

Contaminant Release from Storm Water Culvert Rehabilitation Technologies:

Understanding Implications to the Environment and Long-Term Material Integrity

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Storm sewer pipes in the U.S.

2,272 miles of culvert in place
(FHWA 2005)

189+ miles require rehabilitation
(FHWA 2010)

Mechanical failures can be catastrophic
(traffic disruption, public safety)



Instead of replacing the damaged culvert, often trenchless culvert rehabilitation approaches can be applied

Trenchless Technology Options

Slip lining

Spiral wound pipe

Close fit pipe

Thermoformed pipe

Fold-and-form pipe

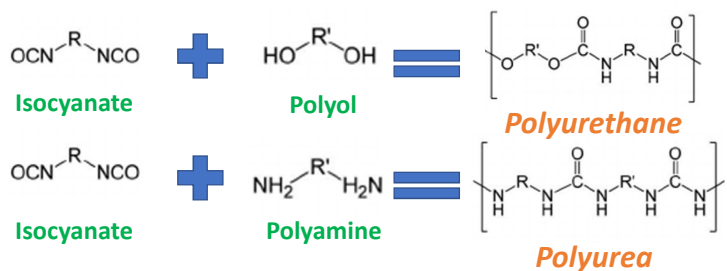
Spray-on lining

Cured-in-place-pipe (CIPP)

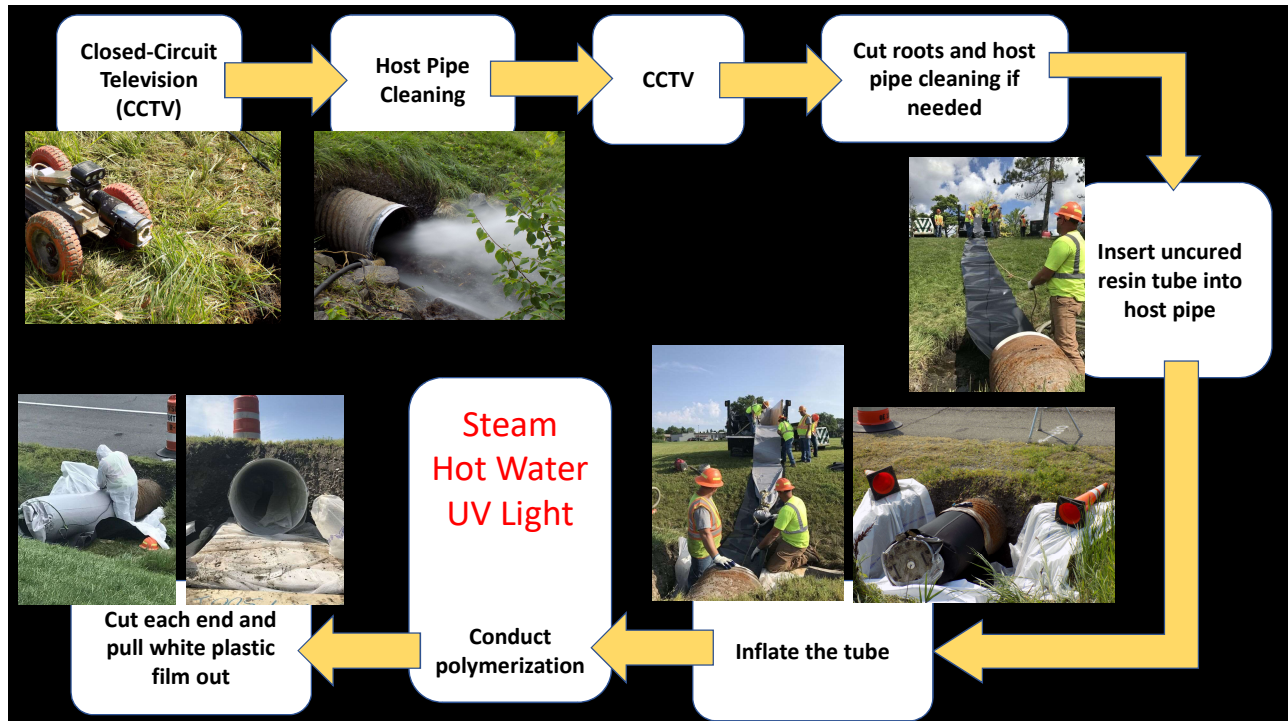
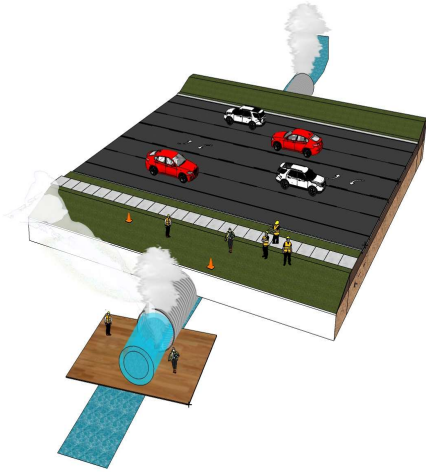
Potential Challenges for Some Options

- Water flow diversion
- Grouting necessary
- Reduction in cross-sectional area
- Structural integrity not improved
- Host pipe must be completely dry
- Cost

Spray-on liners are Chemically Manufactured inside an existing damaged pipe



Cured-in-Place-Pipes (CIPP) are also **Chemically Manufactured** inside an existing damaged pipe





Chemical Emission Concerns and Incidents

- Safety to workers, site visitors, and nearby public
- Aquatic toxicity (i.e., fish kills)
- Surface water contamination (i.e., downstream, water supplies)
- Wastewater toxicity to wastewater treatment facilities
- Leaching magnitude and duration
- Emission into air / complaints and exposures (i.e., inhalation, dermal)

THE NEED: DOTs want to best use technologies but need information to make more informed selection and specification development decisions

2016 RAPID Response Study funded by the National Science Foundation (www.NSF.gov)

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Letter
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Worksite Chemical Air Emission Sanitary Sewer and Stormwater Cured-in-Place Pipe (CIPP)

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Cured-in-Place Pipe Safety Study

News | **In the News**

Scientific report files & associated video files, *Environmental Science & Technology Letters*, July 2017

Frequently Asked Questions (FAQ)

- General Questions
- What Can I Do?
- Questions about Chemicals in the Air, in Building, and in Economy
- Questions about CIPP Technology
- Worker Safety

Incorrect assertions about the CIPP study

In 2016, Purdue researchers began investigating chemical emissions and exposures caused by cured-in-place pipe (CIPP) water pipe repair sites. CIPP is the most popular water pipe repair technologies used in the U.S. Because this technology uses raw chemicals in the field and manufacturers a new plastic pipe inside an existing damaged water pipe, chemicals can be emitted into the environment and enter nearby buildings. CIPP is used for sanitary sewer, storm sewer, and drinking water pipe repairs.

Questions? Contact us: @CIPPSafety@purdue.edu

Visit <http://CIPPSafety.org> or

<https://engineering.purdue.edu/CIPPSafety>

- ✓ FAQs
- ✓ Links to studies
- ✓ Links to resources

You can access FREE CIPP worker and public safety resources

CIPP SAFETY STUDY WEBINAR (Oct 2017)
[neha.http://neha.org/node/59333](http://neha.org/node/59333)



To help local, state, and county health professionals better understand public health and occupational exposures with CIPP. Results of a July 2017 Purdue University CIPP safety study were presented as well as lessons learned from a NIOSH workplace Health Hazard Evaluation, and options for health officials, agencies, companies, and workers to gain technical assistance.



Funded by the US National Science Foundation (www.nsf.gov)

**Pooled Fund Project Overview, 2016-
 Contaminant Release from Storm Water Culvert
 Rehabilitation Technologies: *Environmental* &
 Long-Term *Material Integrity* Impacts**



Determine:

- (1) The scope of the problem across departments of transportation (DOTs) (i.e., the extent of use of these technologies and the scale of their impacts to water quality);
- (2) The effectiveness of existing construction specifications at minimizing contaminant release from rehabilitated culverts; and
- (3) The degree to which the structural integrity and longevity of rehabilitated culverts are compromised by chemical leaching.

Focusing on Spray-On Liners and CIPP



Task 1 (complete): Evaluate the scope of the problem across departments of transportation (DOTs) (i.e., the extent of use of these technologies and the scale of their impacts to water quality)

- ✓ CIPP was the most popular culvert repair technology for partner DOTs.
- ✓ DOTs expressed an interest in spray-on lining. CIPP is currently the primary focus of this pooled fund project.

Task 2 (in progress): To understand how to prevent environmental impacts we need to understand what chemicals can be released, their magnitudes and when during the CIPP installation activity those releases can occur

1. Review of CIPP construction specifications, guidance, and known incidents and impacts
2. Review of spray-on lining construction specifications, guidance, and known incidents and impacts
3. Field and lab-scale activities ongoing for Steam- and UV-CIPPs

For example, Task 2: In 1 State, We Are Studying 5 Steam-CIPP Installations

Installation Number	Host Pipe	Used Preliner? No. Used	Resin Brand	Resin Type	Cooldown Method	Liner Insertion Method
1	CSP	Yes, 1	AOC	Polyester styrene	Ambient Air	Air inversion
2	CSP	No	Ecotek	Vinyl ester low VOC	None	Air inversion
3	CSP	Yes, 2	AOC	Polyester styrene	Hot Air	Air inversion
4	RCP	Yes, 1	AOC	Polyester styrene	None	Air inversion
5	CSP	No	AOC	Polyester styrene	None	Pull-in

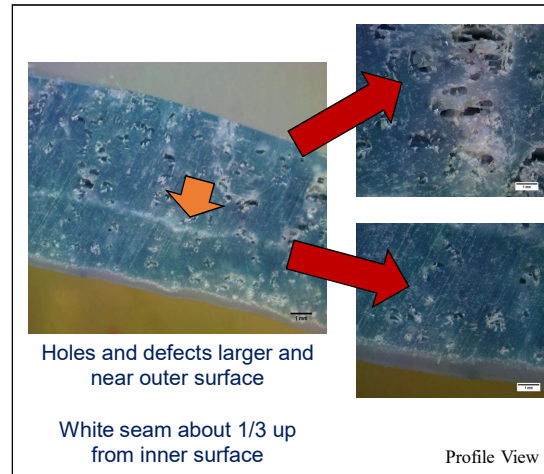
EcoTek Low VOC resin: “Does not contain any styrene monomers or hazardous air pollutants, vinyl ester resin”

AOC resin: 1% Di-(4-*tert*-butyl-cyclohexyl) peroxydicarbonate and 0.5% Trigonox® KSM; Polyester resin, Styrene 32 wt.%.

KEY TAKEAWAY: **NEW** chemicals were created during CIPP installations, not reported on MSDSs or present in the uncured resin tubes.

Task 3 (in progress): To understand the degree to which CIPP structural integrity and longevity is compromised by chemical leaching

- In other fiber reinforced composite systems, leaching and aging can compromise structural integrity and longevity
- Structural Integrity
 - Measured by mechanical and thermomechanical testing for strength and brittleness as resins are leached under various conditions
 - Degree of cure will be investigated and related to actual and optimal cure conditions
- Longevity: Measured by accelerated aging



CIPP post-leaching



Liquid exposure caused fracture along the "seam"



Inner surface still looks "normal"

Thank You

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Visit, download files, and resources:
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