ODOR CONTROL

SARBS Training Seminar
Odor Control, Secondary Treatment, Math, and Plant System Maintenance

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Presentation Outline

- WWTP Odors
- Odor Control Strategies
- Odor Treatment Technologies
- Example Project
- Alternative Configuration
WWTP Odors

- Amines (fishy)
- Ammonia
- Diamines (decayed flesh)
- Hydrogen Sulfide (rotten eggs)
- Mercaptans (skunk)
- Organic Sulfides (rotten cabbage)
- Skatole (fecal)
Better Odor
Major Sources of WWTP Odors

- Headworks – target H2S, reduced sulfur compounds
- Grit and screenings handling areas
- Dewatering and sludge truck loading – target VOCs
Odor Sampling & Measurement

- Odor constituents
  - Hydrogen sulfide
  - Methyl mercaptan
  - Dimethyl sulfide
  - Dimethyl disulfide
  - Etc.

- Odor units or Dilution to threshold (D/T)
  - Threshold – Only half of a group of panelists can smell the odor in a diluted sample.
  - The number of times the sample had to be diluted to reach the threshold is the number of odor units, or D/T.
Air Dispersion Modeling

Existing Conditions
Peak DT Contours
WWTP Odor Control Strategies

- Containment
- Foul air collection
- Foul air treatment
- Other strategies:
  - Air dispersion
  - Liquid treatment
WWTP Odor Control Strategies

- **Containment**
  - Foul air collection
  - Foul air treatment
- Other strategies:
  - Air dispersion
  - Liquid treatment
Containment Strategies

- Covered channels, tanks, bins
- Equipment enclosures
- Equipment selection
- Buildings
- Physical curtains
- Air curtains
Odor Containment – Salem, OR
Odor Containment - OCSD
Odor Containment – Clark County, NV
Odor Curtains
WWTP Odor Control Strategies

- Containment
- **Foul air collection**
- Foul air treatment
- Other strategies:
  - Air dispersion
  - Liquid treatment
Foul Air Collection

- Point source draw-off
- Keep odor source areas under negative pressure
- Draw air away from the work areas
- Ventilation rates may be dictated by area electrical classification requirements
Building Air Drawn Into Bar Screen Channels
WWTP Odor Control Strategies

- Containment
- Foul air collection
- **Foul air treatment**
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  - Air dispersion
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Odor Treatment Technologies

- Biological scrubbers
  - Biofilters
  - Biotrickling filters
- Chemical scrubbers (caustic and hypochlorite scrubbers)
- Adsorption units (activated carbon)
Biofilter
Biofilters

- Proven performance for a diverse mix of complex odors and VOCs
- Greater than 99% H2S removal and 600 D/T
- Media
  - Organic - compost, wood chips, bark
  - Inorganic - lava rock, structured media
- Self-regulating, but requires biological acclimation period
- Lowest operating and maintenance costs
- No chemical storage or handling
- Low profile
- Soil filter type has larger footprint than scrubbers
Biotrickling Filter
Biotrickling Filters

• Very effective for high H2S loading
• Greater than 98% H2S removal and 1000 D/T
• Media - Acid resistant, high porosity inorganic natural or structured synthetic media (foam, rock)
• Optimum balance for growth of the bacteria and the solubility of hydrogen sulfide is pH range of 2.0 to 3.0
• Requires nutrient, e.g. secondary effluent
• Self-regulating, but requires biological acclimation period
• Low O&M costs
• No chemical storage or handling
• High or low profile
• Small footprint
Biotrickling Filters

Louisville

St. Louis

OCSD

Dallas
Biological Media

Natural Media

Synthetic Media
Media Needs

- Support the acclimation of a large diverse microbial population
- Provide pH buffering capabilities
- Have the ability to retain microbes
- Be physically stable
- Have a low pressure drop
- Produce clear drainage water (leachate)
- Drain freely, release excessive moisture
- Have high bearing strength
Chemical Scrubber
Chemical Scrubbers

- Very effective for high H2S loading
- Can achieve 99% H2S removal
- Random packing material media
- Controls include pH and ORP sensors
- Most complex and intensive O&M
- Require chemical storage and handling
- High or low profile
- Small footprint
Activated Carbon Vessel

Diagram showing a carbon vessel with treated air entering at the top, flowing through the carbon bed, and exiting as foul air at the bottom. A fan is connected to the system, indicating the movement of air through the vessel.
Activated Carbon

- Effective for treating transient loads, intermittent airflows, as a polishing stage
- Not suitable for higher H₂S loadings
- Can achieve 99.9% removal efficiency and 100 D/T
- Carbon types: Standard, Impregnated, Blended, and Catalytic
- High O&M cost
Combination Technologies

- Provide the highest removal efficiencies and lowest D/T.
- Multiple stage treatments in separate units or single unit
- First stage – inorganic media for removal of H₂S and other related sulfur-based odor compounds, pH~2-3
- Second stage – organic media for removal of remaining sulfur compounds and VOCs, pH~7
- Exceeds 99% removal efficiency, 300 to 600 D/T and 100-200 D/T if carbon system is used as polishing stage
WWTP Odor Control Strategies

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Wastewater Odor Treatment

Chemicals

- Hydrogen Peroxide
- Magnesium Hydroxide
- Sodium Hydroxide (Caustic soda)
- Sodium Hypochlorite (Bleach)
- Ferrous or Ferric Chloride
- Calcium Nitrate (Bioxide)
Orange County Sanitation
District Plant No. 2
Headworks Replacement
OCSD Plant No. 2
Project Goals

- Replace Plant No. 2 Headworks
  - Age of the structure – 45 years
  - Location of earthquake faults (vulnerability)
  - Upgrade equipment and layout
    - Protect downstream processes from rags, grit
    - Use Best Available Technology (BAT)
    - Improve performance & reliability
    - **Reduce odors**
    - O&M friendly
    - Full automation
Biotrickling Filter Research

- Optimize biological odor treatment
  - Effectively control odors
  - Reduce use of chemicals
  - Reduce operations and maintenance costs
  - Minimize site space requirements
Foam Biotrickling Filter Media

- 4 cm open pore polyurethane foam
- Zander, Germany
Biotrickling Filter Research

Gas Contact Time
Approximately 2 Seconds

Treated Air to Chemical Scrubbers

Sewer Trunkline
Four Air
(H2S = 5-35 ppm)

Packing Media
Replaced
with Foam Media
(Bed Height = 9 feet)

Chlorinated Secondary Effluent

Foul Air Fan
(9,400 cfm)

Diameter = 6 Feet

Replaced 7 hp Recirculation Pump with a 0.5 hp Pump

Filename.ppt
Foam Media
Headworks Odor Control
Process Schematic

P2-66 Headworks
50 ppm H₂S

P2-66 Trunklines & Diversion Structure
40,000 cfm
100 ppm H₂S

188,300 cfm
2 sec EBRT
Foam Biotowers

2 sec EBRT
Foam Biotowers

2 sec EBRT
Single-Stage Wet Chemical Scrubbers

To Atm
Headworks Odor Control Facility Schematic

- Second Stage Plenum: 8 Chemical Scrubbers
- First Stage Plenum: 13 Bio Tower Scrubber Systems
Trunkline Odor Control Facility
Headworks Odor Control Facility
Biological Alternatives

- Vertical biotowers
- Low profile horizontal bioscrubbers
Low Profile Bio-Scrubber Section View
## Low Profile vs Vertical Scrubbers

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<th>Low Profile</th>
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<td>Energy Consumption</td>
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Conclusions

- Understand odors and objectives prior to evaluation of technologies.
- Use containment and collection strategies to reduce foul air.
- Challenging odors may best be treated with a combination technology.
- Selection and design considerations: space constraints, ease of controls, aesthetics, redundancy, ease of servicing, costs.
- Consider low profile package units in addition to towers.