Corrosion Protection with Polymer Liners/Coatings

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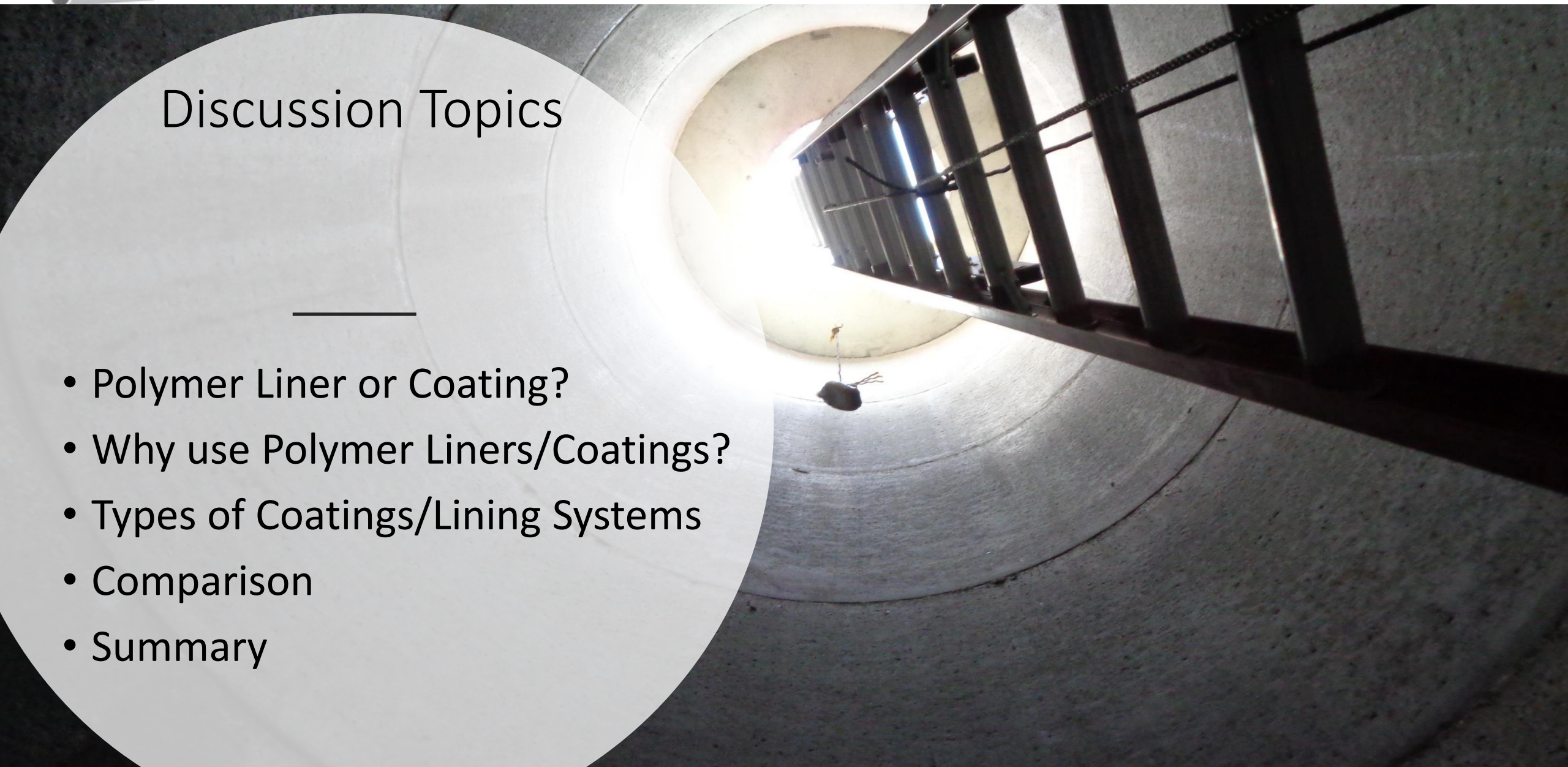
Discussion Topics

- Polymer Liner or Coating?
- Why use Polymer Liners/Coatings?
- Types of Coatings/Lining Systems
- Comparison
- Summary



Definition of Protective Coatings or Linings

- By the corrosion protection industry's definition **(NACE)**; a coating is a material that is applied up to 0.125 inches (<125 mils) in thickness that develops an adhesive bond with surface of the material to be protected. When a material has been applied to a thickness of more than 0.125 inches (>125 mils) it is designated to be a liner; whether it is in a bonded or an un-bonded condition.

Rule of Thumb

- Protective Coating =
  - Applied at approximately 1.0 – 125.0 mils dft.
  - Designed to create a mechanical or chemical bond (adhesion) to the substrate.
- Protective Lining =
  - Applied at 125.0 – 500.0+ mils dft.
  - Can be bonded or un-bonded

FYI - Some say “Coating on the exterior and Lining on the internal”

Why are Polymer Liners/Coatings Systems Used?

- Functional Protective Barriers
  - Chemical Resistance
  - Abrasion Resistance
  - Monolithic (Void and holiday free)
  - Impact Resistance
  - High velocity water resistance
- Infiltration Control
  - Seal and protect manhole structure from infiltration from groundwater
- Visual anniversary inspections

Functional – The look of a long-service life ☺








Polymer chemistry for the protection of Manholes

- Epoxies
  - Hi-Build reinforced Epoxy (80-250+ mils)
  - Thin Film (20-60 mils)
- Polyurethanes
  - Hi-Build (80-300+ mils)
  - Moisture Curing Thin-Film (10-30 mils)
- Polyurea (80-300+ mils)
  - Pure
  - Hybrid

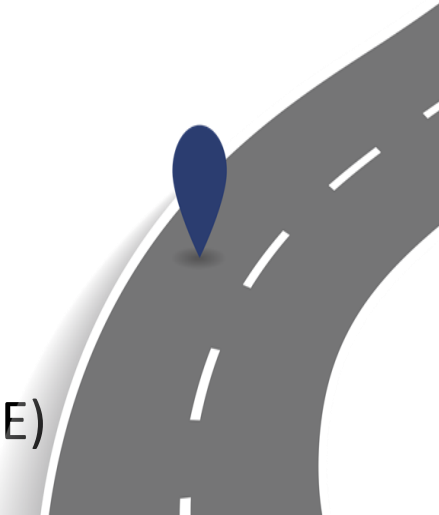
Epoxy (Thin Film)

Pro

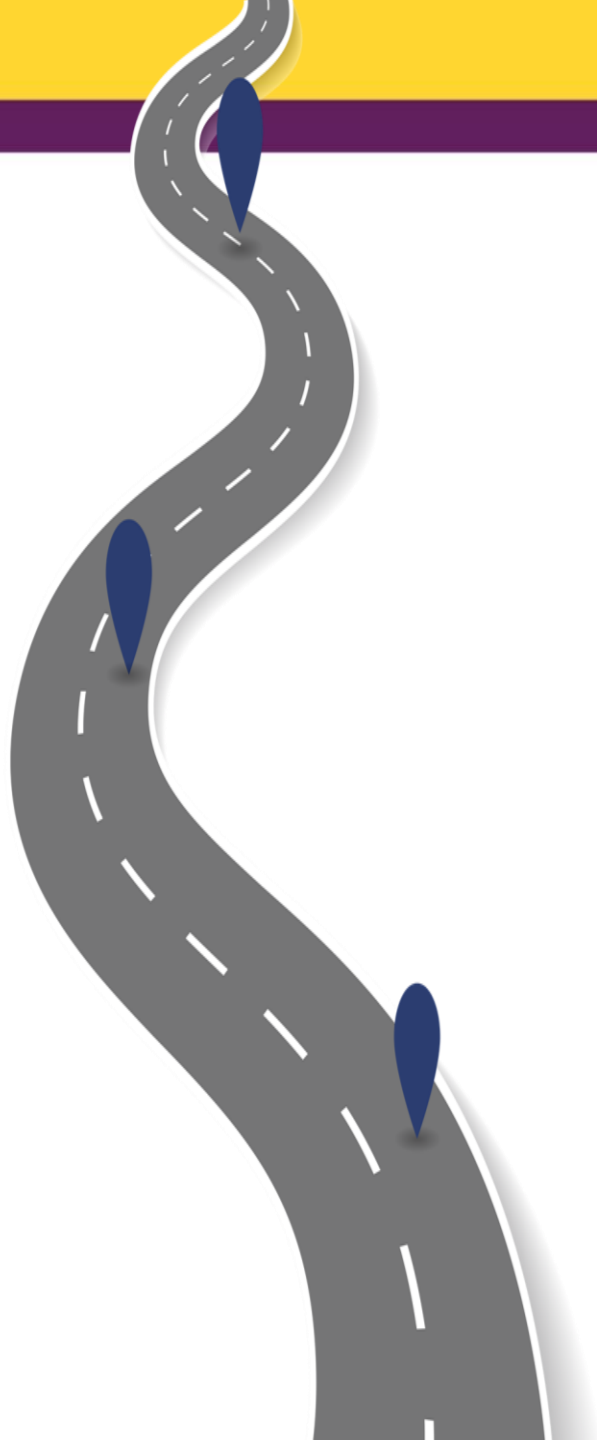
- Long established coating with excellent performance properties to protect structures in industrial environments.
- Thin-film systems applied at 20.0 - 60.0 mils dft.
- Long pot life and can be applied by single leg, conventional airless equipment.

Con

- Physical properties at the low end of what is normally required for the protection of manhole structures
- Multiple coats to meet higher film build requirements
- Can be sensitive to moisture and temperature during application
- Long return to service in wastewater immersion (>24 hours)
- Beware of the applicator!
  - Training, lack of surface preparation knowledge, and use of safety equipment (PPE)



Epoxy (High-Build Reinforced)



Pro

- Excellent Chemical Resistance
- Strong Physical Properties
  - Resistant to hydrostatic pressure due to groundwater
- Application to wet (SSD) concrete
- Good/Excellent adhesion (bond) to the host structure
- Fast return to wastewater service (2-24 hours)

Con

- Rigid (Elongation 2%-10%)
- Expert/trained applicators a must!

Hi-Build Polyurethane

Pro

- Chemical Resistant
- High abrasion resistance
- Can be flexible and crack bridging
- Fast cure to service (some in minutes)
- High-Build (30-250+ mils)

Con

- Sensitive to Moisture
- Fair to good adhesion (bond) to the host structure
  - Primer are recommended for underground structures

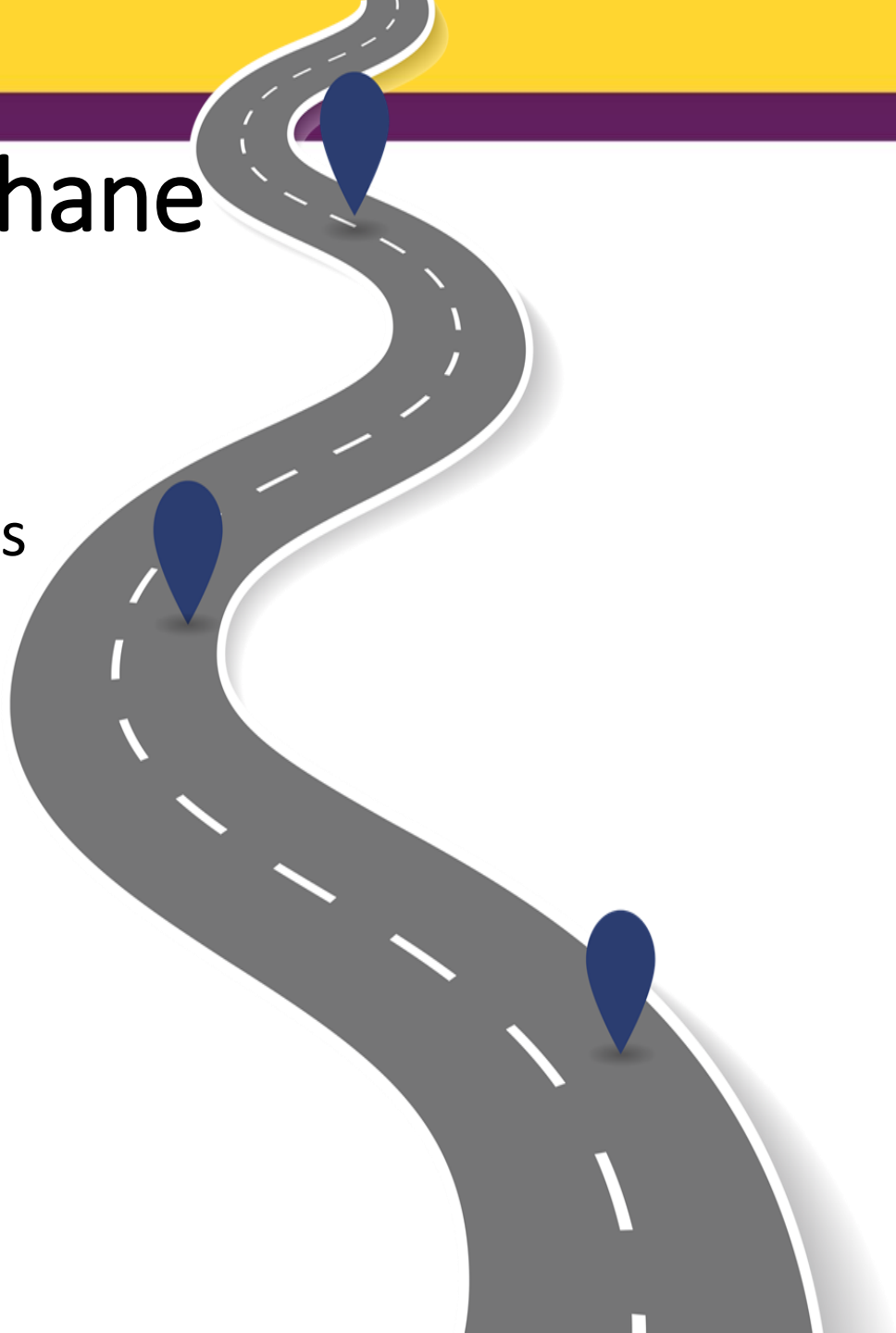
Moisture Curing Polyurethane

Pro

- Single component
- Apply by hand tools or spray methods
- Can be applied at 99% RH

Con

- Very thin-film (10-20 mils)
- Substrate must be visibly dry
- Not for rehabilitation
- Coal-Tar



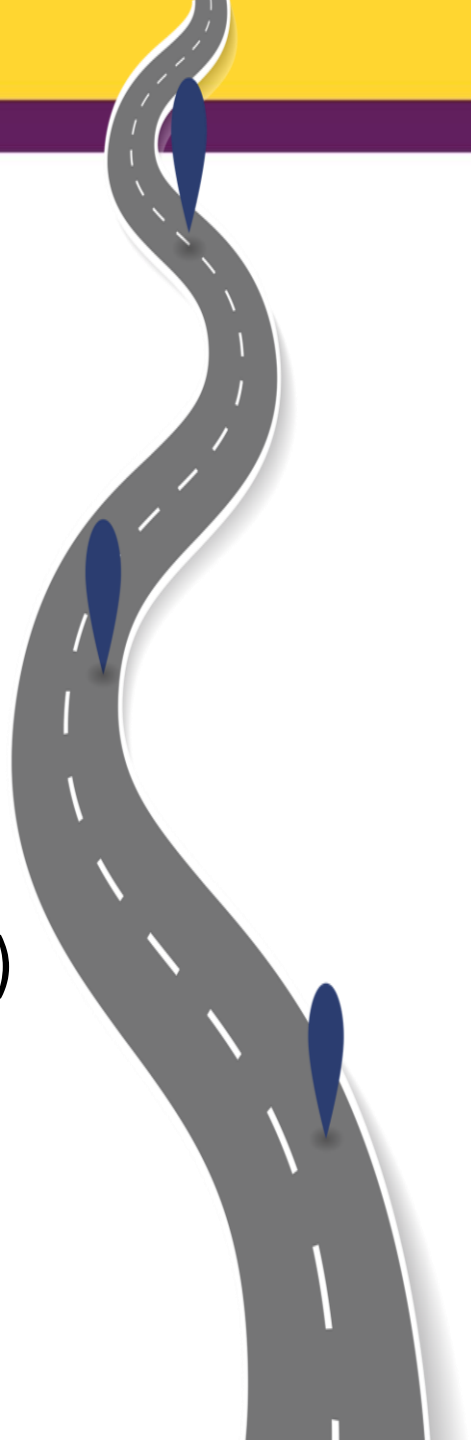
Polyurea – "Pure"

Pro

- Rapid Setting (Tack free 10-30 seconds)
- Flexible and crack bridging (100%-500% tensile elongation)
- Fast return to service
- High-Build (60-500+ mils)
- Good Chemical Resistance
- Can be applied at any ambient temperature (-20°F to 200°F+)

Con

- Fair/Good adhesion to primed concrete
- Sensitive to moisture during application



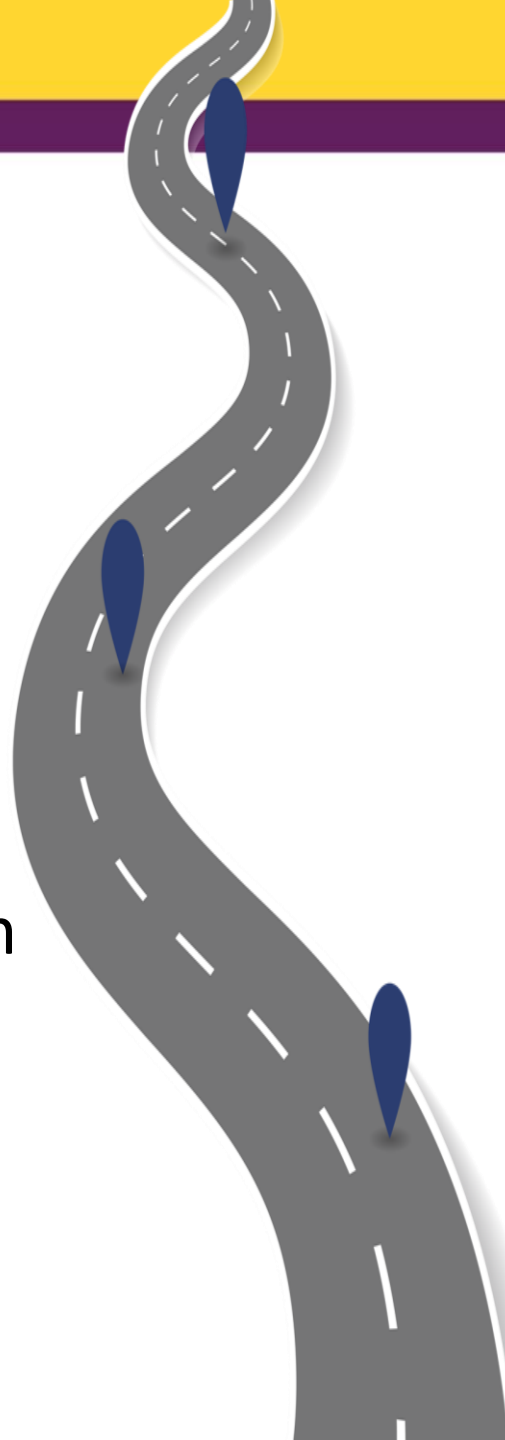
Polyurea – "Hybrid"

Pro

- Rapid Setting (Tack free 10-30 seconds)
- Flexible and crack bridging (100%-400+% tensile elongation)
- Fast return to service
- High-Build (60-300+ mils)
- Good Chemical Resistance
- Slower cure allows air to escape and reduce pinholes in the film
- Good adhesion to primed concrete

Con

- Fair/Good adhesion to primed concrete
- Sensitive to moisture during application



Generic Product Comparison

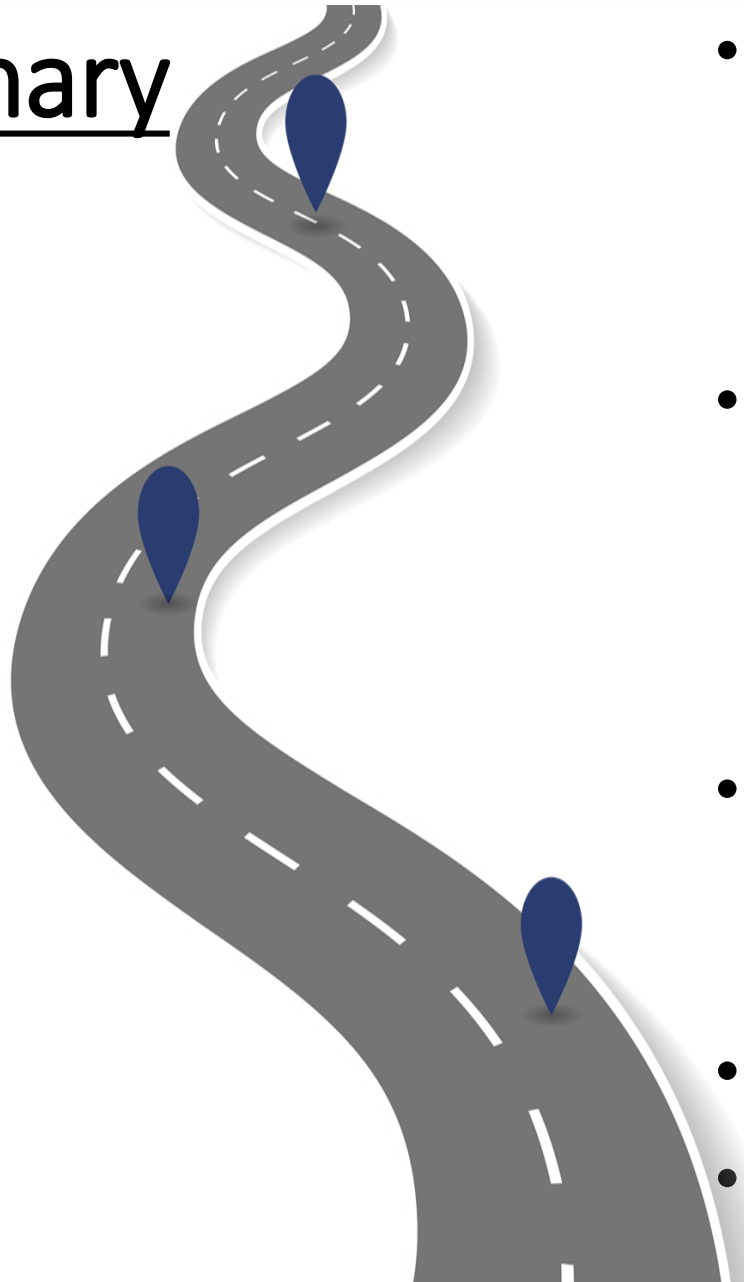
Characteristics	Epoxy (Thin-Film)	Polyurea	Polyurethane	Hi-Build Epoxy
Adhesion to Dry Concrete	Good	Good	Good	Excellent
Moisture Filled	Not recommended	Good (w/Primer)	Good (w/Primer)	Excellent
Wet (SSD)	Not Recommended	Not recommended	Not recommended	Excellent
Tensile Strength (ASTM D638)	Up to 7,000 psi	2,000-3,500 psi	(Flex)2,000-3,000 psi (Rigid) >7,000 psi	5,000-8,000 psi
Tensile Elongation (ASTM D638)	4%-10%	75%-400%	5%-100%	2%-5%
Chemical Resistance 20% Sulfuric Acid	Poor/Fair	Good	Good	Excellent
Max mils per coat	Up to 50 mils dft.	300+ mils	300+ mils	Up to 250+ mils

However, Choose your Polymer Liner/Coating Wisely

Correct product selection, installation and Inspection can help prevent:

- Polymer coating or liner dis-bonding
- Aggressive corrosion after the failure
- Pinholes & thin coating voids
- Ground water infiltration issues

Summary



- Polymer Coatings/Liners are protective, functional, barriers against microbial induced corrosion (MIC), abrasion, erosion, and ground water intrusion.
- Polymer Coating/Liners are typically:
  - Epoxy / Fiber-reinforced Hi-Build Epoxy
  - Polyurethane
  - Polyurea
- And…Choose your polymer liner/coating wisely!
  - Know the conditions of sewer collection structures
- Trained/Certified/Approved Applicators a PLUS
- QA/QC Inspections / Third-Party Testing

Thank You