



CITY OF COLUMBUS ODOR AND CORROSION CONTROL PROGRAM: THEN & NOW



THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

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PRESENTATION OVERVIEW

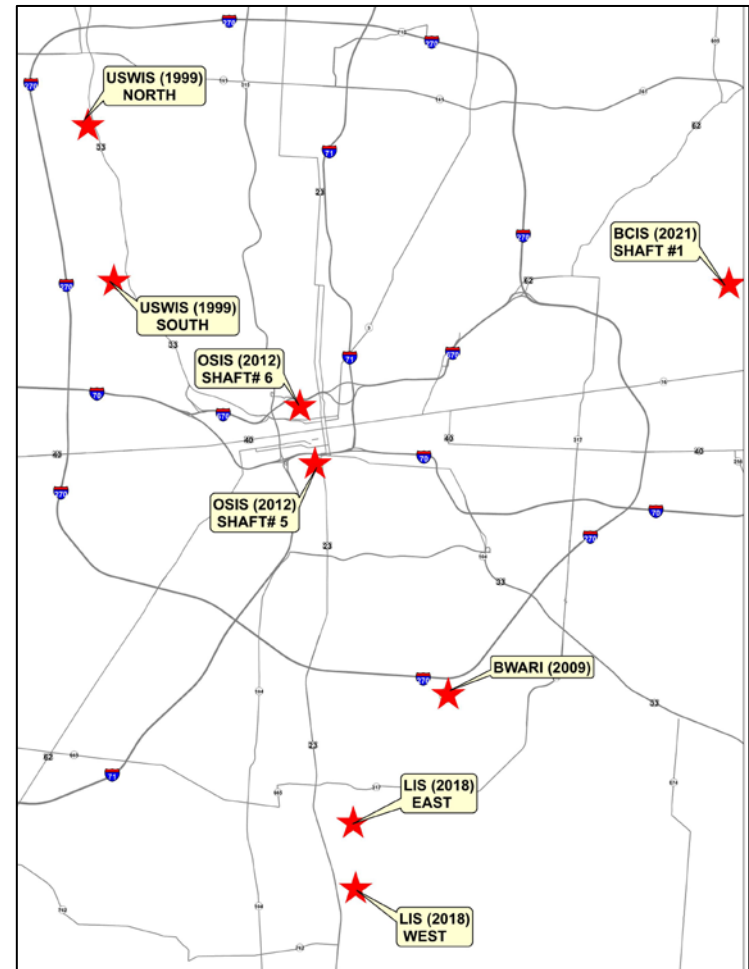
- How our program began
- Why odor control and corrosion control is necessary
- Original system designs
- The evolution of the foul air distribution system and cell design
- The evolution of the system media
- The evolution of the humidification process
- Key design features

PROGRAM INITIATION

- Our collection system air treatment program began in 1999 after the construction of the Upper Scioto West Tunnel.
- Since this project, odor and corrosion studies have been incorporated into major tunnel and trunk extensions.
- We now have 5 active air quality facilities on-line within the collection systems in conjunction with 3 passive air filters.
- An additional 3 facilities are currently under design with the potential to add 2 more in the near future.

CITY OF COLUMBUS ACTIVE 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
- **Lower Olentangy Tunnel (LOT)
- **Big Walnut Trunk (BWT)

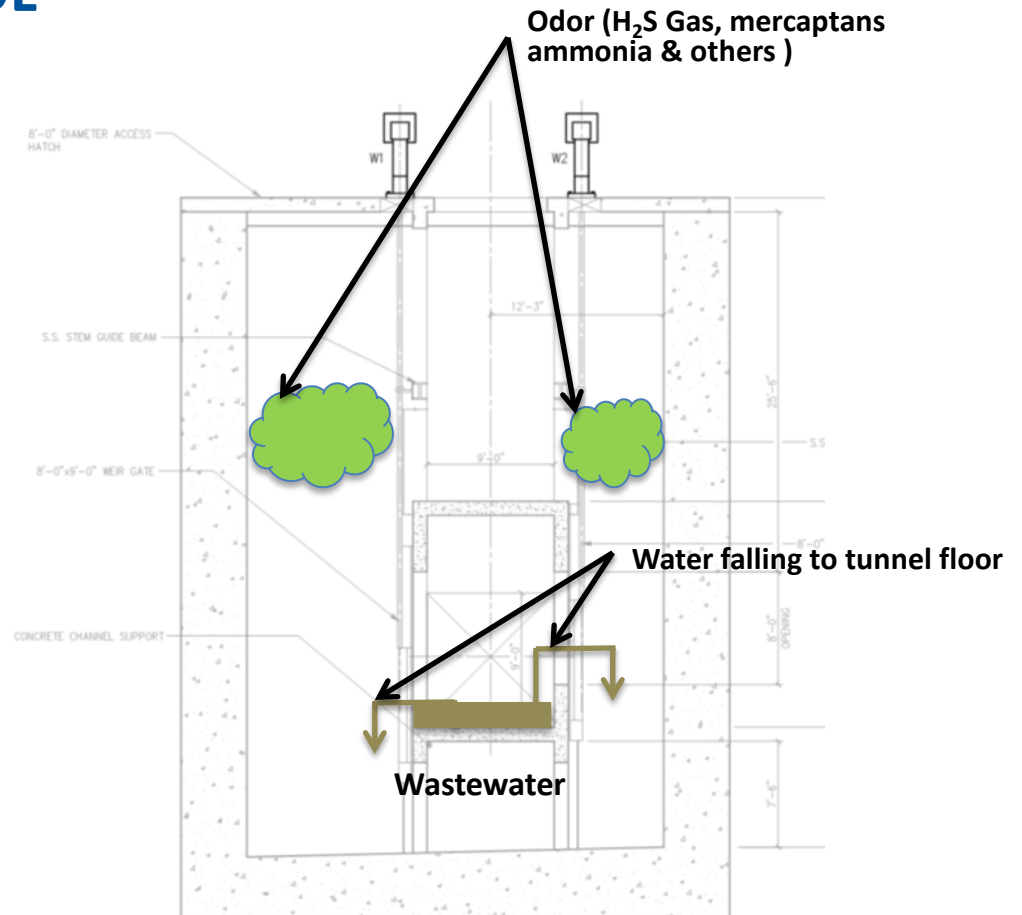


* Currently Under Design

** Planned Future Facility

NEED FOR ODOR CONTROL

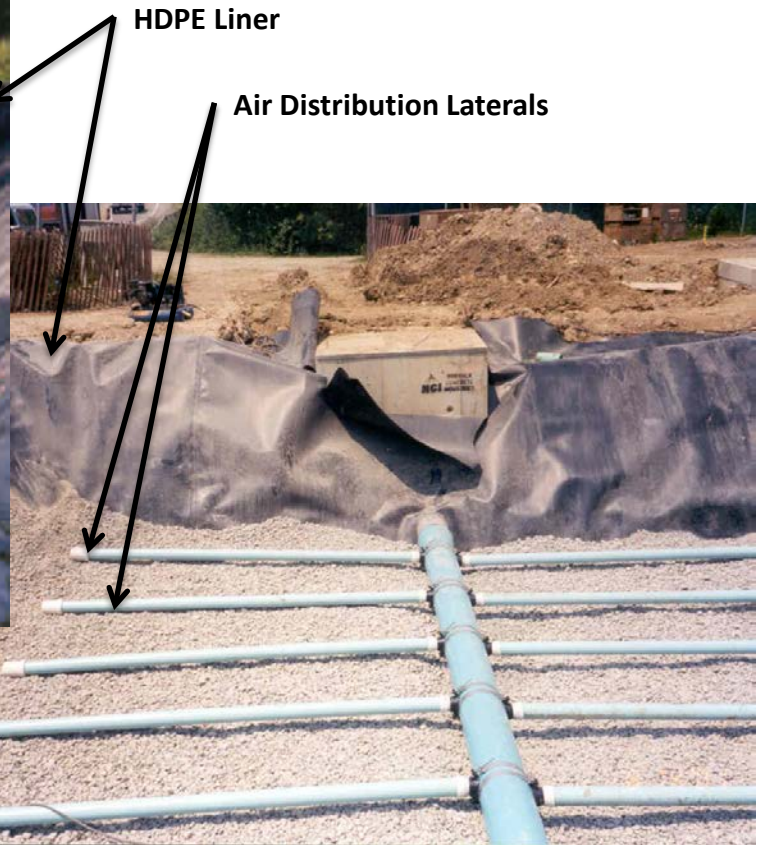
- Combined Sewers
 - Storm Inlets
 - Traps
 - Regulators
- Sanitary Sewers
 - Drop Manholes
 - Force Mains
- CSO and SSO Tunnels
 - drop shafts
 - relief structures



ORIGINAL SYSTEM DESIGN - USWIS Biofilters



Aggregate for Underdrain and Main Air Distribution Header



HDPE Liner

Air Distribution Laterals

ORIGINAL SYSTEM DESIGN - USWIS Biofilters



Inorganic (Granite) Media



Organic Media
(Hardwood Mulch)

AIR PLENUM EVOLUTION

- Perforated Pipe
 - Higher pressure drop
 - Lateral spacing & hole size
- Maintenance Issues
 - Must be replaced/reconstructed
 - Uneven air distribution



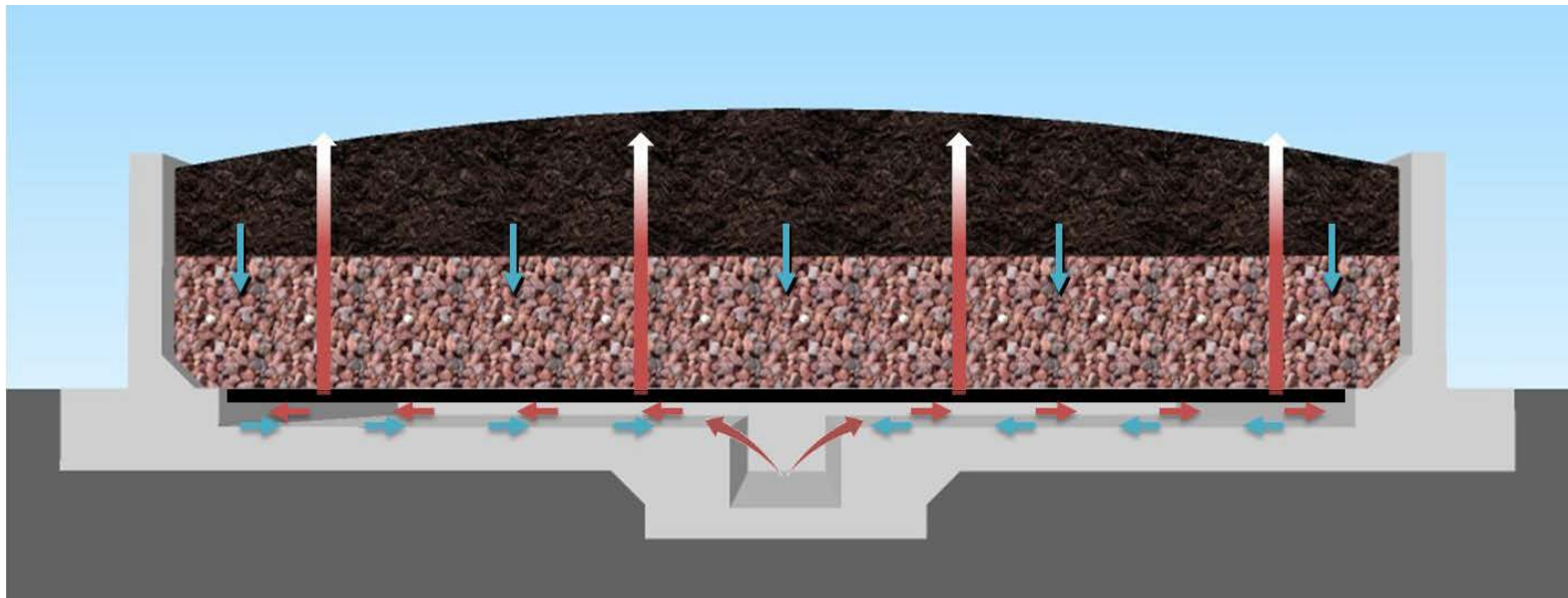
AIR PLENUM EVOLUTION

- Fabricated HDPE Air Plenum Floor
 - Low pressure drop
 - Uniform air distribution
- Air distribution “chamber”
 - Multiple openings
 - Uneven air distribution
- Maintenance
 - Floor does not need to be replaced

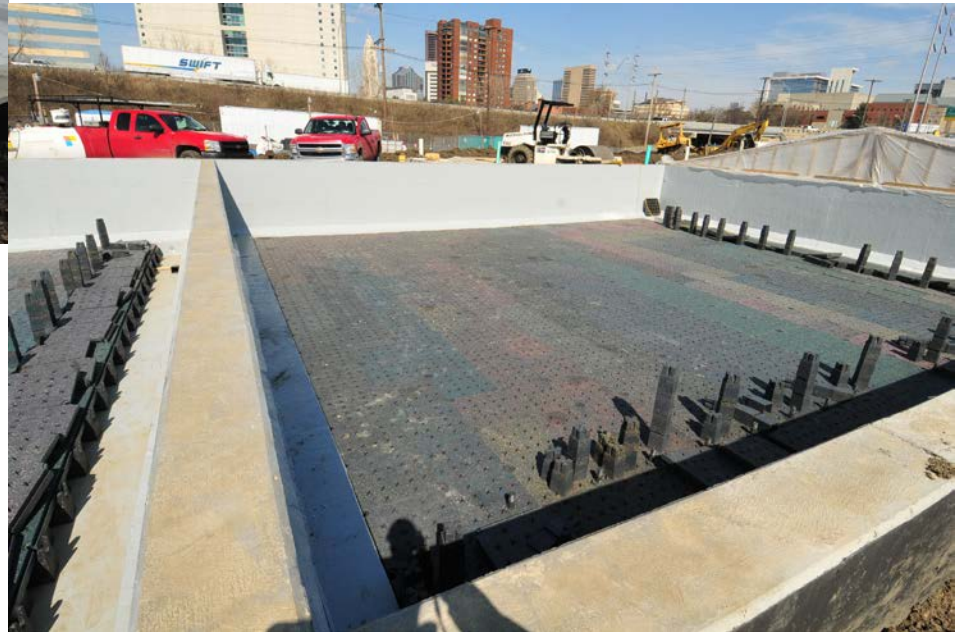


AIR PLENUM EVOLUTION

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



AIR PLENUM EVOLUTION



AIR PLENUM EVOLUTION



- Installed an aluminum, hinged cover
- Louvres added for venting
- Allows for 24/7/365 water usage



SYSTEM MEDIA EVOLUTION

- 2006 USW - Organic media had decomposed and was replaced with locally sourced hardwood mulch
- 2009-2011 Replaced the locally sourced media with southern, yellow pine bark nuggets.



SYSTEM MEDIA EVOLUTION

BWARI



OSIS



USWIS



SYSTEM MEDIA EVOLUTION



HUMIDIFICATION EVOLUTION



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



HUMDIFICATION EVOLUTION

- Surface Irrigation
 - Keeps upper layer of media moist
 - Must be even
- Drip Irrigation
 - NOT Soaker Hose
 - Used for High H₂S only
 - Washes out metabolic byproducts
- Maintenance
 - Less energy & water use
 - Less corrosion



OSIS Downtown Biofilters



KEY BIOFILTER DESIGN FEATURES

Ventilation Rates

- Modelling
- Field Testing – pressure & hydrogen sulfide



Foul Air Stream Characterization

- Odor Constituents
- Seasonal Variations
- Wet Weather Impacts
- Operational Impacts



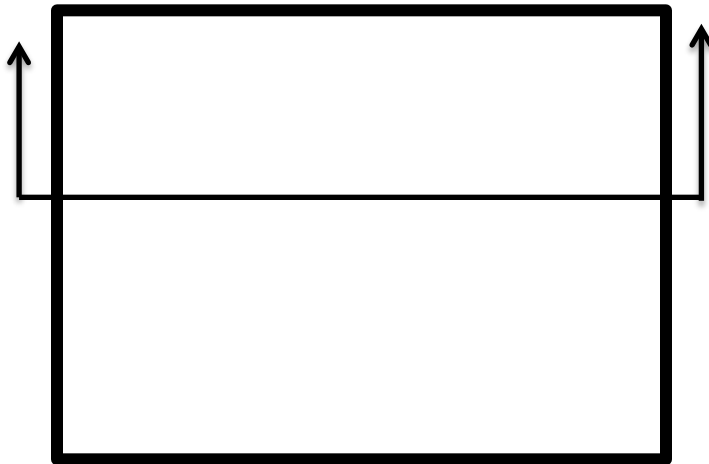
KEY BIOFILTER DESIGN FEATURES

$$\frac{\text{Mass flow rate of Air (cfm)}}{\text{Area of Biofilter (sf)}} = \text{Loading Rate (Cfm / sf)}$$

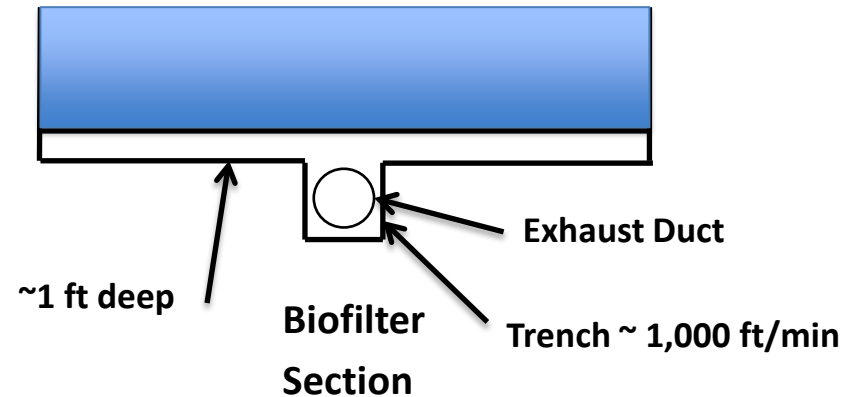
Loading Rate = ~6 Cfm/sf

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

EBCT= 60-90 seconds



**Biofilter
Plan**



KEY BIOFILTER DESIGN FEATURES

Duct And Piping Considerations

- Corrosion Resistance
 - PVC (small diameters)
 - Fiberglass Reinforced Polymer Pipe (large diameters)
- Dampers



Blower Considerations

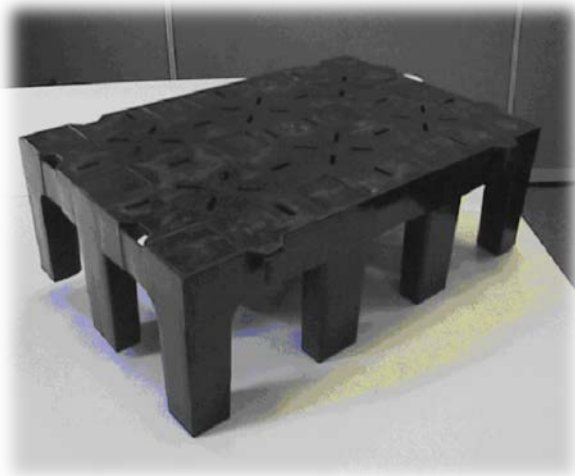
- Corrosion Resistant
- Variable Speed
- Vibration
- Noise
- Foul Air Duct Connection



KEY BIOFILTER DESIGN FEATURES

Plenum Considerations

- Perforated Pipe and Stone
- Pre-manufactured Plastic Floor
 - Hallsten
 - BACTee



KEY BIOFILTER DESIGN FEATURES

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)



KEY BIOFILTER DESIGN FEATURES

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



KEY BIOFILTER DESIGN FEATURES



Proper QA/QC During Construction

- Screening of media materials
- Smoke testing of various media layers



ODOR CONTROL PHILOSOPHY

- Keep it Simple & Uniform
- Proper Design Yields Low Maintenance & High Performance



Thanks for Listening

Any Questions?

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