OVERVIEW

• Need for odor control
• Current and Planned Odor Control Facilities
• Design Standards
NEED FOR ODOR CONTROL

• Combined Sewers
  – Storm Inlets
  – Traps
  – Regulators

• Sanitary Sewers
  – Drop Manholes
  – Force Mains

• CSO and SSO
  Tunnels
  – drop shafts
  – relief structures

Odor (H₂S Gas, mercaptans, ammonia)

Water falling to tunnel floor

Wastewater
CITY OF COLUMBUS ODOR CONTROL FACILITIES

- Upper Scioto West Interceptor Sewer (USWIS) Biofilters
- Big Walnut Augmentation and Rickenbacker Interceptor (BWARI) Biofilter
- Olentangy Scioto Interceptor Sewer (OSIS) Downtown Biofilters
- Lockbourne Intermodal Subtrunk (LIS) Biofilters
- Blacklick Creek Interceptor Sewer (BCIS) Biofilter
USWIS Biofilters

- Constructed to ventilate pressurized tunnel and provide odor removal
- 2 Biofilters – 7,000 CFM Each (original design)
USWIS Biofilters

Aggregate for Underdrain and Main Air Distribution Header

HDPE Liner

Air Distribution Laterals
USWIS Biofilters

Inorganic (Granite) Media

Organic Media (Hardwood Mulch)
USWIS Biofilters

- 2006 Media Replacement
- Organic media had decomposed
USWIS Biofilters

- Repaired diffuser pipes
- Washed inorganic media and reused
- Installed locally sourced, organic media
- Increased Air Flow to 12,000 CFM at North Filter
USWIS Biofilters

2009-2011 – Locally sourced, organic media had become anaerobic from decomposition.

Organic media was replaced with southern, yellow pine bark nuggets.
BWARI Biofilter

- 108" BWO TUNNEL
- FAN BUILDING
- FOUL AIR INTAKE
- BWARI/BWO Interconnect Structure
- 144" BWARI TUNNEL
- BIOFILTER CELLS
BWARI Biofilter
BWARI Biofilter

- Humidification System
  - NPW
  - Boiler
  - Spray Nozzles
  - Recirculation Pumps
  - Controls
BWARI Biofilter
BWARI Biofilter

- Air Distribution Issues
OSIS Downtown Biofilters
OSIS Downtown Biofilters

- Foul air duct from sewer
- Blower to draw foul air
- Air distribution system
- Filter Media
- Irrigation System
- Leachate Drainage System
OSIS Downtown Biofilters
OSIS Downtown Biofilters
OSIS Downtown Biofilters
OSIS Downtown Biofilters
OSIS Downtown Biofilters
OSIS Downtown Biofilters
OSIS Downtown Biofilters
USWIS Biofilters

2016 Reconstruction of north and south filters.

- Removed existing filter beds and replaced them with our new plenum design.
- Utilizing lava rock with western pine nugget media at the south filter.
- Utilizing engineered media at the north site.
- Installing aluminum covers.
## BWARI Biofilter Rebuild (2017)

**Remove:**
- Humidification System

**Replace:**
- Hatches
- Dampers
- Entire Electrical & Control System
- Fan bearings and shaft seals
- Irrigation system
- Coatings
- Conduits and terminals
- Gate Actuators

**Improve:**
- Increase capacity from 23,000 CFM to 35,000 CFM
- Large Western Fir Bark nuggets in place of root wood mulch
- Surface Irrigation
- Electrical upgrades (MCC, conductors, AFDs)
- Corrosion inhibitors in all panels
- Simplify controls and monitoring system
- Building ventilation
LIS Biofilters

• Constructed to ventilate pressurized tunnel and provide odor removal
• 2 Biofilters – 5,000 CFM Each
Biofilter Design

Ventilation Rates
- Modelling
- Field Testing – pressure & hydrogen sulfide

Foul Air Stream Characterization
- Odor Constituents
- Seasonal Variations
- Wet Weather Impacts
- Operational Impacts
Biofilter Design Criteria

\[
\text{Mass flowrate of Air (cfm)} \over \text{Area of Biofilter (sf)} = \text{Loading Rate (Cfm / sf)}
\]

\[
\text{EBCT} = \frac{\text{Volume of Biofilter (cf)}}{\text{Mass Flow of Air (cfm)}} = \text{Empty Bed Contact Time (min)}
\]

Loading Rate = ~6 Cfm/sf

EBCT = 60-90 min

Biofilter Plan

Exhaust Duct

~1 ft deep

Biofilter Section

Trench ~ 1,000 ft/min
Biofilter Design

Duct And Piping Considerations
• Corrosion Resistance
  • PVC (small diameters)
  • Fiberglass Reinforced Polymer Pipe (large diameters)
• Dampers

Blower Considerations
• Corrosion Resistant
• Variable Speed
• Vibration
• Noise
• Foul Air Duct Connection
Biofilter Design

Plenum Considerations

• Perforated Pipe and Stone
• Pre-manufactured Plastic Floor
  • Hallsten
  • BACTee
Biofilter Design

Dual Media Filters

- Organic and Inorganic Media (<0.25 in-H2O)
- Proven to produce effluent with < 0.005 ppm H2S

Pilot Tested Inorganic Media

- Crushed Granite (limestone degrades)
- Lava Rock
- Tire Chips

Lava Rock Advantages

- H2S Removal
- Airflow Characteristics
- Moisture Retention
- Light Weight (compared to granite)
Biofilter Design

Irrigation System Considerations
• Sprinklers (with automatic controls system)
• Drip tubes
• Humidification chambers

Operational Considerations
• Remote monitoring parameters
• Security
• Control requirements
• Communication paths
• Training
• Maintenance
• Monitoring
Odor Control Philosophy

• Keep it Simple & Uniform
• Proper Design Yields Low Maintenance & High Performance
Thanks for Listening

Any Questions?