

## 6. CIPP SAFETY OBSERVATIONS AND RECOMMENDATIONS

### 6.1 Observations during the present study

During this study the project team encountered previously unreported safety hazards associated with CIPP lining projects. This included the discovery that a variety of materials were emitted into air from steam CIPP worksites which included particulates, uncured resin, multiple VOCs and SVOCs, and other materials. Also observed was that some contractors handled uncured resin tubes with their bare hands and stood in the chemical emission plumes without respiratory or complete dermal protection. Some members of the project team also had self-reported eye irritation at a UV CIPP site as air was being blown through the uncured resin tube during UV curing. These symptoms went away when the persons removed themselves from the location. Some of the safety observations are documented in video evidence and also the peer-reviewed papers cited below. A complete list of available studies and additional information can be obtained in Ra et al. (2019).

### 6.2 Select safety related events

In recent years, transportation agencies, municipalities, consultants, utilities, regulators, and health officials have raised concerns regarding chemical emission occurring during and after CIPP installation. Below is a brief summary of events:

- 2019: More than 100 air contamination incidents associated with CIPP use have been documented in the U.S. (Teimouri et al. 2017; Ra et al. 2019). Some storm sewer and sanitary sewer lining projects involved complaints of odors, whereas others involved health symptoms, including incidents in which people were administered medical assistance at schools, day care centers, offices, or residences.
- 2019: In the U.S., an inhalation toxicology study of materials emitted from four steam CIPP manufacturing sites indicated potential health risks as well as variations between worksites regarding emissions and toxicity. The evaluation identified biological pathways that require future evaluation and also demonstrated that exposure assessment of CIPP worksites should examine multiple chemical components beyond styrene, as many cellular responses were styrene-independent (Kobos et al. 2019).

- 2019: Chemical air testing conducted at multiple CIPP worksites in the U.S. revealed a multitude of materials discharged to the air such as uncured resin, particulates, organic vapors, and water vapor. Chemicals (more than styrene) were confirmed to be emitted. Results indicated the need for air monitoring at all worksites and further study. Photoionization detectors (PID) calibrated for styrene did not accurately represent styrene air concentration differing sometimes by 10s- to 1,000s-fold. This was likely due to the fact that multiple VOCs emitted from the CIPP process were found in air samples (Teimouri et al. 2017; Ra et al. 2019). Because PID signals have been shown to be significantly affected by local environmental conditions and other VOCs present in the air (Coffey et al. 2012; LeBouf et al. 2013; LeBouf & Coffey 2015), they should not be solely relied upon at CIPP worksites to identify safe/unsafe conditions.
- 2019: The U.S. National Institute for Occupational Safety and Health (NIOSH) found 140 ppm<sub>v</sub> styrene at a CIPP manufacturing site exceeded the 15 min short-term exposure limit of 100 ppm<sub>v</sub> (U.S. NIOSH 2019). Another chemical, divinylbenzene was also detected in air. The federal agency recommended that workers ventilate manholes, bag excess liner immediately, and change gloves regularly when they contact resin.
- 2018: U.S. researchers published a review of safety data sheets and chemical test results available for current and prior CIPP sewer products. As found on material safety data sheets and in prior field testing, new chemicals can be created during CIPP manufacture that are not listed as ingredients on safety data sheets (Ra et al. 2018). These compounds included endocrine disrupting compounds, carcinogens, hazardous air pollutants and compounds with limited toxicological data. Some compounds had state water quality standards.
- 2018: The U.S. Occupational Safety and Health Administration (OSHA) issued a citation to a CIPP contractor associated with a CIPP worker fatality that occurred in October 2017. Chemical exposure contributed to a worker fatality where blood styrene levels indicated a 220-270 ppm<sub>v</sub> exposure (U.S. OSHA 2018).
- 2018: Researchers in France monitored CIPP worker urine and found their styrene exposures

were punctually high and recommended additional monitoring and testing (Persoons et al. 2018).

- 2017: A worksite fatality during an Illinois, U.S. sanitary sewer CIPP installation triggered a federal investigation (Peterson 2017).
- 2017: The California Department of Public Health (CDPH) issued a second statement about CIPP that included “Persons who detect an odor and experience health symptoms...should contact their medical provider and local health department; utilities, engineering firms, and contractors should not tell residents the exposures are safe. There is no credible testing data for all CIPP installation scenarios” (CDPH 2017b).
- 2017: The CDPH issued a statewide safety alert on the basis of their own investigation of residential building chemical contamination caused by a CIPP sanitary sewer installation (CDPH 2017a).
- 2017: U.S. researchers, invited by U.S. NIOSH, published a summary at the NIOSH blog about potential inhalation and dermal exposure risks associated with CIPP manufacturing sites (Whelton et al. 2017).
- 2016: U.S. researchers reported that at three steam CIPP sanitary sewer worksites in Los Angeles, CA styrene air concentrations of 250-1,070 ppm<sub>v</sub> and 3.62-76.7 ppm<sub>v</sub> were detected during curing and cooldown processes, respectively (Adjari 2016).
- 2012: CIPP chemicals traveled “kilometers from the worksite” aboveground (Bauer 2012). [1 kilometer = 0.62 mile]
- 2012: Sweden’s Institute of Environmental Medicine found that contact dermatitis is associated with epoxy lining CIPP and some workers left the trade because of their allergic reactions (Berglind et al. 2012).
- 2006: In the Netherlands, several emission control and monitoring recommendations implied (1) styrene was the only compound of concern, (2) monitoring should include a photoionization detector (PID), and (3) a fan should be installed on manholes that can move thousands of m<sup>3</sup> air/hour during and for at least 24 hours after CIPP installation (RIVM 2006).

- 2005: In the Netherlands, styrene concentration remained unchanged 1 kilometer [0.62 mi] down a sanitary sewer (RIVM 2005).
- 2005: The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) (2005) investigated a building chemical contamination incident and declared that a CIPP installation caused an indoor air pollution ‘public health hazard’.

## 6.3 Recommendations

The project team recommends that agencies that conduct CIPP manufacture or oversee projects take two actions simultaneously. First, it is recommended that agencies request a free health hazard evaluation from U.S. NIOSH with a set of representative CIPP projects, not every CIPP project. This activity enables NIOSH to conduct confidential worksite monitoring to determine if any upgrades in practices are needed to protect workers; those conducting the installation and those observing the installation. At the time this project was completed, one UV CIPP company had completed a health hazard evaluation (HHE) with NIOSH. Two state transportation agencies had also initiated HHE support. Two common questions the project team received are shown below.

Second, simultaneously agencies should also upgrade existing outdoor CIPP manufacture construction practices, require emission capture and require confirmation they were captured, and provide more oversight that includes well-trained environmental monitoring and industrial hygiene professionals to CIPP worksites. The outdoor CIPP manufacturing process requires engineering and administrative controls as well as safety upgrades to protect the health of CIPP workers as well as transportation agency, and other workers (i.e., consultants, construction inspectors) nearby as well as the environment and public from harm. This can include (1) minimizing dermal and inhalation exposures, (2) capturing emissions and confirming this by chemical monitoring, and (3) using appropriate personal protective equipment even for site observers. More specific recommendations are provided in the construction specifications at the end of this report.

6.3.1 What is a health hazard evaluation and how do I request one?

The NIOSH has a list of frequently asked questions about their program and this information can be found at the website below. Agencies, agency employees, their consultants, and CIPP contractors are encouraged to contact NIOSH for information and

assistance. NIOSH is already working to assist some other state agencies with worksite safety evaluations. The employee who contact's NIOSH for help can have their identity kept confidential when that choice is marked on the request form. NIOSH also protects individually identifiable medical information according to federal law. If you have concerns or questions about confidentiality, call 1-513-841-4382 to speak with a member of NIOSH's staff.

6.3.2 When a CIPP worker, consulting engineer, or municipal employee who visits a worksite has a health concern or safety questions, whom should they contact?

Questions and concerns about the safety of CIPP workers and others who visit CIPP manufacturing sites in the conduct of their duties were raised during the conduct of this study. A worksite safety plan should be created to describe the type and location of hazards (i.e., inhalation, dermal, eye, hearing) associated with the construction activity, including engineering controls (i.e., emission capture), administrative controls (i.e., setback distances), and recommended personal protective equipment (i.e., inhalation, eye,

hearing protection). If an employee has a health concern or safety question, they should consider seeking information from their employer, but are also covered by a state agency for safety/health hazard reporting purposes. The specific agency varies from state to state. If a person wishes to file a complaint alleging unsafe work conditions, they can do so with a regulatory agency. For example, in Illinois, local government employees (city, village, state, county) may file complaints alleging unsafe working conditions with the Illinois Department of Labor. The OSHA website below provides a web link to each state organization with contact details.

All private sector employees may file complaints with federal OSHA where this agency has jurisdiction. There are a number of states that have the legal authority to enforce the OSHA standards and have complaint processes similar to the federal OSHA states. Complaints may be filed electronically, by contacting the OSHA Hotline (1-800-321-OSHA) or by contacting the local OSHA field office.

### **NIOSH Website**

*The NIOSH Health Hazard Evaluation (HHE) Program*

<https://www.cdc.gov/niosh/hhe/default.html>

*Telephone: 1-513-841-4382*

The NIOSH health hazard evaluation program helps employees, union officials, and employers learn whether health hazards are present at their workplace and recommends ways to reduce hazards and prevent work-related illness. Our evaluations are done at no cost to the employees, union official, or employers.

The NIOSH will keep the requester's information confidential.

### **OSHA Website**

*How to file a safety and health complaint*

[https://www.osha.gov/workers/file\\_complaint.html](https://www.osha.gov/workers/file_complaint.html)

The U.S. Occupational Safety and Health Act of 1970 gives employees and their representatives the right to file a complaint and request an OSHA inspection of their workplace if they believe there is a serious hazard or their employer is not following OSHA standards. Workers do not have to know whether a specific OSHA standard has been violated in order to file a complaint. The complaint should be filed as soon as possible after noticing the hazard or lack of compliance because OSHA citations may only be issued for violations that currently exist or existed in the past 6 months.

OSHA will keep the filer's information confidential.