Are Masking Agents and Counteractants Good Odor Management Technologies?

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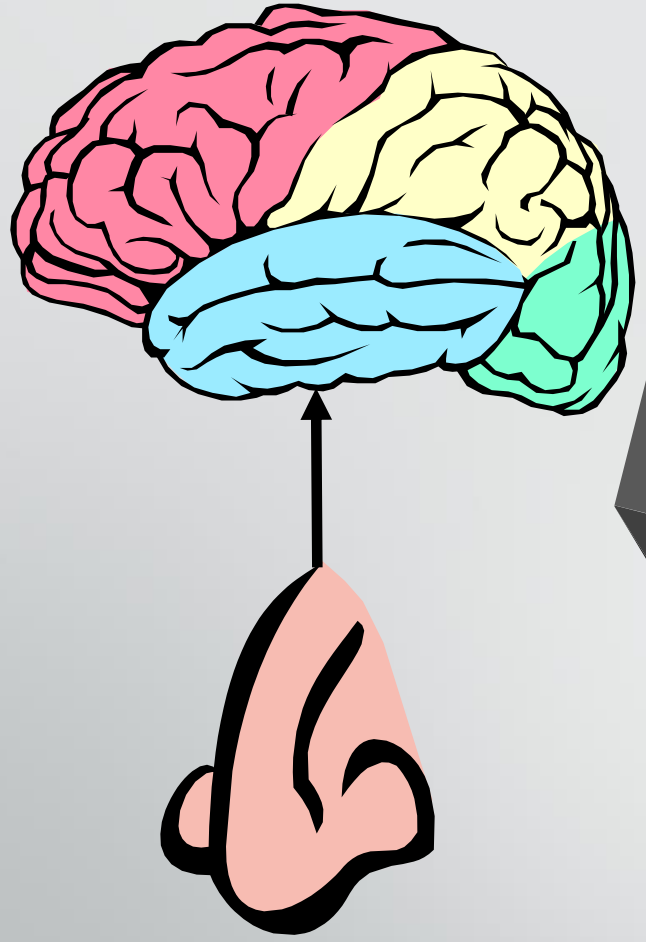

We often Describe Odor as a "Thing" But it is actually a Human Perception

The purpose of masking agents and counteractants is to alter the perception

The Nose Is Hard Wired To The Brain

The Human Perception is a Constantly Influenced by a Mixture of Senses

1. Sight
2. Hear
3. Smell
4. Taste
5. Touch

The First Question should always be: **What is the Tolerance for Odor?**

Tolerance is not one dimensional and it changes with time

Tolerance is Influenced by a mixture of what we like to call…

Our Dog FIDO

- Frequency – Number of Events
- Intensity – Strength of Odor
- Duration – Length of Events
- Offensiveness - Individual's Reaction

F
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D
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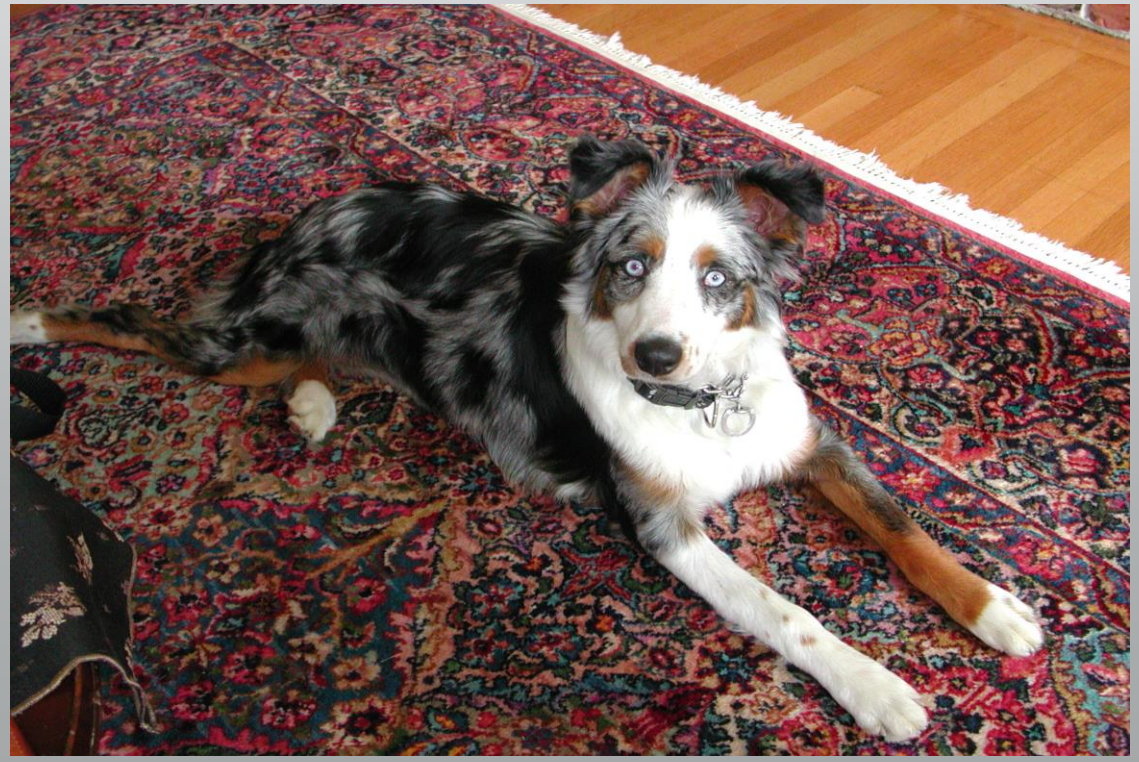
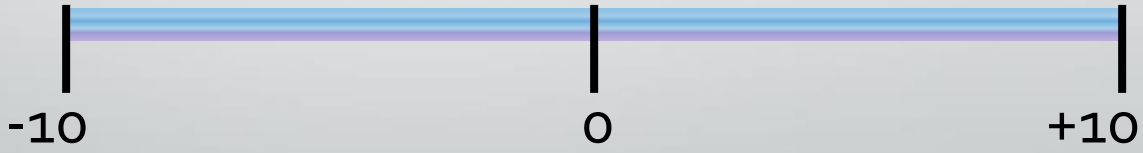
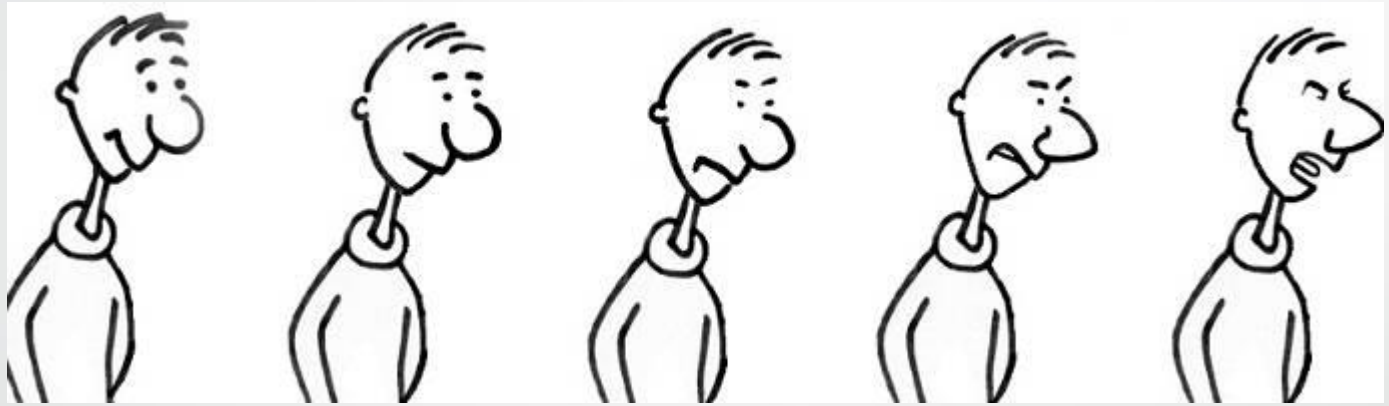


Masking Agent/Counteractant Purpose is to Improve the Hedonic Tone

- Relative Pleasantness or Unpleasantness
- Scale of –10 to +10 with zero neutral



Intensity Scale is Based Upon A Neutral Hedonic Tone



Trace Noticeable Moderate Strong Very Strong

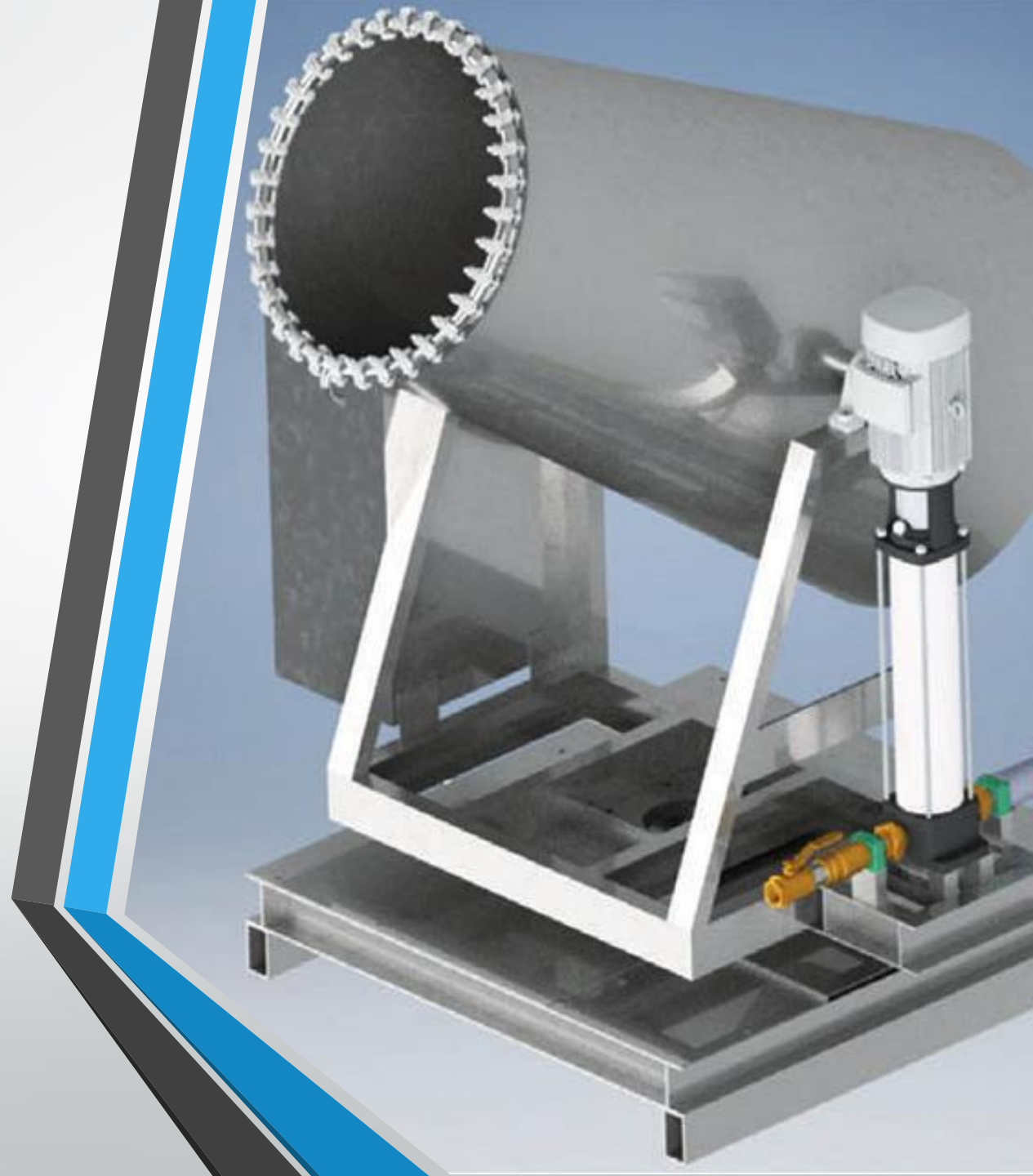
What are the differences between Masking Agents and Counteractants?

Masking agents are chemicals added to the air with the intent to flood the nose and cause an alternative perception

Counteractant agents are chemicals that are designed to bond with the odorants so that the perception is altered

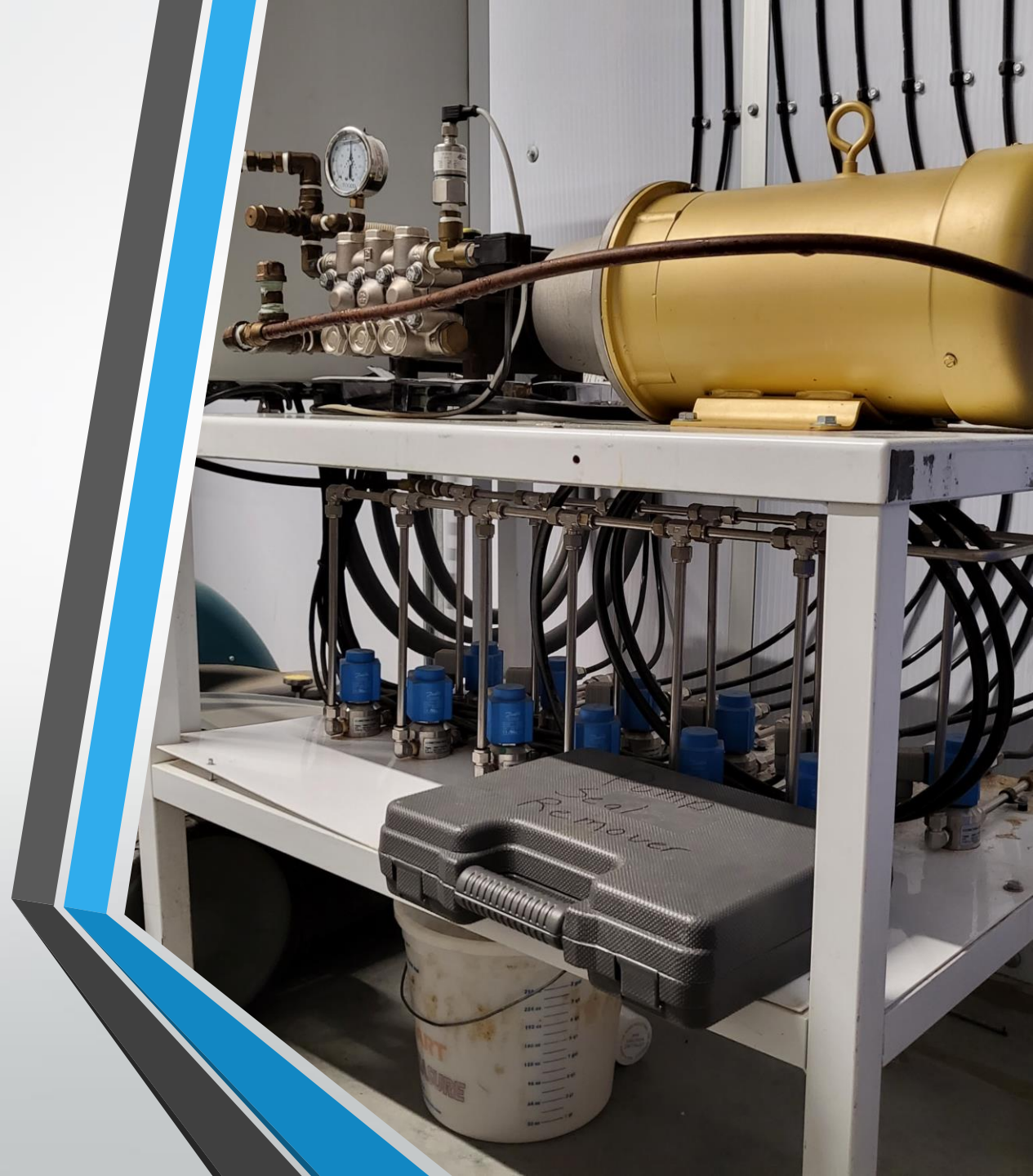
Wait….How are those different?

- Masking agents overwhelm the existing odor so a neighbor will notice a more pleasant mixture of smells than the existing, less pleasant, smell
- Counteractant agents combine with the malodorous compounds and changes the way the combined compound interacts with the olfactory bulb, so the brain receives and perceives them differently



How are Masking and Counteractant Agents Used?

- Masking agents and counteractants are released into the ambient air either before or after exhaust
- All masking agents and counteractants come as a liquid or are mixed into a solution prior to use
- The solution is then pressurized and either “fogged” or “sprayed” for use



Is Oxidant Injection considered a Masking or Counteractant Agent use?

- Most liquid phase additives such as inhibitors (biological or chemical suppressors), reactants (iron salts), or oxidants (peroxide, hypochlorite, permanganate, etc.) will not work in the ambient air because of the differences in the properties of air and water
- Some oxidants (ozone, chlorine dioxide, hydroxyl radicals, etc.) are used to reduce overall odor, but they are not working as a masking agent or counteractant

Masking Agents and Counteractants are Odor Management Options

- Both masking and counteractant compounds add odor; they do not reduce it
- Masking agents are not designed to interact with the odor, so the odor increase is direct and obvious; simply analogous to 1+1 = 2
- Counteractants are often described as "odor-free", but they are not. They may have a neutral hedonic tone, but it does add odor
- Too many times, masking agent and counteractant manufacturers attempt to circumvent the odor control design and specification process and make promises of "equal odor control" for a fraction of the capital cost – when they do I think of this guy….

By Carol M. Highsmith - This image is available from the United States Library of Congress

Masking and Counteractant Agents are not Odor Control

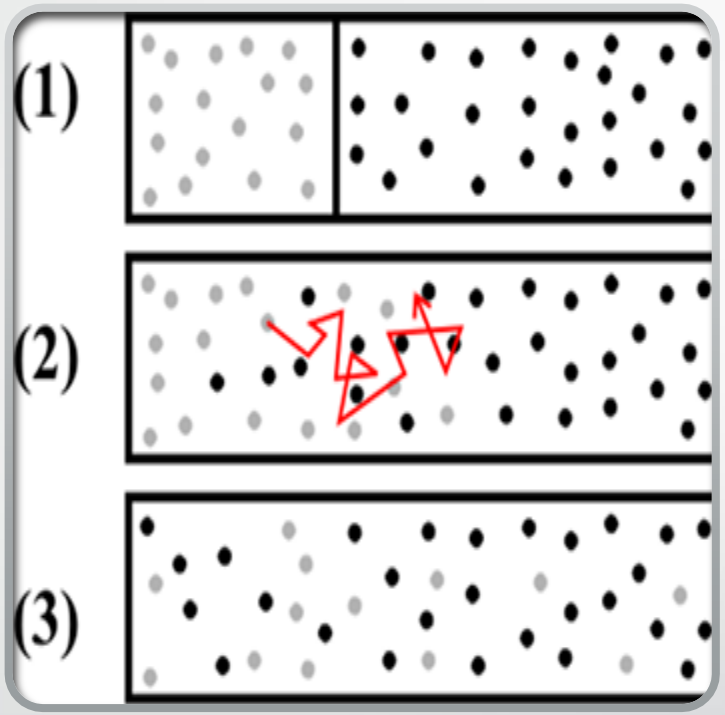
- Since they do not reduce odor, it is impossible to consider the "cost per ton" removed as one would often do in a BACT analysis
- They cannot be "Top-BACT" for odor control
- Therefore, they should always be considered a little differently that true odor control (i.e. odor reduction) measures

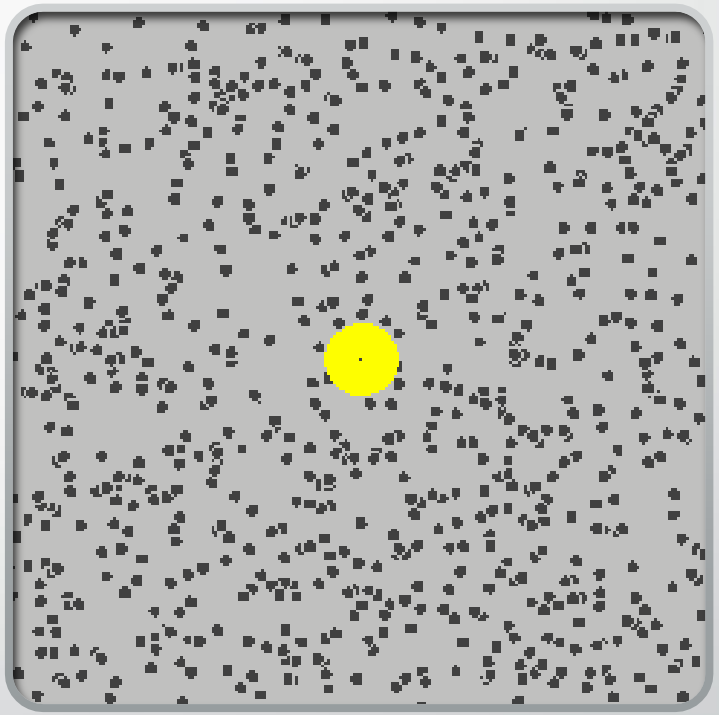
Why would we ever use Masking Agents or Counteractants if there are not "Odor Control"?

- They create an excellent opportunity to abruptly change the odor experience
- In some cases, odor control is simply not viable such as new landfill cells, open area composting operations, or sludge drying beds
- They demonstrate that a facility "doing something" or "taking neighbors' odor concerns seriously"

How effective are they at masking or disrupting odor perception?

- They can be very effective or marginally effective… depending on the application specifics
- Laboratory data is not the same as field data – a pilot project is a must!
- Both processes are enhanced and limited by Brownian Motion

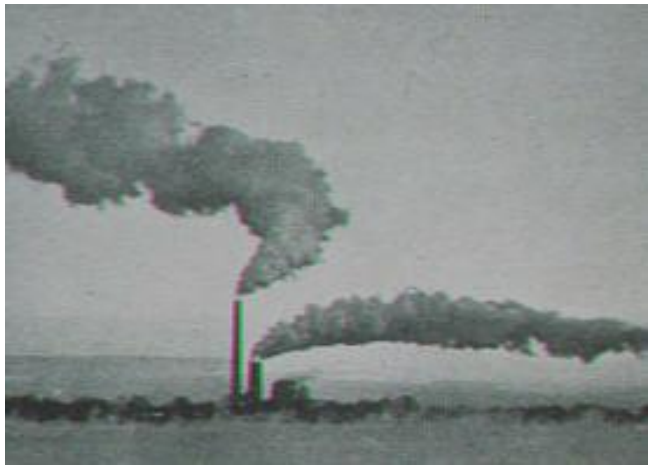




Open Source Brownian Motion Model Java Applet by Professor Paco and Hwang

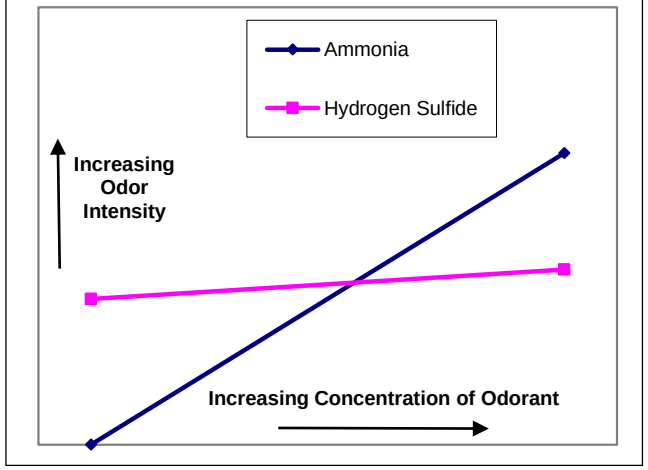
How to maximize masking or disrupting odor perception?

- They must be added to the ambient air in a manner that matches or intersects with the source emissions (Point, Area, Volume Source)




How to maximize masking or disrupting odor perception?

- Provide sufficient contact time for the Counteractants and odorants to "find" each other
- Make sure your Masking Agents are at least as persistent and the lowest detectable odorant

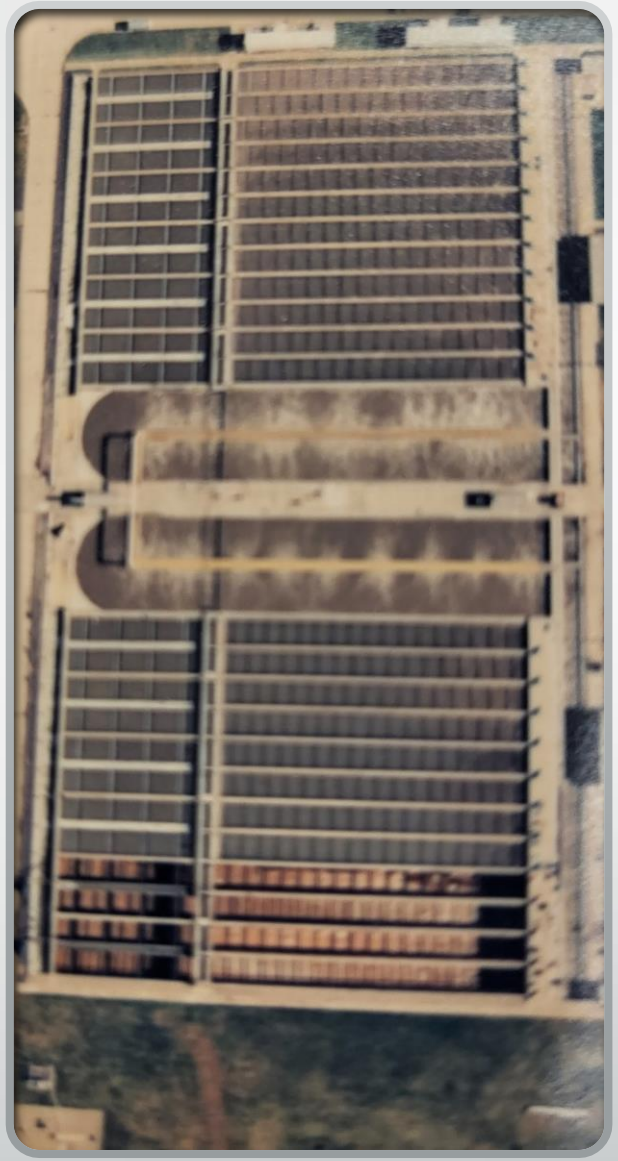


When are Masking Agents and Counteractants Ineffective?

- Lack of adequate contact time
- When the dispersion characteristics of the product does not match the source
- When odor loading is high enough that odor reduction is needed

Example of a Masking Agent/Counteractant Maintenance Use

- After a significant odor control upgrade for the largest wastewater treatment plant in an eastern city, there was a need for a masking agent as well
- As shown in the "before" picture, typically one tank is out of service for maintenance

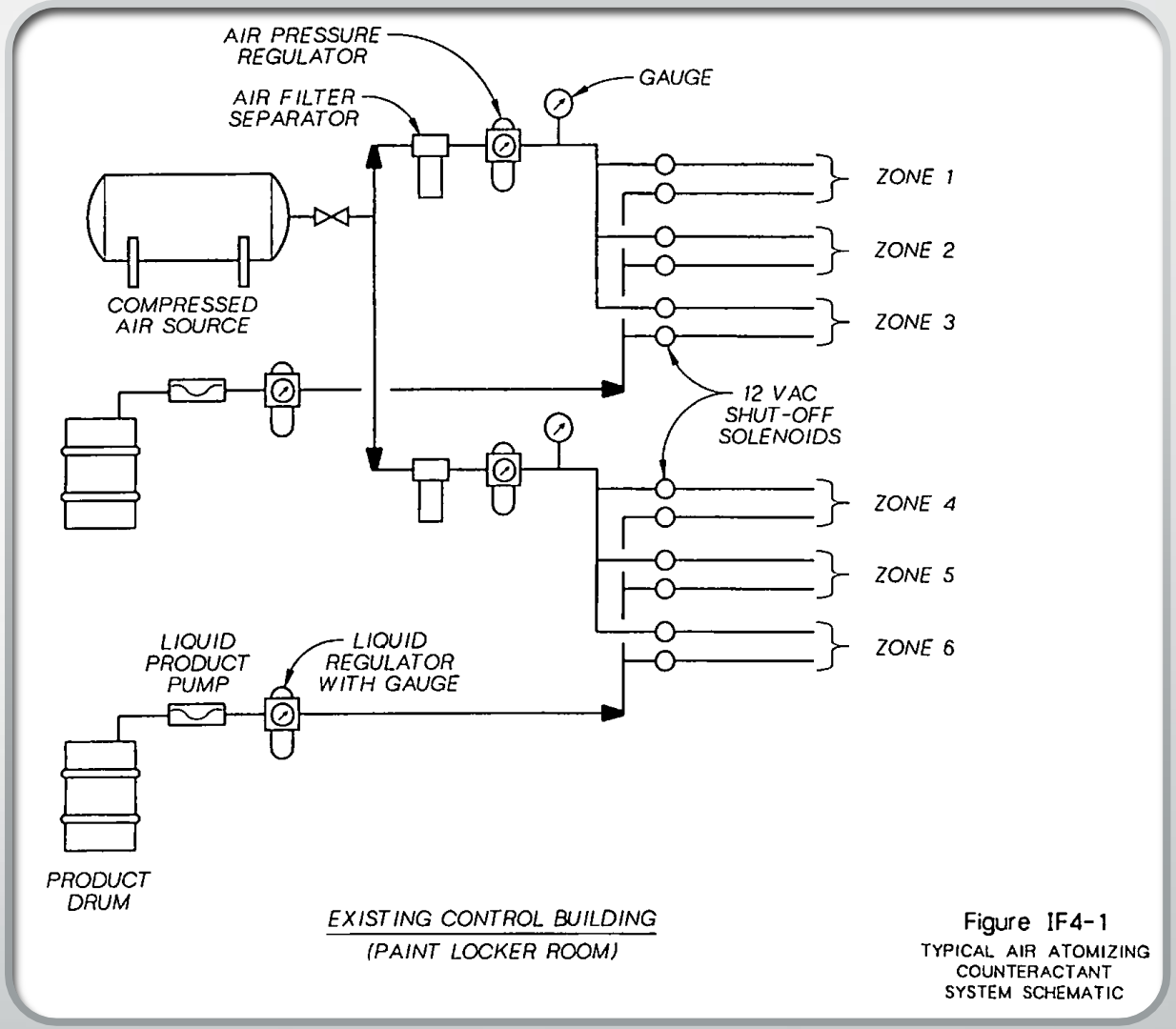


Open Primary Clarifiers

Primary Clarifiers After Covering and Odor Control

Example of a Counteractant Maintenance Use

- A specification required counteractant vendors to demonstrate on paper that their product could minimize the odor dilution-to-threshold to less than 250
- A total of eight (8) counteractant companies responded favorably to the specification for a pilot study
- Five (5) of the companies performed counteractant demonstrations
- The specification required a typical air atomizing counteractant system →
- Power and water to be provided



Example of a Counteractant Maintenance Use

- Percent removal or residual odor could not be calculated in the open tank demonstration project
- A subjective rating system was applied over the timeline of the demonstration project and an average was calculated
- Note that the rating allowed for an increase in odor as well as a decrease

Odor Counteractant Rating System		
Rating	Number	Description
Zero	0	Worse (Higher) Odor than Normal
One	1	No Noticeable Change in Odor
Two	2	Marginal Odor Improvement
Three	3	Noticeable Odor Improvement

Example of a Counteractant Maintenance Use

- The actual manufacturers are not included in these charts because the takeaway should be the trend, not the product specifics for this use
- The trend was for noticeable odor neutralization in all but one trial and for minimal irritation in one trial as well

Counteractant Demonstration Comparison			
Counteractant Manufacturer	Effectiveness Odor Rating	Worker Comfort and Safety Issues	Reason for Elimination after Demonstration
Manufacturer "A"	2.1	No complaints or problems	None
Manufacturer "B"	1.2	No complaints or problems, but large droplets	Ineffective Application
Manufacturer "C"	2.5	Unpleasant residual taste initially because of location of nozzles, but this issue was fixed via relocation	None
Manufacturer "D"	2.0	Worker irritation and discomfort so demonstration terminated	Worker Discomfort
Manufacturer "E"	2.2	No complaints or problems	None

Counteractant cost per gallon is dependent on the “concentrate”

Example of a Counteractant Maintenance Use

- Manufacturer "C" had the best effect on odor, but they claimed in their literature was that they would have 95 to 100% removal of odor. That was not observed.
- Manufacturer "A" had a similar delivery system and some odor neutralization
- Manufacturer "E" had similar results to Manufacturer "A" but a portable system delivery system

Cost Summary of Proposed Air Atomizing Counteractant Systems		
Counteractant Manufacturer	System Description	Estimated 2023 Delivered Capital Cost
Manufacturer "A"	Air atomizing System 50 to 70 psi air compressor supplying 6 air headers for three tanks	$56,000 plus compressor
Manufacturer "C"	Air atomizing System with 25 HP, 50 to 70 psi air compressor supplying 6 air headers for three tanks	$80,000
Manufacturer "E"	Air atomizing system with a low pressure (6 psi) high volume (500 cfm) supplying a single air header to treat one Primary tank at a time. The system is "portable"	$53,000

Example Conclusion: A counteractant should be used but minimizing uncovered "dirty" tank time will be the best way to reduce complaints

Example of a Permanent but Intermittent Masking Agent Use and a Continuous Counteractant Use

- Landfill "A" located in the southeastern United States, like most landfills, it started as the only "development" in the area
- Over time, as new subdivision was built nearby and began to complain of odor
- Look, all these homes now have a beautiful view of the landfill

Example of a Permanent but Intermittent Masking Agent Use and a Continuous Counteractant Use

- The facility had been using a litter fence spray line approach to counteractant application around the active area and newer cells
- As part of our odor study, we examined the complaint logs and the meteorological conditions, and found that most occurred during certain weather conditions

Example of a Permanent but Intermittent Masking Agent Use and a Continuous Counteractant Use

- The facility was using a separate fogging system at times, but was not focused on the meteorological conditions we identified
- While the fogger was “portable” it was then relocated to a particular spot as its new “normal location”, it and was also then only used in certain weather conditions

Example of a Permanent but Intermittent Masking Agent Use and a Continuous Counteractant Use

- Once the unfavorable weather conditions occurred, the odor plume would channel down these power lines, and the fogger was operated
- Any idea what flavor of masking agent was used, and why?

Example of a Temporary Masking Agent Use

- An industrial biosolids and residuals processor pasteurized up to 100,000 pounds a day of 70% septage and 30% grease trap waste to make a Class A biosolids cake that was pressed
- They underestimate their odor potential and had to act quickly to maintain operations
- Most processes were inside a building, but there were outdoor effluent holding tanks that were causing odor complaints

Example of a Temporary Masking Agent Use

- The Facility was initially spraying a masking agent 24 hours a day seven days a week
- Many different masking flavors were tried from fruit to flowers
- Unfortunately, the tanks were very odorous, so for it to work, significant "overdosing" of masking agent was required

Example of a Great Temporary Masking Agent Use

- The facility had ordered a modular biofilter system, but it was back ordered for some time and the City threaten to shut them down without immediate relief
- We designed a temporary wrapped wood cover on the tank and built two biofilters out of dumpsters the facility owned for the time being
- You can see the misting system remained. It was still used after this temporary odor control construction was operartional, but more sparingly

Example of a Great Temporary Masking Agent Use

- Eventually the permanent new biofilter and cover system was delivered and installed
- The misting system remained, but was only used when odor complaints were logged

Example of a Great Temporary Masking Agent Use

- Again, the facility tried many, many masking agents as they were working on the permanent odor control solution
- They would all work for awhile, but eventually the neighbors would complain about the constant "oranges" or "lavender" smell or worse, a mixture of odors
- Any idea which masking agent resulted in the fewest complaints, and why?

Should We Consider Masking Agents and Counteractant Agents?

- Initially both can have a positive effect on hedonic tone and reduce complaints by improving FIDO
- Over time the hedonic tone benefit can fade
- They are not odor control solutions, but sometimes odor control solutions are not needed or feasible
- They are odor management tools, and can be effective at any site for upset or planned temporary increases in odor
- Effectiveness take Brownian Motion collisions
- Reaction time is your friend, lack of it ensures minimal effectiveness
- Very dependent on terrain, neighborhood tolerance and current or past exposure, weather patterns, odor FIDO, so Pilot, Pilot, Pilot !!!

Questions?

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Sometimes even temporary measures are needed to prevent….