



OWR AG - WORLD LEADER IN NBC DECONTAMINATION

Characteristics and Effects of Chemical Warfare Agents													
Description	Nerve Agents				Blister Agents (Vesicants)			Choking Agents		Blood Agents		Psychedelic Agent	
	Tabun	Sarin	Soman	VX	S-Mustard	N-Mustard	Lewisite	Phosgene	Chloropicrin	Hydrogen Cyanide	Cyanogen Chloride	BZ	
US-Description	GA	GB	GD	VX	HD	HN1-3	L	CG	PS	AC	CK	BZ	
Chemical formula	C <sub>5</sub> H <sub>11</sub> N <sub>2</sub> O <sub>2</sub> P	C <sub>4</sub> H <sub>10</sub> FO <sub>2</sub> P	C <sub>7</sub> H <sub>16</sub> FO <sub>2</sub> P	C <sub>11</sub> H <sub>26</sub> NO <sub>2</sub> PS	S(C <sub>2</sub> H <sub>4</sub> Cl) <sub>2</sub>	N(C <sub>2</sub> H <sub>4</sub> Cl) <sub>3</sub>	C <sub>2</sub> H <sub>2</sub> AsCl <sub>3</sub>	COCl <sub>2</sub>	CCl <sub>3</sub> NO <sub>2</sub>	HCN	CNCl	C <sub>21</sub> H <sub>23</sub> NO <sub>3</sub>	
Weight of Molecule [g/mol]	162.3	140.1	182.2	267.4	159.1	204.5 (HN-3)	207.4	98.9	164	27.04	61.4	337.4	
Density at 25°C [g/cm <sup>3</sup> ]	1.073	1.0887	1.022	1.008	1.27 (20°C)	1.24 (25°C)	1.89 (20°C)	1.42	1.69 (0°C)	0.68	1.18	1.33	
Melting point	-50	-56	-80	-30	14	-4	-18	-127.9	-64	-13.2	-6	189	
Boiling point [°C]	246	147	300	167	227.8	230-235	190	7.5	112	25.7	12.66	322	
Flashpoint [°C]	78	non-flammable	121	159	105	n/a	--	--	non-flammable	-18	--	246	
Vapour pressure 25°C [mmHg]	0.07	2.2	0.31	0.0007	0.072 (20°C)	0.011	0.39 (20°C)	1,178 (20°C)	16.9 (20°C)	612 (20°C)	1,002 (20°C)	marginal (solid)	
Volatility at 20°C [mg/l]	0.6	12.5	2.06	0.01	0.61	0.07	2.3	6,370	184	837	3,300	0.0005	
Weather dependent duration of hazard:													
Sun, -10°C, Snow, windless	1-14 days	1-2 days	7-42 days	7-112 days	2-8 weeks	>8 weeks	2-7 days	15-60 min.	similar to Phosgene	1-4 hrs.	15-60 min.		
Rain, 10°C, windy	0.5-6 hrs.	0.25-1 hrs.	3-36 hrs.	1-12 hrs.	12-48 hrs.	like S-Mustard	12-24 hrs.	few min.		few min.	few min.		
Sun, 15°C	1-4 days	0.15-4 hrs.	2.5-5 days	3-21 days	2-7 days	2-5 days	3-6 hrs.	few min.		few min.	few min.		
Water solubility [%]	12	optional	1.5	marginal (1-4)	0.08	0.05	0.05	marginal	very marginal	optional	marginal (7%)	very marginal	
Colour of base product	colourless	colourless	colourless	colourless	colourless	colourless	colourless	colourless	colourless	colourless	colourless	white, solid crystals	
Colour of processed product	yellow-brown	yellow-brown	yellow-brown	colourless	light yellow-brown	light yellow	colourless	colourless	colourless	colourless	colourless		
Toxicity values:													
Lethal dose LD50 [mg/kg]	oral: 5 percutaneous: 14-21	oral: 0.14 percutaneous: 24	oral: 0.14 percutaneous: 5-15	oral: 0.07 percutaneous: 0.2	percutaneous: 60	percutaneous: 15-20	percutaneous: 15-20			1-100 (indiv. different)			
Lethal concentration. LCt50 [mg x min/m <sup>3</sup> ]	300	100-200	40-70	35-45	inhaled: 1,500 percutaneous: 10,000	inhaled: 1,500 percutaneous: 10,000	inhaled: 1,200 percutaneous: 100,000	3,200	12,800	600-2,000	11,000	200,000	
Incapacitating concentration ICt50 [mg x min/m <sup>3</sup> ]	100	75	25	5	eyes: 200 skin: 2,000	eyes: 200 skin: 2,500	eyes: 300 skin: 1,500	1,600	eyes: 25-50 lung: 100-200	1,000	7,000	causing psychosis: 110	
Odour	slightly fruity	almost odourless	fruity, like camphor	odourless	like mustard, onions	fish	geranium	like hay, rotting fruit	pungent	bitter almond	pungent		
Special features	Hydrocyanic Acid through hydrolyse	good penetration of chemical warfare agent Sarin: high volatility		high durability surface permanence	mustard becomes thickened with additives	works well in cold weather	mixable with other chemical warfare agents		strong anti-riot agent	Hydrocyanic Acid not noticeable by all humans (genetic condition)		anticholinergic, latent period 45-60 min.	
Absorption	respiratory tract, skin/mucous membranes, eyes, gastrointestinal tract				skin, eyes, respiratory tract, gastrointestinal tract			respiratory tract		respiratory tract, gastrointestinal tract, rarely skin			
Toxic effects	<b>Vegetative Nervous System:</b> constriction of pupils (miosis), headache, runny nose, hypersalivation, vomiting, abdominal cramps, bronchospasm, diarrhea <b>Peripheral Nervous System:</b> twitching of muscle groups, respiratory paralysis <b>Central Nervous System:</b> convulsion, severe breathing difficulty or respiratory failure				<b>Damaging Effects to Skin:</b> <b>Mustard:</b> Latent period 6-8hrs., then redness, itchiness, pearl-like blisters, necrotic lesions, secondary infections <b>Lewisite:</b> no latent period, itchiness, blisters, lung edema, eyes/respiratory damage, systematic long-term damage			Toxic Pulmonary edema: Latent period (6-8 hrs.), free of symptoms, then coughing, breathlessness, unrest, chest pain, choking, high concentration immediately deadly		Cyanide is thought to act by combining with the enzyme cytochrome oxidase. Impairment of cellular oxygen use. Dizziness, increasingly dyspneic, healthy skin colour, headache, cramps, respiratory standstill		wide pupils, dry mouth, angst, dizziness, hallucinations, worst case unconsciousness	
Safety procedures	Immediately hold breath, put NBC mask and put NBC protective clothing on												
First aid/medical attention	Pay attention to self protection! Remove chemical warfare agent from skin (decontamination powder), wash eyes <b>Antidote:</b> Atropine 2-5-10mg intravenously (until salivation is suspended) <b>Choline reactivation:</b> Obidoxim 250mg intravenously (does not work with Soman poisoning) or Pralidoxime (PAM-CI) 600mg <b>With cramps:</b> Benzodiazepan 5-10mg intravenously <b>Automatic injections:</b> 1. Combined injection (with 2mg Atropine and 220mg Obidoxim) intramuscular, if after 8-10 min. no improvement is made: 1. Atropine automatic injection (2mg), if necessary after 8-10min. 2. Atropine automatic injection if necessary artificial respiration and further treatment of symptoms				<b>Chemical Warfare Agent in eyes:</b> immediately wash eyes <b>Chemical Warfare Agent on skin:</b> decontaminate with decontamination powder, sterile cover, if necessary Sodium-Thiosulfate 250-500mg/kg/body mass, if necessary systemic antihistamins/analgesics; prophylaxis/therapy for toxic lung edema <b>Lewisite contamination:</b> Dimercaprol-eyes/skin-ointment, Dimercaprol initial until 3mg/kg body mass intramuscularly, alternatively DMPS (better compatibility): 100-200mg orally every 2 hrs. or 250mg intravenously every 3-4 hrs.			Immediately end exposure, raise upperbody to ensure airtsupply, if necessary artificial respiration with PEEP (positive end expiratory pressure), if necessary steroid therapy (contested), treatment of symptoms		Oxygen supplementation <b>Antidote:</b> 4-DMAP 3-4 mg/kg/body mass, instantaneously Sodium-Thiosulfate 100mg/kg body mass intravenously, if necessary vitamin B12 intravenously. In most cases decontamination is not needed		isolation, Benzodiazepam (5-10mg) and Physostigmine (2-4 mg intravenously), treatment of symptoms	

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Definitions:

- a. Dose. The dose is the quantity of the compound received by the subject.
- b. LD50. The LD (lethal dose)50 is the dose which kills 50% of the exposed population.
- c. ID50. The ID (incapacitating dose)50 is the dose which incapacitates 50% of the exposed population.
- d. Ct (Concentration time). The Ct is a measure of exposure to a vapour or aerosol. The concentration in the air and the time of exposure govern the dose received, as does rate of respiration. It is assumed that, when the product of concentration and time is constant, so is the biological effect over a limited range of concentration and time. For very short or long exposures the biological effect may vary. Concentration is expressed as mg.m-3 and time as minutes, so that the concentration time (Ct) is expressed as mg.min.m-3.
- e. LCt50. The LCt (lethal concentration time)50 is the Ct which will kill 50% of the exposed population.
- f. ICt50. The ICt (incapacitating concentration time)50 is the Ct which will incapacitate 50% of the exposed population.

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