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EXPOSURE LIMITS FOR AIRBORNE CONTAMINANTS		SAFETY ENGINEERING STANDARD																																	
		ISSUED	APRIL 1961																																
		THIS PAGE REVISED	JULY 1984																																
		STANDARD REAFFIRMED	JULY 1984																																
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		Page 1 of 9																																	
This standard includes requirements of the Occupational Safety and Health Act of 1970 (OSHA) as published in the Federal Register. OSHA information is printed in red.																																			
1. SCOPE 1.1 This standard presents information and data sources on exposure limits of air contaminants to provide criteria for safe Company work environments. Guidance on application of exposure limits is provided. 1.2 The OSHA information presented is a legal requirement in the United States. Local regulations in other countries must be followed. 1.2.1 State and local regulations in the United States are not included, but must be followed if applicable.																																			
2. SOURCES OF EXPOSURE LIMIT INFORMATION 2.1 OSHA. Permissible Exposure Limits (PELs) from OSHA regulations, Section 1910.1000, Table Z1, Z2, and Z3 are presented as Tables 1, 2, and 3. These tables are minimum legal requirements in the United States for the substances listed. The OSHA tables were originally based on the 1968 ACGIH TLV tables (see 2.2). OSHA has made some changes to the tables, but has not made all of the changes made by ACGIH. 2.1.1 OSHA Regulated Materials 2.1.1.1 Rules applying to the manufacture, processing, packaging, handling, and storage of these materials are specified in OSHA regulations 1910.1001 through 1910.1046 as listed below. <table border="0"> <tr><td>1910.1001</td><td>Asbestos</td></tr> <tr><td>1910.1002</td><td>Coal tar pitch volatiles</td></tr> <tr><td>1910.1003</td><td>4-Nitrobiphenyl</td></tr> <tr><td>1910.1004</td><td>alpha-Naphthylamine</td></tr> <tr><td>1910.1006</td><td>Methyl chloromethyl ether</td></tr> <tr><td>1910.1007</td><td>3, 3-Dichlorobenzidine (and its salts)</td></tr> <tr><td>1910.1008</td><td>bis-Chloromethyl ether</td></tr> <tr><td>1910.1009</td><td>beta-Naphthylamine</td></tr> <tr><td>1910.1010</td><td>Benzidine</td></tr> <tr><td>1910.1011</td><td>4-Aminodiphenyl</td></tr> <tr><td>1910.1012</td><td>Ethylacrylamine (Ethylacrylamine)</td></tr> <tr><td>1910.1013</td><td>beta-Proptolactone</td></tr> <tr><td>1910.1014</td><td>2-Acetylaminofluorene</td></tr> <tr><td>1910.1015</td><td>4-Dimethylaminobenzene</td></tr> <tr><td>1910.1016</td><td>N-Nitrosodimethylamine</td></tr> <tr><td>1910.1017</td><td>Vinyl Chloride</td></tr> </table> 1910.1018 Inorganic arsenic 1910.1023 Lead 1910.1028 Benzene 1910.1029 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 2.1.1.2 CAUTION. Regulations are frequently subject to litigation. At the time of this revision, the benzene and lead regulations and parts of the arsenic regulation were under court review. Consult the Legal Department for latest information. 2.1.1.3 These OSHA regulations specify exact and demanding methodology for sampling, employee notification, training, record keeping, and protective equipment. 2.2 American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH annually publishes a booklet containing Threshold Limits Values for many chemical substances and physical agents. Copies of the booklet can be obtained from the Chemical Hazards Information Section, ISD, Centre Road Bldg. The updated booklet is usually available in October. ACGIH TLVs should be used where a Du Pont AEL (see 2.3) has not been established and the TLV is either lower than the OSHA PEL or the material is not listed by OSHA. 2.2.1 TLVs are intended to be used only as guidelines toward the establishment of safe working environments. 2.2.2 Du Pont Use of STEL Values. Short-term Exposure Limit (STEL) values are listed as "tentative values" in the ACGIH "Booklet" and may not have been acted upon by the TLV subcommittee of the parent body. STELs should be used as guides. In most cases STELs were derived by multiplying the TLV by an arbitrarily chosen factor ranging from 1.25 to 3.0. STEL values are subject to change or withdrawal. Consultation with Haskell Laboratory is recommended before a significant expenditure is made to meet STEL values. 2.3 American Industrial Hygiene Association (AIHA). The AIHA publishes Workplace Environmental Exposure Level (WEELs) guides. The WEELs cover both				1910.1001	Asbestos	1910.1002	Coal tar pitch volatiles	1910.1003	4-Nitrobiphenyl	1910.1004	alpha-Naphthylamine	1910.1006	Methyl chloromethyl ether	1910.1007	3, 3-Dichlorobenzidine (and its salts)	1910.1008	bis-Chloromethyl ether	1910.1009	beta-Naphthylamine	1910.1010	Benzidine	1910.1011	4-Aminodiphenyl	1910.1012	Ethylacrylamine (Ethylacrylamine)	1910.1013	beta-Proptolactone	1910.1014	2-Acetylaminofluorene	1910.1015	4-Dimethylaminobenzene	1910.1016	N-Nitrosodimethylamine	1910.1017	Vinyl Chloride
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the 8-hour time weighted average and short-term time weighted average exposures. The WEEL should be used where no Du Pont AEL exists (see 2.4). The ACGIH TLV and the AIHA WEELs shall not contain the same compounds.

2.4 Du Pont Sources

2.4.1 Haskell Laboratory has established Acceptable Exposure Limits (AELs) for some chemicals. Information on AELs can be obtained from Haskell Laboratory. Where they have been established, the AELs should be used instead of the ACGIH TLVs. If the AEL is lower than the OSHA PEL the AEL should be used.

2.4.2 A list, "Industrial Chemicals Designated as Requiring Special Control in Du Pont," is published quarterly by Haskell Laboratory.

2.4.3 A "Carcinogen Synonym List" is published annually by the Corporate Chemicals Information Section, ISD.

2.5 Caution of Use of TLVs, WEELs and Exposure Limits for Nontraditional Work Schedules (section 4). Prior to expenditures associated with any engineering controls, consult the Departmental OSH coordinator so further review can be conducted by Haskell Laboratory.

3. APPLICATION OF PELs

3.1 Many situations where toxic substances are handled may require detailed review by specialized engineers, industrial hygienists, and toxicologists to obtain the optimum in design controls. When additional information is needed on the toxicity of other materials and the health hazard that may be associated with them, consultation should be made with the Haskell Laboratory for Toxicology and Industrial Medicine.

3.2 Safety precautions in DR176X shall be followed when handling radioactive materials.

4. EXPOSURE LIMITS FOR NONTRADITIONAL WORK SCHEDULES

4.1 Exposure limits apply to the traditional 8-hour workday, 40-hour workweek including such variations as rotating shifts which may involve up to seven consecutive 8-hour workdays. Human data used for setting exposure limits have, in many cases, come from such rotating shifts and at least 20 years of experience with them has shown no special adverse health effects. Exposure limits

do not apply to nontraditional schedules such as 10- or 12-hour workdays or a workweek which routinely exceeds 40 hours.

4.2 Reduction Factor Calculations. When nontraditional work schedules are used regularly, an uncertainty exists concerning the effects of greater employee time exposure to chemical agents. Reduced exposure limits should consider the nature of the air contaminant and the increased exposure hours per day, and the decreased hours per day outside the contaminated environment.*

4.2.1 The reduction factor calculations presented in this standard will satisfy OSHA requirements; however, OSHA personnel will use a less restrictive calculation procedure (see reference in 5.1).

4.2.2 In the absence of other guidelines, a reduction factor f is recommended, calculated as follows (see 4.6 for exceptions):

$$f = \left(\frac{8}{h} \right) \left(\frac{24-h}{16} \right) \quad (1)$$

where

f = Reduction factor for the nontraditional work schedule

h = Hours worked per day

and the reduced exposure limit is

$$LNT = fL_e \quad (2)$$

where

LNT = Exposure limit for nontraditional work schedule

L_e = Exposure limit for 8-hour workday, e.g., PEL from Table 1

4.2.3 For the case of a 7-day workweek, the reduction factor is based on exposure hours per week and exposure-free hours per week.

$$f = \left(\frac{40}{\Sigma h} \right) \left(\frac{168 - \Sigma h}{128} \right) \quad (3)$$

4.2.4 For work schedules less than 7 to 8 hours per day or 35 hours per week, Equations (1) and (2) are not applicable.

4.2.5 For 24-hour continuous exposure, Equations (1) through (3) are not applicable. Refer to the 90-day continuous exposure limits of the National Academy of Sciences where applicable.**

* Brief, R. S., and Scale, R. A., "Occupational Exposure Limits for Novel Work Schedules," Amer Ind Hygiene Assoc J. 467 (June 1978)

** "Atmospheric Contaminants in Spacecraft," Report of the Panel on Air Standards for Manned Space Flight, Space Science Board, National Academy of Sciences, Washington, DC, 66 pages (October 1969)



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4.3 CAUTION: The reduction factor calculation is a theoretical estimate with no guarantee that an adequate safety margin is provided. Consult Haskell Laboratory prior to making significant changes in the workplace.

4.4 Exceptions. No adjustment of the exposure limit is necessary for the following:

a. These substances whose exposure limits are based on short-term effects or rapid elimination.

b. Substances such as lead and mercury which accumulate in the body very slowly. Here, the daily exposure is unimportant as long as the average weekly length of exposure remains at 40 hours.

c. Substances for which a limit is set on the "lowest feasible level" concept.

4.5 Examples

4.5.1 For carbon monoxide exposure during a 10-hour workday, 4 days per week where $L_5 = 50$ ppm, the LNT is calculated using Equations (1) and (2):

$$f = \left(\frac{8}{16} \right) \left(\frac{24 - 10}{16} \right) = 0.7$$

$$LNT = (0.7) (50) = 35 \text{ ppm}$$

4.5.2 For methanol exposure during a 12-hour workday, 5 days per week where $L_5 = 200$ ppm, the LNT is calculated using Equations (1) and (2):

$$f = \left(\frac{8}{12} \right) \left(\frac{24 - 12}{16} \right) = 0.5$$

$$LNT = (0.5) (200) = 100 \text{ ppm}$$

4.5.3 For methanol exposure during an 8-hour workday, 7 days per week where the $L_5 = 300$ ppm, the LNT is calculated using Equations (2) and (3):

$$f = \left(\frac{40}{8 \times 7} \right) \left(\frac{168 - (8 \times 7)}{128} \right) = 0.625$$

$$LNT = (0.625) (240) = 125 \text{ ppm}$$

This calculation does not apply to normal rotating shift schedules. See 4.1.

5. OTHER REFERENCES

5.1 Employment Safety and Health Guide No. 419 May 24, 1979 "OSHA Industrial Hygiene Field Operations Manual."

This manual does not have the authority of a regulation. Its purpose is to guide OSHA industrial hygiene compliance officers. Du Pont disagrees with many important statements of fact and interpretations given in the manual. The manual should not be used as guidance in Du Pont but may be useful for determining how an OSHA compliance officer is likely to handle a situation.

Source: Commerce Clearing House, Inc.
4025 W. Peterson Avenue
Chicago, IL 60646

5.2 "NIOSH/OSHA POCKET GUIDE TO CHEMICAL HAZARDS"

DHEW (NIOSH) Publication No. 78-210.

This is a useful concise compilation of information on chemicals, including chemical and physical properties, permissible exposure limits, respirator selection, health hazards, etc. The book contains a number of errors. In addition, it defines "immediately dangerous to life and health" as the "maximum level from which one could escape within 30 minutes without any escape impairing symptoms or any irreversible health effects." The conventional definition (see ANSI Z39.2, 1968) is "any atmosphere that poses an immediate hazard to life or produces immediate irreversible effects on health that will be debilitating." In keeping with its definition the Guide's IDLH values are lower than those which correspond to the ANSI definition. This book may be useful but any information should be checked using a primary source (NIOSH/OSHA Occupational Health Guidelines).

Footnotes for Table 1:

- Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg pressure
- Approximate milligrams of particulate per cubic meter of air
(the footnote "c" is used to avoid confusion with ceiling value notations)
- An atmospheric concentration of not more than 0.02 ppm, or personal protection may be necessary to avoid headache

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TABLE 1 - OSHA TABLE Z - 1

Materials with Names Preceded by "C" - Ceiling Values. If the name of the material in Table 1 is preceded by a "C," the value in the table is a ceiling value. An employee's exposure to a material shall at no time exceed the ceiling value.

Other Materials - 8-Hour Time-Weighted Average. If the name of the material in Table 1 is not preceded by a "C," the value in the table is an 8-hour time-weighted average. An employee's exposure to a material in any 8-hour work shift of a 40-hour week shall not exceed the 8-hour time-weighted average.

Substance	ppm ^{a)}	mg/m ³ ^{b)}	Substance	ppm ^{a)}	mg/m ³ ^{b)}
Acetaldehyde	200	360	Calcium oxide		5
Acetic acid	10	25	Camphor		2
Acetic anhydride	5	20	Carbaryl (Sevin)		5
Acetone	1,000	2,400	Carbon black		3.5
Acetonitrile	40	70	Carbon dioxide	5,000	9,000
Acetylene dichloride, see 1,2-Dichloroethylene			Carbon monoxide	50	55
Acetylene tetrabromide	1	14	Chlordane - Skin		0.5
Acroline	0.1	0.25	Chlorinated camphene - Skin		0.5
Acrylamide - Skin		0.3	Chlorinated diphenyl oxide		0.5
Aldrin - Skin		0.25	C Chlorine	1	3
Allyl alcohol - Skin	2	5	Chlorine dioxide	0.1	0.3
Allyl chloride	1	3	C Chlorine trifluoride	0.1	0.4
C Allylglycidyl ether (AGE)	10	45	C Chloroacetaldehyde	1	3
Allyl propyl disulfide	2	12	o-Chloroacetophenone (phenacylchloride)	0.05	0.3
2-Aminoethanol, see Ethanolamine			Chlorobenzene (monochlorobenzene)	75	360
2-Aminopyridine	0.5	2	o-Chlorobenzylidene malononitrile (OCBM)	0.05	0.4
Ammonia	50	35	Chlorobromomethane	200	1,050
Ammonium sulfate (Ammate)		15	2-Chloro-1,3-butadiene, see Chloroprene		
n-Amyl acetate	100	525	Chlorodiphenyl (42 percent Chlorine) - Skin		1
sec-Amyl acetate	125	650	Chlorodiphenyl (54 percent Chlorine) - Skin		0.5
Aniline - Skin	5	19	1-Chloro-2,3-epoxypropene, see Epichlorohydrin		
Anisidine (o, p-isomers) - Skin		0.5	2-Chloroethanol, see Ethylene chlorohydrin		
Antimony and compounds (as Sb)		0.5	Chloroethylene, see Vinyl chloride		
ANTU (alpha naphthyl thiourea)		0.3	C Chloroform (trichloromethane)	30	240
Arsine	0.05	0.2	1-Chloro-1-nitropropane	30	100
Azinphos-methyl - Skin		0.2	Chloropicrin	0.1	0.7
Barium (soluble compounds)		0.5	Chloroprene (2-chloro-1,3-butadiene) - Skin	25	90
p-Benzoquinone, see Quinone			Chromium, sol. chromic, chromous salts as Cr		0.5
Benzoyl peroxide		5	Metal and insol salts		1
Benzyl chloride	1	5	Coal tar pitch volatiles (benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene		0.2
Biphenyl, see Diphenyl			Cobalt, metal fume and dust		0.1
Boron oxide		15	Copper fume		1
C Boron trifluoride	1	3	Dusts and Mists		1
Bromine	0.1	0.7	Cotton dust (raw)		1
Bromoform - Skin	0.5	5	Crag herbicide		15
Butadiene (1,3-butadiene)	1,000	2,200	Cresol (all isomers) - Skin	5	22
Butanethiol, see Butyl mercaptan			Crotonaldehyde	2	6
2-Butanone	200	690	Cumene - Skin	80	245
2-Butoxy ethanol (Butyl Cellosolve) - Skin	50	240	Cyanide (as CN) - Skin		5
Butyl acetate (n-butyl acetate)	150	710	Cyclohexane	300	1,050
sec-Butyl acetate	200	950	Cyclohexanol	90	200
tert-Butyl acetate	200	950	Cyclohexanone	50	200
Butyl alcohol	100	300			
sec-Butyl alcohol	150	450			
tert-Butyl alcohol	100	300			
C Butylamine - Skin	5	15			
C tert-Butyl chromate (as CrO ₃) - Skin		0.1			
n-Butyl glycidyl ether (BGE)	50	270			
Butyl mercaptan	10	35			
p-tert-Butyltoluene	10	60			

See page 3 for footnotes
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TABLE 1 - OSHA TABLE Z-1 (CONTD)

Substances	ppm ^{a)}	mg/M ³ ^{b)}	Substances	ppm ^{a)}	mg/M ³ ^{b)}
Cyclohexene	300	1.015	Dioxane (Diethylene dioxide) - Skin	100	360
Cyclopentadiene	75	200	Diphenyl	0.2	1
2, 4-D		10	Diphenylmethane diisocyanate [see Methylene bisphenyl isocyanate (MDI)]		
DDT - Skin		1	Dipropylene glycol methyl ether - Skin	100	600
DDVP - Skin		1	Di-sec. octyl phthalate (Di-2-ethylhexylphthalate)		5
Decaborane - Skin	0.05	0.3	Endrin - Skin		0.1
Demeton - Skin		0.1	Epichlorohydrin - Skin	5	19
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	50	240	EPN - Skin		0.5
1,2-diaminodithane, see Ethylenediamine			1,2-Epoxypropene, see Propyleneoxide		
Diazomethane	0.2	0.4	2,3-Epoxy-1-propanol, see Glycidol		
Diborane	0.1	0.1	Ethanethiol, see Ethylmercaptan		
Dibutyl Phosphate	1	5	Ethanolamine	3	6
Dibutylphthalate		5	2-Ethoxyethanol - Skin	200	740
C o-Dichlorobenzene	50	300	2-Ethoxyethylacetate (Cell-solve acetate) - Skin	100	340
p-Dichlorobenzene	75	450	Ethyl acetate	400	1,400
Dichlorodifluoromethane	1,000	4,850	Ethyl acrylate - Skin	25	100
1,3-Dichloro-5,5-dimethyl hydantoin		0.2	Ethyl alcohol (ethanol)	1,000	1,800
1,1-Dichloroethane	100	400	Ethylamine	10	18
1,2-Dichloroethylene	200	780	Ethyl sec-amiyl ketone (5-methyl-3-heptanone)	25	130
C Dichloroethyl ether - Skin	15	90	Ethyl benzene	100	436
Dichloromethane, see Methylenechloride			Ethyl bromide	200	890
Dichloromonofluoromethane	1,000	4,200	Ethyl butyl ketone (3-Heptanone)	50	230
C 1,1-Dichloro-1-nitroethane	10	60	Ethyl chloride	1,000	2,600
1,2-Dichloropropane, see Propylenedichloride			Ethyl ether	400	1,300
Tetrafluoromethane	1,000	7,000	Ethyl formate	100	300
Dieldrin - Skin		0.25	C Ethyl mercaptan	10	25
Diethylamine	25	75	Ethyl silicate	100	850
Diethylamino ethanol - Skin	10	50	Ethylene chlorohydrin - Skin	5	16
Diethylether, see Ethyl ether			Ethylenediamine	10	25
Difluorodibromomethane	100	880	C Ethylene glycol dimethyl and/or Nitroglycerin - Skin	0.2	1
C Diglycidyl ether (DGE)	0.5	2.8	Ethylene glycol monomethyl ether acetate, see Methyl cellosolve acetate		
Dihydroxybenzene, see Hydroquinone			Ethyleneimine - Skin	0.5	1
Diisobutyl ketone	50	280	Ethylene oxide	50	90
Diisopropylamine - Skin	5	20	Ethylidene chloride, see 1,1-Dichloroethane		
Dimethoxymethane, see Methylal			N-Ethylmorpholine - Skin	20	94
Dimethyl acetamide - Skin	10	35	Ferbam		15
Dimethylamine	10	18	Ferrovandium dust		1
Dimethylanilinebenzene, see Xylene			Fluoride (as F)		2.5
Dimethylaniline (N-dimethylaniline) - Skin	5	25	Fluorine	0.1	0.2
Dimethyl 1,3-dibromo-2,2-dichloroethyl phosphate, (Dibrom)		3	Fluorotrichloromethane	1,000	5,800
Dimethylformamide - Skin	10	30	Formic acid	5	9
2,6-Dimethylheptanone, see Diisobutyl ketone			Furfural - Skin	5	20
1,1-Dimethylhydrazine - Skin	0.5	1	Furfuryl alcohol	50	200
Dimethylphthalate		5	Glycidol (2,3-Epoxy-1-propanol)	50	150
Dimethylsulfate - Skin	1	5	Glycol monomethyl ether, see 2-Ethoxyethanol		
Dinitrobenzene (all isomers) - Skin		1	Guthion, see Azinphosmethyl		
Dinitro-o-cresol - Skin		0.2			
Dinitrotoluene - Skin		1.5			

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Percentages printed in red are from OSHA 1810.1000



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TABLE 1 - OSHA TABLE Z-1 (CONTD)

Substance	ppm ^{a)}	mg/m ³ ^{b)}	Substance	ppm	mg/m ³ ^{b)}
Helium		0.5	o-Methylcyclohexanone - Skin	100	480
Heptachlor - Skin		0.5	Methyl ethyl ketone (MEK), see 2-Butanone		
Heptane (n-heptane)	500	2,000	Methyl formate	100	250
Hexachlorocyclopentadiene - Skin	1	10	Methyl iodide - Skin	5	20
Hexachloronaphthalene - Skin		0.2	Methyl isobutyl carbinol - Skin	25	100
Hexane (n-hexane)	500	1,800	Methyl isobutyl ketone, see Hexone		
2-Hexanone	100	410	Methyl isocyanate - Skin	0.02	0.05
Hexone (Methyl isobutyl ketone)	100	410	C Methyl mercaptan	10	20
sec-Hexyl acetate	50	300	Methyl methacrylate	100	410
Hydrazine - Skin	1	1.3	Methyl propyl ketone, see 2- Pentanone		
Hydrogen bromide	3	10	C = Methyl styrene	100	480
C Hydrogen chloride	5	7	C Methylene Bisphenyl isocyanate (MDI)	0.02	0.2
Hydrogen cyanide - Skin	10	11	Molybdenum: Soluble compounds		5
Hydrogen peroxide (30%)	1	1.4	Insoluble compounds		15
Hydrogen selenide	0.05	0.2	Monomethyl aniline - Skin	2	8
Hydroquinone		2	C Monomethyl hydrazine - Skin	0.2	0.35
C Iodine	0.1	1	Morpholine - Skin	20	70
Iron oxide fume		10	Naphtha (coaltar)	100	400
Isamyl acetate	100	525	Naphthalene	10	50
Isamyl alcohol	100	380	Nickel carbonyl	0.001	0.007
Isobutyl acetate	180	700	Nickel, metal and soluble compounds, as Ni		1
Isobutyl alcohol	100	300	Nicotine - Skin		0.5
Isophorone	25	140	Nitric acid	2	5
Isopropyl acetate	250	950	Nitric oxide	25	30
Isopropyl alcohol	400	960	p-Nitroaniline - Skin	1	5
Isopropylamine	5	12	Nitrobenzene - Skin	1	5
Isopropylether	800	2,100	p-Nitrochlorobenzene - Skin		1
Isopropyl glycidyl ether (IGE)	50	240	Nitroethane	100	310
Ketene	0.5	0.9	C Nitrogen dioxide	5	9
Lindene - Skin		0.5	Nitrogen trifluoride	10	20
Lithium hydride		0.025	C Nitroglycerin - Skin	0.2	2
L.P.G. (liquefied petroleum gas)	1,000	1,800	Nitromethane	100	250
Magnesium oxide fume		15	1-Nitropropane	25	90
Malathion - Skin		15	2-Nitropropane	25	90
Maleic anhydride	0.25	1	Nitrotoluene - Skin	5	30
C Manganese		5	Nitrotrichloromethane, see Chloropicrin		
Mesityl oxide	25	100	Octachloronaphthalene - Skin		0.1
Methanethiol, see Methyl mercaptan			Octane	500	2,350
Methoxychlor		15	Oil mist, mineral		5
2-Methoxyethanol, see Methyl cellosolve			Organic Arsenic compounds (as As)		0.5
Methyl acetate	200	810	Osmium tetroxide		0.002
Methyl acetylene (propyne)	1,000	1,550	Oxalic acid		1
Methyl acetylene-propadiene mixture (MAPP)	1,000	1,800	Oxygen difluoride	0.05	0.1
Methyl acrylate - Skin	10	35	Ozone	0.1	0.2
Methylal (dimethoxymethane)	1,000	3,100	Paraquat - Skin		0.5
Methyl alcohol (methanol)	200	280	Parathion - Skin		0.1
Methylamine	10	12	Pentaborane	0.005	0.01
Methyl amyl alcohol, see Methyl isobutyl carbinol			Pentachloronaphthalene - Skin		0.5
Methyl (n-amyl) ketone (2- Heptanone)	100	465	Pentachlorophenol - Skin		0.5
C Methyl bromide - Skin	20	80	Pentane	1,000	2,960
Methyl butyl ketone, see 2- Hexanone			2-Pentanone	200	700
Methyl cellosolve - Skin	25	80	Perchloromethyl mercaptan	0.1	0.8
Methyl cellosolve acetate - Skin	25	120	Perchloryl fluoride	3	13.5
Methyl chloroform	350	1,800	Petroleum distillates (naphtha)	500	2,000
Methylcyclohexane	500	2,000	Phenol - Skin	5	19
Methylcyclohexanol	100	470			

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**EXPOSURE LIMITS FOR
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TABLE 1 - OSHA TABLE Z-1 (CONTD FROM PAGE 6)

Substance	ppm ^{a)}	mg/m ³ ^{b)}	Substance	ppm ^{a)}	mg/m ³ ^{b)}
p-Phenylenediamine - Skin		0.1	1,1,2,2-Tetrachloro-1,2-difluoroethane	500	4.170
Phenyl ether (vapor)	1	7	1,1,2,2-Tetrachloroethane - Skin	5	35
Phenyl ether-biphenyl mixture (vapor)	1	7	Tetrachloromethane, see Carbon tetrachloride		
Phenylethylene, see Styrene			Tetrachloronaphthalene - Skin		2
Phenyl glycidyl ether (PGE)	10	60	Tetraethyl lead (as Pb) - Skin		0.075
Phenyldiazine - Skin	5	22	Tetrahydrofuran	200	580
Phosdrin (Mevinphos) - Skin		0.1	Tetramethyl lead (as Pb) - Skin		0.075
Phosgene (carbonyl chloride)	0.1	0.4	Tetramethyl succinonitrile - Skin	0.5	3
Phosphine	0.3	0.4	Tetranitromethane	1	8
Phosphoric acid		1	Tetryl (2,4,6-trinitrophenyl-methylnitramine) - Skin		1.5
Phosphorus (yellow)		0.1	Thallium (soluble compounds) - Skin as Tl		0.1
Phosphorus pentachloride		1	Thiram		5
Phosphorus pentasulfide		1	Tin (inorganic compounds, except oxides)		2
Phosphorus trichloride	0.5	3	Tin (organic compounds)		0.1
Phthalic anhydride	2	12	C Toluene-2,4-diacrylate	0.02	0.14
Picric acid - Skin		0.1	o-Toluidine - Skin	5	22
Pival (2-Pivalyl-1,3-indandione)		0.1	Toxaphene, see Chlorinated camphene		
Platinum (Soluble Salts) as Pt		0.002	Tributyl phosphate		5
Propane	1,000	1,800	1,1,1-Trichloroethane see Methyl chloroform		
n-Propyl acetate	200	840	1,1,2-Trichloroethane - Skin	10	45
Propyl alcohol	300	500	Titanium dioxide		15
n-Propyl nitrate	25	110	Trichloromethane, see Chloroform		
Propylene dichloride	75	360	Trichloronaphthalene - Skin		5
Propylene imine - Skin	2	5	1,2,3-Trichloropropene	50	300
Propylene oxide	100	240	1,1,2-Trichloro 1,2,2-trifluoroethane	1,000	7,800
Propyne, see Methylacetylene			Triethylamine	25	100
Pyrethrum		5	Trifluoromethanobromomethane	1,000	6,100
Pyridine	5	15	2,4,6-Trinitrophenol, see Picric acid		
Quinone	0.1	0.4	2,4,6-Trinitrophenylmethyl-nitramine, see Tetryl		
Rhodium, Metal fume and dusts, as Rh		0.1	Trinitrotoluene - Skin		1.5
Soluble salts		0.001	Trithiocresyl phosphate		0.1
Ronnel		15	Triphenyl phosphate		3
Rotenone (commercial)		5	Turpentine	100	560
Selenium compounds (as Se)		0.2	Uranium (soluble compounds)		0.05
Selenium hexafluoride	0.05	0.4	Uranium (insoluble compounds)		0.25
Silver, metal and soluble compounds		0.01	C Vanadium:		
Sodium fluoroacetate (1080) - Skin		0.05	V ₂ O ₅ dust		0.5
Sodium hydroxide		2	V ₂ O ₅ fume		0.1
Stibine	0.1	0.5	Vinyl benzene, see Styrene		
Stoddard solvent	500	2,900	Vinylcyanide, see Acrylonitrile		
Strychnine		0.15	Vinyl toluene	100	480
Sulfur dioxide	5	13	Warfarin		0.1
Sulfur hexafluoride	1,000	6,000	Xylene (xylol)	100	435
Sulfuric acid		1	Xylidine - Skin	5	25
Sulfur monochloride	1	6	Yttrium		1
Sulfur pentasulfide	0.025	0.25	Zinc chloride fume		1
Sulfuryl fluoride	5	20	Zinc oxide fume		5
Systox, see Demeton			Zirconium compounds (as Zr)		5
2,4,5T		10			
Tantalum		5			
TEOP - Skin		0.2			
Tellurium		0.1			
Tellurium hexafluoride	0.02	0.2			
TEPP - Skin		0.05			
C Terphenyls	1	9			
1,1,1,2-Tetrachloro-2,2-difluoroethane	500	4.170			

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EXPOSURE LIMITS FOR
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TABLE 1 - OSHA TABLE Z-2

Material	8-Hour Time Weighted Average	Acceptable Ceiling Concentration*	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift.	
			Concentration	Maximum Duration
Benzene (Z37.4 - 1968)**	10 ppm	25 ppm	50 ppm	10 minutes
Beryllium and beryllium compounds (Z37.29 - 1970)	2 µg/M ³	5 µg/M ³	25 µg/M ³	30 minutes
Cadmium dust (Z37.5 - 1970)	0.2 mg/M ³	0.6 mg/M ³		
Cadmium fume (Z37.5 - 1970)	0.1 mg/M ³	0.3 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 minutes in any 4 hours.
Chromic acid and chromates (Z37.7 - 1971)		1 mg/10M ³		
Ethylene dibromide (Z37.31 - 1970)	20 ppm	30 ppm	80 ppm	5 minutes.
Ethylene dichloride (Z37.21 - 1969)	80 ppm	100 ppm	200 ppm	5 minutes in any 3 hours.
Fluoride as dust (Z37.29 - 1969)	2.5 mg/M ³			
Formaldehyde (Z37.16 - 1967)	3 ppm	5 ppm	10 ppm	30 minutes.
Hydrogen fluoride (Z37.28 - 1969)	3 ppm			
Hydrogen sulfide (Z37.2 - 1966)		20 ppm	50 ppm	10 minutes once only if no other measurable exposure occurs.
Mercury (Z37.8 - 1971)		1 mg/10M ³		
Methyl Chloride (Z37.18 - 1968)	100 ppm	200 ppm	300 ppm	5 minutes in any 3 hours.
Ethylene Chloride (Z37.23 - 1968)	500 ppm	1,000 ppm	2,000 ppm	5 minutes in any 2 hours.
Organic (alkyl) mercury (Z37.30 - 1968)	0.01 mg/M ³	0.04 mg/M ³		
Styrene (Z37.15 - 1968)	100 ppm	200 ppm	600 ppm	5 minutes in any 3 hours.
Tetrachloroethylene (Z37.22 - 1967)	100 ppm	300 ppm	300 ppm	5 minutes in any 3 hours.
Toluene (Z37.12 - 1967)	200 ppm	300 ppm	500 ppm	10 minutes.
Trichloroethylene (Z37.19 - 1967)	100 ppm	200 ppm	300 ppm	5 minutes in any 2 hours.

* The "acceptable ceiling concentration" shall not be exceeded during an 8-hour shift except for the time period indicated and the concentration allowed under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift."

** Occupational exposures to benzene are subject to the requirements of Section 1910.1028 except as specifically exempted by Section 1910.1029(a)(2). Exposures exempted by Section 1910.1029(a)(2) are covered by this Section 1910.1000.

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EXPOSURE LIMITS FOR
AIRBORNE CONTAMINANTS

TABLE 3 - OSHA TABLE Z-3

Substance	Mineral Dusts	
	8-Hour Time-Weighted Averages	
	Mppcf*	Mg/M ³
Silica:		
Crystalline:		
Quartz (respirable)	250**	10 mg/M ³ †
	%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	30	30 mg/M ³
		%SiO ₂
Silicates (less than 1% crys- talline silica):		
Mica	30	
Soapstone	30	
Talc (non-asbestos - form)	30††	
Talc (fibrous). Use asbestos limit		
Tremolite (see talc, fibrous)		
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO ₂)		2.4 mg/M ³ or 10 mg/M ³
For more than 5% SiO ₂		%SiO ₂ + 2
Inert or Nuisance Dust:		
Respirable fraction	15	5 mg/M ³
Total dust	50	15 mg/M ³

Note: Conversion factors: mppcf = 25.3 = million particles per cubic foot
= particles per c.c.

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

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

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

†† Containing < 1% quartz; if > 1% quartz, use quartz limit

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