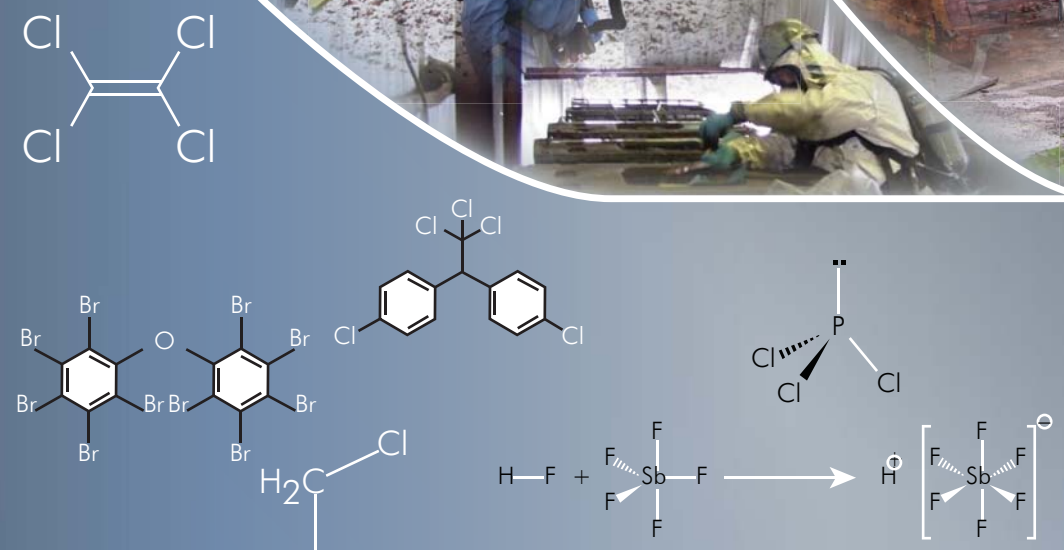
EPA Emergency Response Air Monitoring Guidance Tables



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EPA
EMERGENCY RESPONSE TECHNICAL GROUP

2009 Edition 2

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Executive Summary

Background

The United States Environmental Protection Agency (EPA) assembled the following 16 tables for use by field responders. The tables cover an array of response types and should be used as guidance only.

These tables are a quick-reference guide to assist field responders during an emergency response or a time-critical site clean-up. Additional guidance and resources may need to be consulted for additional information.

For radiological responses, refer to the site-specific health and safety plan (SSHASP), *Radiation Playbook*, and the EPA memorandum *Turnback Guidance for EPA Personnel Responding to Radiological Emergencies*. Consult with a health physicist for guidance in determining an action level.

User Responsibilities

To verify the data in these tables, refer to the Agency for Toxic Substances and Disease Registry (ATSDR), EPA toxicologists, the National Institute of Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), device manufacturer handbooks (most are available online), equipment operating guides, and other authoritative regulatory guidance. More current data from any source used to compile these tables supersedes the information in these tables. This document does not supersede the SSHASP for any response.

During responses to unknown situations, use the most conservative criterion, approach, and personal protective equipment (PPE) as outlined in the SSHASP. For responses involving metals in a particulate form, a particulate air monitoring instrument (*e.g.*, Personal DataRAM or DataRAM) will be the instrument that can provide real-time data. The instrumentation reading will be in milligram per cubic meter (mg/m^3) of particulate and not the metal of interest. Consult with a toxicologist or industrial hygienist for guidance in determining an action level. When monitoring for combustible atmosphere, a combustible gas indicator (*e.g.*, MultiRAE) will need to be used. The action level for a combustible atmosphere is a lower explosive level (LEL) greater than 10%. A normal oxygen level in the ambient air should be between 19.5%-23.5% oxygen (normal 20.8%). An oxygen level below 19.5% or above 23.5% will require a reassessment of the situation.

If you have any changes or revisions please email zintak.leonard@epa.gov or ben.maradkel@westonsolutions.com

Table 1 -- Acid (Spill or Release)

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
					TWA	IDLH		4-hour	8-hour	
Acids										
Hydrochloric Acid	Dräger Tube	1-10 ppm or higher	Yes	12.74 eV	PEL = 5 ppm C REL = 5 ppm TLV = 5 ppm C ACGIH TLV = 2 ppm A4	50 ppm	1 ppm = 1.49 mg/m^3	1.8 ppm	1.8 ppm	www.cdc.gov/niosh/npg/npgd0332.html
	Dräger Chip	1-25 ppm or higher	No (Yes with option)							
	pH Paper	NA	Yes							
	SPM	0.5-15 ppm	No (Yes with option)							
	Dräger Pac III	0-30 ppm	Yes							
	GFG Inc. Micro IV	0-30 ppm	Yes							
Nitric Acid	Dräger Tube	1-50 ppm or higher	Yes	11.95 eV	PEL = 2 ppm REL = 2 ppm TLV = 2 ppm	25 ppm	1 ppm = 2.58 mg/m^3	0.53 ppm	0.53 ppm	www.cdc.gov/niosh/npg/npgd0447.html
	pH Paper	NA	Yes							
	SPM	0.2-6 ppm	No (Yes with option)							
Sulfuric Acid	Dräger Tube	1-5 mg/m^3 (mist)	Yes	12.40 eV	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3 ACGIH TLV = 0.2 mg/m^3 A2	15 mg/m^3	NA	0.2 mg/m^3	0.2 mg/m^3	www.cdc.gov/niosh/npg/npgd0577.html
	pH Paper	NA	Yes							
	SPM	26-750 ppb	No (Yes with option)							
Hydrocyanic Acid	Dräger Tube	2-30 ppm	Yes	13.60 eV	PEL = 10 ppm S REL = ST 4.7 ppm S TLV = 4.7 ppm C S	50 ppm	1 ppm = 1.10 mg/m^3	1.3 ppm	1 ppm	www.cdc.gov/niosh/npg/npgd0333.html
	Dräger Chip	2-50 ppm	No (Yes with option)							
	pH Paper	NA	Yes							
	ToxiRAE II HCN	0-100 ppm	Yes							
	SPM	1.1-30 ppm	No (Yes with option)							
	Multiwarn II	0-50 ppm	Yes							
	Dräger Pac III	0-50 ppm	Yes							
	GFG Inc. Micro IV	0-50 ppm	Yes							
Hydrofluoric Acid	Dräger Tube	0.5-90 ppm	Yes	15.98 eV	PEL = 3 ppm REL = 3 ppm TLV = 0.5 ppm	30 ppm	1 ppm = 0.82 mg/m^3	1 ppm	1 ppm	www.cdc.gov/niosh/npg/npgd0334.html
	pH Paper	NA	Yes							
	SPM	0.6-9 ppm	No (Yes with option)							
	Dräger Pac III	0-30 ppm	Yes							
	GFG Inc Micro IV	0-10 ppm	Yes							
Hydrobromic Acid	pH Paper	NA	Yes	11.62 eV	PEL = 3 ppm REL = 3 ppm C TLV = 2 ppm C	30 ppm	1 ppm = 3.31 mg/m^3	1 ppm	1 ppm	www.cdc.gov/niosh/npg/npgd0331.html
	SPM	0.3-9 ppm	No (Yes with option)							
Acetic Acid	Dräger Tube	5-80 ppm	Yes	10.66 eV	PEL = 10 ppm REL = 10 ppm TLV = 10 ppm	50 ppm	1 ppm = 2.46 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0002.html
	Dräger Chip	2-50 ppm	No (Yes with option)							
	pH Paper	NA	Yes							
	MIRAN SapphIRe	0-100 ppm	Yes							
Gases Produced from Acid Reactions										
Oxygen	MultiRAE/AreaRAE O_2 Sensor	0-30% Vol.	Yes	12.35 eV	< 19.5% O_2 (simple asphyxiant)	NA	NA	NA	NA	< 19.5% O_2 = Level B
	Dräger Tube	5-23% Vol.	Yes							
	Dräger Chip	1-25% Vol.	No (Yes with option)							
	Multiwarn II	0-25% Vol.	Yes							
	Dräger Pac III	0-100% Vol.	Yes							
	GFG Inc Micro IV	0-25%	Yes							
Hydrogen	Dräger Tube	0.2-2% Vol.	Yes	15.42 eV	< 19.5% O_2 (simple asphyxiant)	NA	NA	NA	NA	< 19.5% O_2 = Level B
	Multiwarn II	0-2,000 ppm	Yes							
	Dräger Pac III	0-2,000 ppm	Yes							
	GFG Micro IV	0-4% Vol.	Yes							
Radiation[2]										
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No		300 cpm					

Table 1 -- Acid (Spill or Release)

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with this type of event, only the most common compounds with the lowest action levels.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

Acronyms:

< -- less than
% -- percent
A2 -- suspect human carcinogen
A4 -- concern that the compound may be carcinogenic, but supporting data are lacking
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of work exposure)
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
HCN -- hydrogen cyanide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
O_2 -- oxygen
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
S -- skin notation (compound may be absorbed through the skin)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short term
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
Vol. -- volume

Table 2 -- Ammonia (Spill or Release)

Instrument Guidance | Regulatory Guidance | Reference

Target Compound	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Gas											
Ammonia	MultiRAE/AreaRAE with NH_3 Sensor	1-50 ppm (NH_3 Sensor)	Yes	10.18 eV	NA	PEL = 50 ppm REL = 25 ppm TLV = 25 ppm	300 ppm	1 ppm = 0.70 mg/m^3	30 ppm	30 ppm	www.cdc.gov/niosh/npg/npgd0028.html
	Dräger Tube	0.25-3 ppm or higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	Dräger Pac III	0-300 ppm	Yes								
	SPM	2.6-75 ppm	No (Yes with option)								
	ToxiRAE II NH_3	0-50 ppm	Yes								
	Miran SapphIRe*	0-500 ppm	Yes								
	Multiwarn II	0-300 ppm	Yes								
	MultiRAE/AreaRAE PID	1-2,000 ppm (PID)	Yes		9.7 (10.6 lamp)						
Radiation[1]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

[1]- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor.)

Acronyms:

ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NH_3 -- ammonia
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average

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Table 3 -- Chemical Plant Fire

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL- 1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Benzene	UltraRAE-PID***	0.1-2,000 ppm	Yes	9.24 eV	NA	PEL = 1 ppm REL = 0.1 ppm TLV = 0.5 ppm	500 ppm	1 ppm = 3.19 mg/m³	18 ppm	9 ppm	www.cdc.gov/niosh/npg/npgd0049.html
	Dräger Tube	0.5-10 ppm or higher	Yes								
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)								
	Miran SapphIRe**	10-200 ppm	Yes								
	ppbRAE-PID***	1 ppb-200 ppm	Yes		0.53 (10.6 lamp)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Yes		10.6 lamp 0.702 (10 ppm) - 1.781 (2,000 ppm)						
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m³	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 or 0-10,000 ppm	Yes								
	ToxiRAE II -- CO	0-500 ppm oh higher	Yes								
	GFG Inc. Micro IV	0-2,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm C REL = 10 ppm C TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m³	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	No (Yes with option)								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	Yes								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	GFG Inc. Micro IV	0-500 ppm	Yes		NA						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor***	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m³	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	GFG Inc Micro IV	1-10 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Nitric Oxide	MultiRAE/AreaRAE NO sensor	0-250 ppm	Yes	11.95 eV	NA	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	1 ppm = 1.23 mg/m³	NA	NA	www.cdc.gov/niosh/npg/npgd0448.html
	ToxiRAE II - NO	0-250 ppm	Yes								
	Dräger Pac III	0-100 ppm	Yes								
	GFG Inc. Micro IV	0-100 ppm	Yes								
	Multiwarn II	0-100 ppm	Yes								
Vinyl Chloride	Dräger Tube	0.5-30 ppm or higher	Yes	9.99 eV	NA	PEL = 1 ppm C REL = NL TLV = 1 ppm	ND	1 ppm = 2.56 mg/m³	140 ppm	70 ppm	www.cdc.gov/niosh/npg/npgd0658.html
	Dräger Chip	0.3-10 ppm or higher	No (Yes with option)								
	Multiwarn II	0-100 ppm	Yes								
	MIRAN SapphIRe**	2-20 ppm	Yes								
	Dräger Pac III	0-100 ppm	Yes								

Instrument Guidance — Regulatory Guidance — Reference

Table 3 -- Chemical Plant Fire

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases (continued)											
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 sensor	0-20 ppm	Yes	9.75 eV	NA	PEL = 5 ppm C REL = 1 ppm TLV = 3 ppm	20 ppm	1 ppm = 1.88 mg/m³	0.5 ppm	0.5 ppm	www.cdc.gov/niosh/npg/npgd0454.html
	Dräger Tube	0.5-25 ppm or higher	Yes								
	Dräger Chip	0.5-25 ppm	No (Yes with option)								
	SPM	0.3-9 ppm	No (Yes with option)								
	ToxiRAE II -NO_2	0-20 ppm	Yes								
	Dräger Pac III	0-50 ppm	Yes								
	GFG Inc. Micro IV	0-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
Trichloroethylene	Dräger Tube	2-50 ppm or higher	Yes	9.47 eV	NA	PEL = 100 ppm C REL = NL TLV = 150 ppm	ND	1 ppm = 5.37 mg/m³	84 ppm	77 ppm	www.cdc.gov/niosh/npg/npgd0629.html
	Dräger Chip	5-100 ppm or higher	No (Yes with option)								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		0.54 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm	Yes		10.6 lamp 0.605 (10 ppm) 2.129 (2,000 ppm)						
Phosgene	Dräger Tube	0.02-15 ppm	Yes	11.2 eV	NA	PEL = 0.1 ppm REL = 0.1 ppm TLV = 0.1 ppm	2 ppm	1 ppm = 4 mg/m³	NA	NA	www.cdc.gov/niosh/npg/npgd0504.html
	Dräger Chip	0.05-2 ppm	No (Yes with option)								
	MIRAN SapphIRe**	0.05 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
	MultiRAE/AreaRAE PID***	0-200 ppm	Yes		8.5 (11.7 lamp)						
Metals (as particulates)											
Lead	Personal DataRAM****	0.001-400 mg/m³	No	NA	NA	PEL = 0.05 mg/m³ REL = 0.05 mg/m³ TLV = 0.05 mg/m³	100 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0368.html
	DataRAM 4****	0.001-400 mg/m³	No								
Mercury	Lumex RA-915	2-50,000 ng/m³	No	NA	NA	PEL = 0.1 mg/m³ S Vapor REL = 0.05 mg/m³ S TLV = 0.025 mg/m³ S and A4	10 mg/m³	NA	0.67 mg/m³	0.33 mg/m³	www.cdc.gov/niosh/npg/npgd0383.html
	Jerome 431	1,000-999,000 ng/m³	No								
	Jerome J405	500-999,000 ng/m³	No								
	Jerome 471	30-250,000 ng/m³	No								
Arsenic	Personal DataRAM****	0.001-400 mg/m³	No	9.81 eV	NA	PEL = 0.01 mg/m³ REL = 0.002 mg/m³ TLV = 0.01 mg/m³	5 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0038.html
	DataRAM 4****	0.001-400 mg/m³	No								
Arsenic (organic components)	Dräger Tube	0-3 mg organic arsenic/m³	Yes	NA	NA	PEL = 0.01 mg/m³ REL = 0.002 mg/m³ TLV = 0.01 mg/m³	5 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0039.html
Chromium	Personal DataRAM****	0.001-400 mg/m³	No	NA	NA	PEL = 0.005 mg/m³ REL = 0.01 mg/m³ ACGIH TLV = 0.01 mg/m³	15 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0139.html
	DataRAM 4****	0.001-400 mg/m³	No								
Particulate****											
Particulate	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 5 mg/m³ (respirable fraction) TLV = 3 mg/m³ (respirable fraction)	ND	ND	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m³	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 3 -- Chemical Plant Fire

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with chemical plant fires, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor).
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another.

Acronyms:

A4 -- concern that the compound may be carcinogenic, but supporting data are lacking
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
m^3 -- cubic meter
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
ND -- non-detect
NL -- not listed
ng/m^3 -- nanograms per cubic meter
NIOSH -- National Institute for Occupational Safety and Health
NO -- nitrogen oxide
NO_2 -- nitrogen dioxide
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
S -- skin notation (compound can be absorbed through the skin)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound

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Table 4 -- Chlorine (Spill or Release)

Target Compound	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
					TWA	IDLH		4-hour	8-hour	
Chlorine										
Chlorine	MultiRAE/AreaRAE Cl sensor	0.1-10 ppm	Yes	11.48 eV	PEL = 0.1 ppm C REL = 0.05 ppm C TLV = 0.5 ppm; ST 1 ppm	10 ppm	1 ppm = 2.90 mg/m^3	0.5 ppm	0.5 ppm	www.cdc.gov/niosh/npg/npgd0115.html
	Dräger Pac III Cl Sensor	0.1-20 ppm	Yes							
	Dräger Tube	0.2-30 ppm or higher	Yes							
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)							
	Multiwarn II	0-20 ppm	Yes							
	SPM	0.05-1.5 ppm	No (Yes with option)							
Radiation[1]										
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No		300 cpm					

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

[1]- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers

Acronyms:

ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
Cl -- chlorine
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short-term
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average

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Table 5 -- Electroplating Facility (Spill, Release, or Fire)

Instrument Guidance — Regulatory Guidance — Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	IP & PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 ppm or 0-10,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S sensor	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm C REL = 10 ppm C TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	SPM	1.1-30 ppm or higher	No (Yes with option)								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	Dräger Tube	0.2-6 ppm of higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes		NA						
Nitric Oxide	MultiRAE/AreaRAE NO sensor	0-2,000 ppm	Yes	12.30 eV	NA	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	1 ppm = 1.23 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0448.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Chip	0.5-15 ppm or higher	No (Yes with option)								
	Multiwarn II	0-100 ppm	Yes								
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm C REL = 1 ppm STEL TLV = 3 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.5 ppm	0.5 ppm	www.cdc.gov/niosh/npg/npgd0454.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	Multiwarn II	0-50 ppm	Yes								
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-250 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	Yes								
Trichloroethylene	Dräger Tube	2-50 ppm or higher	Yes	9.47 eV	NA	PEL = 100 ppm C REL = NL TLV = 150 ppm	ND	1 ppm = 5.37 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0629.html
	Dräger Chip	5-100 ppm or higher	No (Yes with option)								
	MultiRAE/AreaRAE PID***	0.5-2,000 ppm (PID)	Yes		5.2 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm	Yes		10.6 lamp 0.605 (10 ppm) 2.129 (2,000 ppm)						
Phosgene	Dräger Tube	0.02-15 ppm	Yes	11.2 eV	NA	PEL = 0.1 ppm REL = 0.1 ppm TLV = 0.1 ppm	2 ppm	1 ppm = 4 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0504.html
	Dräger Chip	0.05-2 ppm	No (Yes with option)								
	MIRAN SapphIRe**	0.05 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
	MultiRAE/AreaRAE PID***	0.02-15 ppm	Yes		5.2 (10.6 lamp)						

Table 5 -- Electroplating Facility (Spill, Release, or Fire)

Instrument Guidance — Regulatory Guidance — Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	IP & PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases (continued)											
Sulfuric Acid	Dräger Tube	1-5 mg/m³ (mist)	Yes	NA	NA	PEL = 1 mg/m³ REL = 1 mg/m³ TLV = 1 mg/m³	15 mg/m³	NA	0.2 mg/m³	0.2 mg/m³	www.cdc.gov/niosh/npg/npgd0577.html
	pH Paper	NA	No (Yes with option)								
	SPM	26-750 ppb	Yes								
Hydrochloric Acid	Dräger Tube	1-10 ppm or higher	Yes	12.74 eV	NA	PEL = 5 ppm REL = 5 ppm TLV = 5 ppm	50 ppm	1 ppm = 1.49 mg/m³	1.8 ppm	1.8 ppm	www.cdc.gov/niosh/npg/npgd0332.html
	Dräger Chip	1-25 ppm or higher	No (Yes with option)								
	pH Paper	NA	Yes								
	SPM	0.5-15 ppm	No (Yes with option)								
Nitric Acid	Dräger Tube	1-50 ppm or higher	Yes	10.46 eV	NA	PEL = 2 ppm REL = 2 ppm TLV = 2 ppm	25 ppm	1 ppm = 2.58 mg/m³	0.53 ppm	0.53 ppm	www.cdc.gov/niosh/npg/npgd0447.html
	Ph Paper	NA	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Hydrocyanic Acid & Hydrogen Cyanide	Dräger Tube	2-30 ppm	Yes	13.60 eV	NA	PEL = 10 ppm REL = ST 4.7 ppm TLV = 4.7 ppm C	50 ppm	1 ppm = 1.10 mg/m³	1.3 ppm	1 ppm	www.cdc.gov/niosh/npg/npgd0333.html
	Dräger Chip	2-50 ppm	No (Yes with option)								
	Ph Paper	NA	Yes								
	ToxiRAE II HCN	0-100 ppm	Yes								
	SPM	1.1-30 ppm	No (Yes with option)								
	Multiwarn II	0-50 ppm	Yes								
	Dräger Pac III	0-50 ppm	Yes								
	GFG Inc. Micro IV	0-50 ppm	Yes								
Metals (as particulates)****											
Cadmium	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 0.005mg/m³ TLV = 2 µg/m³	9 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0087.html
	DataRAM 4	0.001-400 mg/m³	No								
Copper	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 1 mg/m³ REL = 1 mg/m³ TLV = 1 mg/m³	100 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0150.html
	DataRAM 4	0.001-400 mg/m	No								
Hexavalent Chromium	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 0.005 mg/m³ A1 REL = 0.001 mg/m³ A1 TLV = 0.01 mg/m³ A1	15 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0138.html
	DataRAM 4	0.001-400 mg/m³	No								
Lead	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 0.05 mg/m³ REL = 0.05 mg/m³ TLV = 0.05 mg/m³	100 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0368.html
	DataRAM 4	0.001-400 mg/m³	No								
Nickel	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 1 mg/m³ REL = 0.015 mg/m³ TLV = 0.1 mg/m³	10 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0445.html
	DataRAM 4	0.001-400 mg/m³	No								
Particulate****											
Particulate	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 5 mg/m³ (respirable fraction) TLV = 3 mg/m³ (respirable fraction)	NA	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m³	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 5 -- Electroplating Facility (Spill, Release, or Fire)

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with electroplating facility responses, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound
**MIRAN SapphIRe has problems with complex mixtures (*e.g.,* distinguishing benzene from gasoline vapor)
***PIDs and FIDs are non-specific detectors and can not differentiate one VOC from another, even with CFs applied
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

$\mu g/m^3$ -- micrograms per cubic meter
A1 -- carcinogenic effects
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
H_2S -- hydrogen sulfide
HCN -- hydrocyanic acid
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
ND -- non-detect
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
STEL -- short-term exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound

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Table 6 -- General Industrial Fire

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Benzene	UltraRAE PID***	0.1-2,000 ppm	Yes	9.24 eV	NA	PEL = 1 ppm REL = 0.1 ppm TLV = 10 ppm	500 ppm	1 ppm = 3.19 mg/m^3	18 ppm	9 ppm	www.cdc.gov/niosh/npg/npgd0049.html
	Dräger Tube	0.5-10 ppm or higher	Yes								
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	10-200 ppm	Yes								
	ppbRAE PID***	1 ppb - 200 ppm	Yes		0.53 (10.6 lamp)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Yes		10.6 lamp 0.702 (10 ppm) 1.781 (2,000 ppm)						
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 135 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 or 0-10,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrochloric Acid	Dräger Tube	1-10 ppm or higher	Yes	12.74 eV	NA	PEL = 5 ppm C REL = 35 ppm TLV = 25 ppm	50 ppm	1 ppm = 1.49 mg/m^3	1.8 ppm	1.8 ppm	www.cdc.gov/niosh/npg/npgd0332.html
	Dräger Chip	1-25 ppm or higher	No (Yes with option)								
	pH Paper	NA	Yes								
	SPM	0.5-15 ppm	No (Yes with option)								
Hydrocyanic Acid & Hydrogen Cyanide	Dräger Tube	2-30 ppm	Yes	13.60 eV	NA	PEL = 10 ppm REL = ST 4.7 ppm TLV = 4.7 ppm C	50 ppm	1 ppm = 1.10 mg/m^3	1.3 ppm	1 ppm	www.cdc.gov/niosh/npg/npgd0333.html
	Dräger Chip	2-50 ppm	No (Yes with option)								
	pH Paper	NA	Yes								
	ToxiRAE II HCN	0-100 ppm	Yes								
	SPM	1.1-30 ppm	No (Yes with option)								
	Multiwarn II	0-50 ppm	Yes								
	Dräger Pac III	2-50 ppm	Yes								
	GFG Inc. Micro IV	0-100 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S sensor	0-100 ppm	Yes	12.30 eV	NA	PEL = 20 ppm REL = 10 ppm TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	No (Yes with option)								
	Multiwarn II	0-50 ppm	Yes								
	Dräger Pac III	0-50 ppm	Yes								
	GFG Inc. Micro IV	0-50 ppm	Yes								
Phosgene	Dräger Tube	0.02-15 ppm	Yes	11.2 eV	NA	PEL = 0.1 ppm REL = 0.1 ppm TLV = 0.1 ppm	2 ppm	1 ppm = 4 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0504.html
	Dräger Chip	0.05-2 ppm	No (Yes with option)								
	MIRAN SapphIRe**	0.05 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		8.5 (11.7 lamp)						
Vinyl Chloride	Dräger Tube	0.5-3000 ppm	Yes	9.99 eV	NA	PEL = 1 ppm	NA	1 ppm = 2.56 mg/m^3	140 ppm	70 ppm	www.cdc.gov/niosh/npg/npgd0658.html
	Dräger Chip	0.3-250 ppm	No (Yes with option)								
	MIRAN SapphIRe**	0.6-1.6 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes		10.6 lamp 2.334 (10 ppm) 4.397 (2,000 ppm)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		2.0 (10.6 lamp)						

Instrument Guidance — Regulatory Guidance — Reference

Table 6 -- General Industrial Fire

Instrument Guidance — Regulatory Guidance — Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Metals (as particulates)****											
Lead	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 0.05 mg/m^3 REL = 0.05 mg/m^3 TLV = 0.05 mg/m^3	100 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0368.html
	DataRAM 4	0.001-400 mg/m^3	No								
Mercury	**Refer to Table 9 -- Mercury Response**										
Particulate****											
Particulate	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 5 mg/m^3 (respirable fraction) TLV = 3 mg/m^3 (respirable fraction)	NA	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m^3	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 6 -- General Industrial Fire

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with industrial fires, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor)
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied
****Personal Data RAMs and Data RAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
HCN -- hydrocyanic acid
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/kg -- milligrams per kilograms
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
S -- skin notation (compound can be absorbed through the skin)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short-term
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound

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Table 7 -- Landfill (Spill, Release, or Fire)

(If the landfill is on fire, also refer to Table 6)

	Instrument Guidance					Regulatory Guidance					Reference
Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Gases											
Methane	Multiwarn II IR-Ex sensor	0-100,000+ ppm	Yes	12.98 eV	NA	< 19.5% O_2 (simple asphyxiant)[3]	NA	NA	30 ppm	30 ppm	< 19.5% O_2 = Level B
	TVA 1000B***	1-50,000 ppm (FID) no response (PID)	Yes								
	MIRAN SapphIRe**	7.5-100 ppm	Yes								
	MultiRAE Plus/ AreaRAE	0-100% LEL, 0-30% O_2 1-100% LEL, 0-30$ O_2	Yes								
	Multiwarn II LEL	2.6-75 ppm	Yes								
	Landtec Gas Extraction Monitor (GEM)-500	0-70% to specification 0-100% reading	Yes								
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = TWA 50 ppm REL = TWA 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	MultiwarnII	0-2,000 or 0-10,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm C REL = 10 ppm C TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	No (Yes with option)								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	Yes								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 7 -- Landfill (Spill, Release, or Fire)

(If the landfill is on fire, also refer to Table 6)

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with this type of event, only the most common compounds with the lowest action levels.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.
3-ACGIH TLV = 1,000 ppm

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound.
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor).
***PIDs and FIDs are non-specific detectors and can not differentiate one VOC from another, even with CFs applied.

Acronyms:

< -- less than
% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
LEL -- lower explosive level
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
O_2 -- oxygen
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound

Table 8 -- Magnesium Fire

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Benzene	UltraRAE-PID***	0.1-2,000 ppm	Yes	9.24 eV	NA	PEL = 1 ppm REL = 0.1 ppm TLV = 0.5 ppm	500 ppm	1 ppm = 3.19 mg/m^3	18 ppm	9 ppm	www.cdc.gov/niosh/npg/npgd0049.html
	Dräger Tube	0.5-10 ppm or higher	Yes								
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)								
	Miran SapphIRe**	10-200 ppm	Yes								
	ppbRAE-PID***	1 ppb-200 ppm	Yes		0.53 (10.6 lamp)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Yes		10.6 lamp 0.702 (10 ppm) - 1.781 (2,000 ppm)						
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 or 0-10,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm C REL = 10 ppm C TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	No (Yes with option)								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	Yes								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 100B***	0.5-2,000 ppm (PID)	Yes		NA						
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor***	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Metals (as particulates)**											
Magnesium	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 15 mg/m^3 REL = NL TLV = 10 mg/m^3	750 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0374.html
	DataRAM 4	0.001-400 mg/m^3	No								
Particulate**											
Particulate	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 5 mg/m^3 (respirable fraction) TLV = 3 mg/m^3 (respirable fraction)	ND	ND	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m^3	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 8 -- Magnesium Fire

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

[1]- Does not include all compounds associated with magnesium fires, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
[2]- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound.
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor).
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another.

Acronyms:

ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
ND -- non-detect
NIOSH -- National Institute for Occupational Safety and Health
NL -- not listed
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound

Table 9 -- Mercury (Spill or Release)

Instrument Guidance				Regulatory Guidance					Reference
Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	Health Guidance Values[1]		Occupational Action Levels		Conversion	PPE (refer to SSHASP and NIOSH Website)
				Residential	Commercial	TWA	IDLH		
Mercury									
Lumex RA-915	2-50,000 ng/m^3	No	NA	1,000 ng/m^3	3,000 ng/m^3	PEL = 0.1 mg/m^3 REL = 0.05 mg/m^3 S TLV = 0.025 mg/m^3 A4	10 mg/m^3	NA	www.cdc.gov/niosh/npg/npgd0115.html
Jerome 431	1,000-999,000 ng/m^3	No							
Jerome J405	500-999,000 ng/m^3	No							
Jerome 471	30-250,000 ng/m^3	No							
Dräger Tube	0.05-2 ng/m^3	Yes							
Radiation[2]									
Ludlum 192	0-5,000 micro-R/hr	No	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No		300 cpm					

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- EPA and ATSDR Health Guidance Values
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

Acronyms:

A4 -- concern that this is a carcinogen, but sufficient data are lacking
AEGL -- acute exposure guidance levels
ATSDR -- Agency for Toxic Substances and Disease Registry
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
IDLH -- immediately dangerous to life and health
IP -- ionization potential
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
ng/m^3 -- nanograms per cubic meter
NIOSH -- National Institute for Occupational Safety and Health
PPE -- personal protective equipment
R/hr -- Roentgens per hour
S -- skin notation -- can be absorbed through the skin
SSHASP -- site-specific health and safety plan
TWA -- time-weighted average

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Table 10 -- Oil (Spill, Release, or Fire)

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	IP & PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Benzene	UltraRAE PID	0.1-2,000 ppm	Yes	9.24 eV	NA	PEL = 1 ppm REL = 0.1 ppm TLV = 10 ppm	500 ppm	1 ppm = 3.19 mg/m^3	18 ppm	9 ppm	www.cdc.gov/niosh/npg/npgd0049.html
	Dräger Tube	0.5-10 ppm or higher	Yes								
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	10-200 ppm	Yes								
	ppbRAE PID***	1ppb - 200 ppm	Yes		0.53 (10.6 lamp)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Yes		10.6 lamp 0.702 (10 ppm) 1.781 (2,000 ppm)						
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 ppm or 0-10,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S sensor	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm REL = 10 ppm TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	SPM	1.1-30 ppm or higher	No (Yes with option)								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	Dräger Tube	0.2-6 ppm of higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes		NA						
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-250 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	Yes								
PAHs (as particulate)**											
PAHs	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 0.2 mg/m^3 REL = 0.1 mg/m^3 TLV = 0.2 mg/m^3	750 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0374.html
	DataRAM 4	0.001-400 mg/m^3	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 10 -- Oil (Spill, Release, or Fire)

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with this type of event, only the most common compounds with the lowest action levels.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are greater than 100 micro-R/hr or 300 cpm, then further investigation is warranted. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound.
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor).
***PIDs and FIDs are non-specific detectors and can not differentiate one VOC from another, even with CFs applied.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another.

Acronyms:

ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAH -- polyaromatic hydrocarbon
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short term
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average

Table 11 -- Pesticide or Fertilizer Fire

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	IP & PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Benzene	UltraRAE Benzene Tube	0.1-2,000 ppm	Yes	9.24 eV	NA	PEL = 1 ppm REL = 0.1 ppm TLV = 0.5 ppm	500 ppm	1 ppm = 3.19 mg/m^3	18 ppm	9 ppm	www.cdc.gov/niosh/npg/npgd0049.html
	Dräger Tube	0.5-10 ppm or higher	Yes								
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)								
	Miran SapphIRe**	10-200 ppm	Yes								
	ppbRAE-PID***	1 ppb-200 ppm	Yes		0.53 (10.6 lamp)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Yes		10.6 lamp 0.702 (10 ppm) - 1.781 (2,000 ppm)						
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 ppm or 0-10,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S sensor	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm C REL = 10 ppm C TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	SPM	1.1-30 ppm or higher	No (Yes with option)								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	Dräger Tube	0.2-6 ppm of higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes		NA						
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-250 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	Yes								
Phosgene	Dräger Tube	0.02-15 ppm	Yes	11.2 eV	NA	PEL = 0.1 ppm REL = 0.1 ppm TLV = 0.1 ppm	2 ppm	1 ppm = 4 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0504.html
	Dräger Chip	0.05-2 ppm	No (Yes with option)								
	MIRAN SapphIRe**	0.05 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
	MultiRAE/AreaRAE PID***	0.02-15 ppm	Yes		5.2 (10.6 lamp)						
Methyl Bromide	Dräger Tube	0.5-30 ppm or higher	Yes	10.54 eV	NA	PEL = 20 ppm C REL = NL TLV = 1 ppm	250 ppm	1 ppm = 3.89 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0400.html

Table 11 -- Pesticide or Fertilizer Fire

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Pesticides and Fertilizers											
Phosphorus (Yellow)[3]	Personal DataRAM****	0.001-400 mg/m³	No	NA	NA	PEL = 0.1 mg/m³ REL = 0.1 mg/m³ TLV = 0.1 mg/m³	5 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0507.html
	DataRAM 4****	0.5-15 ppm or higher	No								
	AP2Ce*****	0-100 ppm	Yes								
Phosphorus Pentoxide	Personal DataRAM****	0.001-400 mg/m³	No	NA	NA	PEL = 1 mg/m³ REL = 3 mg/m³ ACGIH TLV = 1 mg/m³	250 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0510.html
	DataRAM 4****	0.001-400 mg/m³	No								
Phosphine	MultiRae/AreaRAE PH_3 sensor	0-5 ppm	Yes	9.96 eV	NA	PEL = 0.3 ppm REL = 0.3ppm; ST 1 ppm ACGIH TLV = 0.3 ppm	50 ppm	1 ppm = 1.39 mg/m³	0.5 ppm*	0.25 ppm*	www.cdc.gov/niosh/npg/npgd0505.html
	ToxiRAE	0-5 ppm	Yes								
	Dräger Pac III	0-10 ppm	Yes								
	Dräger Tube	0.1-1 ppm or higher	Yes								
	Dräger Chip	0.1-2.5 ppm or higher	No (Yes with option)								
	Multiwarn II	0-10 or 0-1,000 ppm	Yes								
	GFG Inc. Mico IV PH_3	0-10 ppm	Yes								
	SPM	32-900 ppb	No (yes with option)								
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm C REL = 1 ppm STEL TLV = 3 ppm	100 ppm	1 ppm = 2.62 mg/m³	0.5 ppm	0.5 ppm	www.cdc.gov/niosh/npg/npgd0454.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	Multiwarn II	0-50 ppm	Yes								
Nitric Oxide	MultiRAE/AreaRAE NO sensor	0-2,000 ppm	Yes	12.30 eV	NA	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	1 ppm = 1.23 mg/m³	NA	NA	www.cdc.gov/niosh/npg/npgd0448.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Chip	0.5-15 ppm or higher	No (Yes with option)								
	Multiwarn II	0-100 ppm	Yes								
Metals (as particulates)											
Lead	Personal DataRAM****	0.001-400 mg/m³	No	7.41 eV	NA	PEL = 0.05 mg/m³ REL = 0.05 mg/m³ TLV = 0.05 mg/m³	100 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0368.html
	DataRAM 4****	0.001-400 mg/m³	No								
Cadmium	Personal DataRAM****	0.001-400 mg/m³	No	8.99 eV	NA	PEL = 0.005 mg/m³ REL = NL TLV = 0.002 mg/m³ (respirable fraction)	9 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0087.html
	DataRAM 4****	0.001-400 mg/m³	No								
Arsenic (inorganic compounds)	Personal DataRAM****	0.001-400 mg/m³	No	NA	NA	PEL = 0.01 mg/m³ REL = 0.002 mg/m³ TLV = 0.01 mg/m³	5 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0038.html
	DataRAM 4****	0.001-400 mg/m³	No								
Arsenic (organic compounds)	Dräger Tube	0-3 mg organic arsenic/m³	Yes	NA	NA	PEL = 0.01 mg/m³ REL = 0.002 mg/m³ TLV = 0.01 mg/m³	5 mg/m³	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0039.html
Mercury	**Refer to Table 9 -- Mercury Response**										
Particulate**											
Particulate	Personal DataRAM	0.001-400 mg/m³	No	NA	NA	PEL = 5 mg/m³ (respirable fraction) TLV = 3 mg/m³ (respirable fraction)	ND	ND	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m³	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 11 -- Pesticide or Fertilizer Fire

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with pesticide/fertilizer fire responses, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.
3- Emits irritating oxides of phosphorus, may re-ignite upon exposure to air.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to reseatch AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor)
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another
*****APD2Ce units are specilized versions of the APD2C that are designed to be used in an explosive environment

Acronyms:

µg/m^3 -- micrograms per cubic meter
ACGIH -- American Conference of Industrial Hygienists
AEGL -- Acute Exposure Guideline Levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- Immediately Dangerous to Life and Health
IP -- ionization potential
ISO -- isobutylene
m^3 -- cubic meter
mg -- milligram
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
ND -- non-detect
NIOSH -- National Institute for Occupational Safety and Health
NL -- not listed
OSHA -- Occupational Safety and Health Administration
PEL -- Permissible Exposure Limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- Recommended Exposure Limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- Single-Point Monitor
SSHASP -- site-specific health and safety plan
ST -- short-term
STEL -- Short-Term Exposure Limit
TLV -- Time-Limited Value (ACGIH)
TWA -- Time-Weighted Average
VOC -- volatile organic compound

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Table 12 -- Phosphorus (Spill, Release, or Fire)

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Phosphorus Compounds and Gases											
Phosphorus (Yellow)[3]	Personal DataRAM****	0.001-400 mg/m^3	No	NA	NA	PEL = 0.1 mg/m^3 REL = 0.1 mg/m^3 TLV = 0.1 mg/m^3	5 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0507.html
	DataRAM 4****	0.001-400 mg/m^3	No								
	AP2Ce/AP4C	>1.5 ppb for G agents >60 ppb for HG agents >2µg/cm2 for VX	Yes								
Phosphorus Pentoxide	Personal DataRAM****	0.001-400 mg/m^3	No	NA	NA	PEL = 1 mg/m^3 REL = 3 mg/m^3 ACGIH TLV = 1 mg/m^3	250 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0510.html
	DataRAM 4****	0.001-400 mg/m^3	No								
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 ppm or 0-10,000 ppm	Yes								
	ToxiRAE CO	0-500 ppm or higher	Yes								
	GFG Inc. Micro IV	0-2,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm C REL = 10 ppm C TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	No (Yes with option)								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	ToxiRAE II H_2S	0-100 ppm	Yes		NA						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes								
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe **	6-30 ppm	Yes								
	ToxiRAE II SO_2	0-20 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Particulate**											
Particulate	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 5 mg/m^3 (respirable fraction) TLV = 3 mg/m^3 (respirable fraction)	ND	ND	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m^3	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 12 -- Phosphorus (Spill, Release, or Fire)

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

[1]- Does not include all compounds associated with phosphorus responses, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
[2]- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.
[3]- Emits irritating oxides of phosphorus, may re-ignite upon exposure to air.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound.
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor).
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another.

Acronyms:

> -- greater than
$\mu g/cm^2$ -- micrograms per square centimeter
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
ND -- non-detect
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average

Table 13 -- Tire Fire

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Benzene	UltraRAE with Benzene Tube	0.1-2,000 ppm	Yes	9.24 eV	NA	PEL = 1 ppm REL = 0.1 ppm TLV = 10 ppm	500 ppm	1 ppm = 3.19 mg/m^3	18 ppm	9 ppm	www.cdc.gov/niosh/npg/npgd0049.html
	Dräger Tube	0.5-10 ppm or higher	Yes								
	Dräger Chip	0.2-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	10-200 ppm	Yes								
	ppbRAE PID***	1ppb - 200 ppm	Yes		0.53 (10.6 lamp)						
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes								
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Yes		10.6 lamp 0.702 (10 ppm) - 1.781 (2,000 ppm)						
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 135ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 or 0-10,000 ppm	Yes								
	ToxiRAE II CO	0-500 ppm or higher	Yes								
	GFG Inc. Micro IV	0-2,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S sensor	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm REL = 10 ppm TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	Yes								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	No (Yes with option)								
	Multiwarn II	0-100 ppm or 0-1,000 ppm	Yes								
	ToxiRAE H_2S	0-100 ppm	Yes								
	GFG Inc. Micro IV	0-500 ppm	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes		NA						
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm ACGIH TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	ToxiRAE II SO_2	0-20 ppm	Yes								
	GFG Inc Micro IV	1-10 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
PAHs (as particulate)**											
PAHs	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 0.2 mg/m^3 REL = 0.1 mg/m^3 TLV = 0.2 mg/m^3	750 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0374.html
	DataRAM 4	0.001-400 mg/m^3	No								

Table 13 -- Tire Fire

Instrument Guidance — Regulatory Guidance — Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Metals (as particulate)****											
Lead	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 0.05 mg/m^3 REL = 0.05 mg/m^3 TLV = 0.05 mg/m^3	100 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0368.html
	DataRAM 4	0.001-400 mg/m^3	No								
Particulate****											
Particulate	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 5 mg/m^3 (respirable fraction) TLV = 3 mg/m^3 (respirable fraction)	NA	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m^3	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with tire fires, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound.
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor).
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another.

Acronyms:

ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound

Table 14 -- Wood-Treating Facility (Spill or Release)

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
					TWA	IDLH		4-hour	8-hour	
Acids										
Hydrochloric Acid	Dräger Tube	1-10 ppm or higher	Yes	12.74 eV	PEL = 5 ppm C REL = 5 ppm TLV = 5 ppm C ACGIH TLV = 2 ppm	50 ppm	1 ppm = 1.49 mg/m^3	1.8 ppm	1.8 ppm	www.cdc.gov/niosh/npg/npgd0332.html
	Dräger Chip	1-25 ppm or higher	No (Yes with option)							
	pH Paper	NA	Yes							
	SPM	0.5-15 ppm	No (Yes with option)							
	Drager Pac III	0-30 ppm	Yes							
	GFG Inc. Micro IV	0-30 ppm	Yes							
Nitric Acid	Dräger Tube	1-50 ppm or higher	Yes	11.95 eV	PEL = 2 ppm REL = 2 ppm TLV = 2 ppm	25 ppm	1 ppm = 2.58 mg/m^3	0.53 ppm	0.53 ppm	www.cdc.gov/niosh/npg/npgd0447.html
	pH Paper	NA	Yes							
	SPM	0.2-6 ppm	No (Yes with option)							
Sulfuric Acid	Dräger Tube	1-5 mg/m^3 (mist)	Yes	12.40 eV	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3 ACGIH TLV = 0.2 mg/m^3	15 mg/m^3	NA	0.2 mg/m^3	0.2 mg/m^3	www.cdc.gov/niosh/npg/npgd0577.html
	pH Paper	NA	Yes							
	SPM	26-750 ppb	No (Yes with option)							
Hydrocyanic Acid & Hydrogen Cyanide	Dräger Tube	2-30 ppm	Yes	13.60 eV	PEL = 10 ppm REL = ST 4.7 ppm TLV = 4.7 ppm C	50 ppm	1 ppm = 1.10 mg/m^3	1.3 ppm	1 ppm	www.cdc.gov/niosh/npg/npgd0333.html
	Dräger Chip	2-50 ppm	No (Yes with option)							
	pH Paper	NA	Yes							
	ToxiRAE II HCN	0-100 ppm	Yes							
	SPM	1.1-30 ppm	No (Yes with option)							
	Multiwarn II	0-50 ppm	Yes							
	Dräger Pac III	0-50 ppm	Yes							
	GFG Inc. Micro IV	0-50 ppm	Yes							
Metals (as particulate)										
Arsenic (inorganic components)	Personal DataRAM*	0.001-400 mg/m^3	No	9.81 eV	PEL = 0.01 mg/m^3 REL = 0.002 mg/m^3 TLV = 0.01 mg/m^3	5 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0038.html
	Data RAM 4*	0.001-400 mg/m^3	No							
Arsenic (organic components)	Dräger Tube	0-3 mg organic arsenic/m^3	Yes	NA	PEL = 0.01 mg/m^3 REL = 0.002 mg/m^3 TLV = 0.01 mg/m^3	5 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0039.html
Copper	Personal DataRAM*	0.001-400 mg/m^3	No	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3	100 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0150.html
	DataRAM 4*	0.001-400 mg/m^3	No							
Hexavalent Chromium	Personal DataRAM*	0.001-400 mg/m^3	No	NA	PEL = 0.005 mg/m^3 A1 REL = 0.001 mg/m^3 A1 TLV = 0.01 mg/m^3 A1	15 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0138.html
	DataRAM 4*	0.001-400 mg/m^3	No							
Lead	Personal DataRAM*	0.001-400 mg/m^3	No	NA	PEL = 0.05 mg/m^3 REL = 0.05 mg/m^3 TLV = 0.05 mg/m^3	100 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0368.html
	DataRAM 4*	0.001-400 mg/m^3	No							
PAHs (as particulate)*										
PAHs[3]	Personal DataRAM	0.001-400 mg/m^3	No	NA	PEL = 0.2 mg/m^3 REL = 0.1 mg/m^3 TLV = 0.2 mg/m^3	750 mg/m^3	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0374.html
	DataRAM 4	0.001-400 mg/m^3	No							
Particulate*										
Particulate	Personal DataRAM	0.001-400 mg/m^3	No	NA	PEL = 5 mg/m^3 (respirable fraction) TLV = 3 mg/m^3 (respirable fraction)	NA	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m^3	No							
Radiation[2]										
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No		300 cpm					

Instrument Guidance | Regulatory Guidance | Reference

Table 14 -- Wood-Treating Facility (Spill or Release)

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all compounds associated with a wood treating facility response, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
2- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.
3- PAHs = Coal Tar Pitch Volatiles

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another.

Acronyms:

µg/m^3 -- micrograms per cubic meter
A1 -- carginogenic effects
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
m^3 -- cubic meter
mg -- milligram
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAH -- polyaromatic hydrocarbon
PEL -- permissible exposure limit (OSHA)
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average

Table 15 -- Volcano

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
VOCs and Gases											
Carbon Monoxide	MultiRAE/AreaRAE CO sensor	0-500 ppm	Yes	14.01 eV	NA	PEL = 50 ppm REL = 35 ppm TLV = 25 ppm	1,200 ppm	1 ppm = 1.15 mg/m^3	33 ppm*	27 ppm*	www.cdc.gov/niosh/npg/npgd0105.html
	Dräger Tube	2-300 ppm or higher	Yes								
	Dräger Chip	5-150 ppm	No (Yes with option)								
	Multiwarn II	0-2,000 or 0-10,000 ppm	Yes								
	ToxiRAE II -- CO	0-500 ppm oh higher	Yes								
	GFG Inc Micro IV	0-2,000 ppm	Yes								
	MIRAN SapphIRe**	4.5-250 ppm	Yes								
Carbon Dioxide	Dräger Pac III	0-5% vol.	Yes	13.77 eV	NA	PEL = 5,000 ppm REL = 5,000 ppm TLV = 5,000 ppm	40,000 ppm	1 ppm = 1.80 mg/m^3	NA	NA	www.cdc.gov/niosh/npg/npgd0103.html
	Dräger Tube	2-12% vol.	Yes								
	Dräger Chip	200-25,000 ppm	No (Yes with option)								
	Multiwarn II	0-5% vol.	Yes								
	MIRAN SapphIRe**	7.5-2,000 ppm	Yes								
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S	0-100 ppm	Yes	10.46 eV	NA	PEL = 20 ppm REL = 10 ppm TLV = 10 ppm	100 ppm	1 ppm = 1.40 mg/m^3	0.36 ppm	0.33 ppm	www.cdc.gov/niosh/npg/npgd0337.html
	Dräger Tube	0.2-6 ppm or higher	No (Yes with option)								
	Dräger Chip	0.2-5 ppm or higher	No (Yes with option)								
	SPM	1.1-30 ppm	Yes								
	Multiwarn II	0-100 or 0-1,000 ppm	Yes								
	ToxiRAE H_2S	0-100 ppm	Yes								
	GFG Inc Micro IV	0-500 ppm	Yes								
	MultiRAE/AreaRAE PID***	0-2,000 ppm	Yes		3.3 (10.6 lamp)						
	TVA 1000B***	0.5-2,000 ppm (PID)	Yes		NA						
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 sensor	0-20 ppm	Yes	12.30 eV	NA	PEL = 5 ppm REL = 2 ppm TLV = 2 ppm	100 ppm	1 ppm = 2.62 mg/m^3	0.2 ppm	0.2 ppm	www.cdc.gov/niosh/npg/npgd0575.html
	Dräger Pac III	0-100 ppm	Yes								
	Dräger Tube	0.1-3 ppm or higher	Yes								
	Dräger Chip	0.4-10 ppm or higher	No (Yes with option)								
	MIRAN SapphIRe**	6-30 ppm	Yes								
	Multiwarn II	0-50 ppm	Yes								
	ToxiRAE SO_2	0-20 ppm	Yes								
	GFG Inc Micro IV	1-10 ppm	Yes								
	SPM	0.2-6 ppm	No (Yes with option)								
Particulate**											
Particulate	Personal DataRAM	0.001-400 mg/m^3	No	NA	NA	PEL = 5 mg/m^3 (respirable fraction) TLV = 3 mg/m^3 (respirable fraction)	NA	NA	NA	NA	www.cdc.gov/niosh/npg/npgd0480.html
	DataRAM 4	0.001-400 mg/m^3	No								
Radiation[2]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Table 15 -- Volcano

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

[1]- Does not include all compounds associated with volcanoes, only the most common compounds with the lowest action levels. Depending on the chemical of concern, certain Dräger tubes and chips can be used. In addition, single-gas instruments and sensors and/or a gas chromatography-mass spectrometry instrument may be used.
[2]- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death
http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*AEGL-2- There are no AEGLs-1 for this compound
**MIRAN SapphIRe has problems with complex mixtures (*e.g.*, distinguishing benzene from gasoline vapor)
***PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
H_2S -- hydrogen sulfide
HCN -- hydrocyanic acid
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SO_2 -- sulfur dioxide
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume

Table 16 -- Chemical Warfare Agents

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP[2]	IP & PID CF (ISO)[2]	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Nerve											
Tabun (GA)	APD 2000	15 ppb	No			PEL = 0.0001 mg/m³ U-STEL = 0.00001 mg/m³ WPL = 0.00003 mg/m³ C-STEL = 0.0001 mg/m³ WPL = 0.00003 mg/m³ GPL = 0.000001 mg/m³	0.03 ppm U = 0.1 mg/m³	1 ppm = 6.6 mg/m³	0.00021 ppm (0.0014 mg/m³)	0.00015 ppm (0.001 mg/m³)	Level A
	AP2C[3]	1.5 ppb	No								
	AP4C	10 µg/m³	No								
	SAW Mini-CAD	0.17 ppm	No								
	HAPSITE	0.1 - 10 ppb	No								
	M256 A-1	0.001 ppm	Yes								
	Dräger CDS Tubes	0.025 ppm	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	unknown	0.8 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Sarin (GB)	APD 2000	15 ppb	No			PEL = 0.0001 mg/m³ U-STEL - 0.0001 mg/m³ WPL = 0.00003 mg/m³ C-STEL = 0.0001 mg/m³ WPL = 0.00003 mg/m³ GPL = 0.000001 mg/m³ A-TWA = 0.00003 mg/m³	0.03 ppm U = 0.1 mg/m³	1 ppm = 5.7 mg/m³	0.00024 ppm (0.0014 mg/m³)	0.00017 ppm (0.001 mg/m³)	Level A
	AP2C[3]	1.5 ppb	No								
	AP4C	10 µg/m³	No								
	SAW Mini-CAD	0.17 ppm	No								
	HAPSITE	0.1 - 10 ppb	No								
	M256 A-1	0.0008 ppm	Yes								
	Dräger CDS Tubes	0.025 ppm	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	<16 eV	3-6 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Soman (GD)	APD 2000	15 ppb	No			PEL = 0.0003 mg/m³ U-STEL - 0.001 mg/m³ WPL = 0.00003 mg/m³ GPL = 0.000001 mg/m³ A-TWA = 0.00003 mg/m³	0.05 mg/m³ or 0.008 ppm	1 ppm = 7.5 mg/m³	0.000091 ppm (0.0007 mg/m³)	0.00065 ppm (0.0005 mg/m³)	Level A
	AP2C[3]	1.5 ppb	No								
	AP4C	10 µg/m³	No								
	SAW Mini-CAD	0.02 ppm	No								
	HAPSITE	0.1 - 10 ppb	No								
	M256 A-1	0.001 ppm	Yes								
	Dräger CDS Tubes	0.025 ppm	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	<10.60 eV	~3 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Cyclo-Sarin (GF)	APD 2000	15 ppb	No			PEL = 0.003 mg/m³ U-STEL = 0.001 mg/m³ WPL = 0.00003 mg/m³ GPL = 0.000001 mg/m³ A-TWA = 0.00003 mg/m³	0.05 mg/m³	1 ppm = 7.3 mg/m³	0.0001 ppm (0.0007 mg/m³)	0.0007 ppm (0.0005 mg/m³)	Level A
	AP2C[3]	1.5 ppb	No								
	AP4C	10 µg/m³	No								
	SAW Mini-CAD	0.01 ppm	No								
	HAPSITE	0.1 - 10 ppb	No								
	M256 A-1	0.002 ppm	Yes								
	Dräger CDS Tubes	0.025 ppm	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	10.60 eV	~3 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						

Table 16 -- Chemical Warfare Agents

	Instrument Guidance					Regulatory Guidance					Reference
Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP[2]	IP & PID CF (ISO)[2]	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Nerve											
VX	APD 2000	4 ppb	No			PEL = 0.0001 mg/m³ U-STEL = 0.0001 mg/m³ WPL = 0.00001 mg/m³ GPL = 0.000001 mg/m³ A-TWA = 0.00003 mg/m³	U = 0.05 mg/m³	1 ppm = 7.3 mg/m³	0.0000091 ppm (0.00001 mg/m³)	0.0000065 ppm (0.000071 mg/m³)	Level A
	AP2C[3]	1.5 ppb	No								
	AP4C	10 µg/m³	No								
	SAW Mini-CAD	0.01 ppm	No								
	HAPSITE	0.1 - 10 ppb	No								
	M256 A-1	0.002 ppm	Yes								
	Dräger CDS Tubes	0.025 ppm	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	unknown	~0.5 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Blister											
Mustard (H) & Distilled Mustard (HD)	APD 2000	300 ppb	No			PEL = 0.003 mg/m³ U-STEL - 0.003 mg/m³ WPL = 0.004 mg/m³ GPL = 0.00002 mg/m³ A = 0.0004 mg/m³ C-STEL = 0.003 mg/m³ WPL = 0.004 mg/m³ GPL = 0.00002 mg/m³	0.0005 ppm 0.7 mg/m³	1 ppm = 6.5 mg/m³	0.0030 ppm (0.017 mg/m³)	0.0010 ppm (0.083 mg/m³)	Level A
	AP2C[3]	1.5 ppb	No								
	AP4C	0.5 mg/m³	No								
	SAW Mini-CAD	0.09 ppm	No								
	HAPSITE	0.1 - 10 ppb	No								
	M256 A-1	0.31 ppm	Yes								
	Dräger CDS Tubes	1 mg/m³	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	< 11.1 eV	~0.5 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Nitrogen Mustard (HN1, HN2, HN3)	APD 2000	300 ppb	No			NA	0.0008 ppm	1 ppm = HN1 -- 6.9 mg/m³ HN2 -- 6.4 mg/m³ HM3 -- 8.3 mg/m³	NR	NR	Level A
	AP4C	10 µg/m³	No								
	SAW Mini-CAD	Does not detect	No								
	M256 A-1	0.6 ppm	Yes								
	Dräger CDS Tubes	1 mg/m³	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	<11.1 eV	~0.5 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Lewisite (L)	APD 2000	200 ppb	No			PEL = 0.003 mg/m³ U WPL = 0.003 mg/m³ GPL = 0.003 mg/m³	0.0004 ppm	1 ppm = 8.4 mg/m³	NR	NR	Level A
	AP4C	1.5 mg/m³	No								
	M256 A-1	1 ppm	Yes								
	Dräger CDS Tubes	3.0 mg/m³	Yes								
	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	~10.60 eV	1 (10.6 lamp)						
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						
Phosgene Oxime (CX)	MultiRAE/AreaRAE PID*	0-2,000 ppm	Yes	~10.60 eV	10 (10.6 lamp)	NA	NA	1 ppm = 4.7 mg/m³	NR	NR	Level A
	TVA 1000B*	0.5-2000 ppm (PID) 1-50,000 ppm (FID)	Yes		NA						

Table 16 -- Chemical Warfare Agents

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instruments	Detection Levels	Intrinsically Safe (Y/N)	IP[2]	IP & PID CF (ISO)[2]	Occupational Action Levels		Conversion	AEGL-1		PPE (refer to SSHASP and NIOSH Website)
						TWA	IDLH		4-hour	8-hour	
Blood											
Hydrogen Cyanide (AC), HCN	AP4C	10 mg/m³ or 1.5 ppm	No	NA	NA	PEL = 11 mg/m³ = 1 ppm PEL = 10,000 ppbv ACGIH = 4.7 ppm C	45 ppm NIOSH 50 ppm	1 ppm = 1.1 mg/m³	1.3 ppm	1 ppm	Level A
	M256 A-1	7.13 ppm	Yes								
	Dräger CDS Tubes	1 ppm	Yes								
	Dräger CDS Chips	2 ppm	Yes								
Cyanogen Chloride (CK)	M256 A-1	0.25 ppm	Yes	12.34	NA	REL = 0.6 mg/m3 C REL = 300 ppbv C ACGIH = 0.3 ppm C	NA	1 ppm = 2.52 mg/m³	NR	NR	Level A
	Dräger CDS Tubes	3.13 ppm	Yes								
Arsine (SA)	Dräger CDS Tubes	0.1 ppm	Yes	9.89	NA	PEL = 0.002 mg/m3 PEL = 0.05 ppm ACGIH = 0.005 ppm	3 ppm	1 ppm = 3.19 mg/m³	NR	NR	Level A
Radiation[4]											
Radiation	Ludlum 192	0-5,000 micro-R/hr	No	NA	NA	10 micro-R/hr	NA	NA	NA	NA	Level C
	Ludlum 2241-2 with Pancake Probe	0-9,999 R/hr or 999,000 cpm	No			300 cpm					

Notes:

For guidance only. These tables do not supersede a site-specific health and safety plan at any time or on any response.

1- Does not include all chemical warfare agents, only the most common compounds with the lowest action levels.
2- Estimated response of warfare agent detection products by PID. Source: RAE TN-159
3- AP2Ce is intrinsically safe; however, the AP2Ce may not detect distilled mustard gas (HD) well.
4- Standard EPA Emergency Response Protocol is to screen for radiation with a Micro-R at all emergency responses. If readings are three times background, responders consult with a Health Physicist. Additional radiation equipment is available to monitor for Alpha, Beta, and Gamma, but is not included in this table.

AEGL-1 is the airborne concentration (expressed as ppm or mg/m3) 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.
AEGL-2 is the airborne concentration (expressed as ppm or mg/m3) 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.
AEGL-3 is the airborne concentration (expressed as ppm or mg/m3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

http://www.epa.gov/oppt/aegl/pubs/chemist.html EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.

*PIDs and FIDs are non-specific detectors and cannot differentiate one VOC from another, even with CFs applied.

Table 16 -- Chemical Warfare Agents

Acronyms:

~ -- approximately
< -- less than
µg/m^3 -- micrograms per cubic meter
A -- ATSDR
A-TWA -- ATSDR time-weighted average
A4 -- concern that the compound may be carcinogenic, but supporting data are lacking
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
ATSDR -- Agency for Toxic Substances and Disease Registry
C -- ceiling (concentrations that should not be exceeded during any part of the work exposure)
C-STEL -- CDC short-term exposure limit
CDC -- Centers for Disease Control
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
eV -- electron volt
FID -- flame ionization detector
GPL -- general public limit
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
micro-R/hr -- micro Roentgens per hour
NA -- not available/applicable
NL -- not listed
NIOSH -- National Institute for Occupational Safety and Health
NR -- no response
OSHA -- Occupational Safety and Health Administration
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
PPE -- personal protective equipment
ppm -- parts per million
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
U -- USA CHPPM
U-STEL -- USA CHPPM short-term exposure limit
U-WPL -- USA CHPPM worker protection limit
USA CHPPM -- U.S. Army Center for Health Promotion and Preventive Medicine
WPL -- worker protection limit

Glossary

~	approximately
>	greater than
<	less than
%	percent
µg/m^3	micrograms per cubic meter
A1	carcinogenic effects
A4	concern that the compound may be carcinogenic, but supporting data are lacking
A	ATSDR
A-TWA	ATSDR time-weighted average
ACGIH	American Conference of Governmental Industrial Hygienists
AEGL	Acute Exposure Guideline Levels
ATSDR	Agency for Toxic Substances and Disease Registry
C	ceiling (concentrations that should not be exceeded during any part of work exposure)
C-STEL	CDC short-term exposure limit
CDC	Centers for Disease Control
CF	correction factor
Cl	chlorine
CO	carbon monoxide
cpm	counts per minute
EPA	United States Environmental Protection Agency
eV	electron volt
FID	flame ionization detector
GPL	general public limit
H_2S	hydrogen sulfide
HCN	hydrocyanic acid
HGV	Health Guidance Value
IDLH	Immediately Dangerous to Life and Health
IP	ionization potential
ISO	isobutylene
LEL	lower explosive level
m^3	cubic meter
mg/kg	milligram per kilogram
mg/m^3	milligram per cubic meter
micro-R/hr	micro-Roentgens per hour
NA	not available/applicable
ND	non-detect
ng/m^3	nanogram per cubic meter
NH_3	ammonia
NIOSH	National Institute for Occupational Safety and Health
NL	not listed
NR	no response
O_2	oxygen
OSHA	Occupational Safety and Health Administration

Glossary (continued)

PAH	polyaromatic hydrocarbon
PID	photoionization detector
ppb	parts per billion
PDR	personal dataRAM
PEL	Permissible Exposure Limit (OSHA)
PPE	personal protective equipment
ppm	parts per million
R/hr	Roentgens per hour
REL	Recommended Exposure Limit (NIOSH)
SO_2	sulfur dioxide
SPM	Single-Point Monitor
SSHASP	site-specific health and safety plan
ST	short-term
STEL	Short-Term Exposure Limit
TLV	Time-Limited Value (ACGIH)
TWA	Time-Weighted Average
U	USA CHPPM
U-STEL	USA CHPPM short-term exposure limit
U-WPL	USA CHPPM worker protection limit
USA CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
VOC	volatile organic compound
Vol.	volume
WPL	worker protection limit

Attachment A – Hazard Evaluation Flowchart for Unknowns

Hazard Evaluation Flow Chart for Unknowns

Early Considerations!

Collect intelligence, Document signs and symptoms of victims, Evaluate scene & situation, Potential explosives should be evaluated by the local bomb squad, Cordon off area, Isolate, Evacuate, Disable HVAC, Seal doors and cracks, Delineate hotzone (wind direction and intensity), Turn on radiation meter while preparing entry, Approach uphill/upwind/upstream, Follow H&S plan, Sampling plan, & Decontamination procedures for personnel/sample containers/equipment, consult with Incident Commander and law enforcement

Calibrate instruments/Collect background readings

Team dons Level A or B PPE (consult with H&S Manager)

Team enters hot zone (Photo/video documentation)

Air	Liquid/Solid
1st Entry: CGI/O_2*; Radiation Meter; FID; AP4C_e/APD2000/AP2C_e; MultiRAE; MultiWARN (CGI/O_2; CN; Phosgene; Cl_2; NH_3; H_2S; PID) digital or video camera	**1st Entry:** CGI/O_2*; Radiation Meter; FID; pH Paper; APD 2000/AP2C_e/AP4C_e; M8/M9 Paper; digital or video camera
2nd Entry: Dräger Tubes, Cl, Ps; SAM935/940, or Exploranium; MultiRAE or MultiWARN (CGI/O_2, CN, Phosgene, Cl_2, NH_3, H_2S, PID); SPM; Dräger CMS; Lumex MVA ***Collect Samples As Appropriate***	**2nd Entry:** M256 Kit; Dräger tubes (liquid); SAM935/940, or Exploranium; Ratemeter with Pancake Probe ***Collect Samples As Appropriate***
Additional Monitoring: Portable GCMS; Particulate Monitor (RAM); AreaRAE	**Additional Monitoring:** Portable GCMS; Industrial Chemical Field Tests; PCR; Hazmat ID FTIR

* **intrinsically safe**

Combustible Atmosphere and Oxygen
O_2 Normally 20.8%

CGI >10% LEL
O_2 <19.5% or O_2 > 23.5%

STOP!
Exit Hot Zone or reevaluate

Radiological
Radiation Background
Normally 5-15 µR/hr

> 0.1 mR/hr
> 100 µR/hr
Continuous ambient reading

STOP!
Tech Support
Consult EPA RERT
Consult DOE RAP
Continue Operations with Monitoring

> 10,000 µR/hr
Continuous ambient reading
> 1.5 R/hr
> 1500 mR/hr
> 1,500,000 µR/hr

STOP!
Exit Hot Zone
Await Arrival of State/Federal Health Physicist

Chemical
Chemical Agents Tests

(POS)
If not in level A, exit and don level A

(NEG)

Biological**
Potential Biological Agent

Re-assess situation and send to appropriate lab

(POS) Biological Potential
(POS) Chemical Agents

(NEG)
(POS)

Industrial Chemical Field Tests

Biological Unlikely
(POS) Chemical Agents

(NEG) Biological
(NEG) Chemical Agents
(POS) Industrial Chemical Tests

(POS) Biological
(NEG) Chemical Agents

Send to Chemical Agent Lab ***

Send to Commercial Chemical Lab ***

Send to Biological Lab ***

** If the situation is suspicious send samples to biological lab.

*** Send to laboratory if radiation is less than 3 times background. If above, consult with laboratory prior to shipping.

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