

Magnesium Hydroxide as H₂S Odor and Corrosion Solution

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Magnesia Specialties**



Disengagement of Federal Involvement in Wastewater Infrastructure Build-Out & Maintenance

- Left municipalities short on means to conduct a demanding responsibility
- Particular maintenance challenges:
 - Long retention times
 - High sulfur content
 - High FOG concentrations

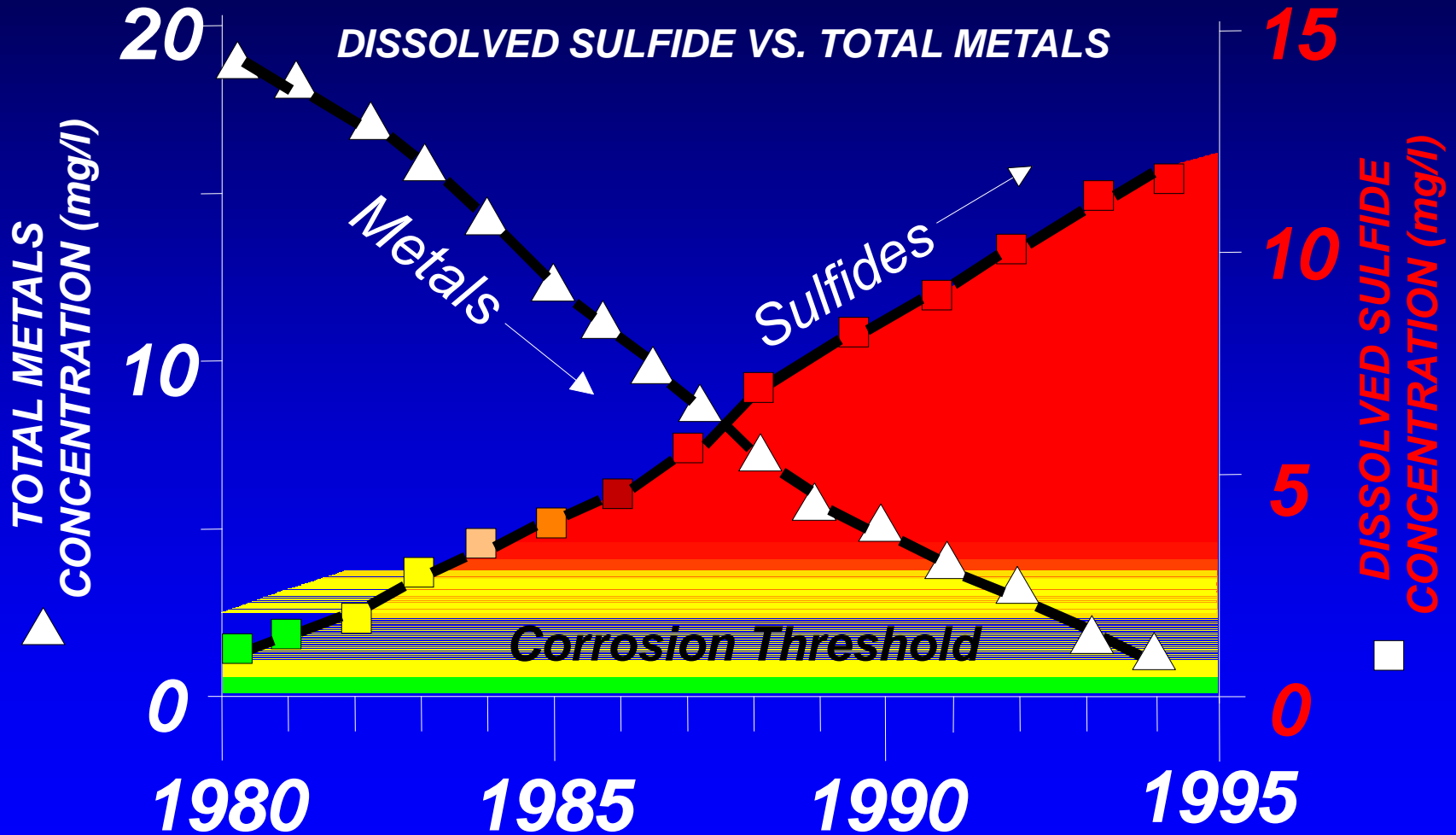
Why has H₂S increased in recent years ?

- Changes in wastewater biochemistry
 - 1983 Categorical Pretreatment Act severely reduces metals limits for industrial dischargers
 - Metals react with dissolved sulfide to render it insoluble
 - Therefore, in absence of metals, dissolved sulfide concentration has increased
 - Shift from phosphate to sulfur-based detergents
- Longer retention times
 - Urban sprawl
 - Centralized treatment
 - Low-flow plumbing fixtures
- With biochemistry changes and longer retention times, wastewater becomes anaerobic

Effects on Municipalities

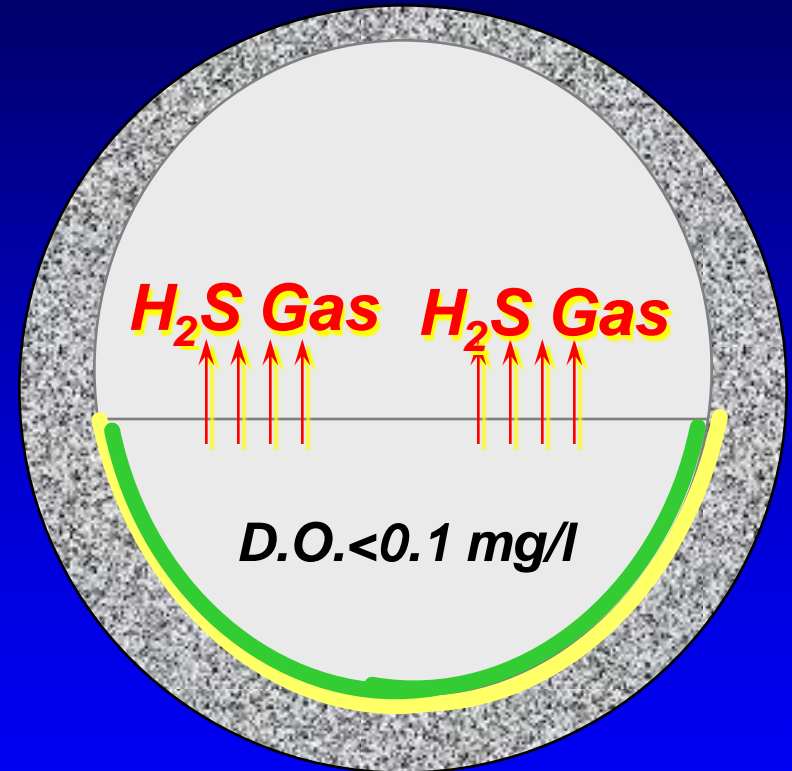
- Accelerated Biogenic Corrosion
- Increased Sewer and Plant Odors
- Grease Buildup (FOG)
- Treatment Plant Upsets
- Higher Cost of Treatment

Corrosion Effect

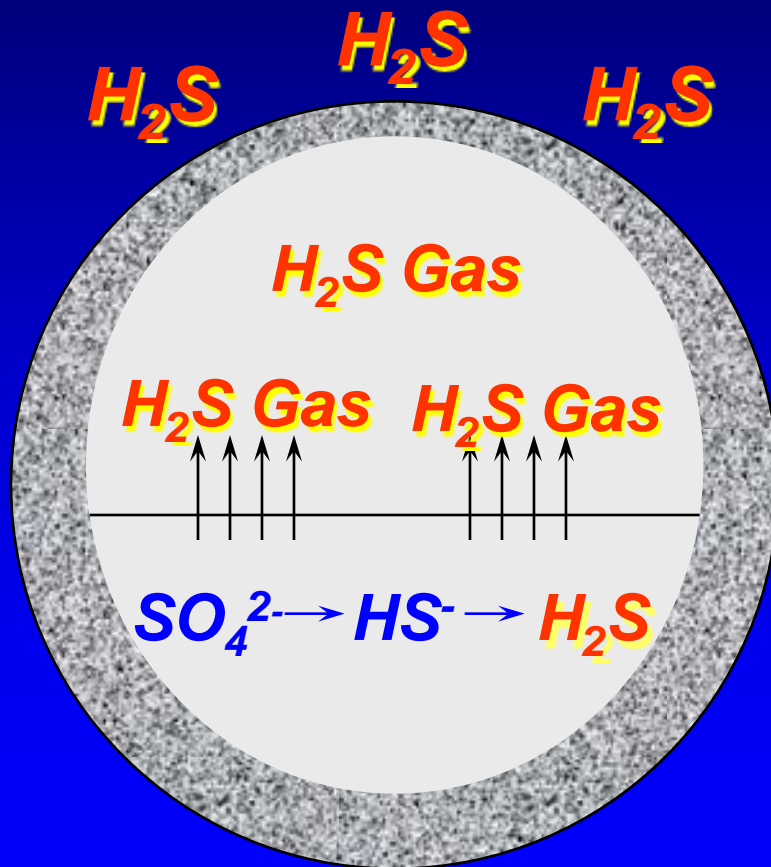


Corrosion Chemistry

- When Dissolved Oxygen Falls Below 0.1 mg/l, Wastewater Turns Septic and Anaerobic
- These Bacteria Reduce Sulfate to Sulfide Producing the Rotten Egg Smell Called Sewer Gas

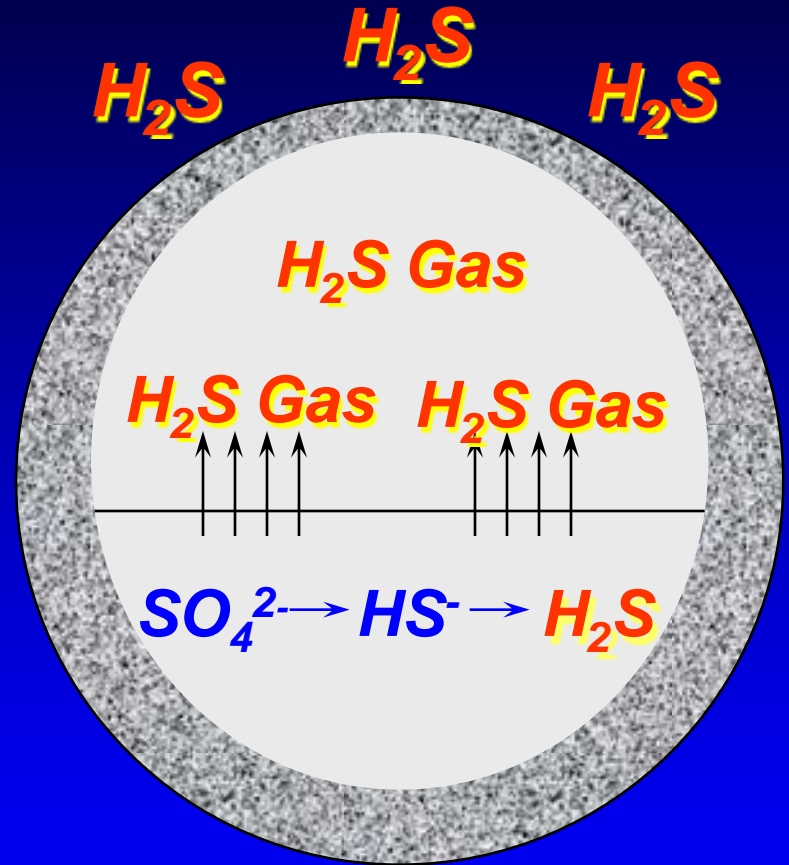
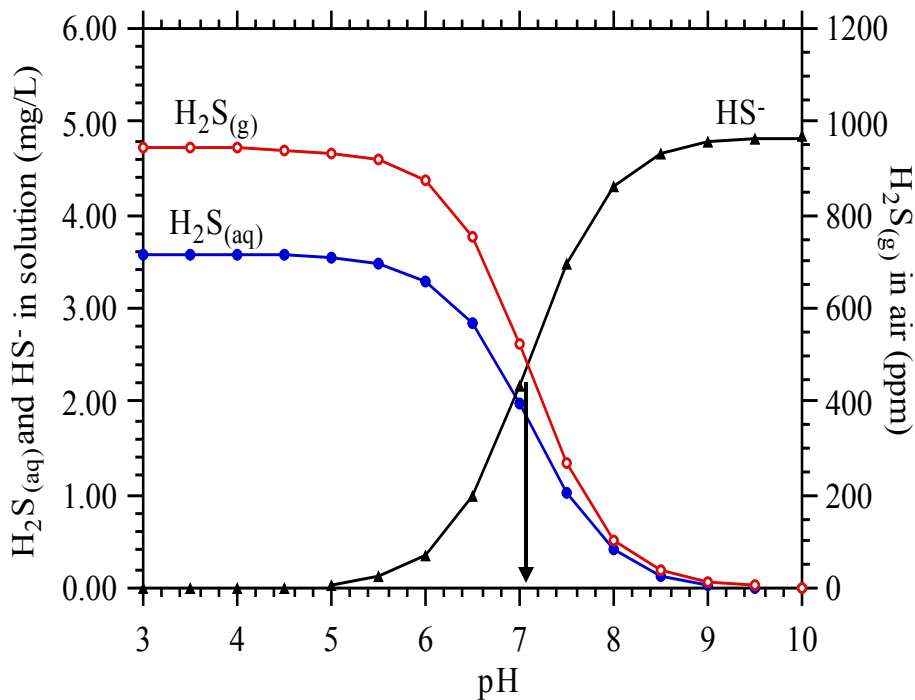


Corrosion Chemistry



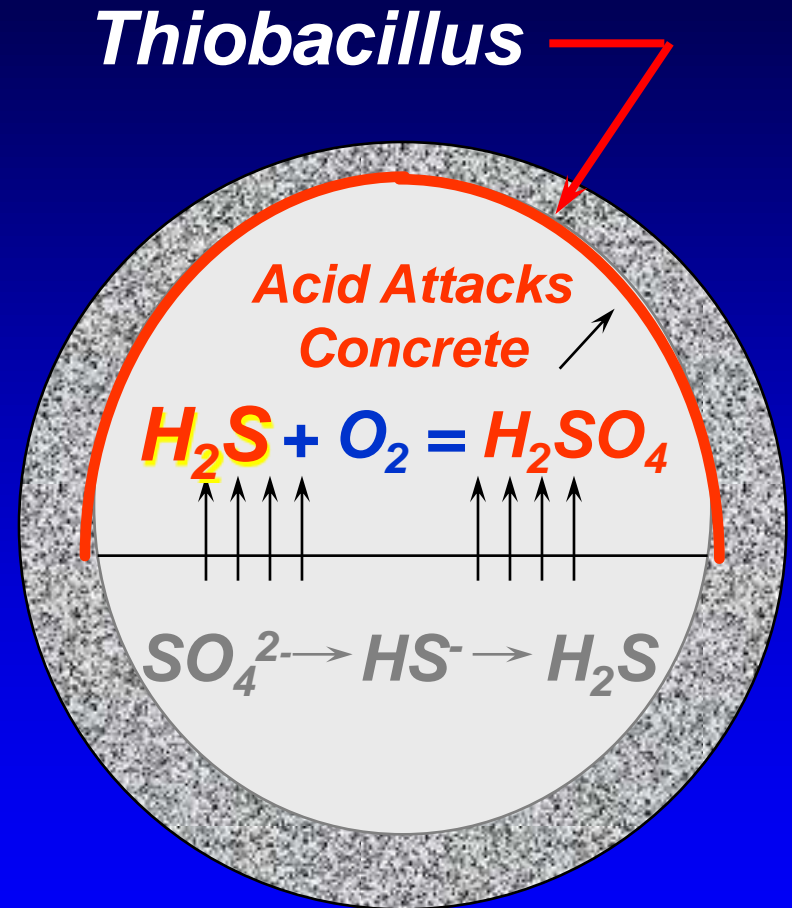
- Hydrogen Sulfide Gas is the Principal Source of Odor and Corrosion
- Evolution of H_2S is a Function of Dissolved Sulfide Concentration, Water Temperature, Turbulence and pH

At pH 7 Roughly 50% of the Dissolved Sulfide can exist as Hydrogen Sulfide



Corrosion Chemistry

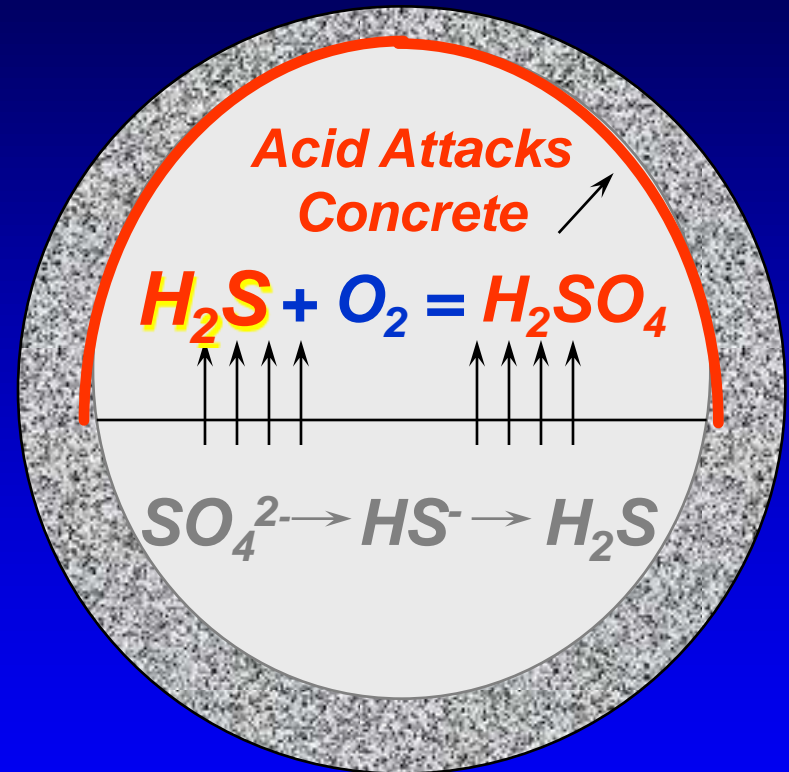
In the Headspace,
 H_2S Gas is
Biologically
Converted to
Strong Sulfuric Acid
by *Thiobacillus*
Bacteria



Results of Corrosion

Once rebar is exposed, the sewer is structurally compromised

Collapses then occur if corrosion continues to progress unchecked



In 2000 the EPA Estimated 8 Percent of U.S. Wastewater Collection Systems were Already in Poor Condition or Worse

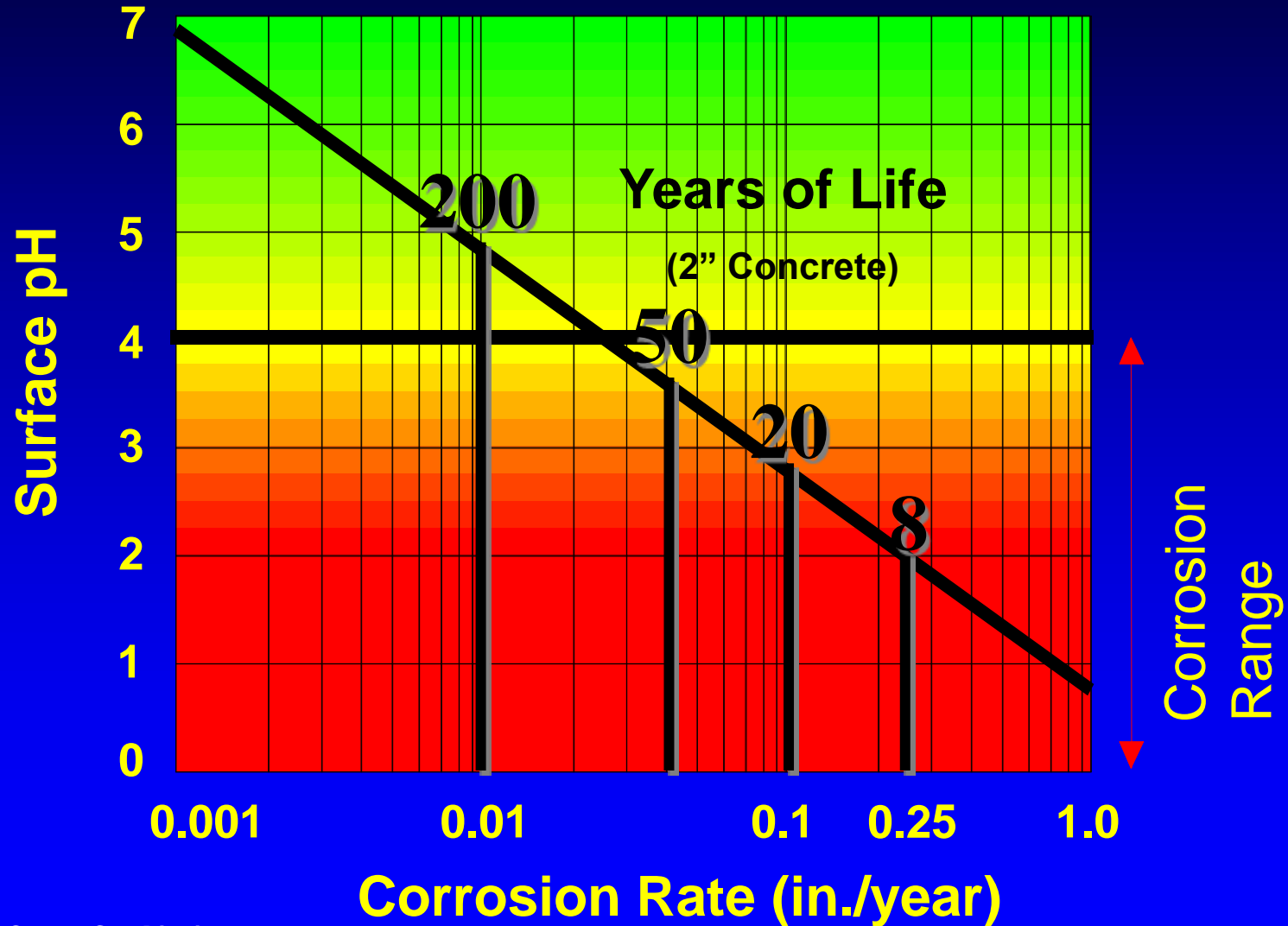


By 2016 it is Expected that More than Half the Country's 600,000 Miles of Sewers will be in Poor, Very Poor or Inoperable Condition

Atlanta's deadly sinkhole



Surface pH vs. Corrosion Rate



Infrastructure Conditions

- It is now Very Common to Find Sewer Infrastructure with Surface pH Below 3
- $\text{pH} \leq 4$ Requires Immediate Attention

Facts

- U.S. Wastewater Infrastructure is Failing Faster than it is Being Replaced
- Sanitary Sewer Overflows (SSO's) are Very Costly Fiscally and Politically
- Odor and FOG are Significant Problems Which Also Carry High Fiscal and Political Expense

Economics of Corrosion

Economics of Corrosion

- Assume We're Responsible for Sewer Assets of \$100 Million
- Surface pH ≥ 4 ; Life Cycle = 100 Years
- Simple Life Cycle Cost:
 - \$100 Million/100 Years = \$ 1,000,000/Year

Economics of Corrosion

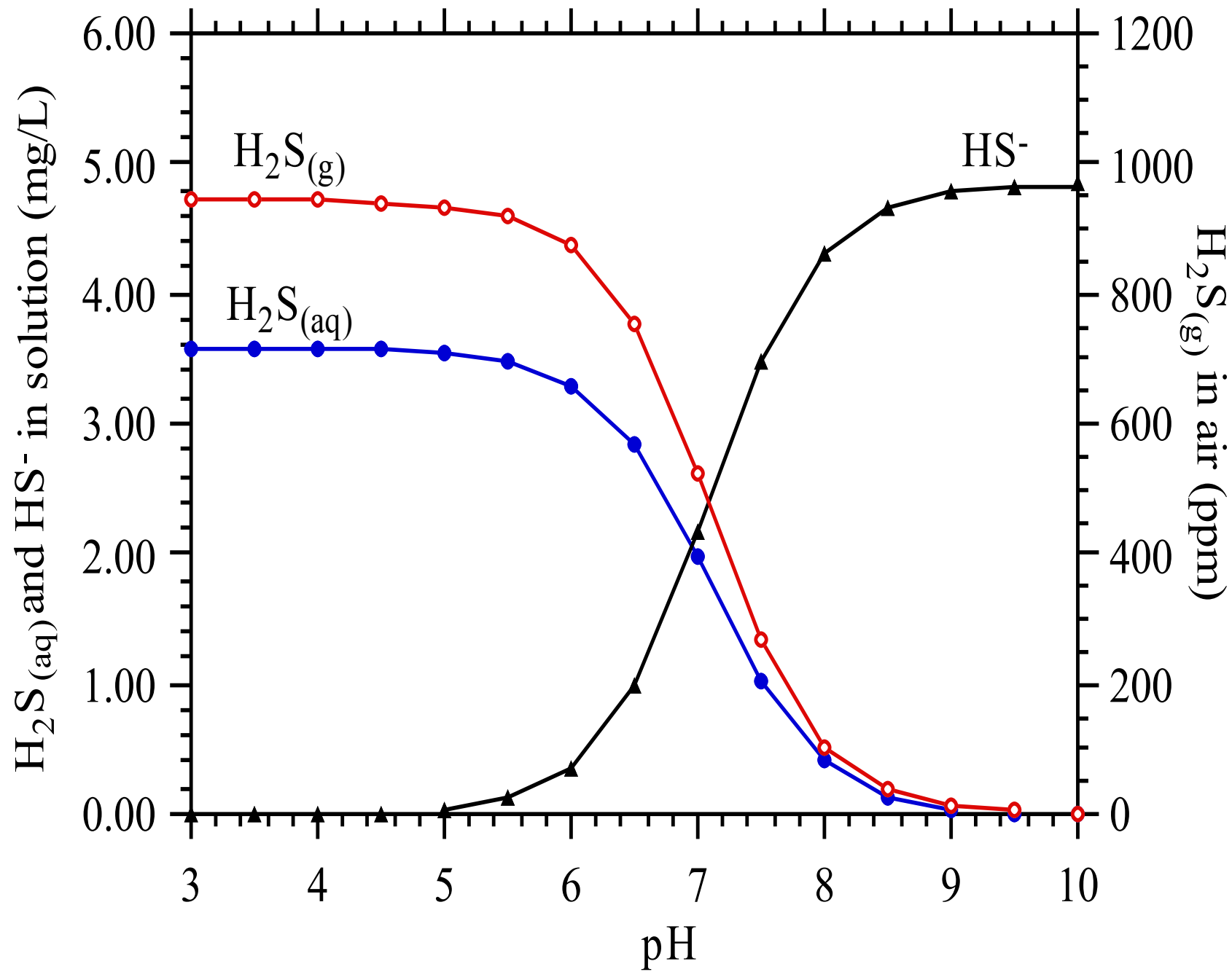
- Surface pH = 2; Life Cycle = 8 Years
- Simple Life Cycle Cost:
 - \$100 Million/8 Years = \$12.5 Million/Year

Economics of Corrosion

- The Difference in Cost Between Surface pH 2 and Surface pH 4 per \$100 Million in Sewer Assets is Approximately:
- $\$12,500,000 - \$1,000,000 = \underline{\$11,500,000/\text{Year}}$
- That's More than 10% of the Asset Value per Year

Magnesium Hydroxide for Odor & Corrosion Control

- Industrial strength Milk of Magnesia
- Magnesium hydroxide adds alkalinity, increasing pH and neutralizing the acid that causes sewer **Corrosion**
- Magnesium hydroxide decreases the rate of sulfide production by shifting the pH range upward to 8.5 - 9.0, away from the ideal sulfide production range of sulfate-reducing bacteria (SRB).



Reaction of a Suspended Treatment Agent

- Magnesium hydroxide particles dissolve only as pH calls for it, providing residual effect miles downstream of injection point
- Since alkalinity is released as needed through dissolution, magnesium hydroxide acts as a buffer, without overshooting pH
- Magnesium hydroxide will continue to dissolve and remain available, hours after its addition
- As a result, fewer feed points are required compared to other odor control methods, thus reducing equipment costs

Other Benefits of Magnesium Hydroxide

A photograph of a kitchen floor with a drain cover. The floor is covered in a layer of brown and grey debris, likely food waste and grease. The drain cover is a white rectangular object in the upper center. The text 'FOG' is written in large, bold, yellow letters with a black outline, and '(Fats, Oils & Grease)' is written in smaller, bold, yellow letters with a black outline below it.

FOG

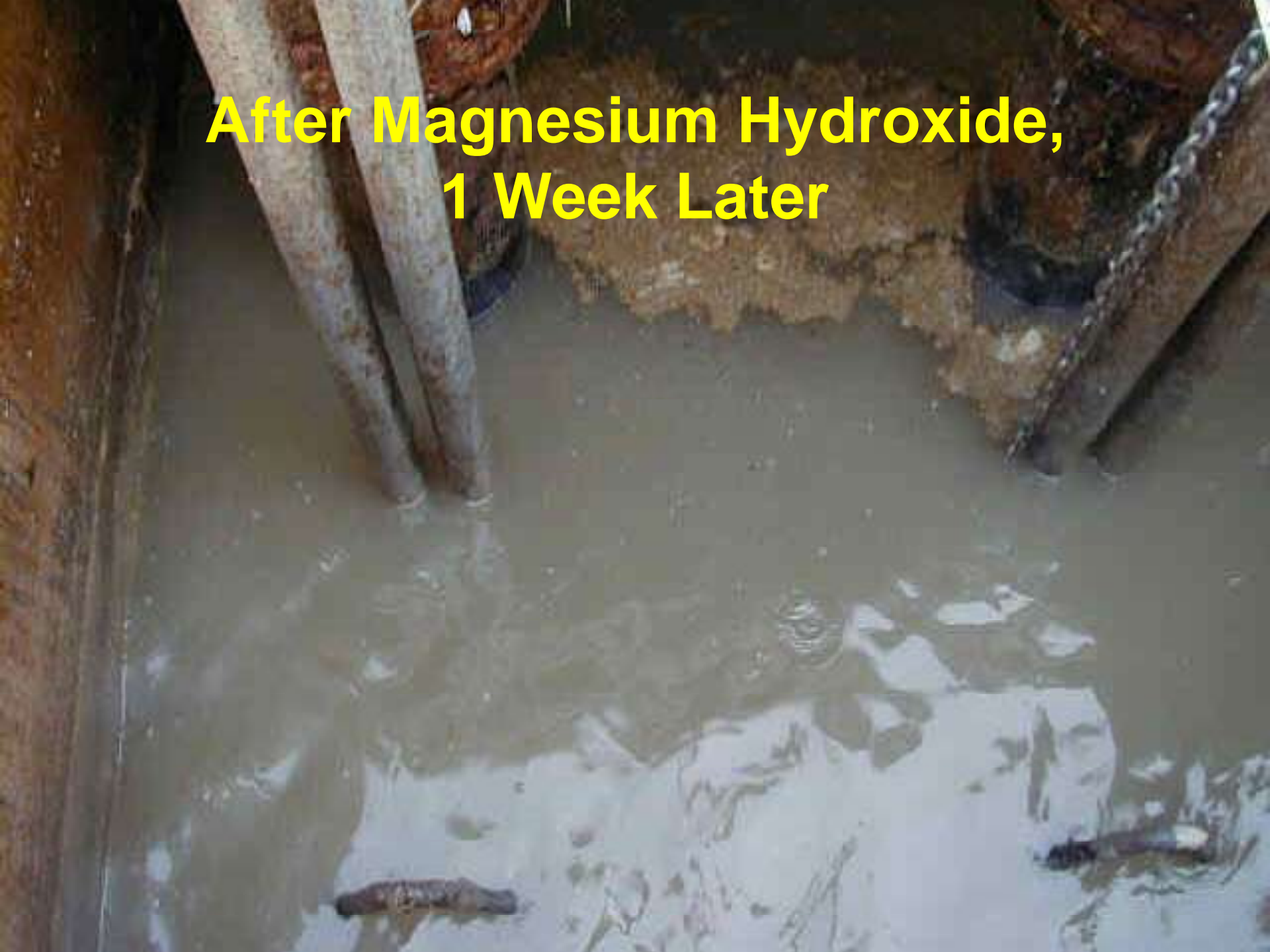
(Fats, Oils & Grease)



Before Magnesium Hydroxide...

**Grease Causes Odor, Increases
Maintenance Costs and Contributes to
SSO's**

**After Magnesium Hydroxide,
1 Week Later**



Treatment Plant Process Benefits

Clarifiers

Mg⁺² cation facilitates bioflocculation and improves sludge density

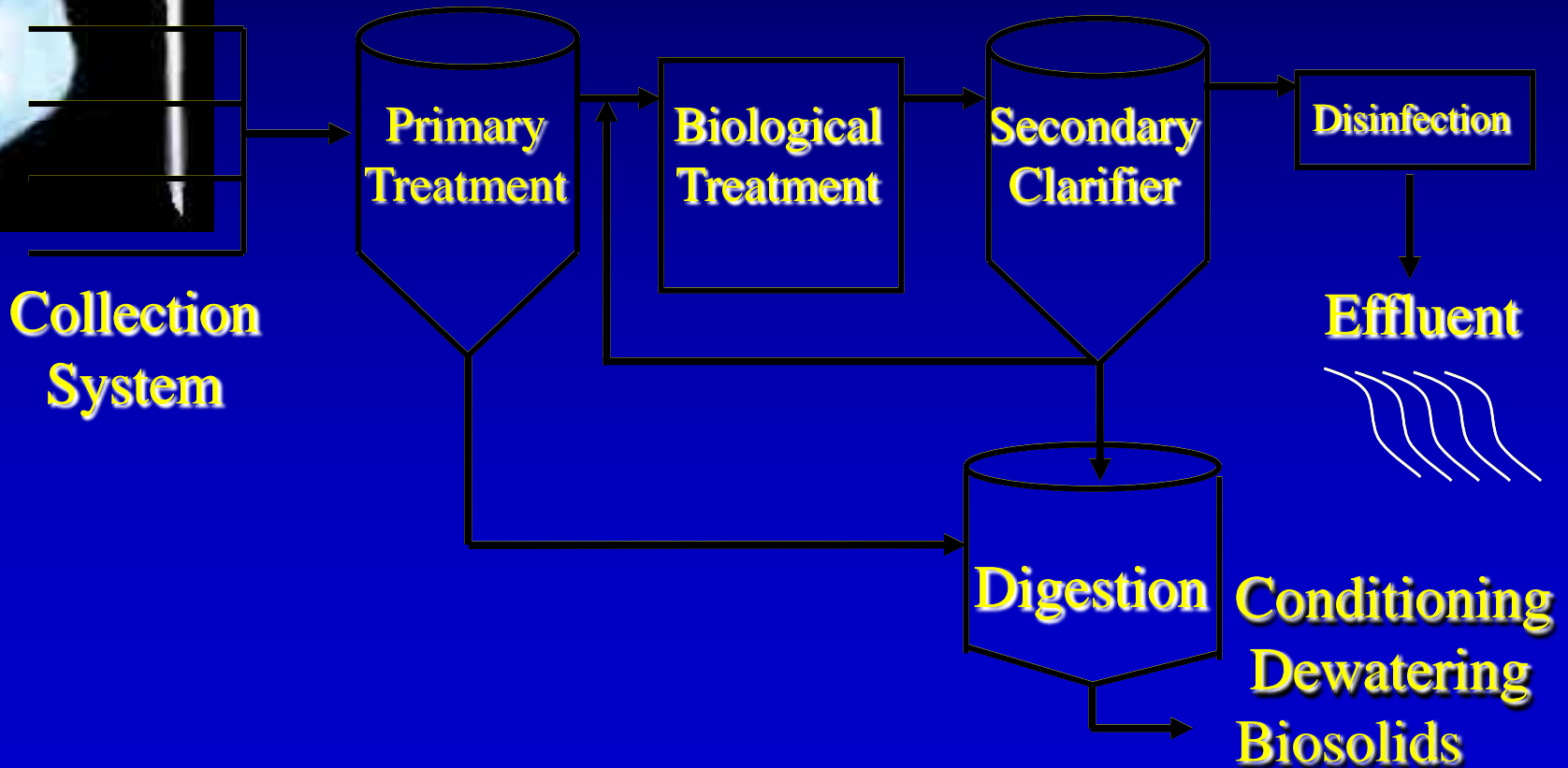
Aeration

beneficially impacts oxygen uptake, causing sulfides to undergo rapid oxidation

Digester

provides necessary alkalinity to buffer acid-producing processes

Magnesium Hydroxide Total System Treatment



Magnesium Hydroxide Total System Treatment

Added Directly to Wastewater, Magnesium Hydroxide Stops Odors, Corrosion and FOG over Long Distances

And

Magnesium Hydroxide Improves Wastewater Treatability for BOD, Turbidity, Ammonia and Phosphorus While Enhancing Settling Characteristics, Activated Sludge Growth, Digestion and Effluent Quality

What differentiates magnesium hydroxide from other agents can best be illustrated by placing all treatment agents into one of four classes:

	Issues Treated	System Treated
	-----	-----
CLASS I	limited	local treatment only
CLASS II	comprehensive	local treatment only
CLASS III	limited	collection system + plant
CLASS IV	comprehensive	collection system + plant

Magnesium hydroxide slurry is able to make the leap into Class IV largely due to the fact that it is a suspension.

U.S. Municipal Wastewater Systems Universally Follow This Configuration:

<i>Step</i>	Primary	Secondary	Tertiary
<i>Subsystem</i>	Collection System	Treatment Plant	Receiving Body
<i>Function</i>	Pretreatment The earliest point in the system where treatment can be initiated	Process Treatment Processes configured to flow volume and characteristics	Natural Treatment Dilution capacity of a receiving body is employed

Why is Collection System Treatment Important ?

- Beginning treatment earlier in process lessens the process burden at the plant.
- Upstream treatment allows the collection system to realize important benefits
- Earlier-in-system treatment increases the quality of discharged flow and can reduce total treatment costs

Magnesium Hydroxide

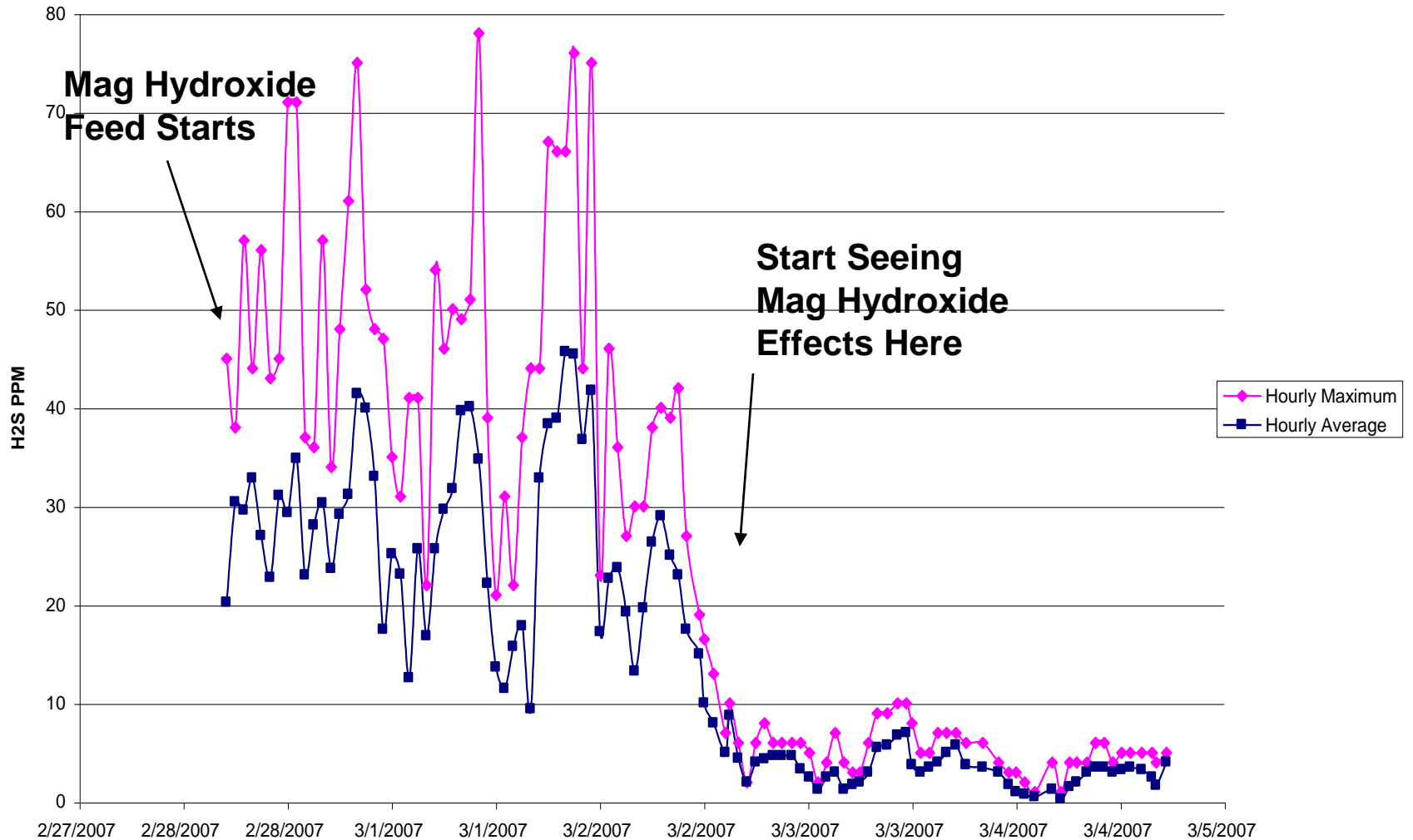
- Eliminates Hydrogen Sulfide Odor & Corrosion in Municipal Collection Systems
- Extends Life of Sewer System
- Reduces Fats, Oils & Grease (FOG)
- Improves Downstream Wastewater Treatment Operations

Benefits of Magnesium Hydroxide

- is Less Expensive
- is More Effective
- is Non-Hazardous and Safe
- can be Used System-Wide
- Solves More Problems

Brief Case Study Summaries

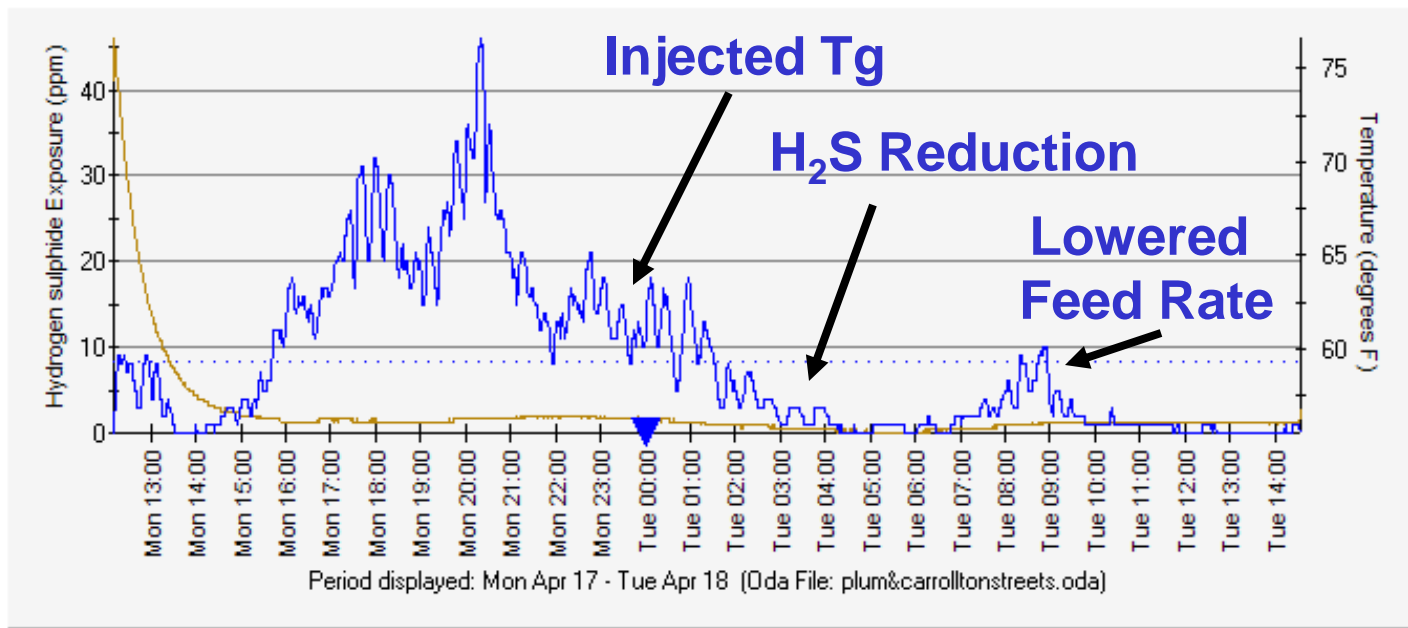
Case Study: Steuben Lakes, IN



Case Study: Canton, OH

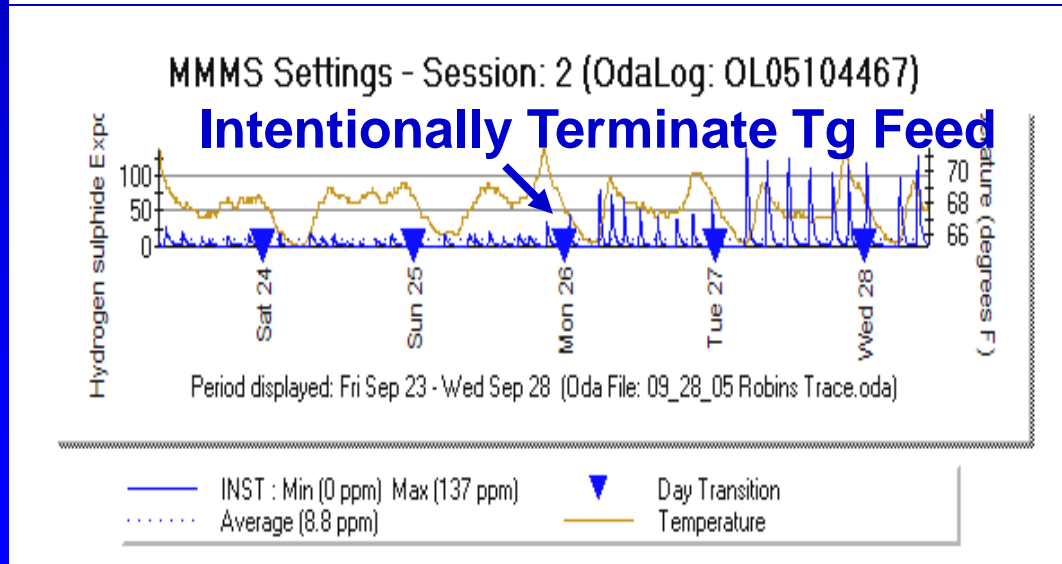
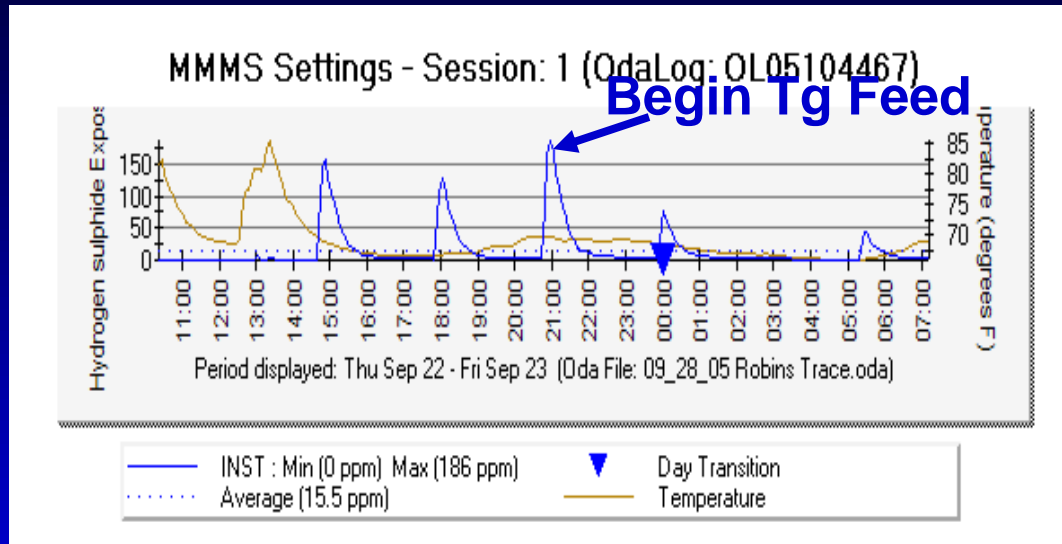
- Using $Mg(OH)_2$ at Stark County (Canton, OH)
 - High H_2S at Plum Street Manhole in Waynesburg, OH
 - Inject 2 Miles Upstream in Magnolia Wetwell

- Session: 1 (OdaLog: OL05085375)



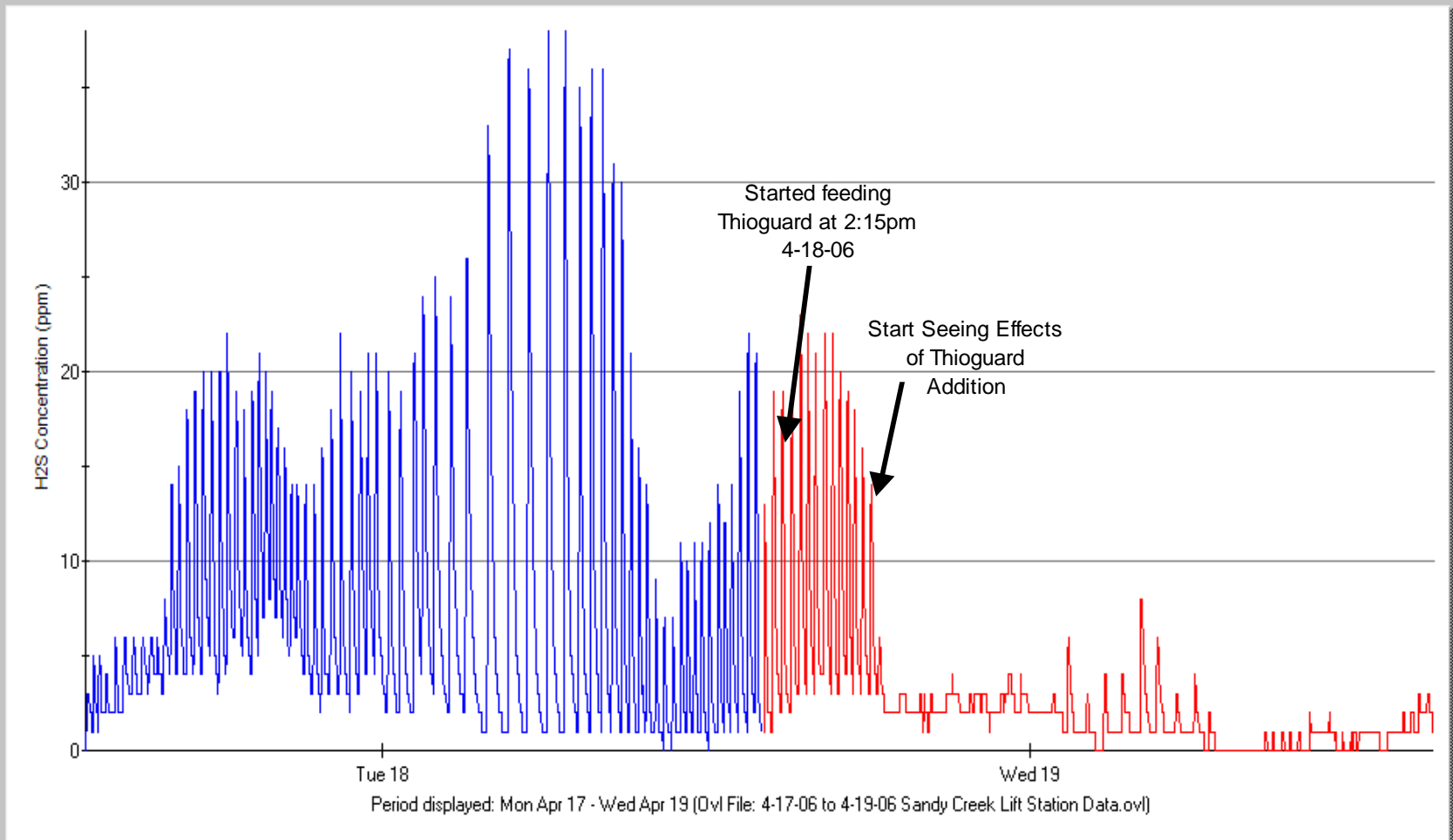
— INST : Min (0 ppm) Max (46 ppm) ▼ Day Transition Average (8.3 ppm) — Temperature

Case Study: Summit County, OH



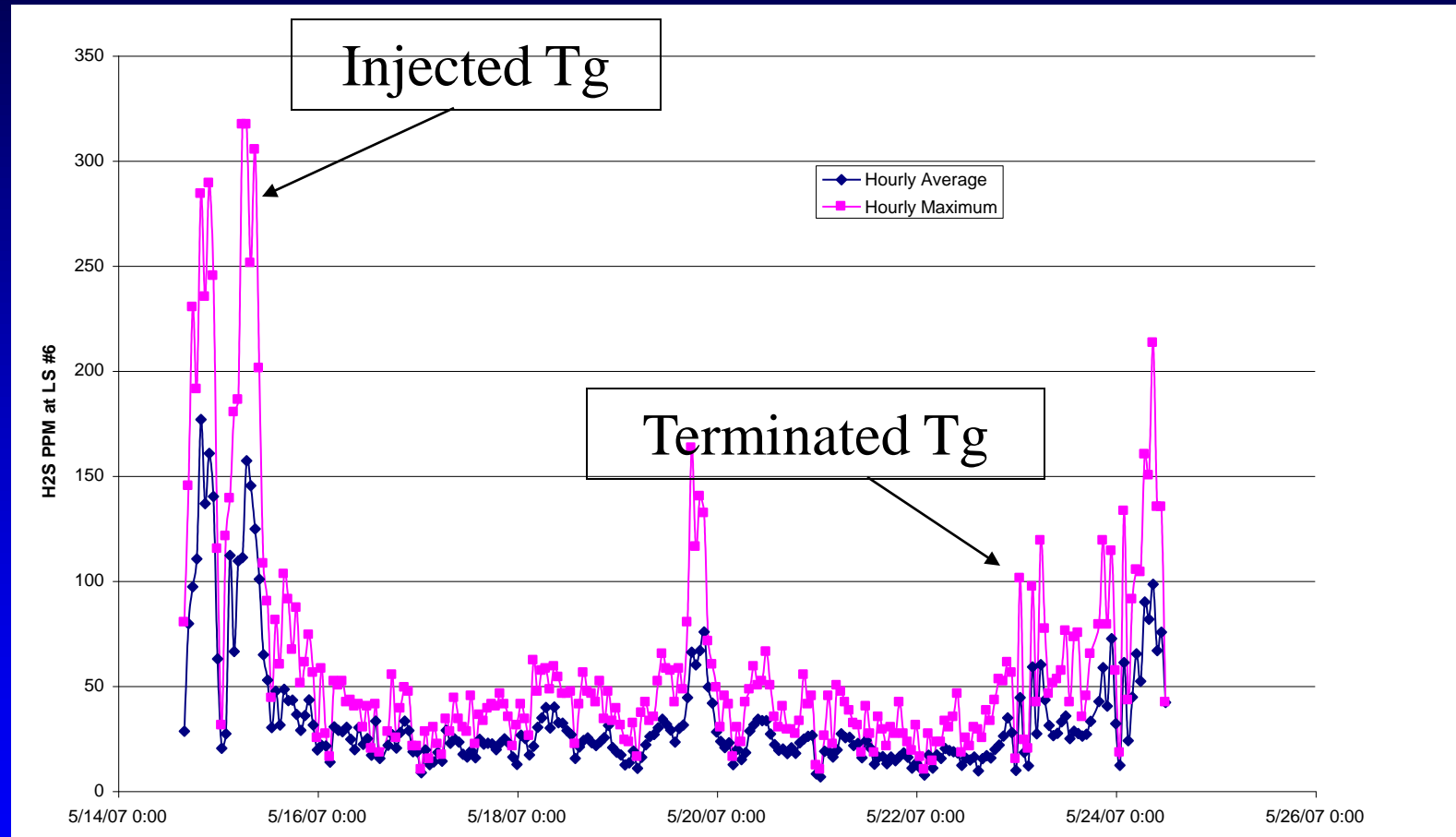
Case Study: Akron, OH

4-17-06 to 4-19-06 Gas H₂S Data in Wet Well at Sandy Creek Lift Station



— 4-17-06 to 4-18-06_Sandy Creek Lift Station on James Street1.log — 4_18_06-04_19#3_2.log

Case Study: Lagrange, IN



Summary

Magnesium Hydroxide Extends the Useful Life of Infrastructure While Improving Performance of the Entire Wastewater Collection and Treatment Process

Thank You.

Any Questions ?