



HSEEP Exercise Design Guidance Chemical Weapons Agents Awareness Information

Chemical Agents							
Agent	Symbol	Hazard	Signs/Symptoms	Onset	Persistency	Physical Properties	Odor
Nerve							
Tabun	GA	Inhalation	Runny nose, localized sweating, dimness of vision, pinpoint pupils, tightness in chest, difficulty breathing, drooling, cramping, frontal headaches, involuntary jerking and twitching, drowsiness, coma, convulsions, nausea, cessation of breathing, death	Very rapid	1–2 days if heavy conc.	Colorless–brown liquid	None when pure; fruity
Sarin	GB	Inhalation		Vapor: seconds	1–2 days will evap. <= water	Colorless liquid	None when pure; fruity
Soman	GD	Inhalation		Liquid: minutes to hours	1–2 days: moderate (non)	Colorless liquid/vapor	
Thickened Soman	TGD	Inhalation			More than 1 week when thickened		Camphor when pure; fruity
GF	GF	Inhalation, absorption, ingestion		Very rapid		Colorless liquid	Sweet, musty, peaches, shellac
V Agent	VX	Inhalation, absorption		Very rapid; death in 15 minutes	High: 1 week if heavy conc.; as volatile as motor oil	Amber, oily thick liquid	None
Vesicants: These agents cause blisters and/or necrosis equivalent to second- and third-degree chemical burns.							
Sulfur Mustard	H	Inhalation, absorption, ingestion	Acts first as a cell irritant, later as a cell poison. Local conjunctivitis, reddening of skin, formation of blisters, inflammation of nose, throat, brachi, bronchi, and lung tissue	Delayed 4 to 6 hours to 24 hours	Days to weeks—very high	Oily, colorless to amber liquid	Garlic, onion
Distilled Mustard	HD	Inhalation, absorption, ingestion			Days to weeks—very high		Garlic, onion, horseradish
Nitrogen Mustard	HN1, 3	Inhalation, Absorption, Ingestion		Delayed 12 hours	High—very high	Dark liquid	Fishy, musty



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Mustargen	HN2	Inhalation, absorption, ingestion		Delayed 12 hours	Moderate	Dark liquid	Fruity (high concentrations); soapy (low)
Lewisite (Arsenical)	L	Inhalation, absorption	Immediate pain, with blisters forming later	Immediate	Days—longer in cold, dry climates	Oily/colorless—brown	Geraniums, or none if pure
Phosgene Oxime (Urticant/Irritant)	CX	Inhalation, absorption	Immediate pain, with blisters forming later	Immediate	2 hours in soil, nonpersistent—low	Colorless prismatic crystals; solid <95°F/liquid	Disagreeably penetrating and severely irritating
Blood							
Hydrogen Cyanide	AC	Inhalation	Cherry red skin or ~30% cyanosis. Victims appear to be gasping for air. This may cause nausea and tearing. Convulsions predeath. Effect like asphyxiation, but more sudden.	Very rapid, 30 seconds to 8 minutes	1 to 2 days; extremely volatile	Colorless liquid/gas	Bitter/burnt almonds or peach kernel
Cyanogen Chloride	CK	Inhalation		Liquid rapidly vaporizes and disperses		Colorless liquid/gas	Tearing makes odor unnoticeable
Arsine	SA	Inhalation		Delayed 2 hours to 11 days	Low	Colorless gas	Mild garlic
Choking							
Chlorine	CL	Inhalation	Tearing, dry throat, apparent choking, painful coughing, tightness in chest, headache, nausea, vomiting, dyspnea, 2 to 6 hours until pulmonary edema. Severe pneumonia.	Immediate if high concentration; 3 hours if low	Short. Vapor may persist in low-lying or enclosed areas.	Gas-norm temp	Bleach
Phosgene	CG	Inhalation		Death 6 to	Dissipates and breaks down fast in water,	Colorless gas	Newly mown hay or freshly cut grass or green
Diphosgene	DP	Inhalation				Colorless gas,	



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				8 minutes	fog, and rain	rapid evap. liquid	corn
Riot Control							
Tear Gas	CS	Inhalation, absorption	Immediate tearing, possibly involuntary closing of the eyes, choking. Effects can occur within seconds, but seldom persist more than a few minutes after exposure.	20 to 60 seconds	Low/high	Colorless solid, powder, liquid	Hair spray or pepper due to the variety of propellants
Tear Gas	CR	Inhalation, absorption		Very rapid	60+ days on porous material	Yellow powder in solid form	
Mace	CN	Inhalation, absorption		Immediate	Low/short	Solid powder	Apple blossoms
Pepper Spray	OC	Inhalation, absorption		Immediate			
Chloropicrin	PS	Inhalation, absorption	Throat irritation, coughing, and vomiting. Causes severe burns on the skin (lesions)	6 hours outside	Approximately 6 hours in vegetation fields	Colorless, oily liquid	Stinging, pungent
Vomiting							
Clark I/Clark II	DA, DC, DX	Inhalation, absorption	Like cold symptoms, plus violent, uncontrolled sneezing, coughing, nausea, and vomiting	30 seconds to 2 minutes	Low/short	Solids vaporize when heated	DA: none DC: garlic/ almonds
Adamsite	DM	Inhalation			Short: aerosolized dissemination		None, but irritating
Incapacitating							
LSD	BZ/ LSD	Inhalation, ingestion	Giddiness, confusion, stumbling, and vomiting	Delay 1 to 4 hours	High: soil, water, and surfaces	White crystals	None



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Chemical Warfare Agents – Responder Information									
Agent	Symbol	Dispersion	ERG	DOT	Initial Treatment	Detection	Self-Protection	OSHA	Decon
Nerve									
Tabun	GA	Aerosolized liquid	153	6.1	MARK I = 2 mg. Atropine and 600 mg 2-Pam Cl (Pralidoxime Chloride). Diazepam follows three MARK Is. IV effects within 1 minute; IM 8 minutes. Ventilation and suction airway.	M-8 or M-9, CAM Colorimetric tubes Detection kits: M-256A1, M-18A2, Pesticide tickets, Electronic meters	Mask and protective clothing	Level B	Flush with large amounts of water and 5% bleach for objects or 0.5% bleach for skin/people.
Sarin	GB	Aerosolized liquid	153	6.1			Mask and protective clothing	Level B	
Soman	GD	Aerosolized liquid	153	6.1			Mask and protective clothing	Level B	
Thickened Soman	TGD	Aerosolized liquid	153				Mask and protective clothing	Level A	
GF	GF	Aerosolized liquid	153					Level B	
V Agent	VX	Aerosolized liquid	153	6.1			Mask and protective clothing	Level A	
Vesicants									
Mustard	H	Aerosolized liquid	153	6.1	Get agent off exposed skin. Remove contaminated clothes. Eyes must not be bandaged.	M-8 or M-9, CAM Detection kits: M-18, M-256, Colorimetric, Electronic	Turnout gear will NOT protect from vapors	Level A	Flush with copious amounts of water and 5% bleach for things or 0.5% bleach for people. Do within 2 minutes
Distilled Mustard	HD	Aerosolized liquid	153	6.1			Mask and protective clothing	Level A	
Nitrogen Mustard	HN1,3	Aerosolized liquid	153	6.1			Mask and protective clothing		



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Chemical Warfare Agents – Responder Information									
Agent	Symbol	Dispersion	ERG	DOT	Initial Treatment	Detection	Self-Protection	OSHA	Decon
Mustargen	HN2	Aerosolized liquid	153	6.1	Flush contaminated areas, but watch runoff. British anti-Lewisite cream (BAL) antidote is dimercaprol for intramuscular. Toxic-symptomatically.	meters	Mask and protective clothing		To prevent tissue damage. CX: none is totally effective
Lewisite	L	Aerosolized liquid	153	6.1		Not CAM, M-8, or M-9	Mask and protective clothing	Level A	
Phosgene Oxime	CX	Aerosolized liquid	153				Mask and protective clothing	Level A	
Blood									
Hydrogen Cyanide	AC	Aerosolized liquid	117	6.1	Move victim out of contaminated area. Assist ventilation. Lilly Cyanide Kit: sodium nitrite amyl nitrite, sodium thiosulfate	Detection kits: M-256/18 Colorimetric tubes Electronic meters Not CAM/SA–none	Mask and protective clothing if handling agent as liquid. Good respirator/aeration.	Level B	Remove wet, contaminated clothing. Flush face/skin with water and hypochlorite solution.
Cyanogen Chloride	CK	Vapor release	125	2.3			SA: protective mask adequate	Level B	
Arsine	SA	Vapor release	119					Level B	
Choking									
Chlorine	CL	Vapor release	124	2.3	Move victim to fresh air and assist breathing.	Detection kits Colorimetric tubes	Protective mask		Vapor: fresh air Liquid: copious water irrigation
Phosgene	CG	Vapor release	125	2.3			Good respirator protection, plus	Level B	



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Chemical Warfare Agents – Responder Information									
Agent	Symbol	Dispersion	ERG	DOT	Initial Treatment	Detection	Self-Protection	OSHA	Decon
Diphosgene	DP				Codeine for cough control. Rest.	Electronic meters	aeration and time		
Riot Control									
Tear Gas	CS	Aerosolized	159		Usually no treatment is necessary; effects are self-limiting.	Limited field detect	Mask and protective clothing secured at neck, wrists, and ankles		Brush off powder. Water. Hypochlorite exacerbates the skin lesion and should NOT be used. Remove clothes.
Tear Gas	CR	Propelled	159			Identify by collecting residue for laboratory analysis.			
Mace	CN		153						
Pepper Spray	OC		159				Protective mask for vapor		
Chloropicrin	PS					Colorimetric tubes for CN and OC	Mask and protective clothing		
Vomiting									
Clark I/Clark II	DA, C, F, X	Dispersed by heat as fine particle smoke				None	Protective mask		0.5% bleach for an enclosed release
Adamsite	DM					None	Protective mask		
Incapacitating									
LSD	BZ/LSD				Observation, restraint, confinement	None	Protective mask		Soap and water



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Chemical Warfare Agents – Technical Data										
Agent	Symbol	Vapor D.	VP at 25° C	LC50/LD50 in mg-min/m3			IDLH	TWA	CAS. No.	Remarks
		Relative to Air	mm Hg	Respiratory	Liquid Form	Vapor Form	in ppm SCBA	in ppm Respirator		
Nerve										
Tabun	GA	5.63	0.037	400	1 to 1.5 gm/prsn	20,000 to 40,000	0.2	0.0001	77-81-6	30 minutes off gas from vapor contract. Less than 2 grams on skin can kill.
Sarin	GB	4.86	2.9/2.10	70 to 100	1.7 gm/prsn	12,000	0.2	0.0001	107-44-8	Covalent bond between GD and acetylcholinesterase= irreversible >2 minutes. Soman is the most poisonous of G series.
Soman	GD	6.33	0.4	70 to 100	0.35 gm/prsn	10,000	0.6	0.00003	96-64-0	
Thickened Soman	TGD									
	GF	6.2	0.044						329-99-7	Conversion; parts per million (ppm)=mg3x24.45/mlclr.wt
V Agent	VX	9.2	0.0007	1 to 100 (30)	0.00945 gm/p	6 to 360	0.02	0.00001	50782-69-9	Pinhead-size drop on skin is lethal.
Vesicants										
Mustard	H	5.4	0.072	1,500	7 gm/prsn	10,000	0.003	0.003	505-60-2	Acts as irritant to tissue and causes fluid secretion of skin, eyes, and lungs that won't cause more blisters. Drop from pinhead can cause blisters. Vapors on skin cause blisters.
Distilled Mustard	HD	5.4	0.072	Decreases as temperature rises			0.003	0.003	505-60-2	
Nitrogen Mustard	HN1, 3	5.9/7.1	0.24/0.0109	1,500	7 gm/prsn		0.003	0.003	538-07-08	
Mustargen	HN2	5.4	0.29	3,000			0.003	0.003	51-75-2	



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		Relative to Air	mm Hg	Respiratory	Liquid Form	Vapor Form	in ppm SCBA	in ppm Respirator		
Lewisite	L	7.2	0.35	1,000 to 1,500	2.8 gm/prsn	100,000+	0.003	0.003	541-25-3	Freeze at 58 °F. L-systemic poisoning: diarrhea, low temperature, low blood pressure, pulmonary edema. Liquid can cause permanent blindness within 1 minute. Reddening begins in 30 minutes. Blisters appear after 30 hours.
Phosgene Oxime	CX	3.9	13 at 40°C (liquid)	3,200	Unknown	Unknown			35274-08-9	
Blood										
Hydrogen Cyanide	AC	0.93	630/742	2,000 to 5,000			50 ppm	5/4.7 ppm	74-90-8	Commonly used chemical. 250,000 tons yearly. CK can break down charcoal filter masks. Death in 15 minutes if remains in lethal concentration. SA is a carcinogen.
Cyanogen Chloride	CK	2.1	1,010/1,000	11,000			50 ppm	0.6/.3 ppm	506-77-4	
Arsine	SA	2.69	11,100	5,000						
Choking										
Chlorine	CL	2.49	6.8 atm/4.8	19,000			10/25/30	1.5/5-1 ppm	7782-50-5	Both shipped daily in tanker trucks and rail cars. CG frequently



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Agent	Symbol	Vapor D.	VP at 25° C	LC50/LD50 in mg-min/m3			IDLH	TWA	CAS. No.	Remarks
		<i>Relative to Air</i>	<i>mm Hg</i>	<i>Respiratory</i>	<i>Liquid Form</i>	<i>Vapor Form</i>	<i>in ppm SCBA</i>	<i>in ppm Respirator</i>		
Phosgene	CG	3.4	1.6 atm/1.173	3,200		4, 300,000	12.1/2/2	0.4/.1 ppm	75-44-5	generated in structure fires from burning plastics. Most deaths occur within 24 hours.
Diphosgene	DP									
Riot Control										
Tear Gas	CS	–	0.00034	61,000			0.3 ppm	0.05 ppm	2698-41-1	Also called lacrimators, irritants, and tear gas. Solid can collect on clothes and increase duration of effectiveness. Not gas! Micropulverized smoke/liquid/powder.
Tear Gas	CR	6.7-calculated	0.00059	–			2 mg/m3		257-07-8	
Mace	CN	5.3	0.0026	7,000 to 14,000			16 ppm	0.05 ppm	532-27-4	
Pepper Spray	OC						100 mg/m	10,000 gm/		
Chloropicrin	PS	5.6	18.3	2,000			4 ppm	0.1 ppm	76-06-2	Decomposes into Cl gas and nitrogen oxide near open fires, producing toxic fumes.
Vomiting										
Clark I/Clark II	DA, C, F, X	No appreciable vapors	0.0002-.0036	10,000 to 15,000					712-48-1	Contains arsenic and chlorine—causing mask removal to vomit=potential alternative exposure
Adamsite	DM		Negligible	11,000 avg				0.04 ppm	578-94-9	



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		<i>Relative to Air</i>	<i>mm Hg</i>	<i>Respiratory</i>	<i>Liquid Form</i>	<i>Vapor Form</i>	<i>in ppm SCBA</i>	<i>in ppm Respirator</i>		
Incapacitating										
LSD	BZ/ LSD	11.6	0.03 at 70 °C	200,000					13004-56-3	Psychochemicals. Normalcy in 48 to 96 hours.



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Military Detection, Monitoring, and Treatment Equipment							
Equipment	Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
M-8 Paper	Nerve-G	Turns yellow	Liquid	≤30 sec	\$3.47/ book	Disposable (after use). Handheld. Dry, undamaged paper has indefinite shelf life.	Chemical agent detector paper. 25 sheets per book; 50 booklets per box. Potential for false readings.
	Nerve-VX	Turns green	Liquid		\$4.50/ book		
	Vesicant-H	Turns red	Liquid		\$166/box		
M-9 Paper	Nerve-G	Develops a single color indicating agent present	Liquid	≤20 sec	\$6.57 /10 m. roll \$38/roll	Disposable (after use). Handheld. 3-year shelf life. Carcinogen	Adhesive-backed dispenser roll or books. Others: Chinese X-1, X-3, three-way and Hungarian double-way patch.
	Nerve-VX		Liquid				
	Mustard		Liquid				
M-18A2 Detector Kit	Nerve-GB	Blue band- yellow	Dangerous concentrations of vapors, aerosols, or liquid droplets	2 to 3 minutes	\$343/kit	Disposal (after use) tubes. Handheld	25 tests per kit. Detector tubes, detector tickets, and M-8 paper. Used to confirm the results of M256. SAW MiniCAD and CAM.
	Nerve-VX	Enzyme ticket-blue			\$500/kit		
	Mustard-H, HN, HD, HT	Blue band-purple					
	Arsenical-CX	Blue band-red/brown					
	Lewisite-L, ED, MD	Yellow-blue/green					
	Phosgene-CG	Green band-green					
	Blood-AC	Red band-blue					



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Military Detection, Monitoring, and Treatment Equipment							
Equipment	Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
	Blood-CK	Blue band- yellow/orange					
	Unknown	White band tube					
M-256A1 Detector Kit	Nerve-G and V	Star test spot	Vapor/liquid	15 minutes -series take longer	\$140/kit	Disposable (after use). Handheld. 5- year shelf life.	Each kit contains 12. Disposable (after use) plastic sampler-detectors and M-8 paper.
	Mustard-H	Square spot	Vapor/liquid		\$133/kit		
	Lewisite-CX	Detecting tablet	Vapor/liquid				
	Blood-AC, CK	Circular spot	Vapor/liquid	AC-25 minutes			
M-272 Water Test Kit	Nerve-G & VX	In water in dangerous amounts	Liquid	7 minutes	\$189/kit	Portable and lightweight. 5-year shelf life.	Used to test raw or treated water. Type I and II detector tubes, eel enzyme detector tickets. Kit conducts 25 tests for each agent.
	Mustard-HD						
	Lewisite						
	Hydrogen Cyanide		Liquid	6 minutes			
Chemical Agent Monitor (CAM)	Nerve-GA, GB, VX		Vapor	30 seconds	\$5,500 each	Handheld. Portable. Battery operated. 6 to 8 hours continuous use. Maintenance required.	Radioactive source. Lightweight, 2 pounds. Point source detector. False alarms: perfume, exhaust, paint, additives to diesel fuel.
	Blister-HD and HN		Vapor	≤1 minute	\$7,500 each \$8,840 tip and alarm		



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Military Detection, Monitoring, and Treatment Equipment							
Equipment	Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
M-90	Nerve		Vapor		\$8,000 each		Chemical agent detection system, ion mobility spectroscopy technology
	Blister		Vapor				
	Blood		Vapor				
M-8A1 Alarm Automatic Chemical Agent Alarm	Nerve–GA, GB, GD	M43 spectroscope (detection)	Gas, vapor	≤2 minutes	\$2, 357 each	Vehicle battery operated. Maintenance required. Nuclear Regulatory Commission (NRC) license required.	Radioactive source (Americium 241). Automatic unattended operation. Remote placement.
	Nerve–VX	M42 remote alarm device					
MM-1 Mobile Mass Spectrom	20–30 CWA		Vapor	≤45 seconds	\$300k military/ \$100k civilian		
Remote Sensing Chemical Agent Alarm (RSCAAL) M-21	Nerve–GA, GB, GD		Vapor		\$110k each	Line-of-sight depen- dent. 10-year shelf life. Two-person portable tripod.	Passive infrared energy detector. Three miles visual/audible warning from 400
	Nerve–VX		Vapor		\$173k each		
	Blister–HD		Vapor				



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Equipment	Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
	Lewisite		Vapor				meters. "Remote Sensing Chemical Agent Alarm" 60° arc. Spectrum in library. Changes in concentration of path link to exceed tolerance level. Account for temperature differential.
AN-PDR-2		Gamma					
		Beta					
AN-PDR-77		Gamma					
		Beta					
		Alpha					
Treatment							
M-291 Skin Decon	Nerve Blister	Decon powder				Six packets decon powder. 5-year shelf life.	Physical removal, absorption, neutralization decon of skin and face
Atropine Autoinjector	Nerve agents	Antidote			\$3.89 each	60-month shelf life	2 mg immediate self-treatment pressure activated, autoinjector following nerve agent symptoms



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Military Detection, Monitoring, and Treatment Equipment							
Equipment	Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
Pralidoxime Chloride (2-PamCl)	Nerve agents	Second half of antidote			\$4.81 each	Sixty-month shelf life	600 mg automatic pressure-activated injector following atropine injection.
Convulsant Antidote Nerve Agents (CANA)	Nerve agents				\$9.38 each	Indefinite unless damaged. Buddy use: NOT self use.	10 mg automatic injector diazepam following three nerve agent antidote kits (NAAKs).



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Emergency Responder Detection and Monitoring Equipment							
Equipment	Haz/Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
Colorimetric Tube Detector Tubes	Nerve–G series	Phosphoric	Vapor	5–25 minutes	\$50–75 box (10)	Affected by sample of volume, temperature, humidity, mixtures, and storage. Up to 35% margin of error. 1- to 3-year shelf life	Brand names: Draeger, Sensidyne, MSA. Draeger has 10 CWA specific tubes. All have “decision matrix” for classification of unknowns. Different brands of tubes and pumps are not interchangeable. Each tube has specific instructions for use and number of pumps. Detects presence as opposed to quantity. Draeger Arsenicals (Blister variation)
	Nerve–VX	Acid Esters	Vapor		\$300 hand pump		
	Mustard–H, HD	Thioether Tube	Vapor		\$850 battery pump		
	Lewisite	Organic Arsenic	Vapor				
	Blood–AC	Hydrocyanic Acid	Gas, vapor		\$942.29		
	Blood–CK	Cyanogen Chloride	Gas, vapor				
	Choking–CG	Phosgene Tube	Gas, vapor		\$1,200– \$2,000		
	Choking–CL	Chlorine Tube	Gas, vapor		Basic set		
	Chloropicrin– PS	Carbon Tetrachloride	vapor				
	Hydrogen Arsenide	Organic Arsenic	Gas, vapor				
DA, DX, DC, DM	Compounds and Arsine	Vapor					



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Emergency Responder Detection and Monitoring Equipment							
Equipment	Haz/Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
Combination Meters Single Gas Meters	Oxygen	0–25 percent by volume	Gas, vapor	Seconds	\$385 each	Lithium battery has an 8-month shelf life.	Use electrochemical cells (ECCs) or metal oxide semiconductors (MOSs). More accurate than detector tubes, but limited to approximately a dozen different chemicals.
	Carbon Monoxide	0-900 ppm/35 ppm	Gas, Vapor	Seconds	\$472 each		
	Hydrogen Sulfide	0–90 ppm/10 ppm	Gas, Vapor	Seconds	\$460 each		
3/4/5–Gas Meters	Lower explosive limit (LEL)	0–100 percent/10 percent	Gas	Seconds	\$1,562/ 3-Gas \$1,878/ 4-Gas	Two C-cell batteries	Monitors may also be found for chlorine, ammonia, sulfur dioxide, and hydrogen cyanide. ToxiRae has added Photoionization detector (PID) and cyanide to meters. Brand names: AIM, MSA, GasTech, Scott-Alert Dynamation, Industrial Scientific, Rae Corp.
	Oxygen	0–25 percent/19.5 –23 percent	Gas	Seconds	\$1,500– 2,500		
	Carbon Monoxide	0–2,000 ppm/35p	Gas	Seconds			
	Hydrogen Sulfur	0–250 ppm/10pp	Gas	Seconds			
	Chlorine		Gas	Seconds			



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Emergency Responder Detection and Monitoring Equipment							
Equipment	Haz/Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
Combustible Gas Indicator (CGI) Destructive Testing (e.g., explosimeter)	Flammability	Measured in percent LEL	Gas, Vapor	Seconds	\$750 to 2,500	Dry cells or rechargeable nickel cadmium (NiCad) batteries. Calibration required. Requires warmup period.	Wheatstone bridge. Measures concentration of combustible gas or vapor in air. Sample drawn across surface of heated platinum. Catalytic combustion procedures proportional heat to the concentration displayed by meter. Calibration to methane or pentane, though equipment varies.
	Combustibility						
Draeger Chip System	Ammonia	2–50 ppm	Gas, vapor	1–2 minutes	\$58each	2-year shelf life. Four AA alkaline batteries 1.6 pounds Handheld \$1,600 per system	Insert chip into analyzer and the concentration displays on the digital readout. Self-check initiated prior to each measurement. Pump system provides a constant mass flow that negates the effects of atmospheric pressure.
	Benzene	0.2–10 ppm	Gas, vapor	1–2 minutes	\$152 each		
	Carbon Dioxide	1,000–25,000 ppm	Gas, vapor	1–2 minutes	\$56 each		
	Carbon Monoxide	5–150 ppm	Gas, vapor	1–2 minutes	\$43 each		
	Chlorine	0.2–10 ppm	Gas, vapor	1–2 minutes	\$60 each		
	Hydrochloric Acid	1–25 ppm	Gas, vapor	1–2 minutes	\$76 each		
	Hydrogen Cyanide	1 to 25 ppm	Gas, vapor	1–2 minutes	\$63 each		



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Emergency Responder Detection and Monitoring Equipment							
Equipment	Haz/Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
	Hydrogen Sulfide	2 to 50 ppm	Gas, vapor	1–2 minutes	\$43 each		
	Nitrogen Dioxide	0.5 to 25 ppm	Gas, vapor	1–2 minutes	\$58 each		
	Nitrous Fumes	0.5 to 15 ppm	Gas, vapor	1–2 minutes	\$56 each		
	Perchloroethylene	5 to 150 ppm	Gas, vapor	1–2 minutes	\$63 each		
	Sulfur Dioxide	0.4 to 10 ppm	Gas, vapor	1–2 minutes	\$58 each		
Electrochemical Cells (ECCs) (Nondestructive) Other ECCs/ Sensors	Flammability	Meas. in percent LEL	Gas, vapor	Seconds			Used with the CGI
	Combustibility	or percent by volume	Gas, vapor	Seconds			
	Oxygen	Range 0–25 percent	Gas, vapor	Seconds		Altitude dependent	Measures percent of oxygen in the air
	Chlorine	Measures in ppm	Gas, vapor	Seconds			
	Hydrogen Cyanide	Measures in ppm	Gas, vapor	Seconds			
	Cyanogen Chloride	Measures in ppm	Gas, vapor	Seconds			
	Phosgene	Measures in ppm	Gas, vapor	Seconds			
	Ammonia	Measures in ppm	Gas, vapor	Seconds			



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Emergency Responder Detection and Monitoring Equipment							
Equipment	Haz/Agent	Readings	Analysis	Time	Cost	Operation/ Maintenance/Limits	Remarks
	Sulfur Dioxide	Measures in ppm	Gas, vapor	Seconds			
Flame Ionization Detector (FID) Organic Vapor Monitor (OVM)		Organic vapors present in ppm	Gas, vapor		\$4,744.50 each (\$6,000–10,000)		Organic Vapor Analyzer. Operates in two modes: (1) Survey: detects total concentrations of gases and vapors; (2) Gas chromatograph: identifies and measures specific compounds.
HazCat Kit Chemical Identification System Chemistry Set	Oxidizers	Blue/black or purple	Liquid, Solids		\$2100–3000 (full kit) \$200 to \$400 EPA version)	[Potassium iodide starch paper–KI] Lead acetate paper Keys out unknown chemicals	Indicator papers test for presence of unknowns, oxidizers in excess of normal O ₂ in the air (chlorine, nitrogen dioxide, O ₂ , and ozone), plus peroxides (organic/hydrogen) and sulfide compounds.
	Peroxide	Blue – positive		15 seconds			
	Hydrogen Sulfide	Brown/black					
	Other						
Lead Test Kit	Lead	On any surface	Water, Solid		\$15/\$61	Indefinite shelf life	Screening device. Rate of change indicates oxidizing ability.
Litmus papers pH paper/spill classification strips	Corrosives, bleach, petroleum products, iodine, fluorine, lead nitrates, oxidizers	Alkalinity–blue	Liquid	Seconds	\$9–25 each \$65–85/box of 12 rolls pH paper	Disposable (after use)/ handheld. Premoisten with water.	Color method uses litmus paper. Readings of pH <2 or >12.5 are cause for extreme caution. Brands: Spillfyter, Chemical Classifier, and Wastewater
		Acidity–red/purple	Liquid	Seconds			



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Polychlorinated Biphenols (PCBs) Test Kit	Chlorinated solvents	Color change	Soil, liquid	5 minutes	\$104 each		PCBs (transformer oil) test kits: Chlor-N-Soil, Chlor-N-Oil, Chlor-D-Tect
Pesticide Test Kit	Organophosphates	Blue change= negative	Liquid, solids	Minutes		Limited shelf life	Cholinesterase changes color in reaction to pesticide. Range of detection: 0.1 to 10 ppm
Tickets	Carbamate pesticide	White= contaminated	Liquid, solids	Minutes			
pH Meter	Corrosivity	Numerical value	Liquid	Seconds	\$300 each	Battery or AC. Calibration required before each use.	Measuring electrode is more accurate. Insert probe into material. High maintenance
Photoionization Detector (PID)	Nerve-GA/GD	10.6- conversion factor about 2	Gas, vapor	Seconds	\$1,464 each to \$4,000/ unit (\$3,000-7,000)	Most commonly calibrated to isobutylene. Response may be affected by radio frequencies, power lines, transformers	Gas sample passes between two charged metal electrodes, irradiated with vacuum ultraviolet radiation: if IP below lamp rating: 10.2, 10.6, or 11.7 electronic volt (eV). Display of total volatile organic compounds (VOCs) in ppm 0.1 to 2,000. Nondestructive. Brands: Mini Rae, MSA Passport, H-NU
	Nerve-GB	10.6/11.7- 10/2	Gas, vapor	Seconds			
	Nerve-VX	10.6-CF about 0	Gas, vapor	Seconds			
	Mustard	10.6-CF about 0	Gas, vapor	Seconds			
	Phosgene	11.7-CF about 2	Gas, vapor	Seconds			
	Lewisite	10.6-CF about 1	Gas, vapor	Seconds			



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SAW MiniCAD	Nerve-G	LED and audible alarm	Vapor	Minute cycles	\$6,072 each	Recharge lithium battery pack—5-year shelf life. Compact. Two-minute warmup period. Lightweight: <1 pound	Surface acoustic wave sensors detect changes in proportion as they travel at ultrasonic frequencies in piezoelectric materials with pattern recognition algorithms to identify agent classes and reject interferant responses.
	Blister-H						
Radiological							
Survey Instrument Ludlum Geiger-Müller (GM) Detector Probe	Beta	14-C needle	Radiation	≤30 seconds	\$746 each	Measures affected by wind, shielding, etc. Batteries should not be stored in unit, 4-year factory calibration.	Alpha scintillation probe. No response does not equal clean! Electromagnetic fields can give “false positives.” Geiger-Mueller is most common probe. 0.01 to 0.05 mR/hour is typical background.
	Gamma	2240 digital	Radiation	≤30 seconds			
	43-5 Alpha	2241 newer	Radiation	≤30 seconds			
	44-6 Side Window		Radiation	≤30 seconds	\$144 each		
				Radiation	Seconds		
Civil Defense Kit	Beta	CDV 715 (High)	Radiation	Seconds		No longer manufactured	Survey meters. Counts per minute (Cpm), roentgen equivalent man (Rem), milliroentgen/hour (mR/hour)
	Beta/Gamma	CDV 700 (Low)	Radiation	Seconds			
Thermoluminescent Dosimeter (TLD)	Gamma		Radiation	Seconds	\$4.95 each	No power source required. Send into lab-exact reading.	Chip absorbs radiation within credit card-sized carrier.
	X-rays		Radiation	Seconds			



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Dosimeter Pocket/Self-Reading	Gamma	CDV-138 0- 200 mR	Radiation	Immediate	\$100 each	Self-reading. Penlight size. Can be reset in the field.	Hold up to light to view meter movement. Used with TLD. Charger required.
	X-rays	CDV-742 0- 200R	Radiation	Immediate			



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