EXECUTIVE SUMMARY

WERF

WATER ENVIRONMENT RESEARCH FOUNDATION

CONVEYANCE SYSTEMS

Minimization of Odors and Corrosion in Collection Systems: Phase I

Communities, system owners and operators, and regulators are increasingly concerned about odor and corrosion in wastewater collection systems. These concerns escalate as prevention and control costs mount, while collection systems age and revenues shrink.

Odor and corrosion prevention is as much art as science. System owners may select common control methods based on practical experience, without a fundamental understanding of why and when methods will be successful. The industry is well versed on the causes of odorous gases in the collection system, but we need more research on the underlying science and mechanisms of odor generation, sewer ventilation, odor characterization and monitoring, and corrosion mechanisms.

Experts have tried numerous approaches to odor and corrosion prevention, with varying degrees of success. Unfortunately, there is no central clearing house for ideas or reports of successes and failures.

In this report, the researchers – from academic, utility management and consulting communities – summarize the current knowledge of odor and corrosion in collection systems. Their extensive information comes from over 4,000 published abstracts and other literature supplied by utilities, manufacturers, and vendors.

The report presents an easily understandable, "plain-English" guide to odor and corrosion in collection systems. It explains how odor- and corrosion-causing

Biological ORP Scale

ORP (mV)	Process	Compound(s) Present	Zone	Products
+ 300 + 200 + 100 0 - 100 - 200 - 300	A B C D	O_2	Aerobic	Carbon Dioxide (CO_2) + Water (H_20)
		NO_3-/NO_2	Sulfide-Producing Anaerobic	Nitrogen Gas (N_2) or Sulfide (S^{2-})
		SO_4		
		Organic Carbon Compounds	Inert-Anaerobic	Fermentation Products and Methane (CH_4)

A = Organic Carbon Oxidation
B = Denitrification if Nitrate/Nitrite Present
C = Sulfate Reduction w/o Nitrate/Nitrite Present
D = Fermentation and Methane Generation

BENEFITS

- Provides an easily understandable overview of odor- and corrosion-causing compounds in a "plain-English" guide.
- Provides a unified approach to liquid and gas phase prevention of odor and corrosion.
- Provides a literature review of over 4,000 references on odor and corrosion assessment, measurement, characterization, monitoring and prevention.

RELATED PRODUCTS

Development of a Tool to Prioritize Sewer Inspections (97CTS7)

Identifying & Controlling Odor in the Municipal Wastewater Environment: Phase II (00HHE5)

Effective Practices for Sanitary Sewer and Collection System Operations and Maintenance (01CTS20T)

Biosolids Processing Modifications for Cake Odor Reduction (03CTS9T)

RELATED ONGOING RESEARCH

Identifying & Controlling Odor in the Municipal Wastewater Environment
- Optimization of Post-digestion Iron and Alum Addition for Odor Control (03-CTS-9A)
- The Impact of Wastewater Cations on Solids Destruction & Odor Generation (03-CTS-9B)

Minimization of Odors and Related Corrosion in Collection Systems: Phase II (04-CTS-1A)

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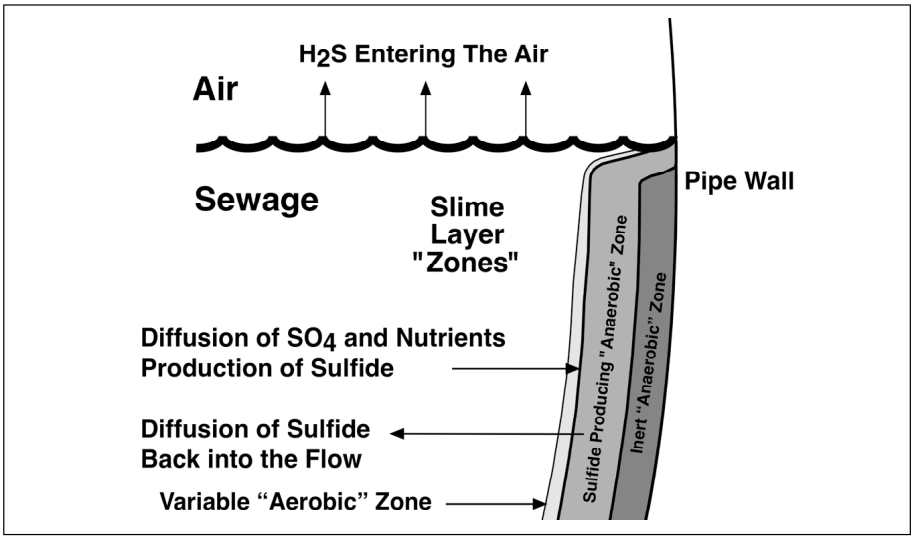

Slime layer chemistry and biology illustration

compounds form and how to control them. The overview of compounds also includes odor-sampling methods.

The researchers identified over a dozen knowledge gaps. Their top three were:

- information on collection system air movement and ventilation;
- the relationship of gas phase H_2S to concrete corrosion rates; and
- the effectiveness of various gas and liquid phase treatment technologies for non-H_2S-related odor compounds.

WERF continues research on the top-ranked gap. The research team will explain their findings in a following report.

This report includes the following chapters:

- **Plain English Guidance** This easy-to-read overview presents causes of odors and corrosion in sewers, some of the important characteristics of the specific chemicals, and methods to interrupt the sulfide cycle.
- **Literature Search and Review** The chapter summarizes the team's comprehensive approach in gathering and reviewing documents on assessment, measurement, and prevention. The literature search covered documents produced since 2000, in addition to information previously reviewed since 1990.
- **Odor- and Corrosion-Causing Compounds** This section discusses compound formation mechanisms, and methods for analysis.
- **Wastewater Collection System Modeling** The chapter reviews the literature on odorous and corrosive gas emissions, and highlights key points about emission models.
- **Sewer Ventilation** The researchers discuss key parameters affecting air movement in collection systems.
- **Liquid Phase Odor and Corrosion Control** This chapter reviews findings on liquid phase treatment options to reduce odor- and corrosion-causing compounds. Some of the options: adding oxidation chemicals and iron salts; shifting pH; adding nitrate; or using bacterial cultures and enzyme supplement products.
- **Gas Phase Odor Treatment** The researchers review gas phase treatment options for collecting and treating odorous and corrosive headspace air in collection systems.
- **Corrosion Mechanisms and Protection** This chapter discusses observations about how corrosion occurs, and measures (like coatings and linings) to mitigate corrosion.
- **Research Gaps Evaluation and Summary** The summary lists all of the research knowledge gaps identified during the literature search. It includes a problem statement as well as a general plan to investigate and fill the gaps.

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