FAQs for new UV CIPP STUDY

General Questions

Why was the study conducted?

The 2018 study published in *Environmental Pollution* scientific journal was conducted to help state transportation agencies in the U.S. better select and oversee cured-in-place-pipe (CIPP) technology for the repair of storm sewer culverts. The goal of the present study was to better understand chemical emissions into water and air due to Ultraviolet (UV) light CIPP installations by addressing those knowledge-gaps. The study objectives were to (1) determine an uncured resin tube's chemical composition, (2) characterize materials released into air and water during four UV CIPP installations, and (3) chemically characterize CIPPs removed from each installation. Recommended future bench- and field-scale research activities were also developed.

Where can I obtain the files for this study?

Go to the *Environmental Pollution* journal website [https://www.sciencedirect.com/science/article/pii/S0269749118329804] and download the following three groups of files:

1. A PDF "Manuscript" file,
2. A PDF “Supporting Information” file that contains a list of CIPP air incidents and other materials,
3. Two (2) videos (est. 50 MB total)

What is CIPP?

Today, the cured-in-place-pipe or CIPP process is used to sanitize sewer, storm sewer, and drinking water pipes. The CIPP process is also used to repair pipes outside the U.S. The CIPP process involves the chemically manufacture of a new plastic pipe inside an existing damaged pipe. The process involves the handling of raw chemicals onsite. 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 new study is part of a project funded by six state transportation agencies. The lead state agency was the Virginia Department of Transportation (VDOT), followed by the California Department of Transportation (CALTRANS), Kansas Department of Transportation (KDOT), North Carolina Department of Transportation (NCDOT), New York Department of Transportation (NYSDOT), and Ohio Department of Transportation (ODOT). The transportation agencies funded the project because they desired to better understand chemical emission from CIPP storm water culvert repairs.

Who was involved?

The study was carried-out by Purdue University professors, staff, and graduate students. Team members included civil, environmental, and materials engineers. Field work was conducted in New York and Virginia at the request of NYSDOT and VDOT. As part of the study, one professor attended a popular CIPP Construction Inspector training course.

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

This research was not supported by public donations. Though, the researchers continue their work on helping the public better understand chemical exposures. If you would like to donate to that effort please go to http://Giving.Purdue.edu/WaterPipeSafety. Funds would be used for supporting future testing 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 *Environmental Pollution* journal. 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 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.

Recommendations

Do you have any recommendations on how to use CIPP and minimize environmental impacts?

Yes. The recommendations are described in the study “RESULTS AND DISCUSSION” section. To minimize the environmental impact of UV CIPP installations, the following actions are recommended:

(1) A barrier material should be placed in the inlet and outlet work area to prevent the uncured resin tube from contacting the ground,

(2) Particulates should be prevented from entering the air and water during CIPP cutting,

(3) Materials deposited on the mat or barrier material should be collected and disposed,

(4) The entire newly installed CIPP's inner surface area should be rinsed, and the rinse water should be collected and disposed,

(5) Water testing should be conducted to determine if water quality standards are exceeded,

(6) Chemical testing should not be solely based on the material SDS because chemicals of concern are not all reported,

(7) New CIPPs should not be placed in service until water tests indicate no water quality limit exceedances,

(8) Chemicals identified in the present study and others, should be considered for water testing, and

(9) Until additional safety data are made available, chemical emission into air should be captured and monitored to confirm complete capture.

Do you have a list of requirements I can insert into my specification?
Please contact the pooled fund Lead Agency Contact.

Questions about Worker, Public Safety and Environmental Protection

Which process emits fewer chemicals UV light, steam, or hot water CIPPs?
Good question. This question cannot be answered at the present time. Too few independent studies have been conducted and the processes themselves, types and durations of emissions are very different. In the Supporting Information file (see above), the authors outlined when chemical emission is possible for the UV CIPP processes examined in the present study. A similar audit approach could be applied to other CIPP installation sites. Contractor CIPP installation practices may differ between and across job sites.

I have been told that UV CIPP does not emit chemicals into the environment unlike other types of CIPP manufacturing processes, is that true?
Evidence from the present study and other studies conducted by other groups in California and Virginia have shown that UV CIPP installations can emit chemicals into the environment. For the present study, some chemicals that were released exceeded state surface water quality standards. It is our belief that some of the chemicals found originated from the dust that was created when contractors cut their newly installed CIPPs, and possibly other pathways. Recommendations are that this material is not permitted to enter the environment, which should reduce the amount o9f contamination. There was a notable amount of volatile organic material that remained inside the new CIPPs though, so these products could leach materials into the environment. The magnitude, duration, and significance of this process requires further study.

Can your new study be used to improve workers and public safety?
Yes. Since little is known about what chemicals can be release from CIPP installations, this new study identifies a host of never before reported chemicals that are present in the uncured resin tube (before manufacture) and in the resulting CIPP (after manufacture) and in water (chemicals that made their way out of the material). Persons who want to conduct air monitoring can use this information to help select the chemicals they could test for.

How similar were the CIPPs in New York and Virginia?
Three CIPPs were created in New York by the same contractor while 1 CIPP was created in Virginia by a different contractor. Chemical residual found in samples

removed from each CIPP were quite different. Additional work is needed to better characterize chemical residual variation across CIPPs.

Also found when two samples were collected from the single Virginia CIPP, one upstream-one downstream, chemical residual also varied considerably. For that reason,

Was styrene the only chemical released into the water?

Styrene as well as other chemicals we were able to find were released into waters and some had state water quality standards. These chemicals included acetophenone, benzaldehyde, Irgacure® 184, phenol, phthalic anhydride, trimethylbenzenes, and xylenes. Dibutyl phthalate may or may not have been emitted from the CIPP sites, but was present in the water contractors used to rinse the pipes.

How long will CIPPs leach chemicals into the environment?

Few studies were found that described chemical emissions or water quality impacts associated with CIPP installations. Because very few studies have been conducted, it is difficult to make generalizations regarding the magnitude and duration of chemical leaching. Additional work is needed to understand how different installation practices, resins, etc. influence chemical leaching. This, along with other recommendations, were outlined in the new study.

What Future Studies are Needed?

1) Determine if ozone is generated during installations, because ozone can be formed upon the exposure of certain wavelengths to oxygen. If generated, ozone may pose a health risk to persons nearby and contribute to secondary organic aerosol formation from ozone and styrene reactions,
2) Particulate characteristics and their fate should be studied,
3) Determine the magnitude and duration of chemical release from UV CIPPs as affected by age, resins/composition, curing conditions, environmental and hydraulic conditions, and longitudinal and radial direction,
4) Further hazard identification and practices to estimate the chemical source strength, and
5) Evaluate the effectiveness of post-installation steps (i.e., water exposure, blowing air through the newly installed CIPP) to expedite chemical release and thereby reduce the amount of chemical that could be released into storm water during the CIPP's service-life.