

List of highly toxic gases

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Many gases have toxic properties, which are often assessed using the LC50 (median lethal dose) measure. In the United States many of these gases have been assigned an NFPA 704 health rating of 4 (may be lethal) or 3 (may cause serious or permanent injury), and/or exposure limits (TLV, TWA or STEL) determined by the ACGIH professional association. Some, but by no means all, toxic gases are detectable by odor which can serve as a warning. Among the best known toxic gases are carbon monoxide, chlorine, nitrogen dioxide and phosgene.

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Definition

- **Toxic:** A chemical that has a median lethal concentration (LC₅₀) in air of more than 200 parts per million (ppm) but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.^[1]
- **NFPA 704:** Materials that, under emergency conditions, can cause serious or permanent injury are given a Health Hazard rating of 3. Their acute inhalation toxicity corresponds to those vapors or gases having LC₅₀ values greater than 1,000 ppm but less than or equal to 3,000 ppm. Materials that, under emergency conditions, can be lethal are given a Health Hazard rating of 4. Their acute inhalation toxicity corresponds to those vapors or gases having LC₅₀ values less than or equal to 1,000 ppm.

List

Chemical name	Chemical formula	CAS number	NIOSH IDLH in ppm	LC50 Model	LC50 toxicity in ppm ^{[note 1][2]}	Odor warning property	NFPA 704 Health Rating
Arsenic pentafluoride	AsF ₅	7784-36-3		Rat	20	inadequate	4
Arsine	AsH ₃	7784-42-1	3	Rat	20; ACGIH (2006) TWA-TLV 0.005ppm		4
Bis(trifluoromethyl)peroxide	C ₂ F ₆ O ₂	927-84-4	10	Rat			
Boron tribromide	BBr ₃	10294-33-4	50	Rat	380; ACGIH (1990) Ceiling limit 1ppm		3
Boron trichloride	BCl ₃	10294-34-5	25	Rat	2541		4
Boron trifluoride	BF ₃	7637-07-2	25		OSHA, ACGIH (1962) 1ppm ceiling		4
Bromine	Br ₂	7726-95-6	3		ACGIH (1991) STEL-TLV 0.2ppm		3
Bromine chloride	BrCl	13863-41-7		Rat	290		
Bromomethane	CH ₃ Br	74-83-9		Rat	811.14		3
Carbon monoxide	CO	630-08-0	1,200 (moderately toxic)		ACGIH (1989) TWA TLV 25ppm; NIOSH 35ppm; NIOSH 200ppm Ceiling limit		3
Chlorine	Cl ₂	7782-50-5	10		ACGIH (1986) STEL-TLV 1ppm	Odor threshold 1ppm	
Chlorine pentafluoride	ClF ₅	13637-63-3					
Chlorine trifluoride	ClF ₃	7790-91-2			ACGIH (1979) Ceiling limit 0.1ppm	inadequate	4
Chlorofluorocarbons							
Chloropicrin	CCl ₃ NO ₂	76-06-2			ACGIH (1990) TWA-TLV 0.1ppm		
Cyanogen	C ₂ N ₂	460-19-5		Rat	350; ACGIH (1966) TWA-TLV 10ppm	inadequate	4
Cyanogen chloride	CNCl	506-77-4		Rat	1.2 mg/l/h; ACGIH (1977) ceiling limit	inadequate	4

Chemical name	Chemical formula	CAS number	NIOSH IDLH in ppm	LC50 Model	LC50 toxicity in ppm ^{[note 1][2]}	Odor warning property	NFPA 704 Health Rating
					0.3ppm		
Diazomethane	CH ₂ N ₂	334-88-3	2		ACGIH (1970) TWA-TLV 0.2ppm		
Diborane	B ₂ H ₆	19287-45-7		Rat	80; ACGIH (1990) TWA-TLV 0.1ppm	inadequate	4
Dichloroacetylene	C ₂ Cl ₂	7572-29-4		Mouse	45.6		
Dichlorosilane	H ₂ Cl ₂ Si	4109-96-0		Rat	314		4
Fluorine	F ₂	7782-41-4		Rat	185; ACGIH (1970) STEL-TLV 2ppm	odor threshold 20ppb	
Formaldehyde, gas	CH ₂ O	50-00-0		Rat	0.66; ACGIH (1987) Ceiling limit 0.3ppm		3
Germane	GeH ₄	7782-65-2		Rat	622	inadequate	4
Hexaethyl tetraphosphate	(C ₂ H ₅ O) ₆ P ₄ O ₇						
Hydrogen azide	HN ₃	7782-79-8					
Hydrogen cyanide	HCN	74-90-8		Rat	40; ACGIH (1991) ceiling limit 4.7ppm	inadequate	4
Hydrogen selenide	H ₂ Se	7783-07-5	1	Rat	2; ACGIH (1990) TWA-TLV 0.05ppm	inadequate	4
Hydrogen sulfide	H ₂ S	7783-06-4	100	Rat	712; ACGIH (1990) STEL-TLV 15ppm		4
Hydrogen telluride	H ₂ Te	7783-09-7					
Nickel tetracarbonyl	Ni(CO) ₄	13463-39-3			ACGIH (1980) TWA-TLV 0.05ppm	inadequate	4
Nitrogen dioxide	NO ₂	10102-44-0				odor threshold 4 ppm	
Osmium tetroxide	OsO ₄	20816-12-0		Rat			
Oxygen difluoride	OF ₂	7783-41-7		Rat	2.6; ACGIH (1983) ceiling limit 0.05ppm		

Chemical name	Chemical formula	CAS number	NIOSH IDLH in ppm	LC50 Model	LC50 toxicity in ppm ^{[note 1][2]}	Odor warning property	NFPA 704 Health Rating
Perchloryl fluoride	<chem>ClFO3</chem>	7616-94-6		Rat	770; ACGIH (1962) STEL-TLV 6ppm		
Perfluoroisobutylene	<chem>C4F8</chem>	382-21-8		Rat	1.2		
Phosgene	<chem>CCl2O</chem>	75-44-5		Rat	5; ACGIH (1992) TWA-TLV 0.1ppm	inadequate	4
Phosphine	<chem>PH3</chem>	7803-51-2	50		NIOSH 0.3ppm time weighted average; ACGIH (1992) STEL-TLV 1ppm	inadequate	4
Phosphorus pentafluoride	<chem>PF5</chem>	7647-19-0		Rat	260		
Selenium hexafluoride	<chem>SeF6</chem>	7783-79-1	2	Rat	50; ACGIH (1992) TWA-TLV 0.05ppm		
Silicon tetrachloride	<chem>SiCl4</chem>	10026-04-7		Rat	750		
Silicon tetrafluoride	<chem>SiF4</chem>	7783-61-1		Rat	450		
Stibine	<chem>H3Sb</chem>	7803-52-3	5	Rat	20		4
Disulfur decafluoride	<chem>S2F10</chem>	5714-22-7	1		ACGIH (1962) ceiling limit 0.01ppm		4
Sulfur tetrafluoride	<chem>SF4</chem>	7783-60-0		Rat	40; ACGIH (1992) ceiling limit 0.1ppm		3
Tellurium hexafluoride	<chem>TeF6</chem>	7783-80-4		Rat	25; ACGIH (1992) TWA-TLV 0.02ppm		
Tetraethyl pyrophosphate	<chem>C8H20O7P2</chem>				ACGIH (2006) TWA-TLV 0.01 mg/cubic meter		
Tetraethyl dithiopyrophosphate	<chem>C8H20O5P2S2</chem>						
Trifluoroacetyl chloride	<chem>C2ClF3O</chem>	354-32-5		Rat	1000		
Tungsten hexafluoride	<chem>WF6</chem>	7783-82-6		Rat	217	inadequate	

Notes

1. unless noted as occupational exposure limits. ACGIH Threshold Limit Values are listed with documentation date.

See also

- List of Schedule 1 substances (CWC)
- List of extremely hazardous substances

References

1. "California Fire Code California Code of Regulations, Title 24, Part 9, Chapter 2 - Definitions" (PDF).
2. ACGIH Threshold Limit Values for Chemical Substances and Physical Agents, 2009, ISBN 978-1-882417-95-7.

Sources

- Principles for the Safe Handling and Distribution of Highly Toxic Gases and Mixtures (http://www.asiaiga.org/docs/AIGA%20026_06%20Principles%20for%20safe%20handling%20&%20distribution%20of%20h.pdf) Asia Industrial Gases Association, 2006

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