



## New Options for Coating Water and Wastewater Treatment Plants



06 May 2015 Protective & Marine Coatings

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### Learning Objectives

- Explain why wastewater flows have become more aggressive
- Explain how Microbiologically Induced Corrosion (MIC) accelerates deterioration
- Describe the different types of linings used for water and wastewater immersion
- Explain why and how inflow and infiltration (I&I) must be addressed
- Describe the different approaches to resurfacing
- Explain the advantage of using optically activated pigments (OAP) for holiday detection
- Identify coatings for anti-fouling and secondary containment
- Identify coatings appropriate for the exterior or water and wastewater treatment plant structures

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### New Lining Systems for Wastewater Structures

- Glass Flake Reinforced Amine Epoxy
- 100% Solids Epoxy Lining / Mortar
- 100% Solids Semi-Structural Epoxy
- 100% Solids Polyurethane Elastomer
- Fast Cure Polyurea Elastomer

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## Why?

Prior to the Clean Water Act of 1972,  $H_2S$  concentrations were below 10 ppm in most municipal systems. The result was *very gradual* acid attack to concrete and metals. As a result, thin film systems (<25m) such as coal tar epoxy provided effective protection for 10-15 years.



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## 1980

Following the amendment of the Clean Water Act of 1980, industrial *pretreatment* of wastewater affluent to eliminate or reduce the presence of heavy metals (lead, mercury, cadmium) was mandated. Prior to 1980, these metals killed or retarded the growth of bacteria.



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## Add Covers and Longer Detention Times

Consequently,  $H_2S$  has risen to levels as high as several hundred ppm, averaging over 30 ppm in collection piping, manholes and tanks.  $H_2SO_4$  concentrations have risen from solutions of 1.5% to as high as 7%, resulting in pH ranges found to be as low as 1.5-2.5, and often less than 1.0!

*add decreased inflow/infiltration*

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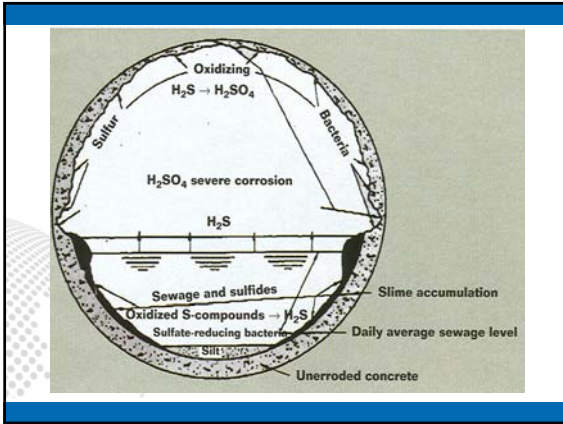
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## The Result

Coating systems that served well prior to 1980, like coal tar epoxy, now often fail **in months, not years!**

Microbial  $H_2SO_4$  generation attacks steel, concrete, and ductile iron.




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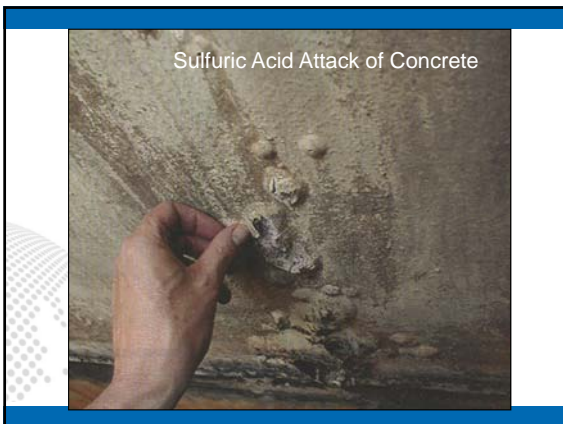
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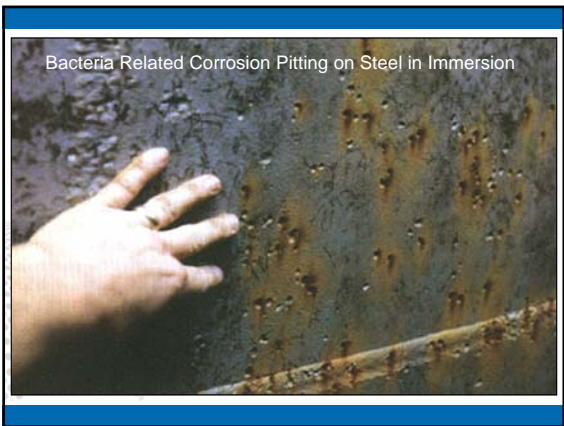
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# Controlling Corrosion

## 1. Change design parameters.

*(Minimize slow flow or stagnant conditions in treatment stream)*

## 2. Different materials of construction.

*(Use of vitrified clay, ductile iron, plastics, anti-microbial concrete)*

## 3. Modification of sewage environment.

*(Raise pH above 9 temporarily to kill SRB; sulfate reducing bacteria)*

## 4. Installation of barrier coatings!

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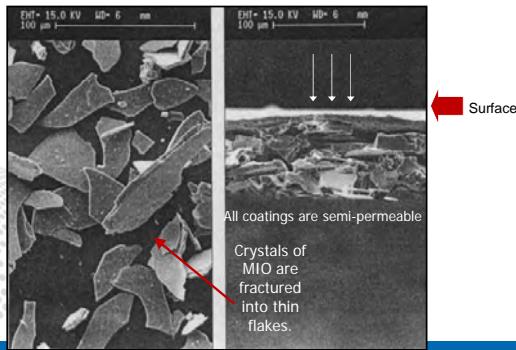
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# Add Flake Fill



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# Types of Flake Reinforcement

- Glass
- Micaceous Iron Oxide (MIO)
- Graphite

*(resistance to halogenated acids)*

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## Glass Flake Reinforced Amine Epoxy

- Upgrade to coal tar epoxy
- Corrosion, impact, and abrasion resistant
- Direct to metal application
- Maybe applied to a surface saturated dry (SSD) concrete
- Up to 20 mils dry in a single coat
- Enhanced performance and edge protection



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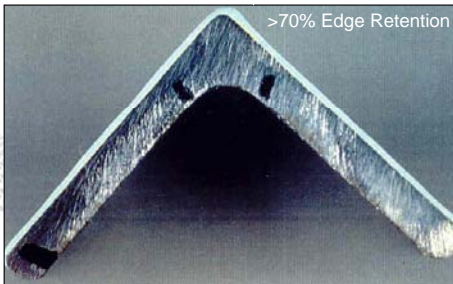
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## Edge Retentive



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## 100% Solids Epoxy Lining / Mortar

- Amine cured
- Chemical Resistant
- Resistant to hydrogen sulfide gas, carbon dioxide gas, and microbiologically induced corrosion, and sulfuric acid attack
- High build capabilities – Up to 60 (even 250) mils DFT in one coat
- 125 - 250 mil mortar system
- Maybe applied to a surface saturated dry (SSD) substrate



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## 100% Solids Epoxy Lining



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## High Strength Corrosion Protection Lining

- 100% Solids, Amine Cured, High Strength Epoxy capable of being applied >125 Mils DFT in a single coat.
- Maybe applied to a surface saturated dry (SSD) substrate.
- Extremely high physical performance characteristics for use as a structural liner in industrial and municipal wastewater environments.

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## 100% Solids Polyurethane Elastomer

- Aromatic polyurethane
- High film build capabilities (> 250 mils)
- Flexible - capable of bridging a 1/8" crack
- Chemical, abrasion, and impact resistant
- Quick setting – short downtime
- Monolithic vertical & overhead application
- Primer required for application to concrete and application to a surface saturated dry (SSD) substrate

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## Accidentally Dropped Pipe

Polyurethane elastomer is well adhered!



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## Manhole Rehabilitation



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### 100% Solids Polyurethane Elastomer



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### Fast Cure Polyurea Elastomer

- 100% Solids Aromatic Polyurea capable of being applied up to 250 Mils DFT
- Fast set and cure - short downtime
- Seamless, flexible and waterproof
- Chemical resistant, impact, tear, and abrasion resistant
- Bridges moving cracks to 1/8"
- Retains physical properties at -20°F to 250°F
- Primer required for application to concrete and application to a surface saturated dry (SSD) substrate

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### Fast Cure Polyurea Elastomer



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### **Chimney Seal Brush Grade Polyurea**

- 100% Solids, Aromatic, Pure Polyurea, Capable of being applied up to 250 Mils DFT in a single coat.
- The product offers a flexible liner capable of bridging a 1/8" crack. It will withstand severe traffic loading and is packaged in a side by side plural component cartridges for pneumatic application.
- Primer required for application to concrete and steel and application to a surface saturated dry (SSD) substrate.

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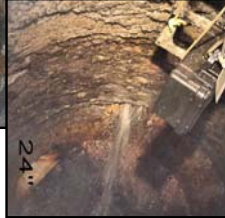
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## Rehabilitation First



- Stop I/I (Infiltration and Inflow)
- Rebuild



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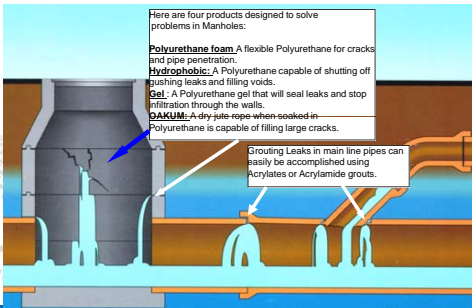
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## Hydrophilic & Hydrophobic Polyurethane Grouts



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## Cementitious Repair Coatings

- Portland cement by-products or calcium aluminates
- Sprayed or trowel applied
- New product mixes allow radial spray with no entry into manhole
- Will degrade as the original surface did



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## Polymer Modified Mortars

### Advantages

1. Good Bond Strength
2. Aesthetic finish
3. Faster overcoat than pure portland

### Disadvantages

1. Susceptible to MIC
2. Longer overcoat than other formulations
3. Repair mortar requires surface preparation prior to coating

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## Water Based Epoxy Cement Resurfacer

- Reduces out gassing concerns associated with epoxy resins
- Maybe applied to a surface saturated dry (SSD) substrate
- Will hang vertically up to 1/4" thickness on a dry substrate with spray application and 3/16" with hand trowel application
- Epoxy materials can be applied directly without the need for a primer.



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## Micro Silica/Fumed Silica Mortars

### Advantages

1. Tighter matrix – lower permeability
2. Chemical resistant
3. Drive water off faster than pure portland
4. Lower cost than Calcium Aluminate

### Disadvantages

1. Susceptible to MIC
2. Longer overcoat time than Calcium Aluminate Mortar



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## Calcium Aluminate Mortar

### Advantages

1. With stands MIC longer than portland based materials
2. Faster set times (Typically 4-24 hours)
3. Can be used as a stand alone liner

### Disadvantages

1. Susceptible to MIC, but at a reduced rate.
2. Cost

#### Two types available in the market.

**Pure or Fused Calcium Aluminate Mortar**  
Binder or paste are calcium aluminate as well as the aggregate.

**Calcium Aluminate Mortar**  
Binder or paste are calcium aluminate and the aggregate is typically silicon dioxide (Silica Sand)

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## Potable Water Linings

- Optically Activated Pigments
- Low VOC, Low Viscosity, High Build Potable Water Epoxy\*
- High Solids Potable Water Epoxy\*
- 100% Solids Polyurethane & Polyurea Elastomers for Potable Water\*

*\*ANSI/NSF 61 Certified*

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## Common Areas of Corrosion



*What can be done to help stop this from happening again?*

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### Traditional Holiday Detection Equipment



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HV

After Coating is Cured & Solvent Free  
Cannot Detect Low Film Build

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### Topcoat over Fluorescent Primer Holiday in Pit



White Light Inspection



Fluorescent Inspection

Topcoat Holiday: Blue crescent is prime coat fluorescence

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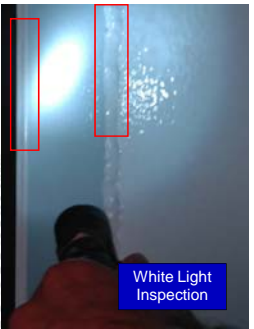
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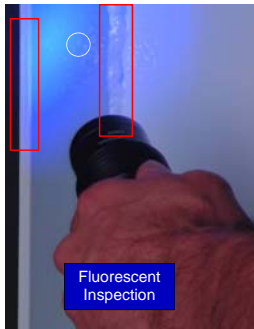
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### Primer Defects Welds and Edges



White Light Inspection



Fluorescent Inspection

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## Low VOC, Low Viscosity, High Build Epoxy

- Available with OAP Technology
- <100 g/l VOC & NSF Standard 61 approved
- Low viscosity primer
- Fast “dry hard” times for stacking of plate
- High build topcoat (up to 14 mils)

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## High Solids Potable Water Epoxy Lining

- Available with OAP Technology
- <100 g/L VOC
- Up to 50 mils in one coat
- Low Temp Hardener
- Edge Retentive
- Fills pits and voids
- Excellent wetting
- 24 hour return to service



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## 100% Solids Polyurethane & Polyurea Elastomers for Potable Water

- Single Coat Application
- Applications up to 100 mils DFT in one coat
- 0 VOC
- Return to immersion service in potable water in 24 hours @ 77F
- Provides a smooth glass like appearance



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## Other Water & Wastewater Coating Enhancements

- Silicone Release Agents
- Styrene Free Vinyl Ester Linings
- Fluoropolymer Urethane Exterior Finishes
- Mildew Resistant Polyurethane Finishes
- Non-Sacrificial Anti-Graffiti Coatings

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## Silicone Release Agents

- Transfer technology from the marine industry to satisfy a problem in W&WW
- The silicone technology prevents the adhesion of soft fouling, like algae, and reduces cleaning time drastically
- NSF Standard 61 approval has allowed the coating to be use for intake pipes prior to chlorine inject to prevent zebra and other mussel attachment
- The silicone technology allows for barnacle growth to be easily removed in salt water intakes

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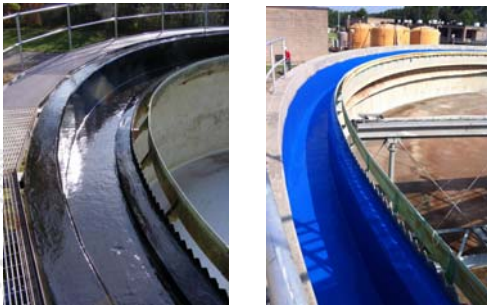
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## SherRelease



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## Styrene Free Vinyl Ester

- Removed the hazards associated with styrene (health, spark and shrinkage)
- VOC's <15 g/l
- Changed in technology increased crosslink density which improved chemical resistance
- No longer requires the addition of wax solution on final coat for proper cure

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## Fluoropolymer Urethane

- Ambient cured
- Superior color and gloss retention
- Available in a wide range of colors
- Graffiti resistant



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## Mildew Resistant Polyurethane

- Mildew Resistant aliphatic acrylic polyurethane
- Excellent color and gloss retention



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## Anti-Graffiti Coating

- Single component, moisture-cure, siloxane-based coating
- Non sacrificial with excellent cleanability.
- Low VOC
- Can be applied over bare concrete or previously painted surfaces
- Clear and limited colors

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## Anti-Graffiti Testing



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## Summary

- Explain why wastewater flows have become more aggressive
- Explain how Microbiologically Induced Corrosion (MIC) accelerates deterioration
- Describe the different types of linings used for water and wastewater immersion
- Explain why and how inflow and infiltration (I&I) must be addressed
- Describe the different approaches to resurfacing
- Explain the advantage of using optically activated pigments (OAP) for holiday detection
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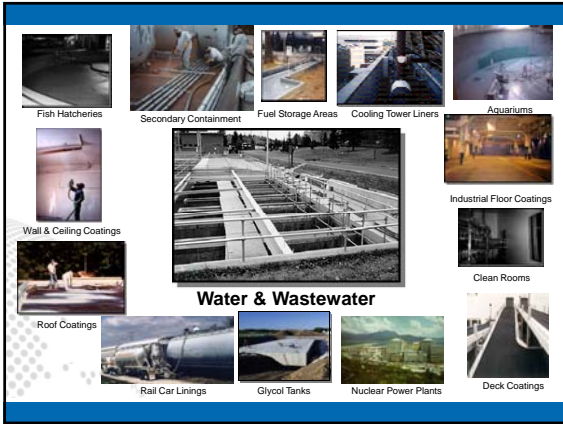
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## Questions?

protective.sherwin-williams.com

- <http://www.go2advertising.com/weblast/sherwinwilliams/SW12095/>
- <https://play.google.com/store/apps/details?id=com.sherwin.SWW>
- <https://itunes.apple.com/us/app/sw-water-wastewater/id942363303?mt=8>



Protective & Marine Coatings

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## Water & Wastewater App Now Available!

Water & Wastewater allows you to explore the best Sherwin-Williams coating for each area of a water treatment or wastewater treatment facility. From conventional to membrane systems, piping and fire hydrants to digesters and clarifiers, Sherwin-Williams has your coatings needs covered. With comprehensive coatings specifications for every aspect of your equipment, Water & Wastewater is interactive, fast, and easy to use.



- Process descriptions, areas of application and recommended applications
- The recommended/primary coatings and primers
- Alternative coating systems
- DFT (mils) for each coat and total dry mils
- Coating attributes

Explore the best coatings for your facility — download the free Water & Wastewater tablet app today!


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