Paul Matrka

Smith Environmental

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Ewh! What Stinks?!!!

Odor Control in the 21st Century

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Fact:

There will be odors wherever there is the
Collection
Transport
&
Treatment of Wastewater

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Odor Control
Why is it Important?

- Steady encroachment of development on treatment plants
- Address community complaints
- Health and safety of plant operators
- Good neighbor policy

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Primary Sources of Odors

- Collection System
- Headworks and Primary Treatment
- Solids Handling

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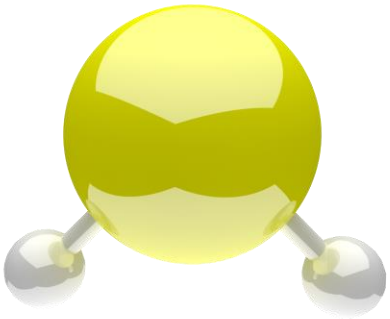
Typical Odors Found in Wastewater Treatment

Hydrogen Sulfide H_2S

- Formed by organic reduction of organic sulfur compounds under anaerobic conditions
- Rotten egg smell
- Low solubility in wastewater
- Colorless gas
- Low concentration odor threshold
- Corrosive
- Potentially toxic



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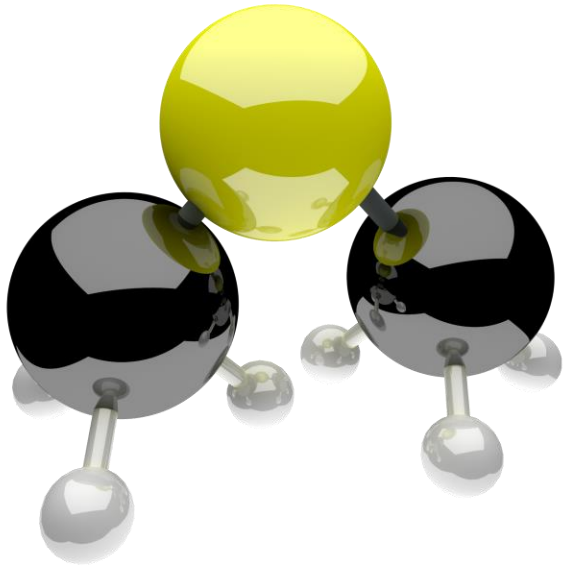
Typical Odors Found in Wastewater Treatment

- Dimethyl-Sulfide

- Volatile organic compound
- Slightly soluble in water
- Disagreeable odor – cabbage like
- Component of bad breath



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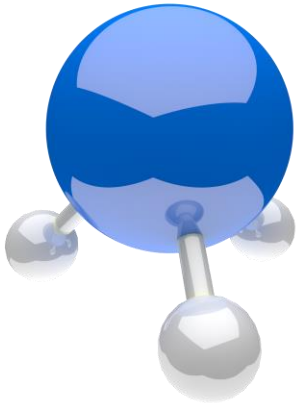
Typical Odors Found in Wastewater Treatment

Ammonia NH_3

- Putrid smell associated with cat urine
- Sources contributing to Ammonia in wastewater are human urea, food processing, pharmaceutical manufacturing
- Produced in anaerobic digestion



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Typical Odors Found in Wastewater Treatment

Mercaptans

- Methanethiol
- Pungent smell of rotting cabbage
- Added to natural gas to give it an odor
- Very low odor threshold – ppb

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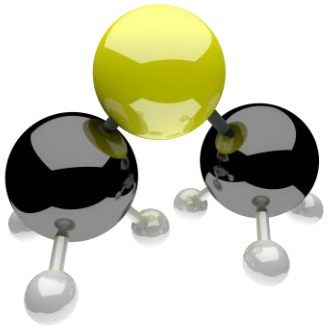
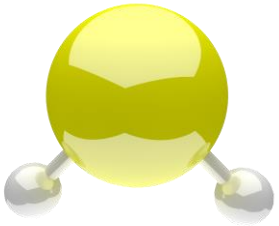
Collection System



Dimethyl Sulfide $(CH_3)_2S$



Hydrogen Sulfide H_2S

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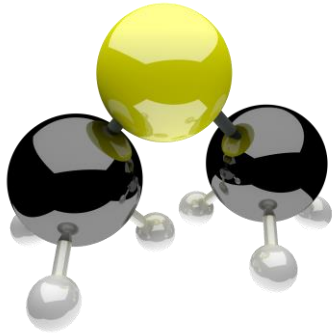
Primary Treatment



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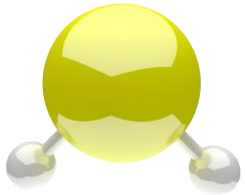

Hydrogen Sulfide H_2S

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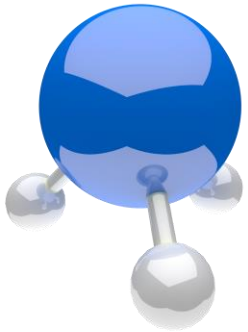
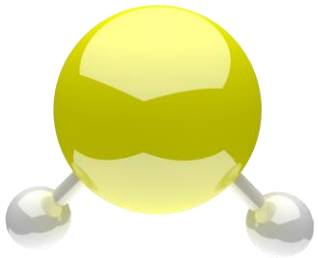
Solids Handling



Ammonia NH_3



Hydrogen Sulfide H_2S

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Quantifying Odors

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Basic Guide to Odor Control Technologies

There are a limitless number of odor control problems. It is impossible to identify one technology as the best solution for all of them.

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Vapor Phase Technologies

Treats the Air Stream

- Chemical Scrubbers
- Biofilters
- Carbon Filters
- Photoionization

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Chemical Scrubbers

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Chemical Scrubbers

- Works on water soluble compounds
- Reliable technology
- Purely chemical process
- 90% removal efficiency

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Chemical Scrubbers

Mechanism of Action

- Sodium Hydroxide – Solubilizes H_2S
- Sodium Hypochlorite oxidizes remaining sulfur compounds
- Scrubber is packed with media
- Chemicals flow down through packed bed while odorous air flows up through the bed
- Chemicals are recirculated through tower

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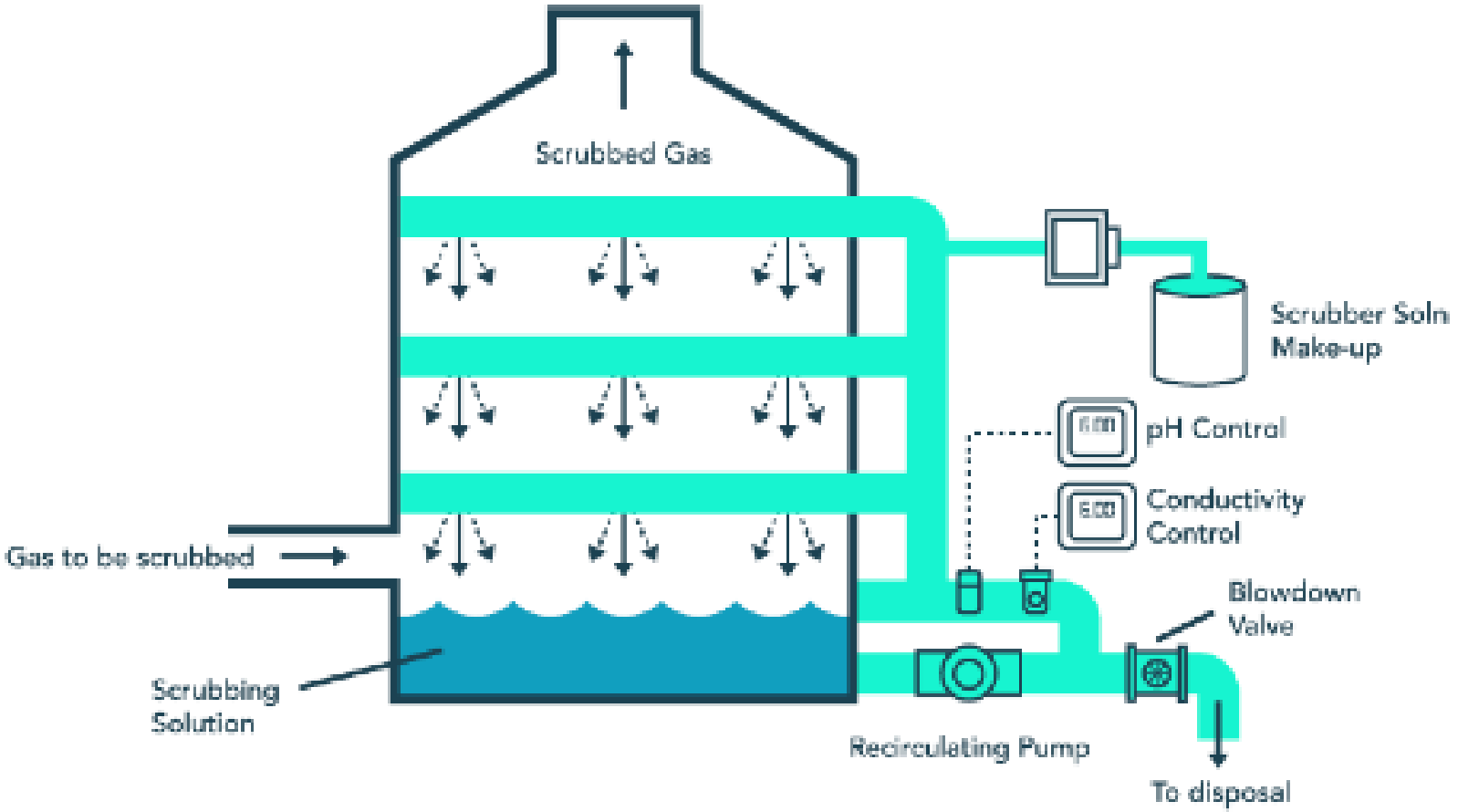
Chemical Scrubbers



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Chemical Scrubbers

Pros:

- Purely chemical process provides consistent results
- 90% removal efficiency

Cons:

- Chemicals are expensive
- Mechanical components, recirc pump and chem feed pumps must be maintained
- Mechanical components must be protected from freezing

Biofiltration

Removes biodegradable water soluble odors

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Biofiltration

Mechanism of Action

- Odorous compounds are solubilized on filter media
- Compounds are then degraded by bacteria on the media
- Sized based Empty Bed Residence Time EBDT
- Typical EBDT is 45 seconds

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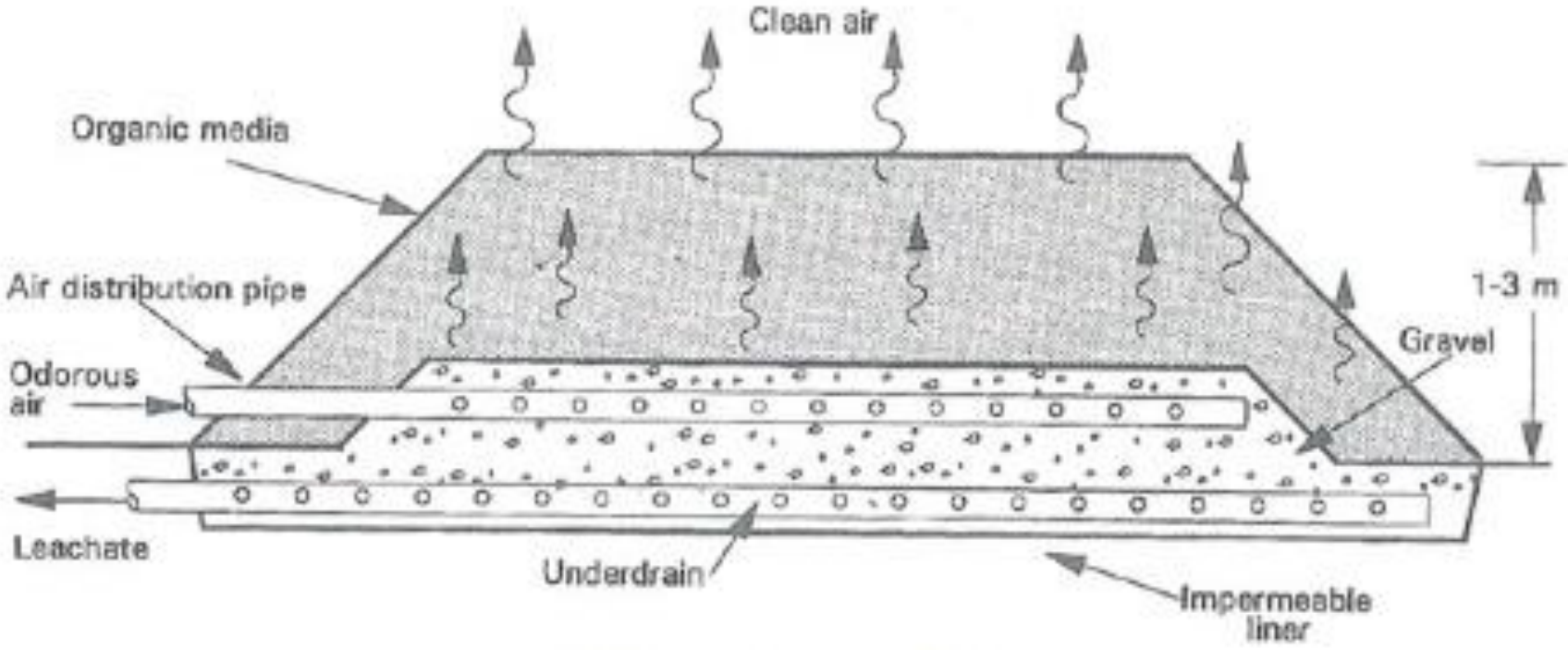
Biofiltration



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Biofiltration

Media is typically shredded wood or mulch. Synthetic media is also used to allow for shorter bed residence time.

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Biofiltration

Pros:

- Simple process good for consistent odor compounds and concentrations
- Typically low capital cost

Cons:

- Biological process may be prone to upsets
- Performance impacted by temperature
- Needs time to acclimate to odors to be treated
- Requires large footprint
- 85% removal efficiency

Carbon Filters

Effective on H_2S and sulfur-based compounds

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Carbon Filters

Mechanism of Action

- Odorous air stream is passed through bed of adsorbent carbon
- Sulfur based odorous compounds adhere to the surface of the carbon removing them from the air stream
- 98% removal efficiency

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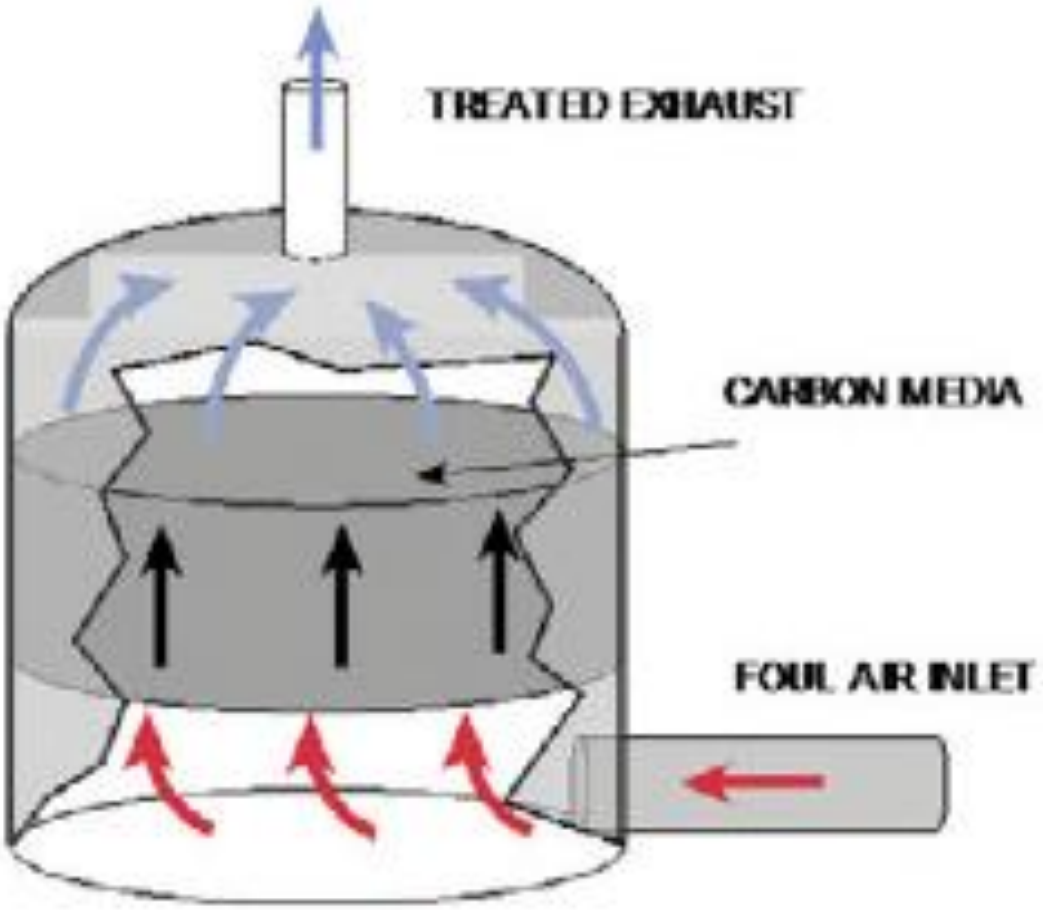
Carbon Filters



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Carbon Filters

Pros:

- Very simple and stable process
- 98% removal efficiency

Cons:

- H_2S concentrations above 10 ppm result in high operating costs
- Does not remove nitrogen based odors
- Humid air impacts performance so high humidity air must be dried prior to entering carbon filter

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Carbon Adsorption

Carbon Filter with de-mister to remove particulate water

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Photoionization

- Odor control technology that's been around for more than 20 years, commonly used in Europe
- Newer odor control technology in North America
- Process uses UV Light in combination with a Catalyst

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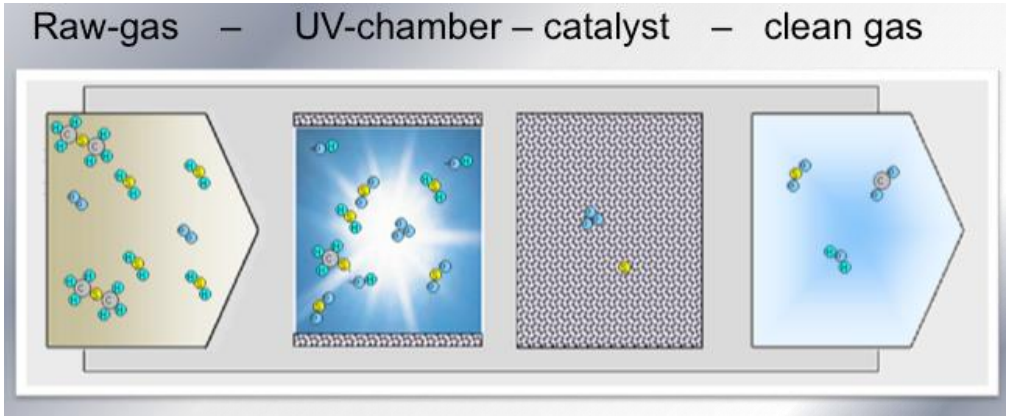
Photoionization

Mechanism of Action

- UV Lamps produce reactive Oxygen ions O^{-2} O_2^- O_2^{-2}, Hydroxyl radicals OH^-, and Ozone O_3 to react and oxidize odorous compounds
- Catalyst provides a place for the reactions to go to completion.
- 98% removal efficiency



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Photoionization

Pros:

- Reacts with all odorous compounds
- Low MX requirements
- Small footprint
- On/Off operation – works immediately
- Handles high concentrations
- Low operating costs compared to other technologies
- 98% efficient

Cons:

- Higher up front capital cost

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Photoionization

NEUTRALOX®

... and the air is clean.

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Liquid Phase Technologies

Treats the liquid stream
Typically used in the collection system

- Iron Salts
- Bioxide
- Hybrid technology

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Iron Salts

Method of Action

- Ferric Salts are metered into the liquid stream
- Chemical reaction – oxidizes some of the Sulfides and precipitates the rest

Iron Salts

Pros:

- Chemical reaction provides consistent results
- Ferric released at the treatment plant will precipitate phosphorous

Cons:

- Requires chemical delivery and storage
- MX of chemical metering pumps
- Must be protected from freezing weather

Bioxide

Method of Action

- Proprietary Nitrate solution is injected in liquid stream in sufficient quantities to biochemically oxidize sulfides

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Bioxide

Pros:

- Multiple point odor control in collection system

Cons:

- Proprietary Process
- Expensive chemical
- Chemical dosing pump need attention
- Must protect equipment from weather

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Ozone Injection

New hybrid odor control technology targeted for Lift Stations, Wet Wells, and Manholes

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Ozone Injection

Mechanism of Action

- Combination of Ozone and H_2O produces reactive Hydroxyl radical OH^-
- Sprayed in the headspace of wet well to oxidize odorous compounds
- Hybrid technology blending Liquid and Vapor Phase odor removal

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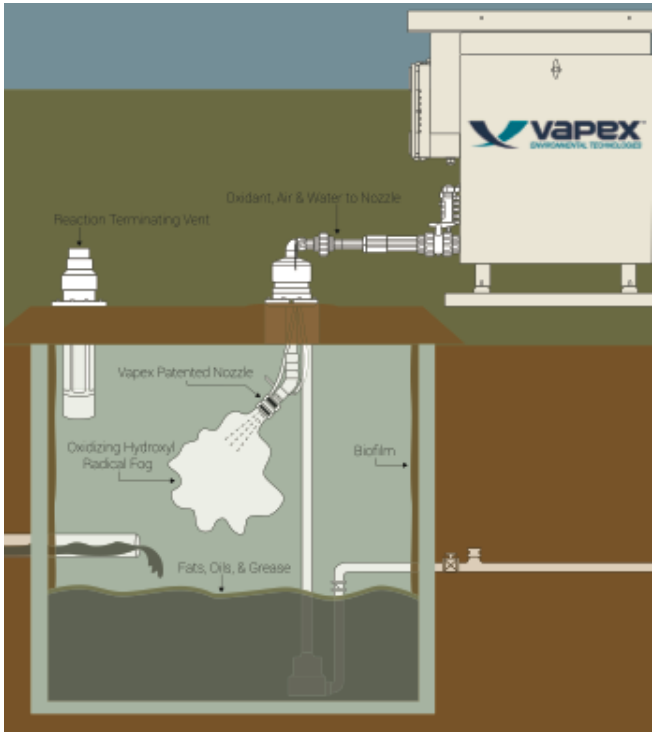
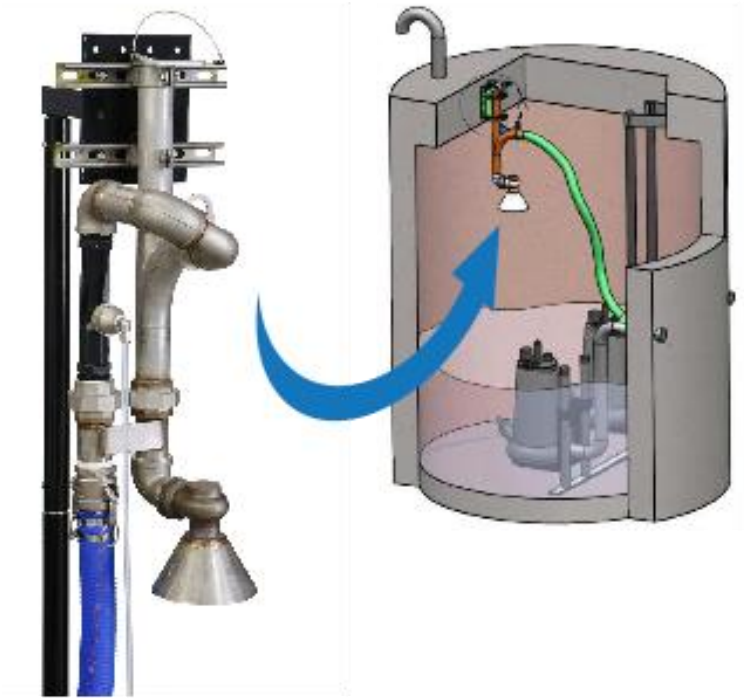
Ozone Injection





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Ozone Injection

Pros:

- In addition to oxidizing odorous compounds, it will break down FOG in the wet well

Cons:

- Power requirements
- New technology with little track record

Questions?

Comments?

General Excitement?

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