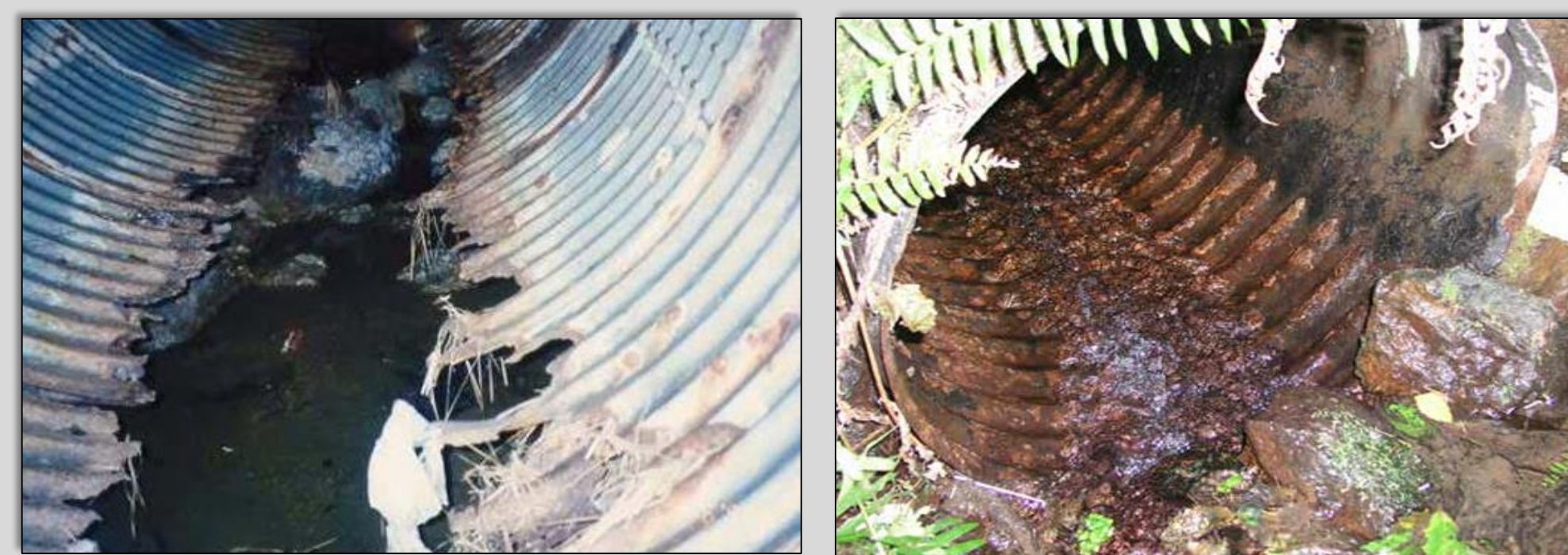


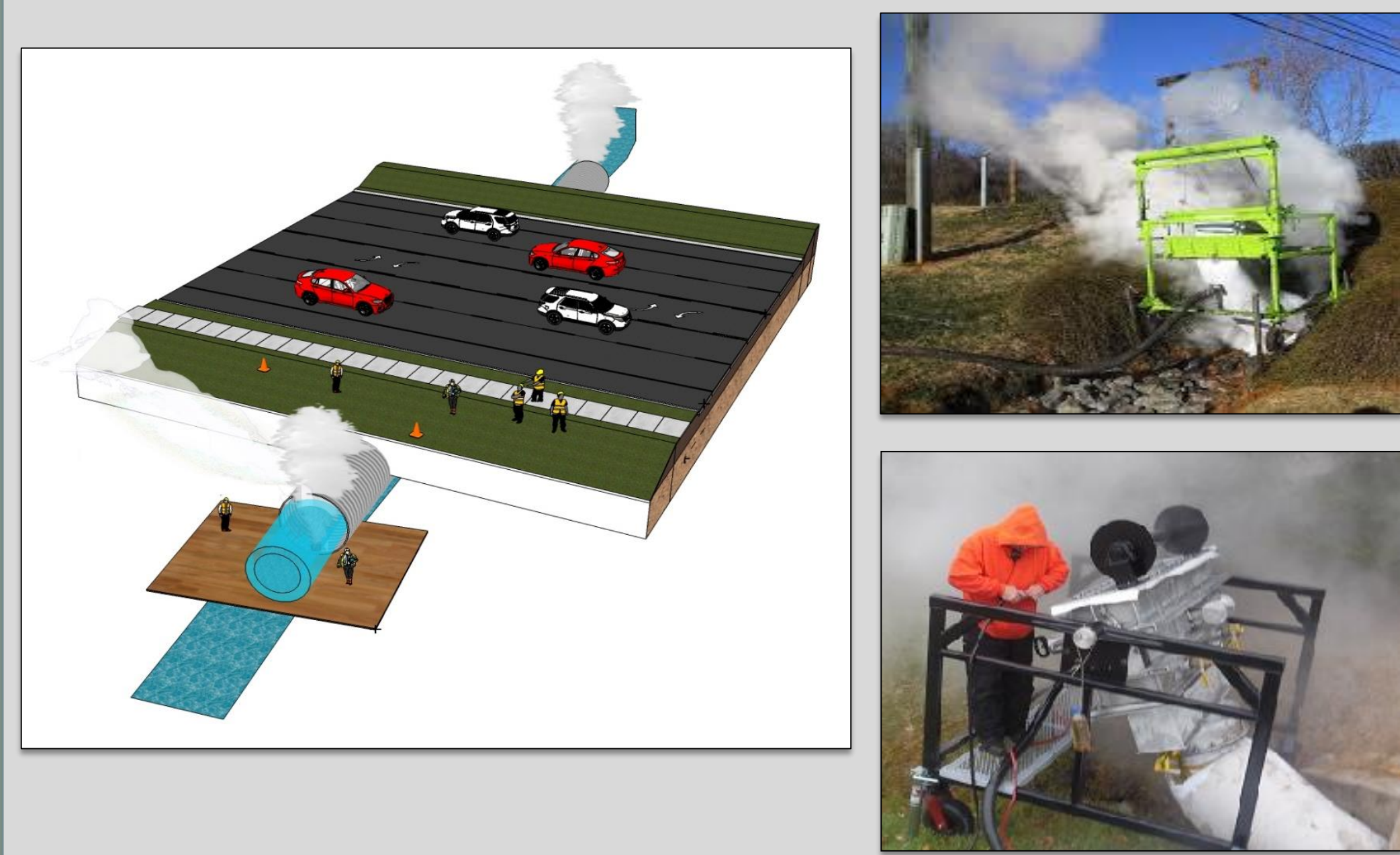
# Understanding and Reducing Impacts of Storm Water Culvert Rehabilitation Technologies to the Environment

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## INTRODUCTION



In the U.S., more than 12 million linear feet of culverts are in place, and more than 1 million existing culverts require rehabilitation. Trenchless technology can be used repair buried assets and cured-in-place pipe, or CIPP has been growing in popularity to rehabilitate sanitary sewer, storm sewer, and drinking water pipes. CIPP installation is chemically manufactured in the field, and new chemicals can be created during manufacturing. Styrene is just the only one of many chemicals used, and possibly released not only from styrene based resin but also from non-styrene based resin.



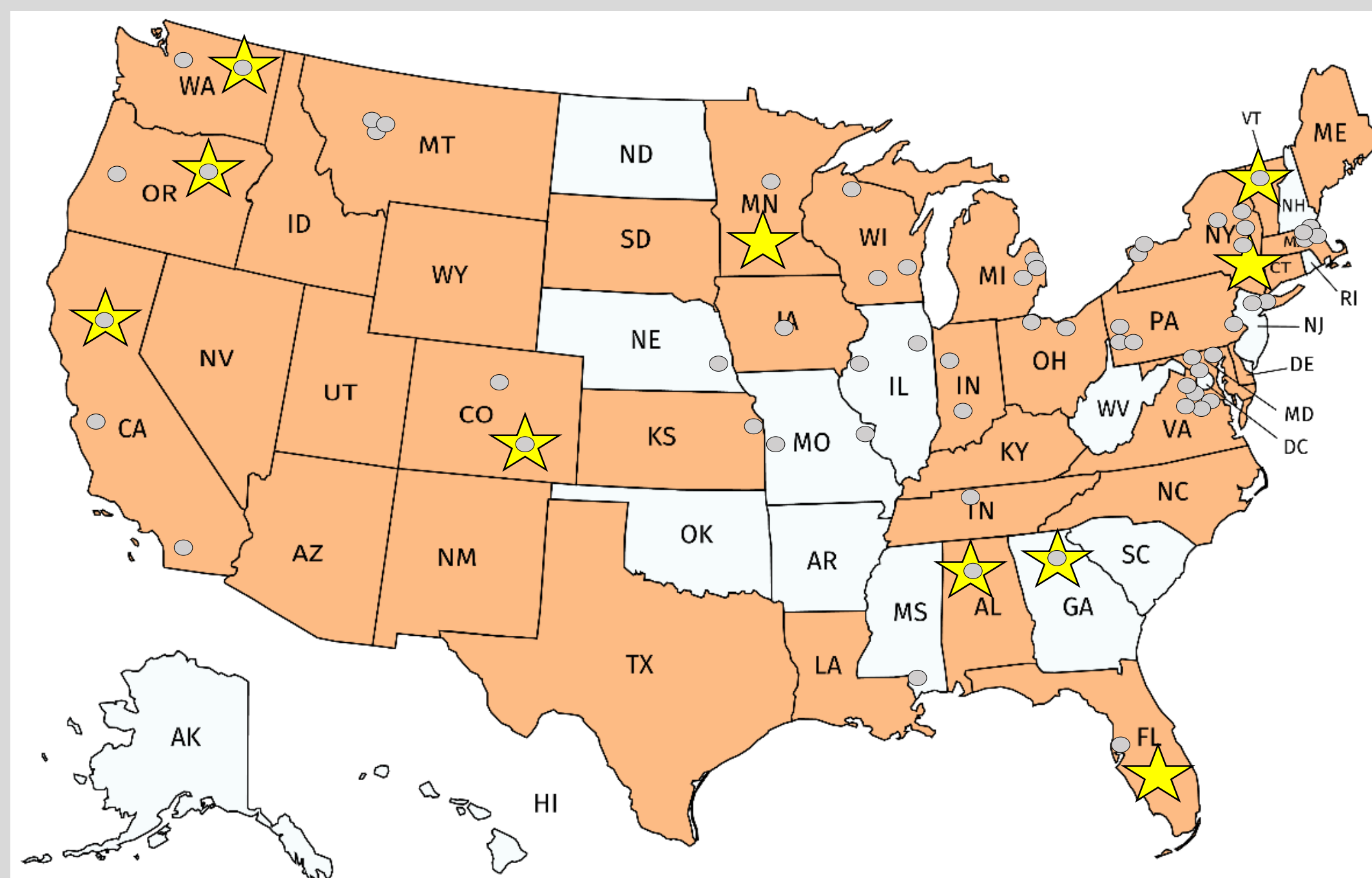
## STUDY GOAL & OBJECTIVES

**Goal:** To better understand existing CIPP and spray-on liner construction practices and past chemical contamination incidents focused on storm sewer.

**Objectives:**

1. Compile and review CIPP- and spray-on related surface water contamination incidents.
  - \*incident = outside a research study
2. Analyze CIPP and spray-on water quality impacts.
3. Evaluate construction practices for 35 state DOT agencies.

## RESULTS



**13 CIPP-related water contamination incidents were found**

**Allowable styrene limits differed across organizations:** 0.1 mg/L (EPA); 2.5 mg/L (VDOT), 1.0 mg/L (VTDOT), 0.005 mg/L (NYSDOT)

**Other chemicals were found in contaminated water, not just styrene.**

**Few (7) sanctioned water quality impact studies:** 18 steam, 4 hot water, 3 UV-CIPP monitored.

Compound detected at a CIPP site or found leaching from CIPP	Compound Class	EPA water testing method required or used by certain state DOTs		
		524.2 (CO)	8260 (CO, VT, VA)	8021B (NV)
Acetone <sup>†‡§Δ¶</sup>		X	X	.
Benzene <sup>§Δ¶</sup>	CAR, EDC, HAP	X	X	X
2-Butanone (Methyl ethyl ketone) <sup>¶</sup>	CAR, HAP	X	X	.
tert-Butyl alcohol <sup>§</sup>		.	X	.
tert-Butyl benzene <sup>¶</sup>		X	X	X
Chloroform <sup>¶¶</sup>	CAR, HAP	X	X	X
o-Chlorotoluene <sup>¶</sup>		X	X	X
Diallyl phthalate (DAP) <sup>¶</sup>	EDC	.	.	.
Ethylbenzene <sup>¶‡</sup>	EDC, HAP	X	X	X
Isopropylbenzene <sup>†§Δ¶Ψ</sup>		X	X	X
p-Isopropyltoluene <sup>¶</sup>		X	X	X
Methylene chloride <sup>¶Ψ</sup>	CAR	X	X	X
N-Propylbenzene <sup>†§Δ¶Ψ</sup>	EDC	X	X	X
Styrene <sup>†‡§¶Δ*</sup>	CAR, EDC, HAP	X	X	X
Toluene <sup>§Δ</sup>	HAP	X	X	X
1,2,4-Trimethylbenzene <sup>¶‡§Δ¶Ψ</sup>	CAR	X	X	X
1,3,5-Trimethylbenzene <sup>¶‡§Δ¶Ψ</sup>	CAR	X	X	X
Xylene (total) <sup>Δ</sup>	EDC, HAP	X	X	X

## CIPP: 32 State Construction Specifications

Requirement	States
<b>No documents provided or no CIPP use</b>	9
<b>Before Construction</b>	
Show POTW permit to the Engineer	4
Install impermeable liner up and downstream	4
Conduct water testing at the site	4
<b>Before Reinstating Flow</b>	
Rinse new liner with clean water, capture, and dispose	5
Prohibit return to service before a minimum unspecified time period	4
Prohibit culvert return to service before a minimum time period (2, 4, or 7 days)	3
<b>General Requirements</b>	
Capture and dispose of compounds, water, and condensate	10
Conduct water testing at the site	4
Contractor is responsible for reporting any water quality alterations	3

## Much Less Info for Spray-On Linings

### Lesser used technology than CIPP

**No spray-on lining-related water contamination incidents were found**

**2 sanctioned water quality impact studies:**  
 No data for storm sewer epoxy and polyurethane

**Cementitious Liner**  
 ↑ Water pH  
 ↑ Alkalinity

**Polyurea Liner**  
 ↓ Water pH  
 ↑ Chemical oxygen demand (COD)  
 ↑ Total organic carbon (TOC)  
 ↑ Total nitrogen (TN)

**Only 3 of 32 states had specifications:**  
 Only 1 had detailed monitoring requirements: Curtains to prevent overspray, water sampling before and after install for diisocyanate (MDI), methylenedianiline (MDA), total cyanide, COD, and TN for polyurea, water rinsing after install until pH < 9 especially for cementitious lining.

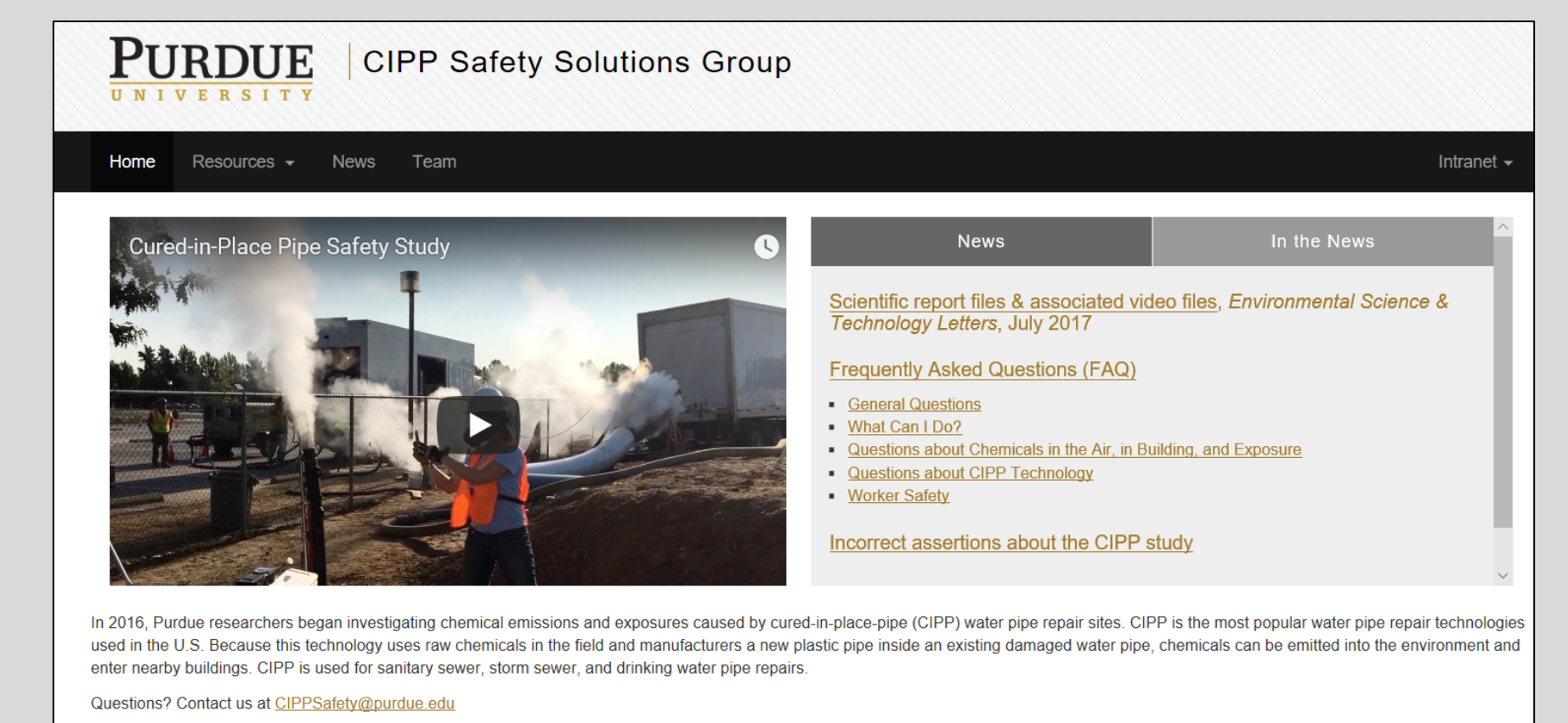
## SPECIFICATION RECOMMENDATIONS

1. **Wear** appropriate personal protective equipment (PPE)
2. **Submit** a POTW permit to the Agency Engineer to verify pre-approval for POTW disposal of rinse water, wastewater, and/or condensate
3. **Conduct** real-time and grab sample air monitoring
4. **Divert** water flow until "acceptable degree of cure" established and new liner passes water quality tests
5. **Utilize** impermeable plastic sheets (i.e., 10 mil thick) immediately upstream and downstream of the pipe
6. **Utilize** curtains to prevent overspray for spray-on liner
7. **Prohibit** chemicals from exiting the pipe during the CIPP manufacturing process (collect gases, liquids, or solids)
8. **Rinse** the new liner after manufacture (collect liquids and solids)
9. **Prohibit** wastewater, rinse water, or condensate to be discharged to waterway unless written approval by state environmental agency
10. **Conduct** water testing before and after installation - compare to standards/specs (use tests capable of detecting all chemicals of concern) - Any exceedance triggers additional testing
11. **Capture** particles and shavings created during cutting the end of liner
12. **Report** accidental discharge, small or large, to state transportation agency and environmental regulatory officials immediately, so downstream water supplies, the environment, and population can be protected.

## MORE INFORMATION

More information being posted online at <http://CIPPSafety.org> and <https://engineering.purdue.edu/CIPPSafety>.

CIPP Safety Study Webinar: <http://neha.org/node/59303>



## ACKNOWLEDGEMENT

Additional specification recommendations and guidance from this Pooled Fund Project will be released. Ongoing work pertains to CIPP longevity and chemical release. Pooled Fund Partners: VA (lead), CA, KS, NC, NY, OH