurs. If the building is ventilated, the chemicals are often expelled and follow-up testing may indicate no chemicals. Immediate building ventilation however does not always resolve the building chemical contamination problem.

CIPP contractors and utility, municipal, and consulting engineers are often not trained in medicine, epidemiology, or industrial hygiene practices. Utility, municipal, and consulting engineers are also often not trained in plastics technology. While their concerns for your health may be valid, you should report all odor and illness complaints to health departments IMMEDIATELY. You should seek medical advice from health professionals, not CIPP contractors, utility, municipal, and consulting engineers.

Health Departments

Learn about the CIPP process, safety risks, document and investigate chemical emissions and chemical exposures caused by the construction practice. Require that utilities notify you about any odor complaints and illness reports associated with CIPP activities. Require that CIPP contractors immediately alert you to odor complaints and illness reports associated with CIPP activities. Ask that fire departments notify you about odor complaints and illness reports associated with CIPP activities. Purdue University offers training if desired. Contact CIPPSafety@purdue.edu for additional information.

Worker Safety Agencies

Learn about CIPP process and safety risks. Investigate chemical emissions and exposures at worksites. Consider CIPP contractors have multiple crews of varying expertise (A, B, C teams), installation conditions, materials, and installation processes (hot water, steam, and UV curing). The Purdue research team can assist in training if desired. Contact CIPPSafety@purdue.edu for additional information.

Municipalities, Utilities, Engineering Companies

Do not permit your employees to enter CIPP sites without appropriate personal protective equipment (PPE). Evidence suggests prior safety postures by CIPP workers and companies did not consider limiting exposure to a variety of toxicants and materials. Steam cured CIPP installations can emit particulates, droplets, organic and water vapors into the air. Other CIPP process also involve raw chemicals. PPE selection decisions should consider information listed on the material SDSs, but *also* the chemicals *created* during the CIPP installation. Material SDSs do not describe the chemicals that are -created- and emitted during the CIPP curing and cooling processes. Material SDSs also do not describe all the chemicals that are used in a product. Some chemicals in the raw chemicals and uncured resin tube inserted into the damaged pipe, while not listed on an SDS, can still be emitted into the air during a CIPP installation based on the Purdue team's observations.

To protect workers, the public, and environment require that CIPP companies capture the chemicals and prevent them from migrating outside the CIPP or off-site. Require air monitoring to confirm chemicals are not released. If no air testing is conducted, you cannot determine if the capture method is effective. Absence of an odor does not mean chemicals were not released. Sometimes chemicals can be present but will not have odor. Provide the health department pre-notification every time a CIPP installation is conducted. Provide residents contact information for the health department should they need to report problems. Advise the contractor tell persons who complain about odors and illnesses to contact the fire department and health department. When complaints are directed to the staff about chemical exposure, those persons should be directed to health departments. If records are recorded, these must be provided to the utility so they are not hidden from FOIA requests through 3rd parties.

Purdue University offers training for utility, municipal, and consulting engineers on the design, use, and aging of plastics technologies used for water infrastructure. Contact CIPPSafety@purdue.edu for additional information.

Fire Departments

Consider evacuating buildings when CIPP caused chemical contamination incidents are suspected or confirmed. Direct potentially exposed persons to receive medical assistance. Notify the health department when incidents occur. Apply appropriate chemical air testing methods to document the chemical exposures.

Recognize the MSDSs provided to you by the contractor, utility, or engineering firm representatives will not describe all the chemicals present in the air. Chemicals are created by the contractor during their construction process. Recognize that organic vapor detectors (called PIDs) may or may not be capable of detecting the airborne chemical exposure threats. We found that calibrated PID devices were sometimes 100s to 1000s times off from the actual styrene air concentration. More specific air testing must be conducted to determine what the health risks are to emergency responders and the public.

Purdue University offers training for emergency responders and security professionals. Contact CIPPSafety@purdue.edu for additional information.

Questions about Chemicals in the Air, in Building, and Exposure

I have been told that being exposed to the steam is safe. Is it safe?

While steam is used at some CIPP installations, in 2017 the Purdue University researchers found the white chemical plume emitted from CIPP sites was not steam. Please review their prior study and recommendations here. No evidence was found that indicated the exposure to materials emitted was safe.

I have been told that the CIPP odor that I smell is safe. Is that true?

The claim that chemical exposures (or odors) associated with CIPP is safe has unfortunately been repeated over and over by utilities and contractors to the general public since our 2017 study was published. Before 2017, it was a staple of press releases issued to the public. Blanket statements about safety, especially for the CIPP process when illness and injuries have been documented are unsupported. Our earlier study indicated some exposures showing that there are conditions where exposure may be a health risk. Federal agencies in and outside the US have already determined chemical exposures associated with CIPP manufacture or projects sometimes are not safe. You can read the reports for yourself as they are cited in our new study.

If chemicals enter my building because of CIPP activity, what should I do?

You should consider evacuating everyone and call the fire department and health department for assistance. If you believe you have been exposed, you may want to seek immediate medical assistance. The Purdue team did not find that CIPP chemical contamination incidents are safe. The most conservative approach is to evacuate the building until it is deemed safe. If upon reentry you again detect a CIPP related odor, immediately notify the fire department and health department again. Odor often means a chemical exposure is taking place.

CIPP contractors, utility, municipal, and consulting engineers are not medical experts and are not qualified to advise you about whether or not the chemical exposures you may have experienced are safe. The fire department and health department can have the authority to demand contractors stop work if they believe there is an imminent public health hazard.

How can chemicals from the CIPP activity get into my building?

Many different ways. Hot water and steam cured CIPP processes involve pressure and sometimes this pressure causes chemicals to escape the worksite and enter nearby building sewer laterals. These laterals connect to buildings and chemicals then can enter the building through wet and dry drains. Just because your drain has water in it does not mean you are protected. If contractors are using pressure for CIPP activities, there are conditions where that water can be blown out of the plumbing trap into the building.

Sometimes resin is squeezed out of the contractor's uncured resin tube after or while they insert it into the existing damaged pipe. Because the resin is away from the main tube it does not rapidly harden along with the rest of the CIPP. Over time chemicals in the resin could partition to the air and then travel up building laterals and into buildings through drains.

Wastewater generated during some CIPP activities can have high levels of chemicals. If this wastewater is discharged to sewer pipes, chemicals in the CIPP wastewater can travel down the sewer pipe and some can partition into the air (sewer pipes often are not 100% completely full). These chemicals in the air then can travel up building laterals and into buildings through drains.

Chemicals that are emitted into the air at the worksite can migrate into nearby buildings through open windows and doors. Air exchanges for commercial buildings have been suspected to withdraw contaminated air into the building.

Sometimes CIPP is used to repair pipes inside buildings. Chemicals emitted from the construction activity could enter the air.

These are the just a few examples of how CIPP chemicals could enter a building.

If chemicals enter my building because of CIPP activity, will they contaminate my belongings?

Possibly. Odor indicative of the CIPP installation would be an indicator that the chemicals entered your building. Follow the advice of health officials regarding how to safely decontaminate affected items. Decontamination should be accompanied with chemical testing – to prove chemicals are not above exposure limits. Also, lack of odor does not mean chemicals are not present. Many chemicals can be present at levels that do not cause odor.

Is the odor I smell when CIPP is installed caused by styrene?

While styrene has a characteristic odor, there is no evidence that the odor detected during a CIPP installation (that has a styrene resin) is only caused by styrene. The new study shows that multiple VOC and SVOC chemicals are emitted into air during CIPP installations. The odor someone detects may be attributed to one or more of these chemicals in the air. Sometimes a single odor can be caused by the presence of multiple chemicals. The Purdue team found no evidence the odor at CIPP sites is only caused by styrene.

Questions about CIPP Technology

What new chemicals did you find in this study compared to your 2017 study?

Quite a few. Methylene chloride and phenol were found being emitted into the air along with other volatile organic compounds (VOCs). Other chemicals are listed in the new study. Persons who are conducting air testing at CIPP manufacturing sites should not just look for the chemicals listed on the material SDS. For example, methylene chloride was not listed on the product SDS.

Specific chemical exposure assessments should be dedicated to identifying conditions when high concentration, short-duration exposures occur. For example, an 8 hour time-weighted-average (TWA) exposure for a chemical may not appropriately characterize the risk posed to workers. Also needed to be considered is the different work tasks, environmental, worksite conditions, PPE used and atypical conditions.

If I use styrene-free resin, is that safer?

The new study confirms that styrene was emitted into the air when a styrene-free (no styrene) CIPP was installed. The contractors installed both styrene and styrene-free resin with their equipment. The researchers believe this was caused because the contractors accidentally contaminated their equipment. Contractors do not chemically test their equipment before installing a new CIPP so if any contamination exists from a prior installation, it could possibly be emitted into the air during their next installation.

Is using UV CIPP safer than steam cured or hot water cured CIPP?

No studies were found that directly compared the safety of the ultraviolet light (UV) CIPP process to that of steam or hot water CIPP process. To determine safety, independent testing data are needed. While UV CIPP does not involve steam, hot water, or forced air, raw chemicals and high-powered UV light is used in CIPP manufacture. An uncured resin tube is also the starting material for the CIPP. We completed a UV CIPP study here:

<https://www.sciencedirect.com/science/article/pii/S0269749118329804>.

If a styrene reduction additive is added to during the CIPP process, is the process safer than if no styrene reduction additive was used?

No studies were found that determined which chemicals are emitted into air from the CIPP process when a styrene reduction agent is used. To determine safety, independent testing data are needed. None are currently available to make this determination. It cannot be ruled out that the addition of another chemical to the resin matrix could cause unanticipated reactions and result in greater chemical emissions and exposures than would not have occurred without that additive. The purpose of styrene reduction agent use has been to reduce odor, but lack of odor does not mean a process is safer.

Worker Safety

I install CIPP, what chemicals am I exposed to?

The chemicals you are exposed to will likely vary based on your work activity and the type of materials you work with. The material SDSs (material safety data sheet) list some, but not all, the chemicals you could be exposed to while working. For example, during steam cured CIPP installation, new chemicals (and materials such as particles, organic vapors, and droplets) are created. In the new study we discovered methylene chloride being emitted into the air from styrene-based resin CIPP installations. Methylene chloride was not listed on the SDS. There is no material SDS that describes the materials each CIPP installation will release into the air.

What type of personal protective equipment (PPE) for chemical exposure should I have?

This will depend on your activity, but you should not be handling the uncured resin tube, working at the site, etc. without proper personal protective equipment (PPE). Again, the Purdue researchers urge workers to sit down and talk with their companies about chemical and worksite safety and reach out the NIOSH for help. Some gloves are insufficient for handling resins and can be rapidly permeated. No one should handle uncured resin with their bare hands. Gloves with greater chemical resistance should be used and the product supplier should be consulted. The material SDS's describe some PPE, but CIPP sites also create new products and emit new and different chemicals into the air. The Purdue team did not find any declarations about what safety equipment will protect workers from the multi-phase materials emitted into the air found during the 2017 study.

Because the short- and long-term health impacts of CIPP related exposures are unknown, the Purdue team recommends respiratory and dermal protection at steam-cured CIPP worksites. Though, respiratory and dermal protection is also recommended for other CIPP technologies. Independent testing data are needed to better understand worksite chemical exposures.

I want my worksite/workplace tested. How can the government help me?

At request of employees, managers, and union representatives a U.S. federal agency called NIOSH, the National Institute for Occupational Safety and Health, can conduct FREE workplace health hazard evaluations (HHE) of CIPP worksites. A formal request must be submitted here: <https://www.cdc.gov/niosh/hhe/default.html>. NIOSH is not OSHA, the Occupational Safety and Health Administration. NIOSH provides assistance directly to workers about workplace safety questions. In 2017, the Purdue researchers alerted NIOSH to the potential hazards at CIPP sites. In 2019, NIOSH published the results of their own worker safety investigation: <https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0009-3334.pdf>. They continue to be able to help CIPP workers. Workers should contact them.

My company says the air testing data they have shows I'm not at risk, am I?

The Purdue team has reviewed the very limited number of company and industry funded air monitoring studies for CIPP. When contacted by the researchers, some companies and researchers chose not to share their studies citing confidentiality. For this reason, the new study cited available reports and it cannot be determined if what those organizations have done previously was or was not credible. Photoionization detectors (PID) seem to be used quite frequently, but the new study shows that these devices can over or underestimate styrene levels in air by orders of magnitude at CIPP worksites. PIDs should not be the only air testing practice at a worksite.

The PID says I was exposed to a chemical at a certain concentration, is that correct?

PIDs or photoionization detectors are often used by hazardous materials responders and firefighters to quickly determine the potential that an area requires more testing. PIDs are also used in industrial settings to help detect workplace exposure problems. The new study shows the reported styrene reading on the calibrated PIDs reported styrene was present either 100s to 1000s times greater or lower concentration in air compared to what it was. Testing revealed that the PIDs were detecting other chemicals in air also released by the CIPP process. PID signals can be also minimized by the presence of other chemicals in the air. More extensive air sampling and chemical testing is needed in to know what chemicals are present and their concentration. PIDs are helpful in determining variations in chemical emission from manufacturing processes. PIDs also have to be maintained, calibrated, the sampling rate should be reported, and persons who use them also need to understand what data they are being provided.