

APPENDIX**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	(ppm or mg/m ³),	Excursion
OEL > 0 – 1	"	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/m ³ b
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

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
Substance	ppma	mg/m3b

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 Dichloroacetylene -----	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
Ferrovandium 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 terphenyls -----	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 mg/m ³ b		
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 ppm mg/m ³	

Propylene glycol monomethyl ether -----	100	360
Propylene imine - Skin -----	2	5
Propylene oxide -----	100	240
Propyne (see Methylacetylene) -----	-	-
Pyrethrum -----	-	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/m ³ b	
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 SnH ₄ and SnO ₂) 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/m ³ b		
Turpentine -----	100	560
Uranium (natural) soluble & insoluble compounds, as U -----	-	0.2
Vanadium (V ₂ O ₅), 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 25°C and 760mm. Hg. pressure.

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

(R) Registered Trade Name.

MINERAL DUSTS

Substance

SILICA, SiO2

Crystalline

Quartz ----- OEL in mppcf: 300

% quartz + 10

OEL for respirable dust in mg/m3:

10 mg/m3

% 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 ₂ O ₃)	Kaolin
Calcium carbonate	Limestone
Calcium silicate	Magnesite
Cellulose (paper fiber)	Marble
Portland Cement	Mineral Wool Fiber
Corundum (Al ₂ O ₃)	Pentaerythritol
Emery	Plaster of Paris
Glass, fibrous or dust	Rouge
Glycerin Mist	Silicon
Graphite (synthetic)	Silicon Carbide
Gypsum	Starch
Vegetable oil mists	Sucrose
(except castor, cashew nut, or similar irritant oils)	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	Hexamethyl phosphoramidate
Benz(a)pyrene	Hydrazine
Beryllium	4,4'-Methylene bis(2-chloroaniline)
Cadmium oxide production	4,4'-Methylene dianiline
Chloroform	Methyl methacrylate
Chromates of lead & zinc	Monomethyl hydrazine
3, 3'-Dichlorobenzidine	Nitrosamines
Dimethylcarbonyl chloride	Propane sulfone
1, 1-Dimethyl hydrazine	beta-Propiolactone
Dimethyl sulfate	Thallium
Epichlorhydrin	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.