4123:1-3-18

APPENDIX I

OCCUPATIONAL EXPOSURE LIMITS (OEL)

This Appendix is for information and guide purposes only. The information contained in this Appendix is not to be construed as specific requirements of this code.

The time-weighted average concentration of air contaminants breathed by employees should not exceed the following occupational exposure limit for an eight-hour daily exposure.

Occupational exposure limits refer to time-weighted average (TWA) concentrations for an eight-hour work day and forty-hour-work week. They should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations.

These limits are intended for use in the practice of industrial hygiene. They are not intended for use, or for modification for use as proof or disproof of an existing disease or physical condition.

Occupational exposure limits should not be used as the sole criterion for establishing evidence of hazards to health but the evaluation of a possible hazard should also be subject to other pertinent factors, such as the nature of the contaminant and the frequency and duration of the exposure, and clinical evidence of the harmful effects.

"Skin" Notation

Listed substances followed by the designation "skin" refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either airborne, or more particularly, by direct contact with the substance. Vehicles can alter skin absorption. This attention-calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the occupational exposure limit is not invalidated.

"C" (Ceiling) Values

A listed value bearing a "C" designation refers to a "ceiling" value that should not be exceeded; all values should fluctuate below the listed value. This, in effect, makes the "C" designation a maximal allowable concentration (MAC). In

general, the bases for assigning or not assigning a "C" value rest on whether excursions of concentration above a proposed limit for periods up to fifteen (15) minutes may result in a) intolerable irritation, b) chronic, or irreversible tissue change, or c) narcosis of sufficient degree to increase accident proneness, impair self-rescue or materially reduce work efficiency.

Excursion Factors

For all substances not bearing "C" notation

OEL		Excursion
OEL > 0 – 1	(ppm or mg/m³),	Factor = 3
OEL > 1 – 10	"	" = 2
OEL > 10 – 100	"	" = 1.5
OEL > 100 – 1000	"	" = 1.25

The number of occasions the excursion above the OEL is permitted is governed by conformity with the time-weighted average OEL.

TABLE OF

OCCUPATIONAL EXPOSURE LIMITS (OEL)

	Substance	ppma	mg/m3b
	Abate		10
	Acetaldehyde	100	180
	Acetic acid	10	25
C	Acetic anhydride	5	20
	Acetone	1,000	2,400
	Acetonitrile	40	70
	Acetylene dichloride, see 1, 2-Dichloroethylene		
	Acetylene tetrabromide	1	14
	Acrolein	0.1	0.25
	Acrylamide - Skin	0.3	
	Acrylonitrile - Skin	20	45
	Aldrin - Skin		0.25
	Allyl alcohol - Skin	2	5
	Allyl chloride	1	3
	Allyl glycidyl ether (AGE) - Skin	5	22
	Allyl propyl disulfide	2	12

Substance	ppma	mg/m3b
2-Aminoethanol, see Ethanolamine		
2-Aminopyridine	0.5	2
C Ammonia	50	36
Ammonium chloride, fume		10
Ammonium sulfamate (Ammate)		10
n-Amyl acetate	100	525
sec-Amyl acetate	125	650
Aniline - Skin	5	19
Anisidine (o-, p-isomers) - Skin	0.1	0.5
Antimony & compounds (as Sb)		0.5
ANTU (alpha naphthyl thiourea)		0.3
Arsenic & compounds (as As)		0.5
Arsine	0.05	0.2
Azinphos methyl - Skin		0.2
Baygon (Propoxur)		0.5
Barium (soluble compounds)		0.5
C Benzene - Skin	10	32
p-Benzoquinone, see Quinone		
Benzoyl peroxide		5
Benzyl chloride	1	5
Beryllium		0.002
Biphenyl	0.2	1
Bismuth telluride		10
Bismuth telluride (Se-doped)		5
Boron oxide		10
Boron tribromide	1	10
C Boron trifluoride	1	3
Bromine	0.1	0.7
Bromine pentafluoride	0.1	0.7
Bromoform - Skin	0.5	5
Butadiene (1, 3-butadiene)	1,000	2,200
Butane	600	1,420
Butanethiol, see Butyl mercaptan		
2-Butanone (see Methyl Ethyl Ketone)		
2-Butoxy ethanol (Butyl Cellosolve) - Skin (see Cellosolves; Butyl Cellosolve)		
Butyl acetate (n-butyl acetate)	150	710
sec-Butyl acetate	200	950

Substance	ppma	mg/m3b
tert-Butyl acetate	200	950
n-Butyl alcohol - Skin	50	150
sec-Butyl alcohol	150	450
tert-Butyl alcohol	100	300
C Butylamine - Skin	5	15
C tert-Butyl chromate (as CrO3) - Skin		0.1
n-Butyl glycidyl ether (BGE)	50	270
Butyl lactate	5	30
Butyl mercaptan	0.5	1.5
p-tert-Butyltoluene	10	60
Cadmium (Metal dust and salts, as Cd)		0.05
C Cadmium oxide fume (as Cd)		0.05
Calcium arsenate, as As		1
Calcium cyanide		0.5
Calcium hydroxide		5
Calcium oxide		2
Camphor (Synthetic)	2	12
Caprolactam Dust		1
Vapor	5	20
Captan		5
Carbaryl (Sevin®)		5
Carbofuran		0.1
Carbon black		3.5
Carbon dioxide	5,000	9,000
Carbon disulfide - Skin	20	60
Carbon monoxide	50	55
Carbon tetrabromide	0.1	1.4
Carbon tetrachloride - Skin	10	65
Cellosolves:		
Butyl cellosolve (2-butoxyethanol) (ethylene glycol mono-n-butyl ether) - Skin	50	240
Ethyl cellosolve (2-ethoxyethanol) (ethylene glycol monoethyl ether) - Skin	200	740
Ethyl cellosolve acetate (2-ethoxy-ethyl acetate) (ethylene glycol monoethyl ether acetate) - Skin	100	540
Methyl cellosolve (2-methoxyethanol) (ethylene glycol monomethyl ether) - Skin	25	80
Methyl cellosolve acetate (2-methox- yethyl acetate) (ethylene glycol monomethyl ether acetate) - Skin	25	120
Cesium hydroxide		2
Chlordane - Skin		0.5
Chlorinated camphene - Skin		0.5
Chlorinated diphenyl oxide		0.5

Substance **ppma** **mg/m3b**

	Substance	ppma	mg/m3b
	Chlorine	1	3
	Chlorine dioxide	0.1	0.3
C	Chlorine trifluoride	0.1	0.4
C	Chloroacetaldehyde	1	3
	a-Chloroacetophenone (phenacylchloride)	0.05	0.3
	Chlorobenzene (monochlorobenzene)	75	350
	o-Chlorobenzylidene malononitrile (OCBM) - Skin	0.05	0.4
	Chlorobromomethane	200	1,050
	2-Chloro-1, 3-butadiene (see Chloroprene)		
	Chlorodifluoromethane	1,000	3,500
	Chlorodiphenyl (42% Chlorine) - Skin		1
	Chlorodiphenyl (54% Chlorine) - Skin		0.5
	1-Chloro, 2, 3-epoxypropane (see Epichlorhydrin)		
	2-Chloroethanol (see Ethylene chlorohydrin)		
	Chloroethylene (see Vinyl chloride)		
	Chloroform (Trichloromethane)	10	50
	bis-Chloromethyl ether	0.001	0.003
	1-Chloro-1-nitropropane	20	100
	Chloropicrin	0.1	0.7
	Chloroprene (2-chloro-1, 3-butadiene) - Skin	25	90
	Chlorpyrifos (Dursban®) - Skin		0.2
	o-Chlorostyrene	50	285
	o-Chlorotoluene	50	250
	2-Chloro-6-(trichloromethyl) pyridine (N-Serve®)		10
	Chromates, certain insoluble forms		0.1
	Chromic acid and chromates (as CrO3)		0.1
	Chromium, sol. chromic, chromous salts as Cr		0.5
	Clopidol (Coyden®)		
	Cobalt, metal fume & dust		0.05
	Copper fume		0.2
	Dusts and Mists		1
	Cotton Dust (raw)		0.2
	Crag® herbicide		10
	Cresol (all isomers)--Skin	5	22
	Crotonaldehyde	2	6
	Crufomate (Ruelene®)		50

Cumene - Skin	50	245
Cyanide (as CN) - Skin	5	
Cyanogen	10	20
Cyclohexane	300	1,050
Cyclohexanol	50	200
Cyclohexanone	50	200
Cyclohexene	300	1,015
Cyclohexylamine - Skin	10	40
Cyclopentadiene	75	200
2, 4-D		10
DDT		1
DDVP (see Dichlorvos)		
Decaborane - Skin	0.05	0.3
Demeton® - Skin	0.01	0.1
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone)	50	240
1, 2-Diaminoethane (see Ethylenediamine)		
Diazinon - Skin		0.1
Diazomethane	0.2	0.4
Diborane	0.1	0.1
1, 2-Dibromoethane (ethylene dibromide) Skin	20	145
Dibrom®		
2-N Dibutylaminoethanol - Skin	2	14
Dibutyl phosphate	1	5
Dibutylphthalate		5
C Dichloracetylene	0.1	0.4
C o-Dichlorobenzene	50	300
p-Dichlorobenzene	75	450
Dichlorodifluoro-methane	500	2,475
1, 3-Dichloro-5, 5-dimethyl hydantoin		0.2
1, 1-Dichloroethane	200	820
1, 2-Dichloroethane	50	200
1, 2-Dichloroethylene	200	790
Dichloroethyl ether - Skin	5	30
Dichloromethane (see Methylene chloride)		
Dichloromonofluoromethane	1,000	4,200
C 1, 1-Dichloro-1-nitroethane	10	60
1, 2-Dichloropropane (see Propylenedichloride)		
Dichlorotetrafluoroethane	1,000	7,000
Dichlorvos (DDVP) - Skin	0.1	1
Dicyclopentadiene	5.0	27
Dicyclopentadienyliron		10
Substance	**ppma**	**mg/m3b**

Dieldrin - Skin		0.25
Diethylamine	25	75
Diethylamino ethanol - Skin	10	50
Diethylene triamine - Skin	1	4
Diethylether (see Ethyl ether)		
Diethylphthalate		5
Difluorodibromomethane	100	860
C Diglycidyl ether (DGE)	0.5	2.8
Dihydroxybenzene (see Hydroquinone)		
Diisobutyl ketone	25	150
Diisopropylamine - Skin	5	20
Dimethoxymethane (see Methylal)		
Dimethyl acetamide - Skin	10	35
Dimethylamine	10	18
Dimethylaminobenzene (see Xylidene)		
Dimethylaniline (N-dimethylaniline) - Skin	5	25
Dimethylbenzene (see Xylene)		
Dimethyl 1, 2-dibromo-2-dichloroethyl phosphate (see Dibrom)		
Dimethylformamide - Skin	10	30
2, 6-Dimethylheptanone (see Diisobutyl ketone)		
1, 1-Dimethylhydrazine - Skin	0.5	1
Dimethylphthalate		5
C Dimethyl sulfate - Skin	1	5
Dinitrobenzene (all isomers) - Skin	0.15	1
Dinitro-o-cresol - Skin		0.2
3, 5-Dinitro-o-toluamide (Zoalene®)		5.0
Dinitrotoluene - Skin		1.5
Dioxane, technical grade - Skin	50	180
Diphenyl (see Biphenyl)		
Diphenyl amine		10
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate [MDI]		
Dipropylene glycol methyl ether - Skin	100	600
Diquat		0.5
Di-sec, octyl phthalate (Di-2-ethyl-hexylphthalate)		5
Substance	**ppma**	**mg/m3b**

	Disulfuram		2
	Disyston - Skin		0.1
	2, 6-Ditert-butyl-p-cresol		10
	Dyfonate		0.1
	Endosulfan (Thiodan®) – Skin		0.1
	Endrin - Skin		0.1
	Epichlorhydrin - Skin	5	19
	EPN - Skin		0.5
	1, 2-Epoxypropane (see Propylene oxide)		
	2, 3-Epoxy-1-propanol (see Glycidol)		
	Ethanethiol (see Ethyl mercaptan)		
	Ethanolamine	3	6
	Ethion (Nialate®) - Skin		0.4
	2-Ethoxyethanol (see Cellosolves: Ethyl Cellosolve) Skin		
	2-Ethoxyethylacetate (see Cellosolves: Ethyl Cellosolve Acetate) - Skin		
	Ethyl acetate	400	1,400
	Ethyl acrylate - Skin	25	100
	Ethyl alcohol (ethanol)	1,000	1,900
	Ethylamine	10	18
	Ethyl sec-amyl ketone (5-methyl-3-heptanone)	25	130
	Ethyl benzene	100	435
	Ethyl bromide	200	890
	Ethyl butyl ketone (3-Heptanone)	50	230
	Ethyl chloride	1,000	2,600
	Ethyl ether	400	1,200
	Ethyl formate	100	300
	Ethyl mercaptan	0.5	1
	Ethyl silicate	100	850
C	Ethylene chlorohydrin - Skin	1	3
	Ethylenediamine	10	25
	Ethylene dibromide (see 1, 2-Dibromoethane)		
	Ethylene dichloride (see 1, 2-Dichloroethane)		
	Ethylene glycol, particulate		10
	Ethylene glycol, vapor	100	260

Substance	**ppma**	**mg/m3b**

C Ethylene glycol dinitrate and/or Nitroglycerin - Skin	0.2 -	
Ethylene glycol monomethyl ether acetate (see Cellosolves: Methyl cellosolve acetate) - Skin	---	
Ethylene oxide	50	90
Ethylenimine - Skin	0.5	1
Ethylidene chloride (see 1, 1-Dichloroethane)		
C Ethylidene norbornene	5	25
N-Ethylmorpholine - Skin	20	94
Fensulfothion (Dasanit)		0.1
Ferbam		10
Ferrovanadium dust		1
Fluoride (as F)		2.5
Fluorine	1	2
Fluorotrichloromethane	1,000	5,600
C Formaldehyde	2	3
Formamide	20	30
Formic acid	5	9
Furfural - Skin	5	20
Furfuryl alcohol	5	20
Germanium tetrahydride	0.2	0.6
Glutaraldehyde, activated and unactivated	0.3	1.2
Glycidol (2, 3-Epoxy-1-propanol)	50	150
Glycol monoethyl ether (see 2-Ethoxyethanol)		
Guthion® (see Azinphosmethyl)		
Hafnium		0.5
Heptachlor - Skin		0.5
Heptane (n-heptane)	400	1,640
Hexachlorocyclopentadiene	0.01	0.11
Hexachloroethane - Skin	1	10
Hexachloronaphthalene - Skin		0.2
Hexafluoroacetone	0.1	0.7
Hexane (n-hexane)	100	350
2-Hexanone (Methylbutyl ketone) - Skin	25	102
Hexone (Methyl isobutyl ketone) - Skin	100	410
sec-Hexyl acetate	50	300
C Hexylene glycol	25	120
Hydrazine - Skin	1	1.3
Hydrogen bromide	3	10
C Hydrogen chloride	5	7
C Hydrogen cyanide - Skin	10	11
Substance	**ppma**	**mg/m3b**

Hydrogen fluoride	3	2
Hydrogen peroxide	1	1.4
Hydrogen selenide	0.05	0.2
C Hydrogen sulfide	10	15
Hydrogenated terphenyis	0.5 -	
Hydroquinone		2
Indene	10	45
Indium and compounds, as In		0.1
C Iodine	0.1	1
Iodoform	0.2	3.2
Iron oxide fume		5
Iron pentacarbonyl	0.01	0.08
Iron salts, soluble, as Fe	-	1
Isoamyl acetate	100	525
Isoamyl alcohol	100	360
Isobutyl acetate	150	700
Isobutyl alcohol	50	151
Substance	ppm	a mg/m3b
C Isophorone	5	25
Isopropyl acetate	250	950
Isopropyl alcohol - Skin	400	980
Isopropylamine	5	12
Isopropyl ether	250	1,050
Isopropyl glycidyl ether (IGE)	50	240
Ketene	0.5	0.9
Lead, inorg., fumes and dusts, as Pb	-	0.15
Lead arsenate, as Pb	-	0.15
Lindane - Skin	-	0.5
Lithium hydride	-	0.025
L.P.G. (Liquefied petroleum gas)	1,000	1,800
Magnesium oxide fume	-	10
Malathion - Skin	-	10
Maleic anhydride	0.25	1
C Manganese and compounds, as Mn	-	5
Manganese cyclopentadienyl tricarbonyl (as Mn) - Skin	-	0.1
Mercury (Alkyl compounds) - Skin, as Hg	0.001	0.01
Mercury (All forms except alkyl) as Hg	-	0.05
Mesityl oxide	25	100
Methanethiol, (see Methyl mercaptan)	-	-
Methoxychlor	-	10
2-Methoxyethanol (see		

Cellosolves: Methyl cellosolve) -
Skin ---------- - -
Methyl acetate ---------- 200 610
Methyl acetylene (propyne) ---------- 1,000 1,650
Methyl acetylene-propadiene mixture
(MAPP) ---------- 1,000 1,800
Methyl acrylate - Skin ---------- 10 35
Methyl acrylonitrile - Skin ---------- 1 3
Methylal (dimethoxymethane) ---------- 1,000 3,100
Methyl alcohol (methanol) - Skin ---------- 200 260
Methylamine ---------- 10 12
Methyl amyl alcohol (see
Methyl isobutyl carbinol) ---------- - -
Methyl 2-cyanoacrylate ---------- 2 8
Methyl isoamyl ketone ---------- 100 475
Methyl n-amyl ketone (2-Heptanone) ---------- 100 465
Methyl bromide - Skin ---------- 15 60
Methyl butyl ketone (see
2-Hexanone) ---------- - -
Methyl cellosolve - 2-Methoxyethanol
(see
Cellosolves: Methyl cellosolve) ---------- - -
Methyl cellosolve acetate - Ethylene
glycol monomethyl ether acetate (see
Cellosolves: Methyl cellosolve
acetate) ---------- - -
Substance ppma mg/m3b
Methyl chloride ---------- 100 210
Methyl chloroform ---------- 350 1,900
Methylcyclohexane ---------- 400 1,600
Methylcyclohexanol ---------- 50 235
o-Methylcyclohexanone - Skin ---------- 50 230
Methylcyclopentadienyl manganese tri-
carbonyl (as Mn) - Skin ---------- 0.1 0.2
Methyl demeton - Skin ---------- - 0.5
Methyl ethyl ketone (MEK) 2-Butanone ---------- 200 590
C Methyl ethyl ketone peroxide ---------- 0.2 1.5
Methyl formate ---------- 100 250
Methyl iodide - Skin ---------- 5 28
Methyl isobutyl carbinol - Skin ---------- 25 100
Methyl isobutyl ketone (see
Hexone) ---------- - -
Methyl isocyanate - Skin ---------- 0.02 0.05
Methyl mercaptan ---------- 0.5 1
Methyl methacrylate ---------- 100 410
Methyl parathion - Skin ---------- - 0.2

Methyl propyl ketone (see
2-Pentanone) ---------- - -
C Methyl silicate ---------- 5 30
C a-Methyl styrene ---------- 100 480
C Methylene bisphenyl isocyanate (MDI) ---------- 0.02 0.2
Methylene chloride
(dichloromethane) ---------- 100 360
C Methylene bis
(4-cyclohexylisocyanate) ---------- 0.01 0.11
Molybdenum (as Mo),soluble compounds ---------- - 5
Insoluble compounds ---------- - 10
Monomethyl aniline - Skin ---------- 2 9
C Monomethyl hydrazine - Skin ---------- 0.2 0.35
Morpholine - Skin ---------- 20 70
Naphthalene ---------- 10 50
Nickel carbonyl ---------- 0.05 0.35
Nickel, metal and insoluble compounds
(as Ni) ---------- - 1
Nickel, soluble salts (as Ni)---------- - 0.1
Nicotine - Skin ---------- - 0.5
Nitric acid ---------- 2 5
Nitric oxide ---------- 25 30
p-Nitroaniline - Skin ---------- 1 6
Nitrobenzene - Skin ---------- 1 5
p-Nitrochlorobenzene - Skin ---------- - 1
Nitroethane ---------- 100 310
C Nitrogen dioxide ---------- 5 9
Nitrogen trifluoride ---------- 10 29
Nitroglycerin - Skin ---------- 0.2 2
Nitromethane ---------- 100 250
1-Nitropropane ---------- 25 90
2-Nitropropane ---------- 25 90
Nitrotoluene - Skin ---------- 5 30
Nitrotrichloromethane (see
Chloropicrin) ---------- - -
Nonane ---------- 200 1,050
Substance ppma mg/m3b
Octachloronaphthalene - Skin ---------- - 0.1
Octane ---------- 300 1,380
Oil mist, particulate ---------- - 5
Osmium tetroxide, as Os ---------- 0.0002 0.002
Oxalic acid ---------- - 1
Oxygen difluoride ---------- 0.05 0.1
Ozone ---------- 0.1 0.2
Paraffin wax fume ---------- - 2
Paraquat

(respirable size) ---------- - 0.1
Parathion -
Skin ---------- - 0.1
Pentaborane ---------- 0.005 0.01
Pentachloronaphthalene - Skin ---------- - 0.5
Pentachlorophenol - Skin ---------- - 0.5
Pentane ---------- 600 1,680
2-Pentanone ---------- 200 700
Perchloroethylene - Skin ---------- 100 670
Perchloromethyl mercaptan ---------- 0.1 0.8
Perchloryl fluoride ---------- 3 14
Phenol - Skin ---------- 5 19
Phenothiazine - Skin ---------- - 5
p-Phenylene diamine - Skin ---------- - 0.1
Phenyl ether (vapor) ---------- 1 7
Phenyl ether-Diphenyl mixture (vapor) ---------- 1 7
Phenylethylene (see
Styrene) ---------- - -
Phenyl glycidyl ether (PGE) ---------- 10 60
Phenylhydrazine - Skin ---------- 5 22
C Phenylphosphine ---------- 0.05 0.25
Phorate (ThimetR) - Skin ---------- - 0.05
Phosdrin (MevinphosR) - Skin ---------- 0.01 0.1
C Phosgene (carbonyl chloride) ---------- 0.05 0.2
Phosphine ---------- 0.3 0.4
Phosphoric acid ---------- - 1
Phosphorus (yellow) ---------- - 0.1
Phosphorus pentachloride ---------- - 1
Phosphorus pentasulfide ---------- - 1
Phosphorus trichloride ---------- 0.5 3
Phthalic anhydride ---------- 1 6
Picloram (TordonR) ---------- - 10
Picric acid - Skin ---------- - 0.1
PivalR (2-Pivalyl-1, 3-indandione) ------- - 0.1
Platinum (Soluble Salts) as Pt ---------- - 0.002
Polychlorobiphenyls (see
Chlorodiphenyls ---------- - -
Potassium hydroxide ---------- - 2
Propargyl alcohol - Skin ---------- 1 2
n-Propyl acetate ---------- 200 840
Propyl alcohol - Skin ---------- 200 500
n-Propyl nitrate ---------- 25 110
Propylene dichloride (1, 2-Dichloropro-
pane) ---------- 75 350
C 1, 2-Propylene glycol dinitrate - Skin ---------- 0.05 0.35
Substance ppma mg/m3b

Propylene glycol monomethyl ether ---------- 100 360
Propylene imine - Skin ---------- 2 5
Propylene oxide ---------- 100 240
Propyne (see
Methylacetylene) ---------- - -
Pyrenthrum ---------- - 5
Pyridine ---------- 5 15
Quinone ---------- 0.1 0.4
RDX - Skin ---------- - 1.5
Resorcinol ---------- 10 45
Rhodium, Metal fume and dusts (as Rh) ---------- - 0.1
Soluble salts ---------- - 0.001
Ronnel ---------- - 10
Rosin Core Solder pyrolysis products
(as formaldehyde) ---------- - 0.1
Rotenone (commercial) ---------- - 5
Selenium compounds (as Se) ---------- - 0.2
Selenium hexafluoride (as Se) ---------- 0.05 0.4
SevinR (see
Carbaryl) ---------- - -
Silane (see
Silicon tetrahydride) ---------- - -
Silicon tetrahydride (Silane) ---------- 0.5 0.7
Silver, metal and soluble compounds
(as Ag) ---------- - 0.01
C Sodium azide ---------- 0.1 0.26
Sodium fluoroacetate (1080) - Skin ---------- - 0.05
C Sodium hydroxide ---------- - 2.0
Stibine ---------- 0.1 0.5
Stoddard solvent ---------- 100 -
Strychnine ---------- - 0.15
Styrene, monomer (Phenylethylene) ---------- 100 420
C Subtilisins (Proteolytic enzymes as
100% pure crystalline enzyme) ---------- - 0.00006
Succindialhyde (see
Glutaraldehyde) ---------- - -
Sulfur dioxide ---------- 5 13
Sulfur hexafluoride ---------- 1,000 6,000
Sulfuric acid ---------- - 1
Sulfur monochloride ---------- 1 6
Sulfur pentafluoride ---------- 0.025 0.25
Sulfur tetrafluoride ---------- 0.1 0.4
Sulfuryl fluoride ---------- 5 20
Systox (see
DemetonR) ---------- - -
2, 4, 5-T ---------- - 10

Tantalum ---------- - 5
TEDP - Skin ---------- - 0.2
Tellurium ---------- - 0.1
Tellurium hexafluoride (as Te) ---------- 0.02 0.2
TEPP - Skin ---------- 0.004 0.05
Substance ppma mg/m3b
C Terphenyls ---------- 1 9
1, 1, 1, 2-Tetrachloro-2, 2-difluoro-
ethane ---------- 500 4,170
1, 1, 2, 2-Tetrachloro-1, 2-difluoro-
ethane ---------- 500 4,170
1, 1, 2, 2-Tetrachloroethane - Skin ---------- 5 35
Tetrachloroethylene (see
Perchloroethylene) ---------- - -
Tetrachloromethane (see
Carbon tetrachloride) ---------- - -
Tetrachloronaphthalene - Skin ---------- - 2
Tetraethyl lead (as Pb) - Skin ---------- - 0.100
Tetrahydrofuran ---------- 200 590
Tetramethyl lead (as Pb) - Skin ---------- - 0.150
Tetramethyl succinonitrile - Skin ---------- 0.5 3
Tetranitromethane ---------- 1 8
Tetryl (2, 4, 6-trinitrophenyl-
methylnitramine) - Skin ---------- - 1.5
Thallium (soluble compounds) - Skin
(as Tl) ---------- - 0.1
4, 4'-Thiobis (6-tert. butyl m-cresol)---------- - 10
ThiramR ---------- - 5
Tin (inorganic compounds, except SnH4
and SnO2) as Sn ---------- - 2
Tin (organic compounds) - Skin (as Sn) ---------- - 0.1
Toluene (toluol) - Skin ---------- 100 375
C Toluene-2, 4-diisocyanate (TDI) ---------- 0.02 0.14
o-Toluidine ---------- 5 22
Toxaphene (see
Chlorinated camphene) ---------- - -
Tributyl phosphate ---------- - 5
1, 1, 1-Trichloroethane (see
Methyl chloroform) ---------- - -
1, 1, 2-Trichloroethane - Skin ---------- 10 45
Trichloroethylene ---------- 100 535
Trichloromethane (see
Chloroform) ---------- - -
Trichloronaphthalene - Skin ---------- - 5
1, 2, 3-Trichloropropane ---------- 50 300
1, 1, 2-Trichloro 1, 2, 2-trifluoro-

ethane ---------- 1,000 7,600
Triethylamine ---------- 25 100
Tricyclohexyltin hydroxide (PlictranR) --- - 5
Trifluoromonobromomethane ---------- 1,000 6,100
Trimethyl benzene ---------- 25 120
2, 4, 6-Trinitrophenol (see
Picric acid) ---------- - -
2, 4, 6-Trinitrophenyl-methylnitramine
(see
Tetryl) ---------- - -
C 2, 4, 6-Trinitrotoluene (TNT) - Skin ---------- 0.05 0.5
Triorthocresyl phosphate ---------- - 0.1
Triphenylamine ---------- - 5
Triphenyl phosphate ---------- - 3
Tungsten & compounds, as W
Soluble ---------- - 1
Insoluble ---------- - 5
Substance ppma mg/m3b
Turpentine ---------- 100 560
Uranium (natural) soluble & insoluble
compounds, as U ---------- - 0.2
Vanadium (V2O5), as V
Dust ---------- - 0.5
C Fume ---------- - 0.05
Vinyl acetate ---------- 10 30
Vinyl benzene (see
Styrene) ---------- - -
Vinyl bromide ---------- 250 100
Vinyl chloride ---------- 1 2.5
Vinyl cyanide (see
Acrylonitrile) ---------- - -
Vinylidene chloride ---------- 10 40
Vinyl toluene ---------- 100 480
Warfarin ---------- - 0.1
Wood dust (nonallergenic) ---------- - 5
Xylene (o-, m-, p-isomers) - Skin ---------- 100 435
C m-Xylene a, a'-diamine ---------- - 0.1
Xylidine - Skin ---------- 5 25
Yttrium ---------- - 1
Zinc chloride fume ---------- - 1
Zinc oxide fume ---------- - 5
Zirconium compounds (as Zr) ---------- - 5

a) Parts of vapor or gas per million parts of contaminated air by volume at 25øC and 760mm. Hg. pressure.

b) Approximate milligrams of substance per cubic meter of air.

(R) Registered Trade Name.

MINERAL DUSTS

Substance

SILICA, SiO_2

Crystalline

Quartz ---------- OEL in mppcf:

$$\frac{300}{\%\ \text{quartz} + 10}$$

OEL for respirable dust in mg/m3:

$$\frac{10\ \text{mg/m3}}{\%\ \text{Respirable quartz} + 2}$$

Cristobalite ----------Use one-half the value calculated from the count or respirable mass formulae for quartz.

Tridymite ----------Use one-half the value calculated from formulae for quartz.

Silica, fused ----------Use quartz formulae.
Tripoli ---------- Use quartz formulae.

Silica, amorphous
including natural
Diatomaceous Earth ---------- 20 mppcf
1 mg/m3 Respirable dust

LESS THAN 1% QUARTZ
Asbestos, all forms ---------- 2 fibers/cc > 5 micrometers in length
Graphite (natural) ---------- 15 mppcf*
Mica ---------- 20 mppcf*
Mineral wool fiber ---------- 30 mppcf*
Perlite ---------- 30 mppcf*
Portland Cement ---------- 30 mppcf*
Soapstone ---------- 20 mppcf*

Talc (nonasbestiform) ----------20 mppcf*
Talc (fibrous) use
Asbestos limit.
Tremolite, see Asbestos

COAL DUST
(bituminous) 2 mg/m3 (respirable dust fraction << 5% quartz).
If > 5% quartz, use respirable mass formula.

_____
mppcf - Millions of particles per cubic foot of air, based on impinger samples counted by light-field technics.

* Or 5 mg/m3 for respirable dust.

NUISANCE PARTICULATES

30 mppcf or 5 mg/m3 of respirable dust << 1% quartz

Conversion factors:
mppcf X 35.3 = million particles per cubic meter

= particles per c.c.

SOME NUISANCE PARTICULATES

OEL, 30 mppcf or 5 mg/m3 (respirable)

Alundum (Al_2O_3)
Calcium carbonate
Calcium silicate
Cellulose (paper fiber)
Portland Cement
Corundum (Al_2O_3)
Emery
Glass, fibrous or dust
Glycerin Mist
Graphite (synthetic)
Gypsum
Vegetable oil mists
(except castor, cashew nut, or similar irritant oils)
Kaolin
Limestone
Magnesite
Marble
Mineral Wool Fiber
Pentaerythritol
Plaster of Paris
Rouge
Silicon
Silicon Carbide
Starch
Sucrose
Tin Oxide
Titanium Dioxide
Zinc Stearate
Zinc oxide dust

SOME SIMPLE ASPHYXIANTS*

Acetylene
Argon
Butane
Ethane
Ethylene
Helium
Hydrogen
Methane
Neon
Nitrous oxide
Propane

*The minimal oxygen shall not be less than 19% under normal atmospheric pressure.

CARCINOGENS

Substances in industrial use that have proven carcinogenic in man, or have induced cancer in animals under appropriate experimental conditions:

4-Aminodiphenyl (p-Xenylamine)*
Antimony trioxide
Arsenic trioxide production
Asbestos, all forms
Benzidine production*
beta-Naphthylamine*
bis (chloromethyl) ether
Chromite ore processing
Nickel sulfide roasting, fume & dust
4-Nitrodiphenyl*
Particulate Polycyclic Aromatic Hydrocarbons
Sulfur dioxide
Vinyl chloride

Industrial substances suspect of carcinogenic potential for man:

Benzene
Benz(a)pyrene
Beryllium
Cadmium oxide production
Chloroform
Chromates of lead & zinc
3, 3'-Dichlorobenzidine
Dimethylcarbamyl chloride
1, 1-Dimethyl hydrazine
Dimethyl sulfate
Epichlorhydrin
Hexamethyl phosphoramide
Hydrazine
4,4'-Methylene is(2-chloroaniline)
4,4'-Methylene dianiline
Methyl methacrylate
Monomethyl hydrazine
Nitrosamines
Propane sultone
beta-Propiolactone
Thallium
Vinyl cyclohexene dioxide

For the above, worker exposure by all routes should be carefully controlled.

Cigarette smoking can enhance the incidence of respiratory cancers from these substances or processes.

* No exposure or contact by any route - respiratory, skin or oral, as detected by the most sensitive methods - should be permitted.

"No exposure or contact" means hermitizing the process or operation by the best practicable engineering methods. The worker should be properly equipped to insure virtually no contact with the carcinogen.

EXPLANATORY NOTE - Guide for Collecting and Measuring Samples:

1) At least three atmospheric samples, spaced at intervals to yield an average measurement of exposure over the entire cycle of operation under test shall be collected in the breathing zone of the employee or wherever such exposures are suspected.

2) For the purposes of this code, the sampling and analysis of contaminated air and the interpretation of the data in relation to the recommended occupational exposure limits shall be done using established sampling and analysis procedures.
3) Temporary concentrations in excess of the recommended occupational exposure limits shall not be permitted if exposure to such concentrations for a period of one hour or less may result in an adverse effect on health.
4) For the purpose of the above recommended occupational exposure limits respirable dust shall be considered all dust below ten (10) microns in size and seventy-five (75) percent below five (5) microns.