Evaluation of Odor Control Strategies in Wastewater Collection Systems

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Why is odor control important for wastewater collection systems?

• Complex buried network of assets over large areas

• Rapid development

• O&M can be more reactive than proactive
Why is odor control important for wastewater collection systems?

• Odor releases occur near
  • Residences
  • Businesses
  • Public Spaces
Comprehensive Odor Control Strategy

Strategy

• Proactive
• Lowest Life Cycle Cost

Odor Impact Assessment

• System/community data
• Odor sampling data
• Solutions Evaluation
• Control Point or System-wide
Odor Generation
Odor Generation

• Long Force Mains/Gravity lines

• Longer Residence Time $\rightarrow$ Anaerobic Conditions $\rightarrow$ High Odor

• High Strength Wastewater

• Warm Temperatures
Corrosion Protection
Odor Release

- Points of release (Control Points or Hot Spots)
- Turbulent Conditions + Opening in system = odor release
- Manholes
- Pump station wet wells
- Air release valves
## Odor Characterization

<table>
<thead>
<tr>
<th>Compound</th>
<th>Smell</th>
<th>Solubility</th>
<th>Detection Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2S</td>
<td>Rotten Eggs</td>
<td>Soluble</td>
<td>0.00047 ppm</td>
</tr>
<tr>
<td>DMS</td>
<td>Rotten Cabbage</td>
<td>Insoluble</td>
<td>0.001 ppm</td>
</tr>
<tr>
<td>DMDS</td>
<td>Sulfide</td>
<td>Insoluble</td>
<td>0.001 ppm</td>
</tr>
<tr>
<td>MM</td>
<td>Rotten Cabbage</td>
<td>Slightly soluble</td>
<td>0.0005 ppm</td>
</tr>
</tbody>
</table>

Hydrogen sulfide (H₂S)  
Dimethyl sulfide (DMS), Dimethyl disulfide (DMDS), Methyl mercaptan (MM)
Odor Characterization

Collections/Headworks Odor Profile

Pump Stations/Collection System/Headworks

H2S (Higher) ➔ RSCs (Lower)

More water = higher H2S levels
Odor Characterization

WWTF Odor Profile

Dewatering/Sludge Handling/Compost stages

H$_2$S (Lower)  RSCs (Higher)

More solids = Higher RSC levels
Odor Sampling Plan

WHY:

Confirm Nuisance Odor Complaints
Develop system design criteria
System performance testing
System monitoring/optimization
Regulatory Requirements or Client Goal (D/T, H2S)
Staff Safety
Developing a Sampling Plan

• Sampling Objectives
• Review Background Data
• Select Locations
• Identify sampling methods and materials
• Schedule (season) and frequency (shipping/lab coordination)
• Sampling Team (Training if Required)
Odor Sampling Plan

HOW:
Liquid Phase Sampling – Wastewater – Odor Potential

Vapor Phase Sampling – Air – Odor Released

Ventilation Dynamics: Differential Pressure and Air Flow
Liquid Phase Sampling

- Dissolved sulfide sampling
- Wastewater pH, temperature, DO, ORP

Figure 4-1: LaMotte Sulfides Test Kit (Photo courtesy of LaMotte Company)
Vapor Phase Sampling

Hydrogen Sulfide
Why: Dominant compound for odor and corrosion control
How: OdaLog, AcruLog, Jerome Meter,
Considerations: Range, safety, sampling system, depth

Keep out of Water!!
Vapor Phase Sampling

Reduced Sulfer Compounds - Initial
Why: Difficult to Remove, Low detection threshold
How: Detection Tubes
Considerations: Accuracy Level
Vapor Phase - Speciation Sampling

- Reduced sulfur compounds
- How: Tedlar bag, vacuum canister
- ASTM D5504-12 (20 sulfur compound list)
- Cannister has 7-day, tedlar bag is 24-hour
Vapor Phase - Sensory Sampling

- Why: Odor concentration (D/T and R/T), intensity, persistence, characterization (hedonic tone and descriptors)
Ventilation Dynamics
Airflow/Differential Pressure Monitoring

Differential Pressure
Why: Determine potential for fugitive emissions
How: Acrulog or Smoke Testing
Considerations: public outreach and moisture

Airflow
Why: Verify system flow rate
How: wind vane anemometer
Considerations: Duct span/diameter
Solutions Evaluation

- Liquid Phase Technologies
  - Chemical Addition
  - Oxygen Injection

- Focus on Odor Prevention
Solutions Evaluation

- Vapor Phase Technologies
  - Biological
  - Chemical
  - Adsorptive (ActivatedCarbon)

- Focus on treatment/capture of released odor
Vapor Phase Technologies – Adsorptive (Activated Carbon)

PROS:
Lower capital cost
No water required
No acclimation period

CONS:
Higher cost media
Difficult to predict media life
Vapor Phase Technologies – Biological Biofilters

PROS:
Lower capital cost
Treat variety of odor compounds
Lower water consumption

CONS:
Large footprint (High EBRT)
Acclimation period needed
Vapor Phase Technologies – Biological Biotrickling Filters

PROS:
Handles high odor loadings
Long media life

CONS:
Low pH discharge water
Acclimation period needed
High profile
Vapor Phase Technologies – Chemical Chemical Scrubbers

PROS:
Handles high odor loadings
Works Instantly
Long media life

CONS:
High water consumption
High chemical demand
Vapor Phase Technologies – Hybrid Multi-Stage System

**PROS:**
- Treats high H2S and RSCs
- Long media life

**CONS:**
- More complex process
- Higher capital cost
Case Study: Mooresville, NC (Pump Station)

**Hydrogen Sulfide:**
Design Average inlet Concentration: 10ppm
Average Removal: 99.9%
Air Flow: 6000 cfm
Case Study: Dual Strategy – Pine Valley, CA

Pump Station Wet Well:
- Shell Biofilter treating PS headspace
- Oxygen Injection at wet well for downstream odor control
Odor Management Showcase: Cary, NC

Odor Control Tips from Cary Staff:
- Prepare infrastructure for low pH discharge water from Biotrickling filters (epoxy coatings)
- Don’t apply one technology everywhere
- Regular system checks – pressure gauges, bed depth (media changes), blowers
- Monitor system performance, odor reduction, O&M efforts
Thank you