



**THE OHIO STATE UNIVERSITY  
COLLEGE OF BIOLOGICAL SCIENCES  
WRITTEN HAZARD COMMUNICATION PLAN  
APPENDIX H**

## **29 CFR Part 1910 Subpart Z Toxic and Hazardous Substances**

Authority: Secs. 6, 8 Occupational Safety and Health Act, 29 U.S.C. 655, 657; Secretary of Labor's Orders 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable; and 29 CFR Part 1911.

All of subpart Z issued under section 6(b) of the Occupational Safety and Health Act, except those substances which have exposure limits listed in Tables Z-1, Z-2, and Z-3 of 29 CFR 1910.1000. The latter were issued under section 6(a) [29 U.S.C. 655(a)]. Section 1910.1000, Tables Z-1, Z-2, Z-3 also issued under 5 U.S.C. 553. Section 1910.1000, Table Z-1, Z-2, and Z-3 not issued under 29 CFR part 1911 except for the arsenic (organic compounds), benzene, and cotton dust listings.

Section 1910.1001 also issued under Sec. 107 of Contract Work Hours and Safety and Standards Act, 40 U.S.C. 333 and 5 U.S.C. 553. Section 1910.1002 not issued under 29 U.S.C. 655 or 29 CFR Part 1911; also issued under 5 U.S.C. 553.

Section 1910.1003 through 1910.1018 also issued under 29 CFR 653.

Section 1910.1025 also issued under 29 U.S.C. 653 and 5 U.S.C. 553.

Section 1910.1028 also issued under 29 U.S.C. 653.

Section 1910.1030 also issued under 29 U.S.C. 653.

Section 1910.1043 also issued under 5 U.S.C. 551 et seq.

Section 1910.1045 and 1910.1047 also issued under 29 U.S.C. 653.

Section 1910.1048 also issued under 29 U.S.C. 653.

Sections 1910.1200, 1910.1499 and 1910.1500 also issued under 5 U.S.C. 553.

Section 1910.1450 is also issued under secs. 6(b), 8(c) and 8(g)(2), Pub. L. 91-596, 84 Stat. 1593, 1955, 1600; 29 U.S.C. 655, 657.

SOURCE: 39 FR 23502, June 27, 1974, unless otherwise noted. Redesignated at 40 FR 23072, May 28, 1975.

\*[55 FR 3327, Jan. 31, 1990; 55 FR 4999, Feb. 13, 1990; 55 FR 12819, Apr. 6, 1990; 55 FR 50686, Dec. 10, 1990; 56 FR, Dec. 6, 1991; 58 FR 21780 April 23, 1993; 58 FR 35310 & 35338, June 30, 1993; 59 FR 6169, Feb. 9, 1994; 59 FR 17479, April 13, 1994; 59 FR 36695, July 19, 1994; 59 FR 40964, Aug. 10, 1994; 59 FR 65947, Dec. 22, 1994; 60 FR 9624, Feb. 21, 1995; 60 FR 33343, June 28, 1995; 60 FR 52856, Oct. 11, 1995]

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

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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.

(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:

(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:

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

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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 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

$(2 \times 150 + 2 \times 75 + 4 \times 50)$  divided by 8 = 81.25 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:

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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.

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.

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(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:

(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:

$(E = C(a)T(a) + C(b)T(b) + \dots + C(n)T(n))$  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.

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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:

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

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

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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.

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**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 dichloroide; 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 1910.1945	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	.05	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 homologue	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	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
ANTU (alpha Naphthylthiourea)	86-88-4		03.	
Arsenic; inorganic compounds (as As) see 1910.1018	7440-38-2			
Arsenic; organic compounds (asAs)	7440-38-2		0.5	
Arsine	7784-42-1	0.05	0.2	
Asbestos; see 1910.1001	(4)			
Asinphos-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. See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028(d)	71-43-2			
Benidine; 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	
Respirable fraction			5	
Boron trifluoride	7637-07-2	(C)1	(C)3	
Bromine	7726-95-6	0.1	0.7	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
Bromoform	75-25-2	0.5	5	X
Buradiene (1,3-buradiene)	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	75-65-3	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 glucidyl 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, sunthetic	76-22-2		2	
Carbaryl (Sevin)	63-25-5		8	
Carbon black	1333-86-4		3.5	
Carbon dioxide	124-38-9	5000	9000	
Carbon disulfide	75-15-0		(2)	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
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	126-99-9	25	90	X

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
2-Chloro-6 (trichloromethyl) pyridine	1929-82-4			
Total dust			15	
Respirable fraction			5	
Chromic acid and chromates (as CrO <sub>3</sub> )	(4)		(2)	
Chromium (II) compounds (as Cr)	440-47-3		0.5	
Chromium (III) compounds (as Cr)	7440-47-3		0.5	
Chromium metal and isol. 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 <sub>2</sub> ), respirable fraction				(3)
Coal dust (> or equal to 5% SiO <sub>2</sub> ), 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

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
Crotonaldehyde	123-73-9 4170-30-3	2	6	
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	17702-41-7	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 Ethylene dibromide				
Dibutyl posphate	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	
Dichlorodiphenyl- trichloroethane (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

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
Dichloromethane; see Methylene chloride				
Dichloromonofluoromethane	75-43-4	1000	4200	
1,1-Dichloro-1-nitroethane	594-72-7	(C)10	(C)60	
1,2-Dichloropropane; see propylene dichloride				
Dichlorotetrafluoroethane	76-14-2	1000	7000	X
Dichlorvos (DDVP)	62-73-7		1	X
Dicyclopentadienyl iron	102-54-5			
Total dust			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-Dimethylaminoazobenzene; 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-dichloroethylphosphate	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	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
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	5321-14-6		1.5	X
Diozane (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	2415-34-8			
Total dust			15	
Respirable fraction			5	
Endosulfan	115-29-7		0.1	
Endrin	72-20-8		0.1	X
Epichlorohydrin	106-89-8	5	19	X
EPN	2104-64-5		0.5	X
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)	34-17-5	1000	1900	
Ethylanime	75-04-7	10	18	
Ethyl amyl ketone (5-Methyl-3-heptanone)	541-85-5	25	130	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
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)	107-06-3		(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			
Total dust			15	
Ferrovandium dust	12604-58-9		1	
Fluorides (as F)	(4)		2.5	
Fluorine	7782-41-4	0.1	0.2	
Fluorotrichloromethane (Trichlorofluoromethane)	75-69-4	1000	5600	
Flomaldehyde; 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, braley)			10	
Glycerin (mist)	56-81-5			
Total dust			15	
Respirable fraction			5	
Glycidol	556-52-5	50	150	
Glycol monoethyl ether; see 2-Ethoxyethanol				

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Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
Graphite, natural				
Respirable dust	7782-42-5		(3)	
Graphite, sunthetic				
Total dust			15	
Respirable fraction			5	
Guthion; see Azinphos methyl				
Gupsum	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 n-butyl 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	
Hydrogen flyoride (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	

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Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
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	
Mangesium oxude fume	1309-48-4			
Total particulate			15	
Malathion	121-75-5			
Total dust			15	X
Maleic anhydride	108-31-3	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	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation	
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-Trichloroethane)	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 judrazine (Monomethyl hydrazine)	60-34-4	(C)0.2	(C)0.35	X	
Methyl iodide	74-88-4	5	28	X	
Methyl isomayl 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		

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
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			
Soluble compounds			5	
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,	7440-02-0		1	
Nickel, soluble compounds (as Ni)metal and insoluble 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
p-Nitrochlorobenzene	100-00-5		1	X

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Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
4-Nitrodiphenyl; see 1910.100392-93-3				
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		15	
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	
Oxygne difluoride	7783-41-7		0.05	0.1
Ozone	0028-15-6		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	

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Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
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		15	
Total dust			15	
Respirable fraction			5	
Picric acid	88-89-1		0.1	X
Pindone (2-Pivalyl-1,3-inandione)	83-26-1		0.1	
Plaster of paris	26499-65-0			
Total dust			15	
Respirable fraction			5	
Platinum (as Pt) Metal	740-06-4			
Soluble Salts			0.002	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
Portland cement	65997-15-1			
Total dust			15	
Respirable fraction			5	
Propane	74-98-6	1000	1800	
beta-Propiolactone; 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	
Ronnel	299-84-3		15	
Rontenone	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, amorphous, 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)	

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Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
Silica, crystalline	15468-32-3		(3)	
tridumite, respirable dust				
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		14807-96-9	(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	2551-35-4	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				

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Substance	CAS No. (c)	ppm (a)(1)	mg/m(3)(b)(1)	Skin designation
2,4,5-T (2,4,5-trichlorophenoxyacetic 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 an compounds (as Te)	13494-80-8		0.1	
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	
Temphos Total dust	3383-96-8		15	
Respirable fraction			5	
TEPP (Tetraethyl pyrophosphate)	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-Tetrachloroethane	79-34-5	5	35	X
Tetrachlorethylene; 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	509-14-5	1	8	
Tetryl (2,4,6-Trinitrophenylmethylnitramine)	479-45-8		105	X
Thallium, soluble compounds (as Tl)	7440-28-0		0.1	X
4,4'-Thiobis (6-tert,Butyl-m-cresol) Total dust	96-69-5		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	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
Titanium dioxide	3463-67-7			
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	321-65-9		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	100	6100	
2,4,6-Trinitrophenyl; see Picric acid				
2,4,6-Trinitrophenylmethyl 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	5013-15-4	100	480	
Warfarin	81-81-2		0.1	

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**TABLE Z-1 - LIMITS FOR AIR CONTAMINANTS**

Substance	CAS No. (c)	ppm (a)(1)	mg/m <sup>3</sup> (b)(1)	Skin designation
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]

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Substance	mppcf(a)		mg/m(3)	
Benzene(a) (Z37.40-1969)	10 ppm	25 ppm	50 ppm	10 minutes
Beryllium and beryllium compounds (Z37.5-1970)	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)	1.2 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 (Z37.28-1966)	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 measured exposure 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	1000 ppm	2000 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(a)	300 ppm	5 mins in any 2 hrs.

(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.

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**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)	$\frac{250(b)}{\%SiO(2)+5}$	$\frac{10 \text{ mg/m}(3)(e)}{\%SiO(2)+2}$
Quartz (Total Dust)		$\frac{30 \text{ mg/m}(3)}{\%SiO(2) +2}$
Cristobalite: Use 1/2 the value calculated from the count or mass formulae for quartz.		
Tridumite: Use 1/2 the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	20	$\frac{80 \text{ mg/m}(3)}{\%SiO(2)}$
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (not containing asbestos)	20 (C)	
Talc (with asbestos) Using asbestos limit		
Tremolite, asbestiform (see 29 cfr 1910.1001)		
Portland cement	50	
Graphite (Natural)	15	
Coal Dust:		
Respirable fraction less than 5% SiO(2)		$\frac{2.4 \text{ mg/m}(3)(e)}{\%SiO(2)+2}$
Respirable fraction greater tahn 5% SiO(2)		$\frac{10 \text{ mg/m}(3)(e)}{\%SiO(2)+2}$
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.

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(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 asize-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]