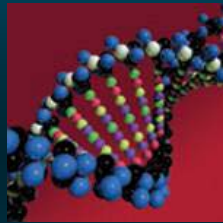


Human Responses to Sulfide Gases and Irritants: *Easy Concepts, Complex Details*



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Overview

- **Review of key compounds for exposures**
- **“Just think what it is doing...”**
- **Classic toxicology – easy**
- **Odors and irritation – complex**



Sulfide Gas Levels Detected

- Carbonyl sulfide

- avg. = 8.6 ppbv; max = 23 ppbv

- Carbon disulfide

- avg. = 7.1 ppbv; max = 13 ppbv

- Hydrogen sulfide

- not detected in lab samples

- few ppb with real-time analyzer - occasionally



Other Gases Found

- Not unique to corrosive drywall homes, but adding to the mixture:
 - Adhesive solvents, aldehydes, various typical indoor air constituents
- Organic acids – found in some corrosive drywall research
 - Acetic acid, isobutyric acid, propionic acid



“Corrosive Gases”

- In context of affected materials – just a term
- When you think about breathing it — decidedly negative connotations
- “If it’s doing that to my pipes, just think what it is doing to me...”





Is the obvious really so obvious?

- Initial reaction – concept seems obvious
- But, we breathe air with “corrosive” properties
- Consume drinks with corrosively low pH
- And, eat foods that contain reduced sulfur volatiles



Come for the Salubrious Sea Air





They left “Corrosive” off the postcard!

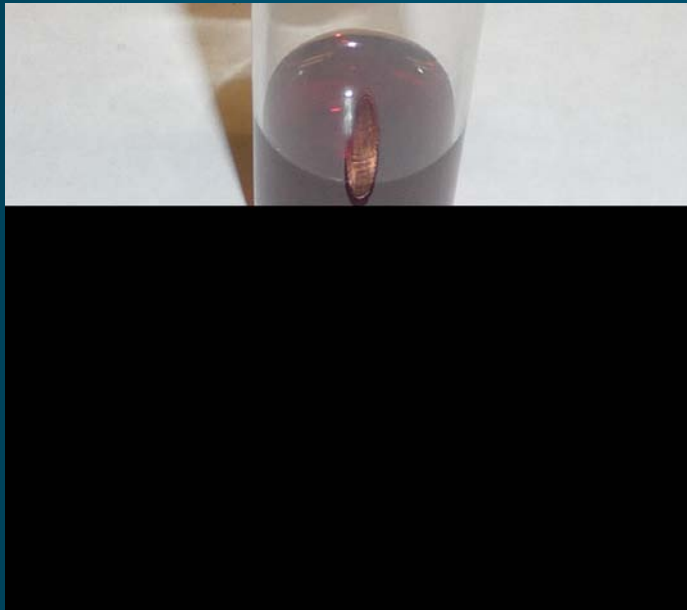


- Few substances as strongly, and broadly corrosive as salt water



Anyone care for a drink?

- Before and after 10 days immersion





Reduced Sulfur Gases

- Cabbage family vegetables good example of foods with “smelly” sulfur compounds





Corrosive, too



- Mild sulfide effects observable after about an hour cooking, leaving the steamer basket for a day or two



Sulfide Gas Toxicology

- **Hydrogen sulfide, carbon disulfide**
 - **Well studied, occupational issues for many decades**
 - **No big surprises coming**
 - **Odor provides warning/avoidance properties (at low to moderate levels)**
- **Carbonyl sulfide –**
 - **Converted to hydrogen sulfide in cells**
 - **“looks like” less potent hydrogen sulfide**



Type of Effects

- Classic effects – neurological
- Respiratory effects can occur
- Observed at many ppm to low percent-type levels
- **THOUSANDS of times higher than low ppb levels associated with corrosive wallboard**



Easy Toxicology Answers

- Emissions from wallboard
 - 1) not out of the ordinary for routine exposures
 - 2) nowhere near acutely toxic levels
 - 3) no accumulation/buildup over time
 - 4) chronic systemic toxicity (e.g., long-term effects on workers) requires ppm-type exposures – not an issue



Can we stop there...

- NO.
- Irritancy and transient responses
- Sensory-induced responses
- Mixtures

And, **“We are all individuals...”**



Irritation Defined

Irritation – 1. the act of stimulating. 2. a state of overexcitation and undue sensitivity.

Dorland's Illustrated Medical Dictionary, 28th ed.



Irritation – Sensory Response

- “The initial response to an inhaled irritant may involve an immediate burning or stinging sensation in the eyes, nose, or throat. Such stimuli may range from unpleasant to extreme pain and are mediated by an interaction of irritants with chemoreceptive nerve endings from the trigeminal nerve in the cornea, nose, tongue, oral cavity, and upper respiratory system.”

p 1086, Valentine, R. and Kennedy, GL “Inhalation Toxicology,” in Hayes, AW, Principles and Methods of Toxicology, 4th ed.



Irritation – Can be Protective

- “Reflex reduction in respiratory rate, laryngeal and bronchial spasm, decreases in pulmonary ventilation and pulse, and increases in blood pressure. All of these responses are generally protective in nature, limiting further exposure of the offending chemical, especially to the lower respiratory tract.”

p 1086, Valentine, R. and Kennedy, GL “Inhalation Toxicology,” in Hayes, AW, Principles and Methods of Toxicology, 4th ed.



Irritation – Transient by Mechanism

- Point of contact, not systemic response
 - Explains transience of response
- Accommodation occurs
 - (you get used to it)
 - Receptor interactions with nervous system change
- NOT an allergy (immune-mediated)



Sensory-Induced Responses

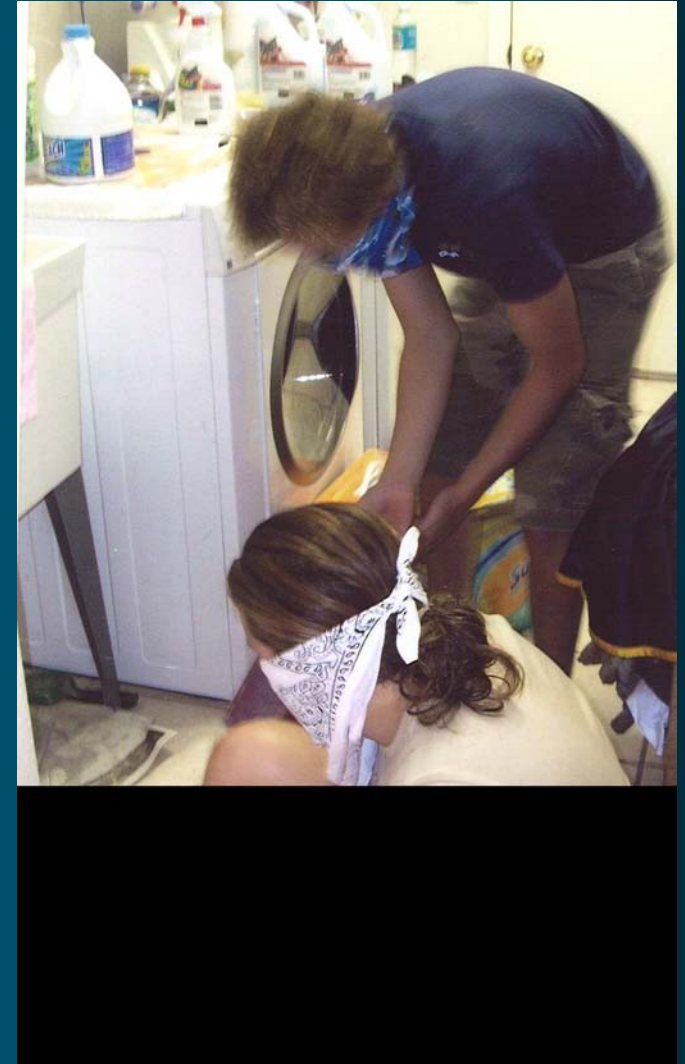
- Odors, even if not irritating, can directly stimulate physiological responses
 - **Perfumes**
 - **Food odors – salivation**
- Odors and irritant responses highly individualized



“I’m not doin’ it!”

- Sometimes the response is unpleasant
- Gagging

Unpleasant responses and irritation are, in fact, unpleasant.





Odors and Symptoms – More Complexity

- Whole field of study on the phenomenon of odor-induced symptomatology
 - **Strong odorants do induce symptom reporting**
- Preconceptions and heightened fear/stress also induce/exacerbate reported symptoms
- NOT – not real, can be very real



Mixtures – More Complex Toxicology

- **Complexity increases with mixtures**
 - **Many strong odorants stimulate same nerves, receptors – true of sulfide gases, aldehydes**
 - **May modulate response to the mixture**
- **Chemicals causing response can be difficult to segregate**
 - **Non-wallboard related indoor air constituents**



Summary

- Dealing with the “corrosive” perception – sort of easy, if you think about it
- Dealing with the “big” toxicology issues – easy – not anywhere near high enough levels
- Dealing with irritancy, annoyance of odors, individual responsiveness – not easy at all