

§1910.1000 Air Contaminants

An employee's exposure to any substance listed in Tables 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) "Substances with limits preceded by "C" - Ceiling Values." An employee's exposure to any substance in Table Z-1, the exposure limit of which is preceded by a "C", shall at no time exceed the exposure limit given for that substance. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day.

(2) "Other substances" - "8-hour Time Weighted Averages." An employee's exposure to any substance in Table Z-1, the exposure limit of which is not preceded by a "C", shall not exceed the 8-hour Time Weighted Average given for that substance any 8-hour work shift of a 40-hour work week.

1910.1000(b)

(b) "Table Z-2." An employee's exposure to any substance listed in Table Z-2 shall not exceed the exposure limits specified as follows:

1910.1000(b)(1)

(1) "8-hour time weighted averages." An employee's exposure to any substance 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 substance in Table Z-2.

(2) "Acceptable ceiling concentrations." An employee's exposure to a substance listed in Table Z-2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the substance 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 Substance A (with a 10 ppm TWA, 25 ppm ceiling and 50 ppm peak) above 25 ppm (but never above 50 ppm) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 ppm.

(c) "Table Z-3." An employee's exposure to any substance listed in Table Z-3, 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 substance in the table.

(d) "Computation formulae." The computation formula which shall apply to employee exposure to more than one substance for which 8-hour time weighted averages are listed in subpart Z of 29 CFR Part 1910 in order to determine whether an employee is exposed over the regulatory limit is as follows:

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

$$(E = C(a)T(a) + C(b)T(b) + \dots C(n)T(n)) \text{ divided by } 8$$

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 specified in Subpart Z or 29 CFR Part 1910 for the substance involved.

(ii) To illustrate the formula prescribed in paragraph (d)(1)(i) of this section, assume that Substance A has an 8-hour time weighted average limit of 100 ppm noted in Table Z-1. Assume that an employee is subject to the following exposure:

Two hours exposure at 150 ppm
Two hours exposure at 75 ppm
Four hours exposure at 50 ppm

Substituting this information in the formula, we have

$$(2 \times 150 + 2 \times 75 + 4 \times 50) \text{ divided by } 8 = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, 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:

$$E(m) = (C(1) \text{ divided by } L(1) + C(2) \text{ divided by } L(2)) + \dots (C(n) \text{ divided by } L(n))$$

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 substance specified in Subpart Z of 29 CFR Part 1910.

The value of E(m) shall not exceed unity (1).

(ii) To illustrate the formula prescribed in paragraph (d)(2)(i) of this section, consider the following exposures:

Substance	Actual concentration of 8-hour exposure (ppm)	8 hour TWA PEL (ppm)
B.....	500	1,000
C.....	45	200
D.....	40	200

Substituting in the formula, we have:

$$E(m) = 500 \text{ divided by } 1,000 + 45 \text{ divided by } 200 + 40 \text{ divided by } 200$$
$$E(m) = 0.500 + 0.225 + 0.200$$
$$E(m) = 0.925$$

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

(e) To achieve compliance with paragraphs (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.

(f) Effective dates. The exposure limits specified have been in effect with the method of compliance specified in paragraph (e) of this section since May 29, 1971.

TABLE Z-1 LIMITS FOR AIR CONTAMINANTS

NOTE: Because of the length of the table, explanatory Footnotes applicable to all substances are given below as well as at the end of the table. Footnotes specific only to a limited number of substances are also shown within the table.

Footnote (1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote (a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote (b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote (c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote (d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote (e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote (f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote (2) See Table Z-2.

Footnote (3) See Table Z-3

Footnote (4) Varies with compound.

TABLE Z-1. - LIMITS FOR AIR CONTAMINANTS

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3) (b)(1)	Skin designation
Acetaldehyde.....	75-07-0	200	360	
Acetic acid.....	64-19-7	10	25	
Acetic anhydride.....	108-24-7	5	20	
Acetone.....	67-64-1	1000	2400	
Acetonitrile.....	75-05-8	40	70	
2-Acetylaminofluorene; see 1910.1014.....	53-96-3			
Acetylene dichloride; see 1,2-Dichloroethylene.				
Acetylene tetrabromide.	79-27-6	1	14	
Acrolein.....	107-02-8	0.1	0.25	
Acrylamide.....	79-06-1	.....	0.3	X
Acrylonitrile; see 1910.1045.....	107-13-1			
Aldrin.....	309-00-2	.....	0.25	X
Allyl alcohol.....	107-18-6	2	5	X
Allyl chloride.....	107-05-1	1	3	
Allyl glycidyl ether... (AGE).....	106-92-3	(C)10	(C)45	
Allyl propyl disulfide.	2179-59-1	2	12	
alpha-Alumina.....	1344-28-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Aluminum Metal (as Al).	7429-90-5			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
4-Aminodiphenyl; see 1910.1011.....	92-67-1			
2-Aminoethanol; see Ethanolamine.....				
2-Aminopyridine.....	504-29-0	0.5	2	
Ammonia.....	7664-41-7	50	35	
Ammonium sulfamate.....	7773-06-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
n-Amyl acetate.....	628-63-7	100	525	
sec-Amyl acetate.....	626-38-0	125	650	
Aniline and homologs...	62-53-3	5	19	X
Anisidine (o-,p-isomers).....	29191-52-4	.....	0.5	X
Antimony and compounds (as Sb).....	7440-36-0	.....	0.5	
ANTU (alpha Naphthylthiourea)....	86-88-4	.....	0.3	
Arsenic, inorganic compounds (as As); see 1910.1018.....	7440-38-2			
Arsenic, organic compounds (as As)....	7440-38-2	.....	0.5	
Arsine.....	7784-42-1	0.05	0.2	
Asbestos; see 1910.1001.....	(4)			
Azinphos-methyl.....	86-50-0	.....	0.2	X
Barium, soluble compounds (as Ba)....	7440-39-3	.....	0.5	
Barium sulfate.....	7727-43-7			
Total dust.....		.....	15	
Respirable fraction..		.....	5	

Benomyl.....	17804-35-2				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Benzene; See 1910.1028.	71-43-2				
See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028(d)					
Benzidine;					
See 1910.1010.....	92-87-5				
p-Benzoquinone;					
see Quinone.					
Benzo(a)pyrene; see Coal tar pitch volatiles.....					
Benzoyl peroxide.....	94-36-0	.....		5	
Benzyl chloride.....	100-44-7	1		5	
Beryllium and beryllium compounds (as Be).....	7440-41-7			(2)	
Biphenyl; see Diphenyl.					
Bismuth telluride, Undoped.....	1304-82-1				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Boron oxide.....	1303-86-2				
Total dust.....		.....		15	
Boron trifluoride.....	7637-07-2	(C)1		(C)3	
Bromine.....	7726-95-6	0.1		0.7	
Bromoform.....	75-25-2	0.5		5	X
Butadiene (1,3-Butadiene).....	106-99-0	1000		2200	
Butanethiol; see Butyl mercaptan.					
2-Butanone (Methyl ethyl ketone)	78-93-3	200		590	
2-Butoxyethanol.....	111-76-2	50		240	X
n-Butyl-acetate.....	123-86-4	150		710	
sec-Butyl acetate.....	105-46-4	200		950	
tert-Butyl-acetate.....	540-88-5	200		950	
n-Butyl alcohol.....	71-36-3	100		300	
sec-Butyl alcohol.....	78-92-2	150		450	
tert-Butyl alcohol.....	75-65-0	100		300	
Butylamine.....	109-73-9	(C)5		(C)15	X
tert-Butyl chromate (as CrO(3)).....	1189-85-1	.....		(C)0.1	X
n-Butyl glycidyl ether (BGE).....	2426-08-6	50		270	
Butyl mercaptan.....	109-79-5	10		35	
p-tert-Butyltoluene....	98-51-1	10		60	
Cadmium (as Cd); see 1910.1027.....	7440-43-9				
Calcium Carbonate.....	1317-65-3				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Calcium hydroxide.....	1305-62-0				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Calcium oxide.....	1305-78-8	.....		5	
Calcium silicate.....	1344-95-2				
Total dust.....		.....		15	
Respirable fraction..		.....		5	

Calcium sulfate.....	7778-18-9				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Camphor, synthetic.....	76-22-2	.....		2	
Carbaryl (Sevin).....	63-25-2	.....		5	
Carbon black.....	1333-86-4	.....		3.5	
Carbon dioxide.....	124-38-9	5000		9000	
Carbon disulfide.....	75-15-0			(2)	
Carbon monoxide.....	630-08-0	50		55	
Carbon tetrachloride...	56-23-5			(2)	
Cellulose.....	9004-34-6				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Chlordane.....	57-74-9	.....		0.5	X
Chlorinated camphene...	8001-35-2	.....		0.5	X
Chlorinated diphenyl oxide.....	55720-99-5	.....		0.5	
Chlorine.....	7782-50-5	(C)1		(C)3	
Chlorine dioxide.....	10049-04-4	0.1		0.3	
Chlorine trifluoride...	7790-91-2	(C)0.1		(C)0.4	
Chloroacetaldehyde.....	107-20-0	(C)1		(C)3	
a-Chloroacetophenone (Phenacyl chloride)..	532-27-4	0.05		0.3	
Chlorobenzene.....	108-90-7	75		350	
o-Chlorobenzylidene malononitrile.....	2698-41-1	0.05		0.4	
Chlorobromomethane.....	74-97-5	200		1050	
2-Chloro-1,3-butadiene; See beta-Chloroprene.					
Chlorodiphenyl (42% Chlorine)(PCB)..	53469-21-9	.....		1	X
Chlorodiphenyl (54% Chlorine)(PCB)..	11097-69-1	.....		0.5	X
1-Chloro-2, 3-epoxypropane; See Epichlorohydrin.					
2-Chloroethanol; See Ethylene chlorohydrin					
Chloroethylene; See Vinyl chloride.					
Chloroform (Trichloromethane)...	67-66-3	(C)50		(C)240	
bis(Chloromethyl) ether; see 1910.1008.	542-88-1				
Chloromethyl methyl ether; see 1910.1006.	107-30-2				
1-Chloro-1-nitropropane	600-25-9	20		100	
Chloropicrin.....	76-06-2	0.1		0.7	
beta-Chloroprene.....	126-99-8	25		90	X
2-Chloro-6 (trichloromethyl) pyridine.....	1929-82-4				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Chromic acid and chromates (as CrO(3))	(4)			(2)	
Chromium (II) compounds (as Cr).....	7440-47-3	.....		0.5	
Chromium (III) compounds (as Cr)....	7440-47-3	.....		0.5	
Chromium metal and insol. salts (as Cr).	7440-47-3	.....		1	
Chrysene; see Coal tar pitch volatiles.....					

Clopidol.....	2971-90-6				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Coal dust (less than 5% SiO(2)), respirable fraction..				(3)	
Coal dust (greater than or equal to 5% SiO(2)), respirable fraction.....				(3)	
Coal tar pitch volatiles (benzene soluble fraction), anthracene, BaP, phenanthrene, acridine, chrysene, pyrene.....	65966-93-2	.....		0.2	
Cobalt metal, dust, and fume (as Co).....	7440-48-4	.....		0.1	
Coke oven emissions; see 1910.1029.....					
Copper.....	7440-50-8				
Fume (as Cu).....		.....		0.1	
Dusts and mists (as Cu).....		.....		1	
Cotton dust (e), see 1910.1043.....		.....		1	
Crag herbicide (Sesone)	136-78-7				
Total dust.....		.....		15	
Respirable fraction..		.....		5	
Cresol, all isomers....	1319-77-3	5		22	X
Crotonaldehyde.....	123-73-9	2		6	
	4170-30-3				
Cumene.....	98-82-8	50		245	X
Cyanides (as CN).....	(4)	.....		5	
Cyclohexane.....	110-82-7	300		1050	
Cyclohexanol.....	108-93-0	50		200	
Cyclohexanone.....	108-94-1	50		200	
Cyclohexene.....	110-83-8	300		1015	
Cyclopentadiene.....	542-92-7	75		200	
2,4-D (Dichlorophen- oxyacetic acid).....	94-75-7	.....		10	
Decaborane.....	17702-41-9	0.05		0.3	X
Demeton (Systox).....	8065-48-3	.....		0.1	X
Diacetone alcohol (4-Hydroxy-4-methyl- 2-pentanone).....	123-42-2	50		240	
1,2-Diaminoethane; see Ethylenediamine..					
Diazomethane.....	334-88-3	0.2		0.4	
Diborane.....	19287-45-7	0.1		0.1	
1,2-Dibromo-3- chloropropane (CBCP); see 1910.1044.....	96-12-8				
1,2-Dibromoethane; see Ethylenedibromide...					
Dibutyl phosphate.....	107-66-4	1		5	
Dibutyl phthalate.....	84-74-2	.....		5	
o-Dichlorobenzene.....	95-50-1	(C)50		(C)300	
p-Dichlorobenzene.....	106-46-7	75		450	
3,3'-Dichlorobenzidine; see 1910.1007.....	91-94-1				
Dichlorodifluoromethane	75-71-8	1000		4950	
1,3-Dichloro-5, 5-dimethyl hydantoin.	118-52-5	.....		0.2	

Dichlorodiphenyltri- chloroethane (DDT)...	50-29-3	.....	1	X
1,1-Dichloroethane.....	75-34-3	100	400	
1,2-Dichloroethane; see Ethylene dichloride..				
1,2-Dichloroethylene...	540-59-0	200	790	
Dichloroethyl ether....	111-44-4	(C)15	(C)90	X
Dichloromethane; see Methylene chloride...				
Dichloromonofluoro- methane.....	75-43-4	1000	4200	
1,1-Dichloro-1- nitroethane.....	594-72-9	(C)10	(C)60	
1,2-Dichloropropane; see Propylene dichloride.				
Dichlorotetrafluoro- ethane.....	76-14-2	1000	7000	
Dichlorvos (DDVP).....	62-73-7	.....	1	X
Dicyclopentadienyl iron Total dust.....	102-54-5	.....	15	
Respirable fraction..		.....	5	
Dieldrin.....	60-57-1	.....	0.25	X
Diethylamine.....	109-89-7	25	75	
2-Diethylaminoethanol..	100-37-8	10	50	X
Diethyl ether; see Ethyl ether.....				
Difluorodibromomethane.	75-61-6	100	860	
Diglycidyl ether (DGE).	2238-07-5	(C)0.5	(C)2.8	
Dihydroxybenzene; see Hydroquinone.....				
Diisobutyl ketone.....	108-83-8	50	290	
Diisopropylamine.....	108-18-9	5	20	X
4-Dimethylaminoazo- benzene; see 1910.1015.....	60-11-7			
Dimethoxymethane; see Methylal.....				
Dimethyl acetamide.....	127-19-5	10	35	X
Dimethylamine.....	124-40-3	10	18	
Dimethylaminobenzene; see Xylidine.....				
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene; see Xylene.....				
Dimethyl-1,2-dibromo-2, 2-dichloroethyl phosphate.....	300-76-5	.....	3	
Dimethylformamide.....	68-12-2	10	30	X
2,6-Dimethyl-4- heptanone; see Diisobutyl ketone....				
1,1-Dimethylhydrazine..	57-14-7	0.5	1	X
Dimethylphthalate.....	131-11-3	.....	5	
Dimethyl sulfate.....	77-78-1	1	5	X
Dinitrobenzene (all isomers).....			1	X
(ortho).....	528-29-0			
(meta).....	99-65-0			
(para).....	100-25-4			
Dinitro-o-cresol.....	534-52-1	.....	0.2	X
Dinitrotoluene.....	25321-14-6	.....	1.5	X
Dioxane (Diethylene dioxide).	123-91-1	100	360	X
Diphenyl (Biphenyl)....	92-52-4	0.2	1	

Diphenylmethane diisocyanate; see Methylene bisphenyl isocyanate.....				
Dipropylene glycol methyl ether.....	34590-94-8	100	600	X
Di-sec octyl phthalate (Di-(2-ethylhexyl) phthalate).....	117-81-7	.....	5	
Emery.....	12415-34-8	.....	15	
Total dust.....		.....	5	
Respirable fraction..		.....	0.1	X
Endosulfan.....	115-29-7	.....	0.1	X
Endrin.....	72-20-8	.....	19	X
Epichlorohydrin.....	106-89-8	5	0.5	X
EPN.....	2104-64-5	.....	
1,2-Epoxypropane; see Propylene oxide.....				
2,3-Epoxy-1-propanol; see Glycidol.....				
Ethanethiol; see Ethyl mercaptan.....				
Ethanolamine.....	141-43-5	3	6	
2-Ethoxyethanol (Cellosolve).....	110-80-5	200	740	X
2-Ethoxyethyl acetate (Cellosolve acetate)..	111-15-9	100	540	X
Ethyl acetate.....	141-78-6	400	1400	
Ethyl acrylate.....	140-88-5	25	100	X
Ethyl alcohol (Ethanol)	64-17-5	1000	1900	
Ethylamine.....	75-04-7	10	18	
Ethyl amyl ketone (5-Methyl-3-heptanone).....	541-85-5	25	130	
Ethyl benzene.....	100-41-4	100	435	
Ethyl bromide.....	74-96-4	200	890	
Ethyl butyl ketone (3-Heptanone).....	106-35-4	50	230	
Ethyl chloride.....	75-00-3	1000	2600	
Ethyl ether.....	60-29-7	400	1200	
Ethyl formate.....	109-94-4	100	300	
Ethyl mercaptan.....	75-08-1	(C)10	(C)25	
Ethyl silicate.....	78-10-4	100	850	
Ethylene chlorohydrin..	107-07-3	5	16	X
Ethylenediamine.....	107-15-3	10	25	
Ethylene dibromide....	106-93-4		(2)	
Ethylene dichloride (1,2-Dichloroethane)..	107-06-2		(2)	
Ethylene glycol dinitrate.....	628-96-6	(C)0.2	(C)1	X
Ethylene glycol methyl acetate; see Methyl cellosolve acetate...				
Ethyleneimine; see 1910.1012.....	151-56-4			
Ethylene oxide; see 1910.1047.....	75-21-8			
Ethylidene chloride; see 1,1-Dichloroethane				
N-Ethylmorpholine.....	100-74-3	20	94	X
Ferbam.....	14484-64-1		15	
Total dust.....		.....	1	
Ferrovandium dust.....	12604-58-9	.....	2.5	
Fluorides (as F).....	(4)	.....	0.2	
Fluorine.....	7782-41-4	0.1		

Fluorotrichloromethane (Trichloro- fluoromethane).....	75-69-4	1000	5600	
Formaldehyde; see 1910.1048.....	50-00-0			
Formic acid.....	64-18-6	5	9	
Furfural.....	98-01-1	5	20	X
Furfuryl alcohol.....	98-00-0	50	200	
Grain dust (oat, wheat barley).....	.....	.....	10	
Glycerin (mist).....	56-81-5			
Total dust.....	.....	.....	15	
Respirable fraction..	.....	.....	5	
Glycidol.....	556-52-5	50	150	
Glycol monoethyl ether; see 2-Ethoxyethanol..				
Graphite, natural respirable dust.....	7782-42-5		(3)	
Graphite, synthetic....				
Total dust.....	.....	.....	15	
Respirable Fraction..	.....	.....	5	
Guthion; see Azinphos methyl..				
Gypsum.....	13397-24-5			
Total dust.....	.....	.....	15	
Respirable fraction..	.....	.....	5	
Hafnium.....	7440-58-6	.....	0.5	
Heptachlor.....	76-44-8	.....	0.5	X
Heptane (n-Heptane)....	142-82-5	500	2000	
Hexachloroethane.....	67-72-1	1	10	X
Hexachloronaphthalene..	1335-87-1	.....	0.2	X
n-Hexane.....	110-54-3	500	1800	
2-Hexanone (Methyl n-butyl ketone).....	591-78-6	100	410	
Hexone (Methyl isobutyl ketone).....	108-10-1	100	410	
sec-Hexyl acetate.....	108-84-9	50	300	
Hydrazine.....	302-01-2	1	1.3	X
Hydrogen bromide.....	10035-10-6	3	10	
Hydrogen chloride.....	7647-01-0	(C)5	(C)7	
Hydrogen cyanide.....	74-90-8	10	11	X
Hydrogen fluoride (as F).....	7664-39-3		(2)	
Hydrogen peroxide.....	7722-84-1	1	1.4	
Hydrogen selenide (as Se).....	7783-07-5	0.05	0.2	
Hydrogen sulfide.....	7783-06-4		(2)	
Hydroquinone.....	123-31-9	.....	2	
Iodine.....	7553-56-2	(C)0.1	(C)1	
Iron oxide fume.....	1309-37-1	.....	10	
Isomyl acetate.....	123-92-2	100	525	
Isomyl alcohol (primary and secondary).....	123-51-3	100	360	
Isobutyl acetate.....	110-19-0	150	700	
Isobutyl alcohol.....	78-83-1	100	300	
Isophorone.....	78-59-1	25	140	
Isopropyl acetate.....	108-21-4	250	950	
Isopropyl alcohol.....	67-63-0	400	980	
Isopropylamine.....	75-31-0	5	12	
Isopropyl ether.....	108-20-3	500	2100	
Isopropyl glycidyl ether (IGE).....	4016-14-2	50	240	
Kaolin.....	1332-58-7			
Total dust.....	.....	.....	15	
Respirable fraction..	.....	.....	5	

Ketene.....	463-51-4	0.5	0.9	
Lead inorganic (as Pb); see 1910.1025.....	7439-92-1			
Limestone.....	1317-65-3			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Lindane.....	58-89-9	.....	0.5	X
Lithium hydride.....	7580-67-8	.....	0.025	
L.P.G. (Liquified petroleum gas).....	68476-85-7	1000	1800	
Magnesite.....	546-93-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Magnesium oxide fume...	1309-48-4			
Total Particulate....		.....	15	
Malathion.....	121-75-5			
Total dust.....		.....	15	X
Maleic anhydride.....	108-31-6	0.25	1	
Manganese compounds (as Mn).....	7439-96-5	.....	(C)5	
Manganese fume (as Mn)..	7439-96-5	.....	(C)5	
Marble.....	1317-65-3			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Mercury (aryl and inorganic)(as Hg)....	7439-97-6		(2)	
Mercury (organo) alkyl compounds (as Hg)....	7439-97-6		(2)	
Mercury (vapor) (as Hg)	7439-97-6		(2)	
Mesityl oxide.....	141-79-7	25	100	
Methanethiol; see Methyl mercaptan.				
Methoxychlor.....	72-43-5			
Total dust.....		.....	15	
2-Methoxyethanol; (Methyl cellosolve)..	109-86-4	25	80	X
2- Methoxyethyl acetate (Methyl cellosolve acetate).....	110-49-6	25	120	X
Methyl acetate.....	79-20-9	200	610	
Methyl acetylene (Propyne).....	74-99-7	1000	1650	
Methyl acetylene propadiene mixture (MAPP).....		1000	1800	
Methyl acrylate.....	96-33-3	10	35	X
Methylal (Dimethoxy-methane)..	109-87-5	1000	3100	
Methyl alcohol.....	67-56-1	200	260	
Methylamine.....	74-89-5	10	12	
Methyl amyl alcohol; see Methyl Isobutyl carbinol.....				
Methyl n-amyl ketone...	110-43-0	100	465	
Methyl bromide.....	74-83-9	(C)20	(C)80	X
Methyl butyl ketone; see 2-Hexanone.....				
Methyl cellosolve; see 2-Methoxyethanol.				
Methyl cellosolve acetate; see 2-Methoxyethyl acetate.....				
Methyl chloride.....	74-87-3		(2)	

Methyl chloroform (1,1,1-Trichloro- ethane).....	71-55-6	350	1900	
Methylcyclohexane.....	108-87-2	500	2000	
Methylcyclohexanol.....	25639-42-3	100	470	
o-Methylcyclohexanone..	583-60-8	100	460	X
Methylene chloride.....	75-09-2		(2)	
Methyl ethyl ketone (MEK); see 2-Butanone				
Methyl formate.....	107-31-3	100	250	
Methyl hydrazine (Monomethyl hydrazine).....	60-34-4	(C)0.2	(C)0.35	X
Methyl iodide.....	74-88-4	5	28	X
Methyl isoamyl ketone..	110-12-3	100	475	
Methyl isobutyl carbinol.....	108-11-2	25	100	X
Methyl isobutyl ketone; see Hexone.....				
Methyl isocyanate.....	624-83-9	0.02	0.05	X
Methyl mercaptan.....	74-93-1	(C)10	(C)20	
Methyl methacrylate....	80-62-6	100	410	
Methyl propyl ketone; see 2-Pentanone.....				
alpha-Methyl styrene...	98-83-9	(C)100	(C)480	
Methylene bisphenyl isocyanate (MDI).....	101-68-8	(C)0.02	(C)0.2	
Mica; see Silicates....				
Molybdenum (as Mo).....	7439-98-7		5	
Soluble compounds....				
Insoluble Compounds				
Total dust.....			15	
Monomethyl aniline.....	100-61-8	2	9	X
Monomethyl hydrazine; see Methyl hydrazine.				
Morpholine.....	110-91-8	20	70	X
Naphtha (Coal tar).....	8030-30-6	100	400	
Naphthalene.....	91-20-3	10	50	
alpha-Naphthylamine; see 1910.1004.....	134-32-7			
beta-Naphthylamine; see 1910.1009.....	91-59-8			
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	
Nickel, metal and insoluble compounds (as Ni).....	7440-02-0		1	
Nickel, soluble compounds (as Ni)....	7440-02-0		1	
Nicotine.....	54-11-5		0.5	X
Nitric acid.....	7697-37-2	2	5	
Nitric oxide.....	10102-43-9	25	30	
p-Nitroaniline.....	100-01-6	1	6	X
Nitrobenzene.....	98-95-3	1	5	X
p-Nitrochlorobenzene...	100-00-5		1	X
4-Nitrodiphenyl; see 1910.1003.....	92-93-3			
Nitroethane.....	79-24-3	100	310	
Nitrogen dioxide.....	10102-44-0	(C)5	(C)9	
Nitrogen trifluoride...	7783-54-2	10	29	
Nitroglycerin.....	55-63-0	(C)0.2	(C)2	X
Nitromethane.....	75-52-5	100	250	
1-Nitropropane.....	108-03-2	25	90	
2-Nitropropane.....	79-46-9	25	90	
N-Nitrosodimethylamine; see 1910.1016				

Nitrotoluene					
(all isomers).....		5	30		X
o-isomer.....	88-72-2				
m-isomer.....	99-08-1				
p-isomer.....	99-99-0				
Nitrotrichloromethane; see Chloropicrin.....					
Octachloronaphthalene..	2234-13-1	.....	0.1		X
Octane.....	111-65-9	500	2350		
Oil mist, mineral.....	8012-95-1	.....	5		
Osmium tetroxide (as Os).....	20816-12-0	.....	0.002		
Oxalic acid.....	144-62-7	.....	1		
Oxygen difluoride.....	7783-41-7	0.05	0.1		
Ozone.....	10028-15-6	0.1	0.2		
Paraquat, respirable dust.....	4685-14-7	.....	0.5		X
	1910-42-5				
	2074-50-2				
Parathion.....	56-38-2	.....	0.1		X
Particulates not otherwise regulated (PNOR)(f).....					
Total dust.....		.....	15		
Respirable fraction..		.....	5		
PCB; see Chlorodiphenyl (42% and 54% chlorine).....					
Pentaborane.....	19624-22-7	0.005	0.01		
Pentachloronaphthalene..	1321-64-8	.....	0.5		X
Pentachlorophenol.....	87-86-5	.....	0.5		X
Pentaerythritol.....	115-77-5				
Total dust.....		.....	15		
Respirable fraction..		.....	5		
Pentane.....	109-66-0	1000	2950		
2-Pentanone (Methyl propyl ketone).....	107-87-9	200	700		
Perchloroethylene (Tetrachloroethylene)	127-18-4		(2)		
Perchloromethyl mercaptan.....	594-42-3	0.1	0.8		
Perchloryl fluoride....	7616-94-6	3	13.5		
Perlite.....	93763-70-3				
Total dust.....		.....	15		
Respirable fraction..		.....	5		
Petroleum distillates (Naphtha)(Rubber Solvent).....		500	2000		
Phenol.....	108-95-2	5	19		X
p-Phenylene diamine....	106-50-3	.....	0.1		X
Phenyl ether, vapor....	101-84-8	1	7		
Phenyl ether-biphenyl mixture, vapor.....		1	7		
Phenylethylene; see Styrene.....					
Phenyl glycidyl ether (PGE).....	122-60-1	10	60		
Phenylhydrazine.....	100-63-0	5	22		X
Phosdrin (Mevinphos)...	7786-34-7	.....	0.1		X
Phosgene (Carbonyl chloride).....	75-44-5	0.1	0.4		
Phosphine.....	7803-51-2	0.3	0.4		
Phosphoric acid.....	7664-38-2	.....	1		
Phosphorus (yellow)....	7723-14-0	.....	0.1		
Phosphorus pentachloride.....	10026-13-8	.....	1		

Phosphorus pentasulfide	1314-80-3	.....	1	
Phosphorus trichloride.	7719-12-2	0.5	3	
Phthalic anhydride.....	85-44-9	2	12	
Picloram.....	1918-02-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Picric acid.....	88-89-1	.....	0.1	X
Pindone (2-Pivalyl-1, 3-indandione).....	83-26-1	.....	0.1	
Plaster of paris.....	26499-65-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Platinum (as Pt).....	7440-06-4			
Metal.....		.....	.....
Soluble Salts.....		.....	0.002	
Portland cement.....	65997-15-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Propane.....	74-98-6	1000	1800	
beta-Propriolactone; see 1910.1013.....	57-57-8			
n-Propyl acetate.....	109-60-4	200	840	
n-Propyl alcohol.....	71-23-8	200	500	
n-Propyl nitrate.....	627-13-4	25	110	
Propylene dichloride...	78-87-5	75	350	
Propylene imine.....	75-55-8	2	5	X
Propylene oxide.....	75-56-9	100	240	
Propyne; see Methyl acetylene.....				
Pyrethrum.....	8003-34-7	.....	5	
Pyridine.....	110-86-1	5	15	
Quinone.....	106-51-4	0.1	0.4	
RDX: see Cyclonite.....				
Rhodium (as Rh), metal fume and insoluble compounds.....	7440-16-6	.....	0.1	
Rhodium (as Rh), soluble compounds....	7440-16-6	.....	0.001	
Ronnell.....	299-84-3	.....	15	
Rotenone.....	83-79-4	.....	5	
Rouge.....				
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Selenium compounds (as Se).....	7782-49-2	.....	0.2	
Selenium hexafluoride (as Se).....	7783-79-1	0.05	0.4	
Silica, amorphous, precipitated and gel.	112926-00-8		(3)	
Silica, amorpous, diatomaceous earth, containing less than 1% crystalline silica	61790-53-2		(3)	
Silica, crystalline cristobalite, respirable dust.....	14464-46-1		(3)	
Silica, crystalline quartz, respirable dust.....	14808-60-7		(3)	
Silica, crystalline tripoli (as quartz), respirable dust.....	1317-95-9		(3)	
Silica, crystalline tridymite, respirable dust.....	15468-32-3		(3)	

Silica, fused, respirable dust.....	60676-86-0		(3)	
Silicates (less than 1% crystalline silica)				
Mica (respirable dust).....	12001-26-2		(3)	
Soapstone, total dust			(3)	
Soapstone, respirable dust.....			(3)	
Talc (containing asbestos): use asbestos limit: see 29 CFR 1910.1001.....			(3)	
Talc (containing no asbestos), respirable dust.....	14807-96-6		(3)	
Tremolite, asbestiform; see 1910.1001.....				
Silicon.....	7440-21-3			
Total dust.....			15	
Respirable fraction..			5	
Silicon carbide.....	409-21-2			
Total dust.....			15	
Respirable fraction..			5	
Silver, metal and soluble compounds (as Ag).....	7440-22-4		0.01	
Soapstone; see Silicates.....				
Sodium fluoroacetate...	62-74-8		0.05	X
Sodium hydroxide.....	1310-73-2		2	
Starch.....	9005-25-8			
Total dust.....			15	
Respirable fraction..			5	
Stibine.....	7803-52-3	0.1	0.5	
Stoddard solvent.....	8052-41-3	500	2900	
Strychnine.....	57-24-9		0.15	
Styrene.....	100-42-5		(2)	
Sucrose.....	57-50-1			
Total dust.....			15	
Respirable fraction..			5	
Sulfur dioxide.....	7446-09-5	5	13	
Sulfur hexafluoride....	2551-62-4	1000	6000	
Sulfuric acid.....	7664-93-9		1	
Sulfur monochloride....	10025-67-9	1	6	
Sulfur pentafluoride...	5714-22-7	0.025	0.25	
Sulfuryl fluoride.....	2699-79-8	5	20	
Systox; see Demeton...				
2,4,5-T (2,4,5-tri- chlorophenoxyacetic acid).....	93-76-5		10	
Talc; see Silicates...				
Tantalum, metal and oxide dust.....	7440-25-7		5	
TEDP (Sulfotep).....	3689-24-5		0.2	X
Tellurium and compounds (as Te)....	13494-80-9		0.1	
Tellurium hexafluoride (as Te).....	7783-80-4	0.02	0.2	
Temephos.....	3383-96-8			
Total dust.....			15	
Respirable fraction..			5	
TEPP (Tetraethyl pyrophosphaate).....	107-49-3		0.05	X

Terphenylis.....	26140-60-3	(C)1	(C)9	
1,1,1,2-Tetrachloro-2, 2-difluoroethane.....	76-11-9	500	4170	
1,1,2,2-Tetrachloro-1, 2-difluoroethane.....	76-12-0	500	4170	
1,1,2,2-Tetrachloro- ethane.....	79-34-5	5	35	X
Tetrachoroethylene; see Perchloroethylene				
Tetrachloromethane; see Carbon tetrachloride.				
Tetrachloronaphthalene.	1335-88-2	.....	2	X
Tetraethyl lead (as Pb)	78-00-2	.....	0.075	X
Tetrahydrofuran.....	109-99-9	200	590	
Tetramethyl lead, (as Pb).....	75-74-1	.....	0.075	X
Tetramethyl succinonitrile.....	3333-52-6	0.5	3	X
Tetranitromethane.....	509-14-8	1	8	
Tetryl (2,4,6-Trinitro- phenylmethyl- nitramine).....	479-45-8	.....	1.5	X
Thallium, soluble compounds (as Tl)....	7440-28-0	.....	0.1	X
4,4'-Thiobis(6-tert, Butyl-m-cresol).....	96-69-5			
Total dust.....			15	
Respirable fraction..			5	
Thiram.....	137-26-8		5	
Tin, inorganic compounds (except oxides) (as Sn).....	7440-31-5	.....	2	
Tin, organic compounds (as Sn).....	7440-31-5	.....	0.1	
Titanium dioxide.....	13463-67-7			
Total dust.....			15	
Toluene.....	108-88-3		(2)	
Toluene-2, 4-diisocyanate (TDI)..	584-84-9	(C)0.02	(C)0.14	
o-Toluidine.....	95-53-4	5	22	X
Toxaphene; see Chlorinated camphene.				
Tremolite; see Silicates.....				
Tributyl phosphate.....	126-73-8	.....	5	
1,1,1-Trichloroethane; see Methyl chloroform				
1,1,2-Trichloroethane..	79-00-5	10	45	X
Trichloroethylene.....	79-01-6		(2)	
Trichloromethane; see Chloroform				
Trichloronaphthalene...	1321-65-9	.....	5	X
1,2,3-Trichloropropane.	96-18-4	50	300	
1,1,2-Trichloro-1,2, 2-trifluoroethane....	76-13-1	1000	7600	
Triethylamine.....	121-44-8	25	100	
Trifluorobromomethane..	75-63-8	1000	6100	
2,4,6-Trinitrophenyl; see Picric acid.....				
2,4,6-Trinitrophenyl- methyl nitramine; see Tetryl.....				
2,4,6-Trinitrotoluene (TNT).....	118-96-7	.....	1.5	X
Triorthocresyl phosphate.....	78-30-8	.....	0.1	

Triphenyl phosphate....	115-86-6	.....	3	
Turpentine.....	8006-64-2	100	560	
Uranium (as U).....	7440-61-1			
Soluble compounds....		.....	0.05	
Insoluble compounds..		.....	0.05	
Vanadium.....	1314-62-1			
Respirable dust				
(as V(2)O(5)).....		.....	(C)0.5	
Fume (as V(2)O(5))...		.....	(C)0.1	
Vegetable oil mist.....				
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Vinyl benzene;				
see Styrene.....				
Vinyl chloride;				
see 1910.1017.....	75-01-4			
Vinyl cyanide;				
see Acrylonitrile				
Vinyl toluene.....	25013-15-4	100	480	
Warfarin.....	81-81-2	.....	0.1	
Xylenes				
(o-, m-, p-isomers)..	1330-20-7	100	435	
Xylidine.....	1300-73-8	5	25	X
Yttrium.....	7440-65-5	.....	1	
Zinc chloride fume.....	7646-85-7	.....	1	
Zinc oxide fume.....	1314-13-2	.....	5	
Zinc oxide.....	1314-13-2			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Zinc stearate.....	557-05-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Zirconium compounds				
(as Zr).....	7440-67-7	.....	5	

Footnote (1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote (a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote (b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote (c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote (d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted

subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote (e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote (f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote (2) See Table Z-2.

Footnote (3) See Table Z-3

Footnote (4) Varies with compound.

[54 FR 36767, Sept. 5, 1989; 54 FR 41244, Oct. 6, 1989; 55 FR 3724, Feb. 5, 1990; 55 FR 12819, Apr 6, 1990; 55 FR 19259, May 9, 1990; 55 FR 46950, Nov. 8, 1990; 57 FR 29204, July 1, 1992; 57 FR 42388, Sept. 14, 1992; 58 FR 35340, June 30, 1993]

1910.1000 TABLE Z-2

Substance	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift	
			Concentra- tion	Maximum duration
Benzene(a) (Z37.40-1969).....	10 ppm.....	25 ppm.....	50 ppm.....	10 minutes.
Beryllium and beryllium compounds (Z37.29-1970).....	2 ug/m(3)...	5 ug/m(3)...	25 ug/m(3).	30 minutes.
Cadmium fume(b) (Z37.5-1970).....	0.1 mg/m(3).	0.3 mg/m(3).	.....
Cadmium dust(b) (Z37.5-1970).....	0.2 mg/m(3).	0.6 mg/m(3).		
Carbon disulfide (Z37.3-1968).....	20 ppm.....	30 ppm.....	100 ppm....	30 minutes.
Carbon tetrachloride (Z37.17-1967).....	10 ppm.....	25 ppm.....	200 ppm....	5 min. in any 4 hrs.
Chromic acid and chromates (Z37-7-1971).....	.....	1 mg/10 m(3)		
Ethylene dibromide (Z37.31-1970).....	20 ppm.....	30 ppm.....	50 ppm.....	5 minutes.
Ethylene dichloride (Z37.21-1969).....	50 ppm.....	100 ppm.....	200 ppm....	5 min. in any 3 hrs.
Fluoride as dust (Z37.28-1969).....	2.5 mg/m(3).	.....	.....
Formaldehyde: see 1910.1048.....	.....	.....	.....
Hydrogen fluoride (Z37.28-1969).....	3 ppm.....	.....	.....
Hydrogen sulfide (Z37.2-1966).....	.....	20 ppm.....	50 ppm.....	10 mins. once only if no other meas. exp. occurs.
Mercury (Z37.8-1971).....	.....	1 mg/10m(3).	.....
Methyl chloride (Z37.18-1969).....	100 ppm.....	200 ppm.....	300 ppm....	5 mins. in any 3 hrs.
Methylene chloride (Z37.23-1969).....	500 ppm.....	1,000 ppm...	2,000 ppm..	5 mins. in any 2 hrs.
Organo (alkyl) mercury (Z37.30-1969).....	0.01 mg/m(3)	0.04 mg/m(3)	.....
Styrene (Z37.15-1969).....	100 ppm.....	200 ppm.....	600 ppm....	5 mins. in any 3 hrs.
Tetrachloroethylene (Z37.22-1967).....	100 ppm.....	200 ppm.....	300 ppm....	5 mins. in any 3 hrs.
Toluene (Z37.12-1967).....	200 ppm.....	300 ppm.....	500 ppm....	10 minutes

Trichloroethylene (Z37.19-1967).....	100 ppm.....	200 ppm.....	300 ppm....	5 mins. in any 2 hrs.
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Footnote (a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the benzene standard at 1910.1028.

Footnote (b) This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.

[57 FR 42388, Sept. 14, 1992; 58 FR 21781, April 23, 1993; 58 FR 35340, June 30, 1993]

1910.1000 TABLE Z-3 Mineral Dusts

(Note: The Federal Register revised Table Z-3 July 27, 1993.)

Substance	mppcf (a)	mg/m(3)
Silica:		
Crystalline		
Quartz (Respirable).....	250(b)	10 mg/m(3)(e)
	%SiO(2)+5	%SiO(2)+2
Quartz (Total Dust).....		30 mg/m(3)
		%SiO(2)+2
Cristobalite: Use 1/2 the value calculated from the count or mass formulae for quartz		
Tridymite: Use 1/2 the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth.....	20	80 mg/m(3)
		%SiO(2)
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (not containing asbestos)	20(c)	
Talc (containing asbestos) Use asbestos limit		
Tremolite, asbestiform (see 29 CFR 1910.1001)		
Portland cement	50	
Graphite (Natural)	15	
Coal Dust:		
Respirable fraction less than 5% SiO(2)		2.4 mg/m(3)(e)
		%SiO(2)+2
Respirable fraction greater than 5% SiO(2)....		10 mg/m(3)(e)
		%SiO(2)+2
Inert or Nuisance Dust:(d)		
Respirable fraction	15	5 mg/m(3)
Total dust	50	15 mg/m(3)

Note. - Conversion factors - mppcf X 35.3 = million particles per cubic meter = particles per c.c.

Footnote (a) Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

Footnote (b) The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.

Footnote (c) Containing less than 1% quartz; if 1% quartz or more, use quartz limit.

Footnote (d) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1.

Footnote (e) 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:

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 (now NRC) instrument. The respirable fraction of coal dust is determined with an MRE; the figure corresponding to that of 2.4 mg/m(3) in the table for coal dust is 4.5 mg/m(3).

[54 FR 2920, Jan. 19, 1989, 54 FR 28059, July 5, 1989, as amended at 54 FR 36767, Sept. 5, 1989; 54 FR 47513, Nov. 15, 1989; 54 FR 50372, Dec. 6, 1989; 55 FR 19259, May 9, 1990; 55 FR 46950, Nov. 8, 1990; 57 FR 29205, July 1, 1992; 58 FR 35340, June 30, 1993; 58 FR 40191, July 27, 1993]