CIPP EMISSION STUDIES UPDATE

By Lynn Osborn, NASSCO Technical Advisory Council Member, LEO Consulting

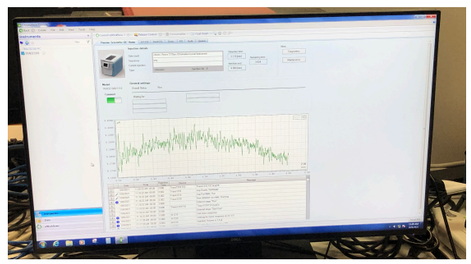
It has been over five years since NASSCO began the program of evaluating cured-in-place pipe (CIPP) air emissions of volatile organic compounds (VOCs) and the effect on worker and public safety. Through an industry workgroup consisting of several highly respected industry organizations, NASSCO commissioned three third-party studies beginning with Phase 1 in late 2017. Phase 1 was awarded to the Center for Underground Infrastructure, Research and Education (CUIRE) at the University of Texas-Arlington and was led by Dr. Mohammad Najafi. The objectives of Phase 1 were a literature review of past CIPP emission studies and a scope of work for Phase 2, field studies.

Phase 2 was awarded to the Trenchless Technology Center (TTC) at Louisiana Tech in the summer of 2018 and was led by Dr. Elizabeth Matthews. The study consisted of emissions testing at nine different air inversion, steam cure CIPP jobsites. The nine installations differed in sewer diameter, sewer length, climate and geographical location. Although the testing detected several VOCs, styrene was the only compound of interest found at concentrations that had the potential to pose health risks, and two primary locations on CIPP sites were of particular concern: 1) emission locations, particularly the exhaust discharge; and 2) the wet-out tube storage unit. TTC made recommendations to mitigate safety concerns near the exhaust discharge. However, a detailed investigation of the wet-out tube storage unit was not within the scope of the Phase 2 study, and TTC recommended that suitable personal protective equipment (PPE) be worn by workers unloading wet-out tubes. Additionally, TTC recommended further investigations in and near the storage unit to better define safety protocols. Copies of both the Phase 1 and Phase 2 reports are available on **nassco.org/safety/styrene-safety**.

Phase 3 work, also at the TTC, began in the summer of 2021 and is being led by Dr. Shaurav Alam. The overall objective of Phase 3 is to quantify possible health hazards to workers in the vicinity of and inside the wet-out tube storage unit and to develop safety protocols to mitigate any risks to worker safety. Phase 3 was broken into three stages:

- **Stage 1** –Thermoplastic coating breakthrough
- **Stage 2** - Storage unit simulation in a chest freezer
- **Stage 3** – Field work in active wet-out tube storage units

In Stage 1 several different thermoplastic tube coatings were tested for the rate of styrene breakthrough. When a wet-out tube is placed inside an empty storage unit for shipment to the jobsite, the styrene level inside the storage unit is typically low. However, as time passes, the styrene level increases. This happens because styrene from the thermoset resin inside the wet-out tube permeates through the coating on the outside of the tube. Several different thermoplastic materials are currently being used for tube coatings, and in Stage 1 seven different types of coatings were blind tested. A special two-chamber vial was developed, and resin was added to the lower chamber.



A portion of coating material was inserted between the two chambers, and the vial was then placed in storage for several days. When ready, the styrene content in the upper chamber was tested in a gas chromatograph (GC).

For Stage 2, a chest freezer was retrofitted to simulate a refrigerated storage unit. Fifteen-foot lengths of 8-inch tube were wet-out and placed inside the storge unit with the temperature set to simulate working storage units. Styrene level measurements inside the storage unit were recorded over time using photoionization detectors (PIDs) to collect gas samples by ports through the freezer wall. The aim for Stage 2 was to create a mathematical model or chart showing emission concentration versus time for different wet-out tube parameters such as quantity of resin, tube surface area, type of coating and so on.

Stage 3 involved two field visits where TTC technicians collected styrene level measurements inside working refrigerated storage units and outside with doors open. During both visits, TTC monitored a storage unit for several days in Florida and Wisconsin as wet-out tubes were loaded, removed, and installed.

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In both instances, a baseline styrene level was established prior to loading. Styrene concentration data inside the storage units was monitored by two (2) specially fitted data logging PIDs located in the truck cab and powered by the truck's electrical system. Styrene concentration data outside the storage units was monitored by a handheld PID when the doors were open. Stage 3 was to validate the model developed in Stage 2 and provide guidance to field crews on what levels of styrene can be expected in and outside storage units.

TTC is currently collecting and evaluating data from the PIDs and preparing the report. A draft copy for review is expected in late October, with the final report available when all peer reviews have been completed. For the most current updates and other vital safety information, please visit **NASSCO.org/Safety.**