Understanding Chemical Emission from In-Situ Water Pipe Repairs

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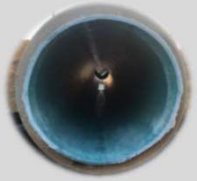
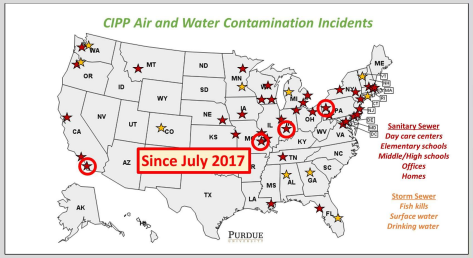
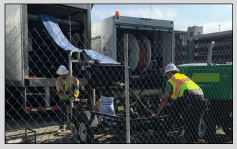
INTRODUCTION

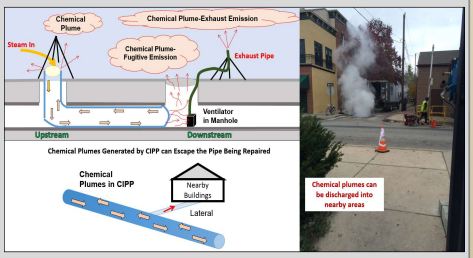


Sanitary sewer and storm water pipe repairs are being completed with cured-in-place-pipes (CIPP) technology. To avoid buried pipe replacement, this technology involves the chemical manufacture of a new plastic pipe, or CIPP, inside the existing damaged pipe. A challenge with this process is that chemicals are emitted into the air, and can enter nearby buildings or public spaces. CIPP installations have been linked to school, office, and residential building evacuations, HAZMAT responses, and children and adults seeking medical attention. A literature review indicated that little is known about what materials are emitted by the CIPP process.





Once the uncured resin tube is installed, it is transformed into a CIPP by steam, hot water, or UV light exposure.



GOAL & OBJECTIVES

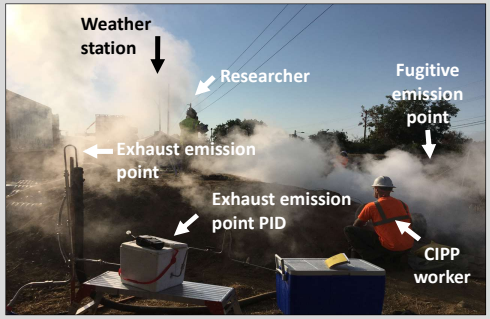
Goal: To better understand materials emitted from CIPP sanitary sewer pipe and storm water pipe repair installations in Indiana and California and their potential toxicity

Objectives:

1. Conduct air sampling and analysis for 7 steam CIPP installation sites that use non-styrene and styrene resins
2. Characterize raw materials and materials emitted
3. Evaluate chemical plume toxicity to mouse lung cells
4. Identify worksite safety issues and provide recommendations on future technology use

RESULTS

Not Steam: A multiphase mixture

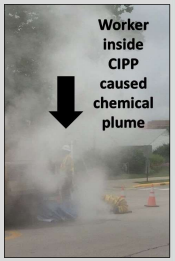


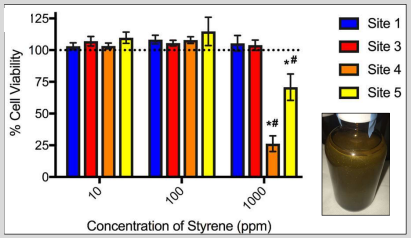
Exhaust & fugitive emission points for one CIPP installation

CONDENSATES: **Maximum Chemical Sampling Flux from the Exhaust Emission Point**

Compound Detected	CIPP Installation Site Chemical Sampling Flux (mg/m².s)				
	Pipe 1 (Resin A)	Pipe 2 (Resin B)	Pipe 3 (Resin A)	Pipe 4 (Resin A)	Pipe 5 (Resin A)
Acetophenone[HAP]	-	1.65, 1.74[ΔΔΔ]	-	-	-
Benzaldehyde[HAP]	0.03, 0.04[Δ]	0.07[ΔΔΔ]	0.25, 0.25[Δ]	-	-
Benzoic acid	1.12, 1.19[Δ]	1.84, 1.99[ΔΔΔ]	1.59, 2.38[Δ]	0.68[Δ]	-
Butylated hydroxytoluene	-	0.08[ΔΔΔ]	-	-	-
4-*tert*-Butylcyclohexanol	-	1.73, 2.06[ΔΔΔ]	-	-	-
Dibutyl phthalate[EDC]	0.02, 0.02[Δ]	0.13[ΔΔΔ]	-	-	-
Phenol[HAP]	0.06, 0.09[Δ]	-	0.23, 0.23[Δ]	-	-
Styrene[CAR, HAP]	6.17, 7.29[Δ]	0.63, 0.81 [ΔΔΔ]	<MRL[Δ]	13.63, 17.4[Δ]	<MRL[Δ]
1-Tetradecanol	0.57, 0.68	-	0.47, 0.58	0.92, 1.48	0.13

[Δ] Indicates number of condensate samples collected. Lowest concentration minimum reporting level (MRL) on calibration curve for styrene: 0.241 ppm. Samples were captured after two cold condensers. Data represent methylene chloride extracts, hexane results not shown. Resin A: Styrene based resin, Resin B: non-styrene based resin; HAP: Hazardous air pollutant; EDC: Endocrine disrupting compound; CAR: Carcinogen.



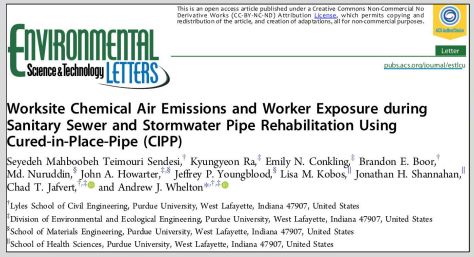


Reduction in cell viability of mouse lung cells after exposure to condensate with styrene level of 1,000 ppm was observed at 2 installations and non-styrene chemicals contributed to toxicity.

ABRIDGED CONCLUSION

1. Materials emitted from steam-CIPP pipe repairs were complex mixtures.
2. Chemicals in addition to styrene were released into the air; The non-styrene based CIPP contained styrene.
3. Non-styrene chemicals contributed to the toxicity of condensate to mouse lung cells.
4. Worker and public safety investigations needed

Full report study and videos can be downloaded free online



http://pubs.acs.org/doi/ipdf/10.1021/acs.estlett.7b00237

View a webinar about this study hosted by the National Environmental Health Association

http://neha.org/node/59303

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