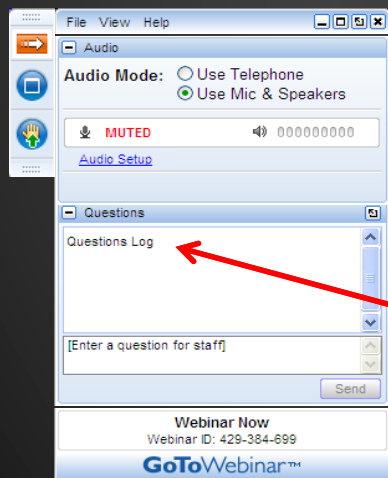




# Temporary Odor Control for Treatment Plants and Collections Systems

Thursday, February 15, 2018  
1 - 2:30 p.m. ET

## How to Participate Today



- Audio Modes
  - Listen using Mic & Speakers
  - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- Submit your questions using the Questions pane.
- A recording will be available for replay shortly after this webcast.



## Introduction to your facilitator

- Neil A. Webster, P.E.
- Webster Environmental Associates, Inc in Louisville, KY
- I am happy to be a part of this team of odor specialists to bring you our insight on how to use temporary or interim odor control measures at your facility

You can't see me but this is what I look like...



....sometimes



## Introduction to the workshop

- There are many needs for temporary odor control, such as:
  - During construction projects or replacement of existing systems
  - While doing sewer construction projects
  - As an interim measure while a permanent long term solution is completed
  - If odor complaints are occurring and something needs to be done quickly



## We have three presentations for you today

### Temporary Odor Control Topics

- Temporary Construction & Process Techniques
- Chemical Addition
- Portable Odor Control Systems



## Our Speakers Today:

- Scott Cowden, P.E.
  - Principal Technologist, CH2M/Jacobs
- Bart Kraakman, CPEng
  - Principal Technologist, CH2M/Jacobs
- Chris Hunniford, P.E.
  - V&A Consulting Engineers
- Shirley Edmondson, P.E.
  - Black & Veatch



## Next Speakers



**Scott Cowden, P.E.**

*Principal Technologist  
CH2M/Jacobs*



**Bart Kraakman, CPEng**

*Principal Technologist  
CH2M/Jacobs*



# Temporary Construction & Process Techniques



## CONTENT

PART A: Construction Techniques

PART B: Use Existing Resources

PART C: Expedite Start-up New Systems

DISCUSSION: Public Outreach Tools



## CONTENT

PART A: Construction Techniques

PART B: Use Existing Resources

PART C: Expedite Start-up New Systems

DISCUSSION: Public Outreach Tools

## Temporary Construction Techniques

### Temporary (floating) Covers - geotextile

- Low cost, synthetic fabric
- Longevity and sealing effectiveness less critical
- Example: Odorous basin + permanent cover lead time + need immediate mitigation



## Temporary Construction Techniques

### Temporary (floating) Covers - straw

- Low cost
- Creates thick barrier for reducing wind impacts
- Example: Outdoor odorous sludge storage or cake storage



Water Environment  
Federation  
*the water quality people*

## Temporary Construction Techniques

### Temporary Dispersion Enhancement- Stack

- Considerations
  - Height
    - Dispersion modeling validation
  - Season of operation
    - Beneficial to operate during off-season
  - Use of permanent bypass stack or temporary stack
  - Permit implications



Water Environment  
Federation  
*the water quality people*

## Temporary Construction Techniques

### Temporary Enhance Dispersion - Dispersion Wall

- Proven effective at increasing mixing/dilution
- Hay bales or low cost fencing
- Example: Weaker odor source located near fenceline



Photo: Dick Nilolai, SDSU

## Temporary Construction Techniques

### Temporary Ductwork Arrangement/Cut-Overs

- Key success factors
  - Routing
  - Material of construction
  - Slope
  - Cost





## Temporary Construction Techniques Sequencing Demolition and New Installation

- Goals:
  - Minimize downtime
  - Minimize containment impacts
  - Minimize ventilation reduction
  - Minimize complexity
  - Low cost
- Considerations:
  - Conduct outside of peak odor season
  - Conduct when plant flows are reduced
  - Conduct at nighttime

## Temporary Construction Techniques Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers
  - Scrubber improvements
    - Nozzle addition
    - Controls
    - Chemical Metering pumps
  - Scrubber interconnect ducting
    - Increased flexibility



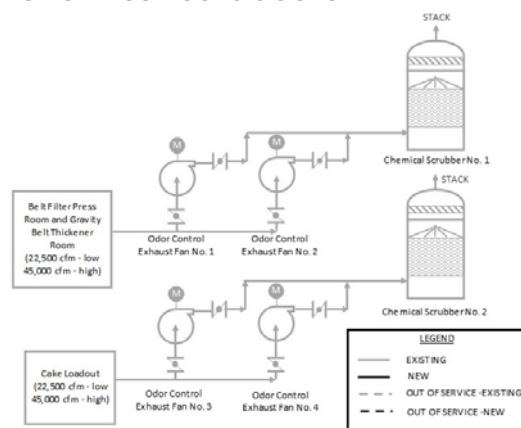
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

#### Existing System Description

- Two chemical scrubbers
- Four fans
- Low and high ventilation



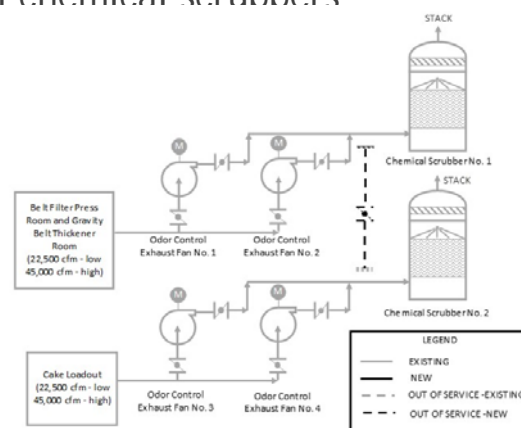
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

#### Step 1

- Install interconnect ducting
- Do not connect to existing ducting
- System remains fully operational



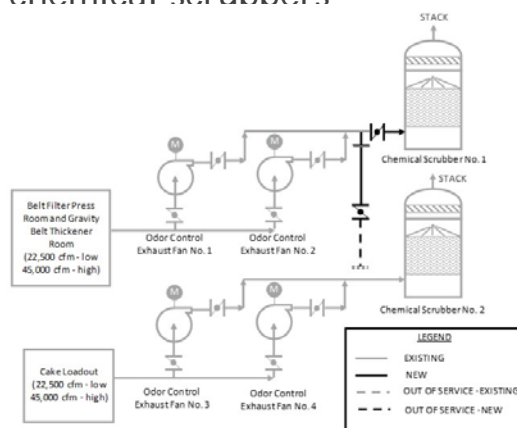
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

#### Step 2

- Connect interconnect ducting to Scrubber No. 1 inlet duct
- Install Scrubber No. 1 isolation damper
- Scrubber No.1 out of service for 24 hours



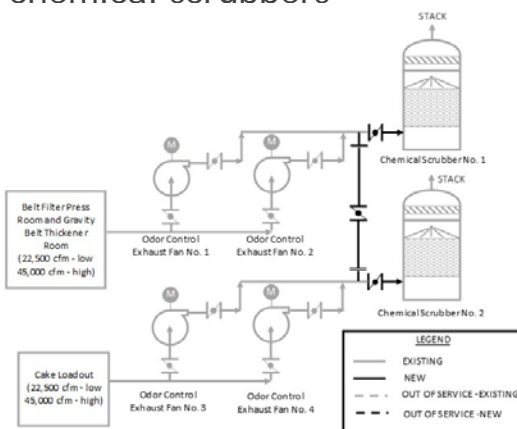
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

#### Step 3

- Connect interconnect ducting to Scrubber No. 2 inlet duct
- Install Scrubber No. 2 isolation damper
- Scrubber No.2 out of service for 24 hours



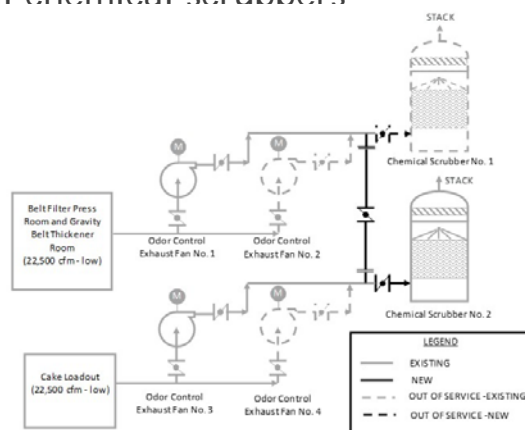
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

#### Step 4

- Isolate Scrubber No. 1
- One of each pairs of fans out of service
- Reduced ventilation
- Scrubber No. 1 mods made



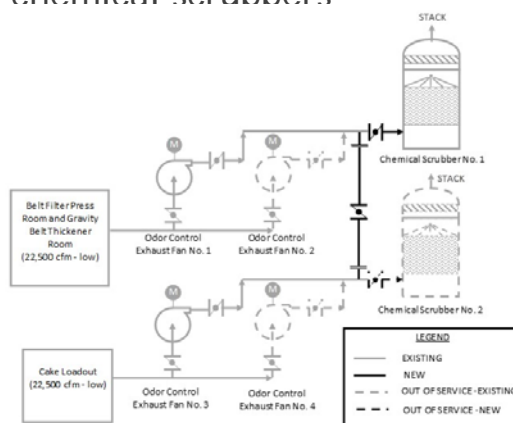
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

#### Step 5

- Isolate Scrubber No. 2
- One of each pairs of fans out of service
- Reduced ventilation
- Scrubber No. 2 mods made



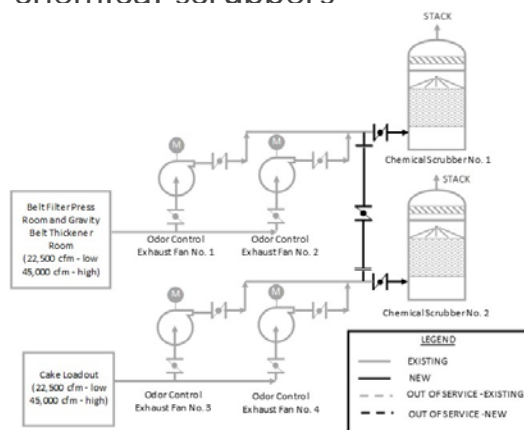
## Temporary Construction Techniques

### Sequencing Demolition and New Installation

- Case Study: Dual chemical scrubbers

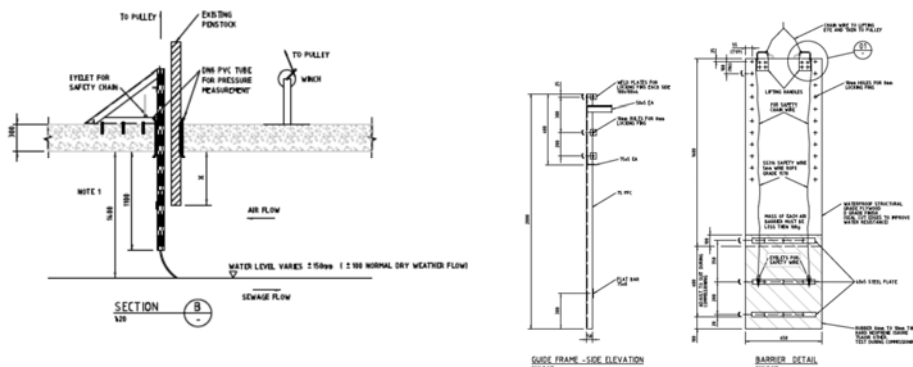
#### Step 6

- All fans and scrubbers put back in service
- Full ventilation
- System provided with maximum flexibility



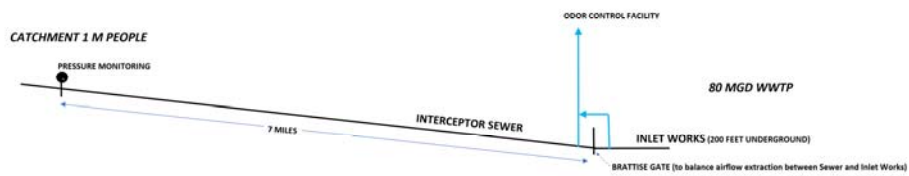
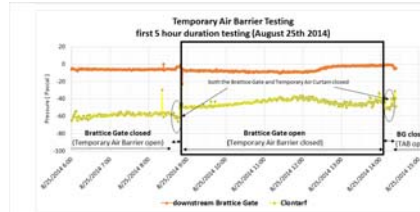
## Temporary Construction Techniques

### Temporary Air Curtains - plywood with rubber flap



## Temporary Construction Techniques

### Temporary Air Curtains - with online dP monitoring



## CONTENT

PART A: Construction Techniques

PART B: Use Existing Resources

PART C: Expedite Start-up New Systems

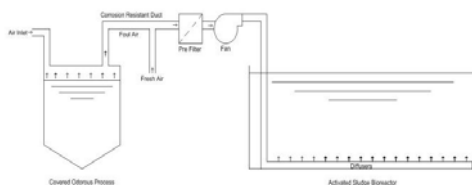
DISCUSSION: Public Outreach Tools

## Use Existing Resources

### Temporarily inject odorous air in the aeration tank

#### Activated Sludge Diffusion

- Oxygen supply (normally ambient air) now foul air extracted from odorous processes
- Activated sludge perform biological degradation of odorous compounds contained in the foul air
- has been practiced at over 50 wastewater treatment sites in United States of America (USA) as permanent solution

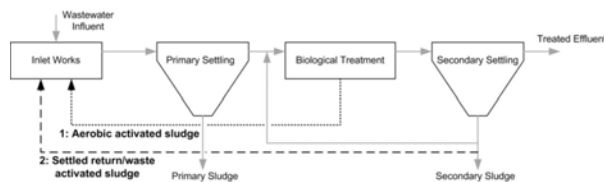


## Use Existing Resources

### Temporary inject activated sludge into the inlet channel

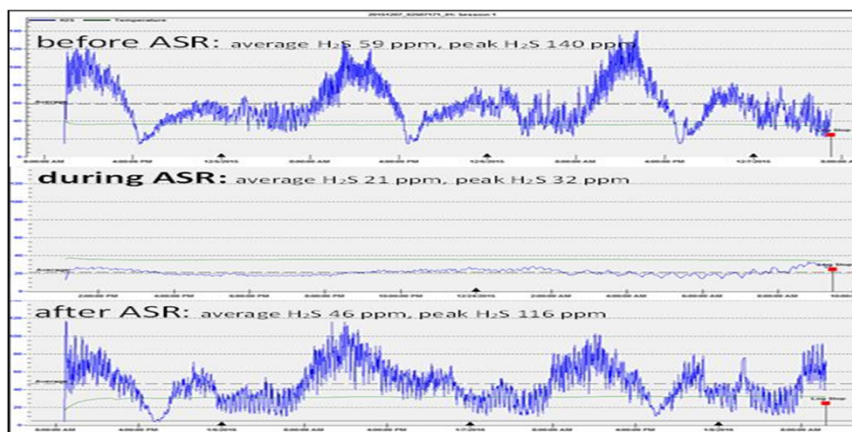
#### Activated Sludge Recycle

- activated sludge (RAS/WAS) or mixed liquor (ML) transferred to Inlet Works.
- Adsorption to the activated sludge flocs followed by oxidation of potential malodorous compounds as well precipitation are the mechanisms.



## Use Existing Resources

Temporary inject activated sludge into the inlet channel



## Use Existing Resources

Biologically Seeding Dewatered Biosolids

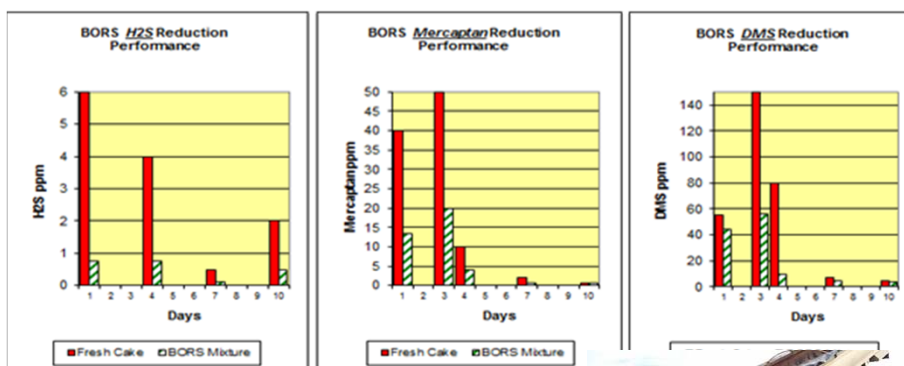


Figure: BORS process odorous compound reduction performance results.





## CONTENT

PART A: Construction Techniques

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DISCUSSION: Public Outreach Tools



## Expedite Start-up New Systems

### Shorten start-up time of biological systems

- a. Add fresh activated sludge
  - a. Mixed Liquor
  - b. WAS
  - c. RAS
- b. add thiosulphate as growth media for H<sub>2</sub>S degrading bugs
  - two weeks before connecting foul air source
  - thiosulphate is powder, non-hazardous and odorless
- c. pre-growth odor degrading bugs in biosolids processing building
  - for more difficult to remove odorous compounds such as DMS and DMDS
  - Aerate RAS in two in-series 60 gallon drums with odorous air from sludge processing bldg



## CONTENT

PART A: Construction Techniques

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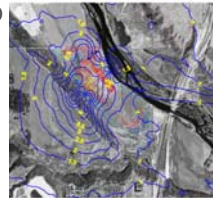


## Public Outreach Tools

Through the employment of effective public outreach tools, it is possible to establish a relationship with the community and develop a forum to discuss their concerns, demystify the operations, and build trust.

Effective methods of establishing a positive relationship

- Training staff to communicate policies effectively
- Use established odor compliant procedures
- Newsletters and Webpages
- Open house tours and public meetings
- Smartphone apps to record and communicate the presence of odors
- Support citizen advisory functions
- Odor surveys and logs



## SUMMARY

- Different examples of Temporary Construction & Process Techniques presented:
  - temporary construction techniques
  - use of existing resources
  - techniques to minimize downtime or enhance start-up of new equipment.
- Public outreach tools discussed.

## Next Speaker



**Chris Hunniford, P.E.**

*V&A Consulting Engineers*



# Chemical Addition as an Interim Solution



## Overview

- Application Considerations
- Available Technologies
- Equipment Requirements
- Safety



## Chemical Addition

- Liquid Phase Treatment
  - Sulfide Control
- Advantages
  - Low Capital Cost
  - Small Footprint
  - Flexibility
- Cost Basis
  - \$2 to \$5 / lb Sulfide Treated
  - $S^{2-}$  Load [lb/day] = Q [MGD] X  $S^{2-}$  Conc. [mg/l] X 8.34



## Application Considerations

- Purpose
  - Temporary Operational Change
  - Health & Safety Issues
  - Delivery of Permanent Solution
- Treatment Objectives
  - Odor Mitigation
  - Hydrogen Sulfide Reduction
  - Long vs. Short Range Control
- Time Frame
- Siting Considerations
  - Footprint
  - Utilities



## Technology Categories

- Chemical Oxidants
- Alternative Oxygen Sources
  - Nitrate Salts
  - Oxygen Injection
- Iron Salts
- pH Adjustment



## Oxidants

- Oxd/Red Reaction
  - Low Reaction Times
    - Source Control
    - Non-Specific
  - High Dose Rates
    - > Stoichiometric
  - Ineffective over Long Distances
- Hypochlorite
  - Peroxide
  - Permanganate



## Alternative Oxygen Sources

- Alternative to Sulfate
  - $O_2 \rightarrow NO_3^- \rightarrow SO_4^{2-}$
  - Specific to  $H_2S$
- Biochemical Reaction
  - Long Detention Times
  - Can be overdosed
- Nitrate
  - Maximize Removal
- Oxygen
  - Forcemain Application



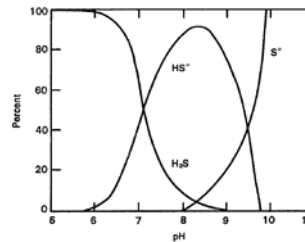
## Iron Salts

- Sulfide Precipitation
  - 0.1 mg/l limit
- Short Reaction Times
  - Can be overdosed
- Ferrous Salts
  - $Fe^{++} + S^{2-} \rightarrow FeS$
- Ferric Salts
  - $2Fe^{+++} + 3S^{2-} \rightarrow Fe_2S_3$



## pH Adjustment

- Sulfide Equilibrium
  - pH 7: 50% as  $\text{H}_2\text{S}(\text{aq})$
  - pH 8: 10% as  $\text{H}_2\text{S}(\text{aq})$
- Does Not Eliminate  $\text{S}^{2-}$
- Long Distance Control
- Magnesium Hydroxide
  - 50 to 100 gallons / MGD
- $\text{S}^{2-} > 10 \text{ mg/l}$



## Equipment Requirements

- Storage Tanks
  - Capacity
- Feed Pumps
  - Controls
  - Feedback
  - Remote Monitoring
- Feed Line
  - Dosing Point
- Mobility





## Safety

- Security
- Secondary Containment
  - Leak Detection
- Health & Safety
  - Hazardous Chemicals
  - Hydrogen Sulfide Exposure
- WWTP Impacts
  - Advanced Biological Treatment
  - Solids



## Next Speaker



**Shirley Edmondson, P.E.**

*Process Engineer  
Black & Veatch*





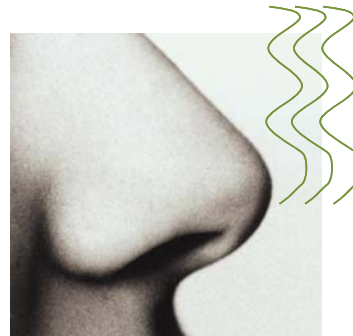
## Portable System Applications

- Temporary odor control
  - Treatment plants and collection systems
  - Scheduled maintenance or repair
  - During construction
  - Demo of existing system



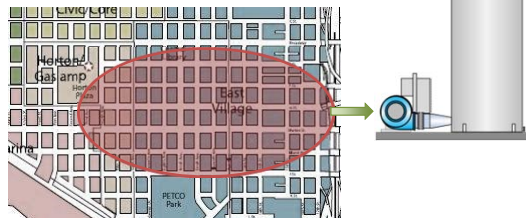
## Portable System Applications

- Emergency response
  - System malfunction
  - Permit violation
  - Odor complaints
- Pilot testing



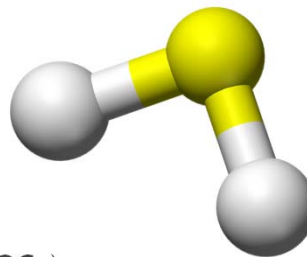
## Portable System Applications

- Mobile testing of collection systems
  - Fan testing with VFDs
  - Determine “zone of influence”
  - Install pressure devices in manholes throughout collection system
  - Modulate airflow to determine impacts
  - Could potentially eliminate need for a second odor control facility by providing enough airflow



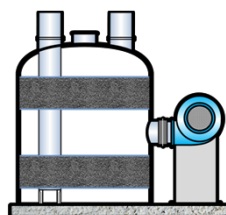
## Types of Portable Systems

- Technologies available
  - Primarily dry media/carbon
    - Easy to operate
    - Minimal components
    - Pre-filter recommended
  - Biological systems
- Odorants treated
  - Hydrogen sulfide (H<sub>2</sub>S)
  - Volatile organic compounds (VOCs)



## Types of Portable Systems - Skid Mounted Carbon Unit

- Delivery: Units transported to site and unloaded with fork lift or crane
- Benefits:
  - Well suited for small to moderate capacity applications
  - Capacity range: 100 to 5,000 cfm
  - Available in both single bed and dual bed configurations
  - Ability to add media if breakthrough occurs
- Limitations:
  - Requires means to unload from truck (or can leave on trailer)
  - Not well suited for higher airflows



## Types of Portable Systems - Skid Mounted Carbon Unit

### Example Sizing



	MODEL	DIAMETER	CFM	L x W x H
<b>SINGLE BED</b>	DAS-300	3' - 0"	100-300	9' x 5' x 8'
	DAS-500	3' - 6"	300-500	10' x 5' x 8'
	DAS-750	4' - 6"	500-750	11' x 7' x 8'
	DAS-950	5' - 0"	750-1000	12' x 7' x 9'
	DAS-1400	6' - 0"	1000-1400	13' x 8' x 9'
	DAS-1900	7' - 0"	1400-1900	15' x 8' x 10'
<b>DUAL BED</b>	DAD-2800	6' - 0"	1900-2800	13' x 8' x 12'
	DAD-4000	7' - 0"	2800-4000	15' x 8' x 12'

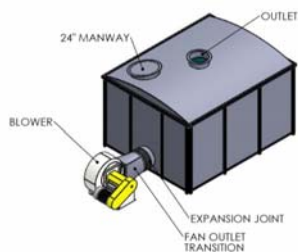
## Types of Portable Systems - Trailer Mounted Carbon Unit

- Delivery: Towed by heavy-duty truck
- Benefits:
  - Includes fan and pre-filter
  - Easily transportable
  - Quick setup - remains on trailer
  - Low profile
  - Available for small systems (up to 1,500 cfm)
  - Available for larger systems (5,000 cfm and 12,500 cfm)
  - Ability to add media if breakthrough occurs
  - Well suited for fan testing
- Limitations:
  - Security measures recommended to prevent theft
  - Only available at specific airflows



## Types of Portable Systems - Trailer Mounted

- 5,000 cfm and 10,000 cfm units
- VFD (turndown to 500 cfm)
- Sound attenuation
- Stainless steel fan
- 3' media bed depth
- Easily transitions to a permanent installation
- Ability to link vessels together for airflow expansion



## Types of Portable Systems - Trailer Mounted

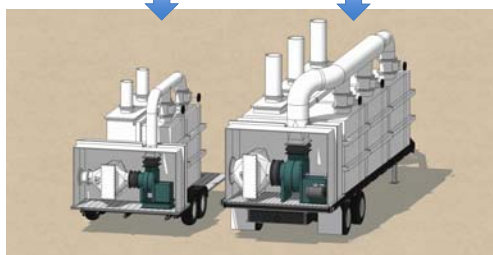
Example Sizing



1,000 cfm; 8.5' W x 16' L x 8.5' H



5,000 cfm; 8.5' W x 27' L x 9' H



Courtesy of Daniel Company



## Types of Portable Systems - Roll-off Container

- Delivery: Use of specialized trucks
- Benefits:
  - Transported with carbon inside
  - Unloading equipment not required
  - Deep carbon bed depth (min 3 ft.)
  - Well suited to large capacity applications
  - Wide capacity range: 5,000 to 18,000 cfm
- Limitations:
  - Separate trailer/skid required for fan and power
  - Media change-out requires new truck delivery
  - Difficulty moving from site to site



Courtesy of Pure Air



Courtesy of Evoqua



## Types of Portable Systems - Roll-off Container

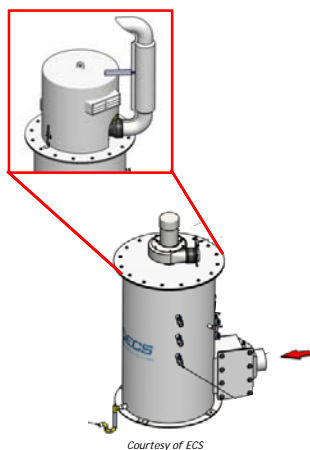
### Example Sizing

CAPACITY	DIMENSIONS (LxWxH)	OPERATING WEIGHT
5,000 cfm	9' x 8' x 9'	10,220 lbs
9,000 cfm	21' x 8.5' x 7'	17,500 lbs
12,000 cfm	21' x 8.5' x 8.5'	30,500 lbs
18,000 cfm	22' x 8.5' x 8.5'	23,500 lbs



Courtesy of Evoqua

## Types of Portable Systems - Low Capacity Carbon Units



- Delivery: Typically intended for permanent installations, but small size makes it suitable for a portable application
- Benefits:
  - Small footprint and light weight
  - Top mounted direct drive fan
  - Integral pre-filter
  - Low maintenance
  - Optional sound attenuation

#### Limitations:

- Available for low capacity: 100 to 1,500 cfm

Courtesy of ECS



## Types of Portable Systems - Biological Systems



- Ideal for pilot systems or long term lease
- Benefits:
  - Refine equipment selection and media type for permanent installation
  - Offers biological treatment with carbon polishing for enhanced odor removal
- Limitations:
  - Lease needs to be scheduled in advance
  - Not well suited for emergency response
  - Not as readily available as other types of portable odor control systems

## Additional Considerations

- Foul air source and location
  - Remote vs. existing facility
- Power source
  - Tie into existing MCC
  - Portable generator
- Security
  - Lights
  - GPS locator device
  - Wheel boot
  - Temporary fencing



## Additional Considerations

- Sound attenuation
  - Fan enclosures
  - Generator exhaust silencers
- Material
  - FRP vessels are durable and cost effective
  - Fans can be provided in either FRP or stainless steel
- Flow adjustment
  - VFDs can be provided



## Additional Considerations

- Max airflow capacity
- Media selection
  - Odorants to be treated
  - Odorant concentration
- Media life dependent on factors noted above, along with temperature and humidity



MEDIA	ADVANTAGES	DISADVANTAGES
High Capacity	<ul style="list-style-type: none"> <li>• Highest H<sub>2</sub>S removal/cc (0.3 g/cc)</li> </ul>	<ul style="list-style-type: none"> <li>• High media cost</li> </ul>
Potassium Permanganate (KMNO <sub>4</sub> ) Alumina	<ul style="list-style-type: none"> <li>• Good removal of organo-sulfurs</li> </ul>	<ul style="list-style-type: none"> <li>• Vulnerable to moisture</li> <li>• Moderate H<sub>2</sub>S removal capacity (0.06-0.11 g/cc)</li> </ul>
Virgin Coconut	<ul style="list-style-type: none"> <li>• Best removal of wide suite of compounds</li> <li>• Low media cost</li> </ul>	<ul style="list-style-type: none"> <li>• Lowest H<sub>2</sub>S capacity (0.06 g/cc)</li> <li>• Higher pressure drop</li> </ul>

## Additional Considerations



- Cost
  - Freight and delivery
  - Rental/lease cost
  - Option to purchase
- Lead time and delivery

## Example Costs

SYSTEM TYPE	AIRFLOW	MOBILIZATION/ DEMOBILIZATION	COST PER MONTH (3 MONTH RENTAL)	OPTIONAL VFD COST	OPTIONAL TRAILER RENTAL COST PER MONTH	MEDIA VOLUME (CF)
Trailer-mounted	1,000 cfm	\$1,900/\$1,900	\$2,650	\$400	Included	35
Skid-mounted	4,000 cfm	\$2,900/\$2,900	\$4,500	\$700	\$1,500	150
Roll-off Container	15,000 cfm	\$3,900	\$7,450	\$1000	\$2,500	570

*Courtesy of Pure Air Filtration*

**Exclusions:**

- Shipping
- Tax
- Media (unit cost varies by type)
- Power
- Costs will vary by vendor

## Facility Design Considerations

- Design to accommodate temporary odor control
- Retain space
- Equipment bypass
- Duct isolation dampers
- Duct blind flange connections



Water Environment  
Federation  
*the water quality people*

## Albuquerque Bernalillo County Water Utility Authority - Portable Odor Control Units

- Purpose is for temporary odor control on collection system projects
- Two systems were purchased in 2017; 1,000 cfm and 5,000 cfm units with carbon vessels mounted on a trailer that can be hauled by heavy duty pick up trucks

 Albuquerque Bernalillo County  
Water Utility Authority

Water Environment  
Federation  
*the water quality people*

## Objectives Set by ABCWUA

- Good performance and flexibility with redundancy
- Two sources of power: portable generator or from power grid like an MCC at a Lift Station
- Meet DOT requirements
- High level of theft prevention
- Quiet fan and generator

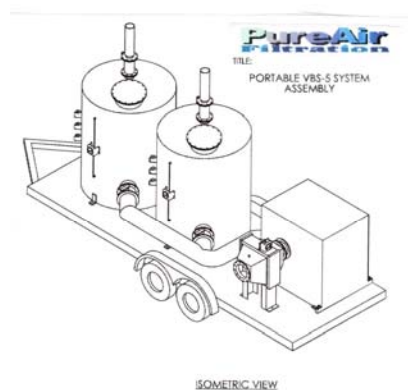


## System No. 1

1,000 cfm unit

- Two 5 ft diameter vessels (one fully redundant)
- 5 HP fan with sound enclosure
- Moisture and grease trap
- High H<sub>2</sub>S capacity carbon
- Control panel
- Cords to plug into generator or utility power
- 20 ft long trailer

Unit built by PureAir  
Filtration

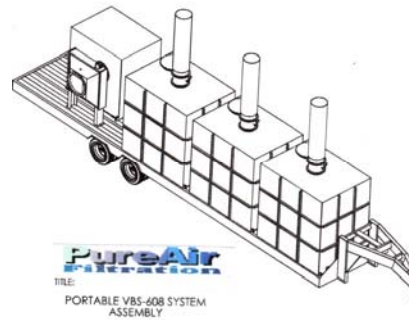


## System No. 2

### 5,000 cfm unit

- Three 6 ft by 8 ft rect vessels (one fully redundant)
- 20 HP fan with sound enclosure
- Moisture and grease trap
- High H<sub>2</sub>S capacity carbon
- Control panel
- Cords to plug into generator or utility power
- 40 ft long trailer, 8.5 ft wide, 30,000 lbs G.V.W.R.

Unit built by PureAir Filtration



## Other Components

### Theft Prevention

- Motion sensor flood lights
- Locks on wheels and trailer hitch
- GPS tracking device with 12 V battery charger
- Locks on control panel

Manhole Lid Adaptor and flexible duct with connections to inlet of fan



# 39 KVA/31 KW Generators

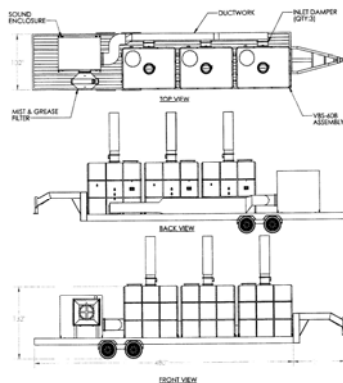


65 dB(A)  
 24 hour fuel tank  
 Hauled separately from Portable Unit

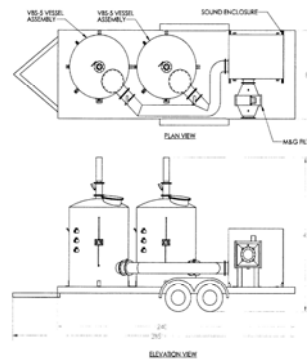


# Layout Diagrams

5,000 cfm  
 \$182,000 complete



1,000 cfm  
 \$62,200 complete



## 5,000 cfm Unit



## 1,000 cfm Unit





