The Latest in Odor Control Issues and Solutions

FWEA Air Quality Seminar Feb 2017

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Brown AND Caldwell

Agenda

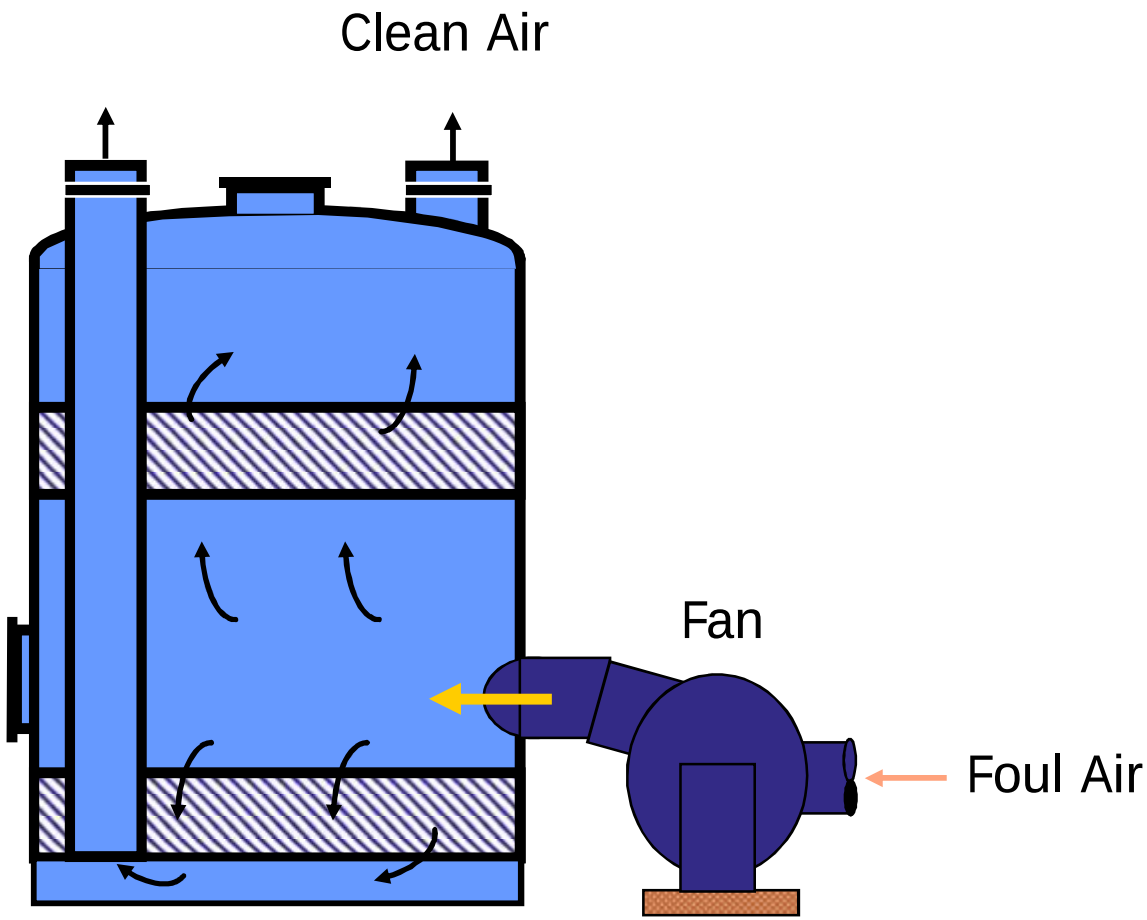
- **Vapor Phase Technologies**
- **Comparison of Technologies**
- **Collect before Treating**
- **Dispersion**

Air Treatment Technologies

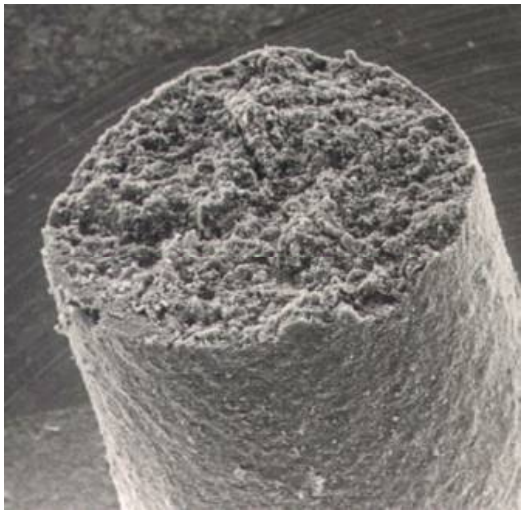
- **Activated Carbon**
- **Chemical Scrubbing**
- **Biotrickling Filter**
- **Bulk Media Biofilter**
- **Ionization**

Activated Carbon and other dry media

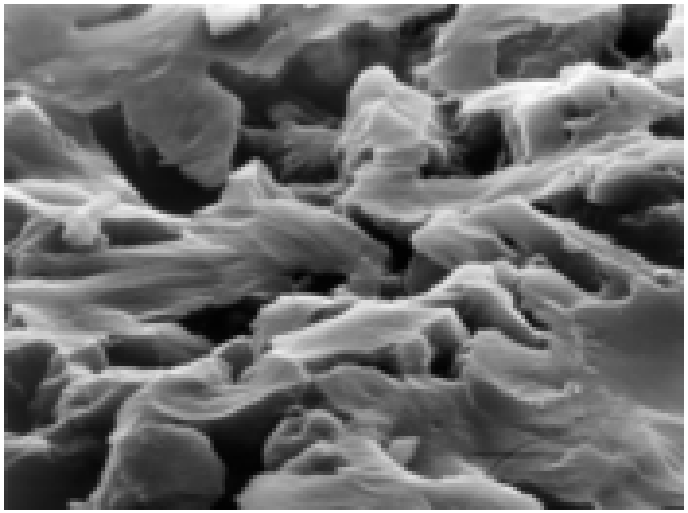
Activated Carbon Adsorber



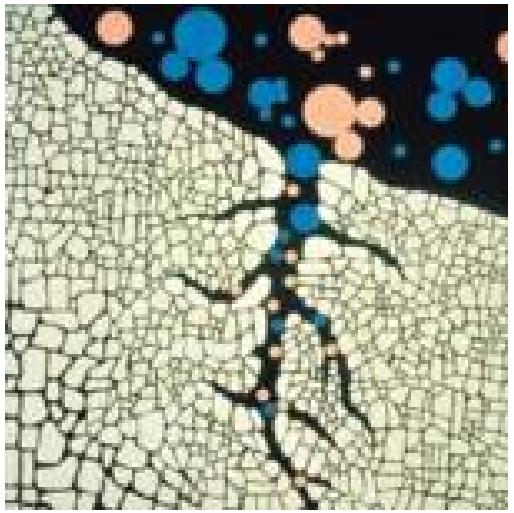
Activated Carbon



Extruded Carbon

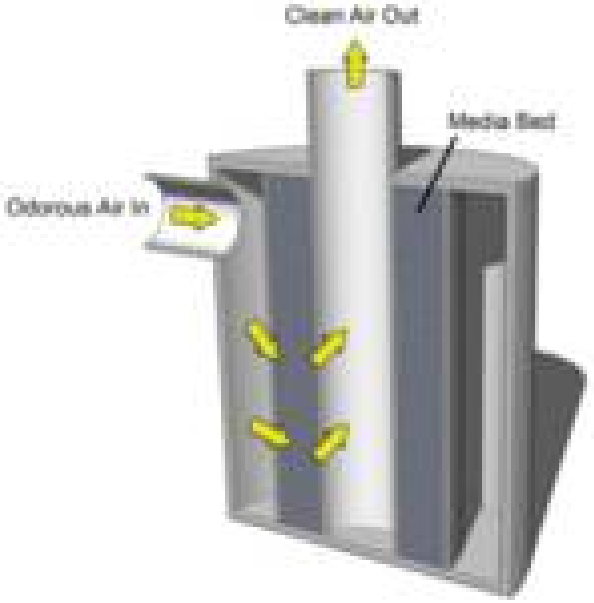


Granular Carbon



Adsorption in pores

Various Vessel Configurations



Mobile Carbon Vessel

Pros / Cons of Carbon

- **Can treat most odors**
- **Minimal maintenance**
- **Stack discharge increases dilution**
- **No chemical usage**
- **High-capacity carbons available**
- **Chemically impregnated media for polishing**

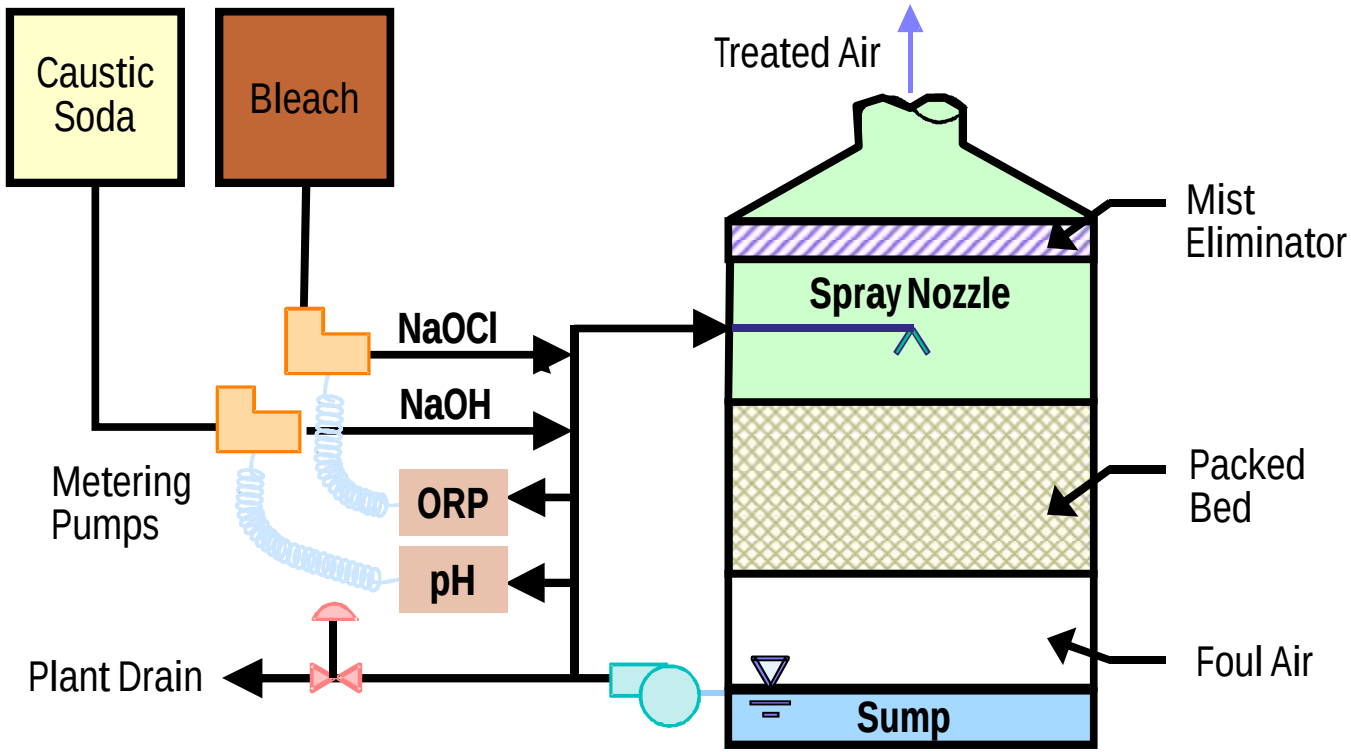
- **Heavily loaded carbons can produce foul odors**
- **Removal of media can be difficult**

Chemical Scrubbing

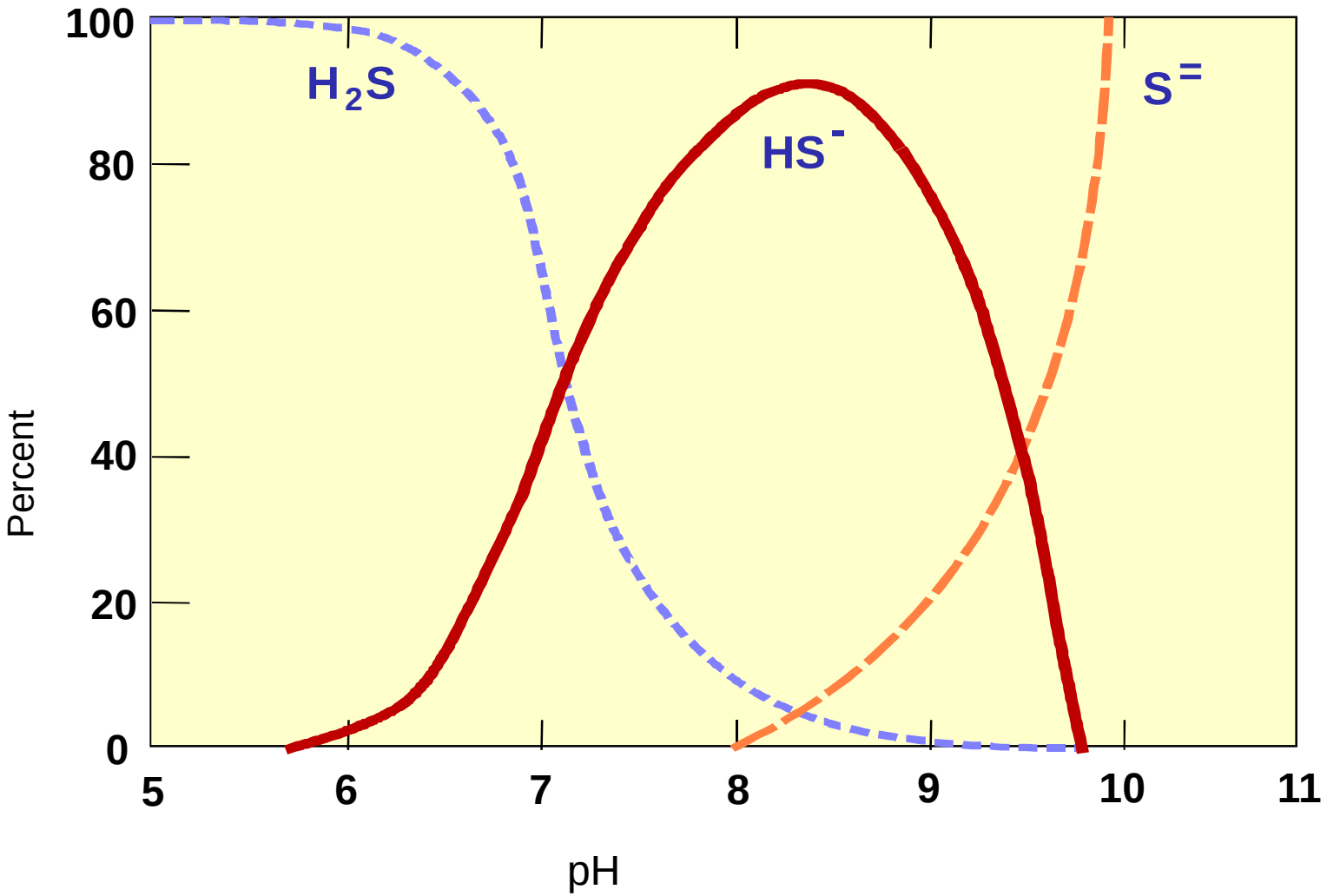
Typical Packed Bed Wet Scrubber Countercurrent Flow

Key use factors:

- Very common control technology
- Very effective
- Somewhat complicated process



Sulfide Species as a Function of pH



Single Stage Scrubber

Pros / Cons of Chemical Scrubbing

- **Can treat most odors but needs significant maintenance**
- **Fast Response to changing conditions**
- **Stack discharge increases dilution**

- **Chemical requirement adds capital and operating costs and operator safety issues**

Packed Bed Chemical Scrubbers

Two-stage scrubbing

Low profile scrubbers

Biotrickling Filter
aka “Bioscrubber”
aka “Biotower”
aka ”Biofilter”

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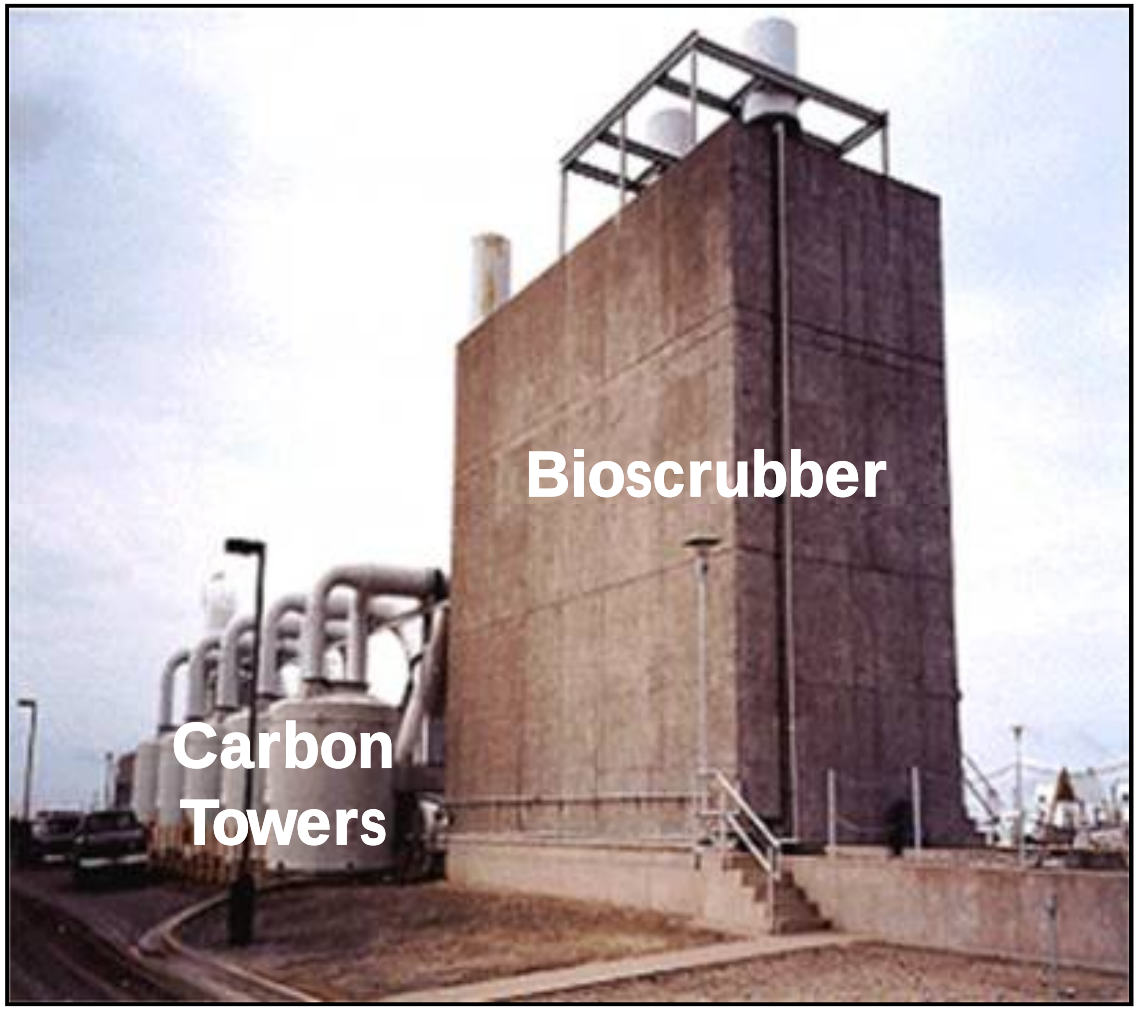
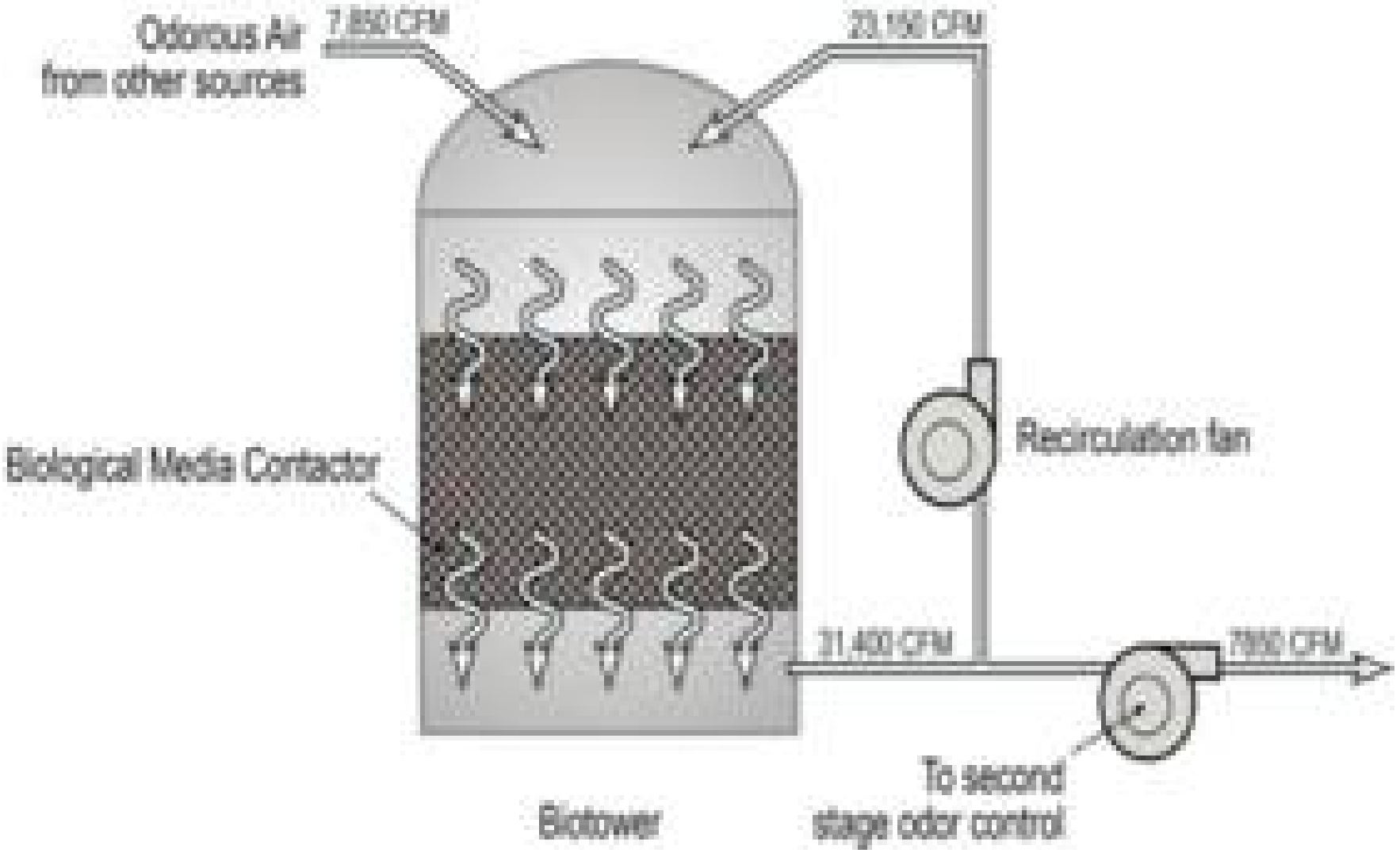
Typical Biotrickling Filters

Sacramento Regional Wastewater Treatment Plant Bioscrubber, 1982



Use a Trickling Filter as a Biotrickling Filter



Biofiltration

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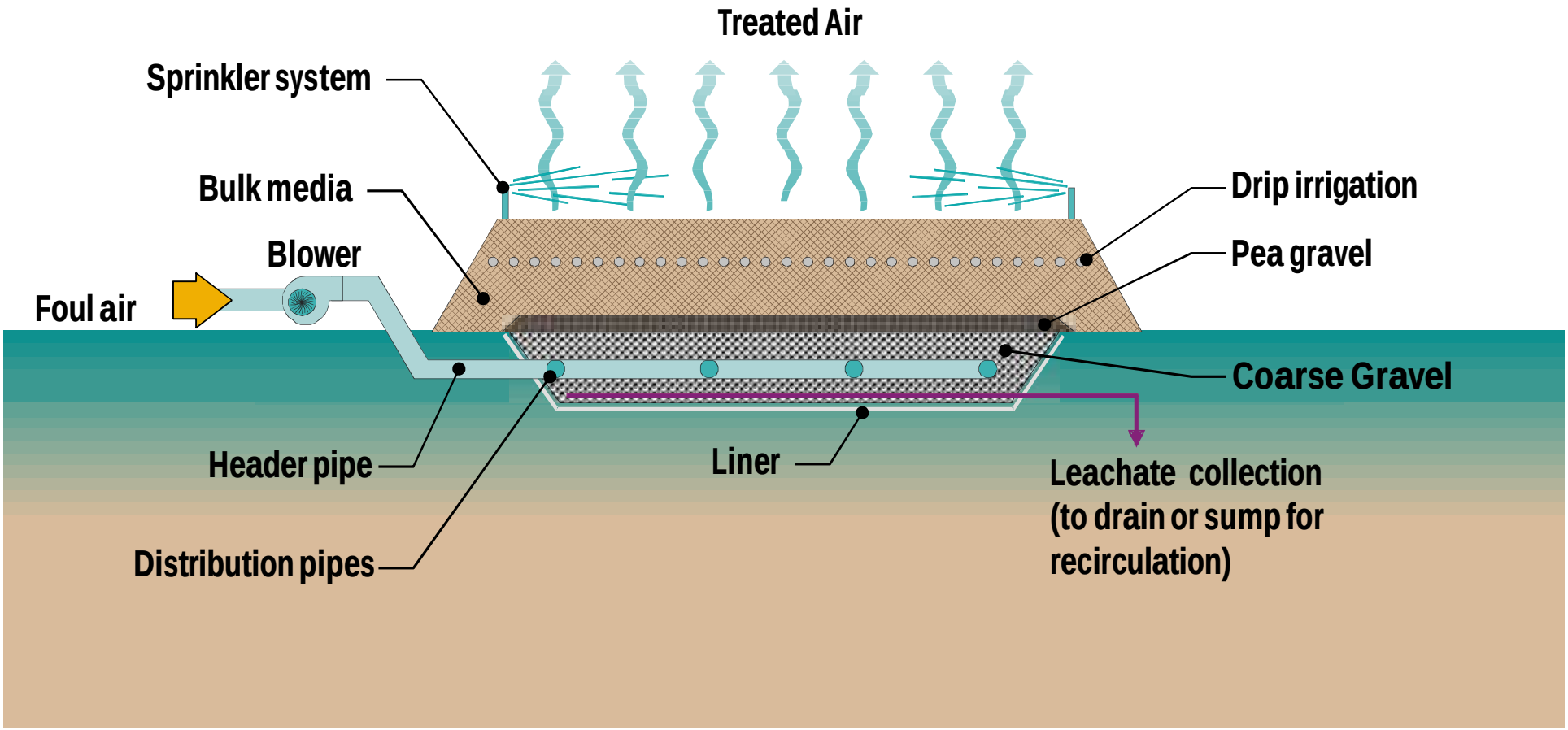
Typical Bulk Media Biofilter



Biofilter in concrete vessel

Enable Access to Media

Small Biofilter at Siphon

Coronado, CA Soil Biofilter

Colorado Park Biofilter

Pros / Cons of Biological treatment

- **Familiar biology to WWTP operators**
- **Sustainable solution**
- **No chemicals required**
- **Operating cost not a function of concentration**
- **New higher capacity media**
- **Biofiltration can blend with landscaping**

- **Biology can be upset**
- **Biofiltration needs large area**
- **Biofiltration can blend with landscaping**

Ionization

(a.k.a. **Electro-Oxygenated Odor Control** non-thermal plasma, bipolar ionization, cold plasma, ozonation, free radicals)

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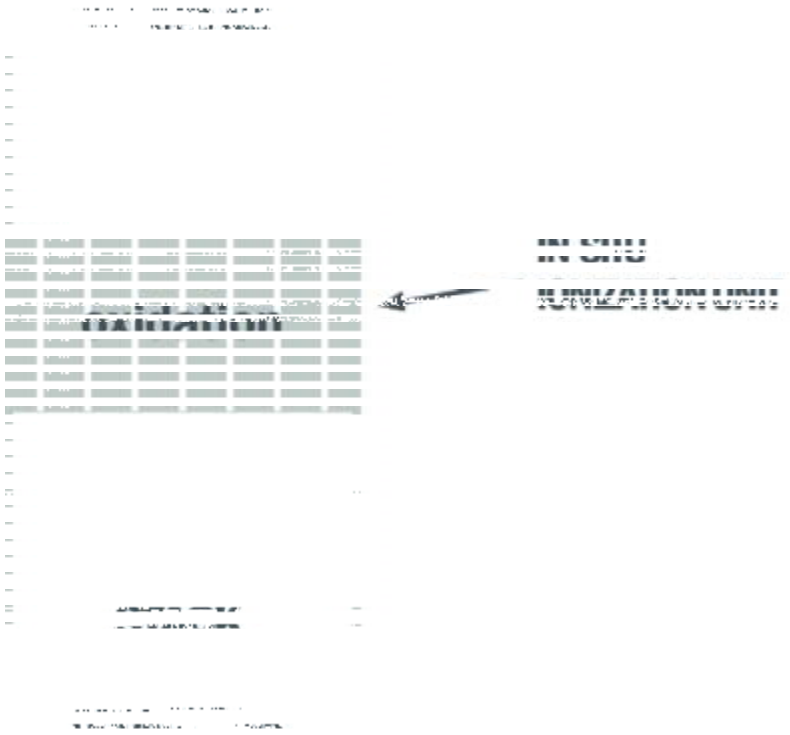
Electro-Oxygenated Odor Control

- Creates free radicals, ionized particles
- Very short particle life
- Can treat supply or exhaust air
- In-situ or ex-situ
- Inappropriate for high concentrations

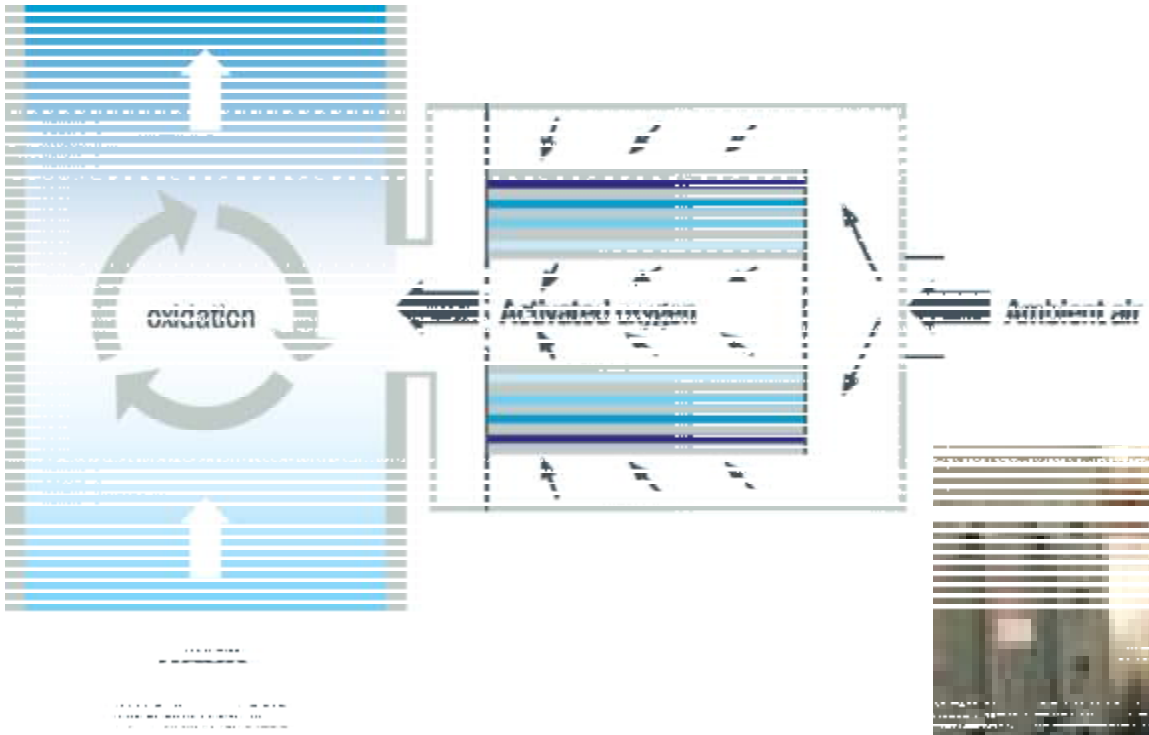
In-situ Exhaust Ionizers

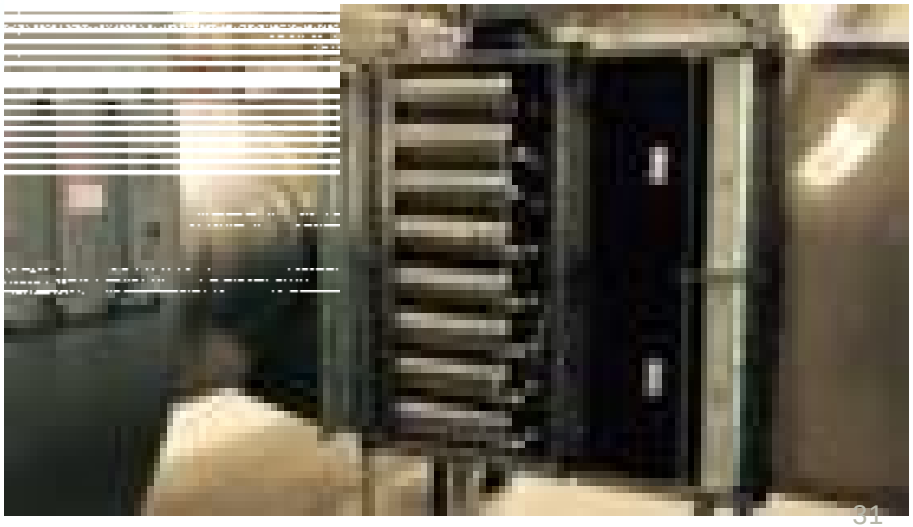
- In-situ treatment places ionizers in odorous air stream
- Two known vendors: IonO2x and Schenk (APP)
- Explosion-proof may be required
- Corrosion potential



Ex-situ Exhaust Ionizers

- Ex-situ places ionizers outside odorous air stream
- Two known vendors: Uniqair and Aerox



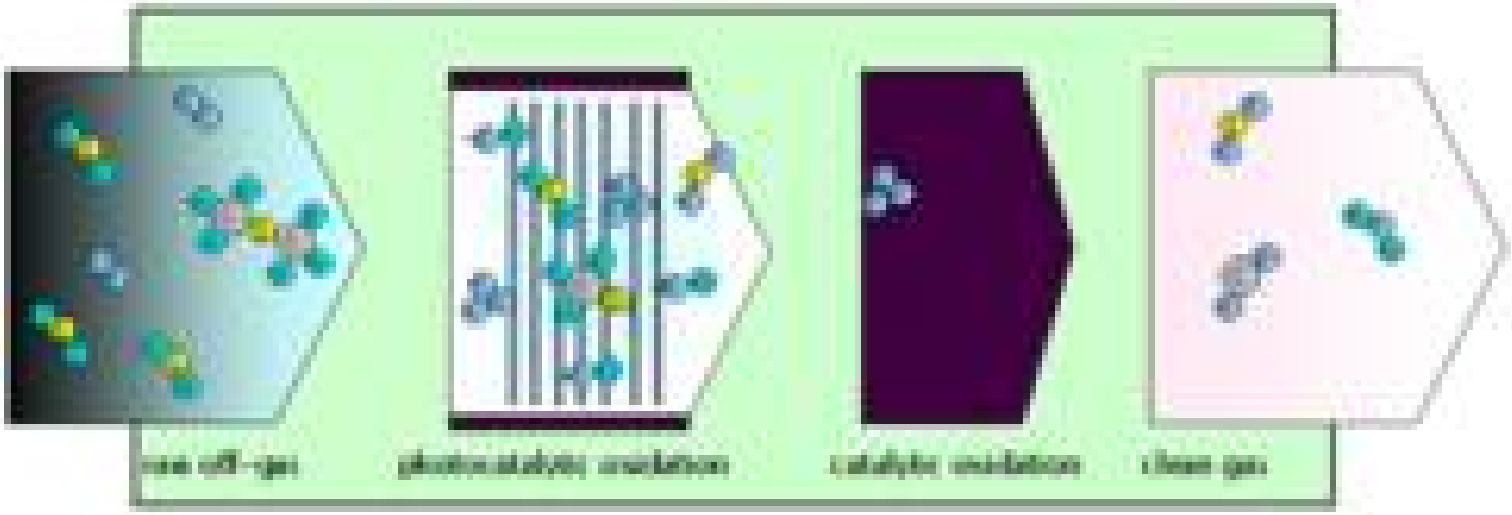


Ex-Situ Supply Ionizers

- Ex-situ supply systems place ionizers in clean outside supply side airstream
- Two known vendors: Aerisa and Transtech

Photocatalytic ionization + Carbon

- Produces free radicals using UV light
- Second stage carbon
- Used in supply or exhaust air



Hydroxyl Radical Fogging

- Creates hydroxyl radicals
- Injected into unoccupied unventilated wet well or channel
- Also provides grease removal
- Be aware of ozone corrosion issues

Pros/Cons of **Electro-Oxygenated Systems**

- Contact Material 304 SS
- Maximum temperature 170 deg F
- Upstream dust removal/particulate filter required
- Some humidity in air stream preferred
- Maximum modular capacity 60,000 cfm
- Emits some ozone; ozone sensor can provide control
- Small footprint
- Low equipment and operating cost
- VOC reduction somewhat established
- Minimal speciated compound data
- Has sometimes failed to perform
- Pilot testing essential to confirm odor reduction

Technology Comparison

	Footprint	Complexity	Capital Cost	Operating Cost
Carbon Adsorption	Medium	Simple	Medium	Medium to Large
Chemical Scrubber	Medium to Small	Complex	Medium to Large	Medium
Biofiltration	Large	Medium	Large	Low
Biotrickling Filter	Medium to Small	Simple	Medium to Large	Low
Ionization	Small	Medium	Medium	Low

Rule of Thumb Selection–based on Average Hydrogen Sulfide Concentration

	Low Concentration < 10 ppm	Medium Concentration 10 – 100 ppm	High Concentration >100 ppm
Low Flow <10,000 cfm	Adsorber Ionization	Adsorber Biofilter	Biofilter
Medium Flow 10-50,000 cfm	Adsorber Ionization	Biofilter Biotrickling filter Chemical scrubber	Biofilter Biotrickling filter
High Flow >50,000 cfm	Adsorber Biofilter Chemical scrubber	Biofilter Biotrickling filter Chemical scrubber	Biotrickling filter

Two-stage Odor Control

Chemical Scrubbers

+

Activated Carbon

Many such combinations

Wastewater Plant Odor Sources-Ranking

- **Headworks**
- **Solids Handling**
- **Primary Clarifiers**
- **Aeration Vessels**
- **Secondary Clarifiers**
- **Disinfection**

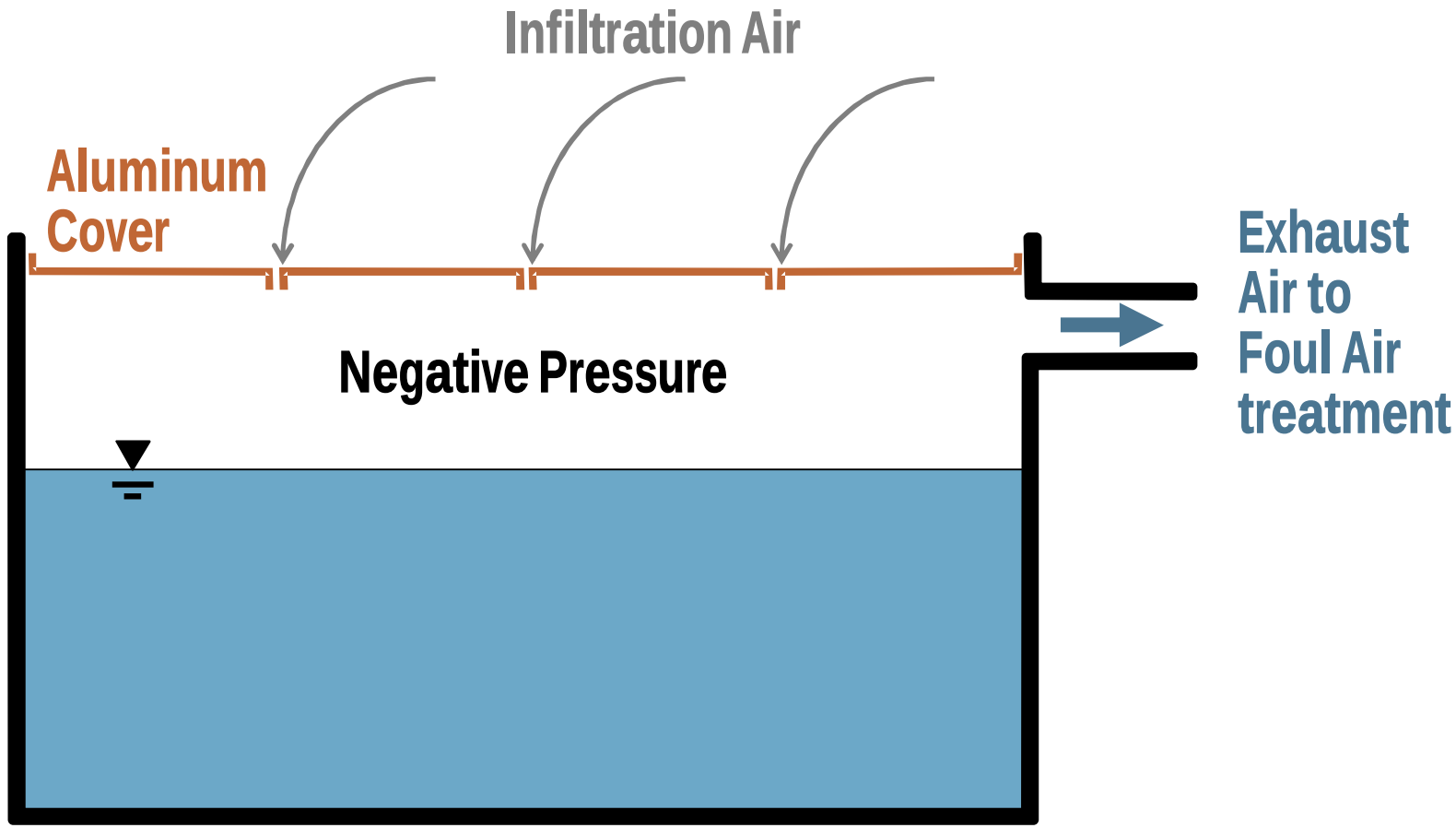
But before you treat,

Collect the odors!

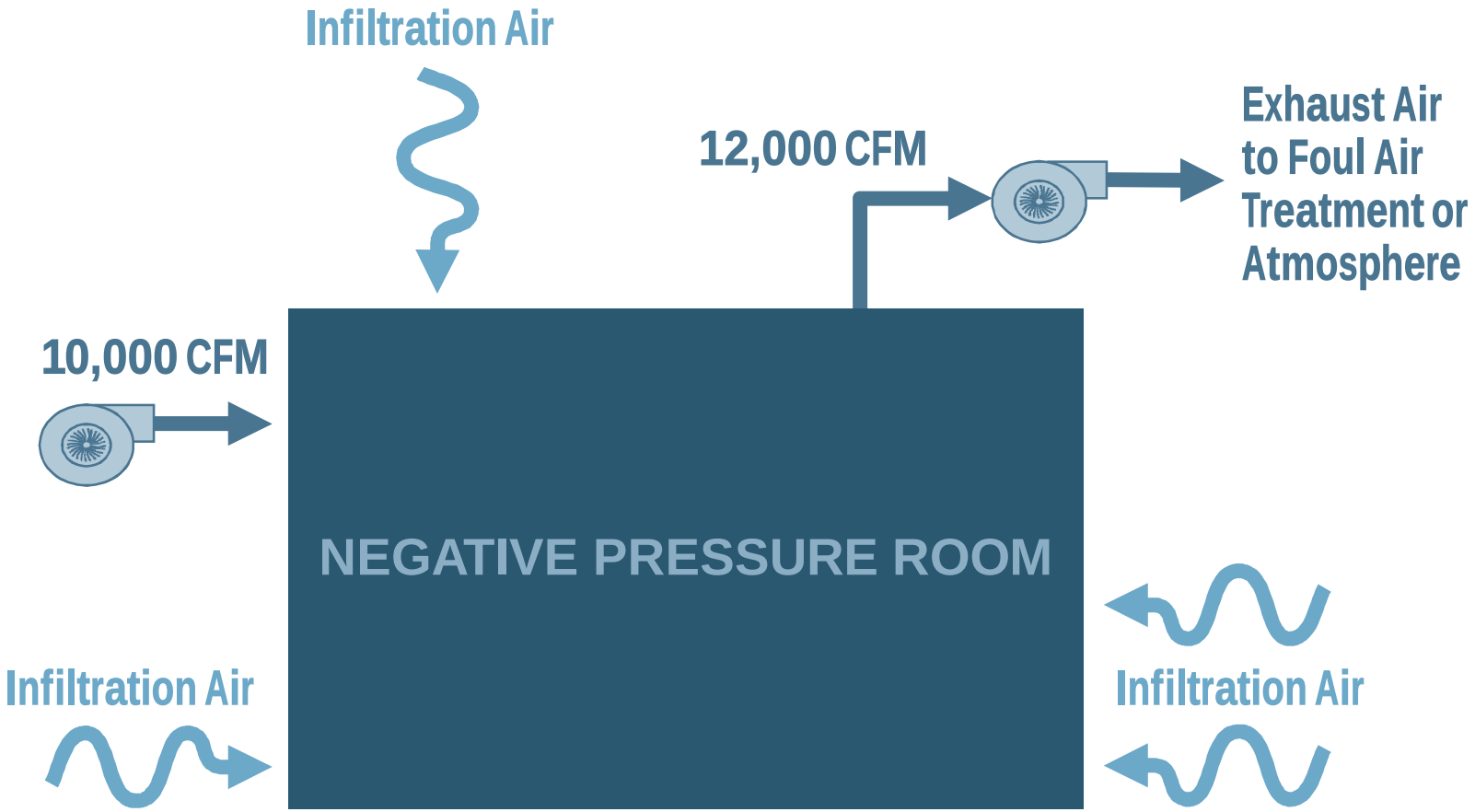
Covers and Enclosures

Extreme Covering Methods

“Collect before Treating”-Covered Process



Rooms: To contain odors exhaust must be greater than supply

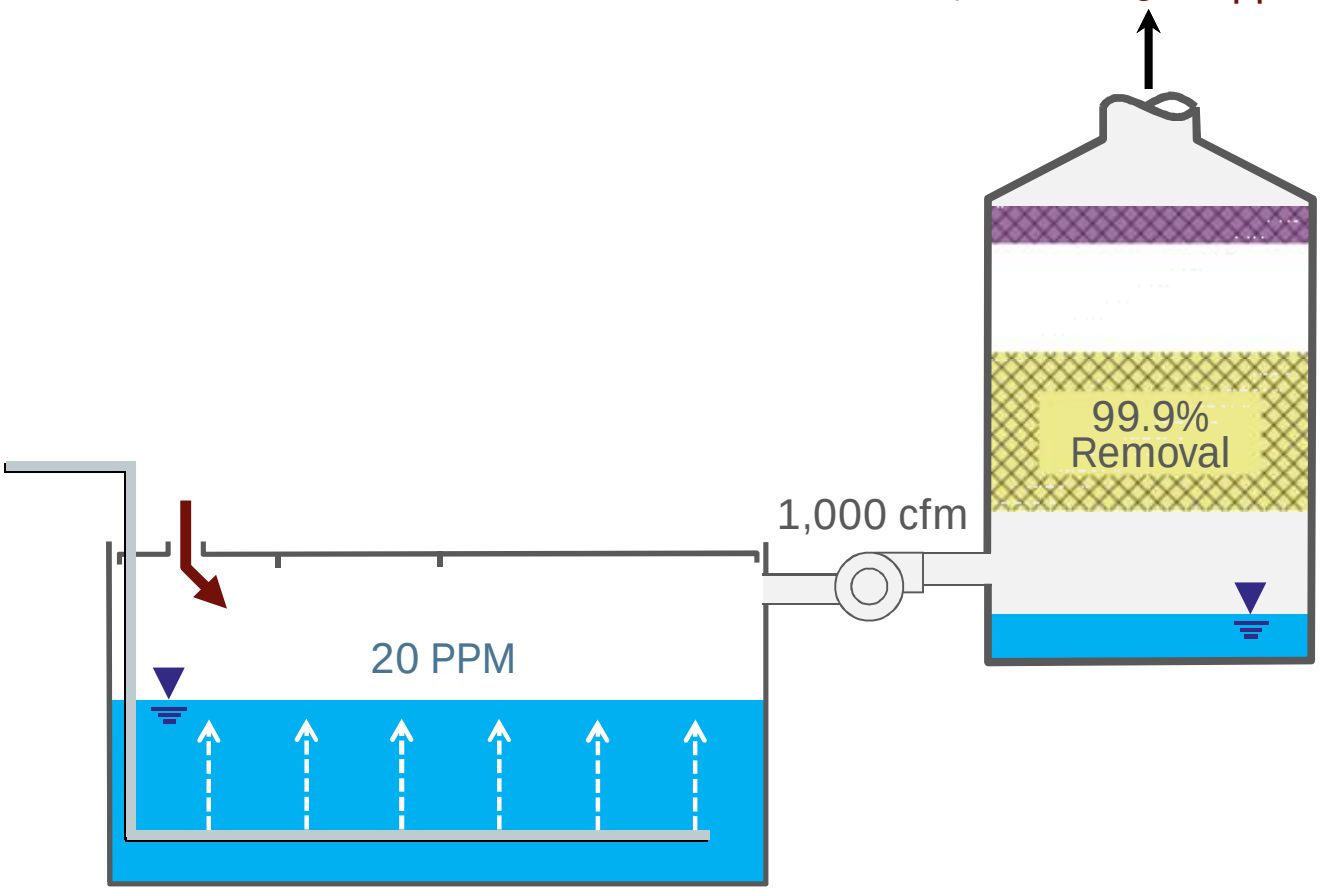


Fugitive emissions can defeat an odor strategy

The Design

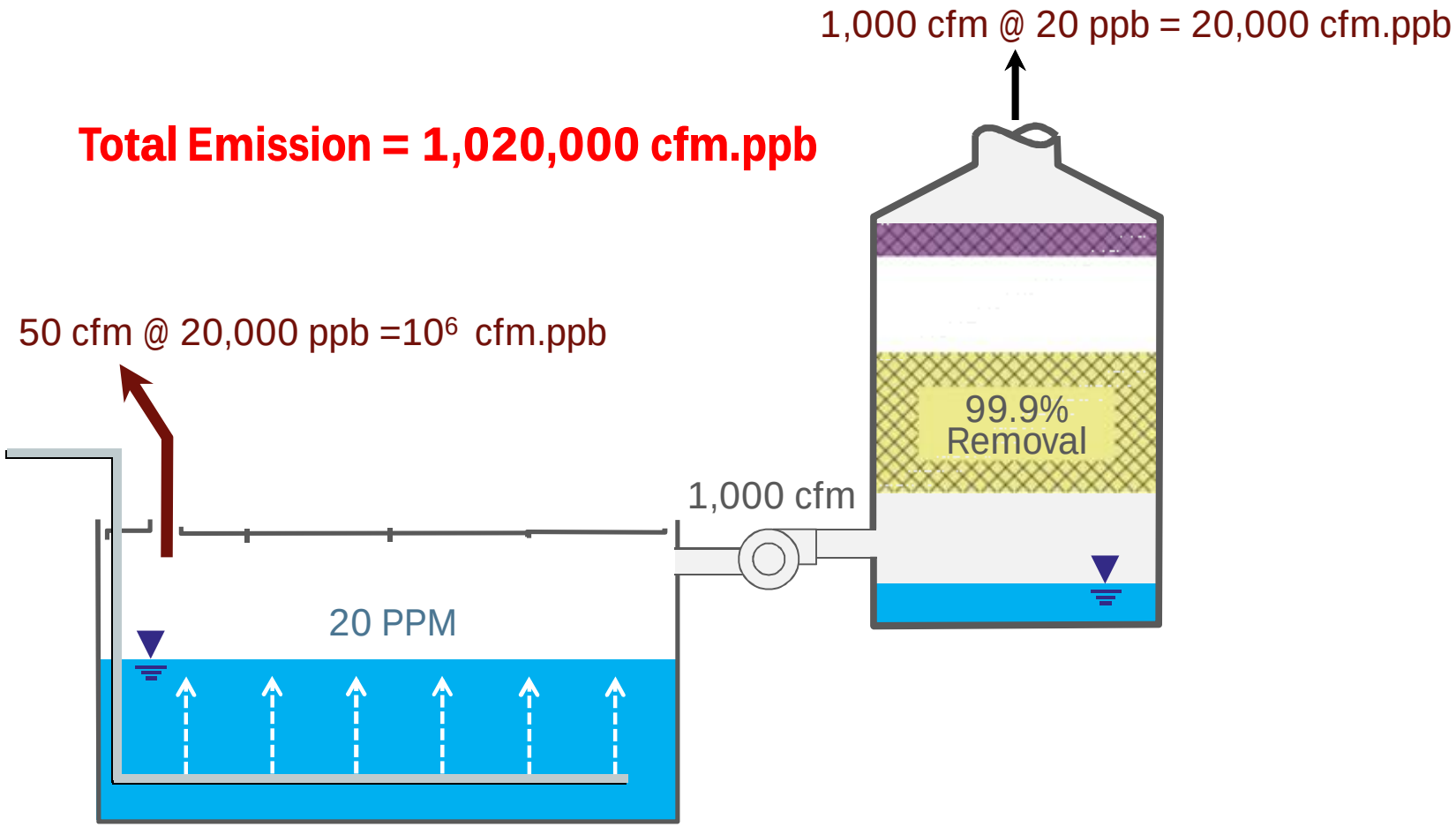
Total Emission = 20,000 cfm.ppb

1,000 cfm @ 20 ppb =20,000 cfm.ppb



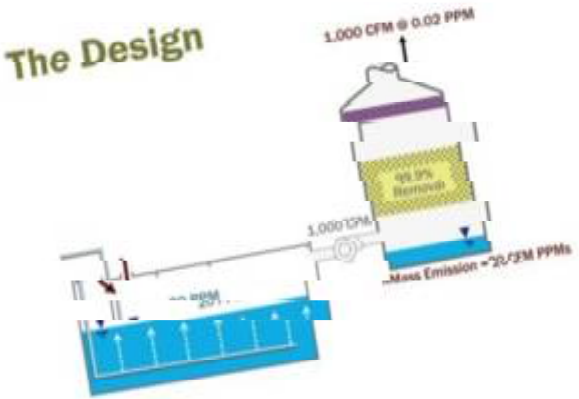
Fugitive emissions can defeat an odor strategy

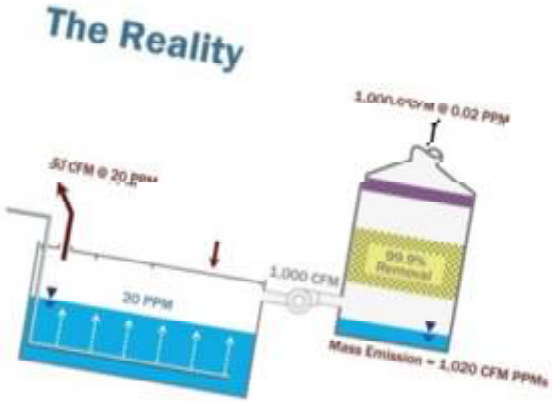
The Potential Reality



Fugitive emissions can defeat an odor strategy

	Discharged Air cfm x ppb		Emission Rate cfm.ppb		Dilution to Fence Line		Offsite Impact
The DESIGN	1,000 x 20	=	20,000	/	500 [stack]	=	40
The REALITY	1,000 x 20 + 50 x 20,000	= =	20,000 + 1,000,000	/ /	500 [stack] 20 [tank]	= =	40 + 50,000
The IMPACT			51 times greater				1,000 times greater

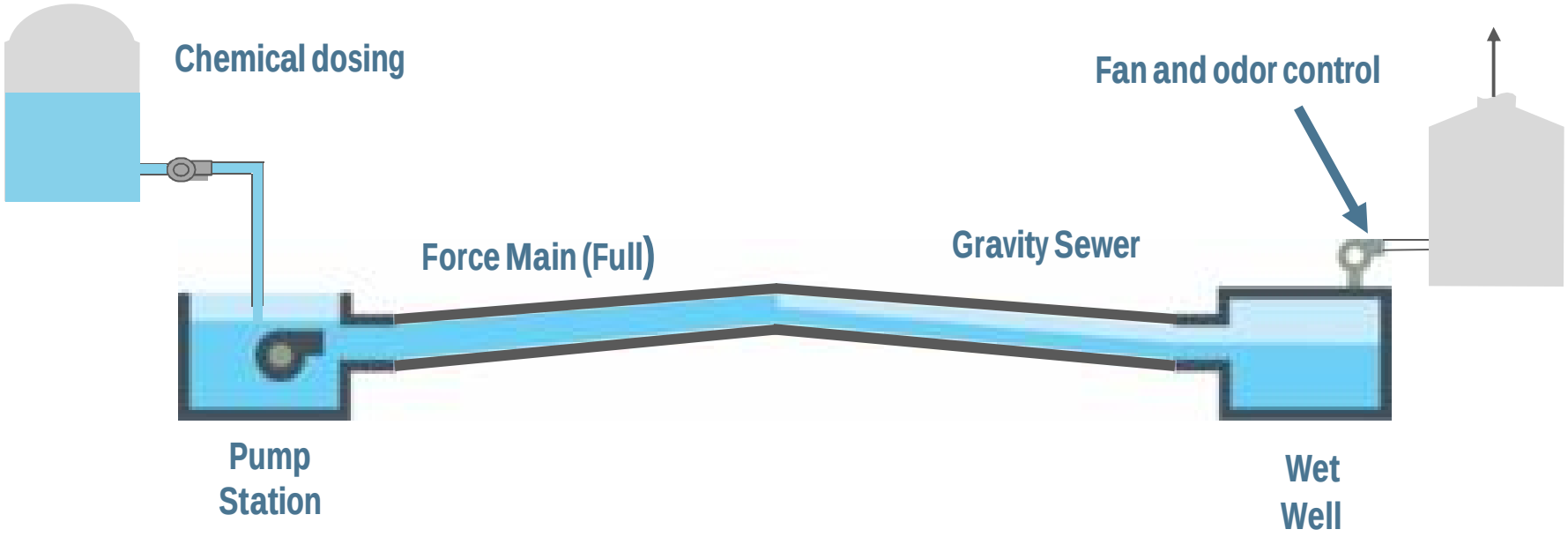




Sequence of Design: Pump Station Control

1. **Determine wet well size**
2. **Calculate Supply air flow (S)**
3. **Increase by approx 10% for exhaust air flow (E=S+10%)**
4. **Calculate air from influent (I)**
5. **Total air flow (V = E + I)**
6. **Calculate H_2S concentration**
7. **Select appropriate control system**
8. **Non-occupied: ignore outside supply air**

Balancing Odor Control Solutions



After Treatment-Dispersion

Optimum Dispersion with High Stack

Disguised Dispersion

A simple wall can be effective nasally and visually

Questions?