

(b) An electronic device.
(c) A switch actuated by a lever, rod, or plate, the latter to be placed on the "up" side of the head pulley so as to just clear a passing step.

(ii) *Manual reset location.* After the manlift has been stopped by a stop device it shall be necessary to reset the automatic stop manually. The device shall be so located that a person resetting it shall have a clear view of both the "up" and "down" runs of the manlift. It shall not be possible to reset the device from any step or platform.

(iii) *Cut-off point.* The initial limit stop device shall function so that the manlift will be stopped before the loaded step has reached a point 24 inches above the top terminal landing.

(iv) *Electrical requirements.* (a) Where such switches open the main motor circuit directly they shall be of the multipole type.

(b) Where electronic devices are used they shall be so designed and installed that failure will result in shutting off the power to the driving motor.

(c) Where flammable vapors or dusts may be present all electrical installations shall be in accordance with the National Electrical Code, NFPA 70-1971; ANSI C1-1971 (Rev. of 1968), requirements for such locations.

(d) Unless of the oil-immersed type controller contacts carrying the main motor current shall be copper to carbon or equal, except where the circuit is broken at two or more points simultaneously.

(6) *Emergency Stop.*—(i) *General.* An emergency stop means shall be provided.

(ii) *Location.* This stop means shall be within easy reach of the ascending and descending runs of the belt.

(iii) *Operation.* This stop means shall be so connected with the control lever or operating mechanism that it will cut off the power and apply the brake when pulled in the direction of travel.

(iv) *Rope.* If rope is used, it shall be not less than three-eighths inch in diameter. Wire rope, unless marlin-covered, shall not be used.

(7) *Instruction and warning signs.*—(i) *Instruction signs at landings or belts.* Signs of conspicuous and easily read style giving instructions for the use of the manlift shall be posted at each landing or stenciled on the belt.

(a) Such signs shall be of letters not less than 1 inch in height and of a color having high contrast with the surface on which it is stenciled or painted (white or yellow on black or black on white or gray).

(b) The instructions shall read approximately as follows:

Face the Belt.
Use the Handholds.
To Stop—Pull Rope.

(ii) *Top floor warning sign and light.*

(a) At the top floor an illuminated sign shall be displayed bearing the following wording:

"TOP FLOOR—GET OFF"

Signs shall be in block letters not less than 2 inches in height. This sign shall

be located within easy view of an ascending passenger and not more than 2 feet above the top terminal landing.

(b) In addition to the sign required by subdivision (a) of this subdivision, a red warning light of not less than 40-watt rating shall be provided immediately below the upper landing terminal and so located as to shine in the passenger's face.

(iii) *Visitor Warning.* A conspicuous sign having the following legend—AUTHORIZED PERSONNEL ONLY—shall be displayed at each landing. The sign shall be of block letters not less than 2 inches in height and shall be of a color offering high contrast with the background color.

(d) *Operating rules.*—(1) *Proper use of manlifts.* No freight, packaged goods, pipe, lumber, or construction materials of any kind shall be handled on any manlift.

(e) *Periodic inspection.*—(1) *Frequency.* All manlifts shall be inspected by a competent designated person at intervals of not more than 30 days. Limit switches shall be checked weekly. Manlifts found to be unsafe shall not be operated until properly repaired.

(2) *Items covered.* This periodic inspection shall cover but is not limited to the following items:

Steps.
Step Fastenings.
Rails.
Rail Supports and Fastenings.
Rollers and Slides.
Belt and Belt Tension.
Handholds and Fastenings.
Floor Landings.
Guardrails.
Lubrication.
Limit Switches.
Warning Signs and Lights.
Illumination.
Drive Pulley.
Bottom (boot) Pulley and Clearance.
Pulley Supports.
Motor.
Driving Mechanism.
Brake.
Electrical Switches.
Vibration and Misalignment.
"Skip" on up or down run when mounting step (indicating worn gears).

(3) *Inspection log.* A written record shall be kept of findings at each inspection. Records of inspection shall be made available to the Assistant Secretary of Labor or his duly authorized representative.

(Source: ANSI A90.1-1969 Safety Code for Manlifts.)

§ 1910.69 Sources of standards.

Sec.	Source
1910.66	ANSI A120.1-1970 Safety Code for Powered Platforms for Exterior Building Maintenance.
1910.67	ANSI A92.2-1969 American National Standard for Vehicle-Mounted Elevating and Rotating Work Platforms.
1910.68	ANSI A90.1-1969 Safety Code for Manlifts.

§ 1910.70 Standards organizations.

Specific standards of the following organizations have been referenced in this subpart. Copies of the standards may be obtained from the issuing organization.

American National Standards Institute, 1430 Broadway, New York, NY 10018.

Subpart G—Occupational Health and Environmental Control

§ 1910.93 Air contaminants.

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

(a) Table G-1:

(1) *Materials with names preceded by "C"—Ceiling Values.* An employee's exposure to any material in table G-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 G-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 G-2:

(1) *8-hour time weighted averages.* An employee's exposure to any material listed in table G-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 G-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 G-3: An employee's exposure to any material listed in table G-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 formulae:

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

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

where:

E is the equivalent exposure for the working shift.

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

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

The value of E shall not exceed the 8-hour time weighted average limit in table

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TABLE G-1—Continued

Substance	p.p.m.*	mg./M ³ *
Ethanol, see Ethylmer-		
capitan.....	3	6
Ethanolamine.....	200	740
2-Ethoxyethanol—Skin.....	100	640
2-Ethoxyethylacetate (Cellu-	100	400
solva acetate)—Skin.....	25	100
Ethyl acetate.....	1,000	1,500
Ethyl acrylate—Skin.....	10	13
Ethyl alcohol (ethanol).....	25	130
Ethylamine.....	100	435
Ethyl sec-amyl ketone (6-	200	890
methy-3-heptanone).....	50	220
Ethyl benzene.....	1,000	2,600
Ethyl bromide.....	400	1,200
Ethyl butyl ketone (3-	100	300
heptanone).....	10	25
Ethyl chloride.....	100	820
Ethyl ether.....	6	10
Ethyl formate.....	10	25
Ethyl mercaptan.....	100	820
Ethyl silicate.....	6	10
Ethylene chlorohydrin—Skin.....	10	25
Ethylene diamine.....		
Ethylene dibromide, see 1,2-		
dibromoethane.....		
Ethylene dichloride, see 1,2-		
dichloroethane.....		
Ethylene glycol dimethyl-		
and/or Nitroglycerin—Skin.....	4.0	1
Ethylene glycol monomethyl		
ether acetate, see Methyl		
cellulosolve acetate.....	0.5	1
Ethyleneimine—Skin.....	50	90
Ethylene oxide.....		
Ethylidene chloride, see 1,1-		
dichloroethane.....		
N-Ethylmorpholine—Skin.....	20	94
Formal.....		
Formaldehyde dust.....	1	2.5
Fluoride (as F).....	0.1	0.2
Fluorine.....	1,000	5,600
Fluorochloromethane.....	5	9
Formic acid.....	5	20
Furfural—Skin.....	50	200
Furfuryl alcohol.....	50	100
Glycidol (2,3-Epoxy-1-		
propanol).....	50	100
Glycol monomethyl ether, see		
2-Ethoxyethanol.....		
Guthion ®, see Azinphos-		
methy-.....		
Heptachlor—Skin.....	0.5	0.5
Heptachlor (n-heptane).....	600	2,000
Heptachloroethane—Skin.....	1	10
Heptachloronaphthalene—Skin.....	500	1,800
Hexane (n-hexane).....	100	410
2-Hexanone.....	100	410
Hexone (Methyl isobutyl		
ketone).....	100	410
Hexyl acetate.....	50	300
Hydrazine—Skin.....	1	1.3
Hydrogen bromide.....	3	10
C Hydrogen chloride.....	5	7
Hydrogen cyanide—Skin.....	10	11
Hydrogen peroxide (90%).....	1	1.4
Hydrogen sulfide.....	0.05	0.2
Hydroquinone.....	1	2
C Iodine.....	0.1	10
Iron oxide fume.....	100	625
Isamyl acetate.....	100	360
Isamyl alcohol.....	150	700
Isobutyl acetate.....	100	300
Isobutyl alcohol.....	25	140
Isopropyl acetate.....	250	950
Isopropyl alcohol.....	400	980
Isopropylamine.....	500	2,100
Isopropylether.....	50	240
Isopropyl glycidyl ether (IGE)		
ketone).....	0.5	0.9
Lead arsenate.....		
Lead.....	0.13	0.5
Lindane—Skin.....		
Lithium hydride.....	0.025	0.025
L.P.G. (Liquified petroleum		
gas).....	1,000	1,800
Magnesium oxide fume.....	15	15
Malathion—Skin.....	15	15
Male anhydride.....	0.25	1
C Manganese.....	5	5
Methyl acetate.....	25	100
Methanethiol, see Methyl		
mercaptan.....		
Methoxychlor.....	15	15
2-Methoxyethanol, see Methyl		
cellulosolve.....		
Methyl acetate.....	2.0	810
Methyl acetylone (propyne).....	1,000	1,650
Methyl acetylene propadiene		
mixture (MAIP).....	1,000	1,800
Methyl mercaptan—Skin.....	10	35
Methylal (dimethoxyethane).....	1,000	2,100
Methyl alcohol (methanol).....	200	250
Methylamine.....	10	12
Methyl amyl alcohol, see		
Methyl isobutyl carbinol.....		

TABLE G-1—Continued

Substance	p.p.m.*	mg./M ³ *
Methyl (n-amyl) ketone (2-		
heptanone).....	100	465
C Methyl bromide—Skin.....	20	80
Methyl butyl ketone, see 2-		
hexanone.....		
Methyl cellosolve—Skin.....	25	80
Methyl cellosolve acetate—Skin.....	25	120
Methyl chloroform.....	350	1,000
Methylcyclohexane.....	600	2,000
Methylcyclohexanol.....	100	470
o-Methylcyclohexanone—Skin.....	100	460
Methyl ethyl ketone (MEK),		
see 2-Butanone.....		
Methyl formate.....	100	250
Methyl iodide—Skin.....	5	25
Methyl isobutyl carbinol—Skin.....	25	100
Methyl isobutyl ketone, see		
hexanone.....		
Methyl isocyanate—Skin.....	0.02	0.05
C Methyl mercaptan.....	10	20
Methyl methacrylate.....	100	410
Methyl propyl ketone, see 2-		
pentanone.....		
C Methyl styrene.....	100	480
C Methylene bisphenyl		
isocyanate (MDI).....	0.02	0.2
Molybdenum.....		
Soluble compounds.....	5	5
Insoluble compounds.....	15	15
Monomethyl aniline—Skin.....	2	9
C Monomethyl hydrazine—		
Skin.....	0.2	0.35
Morpholine—Skin.....	20	70
Naphthalene (coal tar).....	100	400
Naphthalene.....	10	60
Nickel carbonyl.....	0.001	0.007
Nickel, metal and soluble		
compds, as Ni.....	1	1
Nicotine—Skin.....	0.5	0.5
Nitric acid.....	2	5
Nitric oxide.....	25	30
p-Nitroaniline—Skin.....	1	5
Nitrobenzene—Skin.....	1	5
p-Nitrochlorobenzene—Skin.....	100	310
Nitroethane.....	5	9
Nitrogen dioxide.....	10	20
Nitrogen trifluoride.....	0.2	2
Nitroglycerin—Skin.....	100	250
Nitromethane.....	25	90
1-Nitropropane.....	25	90
2-Nitropropane.....	5	30
Nitrotoluene—Skin.....		
Nitrodichloromethane, see		
Chloroform.....		
Octachloronaphthalene—Skin.....	0.1	0.1
*Octane.....	500	2,350
*Oil mist, mineral.....	5	5
Osmium tetroxide.....	0.002	0.002
Oxalic acid.....	1	1
Oxygen difluoride.....	0.05	0.1
Ozone.....	0.1	0.2
Parathion—Skin.....	0.5	0.5
Parathion—Skin.....	0.1	0.1
Pentachlorane.....	0.005	0.01
Pentachloronaphthalene—Skin.....	0.5	0.5
Pentachlorophenol—Skin.....	0.5	0.5
*Pentane.....	1,000	2,920
2-Pentanone.....	200	700
Perchloromethyl mercaptan.....	0.1	0.8
Perchlorophenol.....	15	15
Petroleum distillates (naphtha)		
blend—Skin.....	500	2,000
p-Phenylene diamine—Skin.....	5	19
Phenyl ether (vapor).....	1	7
Phenyl ether diphenyl		
mixture (vapor).....	1	7
Phenylethylene, see Styrene.....		
Phenyl glycidyl ether (PGE).....	10	60
Phenylhydrazine—Skin.....	5	22
Phosdrin (Mevinphos ®) —		
Skin.....	0.1	0.1
Phosgene (carbonyl chloride).....	0.1	0.4
Phosphine.....	0.3	0.4
Phosphoric acid.....	1	1
Phosphorus (yellow).....	0.1	0.1
Phosphorus pentachloride.....	1	1
Phosphorus pentasulfide.....	1	1
Phosphorus trichloride.....	0.5	0.5
Phthalic anhydride.....	2	12
Picric acid—Skin.....	0.1	0.1
Pivalic (2-Methyl-1,2-		
indandione).....	0.1	0.1
Platinum (Soluble Salts) as		
Pl.....	0.002	0.002
Propargyl alcohol—Skin.....	1	1
Propene.....	1,000	1,800
n-Propyl acetate.....	200	840
Propyl alcohol.....	200	660
n-Propyl nitrate.....	25	110
Propylene dichloride.....	75	350
Propylene imine—Skin.....	2	6
Propylene oxide.....	100	240
Propyne, see Methylacetylene.....		
Pyridine.....	5	6
Pyridine.....	16	16
Quinone.....	0.1	0.4
RDX—Skin.....	1.5	1.5

TABLE G-1—Continued

Substance	p.p.m.*	mg./M ³ *
Rhodium, Metal fume and		
dusts, as Rh.....		0.1
Soluble salts.....		0.001
Rouge.....		10
Rotenone (commercial).....		5
Selenium compounds (as Se).....		0.2
Selenium hexafluoride.....	0.05	0.4
Silver, metal and soluble com-		
pounds.....		0.01
Sodium fluoroacetate (1050)—		
Skin.....		0.05
Sodium hydroxide.....		2
Sulfine.....	0.1	0.5
*Standard solvent.....	500	2,070
Styrene.....		0.15
Sulfur dioxide.....	5	13
Sulfur hexafluoride.....	1,000	6,000
Sulfuric acid.....		1
Sulfur monochloride.....	1	6
Sulfur pentoxide.....	0.025	0.25
Sulfuryl fluoride.....	5	20
Systol, see Demeton ®.....		
2,4,5-T.....		10
Tantalum.....		5
TEBP—Skin.....		0.2
Tellurium.....		0.1
Tellurium hexafluoride.....	0.02	0.2
TEPP—Skin.....		0.05
C Terphenyls.....	1	9
1,1,2-Tetrachloro-2,2-difluoro-		
ethane.....	500	4,170
1,1,2,2-Tetrachloro-1,2-difluoro-		
ethane.....	500	4,170
1,1,2,2-Tetrachloroethane—Skin.....	5	25
Tetrachloroethylene, see Per-		
chloroethylene.....		
Tetrachloroethane, see Carbon		
tetrachloride.....		
Tetrachloronaphthalene—Skin.....		2
Tetraethyl lead (as Pb)—Skin.....		0.076
Tetrahydrofuran.....	200	560
Tetraethyl lead (as Pb)—		
Skin.....		0.07
Tetraethyl succinonitrile—		
Skin.....	0.5	3
Tetrahydrofuran.....	1	8
Tetryl (2,4,6-trinitrophenyl-		
methylammonium)—Skin.....		1.5
Thallium (soluble com-		
pounds)—Skin as Tl.....		0.1
Thiamine.....		5
Tin (inorganic compds, except		
oxides).....		2
Tin (organic compds).....		0.1
C Toluene-2,4-dithiocyanate.....	0.02	0.14
o-Toluidine—Skin.....	5	22
Toxaphene, see Chlorinated		
camphene.....		
Triethyl phosphite.....		5
1,1,1-Trichloroethane, see		
Methyl chloroform.....		
1,1,2-Trichloroethane—Skin.....	10	45
Titanium dioxide.....		15
Trichloromethane, see Chloro-		
form.....		
Trichloronaphthalene—Skin.....		5
1,2,3-Trichloropropane.....	50	300
1,1,2-Trichloro-1,2,2-trifluoro-		
ethane.....	1,000	7,000
Triethylamine.....	25	100
Trifluoroacetic acid.....	1,000	6,100
2,4,6-Trinitrophenol, see Picric		
acid.....		
2,4,6-Trinitrophenylmethy-		
lamine, see Tetryl.....		
Trinitrobenzene—Skin.....		1.5
Trinitroethyl phosphite.....		0.1
Triphenyl phosphite.....		3
Turpentine.....	100	560
Uranium (soluble compounds).....		0.05
Uranium (insoluble compounds).....		0.25
C Vanadium.....		0.5
V ₂ O ₅ dust.....		0.1
V ₂ O ₅ fume.....		0.1
Vinyl benzene, see Styrene.....		
*Vinyl chloride.....	500	1,300
Vinylpyridine, see Acrylonitrile.....		
Vinyl toluene.....	100	430
Warfarin.....		0.1
Xylene (xylol).....	100	435
Xylenes—Skin.....	5	25
Yttrium.....		1
Zinc chloride fume.....		1
Zinc oxide fume.....		5
Zirconium compounds (as Zr).....		5

* 1970 Addition.
 * Parts of vapor or gas per million parts of contaminant (air by volume at 25° C. and 760 mm. Hg pressure).
 * Approximate milligrams of particulate per cubic meter of air.
 (No footnote "2" is used to avoid confusion with cooling value notations.)
 * An atmospheric concentration of not more than 0.02 p.p.m. of personal protection may be necessary to avoid headache.
 * As sampled by method that does not collect vapor.
 * For control of general room air, biologic monitoring is essential for personal control.

TABLE G-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift.	
			Concentration	Maximum duration
Benzene (Z37.4-1969).....	10 p.p.m.	25 p.p.m.	50 p.p.m.	10 minutes.
Beryllium and beryllium compounds (Z37.29-1970).....	2 µg./M ³	5 µg./M ³	25 µg./M ³	30 minutes.
Cadmium fume (Z37.5-1970).....	0.1 mg./M ³	0.3 mg./M ³	.....	.....
Cadmium dust (Z37.5-1970).....	0.2 mg./M ³	0.6 mg./M ³	.....	.....
Carbon disulfide (Z37.3-1968).....	20 p.p.m.	30 p.p.m.	100 p.p.m.	Do.
Carbon tetrachloride (Z37.17-1967).....	10 p.p.m.	25 p.p.m.	200 p.p.m.	5 minutes in any 4 hours.
Ethylene dibromide (Z37.31-1970).....	20 p.p.m.	30 p.p.m.	50 p.p.m.	5 minutes.
Ethylene dichloride (Z37.21-1969).....	50 p.p.m.	100 p.p.m.	200 p.p.m.	5 minutes in any 3 hours.
Formaldehyde (Z37.16-1967).....	3 p.p.m.	5 p.p.m.	10 p.p.m.	30 minutes.
Hydrogen fluoride (Z37.28-1969).....	do.	do.	do.	do.
Fluoride as dust (Z37.28-1969).....	2.5 mg./M ³	.....	.....	.....
Lead and its inorganic compounds (Z37.11-1969).....	0.2 mg./M ³	.....	.....	.....
Methyl chloride (Z37.18-1969).....	100 p.p.m.	200 p.p.m.	300 p.p.m.	5 minutes in any 3 hours.
Methylene Chloride (Z37.3-1969).....	500 p.p.m.	1,000 p.p.m.	2,000 p.p.m.	5 minutes in any 2 hours.
Organic (alkyl) mercury (Z37.30-1969).....	0.01 mg./M ³	0.04 mg./M ³	.....	.....
Styrene (Z37.15-1969).....	100 p.p.m.	200 p.p.m.	500 p.p.m.	5 minutes in any 3 hours.
Trichloroethylene (Z37.19-1967).....	do.	do.	300 p.p.m.	5 minutes in any 2 hours.
Tetrachloroethylene (Z37.22-1967).....	do.	do.	do.	5 minutes in any 3 hours.
Toluene (Z37.12-1967).....	200 p.p.m.	300 p.p.m.	500 p.p.m.	10 minutes.
Hydrogen sulfide (Z37.2-1966).....	20 p.p.m.	50 p.p.m.	50 p.p.m.	10 minutes once only if no other measurable exposure occurs.
Mercury (Z37.8-1971).....	.....	1 mg./10M ³	.....	.....
Chromic acid and chromates (Z37.7-1971).....	.....	do.	.....	.....

TABLE G-3—MINERAL DUSTS

Substance	Mppcf*	Mg/M ³	Aerodynamic diameter (unit density sphere)	Percent passing selector
Silica:	250 [†]	10mg/M ³ =	2	90
			2.5	75
			3.5	50
			5.0	25
			10	0
Crystalline:				
Quartz (respirable).....	%SiO ₂ +5	%SiO ₂ +2		
Quartz (total dust).....		%SiO ₂ +3		
		%SiO ₂ +2		
Cristobalite: Use 1/2 the value calculated from the count or mass formulae for quartz.				
Tridymite: Use 1/2 the value calculated from the formulae for quartz.				
Amorphous, including natural diatomaceous earth.....	20	80mg/M ³		
		%SiO ₂		
Silicates (less than 1% crystalline silica):				
Mica.....	20			
Soapstone.....	20			
Talc (non-asbestos-form).....	20 [‡]			
Talc (fibrous). Use asbestos limit.				
Tremolite (see talc, fibrous)				
Portland cement.....	50			
Graphite (natural).....	15			
Coal dust (respirable fraction less than 6% SiO ₂).....		2.4mg/M ³ or		
For more than 6% SiO ₂		10mg/M ³		
		%SiO ₂ +3		
Inert or Nuisance Dust:				
Respirable fraction.....	15	5mg/M ³		
Total dust.....	50	15mg/M ³		

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

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

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

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

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

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

The measurements under this note refer to the use of an AEC instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 Mg/M³ in the table for coal dust is 4.5 Mg/M³.

§ 1910.93a Asbestos.

(a) **Definitions.** For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) **Permissible exposure to airborne concentrations of asbestos fibers.**—(1) **Standard effective July 7, 1972.** The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) **Standard effective July 1, 1976.** The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) **Ceiling concentration.** No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) **Methods of compliance.**—(1) **Engineering methods.** (i) **Engineering controls.** Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) **Local exhaust ventilation.** (a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1971, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z9.2-1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) **Particular tools.** All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) **Work practices.**—(1) **Wet methods.** Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) **Particular products and operations.** No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) **Spraying, demolition, or removal.** Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d) (2) (iii) of this section and with special clothing in accordance with paragraph (d) (3) of this section.

(d) **Personal protective equipment.**—(1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of

this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in subdivision (ii) or (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (a) The employer shall establish a respirator program in accordance with the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2-1969, which is incorporated by reference herein.

b. See § 1910.6 concerning the availability of ANSI Z88.2-1969 and the maintenance of an historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(c) No employee shall be assigned to tasks requiring the use of respirators if,

based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) *Special clothing:* The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) *Change rooms:* (1) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) *Clothes lockers:* The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) *Laundrying:* (a) Laundrying of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(b) Any employer who gives asbestos-contaminated clothing to another person for laundrying shall inform such person of the requirement in (a) of this subdivision to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(c) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 X (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring—(1) Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring—(1) Samples* shall be collected from within the

breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring—(1)* samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels.* (1) *Caution signs.* (i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(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---	¼" Gothic.
Wear Assigned Protective Equipment.	¼" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¼" Gothic.
Breathing Asbestos Dust May Be Hazardous 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 3 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.

(2) **Employee access.** Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this

paragraph, which indicates the employee's own exposure to asbestos fibers.

(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.

(j) **Medical examinations**—(1) **General.** The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) **Preplacement.** The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV₁).

(3) **Annual examinations.** On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV₁).

(4) **Termination of employment.** The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV₁).

(5) **Recent examinations.** No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) **Medical records**—(i) **Maintenance.** Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) **Access.** The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying,

to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

§ 1910.94 Ventilation.

(a) **Abrasive blasting**—(1) **Definitions applicable to this paragraph**—(i) **Abrasive.** A solid substance used in an abrasive blasting operation.

(ii) **Abrasive-blasting respirator.** A continuous flow air-line respirator constructed so that it will cover the wearer's head, neck, and shoulders to protect him from rebounding abrasive.

(iii) **Blast cleaning barrel.** A complete enclosure which rotates on an axis, or which has an internal moving tread to tumble the parts, in order to expose various surfaces of the parts to the action of an automatic blast spray.

(iv) **Blast cleaning room.** A complete enclosure in which blasting operations are performed and where the operator works inside of the room to operate the blasting nozzle and direct the flow of the abrasive material.

(v) **Blasting cabinet.** An enclosure where the operator stands outside and operates the blasting nozzle through an opening or openings in the enclosure.

(vi) **Clean air.** Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.

(vii) **Dust collector.** A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

(viii) **Exhaust ventilation system.** A system for removing contaminated air from a space, comprising two or more of the following elements (a) enclosure or hood, (b) duct work, (c) dust collecting equipment, (d) exhauster, and (e) discharge stack.

(ix) **Particulate-filter respirator.** An air purifying respirator, commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

(x) **Respirable dust.** Airborne dust in sizes capable of passing through the upper respiratory system to reach the lower lung passages.

(xi) **Rotary blast cleaning table.** An enclosure where the pieces to be cleaned are positioned on a rotating table and are passed automatically through a series of blast sprays.

(xii) **Abrasive blasting.** The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

(2) **Dust hazards from abrasive blasting.** (i) **Abrasives** and the surface coatings on the materials blasted are shattered and pulverized during blasting