A person is using a spray gun to apply a white epoxy coating to a brick wall. The spray gun is held in the person's hand, and a stream of white material is being directed towards the wall. The background is a blurred brick wall.

# **100% Solids, VOC Free Protective Epoxy Coatings For Manholes, Lift Stations & Water & WWTP Structures**

Gerhard (Gerry) P. Muenchmeyer, P.E.

# Epoxy Coatings Verses Paint

- **Compared to paints, epoxy coatings are generally described as higher performing systems in relation to chemical and atmospheric protection**
- **Epoxy coatings are a protective layer applied to a surface to retard or prevent corrosion and to isolate the substrate from contact with another material**
- **Applied correctly, a monolithic epoxy coating will effectively protect surfaces and substrates from environmental change better than any other method of corrosion control**

# Coating VS Coating System

- **Coating – products generally available, over the counter, from large paint companies applied by general contractor's with or without experience.**
- **Coating System – specially formulated proven coatings that are applied by manufacturer trained or certified applicators using specially designed application equipment.**

# Purpose of Epoxy Coating System

- **Provide monolithic, defect free, barrier**
- **Protect against corrosion**
- **Control & eliminate infiltration, exfiltration**
- **Extend infrastructure service life**
- **Improve operation & maintenance**



# Epoxy Coatings Provide Solutions

- **Protect new structures from future corrosion**
- **Rehabilitate deteriorated Structures to renew service life**



# Where Epoxy Coatings are Typically Specified

**Water & Wastewater  
Treatment Plants**

**Collection Systems**

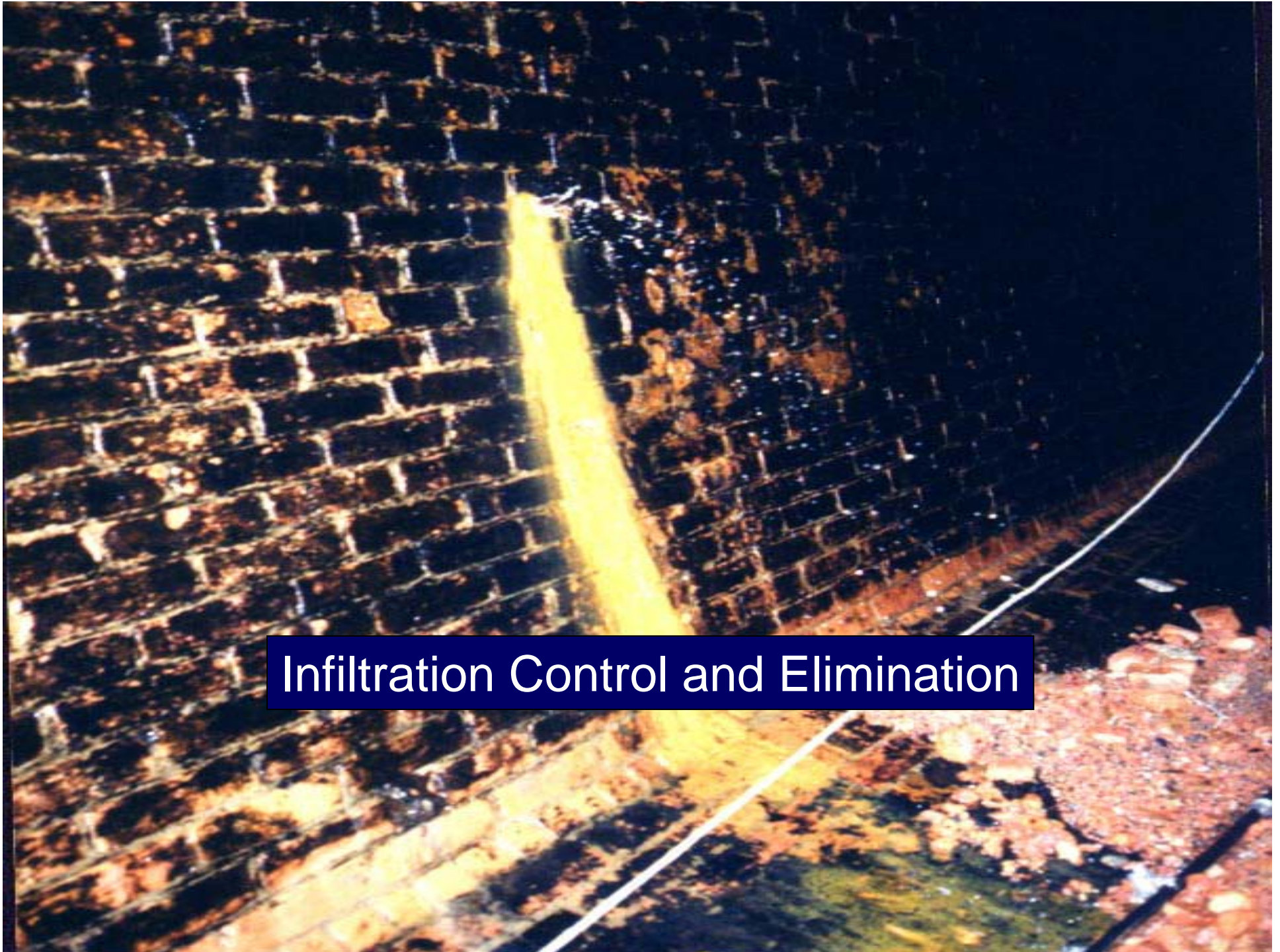
**Water Storage Tanks  
&  
Reservoirs**

**Industrial**

- **Pipelines – Distribution & Collection**
- **Tunnels & Junction Boxes**
- **Tanks (Steel & Concrete)**
- **Lift Stations & Wet Wells**
- **Sedimentation & Filter Basins**
- **Manholes & Utility Vaults**
- **Clarifiers & Digesters**
- **Siphons & Outfalls**
- **Secondary Containment**
- **Floors & Walls**
- **And more...**



Corrosion Protection



**Infiltration Control and Elimination**

# Containment





Structural Enhancement



Structural Rebuild



Improved Operation and  
Ease of Maintenance

# Underground Structure Variables

**Accessibility to apply coating**  
**Temperature and humidity in the structure**  
**Moisture filled substrates**  
**Structure surface conditions**  
**Structural condition**

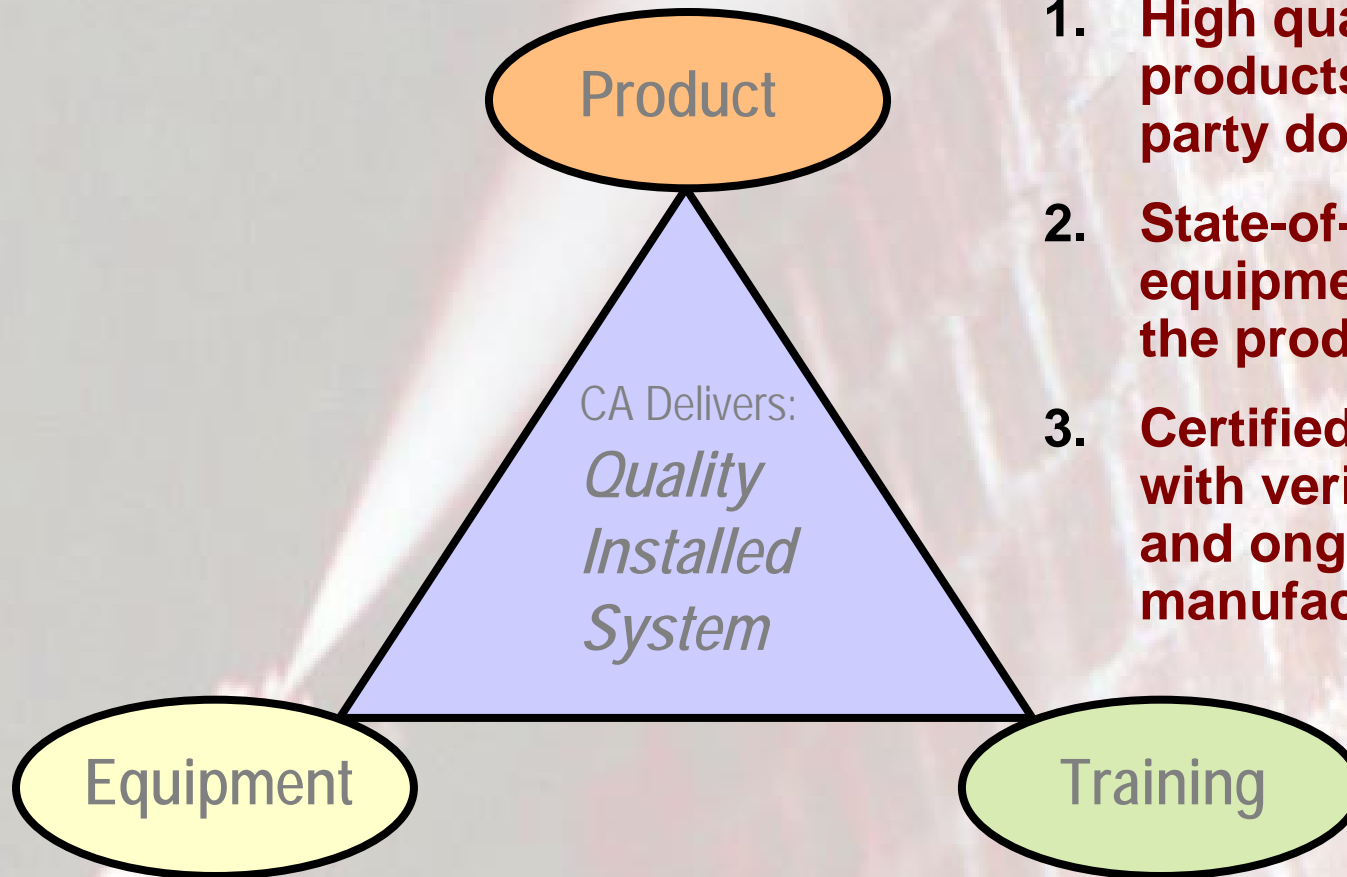


# Selecting the Coating or Coating System

- **Intended service, water, wastewater, industrial, chemical**
- **Coating thickness or build-back required**
- **Normal operating conditions (temperature, corrosion, abrasion)**
- **Existing condition structure**
- **Proven history in similar applications & environments**



# Using An Engineered System Approach (Coating System)



1. **High quality, proven products with third party documentation**
2. **State-of-the-art equipment matched to the product**
3. **Certified Applicators with verifiable training and ongoing manufacturers support**

# Selecting Proven Products

- **100% solids epoxies and grouts**
- **Proven in water & wastewater applications for over 20 years**
- **Available third-party test results and participation in industry evaluations**
- **Diverse system applications confirming long-term protection on a national basis**

# Using The Correct Application Equipment

- **Equipment constructed and/or certified by the manufacturer**
- **Ability to work in difficult to access underground structures & tunnels**
- **High quality, uniform mixing & production capabilities**



# Requiring Certified Applicators?

**“More than 90% of all failures in the Industry result from improper installation”**

## **Certified Applicator Benefits:**

- **Certification by the manufacturer**
- **Initial and ongoing training with annual continuing education courses**
- **Retraining as applicable**
- **Exclusive use of certified equipment**
- **24/7 technical support from Manufacturer**
- **Manufacturer support on special projects**
- **Periodic on-site review and follow-up to verify applicator performance**



# Preparing The Specification

- **Determine the purpose of the coating**
- **What family of products are applicable?**
- **Are all specified materials compatible?**
- **How are the products installed properly**
  - **By requiring qualified applicators with experienced people**
  - **By defining the installation conditions**
  - **By enforcing a QA/QC program**
  - **By implementing a testing program**



# Specifications Choices

- **Prescriptive (Design) Specifications**
  - Applicable to custom projects. Detailed installation procedures & requirements are typically defined.
- **Performance Specifications**
  - Leaves the means & methods of construction up to the contractor with defined verification procedures.
- **Combination of Prescriptive & Performance**
  - Used for custom designs but with commodity product installation



# Why Performance Based Specifications

- **Strive for the best commercial practices**
- **Attract the most qualified contractors**
- **Include statement of the project requirements in terms of anticipated results.**
- **Define functional requirements of the product**
- **Include criteria for verifying compliance**
- **Specify construction by contractor means & methods and owner inspection for compliance**
- **Construction difficulties the responsibility of the contractor**



# Epoxy Application

**Objective:** “To deliver the highest quality proven products with manufacturer trained crews using manufacturer approved equipment”

- **Surface Preparation**
  - obtaining clean, sound surface
- **Coating Application**
  - Proper ratio and coverage
- **Quality Assurance/Quality Control**
  - Quality uniform coverage and application thickness
- **Testing**
  - Verifiable acceptable mechanical bond & barrier without fault
- **Appearance**
  - Free of pinholes, cracking, blisters

# Preparation, Preparation, Preparation

**“Preparation by Certified Applicator with knowledge and expertise to identify and perform proper preparation methods is key”**

- **Clean and abrade to develop profile and open porosity (water or abrasive)**
- **Remove contaminants and existing coatings**
- **Stop active infiltration**
- **Use compatible repair materials to fill bug holes and defects in the surface**



# Coating Application

- **Re-clean structure after repair of bugholes and voids**
- **(Optional) Apply penetrating prime coat**
- **Spray apply first coat of epoxy, allow time to set but stay within recoat window**
- **Spray apply second coat of epoxy**
  - Follow manufacturer's multiple coat recommendations for quality and productivity
- **Additional coats to achieve specified thickness and ensure monolithic coverage**



# Adhesion Testing

**“Verifiably acceptable mechanical bond”**

## Verification :

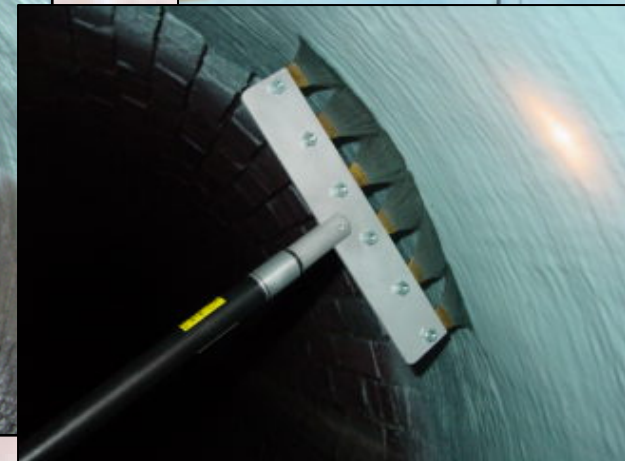
- **Proper surface preparation**
- **Proper mixing & application**
- **Coating bond to substrate**
- **Correct product formulation for moist or damp environments**



# Monolithic Application

**“A barrier without fault”**

- **Calibrate spark tester**
- **Test entire coating surface**
- **Mark all defects**
- **Repair all defects**
- **Retest with spark tester**



# Appearance & Visual Epoxy Coating Inspection

- Cracking, pinholes, blisters, exposed substrate
- Proper rebuild of deteriorated areas
- Sealing of incoming structures and pipes



# Recommended Quality Control & Testing

- **Visual inspection to determine quality – entire coating**
- **Wet film thickness gauge to confirm specified thickness achieved – entire coating during application**
- **Holiday detection to identify defects while verifying monolithic coverage – entire coating**
- **Random adhesion testing to verify integrity of bond achieved through proper surface prep and coating application – 10% of project**



# Impact Of Trained Inspectors On Reducing Failures

- **Trained and qualified inspectors improve quality and the level of quality control, on the project, through increased and improved inspection techniques**

# Project Inspection

- **Inspect the quality of work that is being performed throughout the project at phases assigned.**
- **Perform close visual observations at regular intervals and survey the overall progress of the project.**
- **Inspection schedule shall be coordinated with the Contractor's representative to avoid project delays.**
- **Recognize premature failures, their causes, effects, repair complications and procedures.**
- **Detect improperly ratioed, misapplied or incorrectly installed products.**
- **Maintain project documentation.**

SAMPLE FORM		Quality Assurance/Quality Control					
Contract Name: <u>Manhole Rehabilitation</u>		Contract No: _____					
Contractor/Installer: _____		Construction Observer/Inspector: _____					
Report No. _____		Weather: _____		Structure Temp: Ambient _____		Surface _____	
Other Work in Progress: _____							
					<b>Inspection</b>		
					<b>Results</b>		
<b>No.</b>	<b>Quality Assurance</b>	<b>Performance Standard</b>	<b>Acceptable Quality</b>	<b>Quality Control</b>	<b>Pass/Fail</b>	<b>Comments</b>	
1	Visual inspection of structure substrate after cleaning and preparation	Industry Standard	100%	Visually inspect surfaces to be coated for effective removal of existing coatings, unsound substrate, laitance, infiltration. Visually identify problem areas.			
2	Test substrate for soundness.	SSPC- SP 13 NACE No. 6	100%	Lightly scratch prepared concrete surfaces with a screwdriver or pocket knife. The scratch should leave a shiny mark with no loose particles from the surface. Otherwise, re-prep and re-inspect.			
3	Visual inspection of product application and documentation of proper material ratio/usage	Product Technical Data Sheet (ratio)	100%	Visually observe mixed color which should be homogenous without marbling effect. Inspection recordkeeping of applicator for material usage of product components, verify proper usage.			
4	Wet Film Thickness (WFT) measured during application.	ASTM D-4414	No less than 90% or greater than 120%	Measure and record the WFT in at least four locations for every 500 sf and each coat of material applied.			
5	Holiday Detection using a high voltage holiday detector.	NACE RPO-188	100%	Confirm conductivity by inducing holiday and calibrating detector. Test entire coated surface. Repair and retest as required.			
6	Adhesion Testing using a Elcometer Model 106 on a minimum of 10% of the manhole structures coated.	ASTM D-4541	As specified	Perform a minimum of three pull tests per manhole at locations randomly selected. Evaluate results and repair coating where tested.		Record dolly location, pull strength (psi), mode of failure and whether dolly was scored or unscored.	
<b>Owners Representative: Name</b>		<b>Signature</b>			<b>Date</b>		
<b>Contractor/Installer Representative: Name</b>		<b>Signature</b>			<b>Date</b>		
<i>All QA/QC as per specific manufacturer's recommendations.</i>							

# Summary:

## When Do Coatings & Linings Work?

- **Specifications detailed, accurate and complete**
- **The best system is chosen, by the Engineer, considering product history, environment and anticipated exposure**
- **The selected coating manufacturers certify and supports applicators**
- **Applicators are trained and use manufacturer approved application equipment**
- **Inspectors and project managers are knowledgeable of both product and application techniques**
- **Quality Assurance criteria is clearly specified**
- **Quality Control procedures and testing are implemented during construction and inspectors are properly trained**

# Creating a Corrosion Barrier with Epoxy

- **Concrete, New – 60 to 100 mils**
- **Concrete, Rehab – 125 to 500 mils**
- **Brick – 150 to 500 mils**
- **Steel – 20 to 80 mils**

**Note:** When specifying thickness, identify the minimum recommended coating thickness over the highest peak of the host structures surface profile.

# **100% Solids Epoxy Coatings**

## **The Key to Success**

- **20+ years of product history**
- **Third party tested and proven**
- **Designed for underground as well as above ground applications with a variety of products**
- **Moisture tolerant**
- **Provides structural enhancement to existing structure**
- **Ultra-high build thickness applications**
- **Long recoat window for multiple coat applications**
- **High corrosion resistance**
- **Applied by trained Certified Applicators**
- **Installed with manufacturer approved equipment**
- **Ongoing manufacturer support and training**

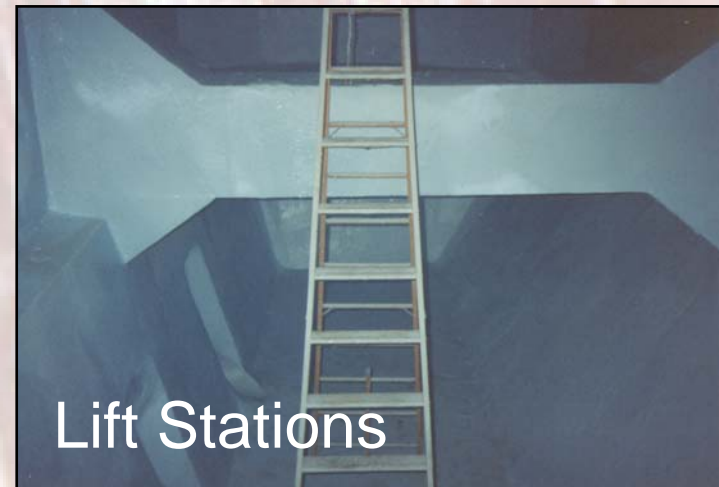
# Conclusion

**“ Epoxy Coatings are an effective solution for the protection of structures against corrosion, provided the application includes tested and proven materials, application equipment that delivers consistent, ratio'd materials and certified applicators are trained to properly prepare the existing structure and correctly apply the material.”**

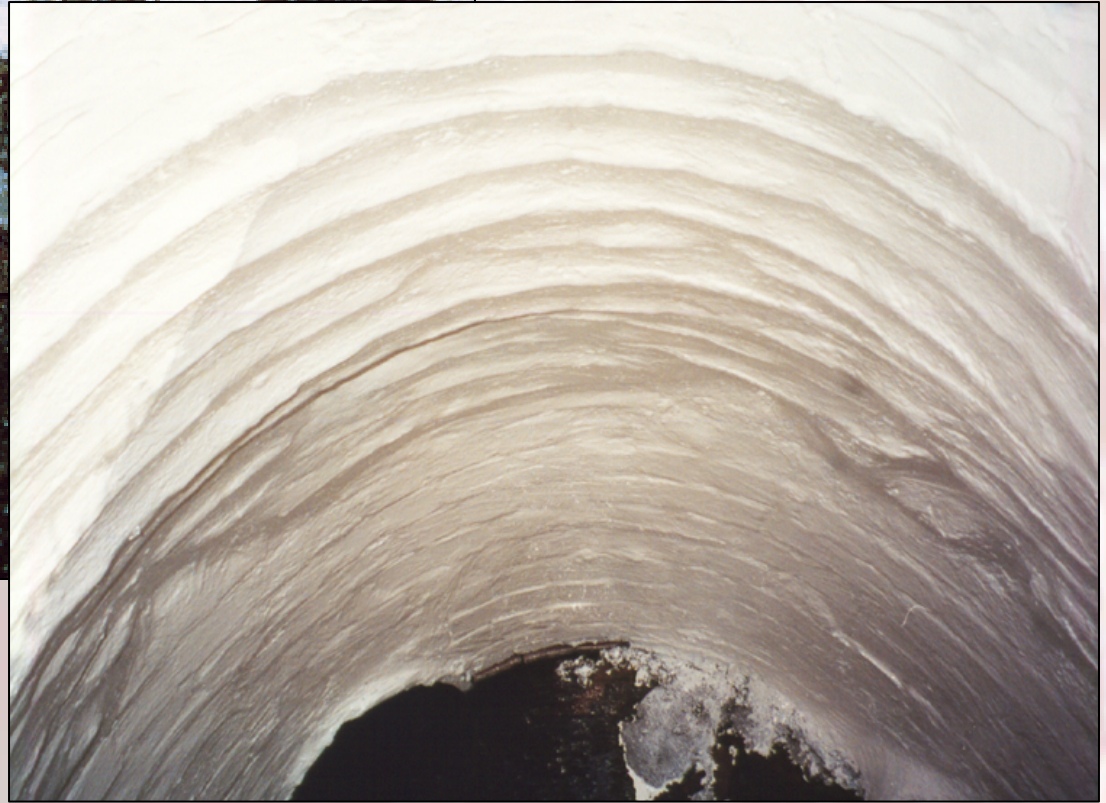
The background of the slide features a close-up photograph of a hand holding a white, cylindrical object, possibly a sample or a tool, against a brick wall. The lighting is soft, and the focus is on the texture of the brick and the object.

# **Samples Project Illustrations**

# New Construction



# Manholes



# Steel Lift Stations



# Precast Lift Stations



# Large Diameter Pipe & Tunnels



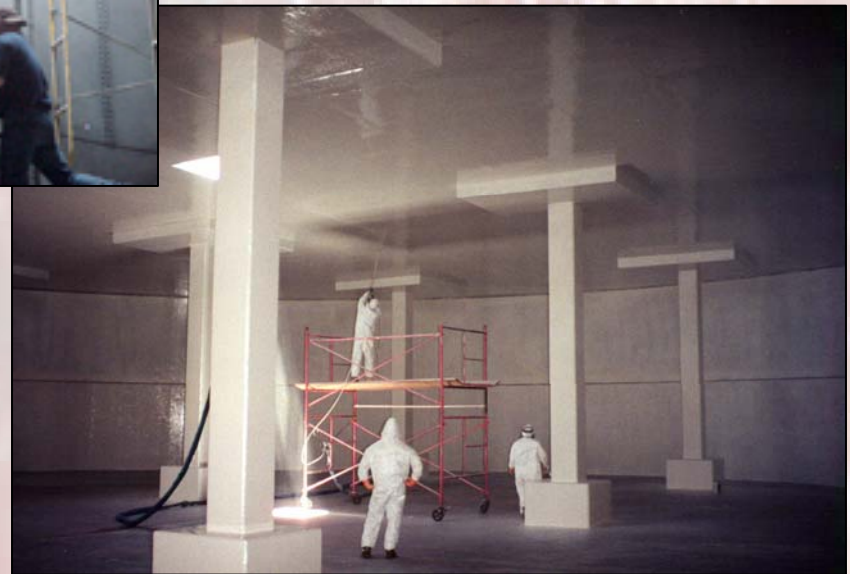
# Composite Systems



# Treatment Facilities



# Potable Water Applications



# Storm Sewers

