

TABLE Z-3—MINERAL DUSTS

Substance	Mppcf *	Mg/M ³
Silica:		
Crystalline:		
Quartz (respirable).....	250 †	10mg/M ³ ‡
	%SiO ₂ +δ	%SiO ₂ +2
Quartz (total dust).....		30mg/M ³
		%SiO ₂ +2
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth.....	20	80mg/M ³
		%SiO ₂
Silicates (less than 1% crystalline silica):		
Mica.....	20	
Soapstone.....	20	
Talc (non-asbestos-form) ..	20*	
Talc (fibrous). Use asbestos limit ..		
Tremolite (see talc, fibrous)		
Portland cement.....	50	
Graphite (natural).....	15	
Coal dust (respirable fraction less than 5% SiO ₂).....		2.4mg/M ³ or 10mg/M ³
For more than 5% SiO ₂		%SiO ₂ +2
Inert or Nuisance Dust:		
Respirable fraction.....	15	5mg/M ³
Total dust.....	50	15mg/M ³

NOTE: Conversion factors—
 mppcf×35.3=millions particles per cubic meter
 =particles per c.c.

* Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

† The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

‡ As determined by the membrane filter method at 430×phase contrast magnification.

§ Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

* Containing < 1% quartz; if > 1% quartz, use quartz limit.

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
10	0

The measurements under this note refer to the use of an AEC instrument.† the respirable fraction of coal dust is determined with a NRE the figure corresponding to that of 2.4 Mg/M³ in the table for coal dust is 4.5 Mg/M³. [39 FR 23502, June 27, 1974. Redesignated and amended at 40 FR 23073, May 28, 1975]

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TABLE Z-1—Continued

Substance	p.p.m. ^a	mg./M ³ ^b
Vinyl toluene.....	100	480
Warfarin.....		0.1
Xylene (xylo).....	100	435
Xylidine—Skin.....	5	25

*1970 Addition.

^a Parts of vapor or gas per million parts of contaminated air by volume at 25° C. and 760 mm. Hg pressure.^b Approximate milligrams of particulate per cubic meter of air.

(No footnote "c" is used to avoid confusion with ceiling value notations.)

TABLE Z-1—Continued

Substance	p.p.m. ^a	mg./M ³
Yttrium.....		1
Zinc chloride fume.....		1
Zinc oxide fume.....		5
Zirconium compounds (as Zr).....		5

^a An atmospheric concentration of not more than 0.02 p.p.m., or personal protection may be necessary to avoid headache.^b As sampled by method that does not collect vapor.

/ For control of general room air, biologic monitoring is essential for personnel control.

TABLE Z-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift.	
			Concentration	Maximum duration
Benzene (Z37.4-1969).....	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes.
Beryllium and beryllium compounds (Z37.29-1970).....	2 µg./M ³	5 µg./M ³	25 µg./M ³	30 minutes.
Cadmium fume (Z37.5-1970).....	0.1 mg./M ³	3 mg./M ³		
Cadmium dust (Z37.5-1970).....	0.2 mg./M ³	0.6 mg./M ³		
Carbon disulfide (Z37.8-1968).....	20 p.p.m.	30 p.p.m.	100 p.p.m.	Do.
Carbon tetrachloride (Z37.17-1967).....	10 p.p.m.	25 p.p.m.	200 p.p.m.	5 minutes in any 4 hours.
Ethylene dibromide (Z37.31-1970).....	20 p.p.m.	30 p.p.m.	50 p.p.m.	5 minutes.
Ethylene dichloride (Z37.21-1969).....	50 p.p.m.	100 p.p.m.	200 p.p.m.	5 minutes in any 3 hours.
Formaldehyde (Z37.16-1967).....	3 p.p.m.	5 p.p.m.	10 p.p.m.	30 minutes.
Hydrogen fluoride (Z37.28-1969).....	do.	do.		
Fluoride as dust (Z37.28-1969).....	2.5 mg./M ³			
Lead and its inorganic compounds (Z37.11-1969).....	0.2 mg./M ³			
Methyl chloride (Z37.18-1969).....	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 3 hours.
Methylene chloride (Z37.3-1969).....	500 p.p.m.	1,000 p.p.m.	2,000 p.p.m.	5 minutes in any 2 hours.
Organo (alkyl) mercury (Z37.30-1969).....	0.01 mg./M ³	0.04 mg./M ³		
Styrene (Z37.15-1969).....	100 p.p.m.	200 p.p.m.	600 p.p.m.	5 minutes in any 3 hours.
Trichloroethylene (Z37.19-1967).....	do.	do.	300 p.p.m.	5 minutes in any 2 hours.
Tetrachloroethylene (Z37.22-1967).....	do.	do.	do.	5 minutes in any 3 hours.
Toluene (Z37.12-1967).....	200 p.p.m.	300 p.p.m.	500 p.p.m.	10 minutes.
Hydrogen sulfide (Z37.2-1966).....		20 p.p.m.	60 p.p.m.	10 minutes once only if no other measurable exposure occurs.
Mercury (Z37.8-1971).....		1 mg./10M ³		
Chromic acid and chromates (Z37.7-1971).....		do.		

TABLE Z-1—Continued

Substance	p.p.m. ^a	mg./M ³ ^b
Nickel carbonyl.....	0.001	0.007
Nickel, metal and soluble cmpds, as Ni.....		1
Nicotine—Skin.....		0.5
Nitric acid.....	2	5
Nitric oxide.....	25	30
p-Nitroaniline—Skin.....	1	5
Nitrobenzene—Skin.....	1	5
p-Nitrochlorobenzene—Skin.....		1
Nitroethane.....	100	310
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.....		
Octachloronaphthalene—Skin.....		0.1
*Octane.....	500	2,350
*Oil mist, mineral.....		5
Osmium tetroxide.....		0.002
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	0.01
Pentachloronaphthalene—Skin.....		0.5
Pentachlorophenol—Skin.....		0.5
*Pentane.....	1,000	2,950
2-Pentanone.....	200	700
Perchloromethyl mercaptan.....	0.1	0.8
Perchloryl fluoride.....	3	13.5
Petroleum distillates (naphtha). Skin.....	500	2,000
Phenol—Skin.....	5	19
p-Phenylenediamine—Skin.....		0.1
Phenyl ether (vapor).....	1	7
Phenyl ether-biphenyl mixture (vapor).....	1	7
Phenylethylene, see Styrene.....		
Phenylglycidyl ether (PGE).....	10	50
Phenylhydrazine—Skin.....	5	22
Phosdrin (Mevinphos ®)— Skin.....		0.1
Phosgene (carbonyl chloride).....	0.1	0.4
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.....	2	12
Picric acid—Skin.....		0.1
Pival ® (2-Pivalyl-1,3- indandione).....		0.1
Platinum (Soluble salts) as Pt.....		0.002
Propargyl alcohol—Skin.....	1	
Propane.....	1,000	1,800
n-Propyl acetate.....	200	840
Propyl alcohol.....	200	500
n-Propyl nitrate.....	25	110
Propylene dichloride.....	75	350
Propylene imine—Skin.....	2	5
Propylene oxide.....	100	240
Propyne, see Methylacetylene.....		
Pyrithrum.....		5
Pyridine.....	5	15
Quinone.....	0.1	0.4
RDX—Skin.....		1.5
Rhodium, Metal fume and dusts, as Rh.....		0.1
Soluble salts.....		0.001
Ronnel.....	10	
Rotenone (commercial).....	5	
Selenium compounds (as Se).....		0.2
Selenium hexafluoride.....	0.05	0.4

See footnotes at end of table.

TABLE Z-1—Continued

Substance	p.p.m. ^a	mg./M ³ ^b
Silver, metal and soluble com- pounds.....		0.01
Sodium fluoroacetate (1080)— Skin.....		0.05
Sodium hydroxide.....		2
Stibine.....	0.1	0.5
*Stoddard solvent.....	500	2,950
Strychnine.....		0.15
Sulfur dioxide.....	5	13
Sulfur hexafluoride.....	1,000	6,000
Sulfuric acid.....		1
Sulfur monochloride.....	1	5
Sulfur pentafluoride.....	0.025	0.25
Sulfuryl fluoride.....	5	20
Systox, see Demeton ®.....		
2,4,5-T.....		10
Tantalum.....		5
TEDP—Skin.....		0.2
Tellurium.....		0.1
Tellurium hexafluoride.....	0.02	0.2
TERP—Skin.....		0.05
Terphenyls.....	1	9
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 Per- chloroethylene.....		
Tetrachloromethane, see Carbon tetrachloride.....		
Tetrachloronaphthalene—Skin.....		2
Tetraethyl lead (as Pb)—Skin.....		0.075
Tetrahydrofuran.....	200	590
Tetramethyl lead (as Pb)— Skin.....		0.07
Tetramethyl succinonitrile— Skin.....	0.5	3
Tetranitromethane.....	1	5
Tetryl (2,4,6-trinitrophenyl- methylnitramine)—Skin.....		1.5
Thallium (soluble com- pounds)—Skin as Tl.....		0.1
Thiram.....		5
Tin (Inorganic cmpds, except oxides).....		2
Tin (Organic cmpds).....		0.1
C Toluene-2,4-dithiocyanate.....	0.02	0.14
o-Toluidine—Skin.....	5	22
Toxaphene, see Chlorinated camphene.....		
Tributyl phosphate.....		5
1,1,1-Trichloroethane, see Methyl chloroform.....		
1,1,2-Trichloroethane—Skin.....	10	45
Titanium dioxide.....		15
Trichloromethane, see Chloro- form.....		
Trichloronaphthalene—Skin.....		5
1,2,3-Trichloropropane.....	50	300
1,1,2-Trichloro 1,2,2-trifluoro- ethane.....	1,000	7,500
Triethylamine.....	25	100
Trifluoromonomobromomethane.....	1,000	6,100
2,4,6-Trinitrophenol, see Picric acid.....		
2,4,6-Trinitrophenylmethyl- nitramine, see Tetryl.....		
Trinitrotoluene—Skin.....		1.5
Triorthoresyl phosphate.....		0.1
Triphenyl phosphate.....		3
Turpentine.....	100	550
Uranium (soluble compounds).....		0.05
Uranium (insoluble compounds).....		0.25
C Vanadium: V ₂ O ₅ dust.....		0.5
V ₂ O ₅ fume.....		0.1
Vinyl benzene, see Styrene.....		
Vinylcyanide, see Acrylonitrile.....		

See footnotes at end of table.

TABLE Z-1—Continued

Substance	p.p.m.*	mg./m ³ †
Dinitro-o-cresol—Skin		0.2
Dinitrotoluene—Skin		1.5
Dioxane (Diethylene dioxide)—Skin	100	360
Diphenyl	0.2	1
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate (MDI))		
Dipropylene glycol methyl ether—Skin	100	600
Di-sec. octyl phthalate (Di-2-ethylhexylphthalate)		5
Endrin—Skin		0.1
Epichlorohydrin—Skin	5	19
EPN—Skin		0.5
1,2-Epoxypropane, see Propyleneoxide		
2,3-Epoxy-1-propanol, see Glycidol		
Ethanol, see Ethylmercaptan		
Ethanolamine	3	8
2-Ethoxyethanol—Skin	200	740
2-Ethoxyethylacetate (Cellosolve acetate)—Skin	100	540
Ethyl acetate	400	1,400
Ethyl acrylate—Skin	25	100
Ethyl alcohol (ethanol)	1,000	1,900
Ethylamine	10	18
Ethyl sec-amy 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
O Ethyl mercaptan	10	25
Ethyl silicate	100	850
Ethylene chlorohydrin—Skin	5	16
Ethylene diamine	10	25
Ethylene dibromide, see 1,2-Dichloroethane		
Ethylene dichloride, see 1,2-Dichloroethane		
O Ethylene glycol dinitrate and/or Nitroglycerin—Skin	0.2	1
Ethylene glycol monomethyl ether acetate, see Methyl cellosolve acetate		
Ethyleneimine—Skin	0.5	1
Ethylene oxide	50	90
Ethylidene chloride, see 1,1-Dichloroethane		
N-Ethylmorpholine—Skin	20	94
Febam		15
Ferrovandium dust		1
Fluoride (as F)		2.5
Fluorine	0.1	0.2
Fluorotrichloromethane	1,000	5,600
Formic acid	5	9
Furfural—Skin	5	20
Furfuryl alcohol	50	200
Glycidol (2,3-Epoxy-1-propanol)	50	150
Glycol monoethyl ether, see 2-Ethoxyethanol		
Guthlon ®, see Azinphos-methyl		
Hafium		0.5
Heptachlor—Skin		0.5
Heptane (n-heptane)	500	2,000
Hexachloroethane—Skin	1	10
Hexachloronaphthalene—Skin		0.2
Hexane (n-hexane)	500	1,800
2-Hexanone	100	410
Hexone (Methyl isobutyl ketone)	100	410
sec-Hexyl acetate	50	300

See footnote at end of table.

TABLE Z-1—Continued

Substance	p.p.m.*	mg./m ³ †
Hydrazine—Skin	1	1.3
Hydrogen bromide	3	10
C Hydrogen chloride	5	7
Hydrogen cyanide—Skin	10	11
Hydrogen peroxide (90%)	1	1.4
Hydrogen selenide	0.05	0.2
Hydroquinone		2
C Iodine	0.1	1
Iron oxide fume		10
Isoamyl acetate	100	525
Isoamyl alcohol	100	260
Isobutyl acetate	150	700
Isobutyl alcohol	100	300
Isophorone	25	140
Isopropyl acetate	250	950
Isopropyl alcohol	400	980
Isopropylamine	5	12
Isopropylether	500	2,100
Isopropyl glycidyl ether (IGE)	50	240
Ketene	0.5	0.9
Lead arsenate		0.15
Lindane—Skin		0.5
Lithium hydride		0.125
L.P.G. (liquefied petroleum gas)	1,000	1,800
Magnesium oxide fume		15
Malathion—Skin		15
Maleic anhydride	0.25	1
C Manganese		5
Mesityl oxide	25	100
Methanethiol, see Methyl mercaptan		
Methoxychlor		15
2-Methoxyethanol, see Methyl cellosolve		
Methyl acetate	200	10
Methyl acetylene (propyne)	1,000	1,500
Methyl acetylene-propadiene mixture (MAPP)	1,000	1,500
Methyl acrylate—Skin	10	35
Methylal (dimethoxymethane)	1,000	3,100
Methyl alcohol (methanol)	200	260
Methylamine	10	12
Methyl amyl alcohol, see Methyl isobutyl carbinol		
Methyl (n-amy) ketone (2-Heptanone)	100	410
C Methyl bromide—Skin	20	80
Methyl butyl ketone, see 2-Hexanone		
Methyl cellosolve—Skin	25	80
Methyl cellosolve acetate—Skin	25	120
Methyl chloroform	350	1,900
Methylcyclohexane	500	2,000
Methylcyclohexanol	100	470
o-Methylcyclohexanone—Skin	100	460
Methyl ethyl ketone (MEK), see 2-Butanone		
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
C Methyl mercaptan	10	20
Methyl methacrylate	100	410
Methyl propyl ketone, see 2-Pentanone		
C α Methyl styrene	100	480
C Methylene bisphenyl isocyanate (MDI)	0.02	0.2
Molybdenum:		
Soluble compounds		5
Insoluble compounds		15
Monomethyl aniline—Skin	2	9
C Monomethyl hydrazine—Skin	0.2	0.35
Morpholine—Skin	20	70
Naphtha (coal tar)	100	400
Naphthalene	10	80

See footnotes at end of table.

TABLE Z-1—Continued

Substance	p.p.m.*	mg./M ³ b
ANTU (alpha naphthyl thiourea).....		0.3
Arsenic and compounds (as As).....		0.5
Arsine.....	0.05	0.2
Azinphos-methyl—Skin.....		0.2
Barium (soluble compounds).....		0.5
p-Benzquinone, see Quinone.....		
Benzoyl peroxide.....		5
Benzyl chloride.....	1	5
Biphenyl, see Diphenyl.....		
Bisphenol A, see Diglycidyl ether.....		
Boron oxide.....		15
C Boron trifluoride.....	1	3
Bromine.....	0.1	0.7
Bromoform—Skin.....	0.5	5
Butadiene (1, 3-butadiene).....	1,000	2,200
Butanethiol, see Butyl mercaptan.....		
2-Butanone.....	200	590
2-Butoxy ethanol (Butyl Cellosolve)—Skin.....	50	240
Butyl acetate (n-butyl acetate).....	150	710
sec-Butyl acetate.....	200	950
tert-Butyl acetate.....	200	950
Butyl alcohol.....	100	300
sec-Butyl alcohol.....	150	450
tert-Butyl alcohol.....	100	300
C Butylamine—Skin.....	5	15
C tert-Butyl chromate (as CrO ₃)—Skin.....		0.1
n-Butyl glycidyl ether (BGE).....	50	270
*Butyl mercaptan.....	10	35
p-tert-Butyltoluene.....	10	60
Calcium arsenate.....		1
Calcium oxide.....		5
**Camphor.....	2	5
Carbaryl (Sevin ®).....		5
Carbon black.....		3.5
Carbon dioxide.....	5,000	9,000
Carbon monoxide.....	50	55
Chlordane—Skin.....		0.5
Chlorinated camphene—Skin.....		0.5
Chlorinated diphenyl oxide.....		0.5
*Chlorine.....	1	3
Chlorine dioxide.....	0.1	0.3
C Chlorine trifluoride.....	0.1	0.4
C Chloroacetaldehyde.....	1	3
α-Chloroacetophenone (phenacylchloride).....	0.05	0.3
Chlorobenzene (monochlorobenzene).....	75	350
o-Chlorobenzyliden malononitrile (OCBM).....	0.05	0.4
Chlorobromomethane.....	200	1,070
2-Chloro-1,3-butadiene, see Chloroprene.....		
Chlorodiphenyl (42 percent Chlorine)—Skin.....		1
Chlorodiphenyl (54 percent Chlorine)—Skin.....		0.5
1-Chloro-2,3-epoxypropane, see Epichlorohydrin.....		
2-Chloroethanol, see Ethylene chlorohydrin.....		
Chloroethylene, see Vinyl chloride.....		
C Chloroform (trichloromethane).....	50	240
1-Chloro-1-nitropropane.....	20	100
Chloropicrin.....	0.1	0.7
Chloroprene (2-chloro-1,3-butadiene)—Skin.....	25	90
Chromium, sol. chromic, chromous salts as Cr.....		0.5
Metal and insol. salts.....		1

See footnotes at end of table.

TABLE Z-1—Continued

Substance	p.p.m.*	mg./M ³ b
Coal tar pitch volatiles (benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene.....		0.2
Cobalt, metal fume and dust.....		0.1
Copper fume.....		0.1
Dusts and Mists.....		1
Cotton dust (raw).....		1
Cragg herbicide.....		15
Cresol (all isomers)—Skin.....	5	22
Crotonaldehyde.....	2	6
Cumene—Skin.....	50	245
Cyanide (as CN)—Skin.....		5
Cyclohexane.....	300	1,050
Cyclohexanol.....	50	200
Cyclohexanone.....	50	200
Cyclohexene.....	300	1,015
Cyclopentadiene.....	75	200
2, 4-D.....		10
DDT—Skin.....		1
DDVP, see Dichlorvos.....		
Decahorane—Skin.....	0.05	0.3
Demeton®—Skin.....		0.1
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone).....	50	240
1,2-diaminoethane, see Ethylenediamine.....		
Diazomethane.....	0.2	0.4
Diborane.....	0.1	0.1
Dibutylphthalate.....		5
C o-Dichlorobenzene.....	50	300
p-Dichlorobenzene.....	75	450
Dichlorodifluoromethane.....	1,000	4,950
1,3-Dichloro-5,5-dimethyl hydantoin.....		0.2
1,1-Dichloroethane.....	100	400
1,2-Dichloroethylene.....	200	790
C Dichloroethyl ether—Skin.....	15	90
Dichloromethane, see Methylenechloride.....		
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.....		1
Dieldrin—Skin.....		0.25
Diethylamine.....	25	75
Diethylamino ethanol—Skin.....	10	50
Diethylether, see Ethyl ether.....		
Difluorodibromomethane.....	100	860
C Diglycidyl ether (DGE).....	0.5	2.5
Dihydroxybenzene, see Hydroquinone.....		
Diisobutyl ketone.....	50	290
Diisopropylamine—Skin.....	5	20
Dimethoxymethane, see Methylal.....		
Dimethyl acetamide—Skin.....	10	35
Dimethylamine.....	10	15
Dimethylaminobenzene, see Xylidene.....		
Dimethylaniline (N-dimethylaniline)—Skin.....	5	25
Dimethylbenzene, see Xylene.....		
Dimethyl 1,2-dithio-2,2-dichloroethyl phosphate, (Dibrom).....		3
Dimethylformamide—Skin.....	10	30
2,6-Dimethylheptanone, see Diisobutyl ketone.....		
1,1-Dimethylhydrazine—Skin.....	0.5	1
Dimethylphthalate.....		5
Dimethylsulfate—Skin.....	1	5
Dinitrobenzene (all isomers)—Skin.....		1

See footnotes at end of table.

work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(d) Computation formulae:

(1) (i) The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = \frac{C_1 T_1 + C_2 T_2 + \dots + C_n T_n}{8}$$

Where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time T where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C .

The value of E shall not exceed the 8-hour time weighted average limit in table Z-1, Z-2, or Z-3 for the material involved.

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, note that isoamyl acetate has an 8-hour time weighted average limit of 100 p.p.m. (table Z-1). Assume that an employee is subject to the following exposure:

Two hours exposure at 150 p.p.m.
Two hours exposure at 75 p.p.m.
Four hours exposure at 50 p.p.m.

Substituting this information in the formula, we have

$$\frac{2 \times 150 + 2 \times 75 + 4 \times 50}{8} = 81.25 \text{ p.p.m.}$$

Since 81.25 p.p.m. is less than 100 p.p.m., the 8-hour time weighted average limit, the exposure is acceptable.

(2) (i) In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \dots + \frac{C_n}{L_n}$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that contaminant, from table Z-1, Z-2, or Z-3.

The value of E_m shall not exceed unity (1).

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, consider the following exposures:

Material	Actual concentration of 8-hour exposure	8-hour time weighted average exposure limit
Acetone (Table Z-1).....	500 p.p.m.	1,000 p.p.m.
2-Butanone (Table Z-1)....	45 p.p.m.	200 p.p.m.
Toluene (Table Z-2).....	40 p.p.m.	200 p.p.m.

Substituting in the formula, we have:

$$E_m = \frac{500}{1,000} + \frac{45}{200} + \frac{40}{200}$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = 0.925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(e) To achieve compliance with paragraph (a) through (d) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with § 1910.134.

TABLE Z-1

Substance	p.p.m.*	mg./M ³ *
Acetaldehyde.....	200	360
Acetic acid.....	10	25
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	6
Allyl chloride.....	1	3
**C Allylglycidyl ether (AGE).....	10	45
Allyl propyl disulfide.....	2	12
7-Aminoethanol, see Ethanol-amine.....		
2-Aminopyridine.....	0.5	2
**Ammonia.....	50	35
Ammonium sulfate (Am-mate).....		15
n-Amyl acetate.....	100	525
sec-Amyl acetate.....	125	650
Aniline—Skin.....	6	19
Anisidine (o, p-isomers)—Skin.....		0.5
Antimony and compounds (as Sb).....		0.5

See footnotes at end of table.

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Subpart Z—Toxic and Hazardous Substances

SOURCE: 39 FR 23502, June 27, 1974, unless otherwise noted. Redesignated at 40 FR 27073, May 28, 1975.

§ 1910.1000 Air contaminants.

An employee's exposure to any material listed in table Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(a) Table Z-1:

(1) *Materials with names preceded by "C"—Ceiling Values.* An employee's exposure to any material in table Z-1, the name of which is preceded by a "C" (e.g., C Boron trifluoride), shall at no time exceed the ceiling value given for that material in the table.

(2) *Other materials—8-hour time weighted averages.* An employee's exposure to any material in table Z-1, the name of which is not preceded by "C", in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average given for that material in the table.

(b) Table Z-2:

(1) *8-hour time weighted averages.* An employee's exposure to any material listed in table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(2) *Acceptable ceiling concentrations.* An employee's exposure to a material listed in table Z-2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the material in the table, except for a time period, and up to a concentration not exceeding the maximum duration and concentration allowed in the column under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift".

(3) *Example.* During an 8-hour work shift, an employee may be exposed to a concentration of Benzene above 25 p.p.m. (but never above 50 p.p.m.) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 p.p.m. so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 p.p.m.

(c) Table Z-3: An employee's exposure to any material listed in table Z-3, in any 8-hour work shift of a 40-hour

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