

8. REGULATIONS AND ADVISORIES

The international, national, and state regulations and guidelines regarding hydrogen sulfide in air, water, and other media are summarized in Table 8–1.

An acute-duration inhalation MRL of 0.2 ppm was derived for hydrogen sulfide. This MRL is based on a minimal LOAEL of 2 ppm for a greater than 30% alteration in two measures of lung function that are suggestive of bronchial obstruction (airway resistance and specific airway conductance) in 2 out of 10 persons with asthma (Jappinen et al. 1990). Although two measures of lung function were altered in two of the subjects, there were no statistically significant alterations in lung function for the whole group. The MRL was derived by dividing the unadjusted LOAEL by an uncertainty factor of 9 (3 for the use of a minimal LOAEL and 3 for human variability). Further details on the derivation of this MRL can be found in the MRL worksheets in Appendix A of this profile.

An intermediate-duration inhalation MRL of 0.02 ppm was derived for hydrogen sulfide. This MRL is based on a NOAEL of 10 ppm and a LOAEL of 30 ppm for olfactory neuron loss and basal cell hyperplasia in the nasal olfactory epithelium of rats exposed for 6 hours/day, 7 days/week for 10 weeks (Brenneman et al. 2000). The NOAEL was adjusted for intermittent exposure and multiplied by the regional gas dose ratio (RDGR) for extrathoracic effects to calculate a human equivalent concentration (HEC). The MRL was derived by dividing the $\text{NOAEL}_{\text{HEC}}$ by an uncertainty factor of 30 (3 to extrapolate from animal to human using dosimetric adjustment and 10 to account for human variability). Further details on the derivation of this MRL can be found in the MRL worksheets in Appendix A of this profile.

EPA has derived a chronic inhalation reference concentration (RfC) for chronic exposure to hydrogen sulfide. The RfC of 0.002 mg/m^3 (0.001 ppm) is based on a NOAEL of 13.9 mg/m^3 (10 ppm) and a LOAEL of 41.7 mg/m^3 (30 ppm) for nasal lesions of the olfactory mucosa in rats (Brenneman et al. 2000). The $\text{NOAEL}_{\text{HEC}}$ of 0.64 mg/m^3 was divided by an uncertainty factor of 300 (3 for interspecies extrapolation with dosimetric adjustment from rat to human, 10 for sensitive populations, and 10 for subchronic exposure) (IRIS 2004).

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Table 8-1. Regulations and Guidelines Applicable to Hydrogen Sulfide

Agency	Description	Information	Reference
<u>INTERNATIONAL</u>			
Guidelines:			
IARC	Carcinogenicity classification	No data	
WHO	Air quality guideline (averaging time of 24 hours)	0.15 mg/m ³	WHO 2000
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV (8-hour TWA)	10 ppm	ACGIH 2003
	STEL	15 ppm	
EPA	Accidental release prevention; threshold quantity	10,000 pounds	EPA 2004a 40CFR68.130
NAC	Interim AEGL-1 ^a		EPA 2004k
	10 minutes	0.75 ppm	
	30 minutes	0.60 ppm	
	60 minutes	0.51 ppm	
	4 hours	0.36 ppm	
	8 hours	0.33 ppm	
	Interim AEGL-2 ^b		
	10 minutes	41 ppm	
	30 minutes	32 ppm	
	60 minutes	27 ppm	
	4 hours	20 ppm	
	8 hours	17 ppm	
	Interim AEGL-3 ^c		
	10 minutes	76 ppm	
	30 minutes	59 ppm	
	60 minutes	50 ppm	
	4 hours	37 ppm	
	8 hours	31 ppm	
NIOSH	REL (10-minute ceiling TWA)	10 ppm	NIOSH 2004
	IDLH	100 ppm	
OSHA	Acceptable ceiling concentration	20 ppm	OSHA 2004e 29CFR1910.1000, Table Z-2
	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift		
	Concentration	50 ppm	
	Maximum duration	10 minutes once, only if no other measured exposure occurs	

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Agency	Description	Information	Reference
<u>NATIONAL</u> (cont.)			
OSHA	PEL (8-hour TWA) for construction industry	10 ppm	OSHA 2004c 29CFR1926.55, Appendix A
	PEL (8-hour TWA) for shipyard industry	10 ppm	OSHA 2004a 29CFR1915.1000, Table Z
	Highly hazardous chemicals that present a potential for a catastrophic event at or above the threshold quantity	1,500 pounds	OSHA 2004b 29CFR1910.119, Appendix A
b. Water			
	Designated as a hazardous substances pursuant to Section 311(b) of the Clean Water Act		EPA 2004j 40CFR116.4
	Reportable quantity of hazardous substance designated pursuant to Section 311(b) of the Clean Water Act	100 pounds	EPA 2004g 40CFR117.3
c. Food			
	No data		
d. Other			
EPA	Carcinogenicity classification	No data	IRIS 2004
	RfC	2×10^{-3} mg/m ³	
	RfD	Withdrawn	
	Superfund; extremely hazardous substances; threshold quantity	500 pounds	EPA 2004d 40CFR355, Appendix A
	Superfund; designated as a hazardous substance pursuant to Section 311(b)(2) of the Clean Water Act; reportable quantity	100 pounds	EPA 2004c 40CFR302.4
<u>STATE</u>			
a. Air			
Minnesota	Ambient air quality standard	0.05 ppm	Minnesota PCA
Wisconsin	Hazardous air contaminant; acceptable ambient concentration for emission rate		Wisconsin DNR 2004
	<25 feet	1.1664 pounds/hour	
	≥25 feet	4.8960 pounds/hour	
	Ambient air standard	335 µg/m ³	
b. Water			
Wisconsin	Drinking water guideline	30 µg/L	HSDB 2004

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Agency	Description	Information	Reference
<u>STATE</u> (cont.)			
c. Food	No data		
d. Other	No data		

^aAEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

^bAEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long lasting adverse health effects or an impaired ability to escape.

^cAEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening adverse health effects or death.

ACGIH = American Conference of Governmental Industrial Hygienists; AEGL = Acute Exposure Guideline Level; CFR = Code of Federal Regulations; DNA = Department of Natural Resources; DWEL = drinking water equivalent level; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; HSDB = Hazardous Substances Data Bank; IARC = International Agency for Research on Cancer; IDLH = immediately dangerous to life or health; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NAC = National Advisory Committee; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PCA = Pollution Control Agency; PEL = permissible exposure limit; RCRA = Resource Conservation and Recovery Act; RfC = reference concentration; RfD = reference dose; STEL = short-term exposure limit; TLV = threshold limit values; TWA = time-weighted average; USC = United States Codes; WHO = World Health Organization