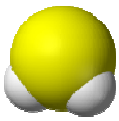
AIR filtration SYSTEMS

Superior Dust & Odor Control

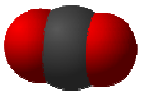
TECH NOTE: SEWER GAS

Components

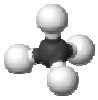
Sewer gas is a generic name for the collection of gases and airborne agents that often accompany sewage and the natural processes and reactions associated with sewage processing and the decomposition of organic materials. The major components of sewer gas can include: hydrogen sulfide (H2S), carbon dioxide (CO2), methane (CH4), ammonia (NH3), biological organisms, water vapor, and other chemicals. The presence and concentration of any of these components can vary with time, composition of the sewage, temperature and pH.



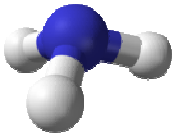
• **Hydrogen sulfide's** concentration in the gas phase is dependent upon its concentration in the liquid phase and ambient equilibrium conditions. At non-toxic levels, H2S has the familiar odor of rotten eggs. At acutely toxic levels, H2S quickly paralyzes an individual's ability to detect its odor, and will rapidly render a victim unconscious. (See Table 1 on page 2)



• **Carbon dioxide** and methane have little or no odor characteristics and have a saturated gas density approximately 1.5 and 0.6 times that of air, respectively. (See Table 2 on page 2)



• **Methane** is extremely flammable, has a wide explosive range, and a low flash point. These characteristics result in a substantial fire and explosion hazard. (See Table 3 on page 2)



• **Ammonia** has a distinct, strong odor with good warning characteristics which are present well before attaining toxic levels. (See URL: http://www.atsdr.cdc.gov/toxprofiles/tp126-c3.pdf)

**All of the above gases are colorless at the concentrations commonly encountered in sewage systems.*
*** see note at end of page 2*

Health Effects and Hazards

The major adverse health effects and hazards from exposure to sewer gases are:

- Poisoning from H2S, Asphyxiation from displaced or consumed oxygen
- Decreased vigilance or fatigue due to reduced oxygen levels (from CO2 and CH4)
- Biological contamination
- Fires and explosions from methane gas, H2S or other flammable gases
- Selected Wastewater Related Diseases and Viruses (inhalation hazard). Common biological agents found in sewer systems may be bacteria, viruses, or parasites.

(Tuberculosis, Poliomyelitis, Common cold, Histoplasmosis, Adenovirus, Echovirus, Coxsackie A & B, Bacillary, dysentery, Rotavirus Pathogen, SARS)

Hydrogen sulfide has been reported as the leading cause of sudden death in the work place. At concentrations in air of approximately 300 ppm, H2S can be immediately deadly. It is absorbed primarily through the lungs, but can also be adsorbed to a limited extent through the skin and mucous membranes. Chronic health effects caused by repeated exposures have not been established. Common symptoms to non-acute exposure levels include eye irritation, fatigue, headache, and dizziness.

Carbon dioxide is a simple asphyxiant (displaces oxygen) and a stimulant for the respiratory system. A concentration of 5% may produce headaches and shortness of breath. Background concentrations of carbon dioxide in air range from 300 to 400 ppm.

Methane is a simple asphyxiant (displaces oxygen), but does not itself cause significant physiological responses.

CDC & Sewer Gas
Hydrogen Sulfide

CAS#: 7783-0604
UN#: 1053

Synonyms include dihydrogen sulfide, sulfur hydride, sulfurated hydrogen, hydrosulfuric acid, "sewer gas," "swamp gas," hepatic acid, sour gas, and "stink damp."

Medical Management Guidelines (MMGs) for Hydrogen Sulfide (H_2S)

MMGs Online Link
http://www.atsdr.cdc.gov/mhmi/mmg114.pdf

Sources:

1. Hutter, Gary M. "Reference Data Sheet on Sewer Gas(es)," Meridian Engineering & Technology, November 1993
2. J.B. Barsky et al., "Simultaneous Multi-Instrumental Monitoring of Vapors in Sewer Headspaces by Several Direct-Reading Instruments," Environmental Research v. 39 #2 (April 1986): 307-320.
3. "Characteristics of Common Gases Found in Sewers," in Operation of Wastewater Treatment Plants, Manual of Practice No. 11. Alexandria, VA, Water Pollution Control Federation, 1976, Table 27-1.
4. R.Garrison and M. Erig, "Ventilation to Eliminate Oxygen Deficiency in Confined Space - Part III: Heavier-than-Air Characteristics," Applied Occupational and Environmental Hygiene v. 6 #2 (February 1991): 131-140.
5. "Criteria for a Recommended Standard - Occupational Exposure to Hydrogen Sulfide," *DHEW Pub. No. 77-158; NTIS PB 274-196.*

Air Filtration Systems, Corp. 6208 Grizzly Gorge Street, Las Vegas, NV. 89130-7208
Phone 702-313-2060 ~ Fax 702-446-5216 ~ Web www.afslasvegas.com ~ E-Mail mail@afslasvegas.com

Health Risk Evaluation for Sewer Gas Tech Note

Table 1: Human Health Effects at Various **Hydrogen Sulfide Concentrations in Air

Exposure (ppm)	Effect/Observation	Reference (URL Link)
0.0005-0.01	Odor threshold	ATSDR 1999; McGavran 2001
0.01-0.6	Increased eye symptoms Increases in nausea Increased headache, mental symptoms, diseases of nervous system and sense organs	ATSDR 1999 (see Appendix B)
2.0	Bronchial constriction in asthmatic individuals	WHO 2003; ATSDR 1999
5.0	Increased eye complaints Mild respiratory, cardiovascular, musculoskeletal, and metabolic changes	WHO 2003 ATSDR 1999 (see Appendix B)
3.6-21	Eye irritation	WHO 2003
20	Fatigue, loss of appetite, headache, irritability, poor memory, dizziness Irritation of mucous membranes	WHO 2003 ATSDR 1999
100	Olfactory paralysis	ATSDR 1999
>560	Respiratory distress	WHO 2003
700	Death	WHO 2003

Table 2: Human Health Effects at Various PERCENTAGES of **Carbon Dioxide Concentrations in Air

Low / High Concentrations	Effect/Observation	Reference (URL Link)
2 to 3%	Shortness of breath, deep breathing Odor threshold	Aerias 2005; IVHHN 2005
5%	Breathing becomes heavy, sweating, pulse quickens	Aerias 2005; IVHHN 2005
7.5%	Headaches, dizziness, restlessness, breathlessness, increased heart rate and blood pressure, visual distortion	Aerias 2005; IVHHN 2005
10%	Impaired hearing, nausea, vomiting, loss of consciousness	Aerias 2005; IVHHN 2005
30%	Coma, convulsions, death	Aerias 2005; IVHHN 2005

Table 3: Human Health Effects at Various PERCENTAGES of **Methane Concentrations in Air

High / Low Concentrations	Effect/Observation (not toxic, displace oxygen)	Reference (URL Link)
12-16%	breathing and pulse rate are increased, with slight muscular incoordination	Canadian Centre for Occupational Health & Safety
10-14%	emotional upsets, abnormal fatigue from exertion, disturbed respiration	
6-10%	Headaches, dizziness, restlessness, breathlessness, increased heart rate and blood pressure, visual distortion	
<6%	Impaired hearing, nausea, vomiting, loss of consciousness	

****Note: information on this Tech Note was gathered for quick reference, for up to date information you will need to follow links or search online.**

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Phone 702-313-2060 ~ Fax 702-446-5216 ~ Web www.afslasvegas.com ~ E-Mail mail@afslasvegas.com