2014 NEWEA
Collection Systems Specialty Conference

City of Milford, CT

Combats Odor & Corrosion with Pure Oxygen

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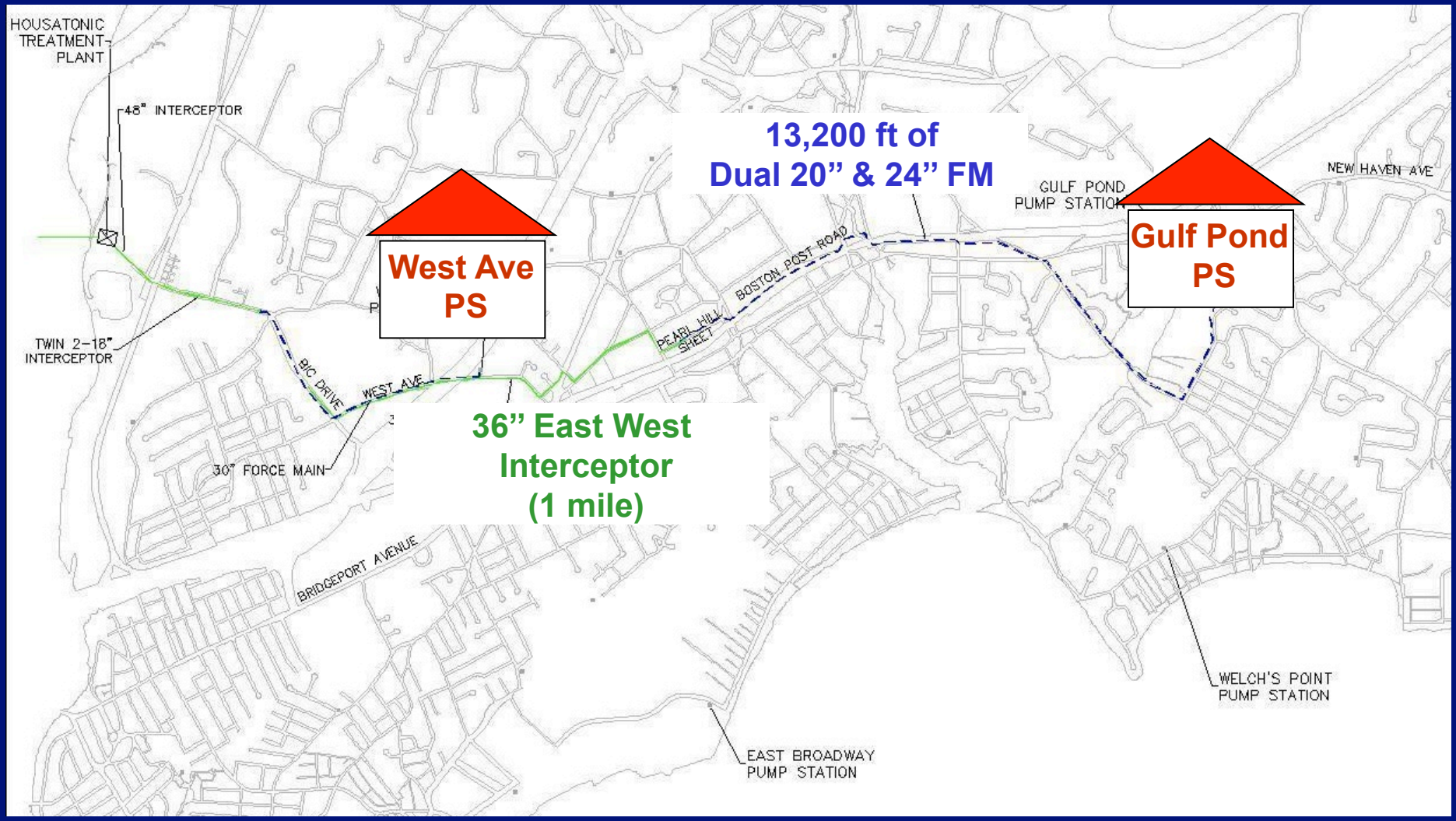
PRESENTATION OUTLINE

1. City of Milford Sewage System
2. Root Cause of H_2S Odor and Corrosion
3. The Solution: A Two-pronged Approach
    1. Force Main Optimization
    2. SuperOxygenation
4. Result: Elimination of H_2S

City of Milford Sewer System



Milford Sewer System

Plagued with Odors

- Odor Complaints from residents of adjacent condo complex
- Unsafe Levels of H_2S

With Odor comes Corrosion…

Milford Sewer System - Corrosion

East-West Interceptor

- 36” Ductile Iron Pipe was perforated
- Manholes were deteriorated
- 1 mile of sewer had to be replaced

West Avenue Pump Station

- Severe damage to concrete in wetwell
- Electrical & HVAC Equipment damaged beyond repair

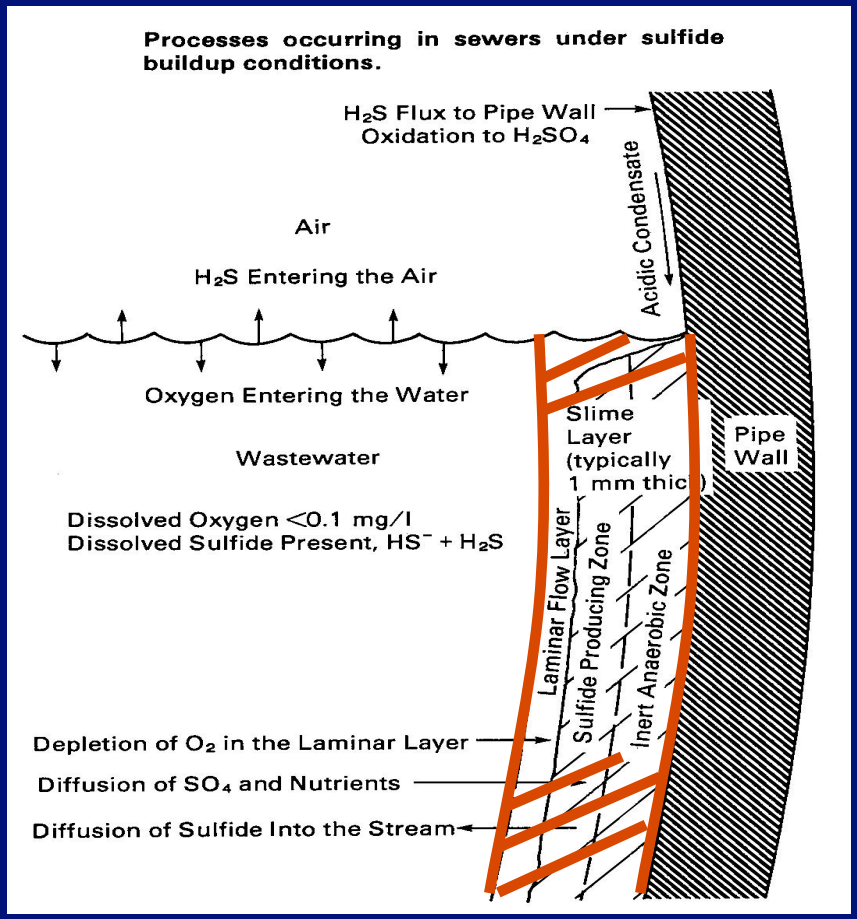
Odor / Corrosion Source

Gulf Pond Pump Station & Force Main

- Dual 13,200ft force mains
- Detention Time: 2 – 7 hours
- Liquid Sulfide Levels in Wetwell: 0mg/L
- Liquid Sulfide Levels at FM Discharge: 3mg/L
- ORP went from 19mV to -109mV

ROOT CAUSE OF *ODOR*

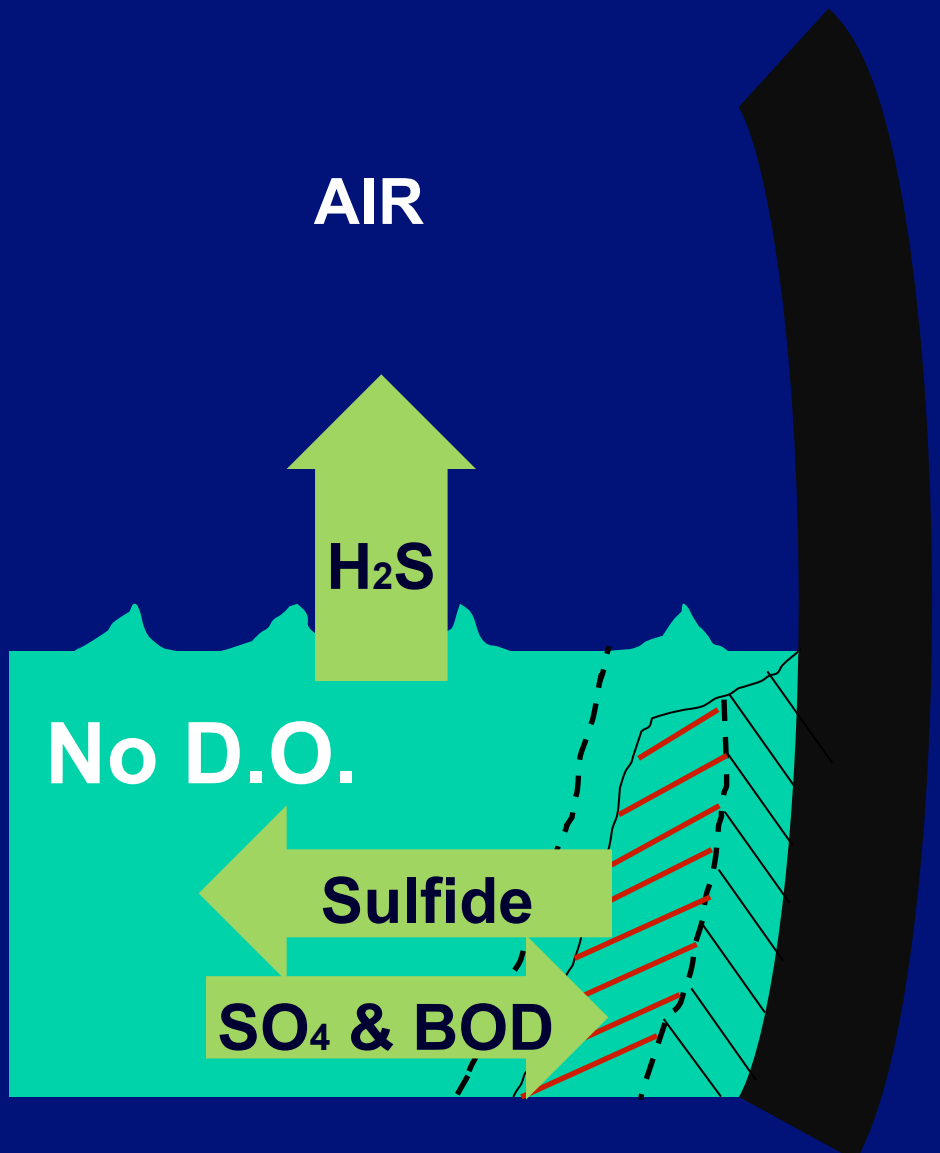
Bacteria consumes BOD



Oxygen Source (Order of Preference):

1. Oxygen (limited)
2. Nitrate (limited)
3. Sulfate (unlimited)

ROOT CAUSE OF *ODOR*

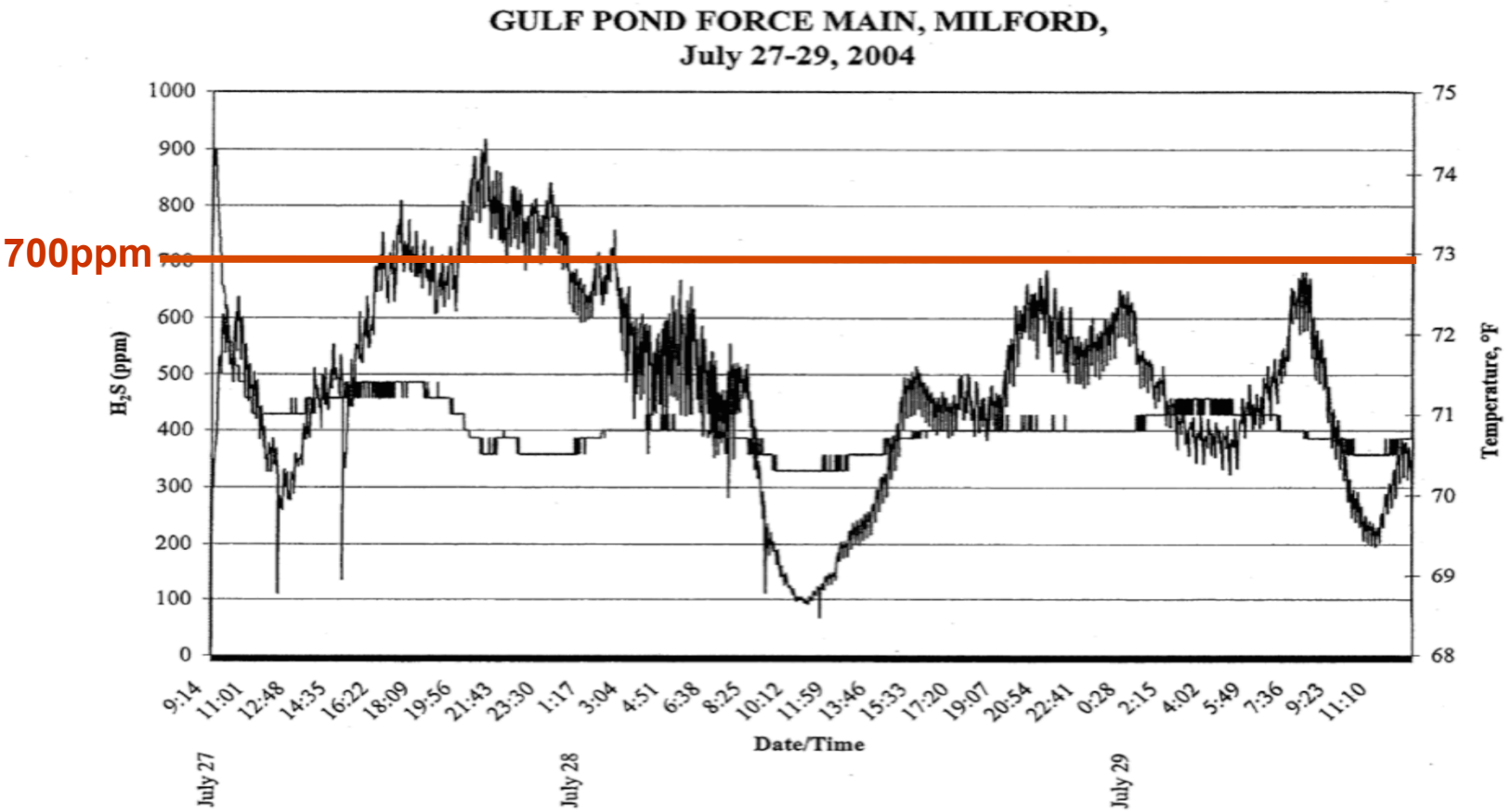


Under ***Anaerobic*** Conditions:

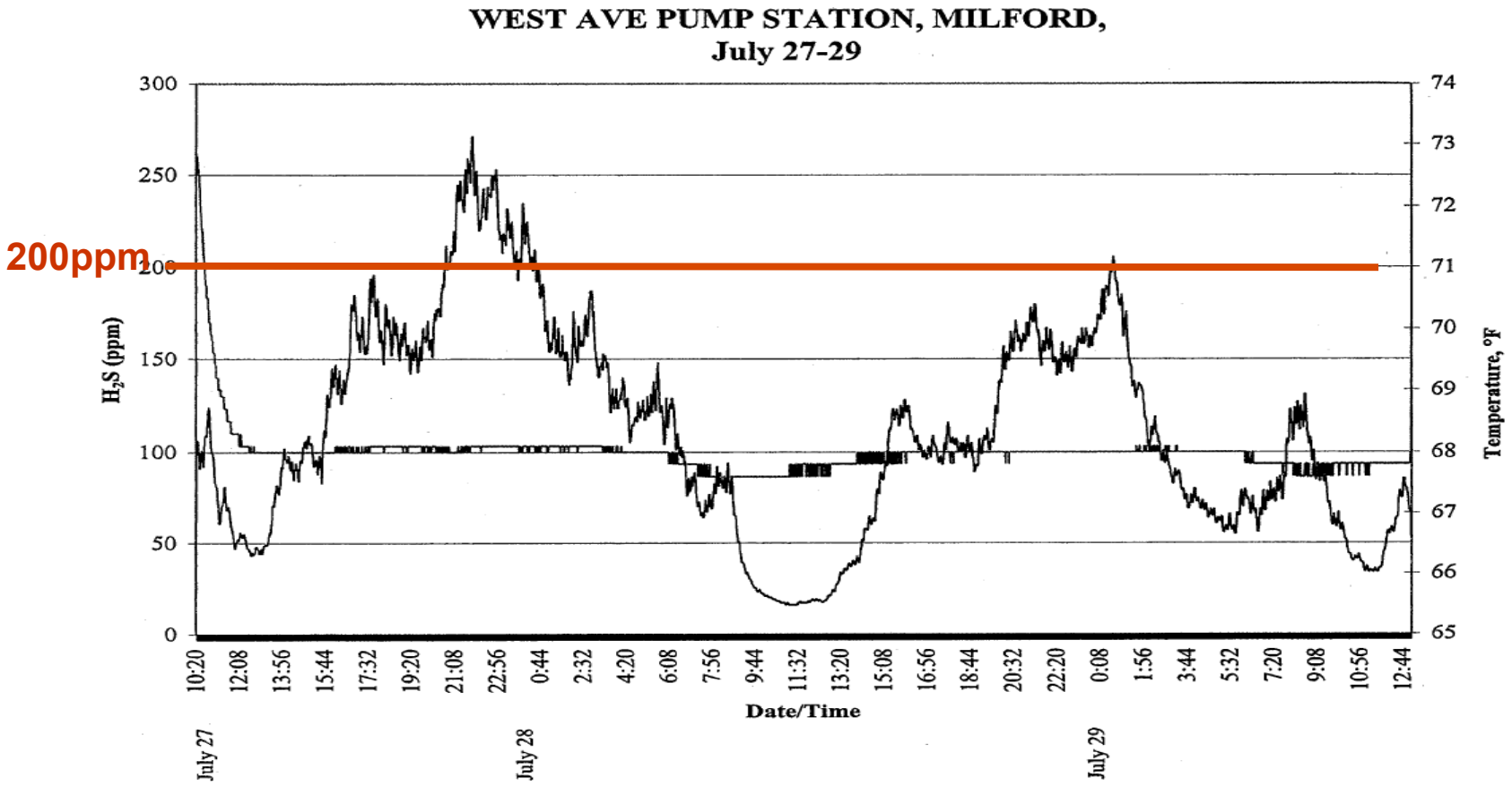
- Bacteria consumes BOD
- Converts Sulfate to Sulfide

SO_4^{2-} + BOD + No D.O. → H_2S

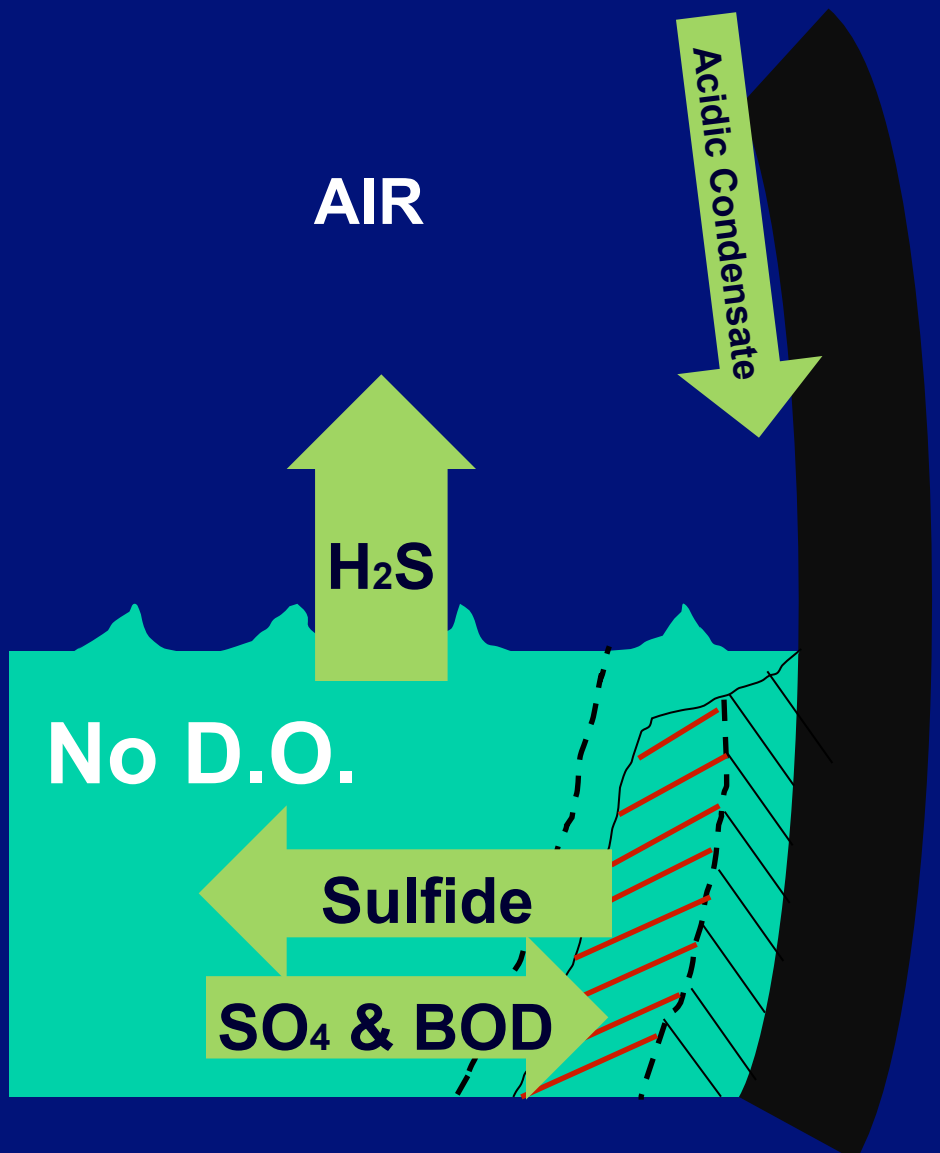
H_2S Concentrations @ FM Discharge



H_2S Concentrations @ West Ave PS



ROOT CAUSE OF *CORROSION*



In Headspace:

- H_2S Flux to Pipe Wall
- Oxidation to Sulfuric Acid
- Acidic Condensate accumulates on pipe wall

→ CORROSION

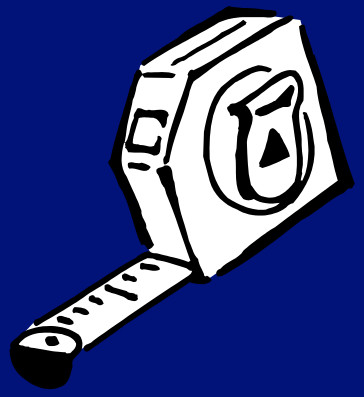
$H_2S + O_2 + Bacteria \rightarrow H_2SO_4$

ODOR LEADS TO CORROSION !

At H_2S concentrations of

20ppm in the headspace,

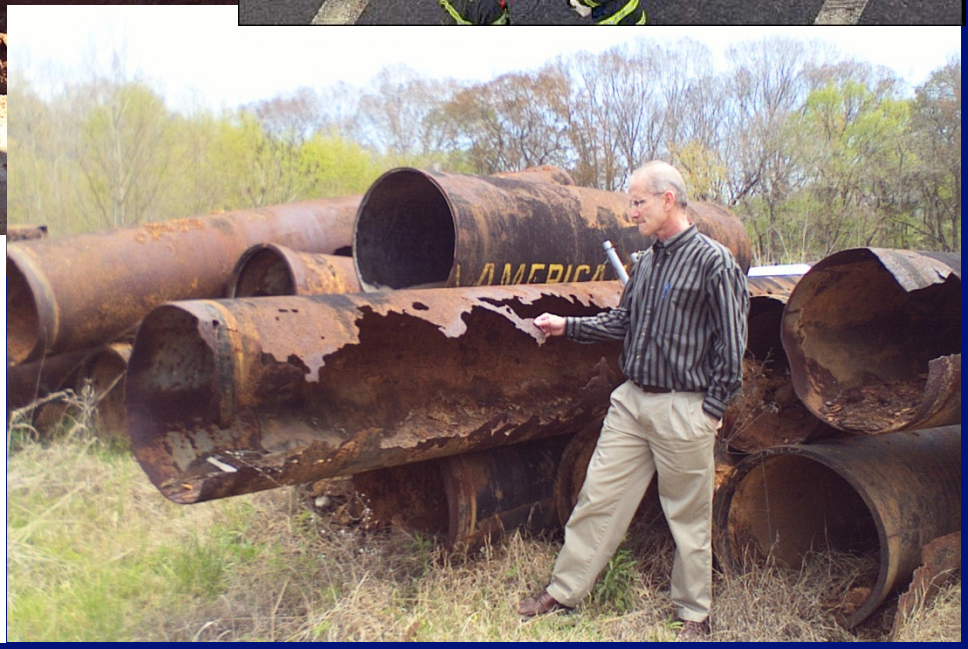
concrete will corrode at a rate of



1 inch in 5 years

ASCE Manual

CORROSION CONCERN



"Severe hydrogen sulfide corrosion may reduce the 50 to 100-year life expectancy of infrastructure to less than ten years."

According to an EPA study

The Solution

1) Optimize Force Main Usage
   - To Reduce the Detention Time

2) Provide Oxygen To Keep Sewage Fresh
   - Pure Oxygen SuperOxygenation System

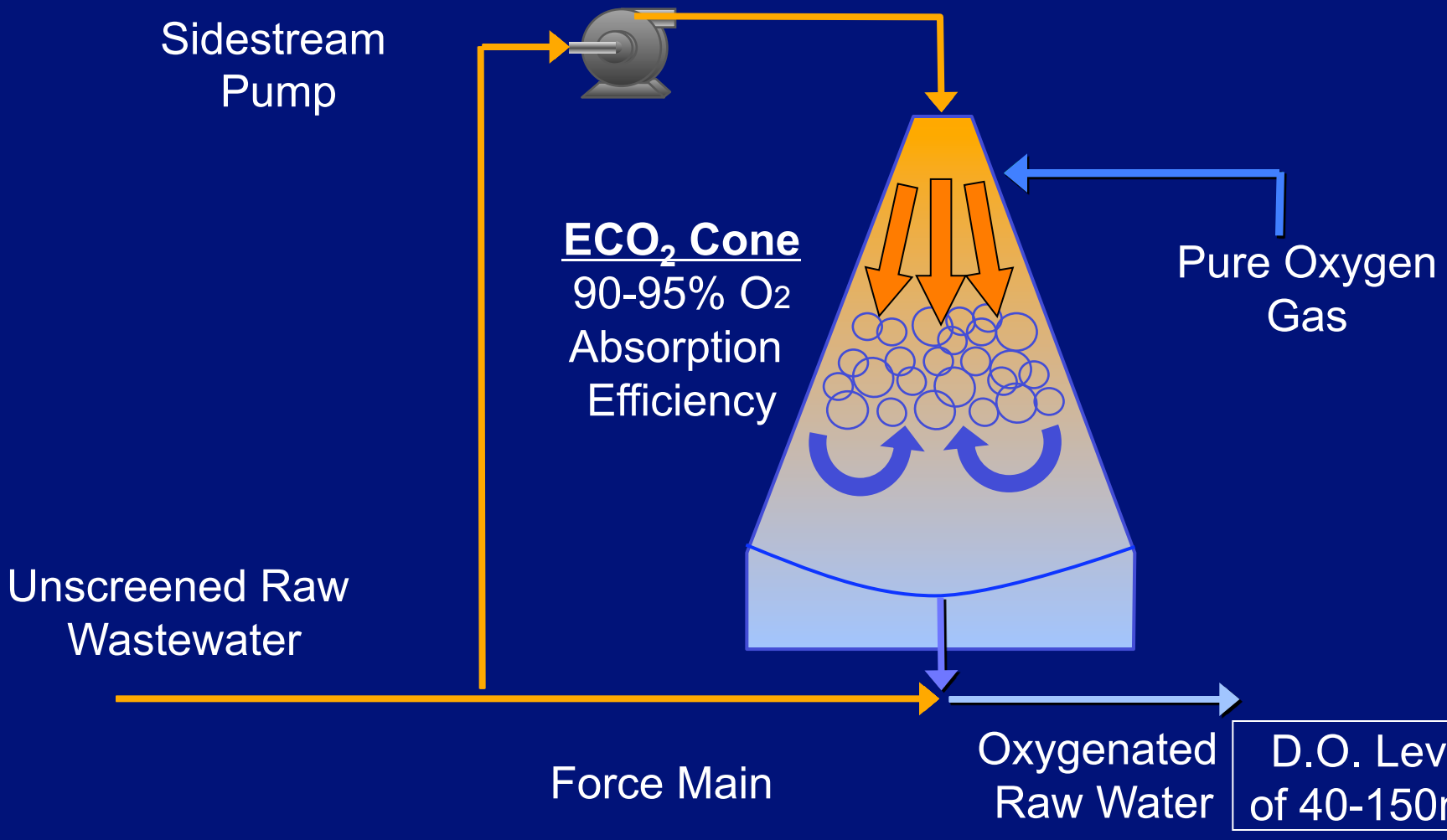
Force Main Optimization

Total Flow (MGD)	Force Main In Use	Remarks
0 to 2.0	20”	
2.0 to 5.0	20” or 24”	Alternate on 2 hr. cycle
5.0 to 7.0	24”	
Over 7.0	20” and 24”	Both Force Mains in Use

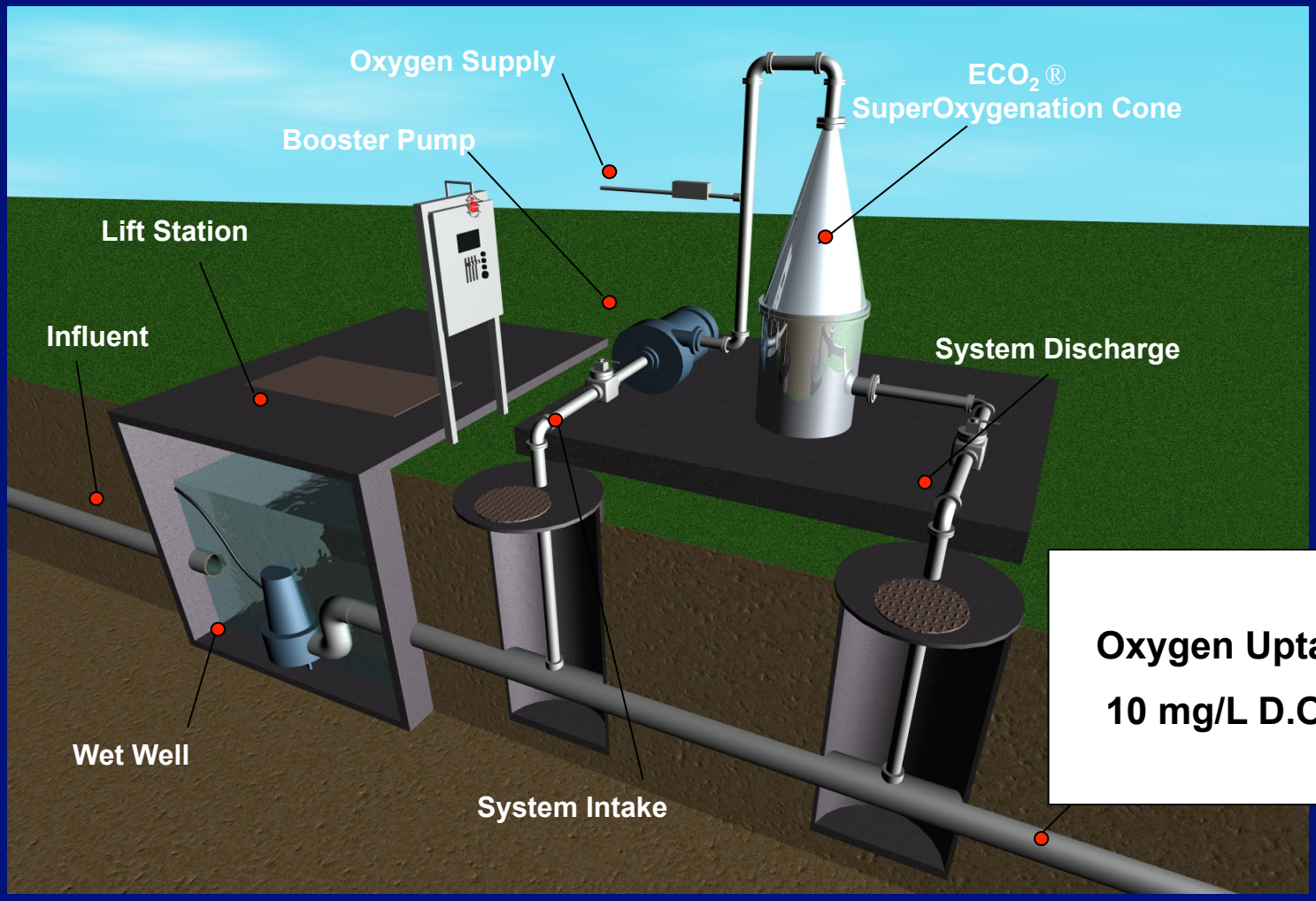
SuperOxygenation System

- Adds Dissolved Oxygen to the Wastewater
- Prevents Anaerobic Conditions
- Prevents the Formation of H_2S

ECO_2 Technology Overview



Typical Force Main Installation



Oxygen Uptake Rate

10 mg/L D.O. / Hour

System Components

SuperOxygenation Cone

Sidestream Pump

O_2 Flow Control

ECO_2 Cone Construction

Hollow Stainless Steel Cone

No mixers, baffles, venturis or injector nozzles, that can clog → Robust and Reliable Operation!

No Moving Parts !

System Controls

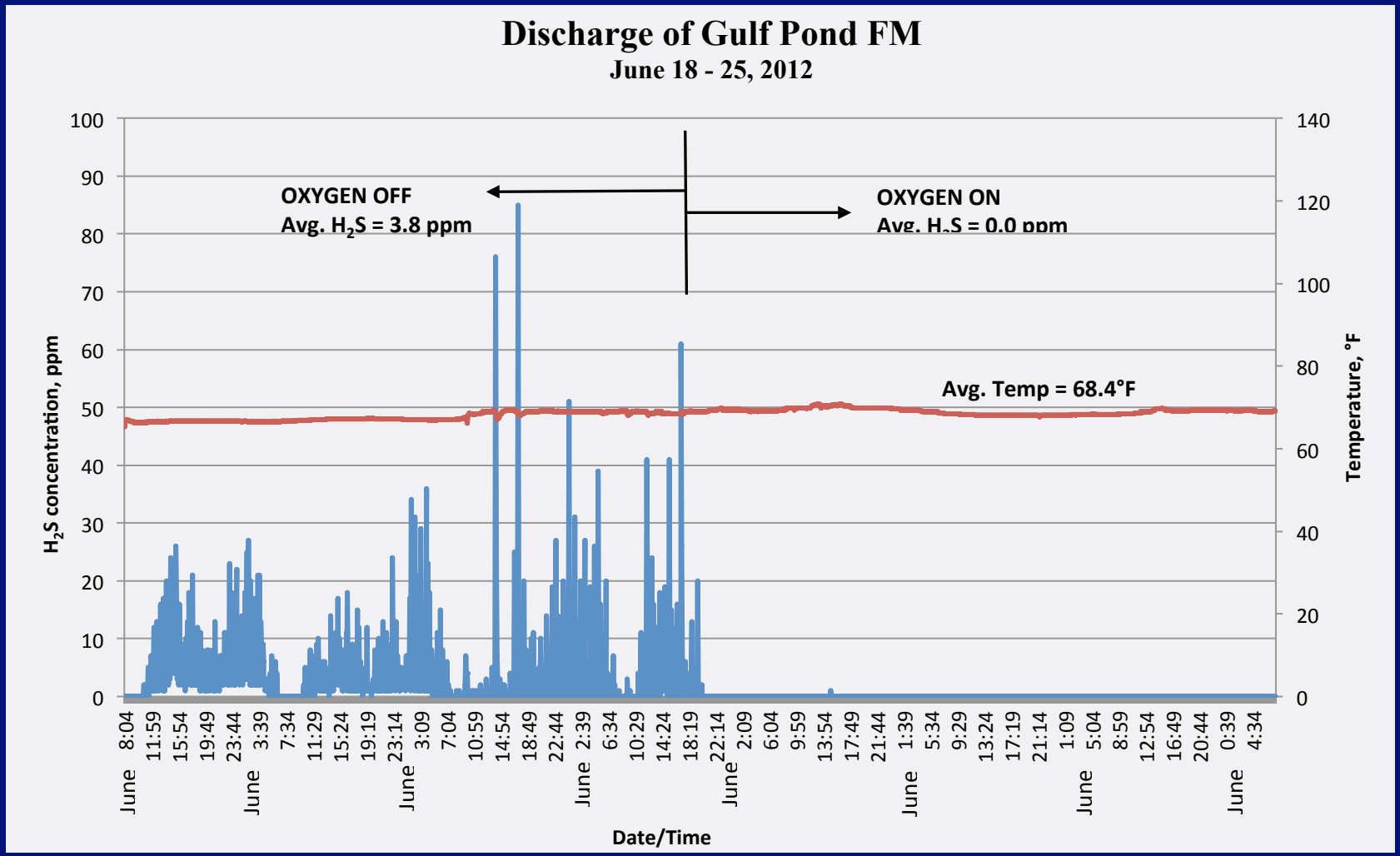
OXYGEN SOURCE

LOX Tank

SYSTEM PERFORMANCE

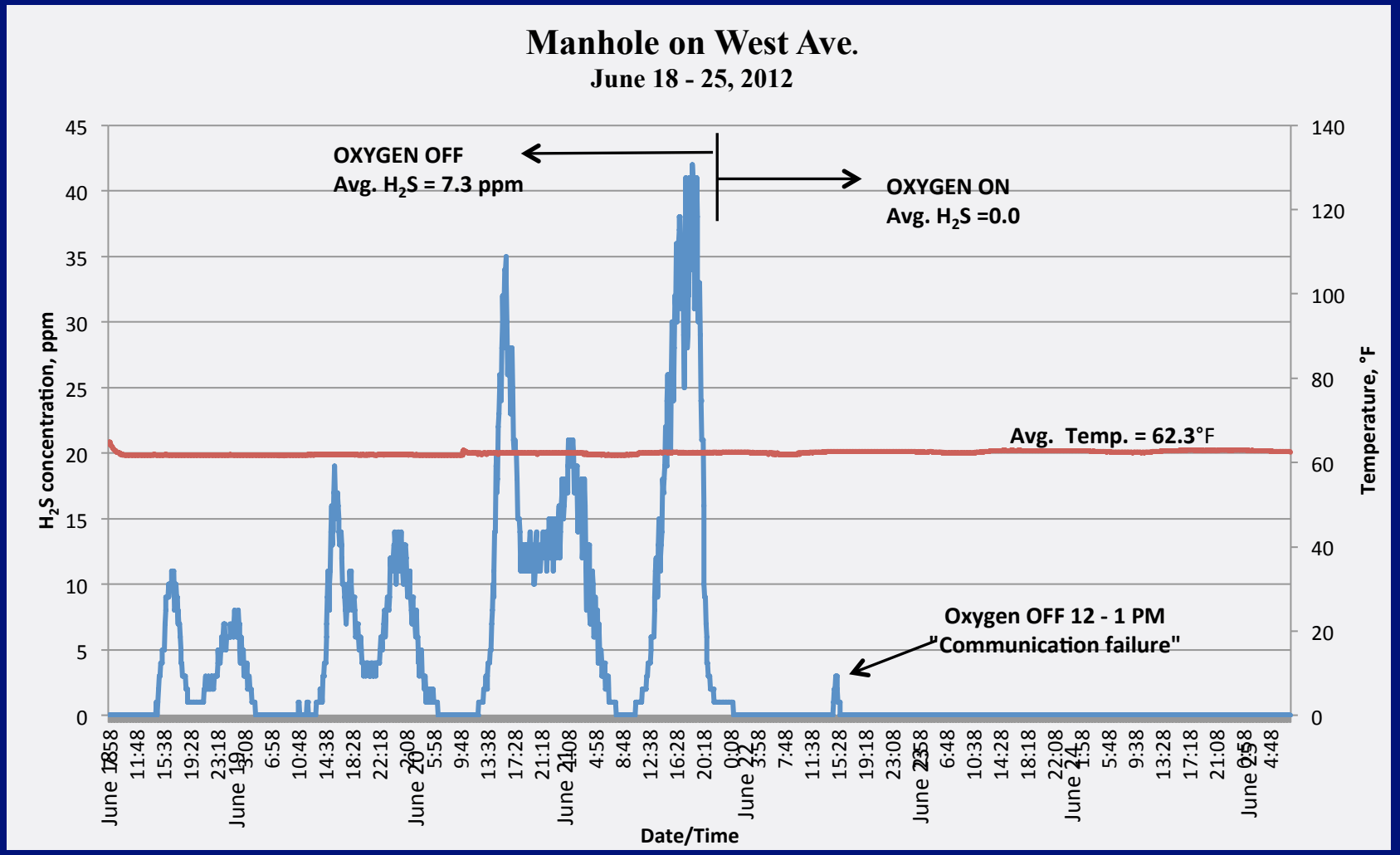
Gulf Pond Force Main Discharge

3 MGD · 1,000 lb O_2 / day



West Avenue PS (1 Mile Downstream)

3 MGD · 1,000 lb O_2 / day



Conclusions

Low Operating Cost

- Oxygen cost approx. $0.06/lb
- Daily cost approx. $50.00

Low Maintenance

- LOX Equipment maintained by supplier
- Sidestream pumps only moving part

Excellent Operational Results

- Complete Elimination of H_2S

Questions ?

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We look forward to working with you !