Hydrogen Sulfide

Shelby County EMS

Training Division

What is H2S?

- Hydrogen sulfide (H2S) is a colorless gas.
- At low concentrations it has an obnoxious odor similar to rotten eggs.
- It is soluble in water.
- It is produced in nature primarily through the decomposition of organic matter by bacteria.
- It is a constituent of natural gas, petroleum, sulfur deposits, volcanic gases and sulfur springs.
- Hydrogen sulfide is oxidized by photochemically-generated free radicals, especially hydroxy radicals.

What is H2S?

- In the United States about 125,000 employees in 73 industries are potentially exposed to Hydrogen sulfide. However, domestic exposure can occur from various sources as follows:
  Ambient air near petroleum refineries, and sewage treatment plants; sewers (sewer gas); hot water tanks; and septic tanks.

Other Names for H2S

- Hydrogen Sulfide is also known by the following names:
- hydro sulfuric acid
- sulfuretted hydrogen
- sewer gas
- sulfane
- sulfur hydride
- sour gas
- sulfurated hydrogen
- hydrosulfuric acid
- stink damp
- rotten egg gas

Half- Life of H2S

- It has a half-life in air ranging from 12 to 37 hours, but varies depending upon photoactive pollutants and temperature. The half-life in air during very cold and dry winter conditions can exceed 37 hours.

H2S Information

- Common Name: **HYDROGEN SULFIDE**
- DOT Number: **UN 1053**
- NAERG Code: **117**
- CAS Number: **7783-06-4**
- Hazard rating NJDHSS NFPA
- **FLAMMABILITY** - 4
- **REACTIVITY** - 0
- FLAMMABLE
- POISONOUS GASES ARE PRODUCED IN FIRE
- CONTAINERS MAY EXPLODE IN FIRE

DANGER!!!!!

- The most dangerous aspect of hydrogen sulfide results from olfactory accomodation and/or olfactory paralysis. This means that the individual can accomodate to the odor and is not able to detect the presence of the chemical after a short period of time. Olfactory paralysis occurs in workers who are exposed to 150 ppm or greater. This occurs rapidly, leaving the worker defenseless. Unconsciousness and death has been recorded following prolonged exposure at 50 ppm.

ODOR!!!

- Odor and Concentrations: Subjective olfactory responses to various concentrations of hydrogen sulfide are summarized as follows:
- Physiological Responses to Acute Exposures: Physiological responses to acute exposure to hydrogen sulfide have been reported as follows:
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DANGER!!

- Hydrogen sulfide is a mitochondrial poison. Its action on mitochondria is similar to that of cyanide through inhibition of cytochrome oxidase (iron containing protein). This prevents the utilization of oxygen with an uncoupling of oxidative phosphorylation. In addition, hydrogen sulfide binds to hemoglobin in red blood cells interfering with oxygen transport.

  Exposure to hydrogen sulfide occurs primarily by inhalation but can also occur by ingestion (contaminated food) and skin (water and air). Once taken into the body, it is rapidly distributed to various organs, including the central nervous system, lungs, liver, muscle, etc.

PPM

- 0.02 ppm No odor
- 0.13 ppm Minimal perceptible odor
- 0.77 ppm Faint, but readily detectable odor
- 4.6 ppm Easily detectable odor, moderate odor
- 27.0 ppm Strong, unpleasant odor, but not intolerable

PPM

- 10 ppm Beginning of Eye Irritation
- 50-100 ppm Slight conjunctivitis and respiratory tract irritation after one hour
- 100 ppm Coughing, eye irritation, loss of sense of smell after 2-15 minutes. Altered respiration, pain the eyes, and drowsiness after 15-30 minutes followed by throat irritation after one hour. Several hours exposure results in gradual increase in severity of symptoms and death may occur within the next 48 hours.
- 200-300 ppm Marked conjunctivitis and respiratory tract irritation after one hour exposure.
- 500-700 ppm Loss of consciousness and possibly death in 30 minutes to one hour of exposure.
- 700-1000 ppm Rapid unconsciousness, cessation of respiration, and death
- 1000-2000 ppm Unconsciousness at once, with early cessation of respiration and death in a few minutes. Death may occur if individual is removed to fresh air at once.

Mg/m3

- O.12 mg/m3 (0.08 ppm)Increased mental depression, dizziness and blurred vision.
- 0.45 mg/m3 (0.32 ppm)Increased incidence of nausea, loss of sleep, shortness of breath, and headaches
- 1.0-10 mg/m3 (0.7-6.7 ppm) Increased incidence of decreased corneal reflex (convergence and divergence)
- 10-70 mg/m3 (6.7-47 ppm)Irritation of conjunctiva, fatigue, loss of appetite, insomnia.

H2S Monitor


ANALYTICAL SYSTEMS INTERNATIONAL
0 TO 25PPM H2S
0.3 FLOW
SAMPLE PRESSURE
CONCOA
SAMPLE IN
ON LINE
MANUAL CAL
SWEEP OUT
Appleton

2008

- A suicide fad is sweeping Japan: Hundreds of Japanese have killed themselves this year by mixing ordinary household chemicals into a lethal cloud of poison gas that often injures others and forces the evacuation of entire apartment blocks.
- **The 517 self-inflicted deaths by hydrogen sulfide poisoning this year are part of a bigger, grimmer story: Nearly 34,000 Japanese killed themselves last year, according to the Japanese national police. That's the second-highest toll ever in a country where the suicide rate is ninth highest in the world and more than double that of the USA, the World Health Organization says.**

US Cases

- in August 2008 the Pasadena, CA, Fire Department responded to a suicide involving Hydrogen Sulfide. The victim, found dead in his car, had mixed a fungicide and a toilet bowl cleaner in a plastic tray creating a bright blue liquid and placed the tray in the back seat of his vehicle. The man that killed himself placed a note on the vehicle warning first responders of the hazard. A subsequent investigation revealed that this person may have been to multiple web sites of Japanese origin that provides information on how to use Hydrogen Sulfide as a tool to commit suicide.

Exposure Limits

- **WORKPLACE EXPOSURE LIMITS**
- OSHA: The legal airborne permissible exposure limit
- Permissible Exposure Limits (PEL) is **20 ppm**, not to be exceeded at any time.

Protect Yourself!!

- Where the potential exists for exposure over **5 ppm**, use MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive pressure
- For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive pressure mode.

Chemicals Used…

- Bonide- Sulfur Spray- Insecticide AND
- Hydrochloric (Muriatic) Acid (Pool Chemical) or
- Toilet Bowl Cleaner AND
- Laundry Detergent
- Chemicals are mixed together in a tray or dish in enclosed environment.
- Sometimes a toxic cloud may be present

Treatment of H2S

- Haz Mat Decon!!!!!
- High Flow 02- H2S acts like Cyanide poisoning and binds with hemoglobin
- Consider Hyperbaric Chamber
- Intravenous Access
- Cardiac Monitor
- Blood Glucose
- Vital Signs

Treatment of H2S

Nitrites

- Sodium Nitrite (Adult and Pediatrics)
  - .33 mL/kg of 3% solution slow IVP with a maximum dose of 10 mL
- Bronchodilators
  - Albuterol
    - Adult- 2.5 mg nebulizer
    - Pediatrics <5 y/o- .25-.5 mL

- QUESTIONS ????