

OCCUPATIONAL SAFETY AND HEALTH STANDARDS SUBPART Z — TOXIC AND HAZARDOUS SUBSTANCES

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Subpart Z—Toxic and Hazardous Substances

Sec.	
1910.1000	Air Contaminants.
1910.1001	Asbestos.
1910.1002	Coal tar pitch volatiles; Interpretation of term.
1910.1003	4-Nitrophenyl.
1910.1004	alpha-Naphthylamine.
1910.1005	4,4'-Methylene bis (2-chloroaniline). [Deleted]
1910.1006	Methyl chloromethyl ether.
1910.1007	3,3'-Dichlorobenzidine (and its salts).
1910.1008	bis-Chloromethyl ether.
1910.1009	beta-Naphthylamine.
1910.1010	Benztidine.
1910.1011	4-Aminodiphenyl.
1910.1012	Ethylenimine.
1910.1013	beta-Propiolactone.
1910.1014	2-Acetylaminofluorene.
1910.1015	4-Dimethylaminobenzene.
1910.1016	N-Nitrosodimethylamine.
1910.1017	Vinyl chloride.
1910.1018	Inorganic arsenic.
1910.1021	Lead.
1910.1022	Benzene. [Deleted]
1910.1023	Coke oven emissions.
1910.1043	Cotton dust.
1910.1044	1,2-dibromo-3-chloropropane.
1910.1045	Acrylonitrile.
1910.1046	Exposure to cotton dust in cotton gins. [Deleted]
1910.1499	Source of standards.
1910.1500	Standards organizations.
§ 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 accord-

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

(d) Computation formulas:

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

$$E = C_1 T_1 + C_2 T_2 + \dots + C_n T_n$$

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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

[Sec. 1910.1000(d)(1)(i)]

Z-1, Z-2, or Z-3 for the material involved.

(1) To illustrate the formula prescribed in subdivision (1) 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.

(ii) To illustrate the formula prescribed in subdivision (1) of this subparagraph, consider the following exposures:

Material	Actual concentration of 8-hour exposure	8-hour time weighted average exposure limit
Amblyone (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.	300 p.p.m.

Substituting in the formula, we have:

$$E_m = \frac{500}{1,000} + \frac{45}{200} + \frac{40}{300}$$

$$E_m = 0.500 + 0.225 + 0.133$$

$$E_m = 0.858$$

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./3ft.*
Acetaldehyde.....	200	360
Acetic acid.....	10	25
Acetic anhydride.....	5	20
Acetone.....	1,000	2,400
Acetonitrile.....	40	70
Acetylene dichloride, see 1,2-Dichloroethane.....		
Acetylene tetrafluoride.....	0.1	0.25
Acrylonitrile-Skin.....		0.3
Aldrin-Skin.....		0.15
Allyl alcohol-Skin.....	2	3
Allyl chloride.....	1	3
C-Allylglycidyl ether (AGE).....	10	15
Allylpropyl disulfide.....	2	12
2-Aminoethanol, see Ethanolamine.....		
2-Aminopropidine.....	0.5	3
Arsenic.....	50	25
Ammonium sulfamate (Am-mate).....		15
n-Amyl acetate.....	100	225
see Amyl acetate.....	125	250
Aniline-Skin.....	5	19
Antimony (as compound)-Skin.....		0.5
Antimony and compounds (as Sb).....		0.5
ANTU (alpha naphthyl thionurea).....		0.3
(Organic) Arsenic compounds (as As).....		0.3
Arsine.....	0.08	0.2
Azobis-isobutyronitrile-Skin.....		0.2
Barium (soluble compounds)-Skin.....		0.5
Benzo(a)pyrene, see Quinones.....		
Benzo(b)pyrene.....		5
Benzo(k)fluoranthene.....		5
Biphenyl, see Diphenyl.....		
Boron oxide.....		15
C Boron trifluoride.....		5
Bromine.....	0.1	0.7
Bromobenzene-Skin.....	0.5	5
Butadiene (1,3-butadiene).....	1,000	2,200
Butanediol, see Butyl methacrylate.....		
2-Butanone.....	200	500
2-Butoxy ethanol (Butyl Cellulosate)-Skin.....	50	240
Butyl acetate (n-butyl acetate), see Butyl acetate.....	150	770
tert-Butyl acetate.....	200	950
tert-Butyl alcohol.....	200	950
tert-Butyl alcohol, see Butyl alcohol.....	100	300
tert-Butyl alcohol.....	150	450
C Butylamine-Skin.....	100	300
C tert-Butyl chromate (as CrO ₃)-Skin.....	5	15
n-Butyl glycidyl ether (BGE).....	50	270
Butyl isocyanate.....	10	35
tert-Butyltoluene.....	10	80
Calcium arsenate.....		1
Calcium oxide.....		5
Camphor.....		2
Carbaryl (Sevin®).....		5
Carbon black.....		1.5
Carbon disulfide.....	1,000	9,000
Carbon monoxide.....	50	15
Chlordane-Skin.....		0.5
Chloroacetaldehyde.....		0.5
Chloroacetaldehyde (phenylchloride).....		0.5
Chlorobenzene (monochlorobenzene).....	75	150
o-Chlorobenzylidene.....		0.05
Chlorobenzylidene (NCSM).....		0.05
Chlorobenzonitrile.....	200	1,000
2-Chloro-1,3-butadiene, see Chloroprene.....		
Chloroethylene (42 percent Chlorine)-Skin.....		1
Chlorodiphenyl (54 percent Chlorine)-Skin.....		0.5
1-Chloro-2,2-dimethoxypropane, see Enchlorfeniridin.....		
2-Chloroethanol, see Ethylene chlorohydrin.....		
Chlorophenylene, see Vinyl chloride.....		
C Chloroform (trichloromethane).....	50	240
1-Chloro-1-nitropropane.....	30	100
Chloroform.....	0.1	0.7
Chloroform (Chloro-1,1,1-trichloroethane)-Skin.....	25	30

Table Z-1-Continued

Substance	p.p.m.*	mg./3ft.*
Chromium, sol. chromic, chromous salts as Cr.....		0.5
Metal and insol. salts.....		0.1
Coal tar pitch volatiles (benzene soluble fraction) anthracene, BaP, phenanthrene, acridene, chrysene, pyrene.....		0.2
Cobalt, metal fume and dust.....		0.1
Copper fume.....		0.1
Dusts and Mists.....		1
Cotton dust (raw).....		10
Cresol (hexachloride).....		15
Cresol (all isomers)-Skin.....	5	25
Crotonaldehyde.....	2	6
Cumene-Skin.....	30	245
Cyanide (as CN)-Skin.....		1
Cyanide fume.....	300	1,000
Cyclohexanone.....	30	200
Cyclohexanone.....	30	200
Cyclohexene.....	300	1,015
Cyclopentadiene.....	75	240
1,4-D.....		10
DOT-Skin.....		1
DOP-Skin.....		1
Dibenzene-Skin.....		0.05
Dibenzoyl-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
Diethyl phosphite.....		5
Diethylphthalate.....		300
C-o-Dichlorobenzene.....	50	300
p-Dichlorobenzene.....	75	450
Dichlorodifluoromethane.....	1,000	4,900
1,2-Dichloro-3,5-dimethylhydantoin.....		0.2
1,1-Dichloroethane.....	100	400
1,2-Dichloroethylene.....	300	750
C Dichloroethyl ether-Skin.....	15	30
Dichloromethane, see Methylenechloride.....		
Dichloromono-fluoromethane.....	1,000	4,200
C 1,1-Dichloro-1-nitroethane.....	10	80
1,2-Dichloropropane, see Propylene dichloride.....		
Dichlorotetrafluoroethane.....	1,000	7,000
Dieldrin-Skin.....		0.25
Dibutylamine.....		75
Dibutylamine-ethanol-Skin.....	10	30
Dibutyl ether, see Ethyl ether.....		
Difluorodichloromethane.....	100	500
C Diisobutyl ether (DUE).....	0.5	2.5
Dihydroxybenzene, see Hydroquinone.....		
Dibutyl ketone.....	50	250
Dibutylamine-Skin.....	5	30
Dibutylphthalate, see Phthalate.....		
Dimethyl acetamide-Skin.....	10	35
Dimethylamine.....	10	15
Dimethylaminobenzene, see Xylidene.....		
Dimethylamine (N-dimethylamine)-Skin.....	5	25
Dimethylbenzene, see Xylene.....		
Dimethyl 1,2-dichloro-2,2-dichloroethyl phosphite.....		3
(Dibrom).....		30
Dimethylformamide-Skin.....	10	30
2,4-Dimethylheptanone, see Dibutyl ketone.....		
1,1-Dimethylhydrazine-Skin.....	0.5	1
Dimethylphthalate.....		5
Dimethylphthalate-Skin.....		1
Dinitrobenzene (all isomers)-Skin.....		0.2
Dinitro-o-cresol-Skin.....		1.5
Dinitrotoluene-Skin.....		1
Dioxane (Dimethylene dioxide)-Skin.....	100	300
Dione.....	0.2	1
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate (MDI)).....		
Dipropylene glycol methyl ether-Skin.....	100	500
Di-sec-octyl phthalate (DI-2-ethylhexylphthalate).....		1
Enamin-Skin.....		1.1
Enchlorfeniridin-Skin.....	5	19
ENV-Skin.....		0.5
1,2-Epoxypropane, see Propylene oxide.....		
2-Epoxy-1-propanol, see Glycidol.....		

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STANDARDS AND INTERPRETATIONS

(ii) Sign specifications. The warning signs required by subdivision (i) of this subparagraph shall conform to the requirements of 20" x 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	Notation
Asbestos.....	1" Sans Serif, Gothic or Block.
Dust Hazard.....	¾" Sans Serif, Gothic or Block.
Avoid Breathing Dust.....	¾" Gothic.
Wear Assigned Protective Equipment...	¾" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¾" Gothic.
Breathing Asbestos Dust May Be Haz- ardous To Your Health.	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) Caution labels.

(i) Labeling. Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) Label specifications. The caution labels required by subdivision (i) of this subparagraph shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers
Avoid Creating Dust
Breathing Asbestos Dust May Cause
Serious Bodily Harm

(h) Housekeeping.

(1) Cleaning. All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) Waste disposal. Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) Recordkeeping.

(1) Exposure records. Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

[41 F.R. 11504, March 19, 1976.]

(2) Access. Employee exposure records required by this paragraph shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g)-(i).

[45 F.R. 35281, May 23, 1980.]

(3) Employee notification. Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.