Capture, Contact, Chemistry
Vapor-Phase Odor Control Operation

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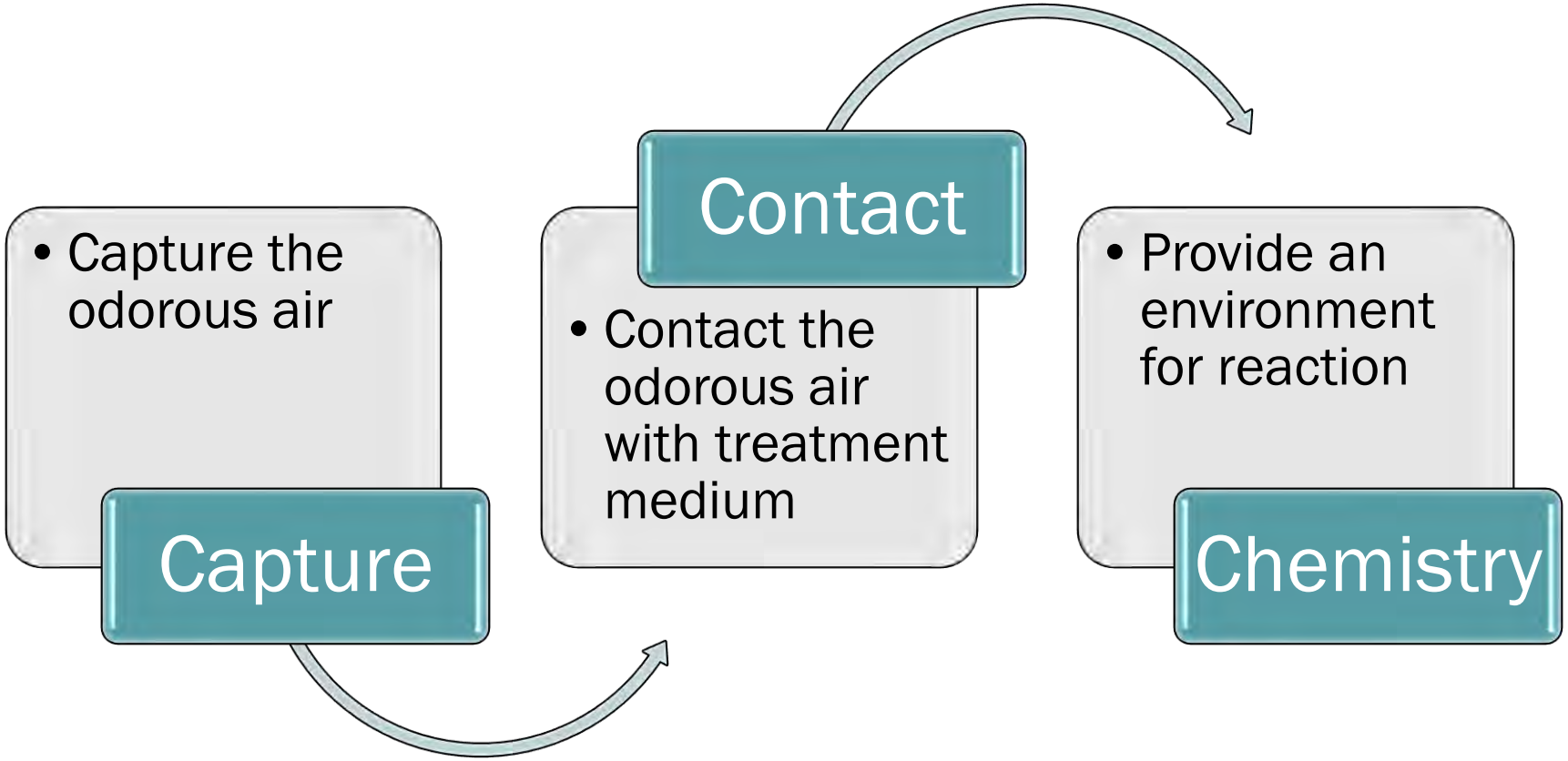
Three Objectives of VPOC



Agenda

- Capture
  - Cover Integrity
  - Air Flow Balance
- Adsorption Systems
  - Contact
  - Chemistry
- Biological Systems
  - Contact
  - Chemistry
- Chemical Scrubber Systems
  - Contact
  - Chemistry
- Other Issues
- Conclusion/Q&A

Presentation Caveats

- Mechanical maintenance is not covered
  - Lubricate bearings, change belts, metering pump maintenance, etc.
- Recommendations are general
- Check with the O&M Manual and/or Manufacturer of your system for specifics

Capture & Ventilation

The most important thing!

Capture & Ventilation

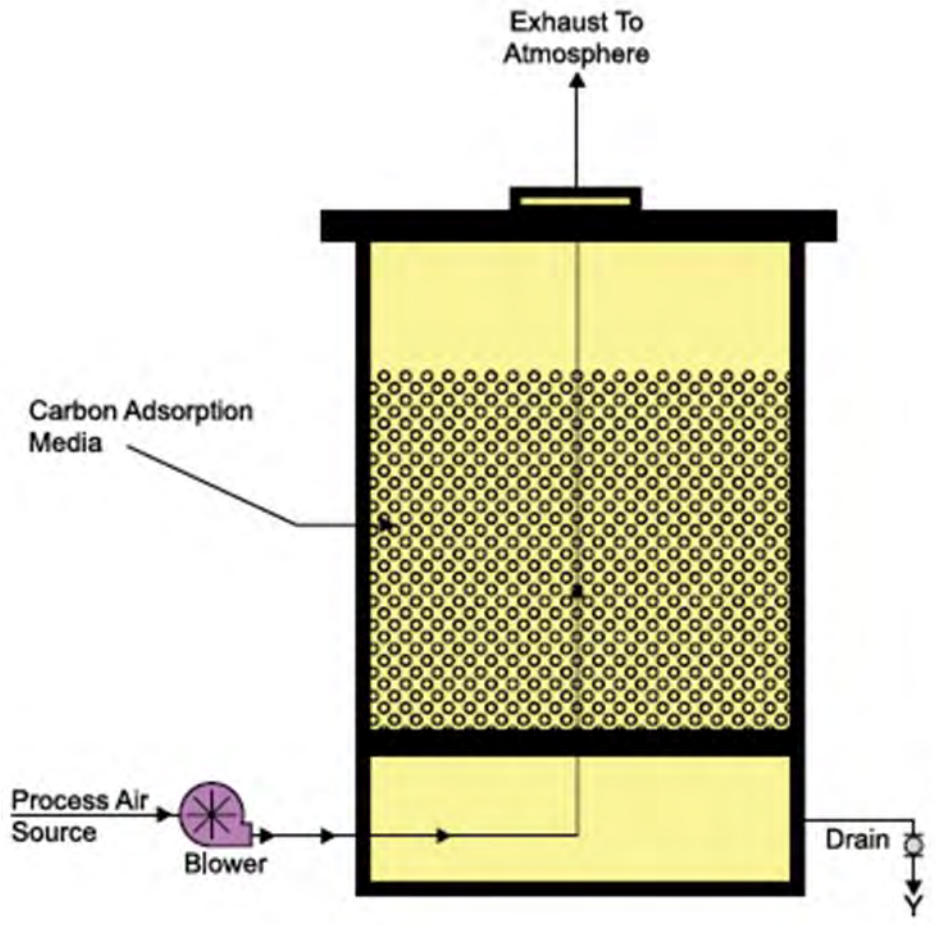
- Keep doors and hatches closed
- Avoid “dead” zones (design)
- Confirm vacuum
  - Air flow on branches
  - Differential pressure
  - Smoke test

What is wrong in this picture?

Adsorption Systems

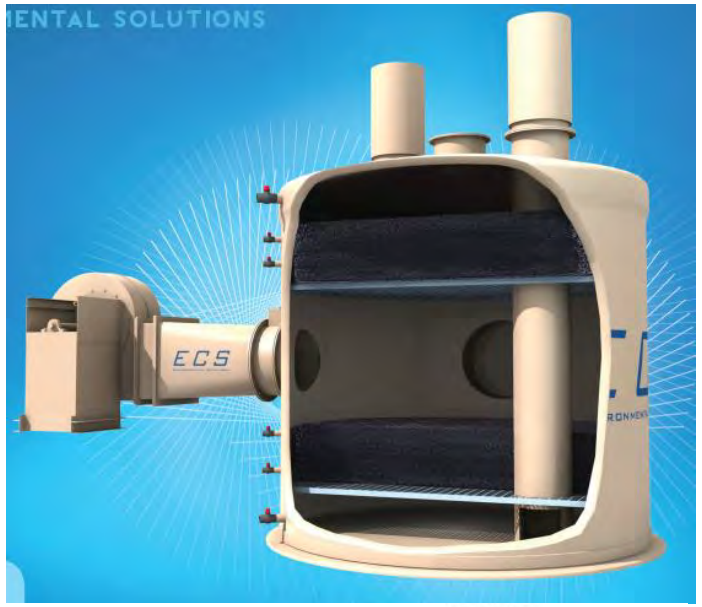
Adsorption Systems

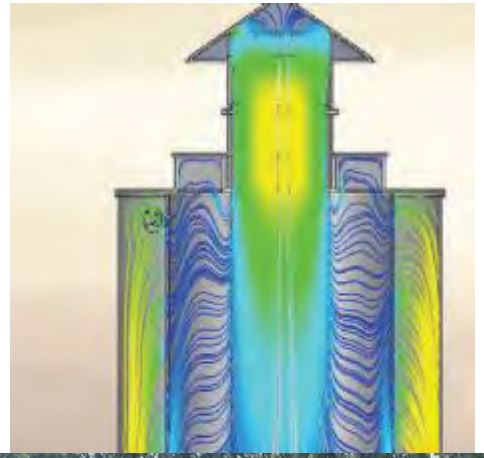
- Air flows through a dry adsorptive media
- H_2S and other odor compounds “adhere” to the media
- Media bases include: activated carbon, alumina, clay, or minerals
- Media is impregnated and/or blended for specific compounds and applications

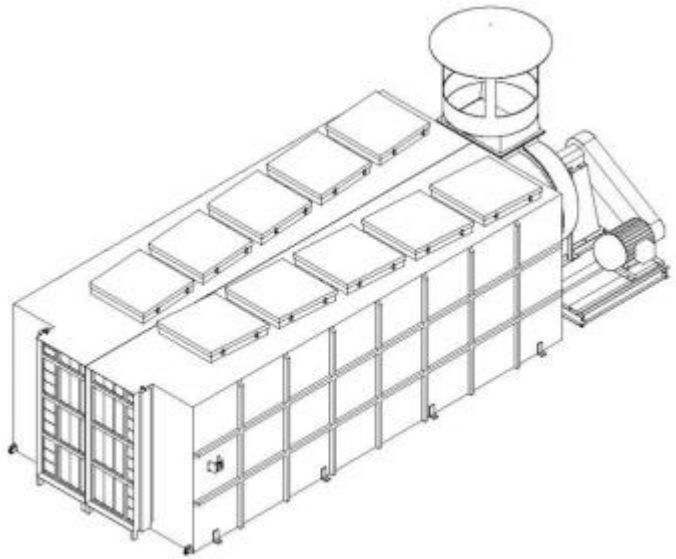


Graphic courtesy of Xylem

Adsorption System Configurations







Graphics courtesy of ECS, PureAir, and Xylem

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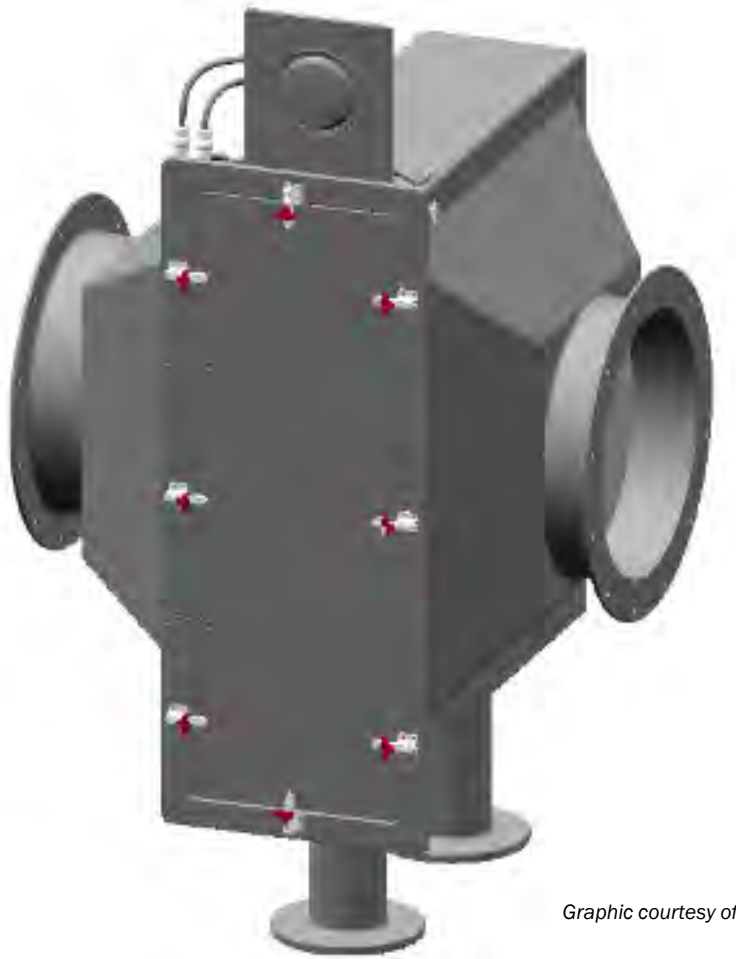
Contact - Adsorption Systems

- **Media blinding & fouling**
  - Mist, dust, FOG
  - Increased pressure drop
  - Restricted air flow
  - Unbalanced air flow
- **Prefilter**
  - Increased pressure drop
  - Restricted air flow



Graphic courtesy of ECS

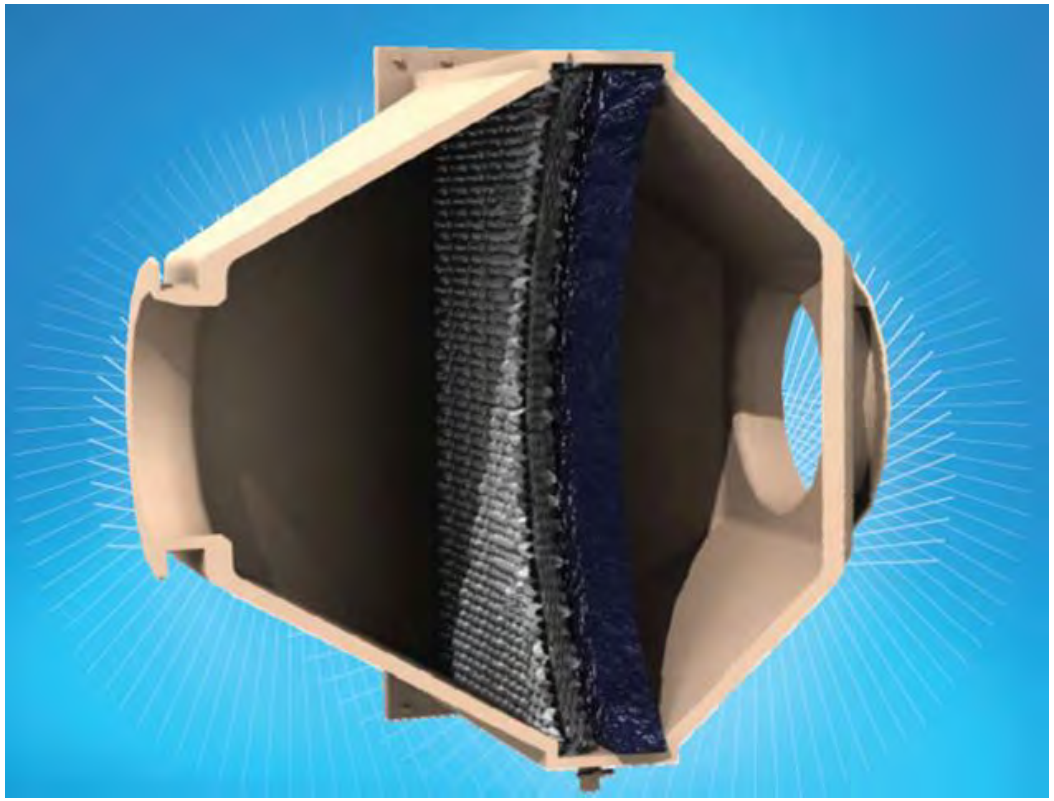
Contact - Adsorption Systems

Media bed

- Check and record pressure drop
- Watch for trends (increase)
- Confirm installed gage with portable gage periodically
- Cleaning may be possible
- Replace media

Prefilter

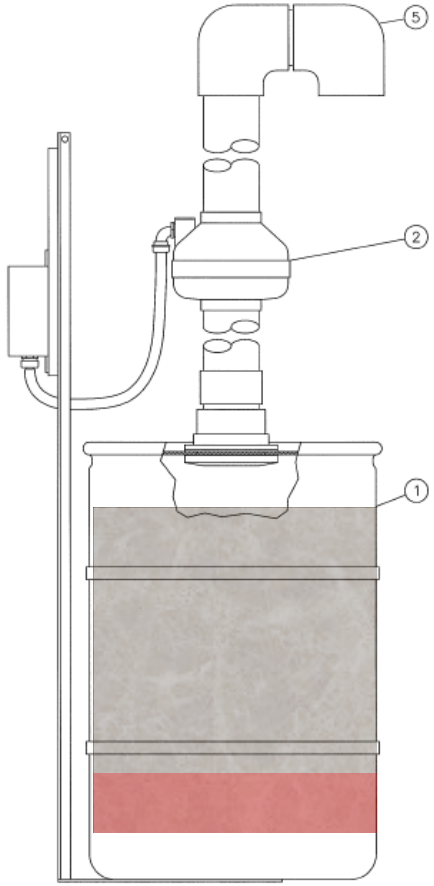
- Check and record pressure drop
- Watch for trends (increase)
- Confirm installed gage with portable gage periodically
- Clean filter regularly
- Replace filter element if it can’t be cleaned or is damaged



Graphic courtesy of ECS

Chemistry – Adsorption Systems

- Media has finite capacity
- Mass Transfer Zone moves through bed over time
- Check inlet and outlet H_2S



Graphic courtesy of Xylem

Chemistry – Adsorption Systems

- Check H_2S progression through bed
- Vertical and horizontal systems usually have sample ports
- Radial and V-Bank systems not conducive to sample ports
- Continuous monitoring systems are available

Graphic courtesy of PureAir

Biological Systems

Biological Systems

Air flows through a damp or wet biologically active media

H_2S and other odor compounds absorb into moisture and are oxidized by bacteria

Media base includes:

Organic material (wood, compost, peat)
Mineral material (clay, sand, soil)
Inert material (plastic, glass)

May require recirculation and/or nutrient addition depending on media type and water source

Biological System Configurations

Graphics courtesy of Bioair, Integrity Municipal Systems, and Xylem

Contact - Biological Systems

- Media blinding
  - Same issues as adsorption systems
  - Use & maintain prefiter
  - Potential sulfur buildup in media (Chemistry)
- Media compaction or “gaps”
  - Susceptible at walls
  - Organic media more susceptible
- Uneven watering
  - Water and air channeling

Contact - Biological Systems

- Check pressure drop
- Physical/visual inspection
- Smoke test(?)
- Clean & adjust spray nozzles
- “Turn” media if compacted
- Flush media if fouled
- Replace media as needed

Chemistry – Biological Systems

Bacteria need 4 things

Steady supply of food (H_2S)

- Rule-of-thumb: <4X peaking factor

Right amount of moisture

- pH 1.5 to 2.5
  - Too low – sulfur fouling
  - Too high – insufficient treatment

Oxygen

- Provided in supply air

Nutrients – N, P, K

- Provided by organic media
- May be in re-use water
- Otherwise need to add

Chemistry – Biological Systems

Check and record inlet & outlet H_2S

- Grab sufficient for routine operation
- Continuous for troubleshooting

Check and record blowdown pH

- Adjust make-up water as needed to maintain range

Check and record blowdown nutrient

- Looking for a residual
- Nitrate is quick and easy with test strips
- Adjust nutrient dosing as needed to have slight residual (1-5 ppm NO_3-N)

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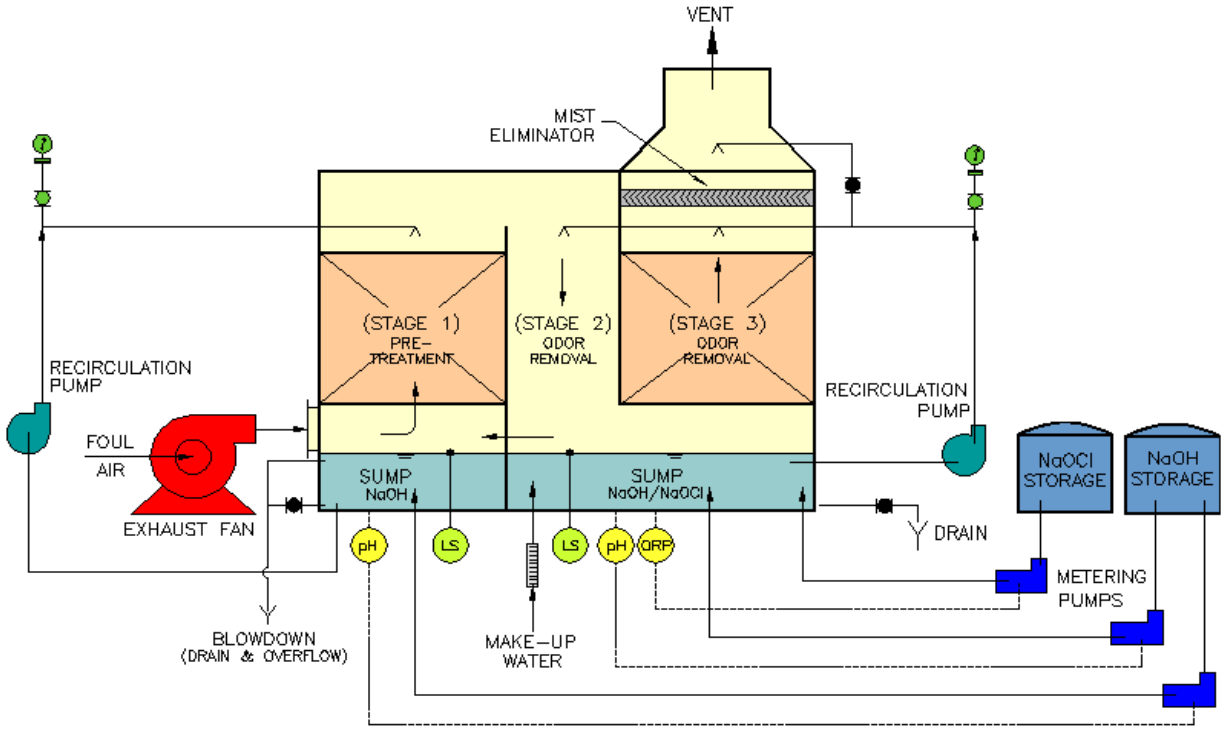
Chemical Systems

Chemical Systems

- Air/Liquid contact on media surface
- Solubilize, Neutralize, Oxidize
- Single and Multi-Stage



Graphic courtesy of Xylem

$$H_2S + 2NaOH \longrightarrow Na_2S + 2H_2O$$

$$Na_2S + 4NaOCl \longrightarrow Na_2SO_4 + 4NaCl$$

$$H_2S + 2NaOH + 4NaOCl \longrightarrow Na_2SO4 + 4NaCl + 2H_2O$$

Chemical System Configurations

Graphics courtesy of Xylem

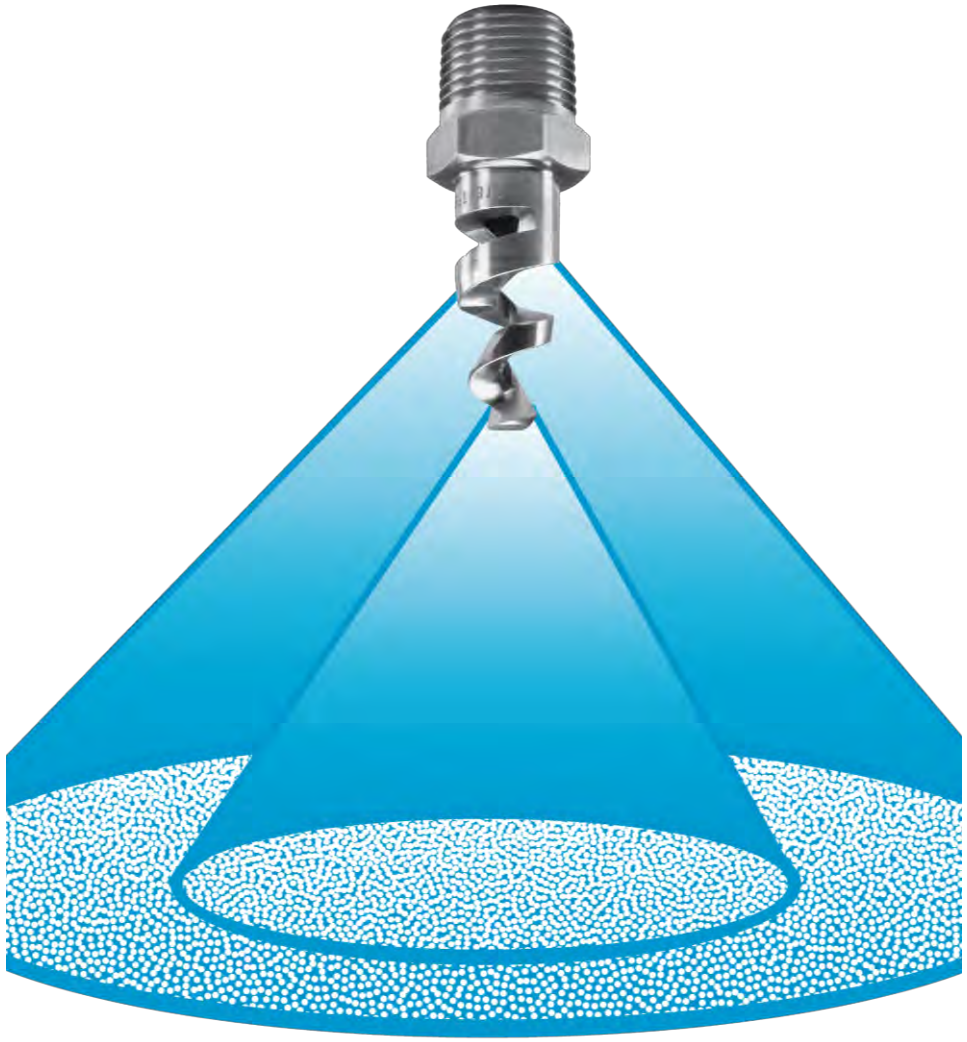
Contact - Chemical Systems

- **Chemical distribution failure**
  - Fouled nozzles
  - Inadequate flow
- **Media fouling**
  - Calcium carbonate scale
  - Restricts air flow
  - Causes channeling
  - FOG, mist, dust generally not a problem

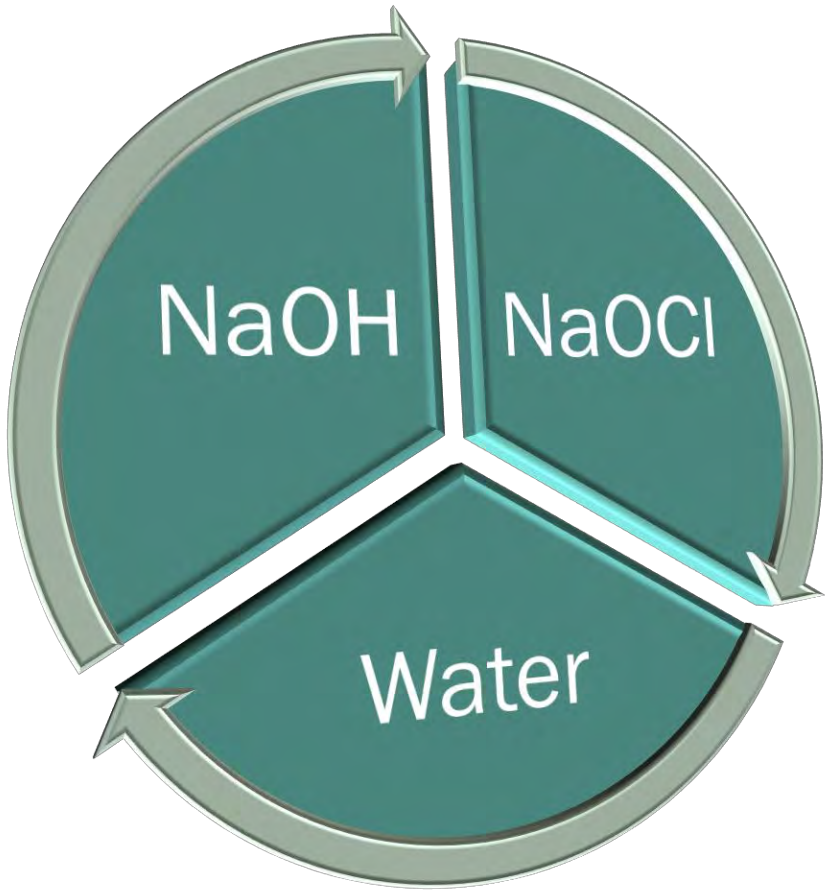
Graphic courtesy of Dick Pope

Contact - Chemical Systems

- Check pressure drop
- Physical/visual inspection
- Acid wash
- Use water softener
- Clean & adjust spray nozzles
- Replace media as needed



Chemistry – Chemical Systems



NaOH

- Check pH
- Validate with hand-held

NaOCl

- Check ORP
- Validate with hand-held and Cl_2 residual test

Water

- Check make-up water supply
- Validate requirement vs loading
- Process of elimination

V&A

Chemistry – Chemical Systems

Likely Issues:

- pH/ORP Controller - Calibration or Probe Failure
- Empty Tank(s)
- Clogged Strainer
- Metering Pump Failure
- Water Supply Failure

Other Issues

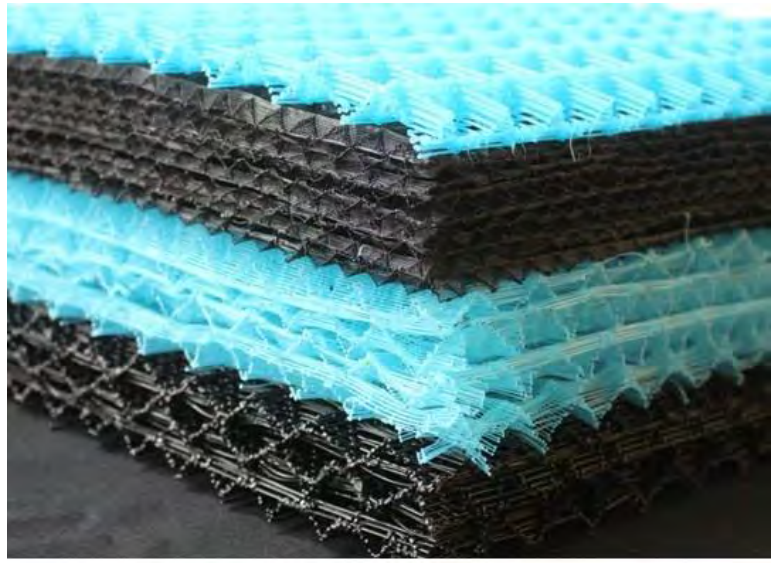
Other Issues

Fugitive odors

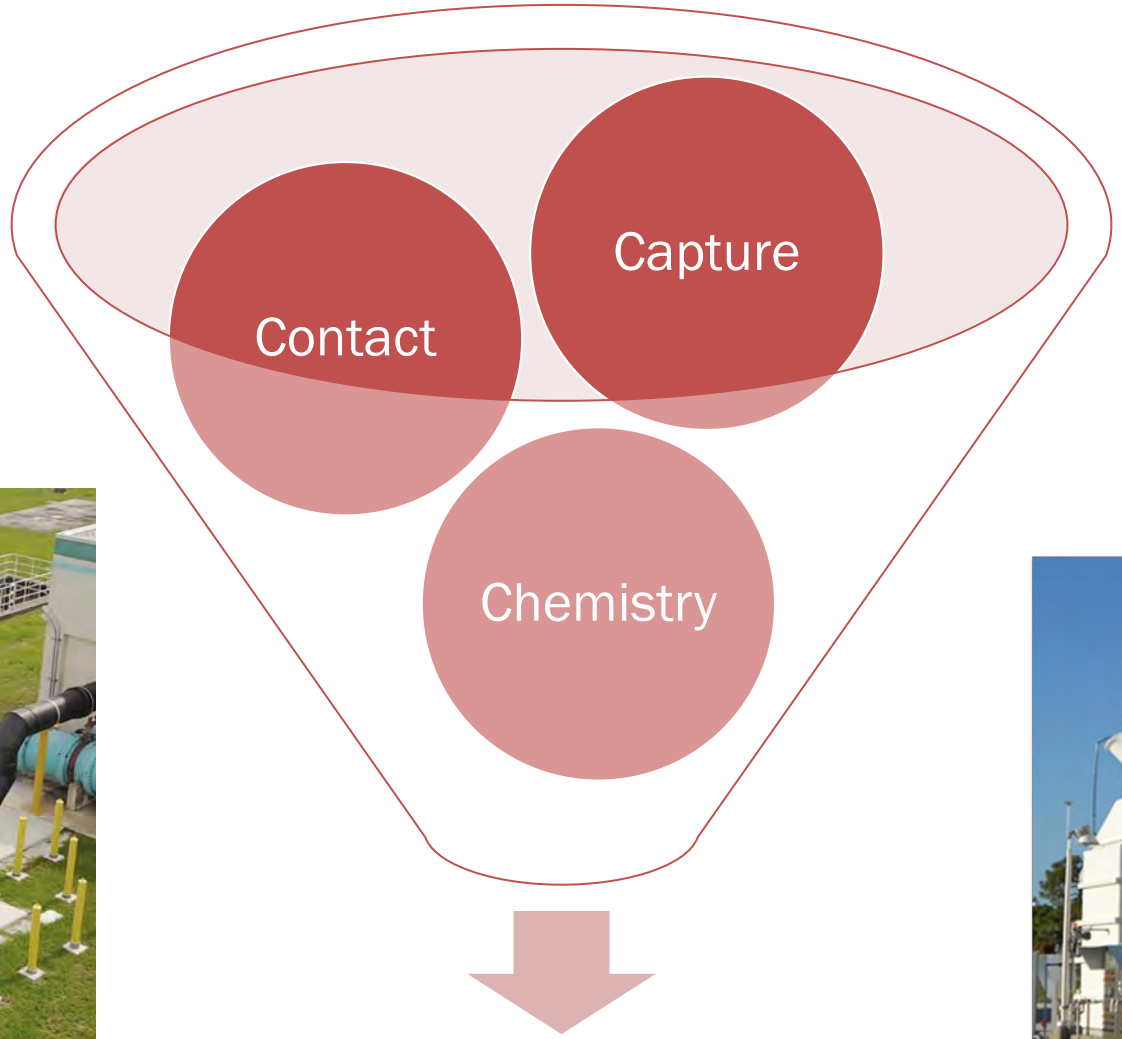
- Pressurized duct leaks
- Fan shaft seals
- Untrapped drains

Overspray

- Dirty/failed mist eliminators
- Biological and chemical systems



Conclusion



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