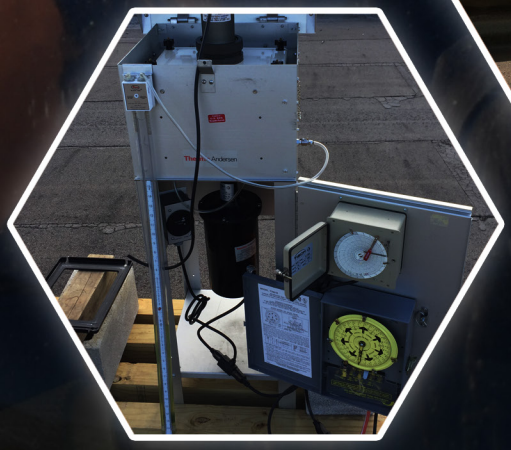
EPA Emergency Response Air Monitoring Guidance Tables

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EPA
EMERGENCY RESPONSE TECHNICAL GROUP




2017 Edition 6

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Executive Summary

Background

The United States Environmental Protection Agency (EPA) assembled the following 21 tables for use by field responders. The tables cover an array of response types and should be used for guidance only.

These tables are considered 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 supplementary 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 presented 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 TSI DustTrak DRX) will provide real-time data. The instrumentation reading will be in total 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 Pro) 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. Teflon tubing is to be used for calibration instead of tygon tubing for volatile organic compound analysis.

If you have any changes or revisions please email:
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Glossary

~	Approximately
>	Greater than
<	Less than
=	Equal to
≥	Greater than or equal to
%	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-TWA	ATSDR time-weighted average
ACGIH	American Conference of Governmental Industrial Hygienists
AEGL	Acute Exposure Guideline Levels
AEL	Airborne exposure limits (CDC)
ATSDR	Agency for Toxic Substances and Disease Registry
C	Ceiling (concentrations that should not be exceeded during any part of work exposure)
°C	Degrees Celsius
Ca	Carcinogenic
C-STEL	CDC short-term exposure limit
CDC	Centers for Disease Control
CF	Correction factor
Cl	Chlorine
CO	Carbon monoxide
cpm	Counts per minute
DAAMS	Depot area air monitoring system
DOE	Department of Energy
EPA	United States Environmental Protection Agency
ERPG	Emergency response planning guideline
eV	Electron volt
FID	Flame ionization detector
GPL	General public limit
H_2S	Hydrogen sulfide
HCN	Hydrocyanic acid
HGV	Health guidance value
IC	Ion chromatography
IDLH	Immediately dangerous to life and health
IP	Ionization potential
ISO	Isobutylene
L/min	Liter per minute
LEL	Lower explosive level
m^3	Cubic meter
mg/kg	Milligram per kilogram

Glossary (continued)

mg/m^3	Milligram per cubic meter
mS/cm	Millisiemens per centimeter
µR/hr	Micro-roentgens per hour
$µg/ m^3$	Micro-grams per cubic meter
mV	Millivolt
MVA	Mercury vapor analyzer
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/Not rated
NTU	Nephelometric turbidity unit
O_2	Oxygen
ORP	Oxygen reduction potential
OSHA	Occupational Safety and Health Administration
PAC	Protective action criteria
PAH	Polyaromatic hydrocarbon
PBAN	Polybutadiene acrylic acid acrylonitrile
pH	Power hydrogen
PID	Photoionization detector
Ppb	Parts per billion
Ppm	Parts per million
Ppt	Parts per trillion
PDR	Personal dataRAM
PEL	Permissible Exposure Limit (OSHA)
PPE	Personal protective equipment
ppm	Parts per million
R/hr	Roentgens per hour
Rec.	Recommended
REL	Recommended exposure limit (NIOSH)
S	Skin notation (compound may be absorbed through the skin)
SO_2	Sulfur dioxide
SPM	Single-point monitor
SSHASP	Site-specific health and safety plan
ST	Short-term
STEL	Short-term exposure limit
TCE	Trichloroethylene
TEEL	Temporary emergency exposure limit
TLV	Time-limited value (ACGIH)
TWA	Time-weighted average

Glossary (continued)

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
WISER	Wireless information system for emergency responders
WPL	Worker protection limit
Y w/option	Yes with option; see manufacturer's instrument manual for information

Attachment A
Hazard Evaluation Flowchart for Unknowns

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Table 1 - Acid (Spill or Release)

Instrument Guidance						Regulatory Guidance							Reference		
						Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Acids															
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	1 ppm = 1.49 mg/m^3	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	1.8 ppm	1.8 ppm	1.8 ppm	1.8 ppm	3 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 240 L/ 600L Max
	MultiRAE Pro HCl Sensor	0-15 ppm	Y												
	Dräger Tube	≥1-10 ppm	Y												
	Dräger Chip	≥1-25 ppm	N (Y w/option)												
	pH Paper	0-14	Y												
	SPM	0.5-15 ppm	N (Y w/option)												
	Dräger Pac III	0-30 ppm	Y												
	GFG Inc. Micro IV	0-30 ppm	Y												
Nitric Acid	Dräger Tube	≥1-50 ppm	Y	11.95 eV	1 ppm = 2.58 mg/m^3	PEL = 2 ppm REL = 2 ppm, ST 4 ppm TLV = 2 ppm, ST 4 ppm	25 ppm	0.16 ppm	0.16 ppm	0.16 ppm	0.16 ppm	1 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 240 L/600L Max
	pH Paper	0-14	Y												
	SPM	0.2-6 ppm	N (Y w/option)												
Sulfuric Acid	Dräger Tube	1-5 mg/m^3	Y	12.4 eV	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	Filter, 37-mm diameter quartz fiber 225-1827	NIOSH 7908	1-5 L/min;/420L, 2000L Max
	pH Paper	0-14	Y												
	SPM	26-750 ppb	N (Y w/option)												
Hydrocyanic Acid (Hydrogen Cyanide)	MultiRAE/AreaRAE HCN Sensor	0-100 ppm	Y	13.6 eV	1 ppm = 1.1 mg/m^3	PEL = 10 ppm S REL = ST 4.7 ppm S TLV = C 10 ppm S	50 ppm	2.0 ppm	1.3 ppm	1 ppm	2 ppm	NA	Sorbent Tube – soda lime and glass fiber filter 226-28	NIOSH 6017	0.05-0.2 L/min; 2-90 L
	MultiRAE Pro HCN Sensor	0-50 ppm	Y												
	Dräger Tube	10-50 ppm	Y												
	Dräger Chip	2-50 ppm	N (Y w/option)												
	pH Paper	0-14	Y												
	ToxiRAE II HCN	0-100 ppm	Y												
	SPM	1.1-30 ppm	N (Y w/option)												
	Dräger Pac III	0-50 ppm	Y												
	GFG Inc. Micro IV	0-50 ppm	Y												
Hydrofluoric Acid (Hydrogen Fluoride)	AreaRAE HF Sensor	2-10 ppm	Y	15.98 eV	1 ppm = 0.82 mg/m^3	PEL = 3 ppm REL = C 3 ppm, ST 6 ppm TLV = C 3 ppm	30 ppm	1 ppm	1 ppm	1 ppm	1 ppm	2 ppm	Pre-filter, cellulose nitrate, 0.8 µm pore size 225-9031	NIOSH 7906	1-2 L/min; 1000 L Max
	MultiRAE Pro HF Sensor	0-10 ppm	Y												
	Dräger Tube	0.5-90 ppm	Y												
	pH Paper	0-14	Y												
	SPM	0.6-9 ppm	N (Y w/option)												
	Dräger Pac III	0-30 ppm	Y												
	GFG Inc. Micro IV	0-10 ppm	Y												

Table 1 - Acid (Spill or Release)

	Instrument Guidance					Regulatory Guidance							Reference		
						Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Hydrobromic Acid	pH Paper	0-14	Y	11.62 eV	1 ppm = 3.31 mg/m^3	PEL = 3 ppm REL = C 3 ppm TLV = C 3 ppm	30 ppm	1 ppm	1 ppm	1 ppm	1 ppm	NA	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 240 L/ 600 L Max
	SPM	0.3-9 ppm	N (Y w/option)												
Acetic Acid	Dräger Tube	5-80 ppm	Y	10.66 eV	1 ppm = 2.46 mg/m^3	PEL = 10 ppm REL = 10 ppm TLV = 10 ppm, ST 15 ppm	50 ppm	NA	NA	NA	5 ppm	5 ppm	Sorbent Tube – charcoal 226-01	NIOSH 1603	0.01-1 L/min; 24 L
	Dräger Chip	2-50 ppm	N (Y w/option)												
	pH Paper	0-14	Y												
	MIRAN SapphIRe	0-100 ppm	Y												
Gases Produced from Acid Reactions															
Oxygen	MultiRAE/AreaRAE O_2 Sensor	0-30% Vol.	Y	12.35 eV	NA	<19.5% O_2 (simple asphyxiant)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dräger Tube	5-23% Vol.	Y												
	Dräger Chip	1-25% Vol.	N (Y w/option)												
	Dräger Pac III	0-100% Vol.	Y												
	GFG Inc. Micro IV	0-25%	Y												
Hydrogen	Dräger Tube	0.2-2% Vol.	Y	15.42 eV	NA	<19.5% O_2 (simple asphyxiant)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dräger Pac III	0-2000 ppm	Y												
	GFG Inc. Micro IV	0-4% Vol.	Y												
Radiation[2]															
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/Y = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N			300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N			300 cpm									

Table 1 - Acid (Spill or Release)

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Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

Acronyms:

≥ -- greater than or equal to
< -- 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 work exposure)
CDC -- Centers for Disease Control and Prevention
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
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
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 2 - Ammonia (Spill or Release)

	Instrument Guidance						Regulatory Guidance							Reference		
Target Compound	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Gas																
Ammonia	MultiRAE/AreaRAE NH_3 Sensor	0-100 ppm	Y	10.18 eV	NA	1 ppm = 0.7 mg/m^3	PEL = 50 ppm REL = 25 ppm, ST 35 ppm TLV = 25 ppm, ST 35 ppm	300 ppm	30 ppm	30 ppm	30 ppm	30 ppm	25 ppm	Sorbent Tube, Silica Gel, 226-10-06	NIOSH 6015	0.1-0.2 L/min; 72 L
	MultiRAE Pro NH_3 Sensor	0-100 ppm	Y													
	Dräger Tube	≥0.25-3 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	Dräger Pac III	0-300 ppm	Y													
	SPM	2.6-75 ppm	N (Y w/option)													
	ToxiRAE II NH_3	0-50 ppm	Y													
	MIRAN SapphIRe*	0-500 ppm	Y													
	MultiRAE/AreaRAE PID**	0-50 ppm	Y		(10.6 lamp)10.9 (11.7 lamp) 5.7											
	TVA 1000B**	0-2,000 ppm (PID) NA ppm (FID)	Y		10.6 lamp 21.666 (10 ppm) - 22.980 (2000 ppm)											
Radiation[1]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/Y = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Table 2 - Ammonia (Spill or Release)

Notes:

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[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 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	Wireless Information System for Emergency Responders (WISER) website
http://www.skcinc.com/	SKC, Inc. website

*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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.

Acronyms:

≥ -- greater than or equal to
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
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
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 3 - Chemical Plant (Fire)

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	Instrument Guidance						Regulatory Guidance									Reference		
							Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																		
Benzene	UltraRAE-PID***	0.1-200 ppm	Y	9.24 eV	9.6 (9.6 lamp)	1 ppm = 3.19 mg/m^3	NA	NA	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/Tedlar bag	NIOSH 1501/TO 15/TO 3	≤0.2 L/min; <200mL/min
	Dräger Tube	≥0.5-10 ppm	Y															
	Dräger Chip	≥0.2-10	N (Y w/option)															
	MIRAN SapphIRe**	2-200 ppm	Y															
	ppbRAE-PID***	1ppb-200ppm	Y		0.55 (10.6 lamp)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID) .5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)													
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	NA	NA	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	NR	NR	NR	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	Instrument Dependent
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y															
	Dräger Tube	≥2-300 ppm	Y															
	Dräger Chip	5-150 ppm	N (Y w/option)															
	ToxiRAE II CO	≥0-500 ppm	Y															
	GFG Inc. Micro IV	0-300 ppm	Y															
	MIRAN SapphIRe**	1-250 ppm	Y															
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	NA	NA	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008	0.05 L/min; 12 L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y															
	Dräger Tube	≥0.2-6 ppm	Y															
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)															
	SPM	1.1-30 ppm	N (Y w/option)															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		3.3 (10.6 lamp)													
	GFG Inc. Micro IV	0-1000 ppm	Y		NA													
	TVA 1000B***	0.5-2,000 ppm (PID)	Y															
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	NA	NA	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y															
	Dräger Tube	≥0.1-3 ppm	Y															
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)															
	MIRAN SapphIRe**	1.2-30 ppm	Y															
	GFG Inc. Micro IV	1-10 ppm	Y															
	SPM	0.2-6 ppm	N (Y w/option)															
Nitric Oxide	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y	9.27 eV	NA	1 ppm = 1.23 mg/m^3	NA	NA	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	NA	NA	NA	0.5 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	0.025 L/min; 1.5-6 L
	ToxiRAE II NO	0-250 ppm	Y															
	Dräger Pac III	0-100 ppm	Y															
	GFG Inc. Micro IV	0-100 ppm	Y															
Vinyl Chloride	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.99 eV	2 (10.6 lamp)	1 ppm = 2.56 mg/m^3	NA	NA	PEL = 1 ppm, C 5 ppm (15 mins) REL = Ca TLV = 5 ppm	NA	250 ppm	140 ppm	70 ppm	250 ppm	500 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/Tedlar bag	NIOSH 1007/TO 15	0.05 L/min; <200mL/min
	Dräger Tube	≥0.5-30 ppm	Y															
	Dräger Chip	≥0.3-10 ppm	N (Y w/option)															
	MIRAN SapphIRe**	2-20 ppm	Y		NA													
	Dräger Pac III	0-100 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Y		10.6 lamp 2.334 (10 ppm) - 4.397 (2000 ppm)													

Table 3 - Chemical Plant (Fire)

	Instrument Guidance						Regulatory Guidance									Reference		
							Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																		
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y	9.75 eV	NA	1 ppm = 1.88 mg/m^3	NA	NA	PEL = C 5 ppm REL = ST 1 ppm TLV = 3 ppm, ST 5 ppm	20 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	1 ppm	Sorbent Tube, Molecular Sieve, 226-40-02	NIOSH 6014	0.025-0.2 L/min; 1.5-6 L
	Dräger Tube	≥0.5-25 ppm	Y															
	Dräger Chip	0.5-25 ppm	N (Y w/option)															
	SPM	0.3-9 ppm	N (Y w/option)															
	ToxiRAE II NO_2	0-20 ppm	Y															
	Dräger Pac III	0-50 ppm	Y															
	GFG Inc. Micro IV	0-50 ppm	Y															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		16 (10.6 lamp)													
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Y		NA													
TCE	Dräger Tube	≥2-250 ppm	Y	9.47 eV	NA	1 ppm = 5.37 mg/m^3	NA	NA	PEL = 100 ppm, C 200 ppm, 300 ppm (5 mins) REL = Ca TLV = 50 ppm, ST 200 ppm	1000 ppm Ca	130 ppm	84 ppm	77 ppm	10ppm	100 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa canister/Tedlar Bag	NIOSH 1022/ TO 15	0.01-0.2 L/min; <200mL/min
	Dräger Chip	≥5-100 ppm	N (Y w/option)															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		0.54 (10.6 lamp)													
	TVA 1000B***	0.5-2000 ppm (PID)	Y		10.6 lamp 0.605 (10 ppm) - 2.129 (2000 ppm)													
Phosgene	Dräger Tube	0.02-15 ppm	Y	11.55 eV	NA	1 ppm = 4.05 mg/m^3	NA	NA	PEL = 0.1 ppm REL = 0.1 ppm, C 0.2 ppm (15 mins) TLV = 0.1 ppm	2 ppm	0.3 ppm*	0.08 ppm*	0.04ppm*	0.027 ppm	NA	Sorbent Tube, XAD-2, 226-117	OSHA 61	1 L/min;
	Dräger Chip	0.05-2 ppm	N (Y w/option)															
	MIRAN SapphIRe**	0.05 ppm	Y															
	TVA 1000B***	0.5-2000 ppm (PID)	Y															
	MultiRAE Pro $COCl_2$ Sensor	0-1 ppm	Y															
	MultiRAE/AreaRAE PID***	0-200 ppm	Y		8.5 (11.7 lamp)													
	TVA 1000B***	0.5-2000 ppm (PID)	Y		NA													
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	NA	1 ppm = 1.49 mg/m^3	NA	NA	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	NR	NR	NR	1.8 ppm	3 ppm	Cartridge – two 37-mm diameter cellulose nitrate, one filter impregnated with NA_2CO_3 225-9032	NIOSH 7907	2 L/min; 240 L/ 600 L Max
	MultiRAE Pro HCl Sensor	0-15 ppm	Y															
	Dräger Tube	≥1-10 ppm	Y															
	Dräger Chip	≥1-25 ppm	N (Y w/option)															
	pH Paper	NA	Y															
	SPM	0.5-15 ppm	N (Y w/option)															
	Dräger Pac III	0-30 ppm	Y															
	GFG Inc. Micro IV	0-30 ppm	Y															
Nitric Acid	Dräger Tube	≥1-50 ppm	Y	11.95 eV	NA	1 ppm = 2.58 mg/m^3	NA	NA	PEL = 2 ppm REL = 2 ppm, ST 4 ppm TLV = 2 ppm, ST 4 ppm	25 ppm	0.16 ppm	0.16 ppm	0.16 ppm	0.53 ppm	1 ppm	Cartridge – two 37-mm diameter cellulose nitrate, one filter impregnated with NA_2CO_3 225-9032	NIOSH 7907	2 L/min; 240 L/ 600 L Max
	pH Paper	NA	Y															
	SPM	0.2-6 ppm	N (Y w/option)															
Sulfuric Acid	Dräger Tube	1-5 mg/m^3	Y	12.4 eV	NA	NA	NA	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	Sorbent Tube, Silica Gel, 226-10-03	NIOSH 7903	0.2-0.5 L/min; 48 L
	pH Paper	NA	Y															
	SPM	26-750 ppb	N (Y w/option)															

Table 3 - Chemical Plant (Fire)

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																		
Acetic Acid	Dräger Tube	5-80 ppm	Y	10.66 eV	NA	1 ppm = 2.46 mg/m^3	NA	NA	PEL = 10 ppm REL = 10 ppm TLV = 10 ppm, ST 15 ppm	50 ppm	NA	NA	NA	5 ppm	5 ppm	Sorbent Tube, Anasorb CSC, 226-01	NIOSH 1603	0.01-1 L/min; 24 L
	Dräger Chip	2-50 ppm	N (Y w/option)															
	pH Paper	NA	Y															
	MIRAN SapphIRe	0-100 ppm	Y															
Hydrobromic Acid	pH Paper	NA	Y	11.62 eV	NA	1 ppm = 3.31 mg/m^3	NA	NA	PEL = 3 ppm REL = C 3 ppm TLV = C 3 ppm	30 ppm	1 ppm	1 ppm	1 ppm	1 ppm	NA	Cartridge – two 37-mm diameter cellulose nitrate, one filter impregnated with NA_2CO_3 225-9032	NIOSH 7907	2 L/min; 600 l Max
	SPM	0.3-9 ppm	N (Y w/option)															
Hydrocyanic Acid (Hydrogen Cyanide)	MultiRAE/AreaRAE HCN Sensor	0-100 ppm	Y	13.6 eV	NA	1 ppm = 1.1 mg/m^3	NA	NA	PEL = 10 ppm S REL = ST 4.7 ppm S TLV = C 10 ppm S	50 ppm	2.0 ppm	1.3 ppm	1 ppm	2 ppm	NA	Sorbent Tube – soda lime and glass fiber filter 226-28	NIOSH 6017	0.05-0.2 L/min; 2-90 L
	MultiRAE Pro HCN Sensor	0-50 ppm	Y															
	Dräger Tube	2-150	Y															
	Dräger Chip	2-50 ppm	N (Y w/option)															
	pH Paper	0-14	Y															
	ToxiRAE II HCN	0-100 ppm	Y															
	SPM	1.1-30 ppm	N (Y w/option)															
	Dräger Pac III	0-50 ppm	Y															
	GFG Inc. Micro IV	0-50 ppm	Y															
Hydrofluoric Acid (Hydrogen Fluoride)	AreaRAE HF Sensor	2-10 ppm	Y	15.98 eV	NA	1 ppm = 0.82 mg/m^3	NA	NA	PEL = 3 ppm REL = C 3 ppm, ST 6 ppm TLV = C 3 ppm	30 ppm	1 ppm	1 ppm	1 ppm	1 ppm	2 ppm	Cartridge – two 37-mm diameter cellulose nitrate, one filter impregnated with NA_2CO_3 225-9031	NIOSH 7906	2 L/min; 1000 L Max
	MultiRAE Pro HF Sensor	0-10 ppm	Y															
	Dräger Tube	0.5-90 ppm	Y															
	pH Paper	0-14	Y															
	SPM	0.6-9 ppm	N (Y w/option)															
	Dräger Pac III	0-30 ppm	Y															
	GFG Inc. Micro IV	0-10 ppm	Y															
Metals - as particulates																		
Lead	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	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	0.15 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 50-2000 L
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150 mg/m^3	N															
Mercury	Lumex RA-915	0.000002-0.05 mg/m^3	N	NA	NA	NA	1000 ng/m^3	3000 ng/m^3	PEL = C 0.1 mg/m^3 S REL = 0.05 mg/m^3 S (vapor), C 0.1 mg/m^3 (other) TLV = 0.025 mg/m^3 S	10 mg/m^3	1.7 mg/m^3*	0.67 mg/m^3*	0.33 mg/m^3*	0.025 mg/m^3*	NA	Sorbent Tube, Anasorb C300, 226-17-1A	NIOSH 6009	0.15-0.25 L/min; 48 L
	Lumex RA-915 Light	0.0001-0.1 mg/m^3	N															
	Jerome 431X	0.003 to 0.999 mg/m^3	N															
	Jerome J405	0.0005-0.999 mg/m^3	N															
	Jerome 471	0.00003-0.25 mg/m^3	N															
	Dräger Tube	0.00000005-0.000002 mg/m^3	Y															

Instrument Guidance | Regulatory Guidance | Reference

Table 3 - Chemical Plant (Fire)

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Metals - as particulates (continued)																		
Arsenic (inorganic compounds)	Personal DataRAM****	0.001-400 mg/m^3	N	9.81 eV	NA	NA	NA	NA	PEL = 0.01 mg/m^3 REL = C 0.002 mg/m^3 (15 mins) TLV = 0.01 mg/m^3	5 mg/m^3 Ca	NA	NA	NA	0.025 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7900	1-3 L/min; 30 L
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150 mg/m^3	N															
Arsenic (organic compounds)	Dräger Tube	0-3 mg organic arsenic/m^3	Y	NA	NA	NA	NA	NA	PEL = 0.5 mg/m^3 TLV = 0.2 mg/m^3	NA	NA	NA	NA	0.025 mg/m^3	NA	Filter, PTFE, w/Support Pad, 1.0um, 37mm, 225-17-01	NIOSH 5022	1-3 L/min; 960 L
Chromium	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 1 mg/m^3 REL = 0.5 mg/m^3 TLV = 0.5 mg/m^3	250 mg/m^3	NA	NA	NA	NA	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7024	1-3 L/min; 10-1000 L
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150 mg/m^3	N															
Chromium (II)	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 0.5 mg/m^3 REL = 0.5 mg/m^3 TLV = 0.5 mg/m^3	250 mg/m^3	NA	NA	NA	NA	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7024	1-3 L/min; 10-1000 L
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/^{m3}	N															
Chromium (III)	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 0.5 mg/m^3 REL = 0.5 mg/m^3 TLV = 0.5 mg/m^3	25 mg/m^3	NA	NA	NA	NA	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7024	1-3 L/min; 10-1000 L
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150 mg/m^3	N															
Chromium (VI)	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 0.005 mg/m^3 REL = 0.001 mg/m^3 TLV = 0.05 mg/m^3	15 mg/m^3	NA	NA	NA	NA	NA	Preloaded Cassette, PVC, GLA-5000, 5.0um, 37mm, 2 Piece, 225-802	NIOSH 7600	1-4 L/min; 240 L
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150 mg/m^3	N															

Table 3 - Chemical Plant (Fire)

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total
Particulate																		
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150 mg/m^3	N															
	eBAM	0-100 mg/m^3	N															
Radiation[2]																		
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/Y = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N						300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N						300 cpm									

Notes:

For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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.

reversible upon cessation of exposure.
AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs,DataRAMs and Dust Tracker RDX are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
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)
Ca -- carcinogenic
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
m^3 -- cubic meter
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NL -- not listed
ng/m^3 -- nanograms per cubic meter
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short term
TCE -- trichloroethylene
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 4 - Chlorine (Spill or Release)

Instrument Guidance						Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
						TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Gas															
Chlorine	MultiRAE/AreaRAE Cl_2 Sensor	0-10 ppm	Y	11.48 eV	1 ppm = 2.9 mg/m^3	PEL = C 1 ppm REL = C 0.5 ppm (15 mins), ST 1 ppm TLV = 0.5 ppm, ST 1 ppm	10 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	1 ppm	Preloaded Cassette, PTFE, Silver Membrane, Coated, 225-9006	NIOSH 6011	0.3-1 L/min; 90 L
	MultiRAE Pro Cl_2 Sensor	0-50 ppm	Y												
	Dräger Pac III Cl Sensor	0.1-20 ppm	Y												
	Dräger Tube	≥0.2-30 ppm	Y												
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)												
	SPM	0.05-1.5 ppm	N (Y w/option)												
Radiation[1]															
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/Y = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N			300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N			300 cpm									

Table 4 - Chlorine (Spill or Release)

Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.
Use teflon tubing for calibration instead of tygon tubing.

[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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

Acronyms:

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AEGL -- acute exposure guideline levels
C -- ceiling (concentrations that should not be exceeded during any part of work exposure)
CDC -- Centers for Disease Control and Prevention
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
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
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	NR	NR	NR	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-2000 ppm	Y													
	MIRAN SapphIRe**	1-250 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	.14 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		3.3 (10.6 lamp)											
	GFG Inc. Micro IV	0-500 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Nitric Oxide	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y	9.27 eV	NA	1 ppm = 1.23 mg/m^3	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	NA	NA	NA	0.5 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	0.025 L/min; 1.5-6 L
	ToxiRAE II NO	0-250 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
	GFG Inc. Micro IV	0-100 ppm	Y													
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y	9.75 eV	NA	1 ppm = 1.88 mg/m^3	PEL = C 5 ppm REL = ST 1 ppm TLV = 3 ppm, ST 5 ppm	20 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	1 ppm	Sorbent Tube, Molecular Sieve, 226-40-02	NIOSH 6014	0.025-0.2 L/min; 1.5-6 L
	Dräger Tube	≥0.5-25 ppm	Y													
	Dräger Chip	0.5-25 ppm	N (Y w/option)													
	SPM	0.3-9 ppm	N (Y w/option)													
	ToxiRAE II NO_2	0-20 ppm	Y													
	Dräger Pac III	0-50 ppm	Y													
	GFG Inc. Micro IV	0-50 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		16 (10.6 lamp)											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	1-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													

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

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
TCE	Dräger Tube	≥2-50 ppm	Y	9.45 eV	NA	1 ppm = 5.37 mg/m^3	PEL = 100 ppm, C 200 ppm, 300 ppm (5 mins) REL = Ca TLV = 50 ppm, ST 200 ppm	1000 ppm Ca	130 ppm	84 ppm	77 ppm	130 ppm	100 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/Tedlar bag	NIOSH 1022/TO 15	0.01-0.2 L/min; 10 L/<200mL/min
	Dräger Chip	≥5-100 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		0.54 (10.6 lamp)											
	TVA 1000B***	0.5-2000 ppm	Y		10.6 lamp 0.605 (10 ppm) - 2.129 (2000 ppm)											
PCE	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.47 eV	0.57 (10.6 lamp)	1 ppm = 6.78 mg/m^3	PEL = 100 ppm, C 200 ppm, 300 ppm REL = Ca 100 ppm TLV = 25, ST 100 ppm	150 ppm Ca	35 ppm	35 ppm	35 ppm	25 ppm	100 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/Tedlar bag	NIOSH 1003/ TO 15	0.01-0.2 L/min; 3 L/<200mL/min
	TVA 1000B***	0.5-2000 ppm	Y		10.6 lamp 0.738 (10 ppm) - 1.99 (2000 ppm)											
Vinyl Chloride	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.99 eV	2 (10.6 lamp)	1 ppm = 2.56 mg/m^3	PEL = 1 ppm, C 5 ppm (15 mins) REL = Ca TLV = 5 ppm	NA	250 ppm	140 ppm	70 ppm	250 ppm	500 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/Tedlar bag	NIOSH 1007/TO 15	0.05 L/min; 5 L /<200mL/min
	Dräger Tube	≥0.5-30 ppm	Y		NA											
	Dräger Chip	≥0.3-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-20 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
	TVA 1000B***	0.5-2000 ppm	Y		10.6 lamp 2.334 (10 ppm) - 4.397 (2000 ppm)											
Phosgene	Dräger Tube	0.02-15 ppm	Y	11.55 eV	NA	1 ppm = 4.05 mg/m^3	PEL = 0.1 ppm REL = 0.1 ppm, C 0.2 ppm (15 mins) TLV = 0.1 ppm	2 ppm	0.3 ppm*	0.08 ppm*	0.04ppm*	0.27 ppm	NA	Sorbent Tube, XAD-2, 226-117	OSHA 61	1 L/min; 240 L
	Dräger Chip	0.05-2 ppm	N (Y w/option)													
	MIRAN SapphIRe**	0.05 ppm	Y													
	TVA 1000B***	0.5-2000 ppm (PID)	Y													
	MultiRAE Pro $COCl_2$ Sensor	0-1 ppm	Y													
	MultiRAE/AreaRAE PID***	0-200 ppm	Y		8.5 (11.7 lamp)											
Sulfuric Acid	Dräger Tube	1-5 mg/m^3 (mist)	Y	12.4 eV	NA	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	Filter, 37-mm diameter quartz fiber	NIOSH 7908	1-5 L/min;/420L, 2000L Max
	pH Paper	0-14	Y													
	SPM	26-750 ppb	N (Y w/option)													
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	NA	1 ppm = 1.49 mg/m^3	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	1.8 ppm	1.8 ppm	1.8 ppm	1.8 ppm	3 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 600 L
	MultiRAE Pro HCl Sensor	0-15 ppm	Y													
	Dräger Tube	≥1-10 ppm	Y													
	Dräger Chip	≥1-25 ppm	N (Y w/option)													
	pH Paper	0-14	Y													
	SPM	0.5-15 ppm	N (Y w/option)													
	Dräger Pac III	0-30 ppm	Y													
	GFG Inc. Micro IV	0-30 ppm	Y													

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

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Nitric Acid	Dräger Tube	≥1-50 ppm	Y	11.95 eV	NA	1 ppm = 2.58 mg/m^3	PEL = 2 ppm REL = 2 ppm, ST 4 ppm TLV = 2 ppm, ST 4 ppm	25 ppm	0.16 ppm	0.16 ppm	0.16 ppm	.16 ppm	1 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 240 L/ 600 L
	pH Paper	0-14	Y													
	SPM	0.2-6 ppm	N (Y w/option)													
Hydrocyanic Acid (Hydrogen Cyanide)	MultiRAE/AreaRAE HCN Sensor	0-100 ppm	Y	13.6 eV	NA	1 ppm = 1.1 mg/m^3	PEL = 10 ppm S REL = ST 4.7 ppm S TLV = C 10 ppm S	50 ppm	2.0 ppm	1.3 ppm	1 ppm	2 ppm	NA	Sorbent Tube – soda lime and glass fiber filter 226-28	NIOSH 6017	0.05-0.2 L/min; 2-90 L
	MultiRAE Pro HCN Sensor	0-50 ppm	Y													
	Dräger Tube	10-50 ppm	Y													
	Dräger Chip	2-50 ppm	N (Y w/option)													
	pH Paper	0-14	Y													
	ToxiRAE II HCN	0-100 ppm	Y													
	SPM	1.1-30 ppm	N (Y w/option)													
	Dräger Pac III	0-50 ppm	Y													
	GFG Inc. Micro IV	0-50 ppm	Y													
Metals - as particulates																
Cadmium	TSI DustTrak DRX	0.001-150 mg/m^3	N	NA	NA	NA	PEL = 0.005 mg/m^3 REL = Ca TLV = 0.01 mg/m^3 (dust), 0.002 mg/m^3 (respirable)	9 mg/m^3 Ca	0.10 mg/m^3	0.063 mg/m^3	0.041 mg/m^3	0.005 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7048	1-3 L/min; 480 L
	Personal DataRAM****	0.001-400 mg/m^3	N													
	DataRAM 4****	0.001-400 mg/m^3	N													
Copper	TSI DustTrak DRX	0.001-150 mg/m^3	N	NA	NA	NA	PEL = 0.1 mg/m^3 (fume), 1 mg/m^3 (dust) REL = 0.1 mg/m^3 (fume), 1 mg/m^3 (dust) TLV = 0.2 mg/m^3 (fume), 1 mg/m^3 (dust, mist)	100 mg/m^3	NA	NA	NA	1 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7029	1-3 L/min; 480 L
	Personal DataRAM****	0.001-400 mg/m^3	N													
	DataRAM 4****	0.001-400 mg/m^3	N													
Chromium (VI)	TSI DustTrak DRX	0.001-150 mg/m^3	N	NA	NA	NA	PEL = 0.005 mg/m^3 REL = 0.001 mg/m^3 TLV = 0.05 mg/m^3	15 mg/m^3	NA	NA	NA	NA	NA	Preloaded Cassette, PVC, GLA-5000, 5.0um, 37mm, 2 Piece, 225-802	NIOSH 7600	1-4 L/min; 240 L
	Personal DataRAM****	0.001-400 mg/m^3	N													
	DataRAM 4****	0.001-400 mg/m^3	N													

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

Instrument Guidance							Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Metals - as particulates																
Lead	TSI DustTrak DRX	0.001-150 mg/m^3	N	NA	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	0.05 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 50-2000 L
	Personal DataRAM****	0.001-400 mg/m^3	N													
	DataRAM 4****	0.001-400 mg/m^3	N													
Nickel	DustTrak DRX	0.001-150mg/m^3	N	NA	NA	NA	PEL = 1 mg/m^3 REL = 0.015 mg/m^3 TLV = 0.1 mg/m^3 (soluble), 1 mg/m^3 (insoluble)	10 mg/m^3	NA	NA	NA	4.5 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 5-1000 L
	Personal DataRAM****	0.001-400 mg/m^3	N													
	DataRAM 4****	0.001-400 mg/m^3	N													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/Y = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

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

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Notes:

For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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
[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

AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs,DataRAMs and Dust Tracker RDX are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
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)
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
$\mu g/m^3$ -- micrograms per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NR- Not Rated
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short-term
TCE -- trichloroethylene
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 6 - General Industrial (Fire/Fireworks)

(Also refer to Table 3)

	Instrument Guidance						Regulatory Guidance									Reference		
							Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																		
Benzene	UltraRAE-PID***	0.1-200 ppm	Y	9.24 eV	9.6 (9.6 lamp)	1 ppm = 3.19 mg/m^3	NA	NA	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/ Tedlar bag	NIOSH 1501/ TO 15/ TO 3	≤0.2 L/min; <200mL/min
	Dräger Tube	≥0.5-10 ppm	Y															
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)															
	MIRAN SapphIRe**	.5-200 ppm	Y															
	ppbRAE-PID***	1ppb-200ppm	Y		0.47 (10.6 lamp)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID) .5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)													
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	NA	NA	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	NR	NR	NR	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	0.01 to 0.05 L/min 2-5 L
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y															
	Dräger Tube	≥2-300 ppm	Y															
	Dräger Chip	5-150 ppm	N (Y w/option)															
	ToxiRAE II CO	≥0-500 ppm	Y															
	GFG Inc. Micro IV	0-2000 ppm	Y															
	MIRAN SapphIRe**	1-250 ppm	Y															
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	NA	1 ppm = 1.49 mg/m^3	NA	NA	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	1.8 ppm	1.8 ppm	1.8 ppm	1.8 ppm	NA	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 600 L Max
	MultiRAE Pro HCl Sensor	0-15 ppm	Y															
	Dräger Tube	≥1-10 ppm	Y															
	Dräger Chip	≥1-25 ppm	N (Y w/option)															
	pH Paper	0-14	Y															
	SPM	0.5-15 ppm	N (Y w/option)															
	Dräger Pac III	0-30 ppm	Y															
	GFG Inc. Micro IV	0-30 ppm	Y															
Hydrocyanic Acid (Hydrogen Cyanide)	MultiRAE/AreaRAE HCN Sensor	0-100 ppm	Y	13.6 eV	NA	1 ppm = 1.1 mg/m^3	NA	NA	PEL = 10 ppm S REL = ST 4.7 ppm S TLV = C 10 ppm S	50 ppm	2.0 ppm	1.3 ppm	1 ppm	2 ppm	NA	Sorbent Tube – soda lime and glass fiber filter 226-28	NIOSH 6017	0.05-0.2 L/min; 2-90 L
	MultiRAE Pro HCN Sensor	0-50 ppm	Y															
	Dräger Tube	10-50 ppm	Y															
	Dräger Chip	2-50 ppm	N (Y w/option)															
	pH Paper	0-14	Y															
	ToxiRAE II HCN	0-100 ppm	Y															
	SPM	1.1-30 ppm	N (Y w/option)															
	Dräger Pac III	0-50 ppm	Y															
	GFG Inc. Micro IV	0-50 ppm	Y															
Phosgene	Dräger Tube	0.02-15 ppm	Y	11.2 eV	NA	1 ppm = 4.05 mg/m^3	NA	NA	PEL = 0.1 ppm REL = 0.1 ppm, C 0.2 ppm (15 mins) TLV = 0.1 ppm	2 ppm	0.3 ppm*	0.08 ppm*	0.04ppm*	0.1 ppm	NA	Sorbent Tube, XAD-2, 226-117	OSHA 61/	1 L/min; 240 L
	Dräger Chip	0.05-2 ppm	N (Y w/option)															
	MIRAN SapphIRe**	0.05 ppm	Y															
	TVA 1000B***	0.5-2000 ppm (PID)	Y															
	MultiRAE Pro $COCl_2$ Sensor	0-1 ppm	Y															
	MultiRAE/AreaRAE PID***	0-200 ppm	Y		8.5 (11.7 lamp)													

Table 6 - General Industrial (Fire/Fireworks)

(Also refer to Table 3)

Instrument Guidance							Regulatory Guidance									Reference		
							Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																		
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	NA	NA	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008	0.05 L/min; 12 L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y															
	Dräger Tube	≥0.2-6 ppm	Y															
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)															
	SPM	1.1-30 ppm	N (Y w/option)															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		3.3 (10.6 lamp)													
	GFG Inc. Micro IV	0-100 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA													
Vinyl Chloride	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.99 eV	2 (10.6 lamp)	1 ppm = 2.56 mg/m^3	NA	NA	PEL = 1 ppm, C 5 ppm (15 mins) REL = Ca TLV = 1 ppm	NA	250 ppm	140 ppm	70 ppm	250 ppm	500 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/ Tedlar bag	NIOSH 1007/TO 15	0.05 L/min; <200mL/min
	Dräger Tube	≥0.5-30 ppm	Y															
	Dräger Chip	≥0.3-10 ppm	N (Y w/option)															
	MIRAN SapphIRe**	2-20 ppm	Y		NA													
	Dräger Pac III	0-100 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		10.6 lamp 2.334 (10 ppm) - 4.397 (2000 ppm)													
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	NA	NA	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y															
	Dräger Tube	≥0.1-3 ppm	Y															
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)															
	MIRAN SapphIRe**	1.2-30 ppm	Y															
	GFG Inc. Micro IV	1-10 ppm	Y															
	SPM	0.2-6 ppm	N (Y w/option)															
Metals - as particulates																		
Lead	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	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	0.15 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 50-2000 L
	TSI DustTrak DRX	0.001-150mg/m^3	N															
	DataRAM 4****	0.001-400 mg/m^3	N															
Mercury	Lumex RA-915	0.000002-0.05 mg/m^3	N	NA	NA	NA	1000 ng/m^3	3000 ng/m^3	PEL = C 0.1 mg/m^3 S REL = 0.05 mg/m^3 S (vapor), C 0.1 mg/m^3 (other) TLV = 0.025 mg/m^3 S	10 mg/m^3	1.7 mg/m^3*	0.67 mg/m^3*	0.33 mg/m^3*	0.025 mg/m^3*	NA	Sorbent Tube, Anasorb C300, 226-17-1A	NIOSH 6009	0.15-0.25 L/min; 48 L
	Lumex RA-915 Light	0.0001-0.1 mg/m^3	N															
	Jerome 431X	0.003 to 0.999 mg/m^3	N															
	Jerome J405	0.0005-0.999 mg/m^3	N															
	Jerome 471	0.00003-0.25 mg/m^3	N															
	Dräger Tube	0.00000005-0.000002 mg/m^3	Y															

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Table 6 - General Industrial (Fire/Fireworks)

(Also refer to Table 3)

Instrument Guidance							Regulatory Guidance									Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Particulate																		
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/m^3	N															
	eBAM	0-100 mg/m^3	N															
Radiation[2]																		
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/Y = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N						300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N						300 cpm									

Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs,DataRAMs and Dust Tracker RDX are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
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)
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
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
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 7 - Landfill (Release or Fire)

(If the Landfill is on fire, also refer to Table 3)

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Gases																
Methane	TVA 1000B***	1-50,000 ppm (FID) no response (PID)	Y	12.98 eV	NA	NA	<19.5% O_2 (simple asphyxiant[3])	NA	30 ppm	30 ppm	30 ppm	NA	NA	NA	NA	NA
	MIRAN SapphIRe**	1.5-100 ppm	Y													
	MultiRAE/AreaRAE	0-100% LEL, 0-30% O_2	Y													
	Landtec GEM 500	0-70% to specification 0-100% reading	Y													
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	50 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-2000 ppm	Y													
	MIRAN SapphIRe**	1-250 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.14 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		(10.6 lamp) 3.3											
	GFG Inc. Micro IV	0-500 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	1-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													

Table 7 - Landfill (Release or Fire)

(If the Landfill is on fire, also refer to Table 3)

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Gases (continued)																
Radon****	Continuous Radon Monitor (CRM)	0.4 pCi/L - ∞	N	NA	NA	NA	NRC DAC occupational = 30pCi/l with progeny, 4000 pCi/l pure 40 hr/wk exposure period. OSHA MPC= 100pCi/l.	NA	NA	NA	NA	NA	NA	Alpha Track Detector, Activated Carbon Canister, Lucas Cell or Tedlar Bag (grab sample)	Lab read-out	Passive, min. 7-day exposure period; Instant grab, or time integrated for variable periods
Vinyl Chloride	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.99 eV	(10.6 lamp) 2	1 ppm = 2.56 mg/m^3	PEL = 1 ppm, C 5 ppm (15 mins) REL = Ca TLV = 5 ppm	NA	250 ppm	140 ppm	70 ppm	250 ppm	500 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/ Tedlar bag	NIOSH 1007/ TO 15	0.05 L/min; 5 L /<200mL/min
	Dräger Tube	≥0.5-30 ppm	Y		10.6 lamp 2.334 (10 ppm) - 4.397 (2000 ppm)											
	Dräger Chip	≥0.3-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-20 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID)	Y													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/ϒ = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Table 7 - Landfill (Release or Fire)

(If the Landfill is on fire, also refer to Table 3)

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Notes:

For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 = 1000 ppm

AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.

**** Radon is unlike any other gas and does not follow the typical guidelines. Consult with a Health Physicist

Acronyms:

≥ -- greater than or equal to
< -- 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 work exposure)
CDC -- Centers for Disease Control and Prevention
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
LEL -- lower explosive limit
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 8 - Magnesium (Fire)

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Benzene	UltraRAE-PID***	0.1-2000 ppm	Y	9.24 eV	(9.6 lamp) 9.6	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	1 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/ Tedlar bag	NIOSH 1501/TO 15/ TO 3	≤0.2 L/min; 6 L/<200mL/min
	Dräger Tube	≥0.5-10 ppm	Y													
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	10-200 ppm	Y													
	ppbRAE-PID***	1ppb-200ppm	Y		(10.6 lamp) 0.47											
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	50 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-2000 ppm	Y													
	MIRAN SapphIRe**	4.5-250 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008	0.05 L/min; 12 L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		3.3 (10.6 lamp)											
	GFG Inc. Micro IV	0-500 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	6-30 ppm	Y													
	GFG Inc. Micro IV	1-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													
Hydrogen	MultiRAE/AreaRAE	0-100% LEL, 0-30% O_2	Y	15.43 eV	NA	1 ppm = 0.82 mg/m^3	PEL = 3 ppm REL = 3 ppm TLV = 5 ppm	30 ppm	1 ppm	1 ppm	1 ppm	0.35 ppm	NA	Gastec Detector Tube, Hydrogen, 0.5-2% Vol, 810-30	OSHA CSI	NA

Table 8 - Magnesium (Fire)

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Metals - as particulates																
Magnesium	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 TLV = 10 mg/m^3	750 mg/m^3	NA	NA	NA	1.25 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225 3-01	NIOSH 7301	1-4 L/min; 5-67 L
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/γ = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Table 8 - Magnesium (Fire)

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[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 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.

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eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
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
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 9 - Mercury (Spill or Release)

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Instrument Guidance						Regulatory Guidance											Reference		
Target Compound	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	PPE		Air Sampling		
						Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Level C Action Level	Level B Action Level	Media	Method	Flow Rate/ Total Volume
Mercury																			
Mercury	Lumex RA-915	2-50,000 ng/m^3	N	NA	NA	1000 ng/m^3	3000 ng/m^3	PEL = C 0.1 mg/m^3 S REL = 0.05 mg/m^3 S (vapor), C 0.1 mg/m^3 (other) TLV = 0.025 mg/m^3 S	10 mg/m^3	1.7 mg/m^3*	0.67 mg/m^3*	0.33 mg/m^3*	0.025 mg/m^3*	NA	25,000 ng/m^3 TO 625,000 ng/m^3	>625,000 ng/m^3 OR If upper limit of MVA is <625,000 ng/m^3	Sorbent Tube, Anasorb C300, 226-17-1A	NIOSH 6009	0.15-0.25 L/min; 48 L
	Lumex RA-915 Light	100-100,000 ng/m^3	N																
	Jerome 431X	3,000 to 999,000 ng/m^3	N																
	Jerome J405	500-999,000 ng/m^3	N																
	Jerome 471	30-250,000 ng/m^3	N																
	Dräger Tube	50,000-2,000,000 ng/m^3	Y																
Radiation[2]																			
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA			RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/γ = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N					300 cpm											
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N					300 cpm											

Notes:
For guidance only. These tables do not supersede a SSHASP 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.
Upgrade from level D PPE to Level C PPE if concentrations are consistently above 25,000 ng in the breathing zone. Upgrade from level C PPE to level B PPE if concentrations are consistently above 625,000 ng or at the upper limit of the MVA being used if less than 625,000 ng.

AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-1 for this compound

Acronyms:

≥ -- greater than or equal to
AEGL -- acute exposure guideline levels
ATSDR -- Agency for Toxic Substances and Disease Registry
CDC -- Centers for Disease Control and Prevention
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
IDLH -- immediately dangerous to life and health
IP -- ionization potential
L/min -- liter per minute
MVA -- mercury vapor analyzer
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PPE -- personal protective equipment
R/hr -- Roentgens per hour
REL -- recommended exposure limit (NIOSH)
S -- skin notation (compound may be absorbed through the skin)
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TWA -- time-weighted average
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Benzene	UltraRAE-PID***	0.1-200 ppm	Y	9.24 eV	NA	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	1 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01/Summa Canister/ Tedlar bag	NIOSH 1501/TO 15/ TO 3	≤0.2 L/min; 6 L/<200mL/min
	Dräger Tube	≥0.5-10 ppm	Y													
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	.5-200 ppm	Y													
	ppbRAE-PID***	1ppb-200ppm	Y		0.47 (10.6 lamp)											
	MultiRAE/AreaRAE PID***	2-200 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) .5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-2000 ppm	Y													
	MIRAN SapphIRe**	0-250 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.14 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008	0.05 L/min; 12 L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		3.3 (10.6 lamp)											
	GFG Inc. Micro IV	0-500 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y													
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	1-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													

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

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
PAHs - as particulates																
PAHs*****	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 0.2 mg/m^3 REL = 0.1 mg/m^3	80 mg/m^3	NA	NA	NA	0.075 mg/m^3	0.25 mg/m^3	Preloaded Cassette, PTFE, 2.0um, 37mm, 2 Piece, 225-1713 & Sorbent Tube, XAD-2, 226-30-04	NIOSH 5506	2 L/min; 480 L
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft3 β/Y = 1250 ft3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

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

Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.
Consult ATSDR for site-specific action levels

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs,DataRAMs and Dust Tracker RDX are non-specific detectors and cannot differentiate one particulate from another
*****PAHs are most conservative value (anthracene, benzo(a)pyrene, chrysene, naphthalene, phenanthrene, pyrene)

Acronyms:

≥ -- greater than or equal to
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)
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/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
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short-term
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information
NR- Not Rated

Table 11 - Pesticide or Fertilizer (Fire)

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	Instrument Guidance						Regulatory Guidance									Reference		
							Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																		
Benzene	UltraRAE-PID***	0 -200 ppm	Y	9.24 eV	9.8 lamp, 0.55	1 ppm = 3.19 mg/m^3	NA	NA	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 6 L ≤200 mL/min
	Dräger Tube	≥0.5-10 ppm	Y															
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)		NA													
	MIRAN SapphIRe**	2-200 ppm	Y															
	ppbRAE-PID***	1ppb-2000 ppm	Y		10.6 lamp, 0.47													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)													
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	NA	NA	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y															
	Dräger Tube	≥2-300 ppm	Y															
	Dräger Chip	5-150 ppm	N (Y w/option)															
	ToxiRAE II CO	≥0-500 ppm	Y															
	GFG Inc. Micro IV	0-300 ppm	Y															
	MIRAN SapphIRe**	0.9-250 ppm	Y															
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	NA	NA	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L 0.1 to 1.5 L/min (0.2 L/min rec); 40L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y															
	Dräger Tube	≥0.2-6 ppm	Y															
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)															
	SPM	1.1-30 ppm	N (Y w/option)															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 3.3													
	GFG Inc. Micro IV	0-100 ppm	Y															
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA													
Nitric Oxide	UltraRAE-PID***	0.5-10000 ppm	Y	9.24 eV	9.8 lamp, 6	1 ppm = 1.23 mg/m^3	NA	NA	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	NA	NA	NA	0.5 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	0.025 L/min; 1.5-6 L
	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y		10.6 lamp, 5.2													
	ToxiRAE II NO	0-250 ppm	Y															
	Dräger Pac III	0-100 ppm	Y															
	GFG Inc. Micro IV	0-100 ppm	Y															
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y	9.75 eV	NA	1 ppm = 1.88 mg/m^3	NA	NA	PEL = C 5 ppm REL = ST 1 ppm TLV = 3 ppm, ST 5 ppm	20 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	1 ppm	Sorbent Tube, Molecular Sieve, 226-40-02	NIOSH 6014	0.025-0.2 L/min; 1.5-6 L
	Dräger Tube	≥0.5-25 ppm	Y															
	Dräger Chip	0.5-25 ppm	N (Y w/option)															
	SPM	0.3-9 ppm	N (Y w/option)															
	ToxiRAE II NO_2	0-20 ppm	Y															
	Dräger Pac III	0-50 ppm	Y															
	GFG Inc. Micro IV	0-50 ppm	Y															
	TVA 1000B***	0.5-2000 ppm (PID)	Y															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 Lamp, 16													

Table 11 - Pesticide or Fertilizer (Fire)

	Instrument Guidance						Regulatory Guidance									Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																		
Methyl Bromide	Dräger Tube	≥0.5-30 ppm	Y	10.54 eV	NA	1 ppm = 3.89 mg/m^3	NA	NA	PEL = C 20 ppm S REL = Ca TLV = 5 ppm S	250 ppm Ca	210 ppm*	67 ppm*	67 ppm*	19 ppm	NA	Sorbent Tube, Anasorb 747, 226-83 / Summa Canister/ Tedlar Bag	OSHA PV2040 TO-15 NIOSH 2520	0.01-0.1 L/min; 3 L ≤200 mL/min
	TVA 1000B***	0.5-2000 ppm (PID)	Y															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 1.7													
Phosgene	Dräger Tube	0.02-15 ppm	Y	11.55 eV	NA	1 ppm = 4.05 mg/m^3	NA	NA	PEL = 0.1 ppm REL = 0.1 ppm, C 0.2 ppm (15 mins) TLV = 0.1 ppm	2 ppm	0.3 ppm*	0.08 ppm*	0.04ppm*	0.027 ppm	NA	Sorbent Tube, XAD-2, 226-117	OSHA 61	1 L/min; 240 L
	Dräger Chip	0.05-2 ppm	N (Y w/option)															
	MIRAN SapphIRe**	0.05-5 ppm	Y															
	TVA 1000B***	0.5-2000 ppm (PID)	Y															
	MultiRAE Pro $COCl_2$ Sensor	0-1 ppm	Y															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		11.7 lamp, 8.5													
Phosphine	MultiRAE/AreaRAE PH_3 Sensor	0-5 ppm	Y	9.96 eV	NA	1 ppm = 1.39 mg/m^3	NA	NA	PEL = 0.3 ppm REL = 0.3 ppm, ST 1 ppm TLV = 0.3 ppm	50 ppm	2 ppm*	0.5 ppm*	0.25 ppm*	1 ppm	NA	Sorbent Tube, Silica Gel, 226-165A	NIOSH 6002	0.01-0.2 L/min; 16 L
	MultiRAE Pro PH_3 Sensor	0-1000 ppm ext. range	Y															
	ToxiRAE	0-5 ppm	Y															
	Dräger Pac III	0-10 ppm	Y															
	Dräger Tube	≥0.1-1 ppm	Y															
	Dräger Chip	0.1-2.5 ppm	N (Y w/option)															
	GFG Inc. Micro IV	0-10 ppm	Y															
	SPM	32-900 ppb	N (Y w/option)															
	MultiRAE/AreaRAE PID***	0-200 ppm	Y		10.6 lamp, 3.9													
	TVA 1000B***	0.5-2000 ppm (PID)	Y		NA													
Phosphorus Pentoxide	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	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	1 mg/m^3	1 mg/m^3	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	OSHA ID 111	2 L/min; 960 L
	DataRAM 4****	0.0001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/m^3	N															
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	NA	NA	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y															
	Dräger Tube	≥0.1-3 ppm	Y															
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)															
	MIRAN SapphIRe**	1.2-30 ppm	Y															
	GFG Inc. Micro IV	0-10 ppm	Y															
	SPM	0.2-6 ppm	N (Y w/option)															

Table 11 - Pesticide or Fertilizer (Fire)

	Instrument Guidance						Regulatory Guidance									Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Health Guidance Values[1]		Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							Residential	Commercial	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Metals - as particulates																		
Arsenic (inorganic compounds)	Personal DataRAM****	0.001-400 mg/m^3	N	9.81 eV	NA	NA	NA	NA	PEL = 0.01 mg/m^3 REL = C 0.002 mg/m^3 (15 mins) TLV = 0.01 mg/m^3	5 mg/m^3 Ca	NA	NA	NA	1.5 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7900	1-3 L/min; 30 L
	DataRAM 4****	0.0001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/m^3	N															
	TVA 1000B***	0.5-2000 ppm (PID)	Y															
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		11.7 lamp, 8.5													
Arsenic (organic compounds)	Dräger Tube	0-3 mg organic arsenic/m^3	Y	NA	NA	NA	NA	NA	PEL = 0.5 mg/m^3 TLV = 0.2 mg/m^3	NA	NA	NA	NA	1.5 mg/m^3	NA	Filter, PTFE, w/Support Pad, 1.0um, 37mm, 225-17-01	NIOSH 5022	1-3 L/min; 960 L
Cadmium	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 0.005 mg/m^3 REL = Ca TLV = 0.01 mg/m^3 (dust), 0.002 mg/m^3 (respirable)	9 mg/m^3 Ca	0.10 mg/m^3	0.063 mg/m^3	0.041 mg/m^3	0.1 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7048	1-3 L/min; 480 L
	DataRAM 4****	0.0001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/m^3	N															
Lead	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	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	0.15 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 50-2000 L
	DataRAM 4****	0.0001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/m^3	N															
Mercury	Lumex RA-915	0.000002-0.05 mg/m^3	N	NA	NA	NA	1000 ng/m^3	3000 ng/m^3	PEL = C 0.1 mg/m^3 S REL = 0.05 mg/m^3 S (vapor), C 0.1 mg/m^3 (other) TLV = 0.025 mg/m^3 S	10 mg/m^3	1.7 mg/m^3*	0.67 mg/m^3*	0.33 mg/m^3*	0.025 mg/m^3*	NA	Sorbent Tube, Anasorb C300, 226-17-1A	NIOSH 6009	0.15-0.25 L/min; 48 L
	Lumex RA-915 Light	0.0001-0.1 mg/m^3	N															
	Jerome 431X	0.003 to 0.999 mg/m^3	N															
	Jerome J405	0.0005-0.999 mg/m^3	N															
	Jerome 471	0.00003-0.25 mg/m^3	N															
	Dräger Tube	0.00000005-0.000002 mg/m^3	Y															
Particulate																		
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N															
	TSI DustTrak DRX	0.001-150mg/m^3	N															
	eBAM	0-100 mg/m^3	N															
Radiation[2]																		
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N						300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N						300 cpm									

Table 11 - Pesticide or Fertilizer (Fire)

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Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
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)
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
m^3 -- cubic meter
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
ST -- short term
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Phosphorus Compounds and Gases																
Phosphorus (elemental[3])	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 0.1 mg/m^3 REL = 0.1 mg/m^3 TLV = 0.1 mg/m^3	5 mg/m^3	3.7 ppm	0.93 ppm	0.47 ppm	0.3 mg/m^3	NA	Sorbent Tube, Tenax, 226-35-03	NIOSH 7905	0.01-0.2 L/min; 12 L
	DataRAM 4****	0.0001-400 mg/m^3 ppm	N													
	TSI DustTrak DRX	0.001-150mg/m^3	N													
Phosphorus Pentoxide	Personal DataRAM****	0.001-400 mg/m^3	N	NA	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	1 mg/m^3	1 mg/m^3	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	OSHA ID 111	2 L/min; 960 L
	TSI DustTrak DRX	0.001-150mg/m^3	N													
	DataRAM 4****	0.0001-400 mg/m^3	N													
Red Phosphorus	MultiRAE/AreaRAE PID**	0-2000 ppm	Y	10.49 eV	NA	NA	NA	NA	3.7 ppm	0.93 ppm	0.47 ppm	0.27 mg/m^3	NA	Sorbent Tube, Tenax, 226-35-03	NIOSH 7905	0.2 L/min; 12 L
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		NA											
Benzene	UltraRAE-PID***	0-200 ppm	Y	9.24 eV	9.8 lamp, 0.55	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 6 L ≤200 mL/min
	Dräger Tube	≥0.5-10 ppm	Y		NA											
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-200 ppm	Y													
	ppbRAE-PID***	1ppb-2000 ppm	Y		10.6 lamp, 0.47											
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-100 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-300 ppm	Y													
	MIRAN SapphIRe**	0.9-250 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L 0.1 to 1.5 L/min (0.2 L/min rec); 40L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 3.3											
	GFG Inc. Micro IV	0-100 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y													

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

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Phosphorus Compounds and Gases (continued)																
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	0-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

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

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Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.

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

Acronyms:

≥ -- greater than or equal to
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)
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IC -- ion chromatography
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
$\mu g/cm^2$ -- micrograms per square centimeter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 13 - Tire Fire (Auto Fluff)

Instrument Guidance							Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Benzene	UltraRAE-PID***	0-200 ppm	Y	9.24 eV	9.8 lamp, 0.55	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 6 L ≤200 mL/min
	Dräger Tube	≥0.5-10 ppm	Y		NA											
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-200 ppm	Y													
	ppbRAE-PID***	1ppb-2000 ppm	Y		10.6 lamp, 0.47											
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-300 ppm	Y													
	MIRAN SapphIRe**	0.9-250 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L 0.1 to 1.5 L/min (0.2 L/min rec); 40L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 3.3											
	GFG Inc. Micro IV	0-100 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y													
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	0-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													

Table 13 - Tire Fire (Auto Fluff)

Instrument Guidance							Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
PAHs - as particulates																
PAHs*****	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 0.2 mg/m^3 REL = 0.1 mg/m^3	80 mg/m^3	NA	NA	NA	0.6 mg/m^3	NA	Preloaded Cassette, PTFE, 2.0um, 37mm, 2 Piece, 225-1713 & Sorbent Tube, XAD-2, 226-30-04	NIOSH 5506	2 L/min; 480 L
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
Metals - as particulates																
Lead	Personal DataRAM****	0.001-400 mg/m^3	N	NA	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	0.05 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 50-2000 L
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Table 13 - Tire Fire (Auto Fluff)

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Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another
*****PAHs are most conservative value (anthracene, benzo(a)pyrene, chrysene, naphthalene, phenanthrene, pyrene)

Acronyms:

≥ -- greater than or equal to
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PAH -- polyaromatic hydrocarbon
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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

Instrument Guidance						Regulatory Guidance							Reference		
						Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases															
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	1 ppm = 1.49 mg/m^3	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	1.8 ppm	1.8 ppm	1.8 ppm	1.8 ppm	3 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 30 L
	MultiRAE Pro HCl Sensor	0-15 ppm	Y												
	Dräger Tube	≥1-10 ppm	Y												
	Dräger Chip	≥1-25 ppm	N (Y w/option)												
	pH Paper	0-14	Y												
	SPM	0.5-15 ppm	N (Y w/option)												
	Dräger Pac III	0-30 ppm	Y												
	GFG Inc. Micro IV	0-30 ppm	Y												
Nitric Acid	Dräger Tube	≥1-50 ppm	Y	11.95 eV	1 ppm = 2.58 mg/m^3	PEL = 2 ppm REL = 2 ppm, ST 4 ppm TLV = 2 ppm, ST 4 ppm	25 ppm	0.16 ppm	0.16 ppm	0.16 ppm	0.16 ppm	1 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 30 L
	pH Paper	0-14	Y												
	SPM	0.2-6 ppm	N (Y w/option)												
Sulfuric Acid	Dräger Tube	1-5 mg/m^3	Y	12.4 eV	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	FILTER, 37-mm diameter quartz fiber; PTFE, 0.45 µm pore size 225-1827	NIOSH 7908	1-5 L/min; 15 - 1000 L
	pH Paper	0-14	Y												
	SPM	26-750 ppb	N (Y w/option)												
Hydrocyanic Acid (Hydrogen Cyanide)	MultiRAE/AreaRAE HCN Sensor	0-100 ppm	Y	13.6 eV	1 ppm = 1.1 mg/m^3	PEL = 10 ppm S REL = ST 4.7 ppm S TLV = C 10 ppm S	50 ppm	2.0 ppm	1.3 ppm	1 ppm	2 ppm	NA	Sorbent Tube, Soda Lime, 226-28	NIOSH 6010 NIOSH 6017	0.05-0.2 L/min; 2-90 L
	MultiRAE Pro HCN Sensor	0-50 ppm	Y												
	Dräger Tube	2-30 ppm	Y												
	Dräger Chip	2-50 ppm	N (Y w/option)												
	pH Paper	0-14	Y												
	ToxiRAE II HCN	0-100 ppm	Y												
	SPM	1.1-30 ppm	N (Y w/option)												
	Dräger Pac III	0-50 ppm	Y												
	GFG Inc. Micro IV	0-50 ppm	Y												
PAHs - as particulates															
PAHs*****	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	PEL = 0.2 mg/m^3 REL = 0.1 mg/m^3	80 mg/m^3	NA	NA	NA	0.6 mg/m^3	NA	Preloaded Cassette, PTFE, 2.0um, 37mm, 2 Piece, 225-1713 & Sorbent Tube, XAD-2, 226-30-04	NIOSH 5506	2 L/min; 200-1000 L
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
Pentachlorophenol and Dioxin-Furans - as particulates															
Pentachloro phenol	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	PEL = 0.5 mg/m^3 REL = 0.5 mg/m^3 S	2.5 mg/m^3	NA	NA	NA	1 mg/m^3	NA	Cassette, SureSeal, Leak Free, 37mm, 3 Piece, Clear Styrene, 225-3LF	NIOSH 5512	0.5-1 L/min; 480 L
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
Dioxin-Furan	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	NA	NA	NA	NA	0.0015 mg/m^3	NA	PUF Tube Filter, 226-131	EPA TO-9A	225-280 L/min; NA
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												

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

	Instrument Guidance					Regulatory Guidance							Reference		
						Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Metals - as particulates															
Arsenic (inorganic compounds)	Personal DataRAM****	0.001-400 mg/m^3	N	9.81 eV	NA	PEL = 0.01 mg/m^3 REL = C 0.002 mg/m^3 (15 mins) TLV = 0.01 mg/m^3	5 mg/m^3 Ca	NA	NA	NA	1.5 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7900	1-3 L/min; 30 L
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y												
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA										
Arsenic (organic compounds)	Dräger Tube	0-3 mg organic arsenic/m^3	Y	NA	NA	PEL = 0.5 mg/m^3 TLV = 0.2 mg/m^3	NA	NA	NA	NA	1.5 mg/m^3	NA	Filter, PTFE, w/Support Pad, 1.0um, 37mm, 225-17-01	NIOSH 5022	1-3 L/min; 960 L
Copper	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	PEL = 0.1 mg/m^3 (fume), 1 mg/m^3 (dust) REL = 0.1 mg/m^3 (fume), 1 mg/m^3 (dust) TLV = 0.2 mg/m^3 (fume), 1 mg/m^3 (dust, mist)	100 mg/m^3	NA	NA	NA	3 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7029	1-3 L/min; 480 L
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
Chromium (VI)	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	PEL = 0.005 mg/m^3 REL = 0.001 mg/m^3 TLV = 0.05 mg/m^3	15 mg/m^3	NA	NA	NA	NA	NA	Preloaded Cassette, PVC, GLA-5000, 5.0um, 37mm, 2 Piece, 225-802	NIOSH 7600	1-4 L/min; 240 L
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
Lead	Personal DataRAM****	0.001-400 mg/m^3	N	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	0.15 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7300	1-4 L/min; 50-2000 L
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
Particulate															
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N												
	TSI DustTrak DRX	0.001-150 mg/m^3	N												
	eBAM	0-100 mg/m^3	N												
Radiation[2]															
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N			300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N			300 cpm									

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

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Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another
*****PAHs are most conservative value (anthracene, benzo(a)pyrene, chrysene, naphthalene, phenanthrene, pyrene)

Acronyms:

≥ -- greater than or equal to
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)
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppb -- parts per billion
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
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 15 - Volcano

Instrument Guidance							Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-300 ppm	Y													
	MIRAN SapphIRe**	0.9-250 ppm	Y													
Carbon Dioxide	Dräger Pac III	0-5% Vol.	Y	13.77 eV	NA	1 ppm = 1.8 mg/m^3	PEL = 5000 ppm, ST 30,000 ppm REL = 5000 ppm, ST 30,000 ppm TLV = 5000 ppm, ST 30,000 ppm	40,000 ppm	NA	NA	NA	30000 ppm	NA	Dräger Diffusion Tube, Carbon Dioxide, 65-20,000 ppm, 800-01381/ Gas Sampling Bag	NIOSH 6603	0.02-0.1 L/min; NA
	Dräger Tube	2-12% Vol.	Y													
	Dräger Chip	200-25,000 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.5-2000 ppm	Y													
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L 0.1 to 1.5 L/min (0.2 L/min rec); 40L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 3.3											
	GFG Inc. Micro IV	0-100 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y													
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	0-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													

Table 15 - Volcano

Instrument Guidance							Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Notes:
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[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
L/min -- liter per minute
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 16 - Ethanol (Spill, Release, or Fire)

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Benzene	UltraRAE-PID***	0-200 ppm	Y	9.24 eV	9.8 lamp, 0.55	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 6 L ≤200 mL/min
	Dräger Tube	≥0.5-10 ppm	Y		NA											
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-200 ppm	Y													
	ppbRAE-PID***	1ppb-2000 ppm	Y		10.6 lamp, 0.47											
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-300 ppm	Y													
	MIRAN SapphIRe**	0.9-250 ppm	Y													
Ethanol	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.47 eV	10.6 lamp, 9.6	1 ppm = 1.89 mg/m^3	PEL = 1000 ppm REL = 1000 ppm TLV = 1000 ppm	3300 ppm	NA	NA	NA	1800 ppm	1800 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister / Tedlar Bag	NIOSH 1400 (Alcohols I) TO-15	≤ 0.05 L/min; 1 L ≤200 mL/min
	Dräger Tube	25-2000 ppm	Y		NA											
	Dräger Chip	100-2500 ppm	N (Y w/option)													
	MIRAN SapphIRe*	5-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 5.303 (10 ppm) - 7.066 (2000 ppm)											
Gasoline	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	NA	10.6 lamp, 0.9	1 ppm = 4.5 mg/m^3 (approx.)	PEL = None TLV = 300 ppm	NA	730 ppm	730 ppm	730 ppm	200 ppm	200 ppm	Sorbent Tube, Anasorb CSC, 226-01	OSHA PV2028	≤ 0.1 L/min (10 L max vol.); 10 L
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		NA											
Nitric Oxide	UltraRAE-PID***	0-10000 ppm	Y	9.24 eV	9.8 lamp, 6	1 ppm = 1.23 mg/m^3	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	NA	NA	NA	0.5 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	0.025 L/min; 1.5-6 L
	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y		10.6 lamp, 5.2											
	ToxiRAE II NO	0-250 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
	GFG Inc. Micro IV	0-100 ppm	Y													

Table 16 - Ethanol (Spill, Release, or Fire)

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Hydrogen Sulfide	MultiRAE/AreaRAE H_2S Sensor	0-100 ppm	Y	10.46 eV	NA	1 ppm = 1.4 mg/m^3	PEL = C 20 ppm, 50 ppm (10 mins) REL = C 10 ppm (10 mins) TLV = 10 ppm, ST 15 ppm	100 ppm	0.51 ppm	0.36 ppm	0.33 ppm	0.51 ppm	0.1 ppm	Sorbent Tube, Silica Gel, For Hydrogen Sulfide, Sulfur Dioxide, 266-177	OSHA 1008 NIOSH 6013	0.05 L/min; 12 L 0.1 to 1.5 L/min (0.2 L/min rec); 40L
	MultiRAE Pro H_2S Sensor	0-1000 ppm ext. range	Y													
	Dräger Tube	≥0.2-6 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	SPM	1.1-30 ppm	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 3.3											
	GFG Inc. Micro IV	0-100 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y													
Sulfur Dioxide	MultiRAE/AreaRAE SO_2 Sensor	0-20 ppm	Y	12.3 eV	NA	1 ppm = 2.62 mg/m^3	PEL = 5 ppm REL = 2 ppm, ST 5 ppm TLV = 2 ppm, ST 5 ppm	100 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.2 ppm	0.3 ppm	Preloaded Cassette, MCE, Coated, Sodium Carbonate, 225-9005	NIOSH 6004	0.5-1.5 L/min; 180 L
	Dräger Pac III	0-100 ppm	Y													
	Dräger Tube	≥0.1-3 ppm	Y													
	Dräger Chip	≥0.4-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.2-30 ppm	Y													
	GFG Inc. Micro IV	0-10 ppm	Y													
	SPM	0.2-6 ppm	N (Y w/option)													
Ammonia	MultiRAE/AreaRAE NH_3 Sensor	0-50 ppm	Y	10.18 eV	NA	1 ppm = 0.7 mg/m^3	PEL = 50 ppm REL = 25 ppm, ST 35 ppm TLV = 25 ppm, ST 35 ppm	300 ppm	30 ppm	30 ppm	30 ppm	30 ppm	25 ppm	Sorbent Tube, Silica Gel, 226-10-06	NIOSH 6015	0.1-0.2 L/min; 72 L
	MultiRAE Pro NH_3 Sensor	0-100 ppm	Y													
	Dräger Tube	≥0.25-3 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	Dräger Pac III	0-300 ppm	Y													
	SPM	2.6-75 ppm	N (Y w/option)													
	ToxiRAE II NH_3	0-50 ppm	Y													
	MIRAN SapphIRe*	0.7-500 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 10.9											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		10.6 lamp 21.666 (10 ppm) - 22.980 (2000 ppm)											
Sodium Hydroxide	Dräger pH Tube	Qualitative	Y	NA	NA	NA	PEL = 2 mg/m^3 REL = C 2 mg/m^3 TLV = C 2 mg/m^3	10 mg/m^3	NA	NA	NA	0.5 mg/m3	0.5 mg/m3	Filter, PTFE, w/Support Pad, 1.0um, 37mm, 225-17-01	NIOSH 7401	1-4 L/min; 360 L
	pH Paper	0-14	Y													
Sulfuric Acid	Dräger Tube	1-5 mg/m^3	Y	12.4 eV	NA	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	FILTER, 37-mm diameter quartz fiber; PTFE, 0.45 µm pore size / Sorbent Tube, Silica Gel, 226-10-03	NIOSH 7908	1-5 L/min; 15 - 1000 L
	pH Paper	0-14	Y													
	SPM	26-750 ppb	N (Y w/option)													

Table 16 - Ethanol (Spill, Release, or Fire)

Instrument Guidance							Regulatory Guidance								Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 17 - Spacecraft Debris

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Liquid Oxygen	MultiRAE/AreaRAE O_2 Sensor	0-30% Vol.	Y	15.58 eV	NA	1 ppm = 2.21 mg/m^3	PEL = 0.05 ppm REL = 0.05 ppm TLV = 0.05 ppm	0.5 ppm	NA	NA	NA	0.1 ppm	NA	Gastec Detector Tube, Oxygen, 3-24% Vol, 810-31B	OSHA CSI	NA
Liquid Hydrogen	MultiRAE/AreaRAE	0-100% LEL, 0-30% O_2	Y	15.43 eV	NA	1 ppm = 0.82 mg/m^3	PEL = 3 ppm REL = 3 ppm TLV = 5 ppm	30 ppm	1 ppm	1 ppm	1 ppm	0.35 ppm	NA	Gastec Detector Tube, Hydrogen, 0.5-2% Vol, 810-30	OSHA CSI	NA
Liquid Methane	TVA 1000B***	0.5-50,000 ppm (FID) no response (PID)	Y	12.61 eV	NA	1 ppm = 3.77 mg/m^3	PEL = 200 ppm REL = 100 ppm TLV = NA	500 ppm	200 ppm	200 ppm	200 ppm	1000 ppm	NA	Dräger Detector Tube, Natural Gas, Qualitative, 800-20001	OSHA CSI	NA
	MultiRAE/AreaRAE	0-100% LEL, 0-30% O_2	Y													
Ethanol	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.47 eV	10.6 lamp, 9.6	1 ppm = 1.89 mg/m^3	PEL = 1000 ppm REL = 1000 ppm TLV = 1000 ppm	3300 ppm	NA	NA	NA	1800 ppm	1800 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister / Tedlar Bag	NIOSH 1400 (Alcohols I) TO-15 TO-3	≤ 0.05 L/min; 1 L ≤ 200 mL/min
	Dräger Tube	25-2000 ppm	Y		NA											
	Dräger Chip	100-2500 ppm	N (Y w/option)													
	MIRAN SapphIRe*	5-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 5.303 (10 ppm) - 7.066 (2000 ppm)											
Kerosene	MultiRAE/AreaRAE	0-100% LEL, 0-30% O_2	Y	NA	10.6 lamp, 0.6 - 1	NA	PEL = NA REL = 100 mg/m^3 TLV = NA	NA	290 mg/m^3	290 mg/m^3	290 mg/m^3	290 mg/m^3	NA	Sorbent Tube, Anasorb CSC, 226-01	OSHA PV 2139 NIOSH 1550	0.1 L/min; 20 L 0.01 - 0.2 L/min; 20 L
Hydrazine	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	8.93 eV	10.6 lamp, 2.6	1 ppm = 1.31 mg/m^3	PEL = 1.3 mg/m^3 REL = 0.04 mg/m^3 TLV = 1.3 mg/m^3	50 ppm	0.1 ppm	0.1 ppm	0.1 ppm	0.1 ppm	0.5 ppm	Midget Impinger, Glass, 25ml, Fritted Nozzle, 225-36-2	NIOSH 3503	0.2 -1 L/min; 100 L
	Dräger Tube	0.01-0.4 ppm	Y		NA											
Monomethyl hydrazine (MMH)	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	8.0 eV	NA	1 ppm = 1.89 mg/m3	PEL = 0.2 ppm REL = 0.04 ppm TLV = 0.2 ppm	20 ppm	0.9 ppm*	0.23 ppm*	0.11 ppm*	0.082 ppm	NA	Midget Impinger, Glass, 25ml, Fritted Nozzle, 225-36-2	NIOSH 3510	0.5 -1.5 L/min; 20 L
	Dräger Tube	0.01-0.4 ppm	Y													
Dimethyl hydrazine (UDMH)	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	8.05 eV	10.6 lamp, 0.6	1 ppm = 2.46 mg/m3	PEL = 0.5 ppm REL = 0.06 ppm TLV = 0.5 ppm	15 ppm	3 ppm*	0.75 ppm*	0.38 ppm*	0.27 ppm	NA	Midget Impinger, Glass, 25ml, Fritted Nozzle, 225-36-2	NIOSH 3515	0.2 -1 L/min; 100 L
	Dräger Tube	0.01-0.4 ppm	Y		NA											
Nitrogen Tetroxide	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y	10.8 eV	NA	1 ppm = 1.88 mg/m3	PEL = 5 ppm REL = 1 ppm TLV = NA	20 ppm	0.25 ppm	0.25 ppm	0.25 ppm	0.25 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	25-200 ml/min; 1.5-6 L
	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													

Table 17 - Spacecraft Debris

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Hydrogen Peroxide	Dräger Tube	0.1-3 ppm	Y	10.54 eV	NA	1 ppm = 1.39 mg/m^3	REL = 1 ppm PEL = 1 ppm TLV = 1 ppm	75 ppm	NA	NA	NA	10 ppm	10 ppm	Midget Impinger, Glass, 25ml, Fritted Nozzle, 225-36-2	OSHA ID-126-SG	1 L/min; 100 L
	MultiRAE/AreaRAE O_2 Sensor	0-30% Vol.	Y													
Red-Fuming Nitric Acid	Dräger Tube	≥1-50 ppm	Y	11.95 eV	NA	1 ppm = 2.58 mg/m^3	REL = 2 ppm PEL = 2 ppm TLV = 2 ppm	25 ppm	0.53 ppm	0.53 ppm	0.53 ppm	0.53 ppm	1 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na2CO3, 225-9032	NIOSH 7907	2 L/min; 30 L
	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y													
	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
Nitrous Oxide	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y	12.89 eV	NA	1 ppm = 1.80 mg/m^3	REL = 25 ppm TLV = 50 ppm	NA	NA	NA	NA	910 ppm	NA	Bag, SamplePro PVDF, 5L, Dual SS Fittings, No Eyelets, 248-05	NIOSH 6600	0.1-4 L/min; 3 L
	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y													
Hydroxyl-terminated polybutadiene	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	REL = 50 ppm Ca PEL = 1 ppm TLV = 2 ppm	NA	NA	NA	NA	NA	NA	NA	NA	NA
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	ppbRAE-PID***	1ppb-2000ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
Ammonium Perchlorate	MultiRAE/AreaRAE Cl_2 Sensor	0-10 ppm	Y	NA	NA	NA	NA	NA	NA	NA	NA	4.6 mg/m^3	NA	NA	NA	NA
	Dräger Tube ClO_2	0.025-3 ppm	Y													
	Dräger Tube HCl	≥1-10 ppm	Y													
	MultiRAE/AreaRAE O_2 Sensor	0-30% Vol.	Y													
Acetaldehyde	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.22 eV	10.6 lamp, 6	1 ppm = 1.80 mg/m^3	REL = Ca PEL = 200 ppm TLV = C 25 ppm	2000 ppm Ca	45 ppm	45 ppm	45 ppm	45 ppm	10 ppm	Sorbent Tube, XAD-2, 226-27	NIOSH 2538	0.01 - 0.05 L/min; 12 L
	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y		NA											
	Dräger Tube	100-1000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y													
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-300 ppm	Y													
	MIRAN SapphIRe**	0.9-250 ppm	Y													

Table 17 - Spacecraft Debris

Instrument Guidance | Regulatory Guidance | Reference

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Ammonia	MultiRAE/AreaRAE NH_3 Sensor	0-50 ppm	Y	10.18 eV	NA	1 ppm = 0.7 mg/m^3	PEL = 50 ppm REL = 25 ppm, ST 35 ppm TLV = 25 ppm, ST 35 ppm	300 ppm	30 ppm	30 ppm	30 ppm	30 ppm	25 ppm	Sorbent Tube, Silica Gel, 226-10-06	NIOSH 6015	0.1-0.2 L/min; 72 L
	MultiRAE Pro NH_3 Sensor	0-100 ppm	Y													
	Dräger Tube	≥0.25-3 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	Dräger Pac III	0-300 ppm	Y													
	SPM	2.6-75 ppm	N (Y w/option)													
	ToxiRAE II NH_3	0-50 ppm	Y													
	MIRAN SapphIRe*	0.7-500 ppm	Y													
	MultiRAE/AreaRAE PID**	0-2000 ppm	Y		10.6 lamp, 10.9											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		10.6 lamp 21.666 (10 ppm) - 22.980 (2000 ppm)											
Formaldehyde	MultiRAE/AreaRAE PID**	0-2000 ppm	Y	10.88 eV	11.7 lamp, 1.6	1 ppm = 1.23 mg/m^3	REL = Ca 0.016 ppm, C 0.1 ppm (15-min) PEL = 0.75 ppm, ST 2 ppm TLV = C 0.3 ppm	20 ppm Ca	0.9 ppm	0.9 ppm	0.9 ppm	0.9 ppm	1 ppm	Sorbent Tube, Silica Gel, High Purity, 226-119	NIOSH 2016	0.03-1.5 L/min; 1-<15 L
	MultiRAE Pro HCHO Sensor	0-10 ppm	Y		NA											
	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y													
	Dräger Tube	0.2-5 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 1.169 (10 ppm) - 0.605 (500 ppm)											
Vinyl Chloride	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.99 eV	10.6 lamp, 2	1 ppm = 2.56 mg/m^3	PEL = 1 ppm, C 5 ppm (15 mins) REL = Ca TLV = 5 ppm	NA	250 ppm	140 ppm	70 ppm	250 ppm	500 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister / Tedlar Bag	NIOSH 1007 TO-15	0.05 L/min; 5 L ≤ 200 mL/min
	Dräger Tube	≥0.5-30 ppm	Y		NA											
	Dräger Chip	≥0.3-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	0.6-20 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
Freon 113	Dräger Tube	200-2600 ppm	Y	11.99 eV	NA	1 ppm = 7.67 mg/m^3	REL = 1000 ppm, ST 1250 ppm PEL = 1000 ppm TLV = 1000 ppm, ST 1250 ppm	2000 ppm	NA	NA	NA	1250 ppm	NA	Sorbent Tube, Anasorb CSC, 226-01	NIOSH 1020	0.01-0.05 L/min; 2.4 L
	MultiRAE/AreaRAE Cl_2 Sensor	0-10 ppm	Y		11.7 lamp, 1											
	Dräger Tube ClO_2	0.025-3 ppm	Y		NA											
	Dräger Tube HCl	≥1-10 ppm	Y													
	Dräger Tube F	0.1-2 ppm	Y													
	AreaRAE HF Sensor	2-10 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		NA											

Table 17 - Spacecraft Debris

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Methanol	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.84 eV	11.7 lamp, 2.5	1 ppm = 1.31 mg/m^3	REL = 200 ppm, ST 250 ppm S PEL = 200 ppm TLV = 200 ppm S, ST 250 ppm S	6000 ppm	530 ppm	340 ppm	270 ppm	530 ppm	200 ppm	Sorbent Tube, Silica Gel, 226-51	NIOSH 2000	0.02-0.2 L/min; 5 L
	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		11.8 lamp 5.265 (10 ppm) - 7.167 (2000 ppm)											
Octamethyl trisiloxane	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	<10 eV	10.6 lamp, 0.18	NA	PEL = 200 ppm	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y		NA											
	Dräger Tube Formaldehyde	0.2-5 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Instrument Guidance | Regulatory Guidance | Reference

Table 17 - Spacecraft Debris

Notes:
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[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.

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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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website
	Spacecraft Maximum Allowable Concentrations for Selected Airborne Contaminates, Volume 5, 2008

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

Acronyms:

≥ -- greater than or equal to
% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PBAN -- polybutadiene acrylic acid acrylonitrile
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 18 - Special Event

(Also refer to Hazardous Waste Flow Chart)

Instrument Guidance							Regulatory Guidance							Reference		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
2-Chlorobenzalmalononitrile (CS)																
Tear Gas/ Coughing Smoke	APD 2000	4 ppb	N	NA	NA	1 ppm = 7.71 mg/m^3	REL = C 0.05 ppm S PEL = 0.05 ppm	2 mg/m^3	0.083* mg/m^3	0.083* mg/m^3	0.083* mg/m^3	0.005 mg/m^3	0.005 mg/m^3	PTFE Filter 225-1716 and Tenax Sorbent Tube 226-35-03	P&CAM304 (II-5)	1.5 L/min ; 135 L
Phenacyl chloride or 2-chloro-1-phenylethanone (CN)																
Mace	APD 2000	4 ppb	N	9.44 eV	NA	1 ppm = 6.32 mg/m^3	REL = 0.3 mg/m^3 PEL = 0.3 mg/m^3	15 mg/m^3	NA	NA	NA	NA	NA	NA	P&CAM291 (II-5)	NA
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 9.7											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Oleoresin Capsicum (OC)																
Pepper Spray	APD 2000	4 ppb	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Filter, Glass Fiber, No Support Pad, 1.0um, 13mm, Type AE, 225-16	NIOSH 5041	1 L/min; 480 L
	ChemPro 100i	*****	N													
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Table 18 - Special Event

(Also refer to Hazardous Waste Flow Chart)

Notes:

For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.

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

*****Detectability after attack = 1 hour (2% OC); Designed to identify the presence of OC

Acronyms:

≥ -- greater than or equal to
% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

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Table 19 - Clandestine Lab

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Acids																
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	NA	1 ppm = 1.49 mg/m^3	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	1.8 ppm	1.8 ppm	1.8 ppm	1.8 ppm	3 ppm	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na_2CO_3 225-9032	NIOSH 7907	2 L/min; 30 L
	MultiRAE Pro HCl Sensor	0-15 ppm	Y													
	Dräger Tube	≥1-10 ppm	Y													
	Dräger Chip	≥1-25 ppm	N (Y w/option)													
	pH Paper	0-14	Y													
	SPM	0.5-15 ppm	N (Y w/option)													
	Dräger Pac III	0-30 ppm	Y													
	GFG Inc. Micro IV	0-30 ppm	Y													
VOCs and Gases																
Acetone	Dräger Tube	≥40-12,000 ppm	Y	9.69 eV	NA	1 ppm = 2.38 mg/m3	REL = 250 ppm PEL = 1000 ppm TLV = 500 ppm	2500 ppm	200 ppm	200 ppm	200 ppm	200 ppm	NA	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1300 TO-15 TO-3	0.01 to 0.2 L/min; 2 L ≤200 mL/min
	MultiRAE/AreaRAE PID**	0-2000 ppm	Y		10.6 lamp, 0.9											
Carbon Monoxide	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y	14.01 eV	NA	1 ppm = 1.15 mg/m3	PEL = 50 ppm REL = 35 ppm, C 200 ppm TLV = 25 ppm	1200 ppm	83 ppm*	33 ppm*	27 ppm*	75 ppm	200 ppm	Pac 7000 Oxygen, Lithium, Datalogging, 805-18972 / Portable Direct Reading CO Monitor	OSHA ID 209 NIOSH 6604	NA
	MultiRAE Pro CO Sensor	0-2000 ppm ext. range	Y													
	Dräger Tube	≥2-300 ppm	Y													
	Dräger Chip	5-150 ppm	N (Y w/option)													
	ToxiRAE II CO	≥0-500 ppm	Y													
	GFG Inc. Micro IV	0-300 ppm	Y													
	MIRAN SapphIRe**	0.9-250 ppm	Y													
Carbon Dioxide	Dräger Pac III	0-5% Vol.	Y	13.77 eV	NA	1 ppm = 1.8 mg/m^3	PEL = 5000 ppm, ST 30,000 ppm REL = 5000 ppm, ST 30,000 ppm TLV = 5000 ppm, ST 30,000 ppm	40,000 ppm	NA	NA	NA	30000 ppm	NA	Dräger Diffusion Tube, Carbon Dioxide, 65-20,000 ppm, 800-01381/ Gas Sampling Bag	NIOSH 6603	0.02-0.1 L/min; NA
	Dräger Tube	2-12% Vol.	Y													
	Dräger Chip	200-25,000 ppm	N (Y w/option)													
	MIRAN SapphIRe**	1.5-2000 ppm	Y													
Ether	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	9.53 eV	NA	1 ppm = 3.03 mg/m3	REL = 400 ppm, ST 500 ppm PEL = 400 ppm TLV = 400 ppm, ST 500 ppm	1900 ppm	NA	NA	NA	500 ppm	NA	Sorbent Tube, Anasorb CSC, 226-01	NIOSH 1610	0.01 to 0.2 L/min; 0.25-3 L
Hydriodic Acid (Iodine Vapors)	pH Paper	0-14	Y	NA	NA	NA	NA	NA	1 ppm	1 ppm	1 ppm	1 ppm	NA	Sorbent Tube, Anasorb 747, 226-80	OSHA ID 212	0.5 L/min; 2.5 L
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
Iodine Crystal	Dräger Tube	≥0.1-6 ppm	Y	9.31 eV	NA	1 ppm = 10.38 mg/m^3	REL = C 0.1 ppm PEL = C 0.1 ppm TLV = C 0.1 ppm	2 ppm	NA	NA	NA	0.1 ppm	NA	Sorbent Tube, Anasorb CSC, 226-67	NIOSH 6005	0.5 to 1 L/min; 15 L
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 0.1											

Table 19 - Clandestine Lab

Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Lithium	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	5.39 eV	NA	NA	NA	NA	NA	NA	NA	3.3 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7301	1-4 L/min; 100-2000 L
Nitric Oxide	MultiRAE/AreaRAE NO Sensor	0-250 ppm	Y	9.24 eV	10.6 lamp, 5.2	1 ppm = 1.23 mg/m^3	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	NA	NA	NA	0.5 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	0.025 L/min; 1.5-6 L
	ToxiRAE II NO	0-250 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
	GFG Inc. Micro IV	0-100 ppm	Y													
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y	9.75 eV	NA	1 ppm = 1.88 mg/m^3	PEL = C 5 ppm REL = ST 1 ppm TLV = 3 ppm, ST 5 ppm	20 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	1 ppm	Sorbent Tube, Molecular Sieve, 226-40-02	NIOSH 6014	0.025-0.2 L/min; 1.5-6 L
	Dräger Tube	≥0.5-25 ppm	Y													
	Dräger Chip	0.5-25 ppm	N (Y w/option)													
	SPM	0.3-9 ppm	N (Y w/option)													
	ToxiRAE II NO_2	0-20 ppm	Y													
	Dräger Pac III	0-50 ppm	Y													
	GFG Inc. Micro IV	0-50 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 Lamp, 16											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Phosphine	MultiRAE/AreaRAE PH_3 Sensor	0-5 ppm	Y	9.96 eV	NA	1 ppm = 1.39 mg/m^3	PEL = 0.3 ppm REL = 0.3 ppm, ST 1 ppm TLV = 0.3 ppm	50 ppm	2 ppm*	0.5 ppm*	0.25 ppm*	1 ppm	NA	Sorbent Tube, Silica Gel, 226-165A	NIOSH 6002	0.01-0.2 L/min; 12 L
	ToxiRAE	0-5 ppm	Y													
	Dräger Pac III	0-10 ppm	Y													
	Dräger Tube	≥0.1-1 ppm	Y													
	Dräger Chip	0.1-2.5 ppm or higher	N (Y w/option)													
	GFG Inc. Micro IV	0-10 ppm	Y													
	SPM	32-900 ppb	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-200 ppm	Y		10.6 lamp, 3.9											
Red Phosphorus	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.49 eV	NA	NA	NA	NA	NA	NA	NA	0.27 mg/m^3	NA	Sorbent Tube, Tenax, 226-35-03	NIOSH 7905	0.2 L/min; 12 L
Toluene	Dräger Tube	≥5-1800 ppm	Y	8.82 eV	NA	1 ppm = 3.77 mg/m^3	REL = 100 ppm, ST 150 ppm PEL = 200 ppm, C 300 ppm, 500 ppm (10-min. max. peak) TLV = 50 ppm S	500 ppm	67 ppm	67 ppm	67 ppm	67 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 1-8 L ≤200 mL/min
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 0.45											
Sodium Hydroxide	Dräger pH Tube	Qualitative	Y	NA	NA	NA	PEL = 2 mg/m^3 REL = C 2 mg/m^3 TLV = C 2 mg/m^3	10 mg/m^3	NA	NA	NA	0.5 mg/m3	0.5 mg/m3	Filter, PTFE, w/Support Pad, 1.0um, 37mm, 225-17-01	NIOSH 7401	1-4 L/min; 360 L
	pH Paper	0-14	Y													
Sulfuric Acid	Dräger Tube	1-5 mg/m^3	Y	12.4 eV	NA	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	FILTER, 37-mm diameter quartz fiber; PTFE, 0.45 µm pore size 225-1827	NIOSH 7908	1-5 L/min; 15 - 1000 L
	pH Paper	0-14	Y													
	SPM	26-750 ppb	N (Y w/option)													

Table 19 - Clandestine Lab

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Ammonia	MultiRAE/AreaRAE NH_3 Sensor	0-50 ppm	Y	10.18 eV	NA	1 ppm = 0.7 mg/m^3	PEL = 50 ppm REL = 25 ppm, ST 35 ppm TLV = 25 ppm, ST 35 ppm	300 ppm	30 ppm	30 ppm	30 ppm	30 ppm	25 ppm	Sorbent Tube, Silica Gel, 226-10-06	NIOSH 6015	0.1-0.2 L/min; 72 L
	MultiRAE Pro NH_3 Sensor	0-100 ppm	Y													
	Dräger Tube	≥0.25-3 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	Dräger Pac III	0-300 ppm	Y													
	SPM	2.6-75 ppm	N (Y w/option)													
	ToxiRAE II NH_3	0-50 ppm	Y													
	MIRAN SapphIRe*	0.7-500 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 10.9											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		10.6 lamp 21.666 (10 ppm) - 22.980 (2000 ppm)											
Benzene	UltraRAE-PID***	0-200 ppm	Y	9.24 eV	9.8 lamp, 0.55	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 6 L ≤200 mL/min
	Dräger Tube	≥0.5-10 ppm	Y		NA											
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-200 ppm	Y													
	ppbRAE-PID***	1ppb-2000 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 0.47											
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Methanol	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.84 eV	11.7 lamp, 2.5	1 ppm = 1.31 mg/m^3	REL = 200 ppm, ST 250 ppm S PEL = 200 ppm TLV = 200 ppm S, ST 250 ppm S	6000 ppm	530 ppm	340 ppm	270 ppm	530 ppm	200 ppm	Sorbent Tube, Silica Gel, 226-51	NIOSH 2000	0.02-0.2 L/min; 5 L
	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		11.8 lamp 5.265 (10 ppm) - 7.167 (2000 ppm)											

Table 19 - Clandestine Lab

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Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
							TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Notes:
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[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.
ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.
PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.
****Personal DataRAMs and DataRAMs are non-specific detectors and cannot differentiate one particulate from another

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FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 20 - Plastics Fire

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases																
Benzene	UltraRAE-PID***	0.1-200 ppm	Y	9.24 eV	NA	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01	NIOSH 1501	≤0.2 L/min; 6 L
	Dräger Tube	≥0.5-10 ppm	Y													
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	.5-200 ppm	Y													
	ppbRAE-PID***	1ppb-200ppm	Y		0.53 (10.6 lamp)											
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) .5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Styrene	Drager tube	0.1-200 ppm	Y	9.24 eV	NA	1 ppm = 4.26 mg/m3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	700 ppm	20 ppm	20 ppm	20 ppm	20 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01	NIOSH 1501	≤0.2 L/min; 6 L
	Drager Pac III	0-100 PPM	Y													
	Dräger Chip	2-40 PPM	N (Y w/option)													
	Multi Rae	0-2000 PPM	Y													
	ppbRAE-PID***	1ppb-10000 Ppm .01ppm-5000ppm	Y		0.53 (10.6 lamp)											
	TVA 1000B***	0.5-2,000 ppm (PID) 1-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Acids																
Hydrochloric Acid (Hydrogen Chloride)	AreaRAE HCl Sensor	2-15 ppm	Y	12.74 eV	NA	1 ppm = 1.49 mg/m^3	PEL = C 5 ppm REL = C 5 ppm TLV = C 5 ppm	50 ppm	1.8 ppm	1.8 ppm	1.8 ppm	0.5 ppm	NA	Cartridge - two 37-mm diameter quartz fiber filters, one filter impregnated with Na2CO3 225-9032	NIOSH 7907	2L/min; 600L max
	MultiRAE Pro HCl Sensor	0-15 ppm	Y													
	Dräger Tube	≥1-10 ppm	Y													
	Dräger Chip	≥1-25 ppm	N (Y w/option)													
	pH Paper	NA	Y													
	SPM	0.5-15 ppm	N (Y w/option)													
	Dräger Pac III	0-30 ppm	Y													
	GFG Inc. Micro IV	0-30 ppm	Y													
Metals- as																
Lead	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 0.05 mg/m3 REL = 0.05 mg/m3 TLV = 0.05 mg/m3	100 mg/m3	NA	NA	NA	.15 mg/m^3	NA	Filter(0.8-µm, cellulose ester membrane, or5.0-µm, polyvinyl chloride membrane) 225-3-01	NIOSH 7300	1-4 L/min
	DataRAM 4****	0.001-400 mg/m^3	N													
Cadmium	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 0.005 mg/m^3 REL = Ca TLV = 0.01 mg/m3 (dust), 0.002 mg/m3 (respirable)	9 mg/m3 Ca	0.10 mg/m3	0.063 mg/m3	0.041 mg/m3	0.005 mg/m3	NA	Filter(0.8-µm cellulose ester membrane) 225-3-01	NIOSH 7048	1-3 L/min
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
Chromium (IV)	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 0.1 mg/m^3 REL = 0.001 mg/m^3 TLV = 0.05 mg/m^3	15 mg/m^3	NA	NA	NA	NA	NA	Filter(5.0-µm PVC membrane), 225-802	NIOSH 7600	1-4 L/min
	DataRAM 4****	0.001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													

Table 20 - Plastics Fire

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	15-min TWA	1-hr	Media	Method	Flow Rate/ Total Volume
Systemic																
Lithium	AP4C	10 mg/m3 or 1.5 ppm	N	5.39 eV	NA	NA	NA	NA	NA	NA	NA	3.3 mg/m^3	NA	Preloaded Cassette, MCE, 0.8um, 37mm, 3 Piece, PRE-BANDED, 225-3-01	NIOSH 7301	1-4 L/min; 100-2000 L
Nitric Oxide	M256 A-1	7.13 ppm	Y	9.24 eV	10.6 lamp, 5.2	1 ppm = 1.23 mg/m^3	PEL = 25 ppm REL = 25 ppm TLV = 25 ppm	100 ppm	NA	NA	NA	0.5 ppm	NA	Sorbent Tube, Molecular Sieve, 226-40	NIOSH 6014	0.025 L/min; 1.5-6 L
	Dräger CDS Tube	1 ppm	Y													
	Dräger Pac III	0-100 ppm	Y													
	GFG Inc. Micro IV	0-100 ppm	Y													
Nitrogen Dioxide	MultiRAE/AreaRAE NO_2 Sensor	0-20 ppm	Y	9.75 eV	NA	1 ppm = 1.88 mg/m^3	PEL = C 5 ppm REL = ST 1 ppm TLV = 3 ppm, ST 5 ppm	20 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	1 ppm	Sorbent Tube, Molecular Sieve, 226-40-02	NIOSH 6014	0.025-0.2 L/min; 1.5-6 L
	Dräger Tube	≥0.5-25 ppm	Y													
	Dräger Chip	0.5-25 ppm	N (Y w/option)													
	SPM	0.3-9 ppm	N (Y w/option)													
	ToxiRAE II NO_2	0-20 ppm	Y													
	Dräger Pac III	0-50 ppm	Y													
	GFG Inc. Micro IV	0-50 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 Lamp, 16											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		NA											
Phosphine	MultiRAE/AreaRAE PH_3 Sensor	0-5 ppm	Y	9.96 eV	NA	1 ppm = 1.39 mg/m^3	PEL = 0.3 ppm REL = 0.3 ppm, ST 1 ppm TLV = 0.3 ppm	50 ppm	2 ppm*	0.5 ppm*	0.25 ppm*	1 ppm	NA	Sorbent Tube, Silica Gel, 226-165A	NIOSH 6002	0.01-0.2 L/min; 12 L
	ToxiRAE	0-5 ppm	Y													
	Dräger Pac III	0-10 ppm	Y													
	Dräger Tube	≥0.1-1 ppm	Y													
	Dräger Chip	0.1-2.5 ppm or higher	N (Y w/option)													
	GFG Inc. Micro IV	0-10 ppm	Y													
	SPM	32-900 ppb	N (Y w/option)													
	MultiRAE/AreaRAE PID***	0-200 ppm	Y		10.6 lamp, 3.9											
Red Phosphorus	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.49 eV	NA	NA	NA	NA	NA	NA	NA	0.27 mg/m^3	NA	Sorbent Tube, Tenax, 226-35-03	NIOSH 7905	0.2 L/min; 12 L
Toluene	Dräger Tube	≥5-1800 ppm	Y	8.82 eV	NA	1 ppm = 3.77 mg/m^3	REL = 100 ppm, ST 150 ppm PEL = 200 ppm, C 300 ppm, 500 ppm (10-min. max. peak) TLV = 50 ppm S	500 ppm	67 ppm	67 ppm	67 ppm	67 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 1-8 L ≤200 mL/min
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 0.45											
Sodium Hydroxide	Dräger pH Tube	Qualitative	Y	NA	NA	NA	PEL = 2 mg/m^3 REL = C 2 mg/m^3 TLV = C 2 mg/m^3	10 mg/m^3	NA	NA	NA	0.5 mg/m3	0.5 mg/m3	Filter, PTFE, w/Support Pad, 1.0um, 37mm, 225-17-01	NIOSH 7401	1-4 L/min; 360 L
	pH Paper	0-14	Y													
Sulfuric Acid	Dräger Tube	1-5 mg/m^3	Y	12.4 eV	NA	NA	PEL = 1 mg/m^3 REL = 1 mg/m^3 TLV = 1 mg/m^3, ST 3 mg/m^3	15 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	2 mg/m^3	FILTER, 37-mm diameter quartz fiber; PTFE, 0.45 µm pore size 225-9032	NIOSH 7908	1-5 L/min; 15 - 1000 L
	pH Paper	0-14	Y													
	SPM	26-750 ppb	N (Y w/option)													

Table 20 - Plastics Fire

	Instrument Guidance						Regulatory Guidance							Reference		
							Occupational Action Levels		AEGL-1			PAC-1	ERPG-1	Air Sampling		
Target Compound[1]	Instrument	Detection Level	Intrinsically Safe (Y/N)	IP	PID LAMP, CF (ISO)	Conversion	TWA	IDLH	1-hr	4-hr	8-hr	1-hr	1-hr	Media	Method	Flow Rate/ Total Volume
VOCs and Gases (continued)																
Ammonia	MultiRAE/AreaRAE NH_3 Sensor	0-50 ppm	Y	10.18 eV	NA	1 ppm = 0.7 mg/m^3	PEL = 50 ppm REL = 25 ppm, ST 35 ppm TLV = 25 ppm, ST 35 ppm	300 ppm	30 ppm	30 ppm	30 ppm	30 ppm	25 ppm	Sorbent Tube, Silica Gel, 226-10-06	NIOSH 6015	0.1-0.2 L/min; 72 L
	MultiRAE Pro NH_3 Sensor	0-100 ppm	Y													
	Dräger Tube	≥0.25-3 ppm	Y													
	Dräger Chip	≥0.2-5 ppm	N (Y w/option)													
	Dräger Pac III	0-300 ppm	Y													
	SPM	2.6-75 ppm	N (Y w/option)													
	ToxiRAE II NH_3	0-50 ppm	Y													
	MIRAN SapphIRe*	0.7-500 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y		10.6 lamp, 10.9											
	TVA 1000B***	0.5-2,000 ppm (PID)	Y		10.6 lamp 21.666 (10 ppm) - 22.980 (2000 ppm)											
Benzene	UltraRAE-PID***	0-200 ppm	Y	9.24 eV	9.8 lamp, 0.55	1 ppm = 3.19 mg/m^3	PEL = 1 ppm REL = 0.1 ppm, ST 1 ppm TLV = 10 ppm	500 ppm	52 ppm	18 ppm	9 ppm	52 ppm	50 ppm	Sorbent Tube, Anasorb CSC, 226-01 / Summa Canister/ Tedlar Bag	NIOSH 1501 TO-15 TO-3	≤0.2 L/min; 6 L ≤200 mL/min
	Dräger Tube	≥0.5-10 ppm	Y		NA											
	Dräger Chip	≥0.2-10 ppm	N (Y w/option)													
	MIRAN SapphIRe**	2-200 ppm	Y		10.6 lamp, 0.47											
	ppbRAE-PID***	1ppb-2000 ppm	Y													
	MultiRAE/AreaRAE PID***	0-2000 ppm	Y													
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		10.6 lamp 0.702 (10 ppm) - 1.781 (2000 ppm)											
Methanol	MultiRAE/AreaRAE PID***	0-2000 ppm	Y	10.84 eV	11.7 lamp, 2.5	1 ppm = 1.31 mg/m^3	REL = 200 ppm, ST 250 ppm S PEL = 200 ppm TLV = 200 ppm S, ST 250 ppm S	6000 ppm	530 ppm	340 ppm	270 ppm	530 ppm	200 ppm	Sorbent Tube, Silica Gel, 226-51	NIOSH 2000	0.02-0.2 L/min; 5 L
	MultiRAE/AreaRAE CO Sensor	0-500 ppm	Y		NA											
	TVA 1000B***	0.5-2,000 ppm (PID) 0.5-50,000 ppm (FID)	Y		11.8 lamp 5.265 (10 ppm) - 7.167 (2000 ppm)											
Particulate																
Particulate	Personal DataRAM****	0.001-400 mg/m^3	N	NA	NA	NA	PEL = 15 mg/m^3 (total), 5 mg/m^3 (respirable) TLV = 10 mg/m^3 (total), 3 mg/m^3 (respirable)	NA	NA	NA	NA	10 mg/m^3	NA	Filter (total) Cyclone + Filter (respirable)	NIOSH 0500 (total) NIOSH 0600 (respirable)	1-2 L/min (total) 1.7-2.5 L/min (respirable)
	DataRAM 4****	0.0001-400 mg/m^3	N													
	TSI DustTrak DRX	0.001-150 mg/m^3	N													
	eBAM	0-100 mg/m^3	N													
Radiation[2]																
Radiation	Ludlum Model 192	0-5,000 µR/hr	N	NA	NA	NA	10 µR/hr	NA	NA	NA	NA	NA	NA	RADeCO Filter Paper (2")	RSSOP 209/501	α = 2500 ft^3 β/γ = 1250 ft^3
	Ludlum Model 2241-2 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									
	Ludlum Model 2241-3 w/Pancake Probe	0-9,999 R/hr or 999,000 cpm	N				300 cpm									

Table 20 - Plastics Fire

Notes:
For guidance only. These tables do not supersede a SSHASP at any time or on any response.

[1] Does not include all pollutants associated with this type of event, only the most common pollutants 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 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.

ERPG-1 is the acute exposure concentration of the general population for up to 1 hour associated with effects expected to be mild or transient.

PAC-1 is based on the applicable AEGL-1, ERPG-1, or TEEL-1 value

http://www.epa.gov/oppt/aegl/pubs/chemlist.htm	EPA's website used to research AEGLs using the chemical's name or chemical abstracts service registry numbers.
http://www.cdc.gov/niosh/npg/npgsyn-a.html	CDC NIOSH Pocket Guide to Chemical Hazards website
http://wiser.nlm.nih.gov/	WISER website
http://www.skcinc.com/	SKC, Inc. website

*AEGL-2--There are no AEGL-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. See RAE PID Correction factor guidance document TN-106 for more information and TVA Response Factor document P/N 50039 THERMO.

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

Acronyms:

≥ -- greater than or equal to
% -- percent
ACGIH -- American Conference of Governmental Industrial Hygienists
AEGL -- acute exposure guideline levels
CDC -- Centers for Disease Control and Prevention
CF -- conversion factor
CO -- carbon monoxide
cpm -- counts per minute
EPA -- U.S. Environmental Protection Agency
ERPG -- emergency response planning guideline
eV -- electron volt
FID -- flame ionization detector
IDLH -- immediately dangerous to life and health
IP -- ionization potential
ISO -- isobutylene
mg/m^3 -- milligrams per cubic meter
µR/hr -- micro Roentgens per hour
NA -- not available/applicable
NIOSH -- National Institute for Occupational Safety and Health
OSHA -- Occupational Safety and Health Administration
PAC -- protective action criteria
PEL -- permissible exposure limit (OSHA)
PID -- photoionization detector
ppm -- parts per million
R/hr -- Roentgens per hour
rec. -- recommended
REL -- recommended exposure limit (NIOSH)
SPM -- single-point monitor
SSHASP -- site-specific health and safety plan
TEEL -- temporary emergency exposure limit
TLV -- time-limited value (ACGIH)
TWA -- time-weighted average
VOC -- volatile organic compound
Vol. -- volume
WISER -- Wireless Information System for Emergency Responders
Y w/option - yes with option; see manufacturer's instrument manual for information

Table 21 - Water Quality Monitoring

Instrument Guidance

Parameter	Instrument	Detection Level
pH	YSI 556 MPS	0-14
	YSI PRODSS	
	Horiba U-50	
Temperature	YSI 556 MPS	-5 to 45°C
	YSI PRODSS	-5 to 70°C
	Horiba U-50	-10 to 55°C
Turbidity	YSI PRODSS*	0 to 4000 NTU
	Horiba U-50	0-800 NTU
	Hach 2100	0 - 1000 NTU
Conductivity	YSI 556 MPS	0 - 200 mS/cm
	YSI PRODSS	
	Horiba U-50	0 - 100 mS/cm
Salinity	YSI 556 MPS	0 - 40 ppt
	YSI PRODSS	0 - 70 ppt
	Horiba U-50	
Total Dissolved Solids (TDS)	YSI 556 MPS	0 - 100 g/L
	YSI PRODSS	
	Horiba U-50	
Dissolved Oxygen	YSI 556 MPS	0-50 mg/L
	YSI PRODSS*	
	Horiba U-50	
ORP	YSI 556 MPS	-1999 to +1999 mV
	YSI PRODSS	
	Horiba U-50	-2000 to +2000 mV

Notes:

DRAFT ONLY. For guidance only. These tables do not supersede a SSHASP at any time or on any response

* -- Sensor on the YSI PRODSS is optical

°C -- Degrees Celsius

mg/L -- Milligrams per Liter

mS/cm -- Millisiemens per Centimeter

mV -- Millivolt

NTU -- Nephelometric Turbidity Unit

ORP -- Oxygen Reduction Potential

pH -- Power of Hydrogen

ppt -- Parts per Trillion