

Identifying and Controlling Odor in the Municipal Wastewater
Environment

下水処理場における臭気の検出と制御

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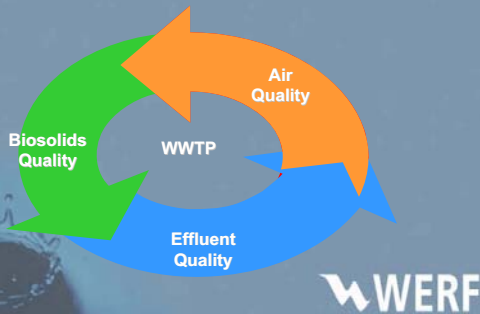


Odor Issues in the United States

- Growing Public Concerns, Awareness and Involvement
- Increased development around POTW's
- New Regulations
- Impact on Biosolids Management
- Health effects / Long-term Exposure
- Air Emissions: "If you can smell it, it must be bad"

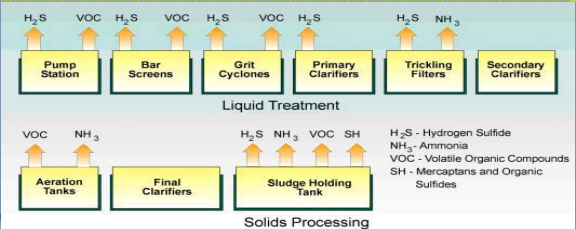


In the "Big Picture" - Effluent, biosolids, and air quality are equally important to WWTPs



Understanding the Sources

Collection System and Treatment Plant



WERF Phase 1 Project: Odor Assessment, Measurement & Control Literature Search

Overall goal:
To compile and evaluate existing information about controlling odors and addressing public issues



Phase 1 - The Odor Assessment Asked These Questions...

- What are the sources?
- What are source emission strengths?
- What are the odor compounds of concern?
- What is the best way to measure odors?
- What are potential off-site impacts?
- What is the public's perception of odors?



Phase 1 - Conclusions

- Odor control for some sources is more art than science
- One solution or chemical may not work for all applications
- Lots of gaps exist in our research knowledge and in our peer reviewed papers
- Many questions on measurement and characterization approaches
- Do we need a national odor standard and standard measurement approaches?
- Can industry and agricultural applications provide insights into our own control issues?
- Public perception and its impact on odor criteria at fence line is unclear - How many complaints warrant a response...?



Phase 1 Summary

Recommended Research Agenda Items for Phase 2

1. Anaerobic Digestion Research / Biosolids **
2. Lime Stabilization Research / Biosolids
3. Public Presentation Materials for Odors & Outreach
4. Two-stage Biofiltration Design
5. Natural Ventilation of Collection Systems

** Based on the Phase 1 study, ODORS related to BIOSOLIDS was the topic selected for Phase 2 research



WERF Phase 2 Project: Impacts of In-Plant Parameters on Biosolids Odor Quality

Overall Goal:

To better understand the generation of odors from biosolids produced by wastewater treatment plants



WERF Phase 2 Project Research Approach

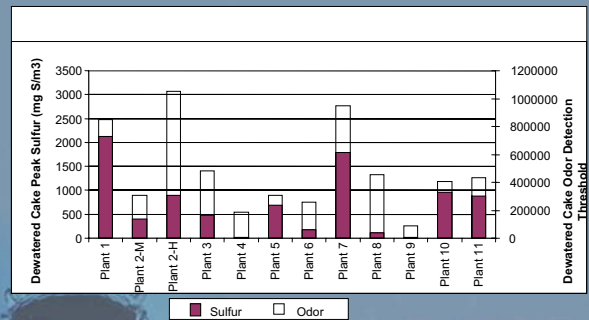
- Focus on anaerobic digestion due to its role as a biosolids stabilization method
- Examine Parameters that could influence biosolids odor quality
 - > WAS and primary solids quality (pH, ORP, VS)
 - > Solids storage conditions (pre- and post-digestion)
 - > Stabilization parameters (digestion time, VS destruction, mixing, heat addition, etc.)
 - > Thickening and dewatering parameters (shear, polymer, etc.)
 - > Conveyance systems (screws, belts, pumps)



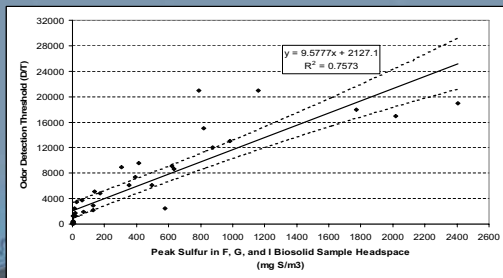
WERF Odor Study - Test Plant Locations



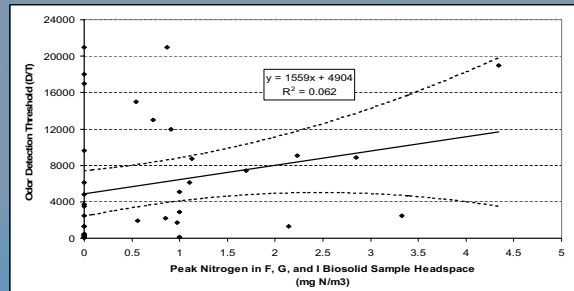
Sulfur and Odor Patterns



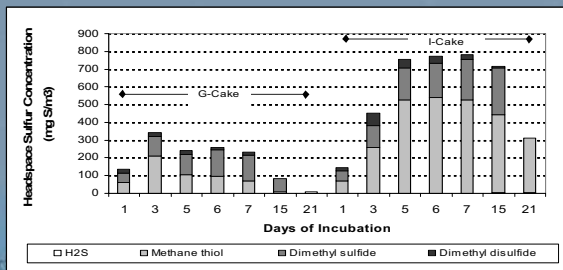
Odor Detection Threshold (DT) in Odor Units (D/T) versus Volatile Total Sulfur



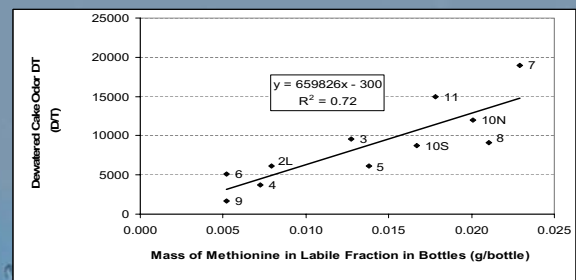
Odor Detection Threshold (DT) versus Peak Volatile Nitrogen (TMA, Indole, Skatole)



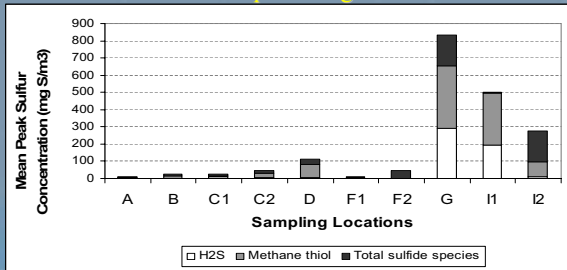
Pattern of Volatile Sulfur Versus Sample Incubation Time at WWTP No. 2: Low-solids vs. High-solids Centrifuge Cake



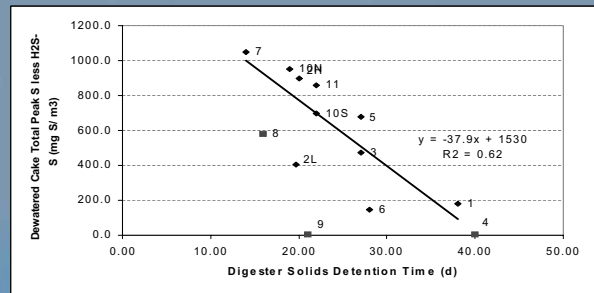
Relationship Between Odor DT from Stored Cake and Mass of Methionine in Sample Bottles



Mean Peak Sulfur Concentration (all WWTPs) through Treatment Process at Days 1, 3, 5 and 7 of Sample Storage



Dewatered Cake Peak Organosulfur Concentration vs. Digester SRT



(WWTPs 4&9 do not have Centrifuges and WWTP 8 has Thermophilic Digestion)



WERF Phase 2 Project Findings

- No clear correlation was found between biosolids stability, as measured by % volatile solids reduction, and reduction in biosolids cake odors.
- Higher amounts of **bioavailable protein** in biosolids cake create more odors.
- Some **dewatering** practices tend to increase odors in biosolids cake, as compared with other dewatering practices.
- Volatile sulfur compounds (VSCs)** are the major sources of odor in digested biosolids.
- Odor levels in digested biosolids cake rise and then decline during storage time.



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Research in progress: WERF Odor Study Phase 3

Biosolids Processing Modifications for Cake Odor Reduction



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WERF Odor Study Phase 3 Research Objectives

Enhance anaerobic digestion and downstream biosolids handling processes to produce dewatered biosolids of significantly reduced odor intensity through:

- > Anaerobic digestion enhancements to destroy or bind sufficient bioavailable protein to reduce odors
- > Keeping protein in digested biosolids bound through out subsequent biosolids handling processes and management practices.

These two approaches are complimentary; both may be needed for significant odor reduction in biosolids.



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WERF Phase 3 Research Approach

- Investigate promising hypotheses in the laboratory that can directly reduce cake odors.
- Determine WERF members' biosolids processing & management approaches to meet regulations while minimizing odor complaints.
- Determine full-scale approaches and equipment modifications that can reduce biosolids cake odors cost effectively.



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WERF Phase 3 Research Outcome and Goals

Supply owners, Design Engineers and manufacturers of biosolids dewatering equipment or digestion processes with a roadmap that can be used for producing biosolids cake with minimal odors

Benefit: will decrease the potential for the creation of a public nuisance in the communities surrounding the WWTP sites or biosolids handling facilities



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Questions?



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