

1973 OSHA CONCENTRATION LIMITS

Incorporating Infrared Analytical Data For Comparison

Of the 400-odd gases and vapors for which maximum tolerable limits have been established by the Occupational Safety and Health Administration, many have characteristic infrared absorption sufficiently strong to be detected and quantized by an

Data for Ambient Air Analysis
Using the MIRAN Gas Analyzer

Compound	Maximum Allowable Exposure ¹ (8 Hour Weighted Average)		Analytical Wavelength	Minimum Concentration which the MIRAN Analyzer can detect	Absorbance equivalent to the OSHA Limit ²		
	PPM	mg/M ³			Absorbance	Scale Expansion	Pathlength
Acetaldehyde	200	360	9.1 μ	0.8 PPM	0.23	1	20.25 M
Acetic Acid	10	25	8.5	0.1	0.044	5	20.25
Acetic Anhydride	5	20		N.A.	N.A.		
Acetone	1000	2400	8.2	0.09	0.49	1	2.25
Acetonitrile	40	70	6.5	4.	0.01	5	20.25
Acetylene Dichloride, see 1,2-Dichloroethylene							
Acetylene Tetrabromide	1	14	8.85	0.1	0.0047	20	20.25
Acrolein	0.1	0.25	8.8	0.1	0.0004	20	20.25
Acrylamide - Skin		0.3					
Acrylonitrile - Skin	20	45	10.5	0.4	0.06	1	20.25
Aldrin - Skin		0.25					
Allyl Alcohol - Skin	2	5	9.8	0.3	0.0055	20	20.25
Allyl Chloride	1	3					
**C Allylglycidylether (AGE)	10	45	9.1	0.07	0.08	1	20.25
Allyl Propyl Disulfide	2	12		N.A.	N.A.		
2-Aminoethanol, see Ethanolamine							
2-Aminopyridine	0.5	2					
**Ammonia	50	35	10.3	0.2	0.14	1	20.25
n-Amyl Acetate	100	525	8.	0.01	0.19	1	0.75
sec-Amyl Acetate	125	650		N.A.	N.A.		
Aniline - Skin	5	19	9.3	0.3	0.011	5	20.25
Anisidine (o,p-isomers) - Skin		0.5					
Arsine	0.05	0.2					
Arylam, see Carbaryl							
Benzene	25	80	3.3	0.15	0.05	1	20.25
p-Benzoquinone, see Quinone							
Benzoyl Peroxide		5					
Benzyl Chloride	1	5	7.9	0.7	0.0027	20	20.25
Biphenyl, see Diphenyl							
Bisphenol A, see Diglycidyl Ether							
C Boron Trifluoride	1	3		N.A.	N.A.		
Bromine	0.1	0.7					
Bromoform - Skin	0.5	5		N.A.	N.A.		
Butadiene, (1,3 Butadiene)	1000	2200	11.	0.4	0.46	1	2.25
Butanethiol, see Butyl Mercaptan							
2-Butanone (MEK)	200	590	8.5	0.08	0.68	1	20.25
2-Butoxyethanol (Butyl Cellosolve) - Skin	50	240	8.9	0.08	0.2	1	9.75
Butyl Acetate (n-Butyl Acetate)	150	710	8.1	0.1	0.53	1	3.75
sec-Butyl Acetate	200	950	9.9	0.15	0.48	1	9.75
tert-Butyl Acetate	200	950	9.9	0.2	0.36	1	9.75
n-Butyl Alcohol	100	300	9.6	0.15	0.15	1	5.25
sec-Butyl Alcohol	150	450	10.1	0.05	0.15	1	9.75
tert-Butyl Alcohol	100	300	8.2	0.07	0.58	1	20.25
C Butylamine - Skin	5	15					
C tert-Butylchromate (as CrO ₃) - Skin		0.1					
n-Butyl Glycidyl Ether (BGE)	50	270		N.A.	N.A.		
*Butyl Mercaptan	10	35	3.37	0.08	0.04		
p-tert-Butyltoluene							

infrared spectrometer equipped with a cell with an optical path of 20 meters. The data given below is intended to provide the user of such equipment with calibratic information to enable him to make ambient air determinations of many materials in the

Data for Ambient Air Analysis
Using the MIRAN Gas Analyzer

Compound	Maximum Allowable Exposure ¹ (8 Hour Weighted Average)		Analytical Wavelength	Minimum Concentration which the MIRAN Analyzer can detect	Absorbance equivalent to the OSHA Limit ²		
	PPM	mg/M ³			Absorbance	Scale Expansion	Pathlength
Dimethylamine (N, N-Dimethyl Aniline) - Skin	5	25		N.A.	N.A.		
Dimethylbenzene, see Xylene							
Dimethyl 1,2-Dibromo-2,2-Dichloroethyl Phosphate (Dibrom)		3					
Dimethylformamide - Skin	10	30	9.2 μ	0.1 PPM	0.063	5	20.25 M
2,6-Dimethylheptanone, see Diisobutyl Ketone							
1,1-Dimethylhydrazine - Skin	0.5	1					
Dimethylphthalate		5					
Dimethylsulfate - Skin	1	5		N.A.	N.A.		
Dinitrobenzene (all Isomers) - Skin		1					
Dinitro-o-Cresol - Skin		0.2					
Dinitrotoluene - Skin		1.5					
Dioxane (Diethylene Dioxide) - Skin	100	360	8.9	0.05	0.38	1	5.25
Diphenyl	0.2	1					
Diphenylmethane Disocyanate, see Methylene Bisphenyl Isocyanate, MDI							
Dipropylene Glycol Methyl Ether - Skin	100	600		N.A.	N.A.		
Di-sec-octyl Phthalate (Di-2-ethylhexylphthalate)		5					
Endrin - Skin		0.1					
Epichlorohydrin - Skin	5	19		N.A.	N.A.		
EPN - Skin		0.5					
1,2-Epoxypropane, see Propyleneoxide							
2,3-Epoxy-1-Propanol, see Glycidol							
Ethanolamine	3	6		N.A.	N.A.		
2-Ethoxyethanol (Cellosolve) - Skin	200	740	8.9	0.06	0.24	1	2.25
2-Ethoxyethyl Acetate (Cellosolve Acetate) - Skin	100	540	8.8	0.03	0.58	1	8.25
Ethyl Acetate	400	1400	8.0	0.1	1.0	1	2.25
Ethyl Acrylate - Skin	25	100	8.4	0.04	0.33	1	20.25
Ethyl Alcohol (Ethanol)	1000	1900	9.5	0.2	0.5	1	2.25
Ethylamine	10	18	3.4	0.2	0.015	5	20.25
Ethyl Sec-Amyl Ketone (5-Methyl-3-Heptanone)	25	130		N.A.	N.A.		
Ethylbenzene	100	435		N.A.	N.A.		
Ethyl Bromide	200	890		N.A.	N.A.		
Ethyl Butyl Ketone (3-Heptanone)	50	230	9.0	0.4	0.12	1	20.25
Ethyl Chloride	1000	2600	10.4	0.8	0.62		
Ethyl Ether	400	1200					

1A CONCENTRATION LIMITS FOR GASES

Incorporating Infrared Analytical Data For Compliance Testing

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ing the MIRAN Gas Analyzer

infrared spectrometer equipped with a cell with an optical path of 20 meters. The
data given below is intended to provide the user of such equipment with calibration
information to enable him to make ambient air determinations of many materials in the

Data for Ambient Air Analysis
Using the MIRAN Gas Analyzer

num tration the alyzer tect	Absorbance equivalent to the OSHA Limit ²			Compound	Maximum Allowable Exposure ¹ (8 Hour Weighted Average)		Analytical Wavelength	Minimum Concentration which the MIRAN Analyzer can detect	Absorbance equivalent to the OSHA Limit ²		
	Absorbance	Scale Expansion	Pathlength		PPM	mg/M ³			Absorbance	Scale Expansion	Pathlength
PPM	0.23	1	20.25 M	Dimethylamine (N, N- Dimethyl Aniline) - Skin	5	25		N.A.	N.A.		
	0.044	5	20.25	Dimethylbenzene, see Xylene							
	N.A.			Dimethyl 1,2-Dibromo-2,2 Dichloroethyl Phosphate (Dibrom)		3					
	0.49	1	2.25	Dimethylformamide - Skin	10	30	9.2 μ	0.1 PPM	0.063	5	20.25 M
	0.01	5	20.25	2,6-Dimethylheptanone, see Diisobutyl Ketone							
	0.0047	20	20.25	1,1-Dimethylhydrazine - Skin	0.5	1					
	0.0004	20	20.25	Dimethylphthalate		5					
	0.06	1	20.25	Dimethylsulfate - Skin	1	5		N.A.	N.A.		
	0.0055	20	20.25	Dinitrobenzene (all isomers) - Skin		1					
	0.08	1	20.25	Dinitro-o-Cresol - Skin		0.2					
	N.A.			Dinitrotoluene - Skin		1.5					
	0.14	1	20.25	Dioxane (Diethylene Dioxide) - Skin	100	360	8.9	0.05	0.38	1	5.25
	0.19	1	0.75	Diphenyl	0.2	1					
	N.A.			Diphenylmethane Disocyanate, see Methylene Bisphenyl Isocyanate, MDI							
	0.011	5	20.25	Dipropylene Glycol Methyl Ether - Skin	100	600		N.A.	N.A.		
	0.05	1	20.25	Di-sec-octyl Phthalate (Di-2- ethylhexylphthalate)		5					
	0.0027	20	20.25	Endrin - Skin		0.1					
	N.A.			Epichlorohydrin - Skin	5	19		N.A.	N.A.		
	0.04	1	20.25	EPN - Skin		0.5					
	0.015	5	20.25	1,2-Epoxypropane, see Propyleneoxide							
	0.04	1	20.25	2,3-Epoxy-1-Propanol, see Glycidol							
	0.015	5	20.25	Ethanolamine	3	6		N.A.	N.A.		
	0.46	1	2.25	2-Ethoxyethanol (Cellosolve) - Skin	200	740	8.9	0.06	0.24	1	2.25
	0.68	1	20.25	2-Ethoxyethyl Acetate (Cellosolve Acetate) - Skin	100	540	8.8	0.03	0.58	1	8.25
	0.2	1	9.75	Ethyl Acetate	400	1400	8.0	0.1	1.0	1	2.25
	0.53	1	3.75	Ethyl Acrylate - Skin	25	100	8.4	0.04	0.33	1	20.25
	0.48	1	9.75	Ethyl Alcohol (Ethanol)	1000	1900	9.5	0.2	0.5	1	2.25
	0.36	1	9.75	Ethylamine	10	18	3.4	0.2	0.015	5	20.25
	0.15	1	5.25	Ethyl Sec-Amyl Ketone (5- Methyl-3-Heptanone)	25	130		N.A.	N.A.		
	0.15	1	9.75	Ethylbenzene	100	435		N.A.	N.A.		
	0.58	1	20.25	Ethyl Bromide	200	890		N.A.	N.A.		
				Ethyl Butyl Ketone (3-Heptanone)	50	230	9.0	0.4	0.12	1	20.25
				Ethyl Chloride	1000	2600	10.4	0.8	0.62	1	20.25
				Ethyl Ether	400	1200	8.8	0.06	0.58	1	2.25
				Ethyl Formate	100	300	8.5	0.06	0.1	1	2.25
				C Ethyl Mercaptan	10	25		N.A.	N.A.		
				Ethyl Silicate	100	250					

table. With these data, determinations to an accuracy of ±10% or better should be
possible. The user is cautioned to check major absorption bands of other materials
thought to be present for possible interference with or masking of desired spectrum.

Data for Ambient Air Analysis
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Compound	Maximum Allowable Exposure ¹ (8 Hour Weighted Average)		Analytical Wavelength	Minimum Concentration which the MIRAN Analyzer can detect	Absorbance equivalent to the OSHA Limit ²		
	PPM	mg/M ³			Absorbance	Scale Expansion	Pathlength
Methyl Methacrylate	100	410	8.5 μ	0.03 PPM	0.21	1	2.25 M
Methyl Propyl Ketone, see 2-Pentanone							
C α Methyl Styrene	100	480	11.1	0.7	0.15	1	20.25
C Methylene Bisphenyl Isocyanate (MDI)	0.02	0.2					
Monomethylaniline - Skin	2	9					
C Monomethyl Hydrazine - Skin	0.2	0.35					
Morpholine - Skin	20	70	9.0	0.7	0.02	1	20.25
Naphtha (Coal Tar)	100	400		N.A.	N.A.		
Naphthalene	10	50		N.A.	N.A.		
Nickel Carbonyl	0.001	0.007					
Nicotine - Skin		0.5					
Nitric Acid	2	5		N.A.	N.A.		
Nitric Oxide (NO)	25	30					
p-Nitroaniline - Skin	1	6					
Nitrobenzene - Skin	1	5	11.8	0.4	0.005	20	20.25
p-Nitrochlorobenzene - Skin		1					
Nitroethane	100	310	9.0	1.2	0.08	1	20.25
Nitrogen Dioxide (NO ₂)	5	9		N.A.	N.A.		
Nitrogen Trifluoride	10	29		N.A.	N.A.		
Nitroglycerin - Skin	0.2	2					
Nitromethane	100	250	9.3	1.5	0.056	5	20.25
1-Nitropropane	25	90		N.A.	N.A.		
2-Nitropropane	25	90		N.A.	N.A.		
Nitrotoluene - Skin	5	30	11.8	1.2	0.0076	5	20.25
Nitrotrichloromethane, see Chloropicrin							
Octachloronaphthalene - Skin		0.1					
*Octane	500	2350	3.4	0.02	0.40	1	0.75
Organo (Alkyl) Mercury		0.01					
Oxalic Acid		1					
Oxygen Difluoride	0.05	0.1					
Ozone	0.1	0.2					
Paraquat - Skin		0.5					
Parathion - Skin		0.11					
Pentaborane	0.005						
Pentachloronaphthalene - Skin		0.5					
Pentachlorophenol - Skin		0.5					
*Pentane	1000	2950	3.4	0.02	0.42	1	0.75
2-Pentanone	200	700	8.5	0.1	0.23	1	5.25
Perchloroethylene	100		10.9	0.05	0.63	1	5.25
Perchloromethyl Mercaptan	0.1	0.8					
Perchloryl Fluoride	3	13.5		N.A.	N.A.		
Petroleum Distillates (Naphtha)	500	2000	3.4	0.02	0.65	1	2.25
Phenol - Skin	5	19		N.A.	N.A.		
p-Phenylene Diamine							

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0.19	1	0.75	Diphenyl	0.2	1	8.9	0.05	0.38	1	5.25	Nitroethane	100	310	9.0	1.2	0.08	1	20.25
N.A.			Diphenylmethane Disocyanate, see Methylene Bisphenyl Isocyanate, MDI								Nitrogen Dioxide (NO ₂)	5	9		N.A.	N.A.		
0.011	5	20.25	Dipropylene Glycol Methyl Ether - Skin	100	600		N.A.	N.A.			Nitrogen Trifluoride	10	29		N.A.	N.A.		
0.05	1	20.25	Di-sec-octyl Phthalate (Di-2-ethylhexylphthalate)		5						Nitroglycerin - Skin	0.2	2					
			Endrin - Skin		0.1						Nitromethane	100	250	9.3	1.5	0.056	5	20.25
			Epichlorhydrin - Skin	5	19		N.A.	N.A.			1-Nitropropane	25	90		N.A.	N.A.		
0.0027	20	20.25	EPN - Skin		0.5						2-Nitropropane	25	90		N.A.	N.A.		
N.A.			1,2-Epoxypropane, see Propyleneoxide								Nitrotoluene - Skin	5	30	11.8	1.2	0.0076	5	20.25
			2,3-Epoxy-1-Propanol, see Glycidol								Nitrotrichloromethane, see Chloropicrin							
			Ethanthiol, see Ethylmercaptan								Octachloronaphthalene - Skin	500	0.1	3.4	0.02	0.40	1	0.75
N.A.			Ethanolamine	3	6		N.A.	N.A.			*Octane	500	2350					
0.46	1	2.25	2-Ethoxyethanol (Cellosolve) - Skin	200	740	8.9	0.06	0.24	1	2.25	Organo (Alkyl) Mercury		0.01					
0.68	1	20.25	2-Ethoxyethyl Acetate (Cellosolve Acetate) - Skin	100	540	8.8	0.03	0.58	1	8.25	Oxalic Acid		1					
0.2	1	9.75	Ethyl Acetate	400	1400	8.0	0.1	1.0	1	2.25	Oxygen Difluoride	0.05	0.1					
0.53	1	3.75	Ethyl Acrylate - Skin	25	100	8.4	0.04	0.33	1	20.25	Ozone	0.1	0.2					
0.48	1	9.75	Ethyl Alcohol (Ethanol)	1000	1900	9.5	0.2	0.5	1	2.25	Paraquat - Skin		0.5					
0.36	1	9.75	Ethylamine	10	18	3.4	0.2	0.015	5	20.25	Parathion - Skin		0.11					
0.15	1	5.25	Ethyl Sec-Amyl Ketone (5-Methyl-3-Heptanone)	25	130		N.A.	N.A.			Pentaborane	0.005						
0.15	1	9.75	Ethylbenzene	100	435		N.A.	N.A.			Pentachloronaphthalene - Skin		0.5					
0.58	1	20.25	Ethyl Bromide	200	890		N.A.	N.A.			Pentachlorophenol - Skin		0.5					
			Ethyl Butyl Ketone (3-Heptanone)	50	230	9.0	0.4	0.12	1	20.25	*Pentane	1000	2950	3.4	0.02	0.42	1	0.75
N.A.			Ethyl Chloride	1000	2600	10.4	0.8	0.62	1	20.25	2-Pentanone	200	700	8.5	0.1	0.23	1	5.25
0.04	1	20.25	Ethyl Ether	400	1200	8.8	0.06	0.58	1	2.25	Perchloroethylene	100		10.9	0.05	0.63	1	5.25
0.015	5	20.25	Ethyl Formate	100	300	8.5	0.06	0.1	1	2.25	Perchloromethyl Mercaptan	0.1	0.8		N.A.	N.A.		
			C Ethyl Mercaptan	10	25		N.A.	N.A.			Perchloryl Fluoride	3	13.5					
			Ethyl Silicate	100	850	9.1	0.02	0.93	1	5.25	Petroleum Distillates (Naphtha)	500	2000	3.4	0.02	0.65	1	2.25
			Ethylene Chlorohydrin - Skin	5	16	9.3	0.08	0.026	5	20.25	Phenol - Skin	5	19		N.A.	N.A.		
			Ethylenediamine	10	25		N.A.	N.A.			p-Phenylene Diamine - Skin		0.1					
0.015	5	20.25	Ethylene Dibromide (1,2-Dibromoethane)	20		8.4	0.06	0.12	1	20.25	Phenylether (Vapor)	1	7	8.	0.02	0.013	20	20.25
1.2	5	0.75	Ethylene Dichloride (1,2-Dichloroethane)	50		8.2	0.3	0.09	1	20.25	Phenyl Ether-Biphenyl Mixture (Vapor)	1	7		N.A.	N.A.		
0.04	5	20.25	C Ethylene Glycol Dinitrate and/or Nitroglycerin - Skin	0.2	1						Phenylethylene, see Styrene							
0.3	1	20.25	Ethylene Glycol Monomethyl Ether Acetate, see Methyl Cellosolve Acetate								Phenylglycidyl Ether (PGE)	10	60		N.A.	N.A.		
			Ethylene Imine - Skin	0.5	1						Phenylhydrazine - Skin	5	22	8.5	0.9	0.0029	20	20.25
			Ethylene Oxide	50	90	11.8	0.9	0.12	1	20.25	Phosdrin (Mevinphos®) - Skin		0.1					
			Ethylidene Chloride, see 1,1-Dichloroethane								Phosgene (Carbonyl Chloride)	0.1	0.4		N.A.	N.A.		
			N-Ethylmorpholine - Skin	20	94						Phosphine	0.3	0.4					
			Fluorine	0.1	0.2						Phosphoric Acid		1					
0.26	1	20.25	Fluorotrichloromethane (Freon 11)	1000	5600	11.9	0.01	1.7	20	0.75	Phosphorus Pentachloride		1					
			Formaldehyde	3							Phosphorus Pentasulfide		1					
			Formic Acid	5	9	8.2	0.2	0.14	5	20.25	Phosphorus Trichloride	0.5	3		N.A.	N.A.		
0.29	1	9.75	Furfural - Skin	5	20	13.3	0.3	0.05	5	20.25	Phthalic Anhydride	2	12		N.A.	N.A.		
			Furfuryl Alcohol	50	200	9.8	0.3	0.09	1	20.25	Picric Acid - Skin		0.1					
			Glycidol (2,3-Epoxy-1-Propanol)	50	150	9.9	3.	0.020	5	20.25	Pival® (2-Pivalyl-1,3-Indandione)		0.1					
			Glycol Monomethyl Ether, see 2-Ethoxyethanol								Propane	1000	1800	3.35	0.03	0.79	1	2.25
			Guthion, ®, see Azinphosmethyl								Propargyl Alcohol - Skin	1						
			Heptachlor - Skin		0.5						n-Propyl Acetate	200	840	8.1	0.02	0.18	1	0.75
			Heptane (n-Heptane)	500	2000	3.4	0.01	0.29	1	0.75	Propyl Alcohol	200	500	9.4	0.2	0.39	1	9.75
			Hexachloroethane - Skin	1	10		N.A.	N.A.			n-Propyl Nitrate	25	110	10.4	0.3	0.11	1	20.25
			Hexachloronaphthalene - Skin		0.2						Propylene Dichloride	75	350	9.8	0.6	0.12	1	20.25
0.45	1	5.25	Hexane (n-Hexane)	500	1800	3.3	0.02	0.26	1	0.75	Propylene Imine - Skin	2	5		N.A.	N.A.		
1.04	5	20.25	2-Hexanone	100	410	8.6	0.1	0.42	1	20.25	Propylene Oxide	100	240	12.	0.8	0.32	1	20.25
			Hexone (Methyl Isobutyl Ketone)	100	410	8.5	0.2	0.31	1	20.25	Propyne, see Methylacetylene		5					
			sec-Hexyl Acetat	50	300	9.8	0.2	0.1	1	9.75	Pyrethrum		5					
			Hydrazine - Skin	1	1.3		N.A.	N.A.			Pyridine	5	15	14.2	0.2	0.05	5	20.25
			Hydrogen Bromide	3	10		N.A.	N.A.			Quinone	0.1	0.4					
1.08	1	20.25	C Hydrogen Chlorid	5	7	3.37	0.5	0.0026	20	20.25	RDX (Cyclonite) - Skin		1.5					
			Hydrogen Cyanide - Skin	10	11		N.A.	N.A.			Ronnel		10					
			Hydrogen Fluoride	3							Rotenone (Commercial)		5					
			Hydrogen Peroxide (90%)	1	1.4						Selenium Compounds (as Se)		0.2					
			Hydrogen Sulfide								Selenium Hexafluoride	0.05	0.4					
											Stibine	0.1	0.5					
											*Stoddard Solvent	500	2950	3.4	0.01	0.39	1	0.75
											Strychnine		0.15					
											Styrene	100	427	11.0	0.4	0.16	1	12.75
											Sulfur Dioxide	5	14	8.6	0.5	0.004	20	20.25
											Sulfur Hexafluoride	1000	6000	10.7	0.02	0.7	1	0.75
											Sulfuric Acid		1					
											Sulfur Monochloride		1					

0.04	5	20.25	Hexone (Methyl Isobutyl Ketone)	100	410	8.6	0.1	0.42	1	0.75	Selenium Compounds (as Se)	0.05	0.2						
			sec-Hexyl Acetate	50	300	9.8	0.2	0.31	1	20.25	Selenium Hexafluoride	0.05	0.4						
			Hydrazine - Skin	1	1.3						Stibine	0.1	0.5						
0.08	1	20.25	Hydrogen Bromide	3	10						*Stoddard Solvent	500	2950	3.4	0.01	0.39	1	0.75	
			C Hydrogen Chloride	5	7	3.37	0.5	0.1	1	9.75	Strychnine		0.15						
			Hydrogen Cyanide - Skin	10	11						Styrene	100	427	11.0	0.4	0.16	1	12.75	
			Hydrogen Fluoride	3							Sulfur Dioxide	5	14	8.6	0.5	0.004	20	20.25	
			Hydrogen Peroxide (90%)	1	1.4						Sulfur Hexafluoride	1000	6000	10.7	0.02	0.7	1	0.75	
			Hydrogen Selenide	0.05	0.2						Sulfuric Acid		1						
			C Hydrogen Sulfide	20							Sulfur Monochloride	1	6						
0.066	20	20.25	Hydroquinone		2						Sulfur Pentafluoride	0.025	0.25						
			C Iodine	0.1	1						Sulfuryl Fluoride	5	20	11.5	0.1	0.08	1	20.25	
			Isoamyl Acetate	100	525	9.4	0.14	0.27	1	9.75	Systox, see Demeton®								
A. 031	1	9.75	Isoamyl Alcohol	100	360	9.4	0.2	0.22	1	9.75	2,4,5-T [(2,4,5-Trichloro-phenoxy) Acetic Acid]		10						
32	1	2.25	Isobutyl Acetate	150	700	8.2	0.02	0.4	1	2.25	TEDP - Skin		0.2						
28	1	20.25	Isobutyl Alcohol	100	300	9.6	0.3	0.30	1	5.25	Tellurium Hexafluoride	0.02	0.2						
1	1	20.25	Isophorone	25	140	3.4	0.4	0.02	5	20.25	TEPP - Skin		0.05						
64	1	5.25	Isopropyl Acetate	250	950	8.0	0.02	0.63	1	2.25	C Terphenyls	1	9		N.A.	N.A.			
			Isopropyl Alcohol	400	980	8.7	0.2	0.46	1	5.25	1,1,1,2-Tetrachloro-2,2-Difluoroethane	500	4170		N.A.	N.A.			
			Isopropylamine	5	12	9.	0.4	0.009	5	20.25	1,1,2,2-Tetrachloro-1,2-Difluoroethane (Freon 112)	500	4170		N.A.	N.A.			
			Isopropyl Ether	500	2100	8.9	0.07	0.17	1	0.75	1,1,2,2-Tetrachloroethane - Skin	5	35	8.3	0.3	0.014	5	20.25	
			Isopropyl Glycidyl Ether (IGE)	50	240						Tetrachloroethylene, see Perchloroethylene								
			Ketene	0.5	0.9						Tetrachloromethane, see Carbon Tetrachloride								
			Lindane (1,2,3,4,5,6-Hexachlorocyclohexane) - Skin		0.5						Tetrachloronaphthalene - Skin		2						
			LPG (Liquified Petroleum Gas)	1000	1800	3.4	0.4	0.24	1	0.75	Tetraethyl Lead (as Pb)		0.075						
5	1	20.25	Malathion - Skin		15						Tetrahydrofuran	200	590	9.3	0.6	0.27	1	20.25	
			Maleic Anhydride	0.25	1						Tetramethyl Lead (as Pb) - Skin		0.075						
			Mesityl Oxide	25	100	8.2	0.08	0.33	1	5.25	Tetramethyl Succinonitrile - Skin		0.5	3					
			Methanethiol, see Methyl Mercaptan								Tetranitromethane	1	8						
			Methoxychlor		15						Tetryl (2,4,6-Trinitrophenyl-Methylnitramine) - Skin		1.5						
			2-Methoxyethanol, see Methyl Cellosolve								Thiram		5						
13	1	20.25	Methyl Acetate	200	610	9.5	0.2	0.31	1	5.25	Toluene	200		13.7	0.5	0.38	1	5.25	
7	1	9.75	Methyl Acetylene - (Propyne)	1000	1650	7.9	2.	0.77	1	20.25	C Toluene-2,4-Diisocyanate (TDI)	0.02	0.14						
2	1	0.75	Methyl Acetylene-Propadiene Mixture (MAPP)	1000	1800						o-Toluidine - Skin	5	22	13.5	0.5	0.029	5	20.25	
			Methyl Acrylate - Skin	10	35	8.4	0.03	0.15	1	20.25	Toxaphene, see Chlorinated Camphene								
			Methylal								Tributyl Phosphate		5						
			(Dimethoxymethane)	1000	3100	9.5	0.1	0.43	1	0.75	1,1,1-Trichloroethane, see Methyl Chloroform								
			Methyl Alcohol (Methanol)	200	260	9.5	0.2	0.3	1	5.25	1,1,2-Trichloroethane - Skin	10	45	10.7	0.5	0.020	1	20.25	
			Methylamine	10	12	3.4	0.1	0.02	5	20.25	Trichloroethylene	100		10.6	0.2	0.29	1	5.25	
			Methyl Amyl Alcohol, see Methyl Isobutyl Carbinol								Trichloromethane, see Chloroform								
			Methyl n-Amyl Ketone (2-Heptanone)	100	465	8.6	0.3	0.14	1	9.75	Trichloronaphthalene - Skin		5						
			C Methyl Bromide - Skin	20	80	7.6	1.3	0.014	5	20.25	1,2,3-Trichloropropane	50	300	12.4	0.7	0.16	1	20.25	
			Methyl Butyl Ketone, see 2-Hexanone								1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1000	7600	8.4	0.02	0.46	1	0.75	
			Methyl Cellosolve - Skin	25	80	8.8	0.05	0.19	1	20.25	Triethylamine	25	100	9.3	0.3	0.077	1	20.25	
4	20	0.75	Methyl Cellosolve Acetate - Skin	25	120	8.0	0.02	0.39	1	20.25	Trifluoromonomobromomethane (Freon 13B1)	1000	6100						
	20	20.25	Methyl Chloride	100	207	13.4	1.5	0.14	1	20.25	2,4,6-Trinitrophenol, see Picric Acid								
			Methyl Chloroform	350	1900	13.9	0.05	0.56	1	0.75	2,4,6-Trinitrophenylmethyl-Nitramine, see Tetryl								
			Methylcyclohexane	500	2000	3.4	0.04	0.84	1	2.25	Trinitrotoluene (TNT) - Skin		1.5						
			Methylcyclohexanol	100	470	9.5	0.4	0.24	1	20.25	Triorthocresyl Phosphate		0.1						
			o-Methylcyclohexanone - Skin	100	460						Triphenyl Phosphate		3						
			Methylene Chloride	500		13.3	0.2	0.31	1	0.75	Turpentine	100	560	3.4	0.02	0.13	1	2.25	
			Methyl Ethyl Ketone (MEK), see 2-Butanone								Vinyl Benzene, see Styrene								
			Methyl Formate	100	250	8.5	0.9	0.13	1	0.75	**C Vinyl Chloride	500	1300	10.9	0.7	0.88	1	20.25	
			Methyl Iodide - Skin	5	28	7.9	0.4	0.009	5	20.25	Vinylcyanide, see Acrylonitrile								
			Methyl Isobutyl Carbinol - Skin	25	100	8.7	0.5	0.049	5	20.25	Vinyl Toluene	100	480		N.A.	N.A.			
			Methyl Isobutyl Ketone, see Hexone								Warfarin		0.1						
			Methyl Isocyanate - Skin	0.02	0.05						Xylene (Xylol)	100	435	12.6	0.6	0.33	1	20.25	
			C Methyl Mercaptan	10	20	3.38	0.4	0.008	1	20.25	Xylidine - Skin	5	25		N.A.	N.A.			

s is probably possible. A

1 The Occupational Safety and Health Administration has set standards limiting the concentration of various toxic materials to which an employee may be exposed. The information in this column was set forth in the Federal Register, Volume 37, Number 22140, October 18, 1972 and was current at the time of printing.

2 See Explanation Of The Table for the interpretation of this data.

*1970 Addition

**Changes in these limits are being considered

<i>Propylene dichloride</i>								
Dichlorotetrafluoroethane (Freon 114)	1000	7000	8.4	0.02	1.43	20	0.75	
Dichlorvos (DDVP) - Skin	0.1	1	9.4	0.02	0.0014	20	20.25	
Dieldrin - Skin		0.25						
Diethylamine	25	75	3.35	0.05	0.15	1	20.25	
Diethylamino Ethanol - Skin	10	50		N.A.	N.A.			
<i>Diethylether, see Ethyl Ether</i>								
Diffuorodibromomethane	100	860		N.A.	N.A.			
C Diglycidyl Ether (DGE) Bis (2,3-Epoxy-1 Propyl) Ether	0.5	2.8						
<i>Dihydroxybenzene, see Hydroquinone</i>								
Diisobutyl Ketone	50	200		N.A.	N.A.			
Diisopropylamine - Skin	5	20		N.A.	N.A.			
<i>Dimethoxymethane, see Methylal</i>								
N, N-Dimethylacetamide - Skin	10	35	9.9	0.5	0.02	5	20.25	
Dimethylamine	10	18		N.A.	N.A.			
<i>Dimethylaminobenzene, see Xylidene</i>								

N.A. — In the table, N.A. indicates that no data are available at present, but that the analysis is probably possible. A blank in the table indicates that the MIRAN Analyzer is probably unsuitable for this analysis.

C — Entries preceded by a C are ceiling values which must not be exceeded at any time.

<i>C Methyl Bromide - Skin</i>	20	80	6.6	0.3	0.14	1	9.75	
<i>Methyl Butyl Ketone, see 2-Hexanone</i>			7.6	1.3	0.014	5	20.25	
Methyl Cellosolve - Skin	25	80	8.8	0.05	0.19	1	20.25	
Methyl Cellosolve Acetate - Skin	25	120	8.0	0.02	0.39	1	20.25	
Methyl Chloride	100	207	13.4	1.5	0.14	1	20.25	
Methyl Chloroform	350	1900	13.9	0.05	0.56	1	0.75	
Methylcyclohexane	500	2000	3.4	0.04	0.84	1	2.25	
Methylcyclohexanol	100	470	9.5	0.4	0.24	1	20.25	
<i>o-Methylcyclohexanone - Skin</i>	100	460		N.A.	N.A.			
Methylene Chloride	500		13.3	0.2	0.31	1	0.75	
<i>Methyl Ethyl Ketone (MEK), see 2-Butanone</i>								
Methyl Formate	100	250	9.5	0.9	0.13	1	0.75	
Methyl Iodide - Skin	5	28	7.9	0.4	0.009	5	20.25	
Methyl Isobutyl Carbinol - Skin	25	100	8.7	0.5	0.049	5	20.25	
<i>Methyl Isobutyl Ketone, see Hexone</i>								
Methyl Isocyanate - Skin	0.02	0.05						
C Methyl Mercaptan	10	20	3.38	0.4	0.008	1	20.25	

¹ The Occupational Safety and Health Administration has set standards limiting the concentration of various toxic materials to which an employee may be exposed. The information in this column was set forth in the Federal Register, Volume 37, Number 22140, October 18, 1972 and was current at the time of printing.

1,1,2-Trichloroethane
Trichloroethylene
Trichloromethane,
Trichloronaphthalene
1,2,3-Trichloropropane
1,1,2-Trichloroethane
Trifluoroethane
Triethylamine
Trifluoromethane (Freon 13B1)
2,4,6-Trinitrophenol
2,4,6-Trinitrophenyl Nitramine, see Te
Trinitrotoluene (TNT)
Triorthocresyl Phosphate
Turpentine
Vinyl Benzene, see Styrene
**C Vinyl Chloride
Vinylcyanide, see Acrylonitrile
Vinyl Toluene
Warfarin
Xylene (Xylol)
Xylidine - Skin

² See Explanation of Table.

* 1970 Addition
** Changes in these limits

EXPLANATION OF TABLE

Compound Names: Wherever possible compounds are listed or cross referenced under the name used in the Merck Index.

Exposure Limits: Exposure limits are those set by the Occupational Safety and Health Administration and were taken from the Federal Register 37, 22 140 Oct. 18, 1972. These limits were current at the time of printing the chart, Oct. 1973.

Analytical Wavelength: The analytical wavelength has usually been chosen as that of the strongest band in the spectrum which is free from interference due to atmospheric water and CO₂. If more than one infrared absorbing material is present in the air in significant concentration, the possibility of interference must be considered. A discussion of the methods for detection and elimination of interferences is available from Wilks Scientific.

Minimum Concentration Which the MIRAN Analyzer Will Detect: The minimum concentration detectable is taken to be that concentration which would produce an absorbance equal to the peak-to-peak noise of the instrument.

Absorbance Equivalent to the OSHA Limit: Suitable instrument settings are given for ambient air measurements. The absorbance values reported in the table are true absorbances regardless of the scale expansion used. When using scale expansion with a linear transmittance instrument (old style), the transmittance scale should be read, the reading divided by the scale expansion factor and the result converted to absorbance. When using a linear absorbance instrument (new style), the absorbance may in all cases be read directly from the meter. The scale expansion values in the table refer to linear transmittance instruments; for linear absorbance instruments use scales 0 - 1 for 1X, 0 - 0.1 for 5X and 0 - 0.025 for 20X. A discussion of the use of scale expansion is given in the MIRAN Instruction Manual. Where possible, the conditions chosen for the measurements were those that gave approximately mid-scale deflections for a concentration equal to the exposure limit.

THE MIRAN PORTABLE INFRARED GAS ANALYZER

The data in this table were prepared on a MIRAN portable infrared gas analyzer with a variable path cell (Model 5633.) The table is designed to be used with this instrument. The MIRAN gas analyzer weighs about 25 pounds, requires about 25 watts of power, and is ruggedly constructed for use in the laboratory or in the field. A built-in air pump, sample hose, and filter are provided for ambient air sampling at any location. Response time is only a few seconds so that concentration level variations can be quickly plotted at different locations within the area of interest to create a vapor concentration profile.

The MIRAN gas analyzer can detect and identify gases such as SO₂, CO, CO₂, and hydrocarbons in concentrations from a few percent down to a few parts per million. Portability, rugged construction, and low power requirements make the instrument useful in many applications, including:

- vapor concentration and ambient air studies in manufacturing plant, processing areas, laboratories, printing plants, solvent cleaning areas, and other locations where gaseous air contaminant analyses or monitoring are required.
- Stack gas monitoring.
- Auto exhaust analyses.
- Plant emission analyses.

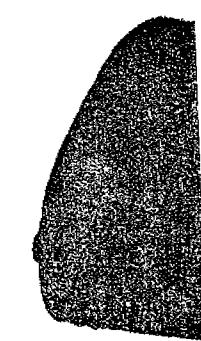
The MIRAN gas analyzer is equipped with a unique variable-path gas sampling cell that is easily adjustable by an external knob to any pathlength between 3/4 and 20 meters. The cell has a volume of about 5 liters and is capable of withstanding a pressure of 10 atmospheres.

The MIRAN spectrometer uses a circular variable filter to provide monochromatic infrared radiation over the spectral region from 2.5 to 14.5 microns. Automatic scanning and manual scanning are provided. Output jacks are provided for connection to a recorder.

USEFUL CONVERSIONS

Concentration

Flow Rate Conversion



The MIRAN portable sample cell can be used in concentrations

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P.O. BOX 449, S. NORWALK, CT. 06856, 203/838-4537

20
20
1
5

Methyl Cellosolve - Skin	20	80	7.6	1.3	0.14	1	9.75
Methyl Cellosolve Acetate - Skin	25	80	8.8	0.05	0.19	1	20.25
Methyl Chloride	25	120	8.0	0.02	0.39	1	20.25
Methyl Chloroform	100	207	13.4	1.5	0.14	1	20.25
Methylcyclohexane	350	1900	13.9	0.05	0.56	1	0.75
Methylcyclohexanol	500	2000	3.4	0.04	0.84	1	2.25
o-Methylcyclohexanone - Skin	100	470	9.5	0.4	0.24	1	20.25
Methylene Chloride	100	460		N.A.	N.A.		
Methyl Ethyl Ketone (MEK), see 2-Butanone	500		13.3	0.2	0.31	1	0.75
Methyl Formate	100	250	8.5	0.9	0.13	1	0.75
Methyl Iodide - Skin	5	28	7.9	0.4	0.009	5	20.25
Methyl Isobutyl Carbinol - Skin	25	100	8.7	0.5	0.049	5	20.25
Methyl Isobutyl Ketone, see Hexone							
Methyl Isocyanate - Skin	0.02	0.05					
C Methyl Mercaptan	10	20	3.38	0.4	0.008	1	20.25

1,1,2-Trichloroethane - Skin	10	45	10.7	0.5	0.020	1	20.25
Trichloroethylene	100		10.6	0.2	0.29	1	5.25
Trichloromethane, see Chloroform							
Trichloronaphthalene - Skin		5					
1,2,3-Trichloropropan	50	300	12.4	0.7	0.16	1	20.25
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1000	7600	8.4	0.02	0.46	1	0.75
Triethylamine	25	100	9.3	0.3	0.077	1	20.25
Trifluoromonomobromomethane (Freon 13B1)	1000	6100		N.A.	N.A.		
2,4,6-Trinitrophenol, see Picric Acid							
2,4,6-Trinitrophenyl(methyl-Nitramine, see Tetryl							
Trinitrotoluene (TNT) - Skin		1.5					
Triorthocresyl Phosphate		0.1					
Triphenyl Phosphate		3					
Turpentine	100	560	3.4	0.02	0.13	1	2.25
Vinyl Benzene, see Styrene							
**C Vinyl Chloride	500	1300	10.9	0.7	0.88	1	20.25
Vinylcyanide, see Acrylonitrile							
Vinyl Toluene	100	480		N.A.	N.A.		
Warfarin		0.1					
Xylene (Xylol)	100	435	12.6	0.6	0.33	1	20.25
Xylidine - Skin	5	25		N.A.	N.A.		

probably possible. A
The Occupational Safety and Health Administration has set standards limiting the concentration of various toxic materials to which an employee may be exposed. The information in this column was set forth in the Federal Register, Volume 37, Number 22140, October 18, 1972 and was current at the time of printing.

See Explanation Of The Table for the interpretation of this data.
*1970 Addition
**Changes in these limits are being considered

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THE MIRAN PORTABLE INFRARED GAS ANALYZER

The data in this table were prepared on a MIRAN portable infrared gas analyzer with a variable path cell (Model 5633.) The table is designed to be used with this instrument. The MIRAN gas analyzer weighs about 25 pounds, requires about 25 watts of power, and is ruggedly constructed for use in the laboratory or in the field. A built-in air pump, sample hose, and filter are provided for ambient air sampling at any location. Response time is only a few seconds so that concentration level variations can be quickly plotted at different locations within the area of interest to create a vapor concentration profile.

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The MIRAN gas analyzer is equipped with a unique variable-path gas sampling cell that is easily adjustable by an external knob to any pathlength between ¾ and 20 meters. The cell has a volume of about 5 liters and is capable of withstanding a pressure of 10 atmospheres.

The MIRAN spectrometer uses a circular variable filter to provide monochromatic infrared radiation over the spectral region from 2.5 to 14.5 microns. Automatic scanning and manual scanning are provided. Output jacks are provided for connection to a recorder.

USEFUL CONVERSION FACTORS

Concentration Conversion

$$C \frac{(mg)}{(m^3)} = C (ppm) \times \frac{M}{24.5} \text{ at } 25^{\circ}C$$

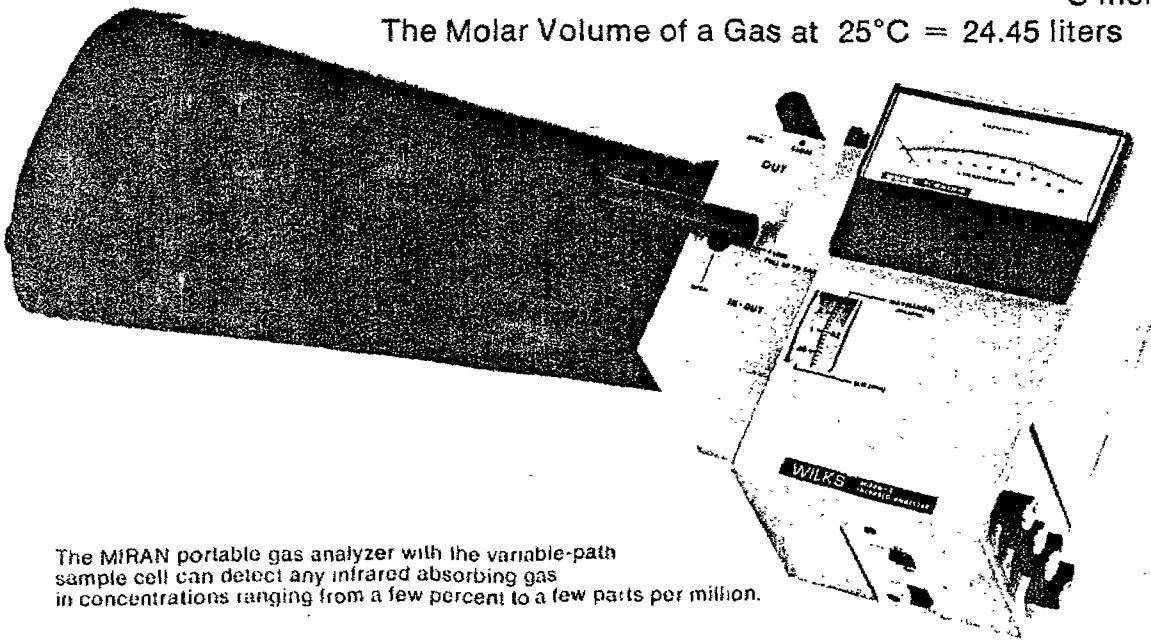
where M is the molecular weight.

Flow Rate Conversion

$$1 \text{ cfm} = 28.3 \text{ liters/min.}$$

$$\text{The Universal Gas Constant } R = 0.0821 \frac{\text{liter atm.}}{^{\circ}C \text{ mole.}}$$

$$\text{The Molar Volume of a Gas at } 25^{\circ}C = 24.45 \text{ liters}$$



The MIRAN portable gas analyzer with the variable-path sample cell can detect any infrared absorbing gas in concentrations ranging from a few percent to a few parts per million.

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