

4123:1-3-24 Roof car suspended platforms - construction.

(A) Roof car.

- (1) The horizontal speed of a roof car shall be no more than fifty feet per minute.
- (2) A roof car may not be moved horizontally unless means are in place to prevent the car from moving outside the areas provided for roof car travel.
- (3) The roof car shall be designed and installed in such a manner as to remain stable and upright under every loading condition.
- (4) A roof car shall be so positioned and anchored to the structure as to insure that the working platform is placed and retained in proper position for vertical travel.
- (5) The operating device controlling movement of a roof car shall be of the continuous pressure weatherproof electric type and shall be located on the roof car, the working platform, or both. If located on both, such operating devices shall be interlocked so that control is possible only from one at a time.
- (6) The operating device controlling movement of a roof car shall not be operable until the working platform is at its uppermost position for travel and is not in contact with the building face or fixed vertical guides in the face of the building, and until all protective devices and interlocks are in a position for movement.
- (7) If the access to the roof car at any point of its travel is not over the roof area, standard guardrails with self-closing, self-locking gates shall be provided on the roof car.

(B) Working platforms.

- (1) The working platform shall be of girder or truss construction and shall be capable of supporting its rated load under any position of loading.
- (2) Each working platform shall bear the manufacturer's load rating plate, conspicuously posted and legible, stating the maximum permissible load.
- (3) The vertical speed of a working platform suspended by four or more hoisting ropes shall be no more than seventy-five feet per minute.
- (4) The vertical speed of a working platform suspended by less than four hoisting ropes shall be no more than thirty-five feet per minute.
- (5) The working platform shall be no less than twenty-four inches wide.
- (6) The working platform shall be provided with toeboards and with permanent guardrails no less than thirty-six inches high, and no more than forty-two inches high at the front (building side). At the rear, and on the sides, a standard guardrail and toeboard shall be provided. An

intermediate guardrail shall be provided around the entire platform between the top guardrail and the toeboard.

(7) The platform flooring shall be of the nonskid type.

(8) Where access gates are provided, they shall be self-closing and self-locking. Such gates are required where access to the working platform is not over the roof area.

(9) A means shall be provided to prevent inadvertent horizontal movement of the working platform.

(10) The operating device controlling vertical movement of the working platform shall be located on the working platform and shall be of the continuous pressure weatherproof electric type.

(11) The operating device controlling vertical movement shall be operable only when all electrical protective devices and interlocks on the working platform are in normal operating position, and the roof car is at an established operating point.

(12) On roof-powered platforms, an emergency electric operating device shall be provided near the hoisting machine for use in the event of failure of the normal operating device for the working platform or failure of the traveling cable system. This emergency device shall be mounted in a locked compartment and shall have a legend mounted thereon reading: "For Emergency Operation Only. Establish Communication With Personnel On Working Platform Before Use." A key for unlocking the compartment housing the emergency operating device shall be mounted in a break-glass receptacle located near the device.

(C) Hoisting equipment.

(1) Hoisting equipment shall consist of a power-driven drum or drums contained in the roof car (i.e., roof-powered platform) or contained on the working platform (i.e., self-powered platform).

(2) Hoisting equipment shall be power-operated in both up and down directions.

(3) Where exposed to contact, rotating shafts, drums, couplings, other mechanisms and gears shall be guarded.

(4) Friction devices or clutches shall not be used for connecting the main driving mechanism to the drum or drums. Belt- or chain-driven machines are prohibited.

(5) Hoisting motors shall be electric and of weatherproof construction.

(6) Hoisting motors shall be directly connected to the hoisting machinery. Motor couplings, if used, shall be of steel construction.

(7) Hoisting machines shall have two independent braking means, each designed to stop and hold the working platform with one hundred twenty-five per cent of rated load.

(D) Hoisting ropes and winding drums.

(1) Each hoisting rope shall be made of wire and shall be no less than five-sixteenths-inch diameter.

(2) Working platforms shall be suspended by no less than two ropes with a safety factor of ten as calculated under the following formula:

$$\frac{F = S \times N}{w}$$

Where

S = manufacturer's rated breaking strength
of one rope

N = number of ropes under load

W = maximum static load on all ropes with
the platform and its rated load at
any point of its travel

(3) Where winding drums are used, the rope shall be wound in level layers.

(4) Winding drums shall have no less than three turns of rope remaining when the working platform is at its lowest possible point of travel.

(5) Where the working platform is suspended by more than two ropes, the non-drum ends of the ropes shall be provided with individual shackle rods which will permit individual adjustment of rope lengths.

(6) The lengthening or repairing of wire ropes by splicing is prohibited.

(7) More than two reverse bends in each rope are prohibited.

(8) Wire rope shall not be used if, in any length of eight diameters, the total number of visible broken wires exceeds ten per cent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.

(E) Electrical protective devices.

(1) Electrical protective devices and interlocks shall be of the weatherproof type.

(2) When a traveling cable storage reel is used, an electric contact shall be provided and so connected that it will cause the relay for vertical travel to open if the tension on the traveling cable exceeds safe limits.

(3) An automatic overload device shall be provided to cut off electrical power to the circuit in all hoisting motors for travel in the up direction, should the load applied to the hoisting ropes at either end of the working platform exceed one hundred twenty-five per cent of its normal tension with rated load as shown on the manufacturer's data plate on the working platform.

(4) An automatic device shall be provided for each hoisting rope which will cut off electrical power to the hoisting motor or motors in the down direction and will apply the brakes if any hoisting rope becomes slack.

(5) Upper and lower directional limit devices shall be provided to prevent the travel of the working platform beyond the normal upper and lower limits of travel.

(6) Directional limit devices, if driven from the hoisting machine by chains, tapes, or cables, shall incorporate a device to disconnect the electric power from the hoisting machine and apply both the primary and secondary brakes in the event of failure of the driving means.

(7) On platforms with four or more ropes, final terminal stopping devices for the working platform shall be provided as a secondary means of preventing the working platform from over-traveling at the terminals.

(8) Emergency stop switches shall be provided in or adjacent to each operating device.

(9) Electrical cord strain relief anchors and grip or equivalent means shall be provided to prevent the electrical cord from pulling on the receptacle.

(F) Emergency communications.

A means of two-way communication shall be provided for each roof car suspended platform for use in an emergency.

(G) Safety belts and lifelines.

A safety belt or harness with means for attachment to a lifeline on the roof or to the working platform shall be provided for each employee on a working platform suspended by less than four wire ropes.

APPENDIX I
TABLE OF STANDARD MATERIALS AND DIMENSIONS*

Material	Clearance from moving part at all points	Largest mesh of opening allowable	Minimum gauge (U.S. Standard) or thickness	Minimum height of guard from floor or platform level
	Inches	Inches		Feet
Woven wire	Under 2	3/8	No. 16	7
	2-4	1/2	No. 16	7
	Under 4	1/2	No. 16	7
Expanded metal	4-15	2	No. 12	7
	Under 4	1/2	No. 18	7
	4-15	2	No. 13	7
Perforated metal	Under 4	1/2	No. 20	7
	4-15	2	No. 14	7
Sheet metal	Under 4		No. 22	7
	4-15		No. 22	7
Wood or metal strip crossed	Under 4	3/8	Wood 3/4 Metal No. 16	7
	4-15	2	Wood 3/4 Metal No. 16	7
Wood or metal strip not crossed	Under 4	1/2 width	Wood 3/4 Metal No. 16	7
	4-15	1 width	Wood 3/4 Metal No. 16	7
Standard guard railing**	Minimum 15			
	Maximum 20			

* Guards constructed of these materials shall be securely fastened in place.
** Permissible only where indicated.

(H) Installations or constructions built or contracted for prior to the effective date of this rule shall be deemed to comply with the provisions of these requirements if such installations or constructions comply either with the provisions of these requirements or with the provisions of any applicable specific requirement which was in effect at the time contracted for or built.

Effective: 1/1/83

APPENDIX II

THRESHOLD LIMIT VALUES (TLV)

This Appendix is for information and guide purposes only. The information contained in this Appendix is not to be construed as specific requirements of this code.

The time-weighted average concentration of air contaminants breathed by employees should not exceed the following threshold limit values for an eight-hour daily exposure.

Threshold limit values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the threshold limit; a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness.

Threshold limit values refer to time-weighted concentrations for an eight-hour workday and forty-hour workweek. They should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations. (Exceptions are substances designated with a "C" or "Ceiling" value.)

These limits are intended for use in the practice of industrial hygiene. They are not intended for use, or for modification for use as proof or disproof of an existing disease or physical condition.

Threshold limit values should not be used as the sole criterion for establishing evidence of hazards to health but the evaluation of a possible hazard should also be subject to other pertinent factors, such as the nature of the contaminant and the frequency and duration of the exposure, and clinical evidence of the harmful effects.

"Skin" Notation

Listed substances followed by the designation "skin" refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either airborne, or more particularly, by direct contact with the substance. Vehicles can alter skin absorption. This attention-calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the threshold limit is not invalidated.

"C" (Ceiling) Values

A listed value bearing a "C" designation refers to a "ceiling" value that should not be exceeded; all values should fluctuate below the listed value. This, in effect, makes the "C" designation a maximal allowable concentration (MAC). In general, the bases for assigning or not assigning a "C" value rest on whether excursions of concentration above a proposed limit for periods up to fifteen (15) minutes may result in a) intolerable irritation, b) chronic, or irreversible tissue change, or c) narcosis of sufficient degree to increase accident proneness, impair self-rescue or materially reduce work efficiency.

Excursion Factors

For all substances not bearing "C" notation

Excursion Factors

For all substances not bearing "C" notation

		Excursion	
	(ppm or mg/m ³),	Factor	=
TLV > 0-1			3
TLV > 1-10	"	"	2
TLV > 10-100	"	"	1.5
TLV > 100-1000	"	"	1.25

The number of occasions the excursion above the TLV is permitted is governed by conformity with the Time-weighted Average TLV.

TABLE OF

THRESHOLD LIMIT VALUES (TLV)

Substance	ppma	mg/m ³ b
Abate -----10		
Acetaldehyde -----100		180
Acetic acid -----10		25
C Acetic anhydride -----5		20
Acetone -----1,000		2,400
Acetonitrile -----40		70
Acetylene dichloride, see 1, 2-Dichloroethylene -----		
Acetylene tetrabromide -----	1	14
Acrolein -----	0.1	0.25
Acrylamide - Skin -----		0.3
Acrylonitrile - Skin -----	20	45
Substance	ppma	mg/m³b
Aldrin - Skin -----		0.25
Allyl alcohol - Skin -----	2	5
Allyl chloride -----	1	3
Allyl glycidyl ether (AGE) - Skin -----	5	22
Allyl propyl disulfide -----	2	12
2-Aminoethanol, see		

Ethanolamine -----			
2-Aminopyridine -----	0.5		2
C Ammonia -----	50		36
Ammonium chloride, fume -----			10
Ammonium sulfamate (Ammate) -----			10
n-Amyl acetate -----	100		525
sec-Amyl acetate -----	125		650
Aniline - Skin -----	5		19
Anisidine (o-, p-isomers) - Skin -----	0.1		0.5
Antimony & compounds (as Sb) -----			0.5
ANTU (alpha naphthyl thiourea) -----			0.3
Arsenic & compounds (as As) -----			0.5
Arsine -----	0.05		0.2
Azinphos methyl - Skin -----			0.2
Baygon (Propoxur) -----			0.5
Barium (soluble compounds) -----	0.5		
C Benzene - Skin -----	10	32	
p-Benzoquinone, see Quinone -----			
Benzoyl peroxide -----		5	
Benzyl chloride -----	1	5	
Beryllium -----			0.002
Biphenyl -----		0.2	1
Bismuth telluride -----			10
Bismuth telluride (Se-doped) -----			5
Boron oxide -----			10
Boron tribromide -----			10
C Boron trifluoride -----	1		3
Bromine -----	0.1		0.7
Bromine pentafluoride -----	0.1		0.7
Bromoform - Skin -----	0.5		5
Butadiene (1, 3-butadiene) -----	1,000		2,200
Butane -----	600	1,420	
Butanethiol, see Butyl mercaptan -----			
2-Butanone (see Methyl Ethyl Ketone) -----			
Substance		ppma	mg/m3b
2-Butoxy ethanol (Butyl Cellosolve) - Skin (see Cellosolves; Butyl Cellosolve) -----			
Butyl acetate (n-butyl acetate) -----	150	710	
sec-Butyl acetate -----	200	950	
tert-Butyl acetate -----	200	950	
n-Butyl alcohol - Skin -----	50	150	
sec-Butyl alcohol -----	150	450	
tert-Butyl alcohol -----	100	300	

C Butylamine - Skin -----	5	15
C tert-Butyl chromate (as CrO3) - Skin-----		0.1
n-Butyl glycidyl ether (BGE) -----	50	270
Butyl lactate -----	5	30
Butyl mercaptan -----	0.5	1.5
p-tert-Butyltoluene -----	10	60
Cadmium (Metal dust and salts, as Cd) -----		0.05
C Cadmium oxide fume (as Cd) -----		0.05
Calcium arsenate, as As -----		1
Calcium cyanide -----	0.5	
Calcium hydroxide -----		5
Calcium oxide -----		2
Camphor (Synthetic) -----	2	12
Caprolactam Dust -----		1
Vapor -----	5	20
Captan -----		5
Carbaryl (SevinR) -----		5
Carbofuran -----		0.1
Carbon black -----		3.5
Carbon dioxide -----	5,000	9,000
Carbon disulfide - Skin -----	20	60
Carbon monoxide -----	50	55
Carbon tetrabromide -----	0.1	1.4
Carbon tetrachloride - Skin -----	10	65
Cellosolves:		
Butyl cellosolve (2-butoxyethanol)		
(ethylene glycol mono-n-butyl ether) - Skin -----	50	240
Ethyl cellosolve (2-ethoxyethanol)		
(ethylene glycol monoethyl ether) - Skin -----	200	740
Ethyl cellosolve acetate (2-ethoxy-ethyl acetate)		
(ethylene glycol monoethyl ether acetate) - Skin --	100	540
Methyl cellosolve (2-methoxyethanol)		
(ethylene glycol monomethyl ether) - Skin -----	25	80
Methyl cellosolve acetate (2-methox- yethyl acetate)		
Substance	ppma	mg/m3b
(ethylene glycol monomethyl ether acetate) - Skin	25	120
Cesium hydroxide -----		2
Chlordane - Skin -----		0.5
Chlorinated camphene - Skin -----		0.5
Chlorinated diphenyl oxide -----		0.5
Chlorine -----	1	3
Chlorine dioxide -----	0.1	0.3
C Chlorine trifluoride -----	0.1	0.4
C Chloroacetaldehyde -----	1	3
a-Chloroacetophenone (phenacylchloride)-----	0.05	0.3
Chlorobenzene (monochlorobenzene) -----	75	350
o-Chlorobenzylidene malononitrile		

(OCBM) - Skin -----	0.05	0.4
Chlorobromomethane -----	200	1,050
2-Chloro-1, 3-butadiene (see Chloroprene) -----		
Chlorodifluoromethane -----	1,000	3,500
Chlorodiphenyl (42% Chlorine) - Skin -----		1
Chlorodiphenyl (54% Chlorine) - Skin -----		0.5
1-Chloro, 2, 3-epoxypropane (see Epichlorhydrin) -----		
2-Chloroethanol (see Ethylene chlorohydrin) -----		
Chloroethylene (see Vinyl chloride) -----		
Chloroform (Trichloromethane) -----	10	50
bis-Chloromethyl ether -----	0.001	0.003
1-Chloro-1-nitropropane -----	20	100
Chloropicrin -----	0.1	0.7
Chloroprene (2-chloro-1, 3-butadiene) Skin -----	25	90
Chlorpyrifos (DursbanR) - Skin -----		0.2
o-Chlorostyrene -----	50	285
o-Chlorotoluene -----	50	250
2-Chloro-6-(trichloromethyl) pyridine (N-ServeR) -----		10
Chromates, certain insoluble forms -----		0.1
Chromic acid and chromates (as CrO ₃)-----		0.1
Chromium, sol. chromic, chromous salts as Cr -----		0.5
Clopidol (CoydenR) -----		10
Cobalt, metal fume & dust -----		0.05
Copper fume -----		0.2
Dusts and Mists -----		1
Substance	ppma	mg/m³b
Cotton Dust (raw) -----		0.2
Crag ® herbicide -----		10
Cresol (all isomers) - Skin -----	5	22
Crotonaldehyde -----	2	6
Crufomate (Ruelene®) -----		50
Cumene - Skin -----	50	245
Cyanide (as CN) - Skin -----		5
Cyanogen -----	10	20
Cyclohexane -----	300	1,050
Cyclohexanol -----	50	200
Cyclohexanone -----	50	200
Cyclohexene -----	300	1,015
Cyclohexylamine - Skin -----	10	40
Cyclopentadiene -----	75	200
2, 4-D -----		10

DDT -----		1	
DDVP (see Dichlorvos) -----			
Decaborane - Skin -----	0.05	0.3	
DemetonR - Skin -----	0.01	0.1	
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone) -----	50	240	
1, 2-Diaminoethane (see Ethylenediamine) -----			
Diazinon - Skin -----		0.1	
Diazomethane -----	0.2	0.4	
Diborane -----	0.1	0.1	
1, 2-Dibromoethane (ethylene dibromide) - Skin -----	20	145	
DibromR -----		3	
2-N Dibutylaminoethanol - Skin -----	2	14	
Dibutyl phosphate -----	1	5	
Dibutylphthalate -----		5	
C Dichloracetylene -----	0.1	0.4	
C o-Dichlorobenzene -----	50	300	
p-Dichlorobenzene -----	75	450	
Dichlorodifluoro- methane -----	500	2,475	
1, 3-Dichloro-5, 5-dimethyl hydantoin -----		0.2	
1, 1-Dichloroethane -----	200	820	
1, 2-Dichloroethane -----	50	200	
1, 2-Dichloroethylene -----	200	790	
Dichloroethyl ether - Skin -----	5	30	
Dichloromethane (see Substance	ppma	mg/m3b	
Methylene chloride) -----			
Dichloromonofluoromethane -----	1,000	4,200	
C 1, 1-Dichloro-1-nitroethane -----	10	60	
1, 2-Dichloropropane (see Propylenedichloride) -----			
Dichlorotetrafluoroethane -----	1,000	7,000	
Dichlorvos (DDVP) - Skin -----		0.1	1
Dicyclopentadiene -----	5.0	27	
Dicyclopentadienyliron -----		10	
Dieldrin - Skin -----		0.25	
Diethylamine -----	25	75	
Diethylamino ethanol - Skin -----	10	50	
Diethylene triamine - Skin -----	1	4	
Diethylether (see Ethyl ether) -----			
Diethylphthalate -----		5	
Difluorodibromomethane -----	100	860	
C Diglycidyl ether (DGE) -----	0.5	2.8	

Dihydroxybenzene (see Hydroquinone) -----		
Diisobutyl ketone -----	25	150
Diisopropylamine - Skin -----	5	20
Dimethoxymethane (see Methylal) -----		
Dimethyl acetamide - Skin -----	10	35
Dimethylamine -----	10	18
Dimethylaminobenzene (see Xylidene) -----		
Dimethylaniline (N-dimethylaniline) - Skin -----	5	25
Dimethylbenzene (see Xylene) -----		
Dimethyl 1, 2-dibromo-2-dichloroethyl phosphate (see Dibrom) -----		
Dimethylformamide - Skin -----	10	30
2, 6-Dimethylheptanone (see Diisobutyl ketone) -----		
1, 1-Dimethylhydrazine - Skin -----	0.5	1
Dimethylphthalate -----		5
C Dimethyl sulfate - Skin -----	1	5
Dinitrobenzene (all isomers) - Skin -----	0.1	5.1
Dinitro-o-cresol - Skin -----		0.2
3, 5-Dinitro-o-toluamide (ZoaleneR) -----		5.0
Substance	ppma	mg/m3b
Dinitrotoluene - Skin -----		1.5
Dioxane, technical grade - Skin -----	50	180
Diphenyl (see Biphenyl) -----		
Diphenyl amine -----		10
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate [MDI] -----		
Dipropylene glycol methyl ether - Skin-----	100	600
Diquat -----		0.5
Di-sec, octyl phthalate (Di-2-ethyl-hexylphthalate) -----		5
Disulfuram -----		2
Disyston - Skin -----		0.1
2, 6-Ditert-butyl-p-cresol -----		10
Dyfonate -----		0.1
Endosulfan (ThiodanR) - Skin -----		0.1
Endrin - Skin -----		0.1
Epichlorhydrin - Skin -----	5	19
EPN - Skin -----		0.5
1, 2-Epoxypropane (see		

Propylene oxide) -----			
2, 3-Epoxy-1-propanol (see Glycidol) -----			
Ethanethiol (see			
Ethyl mercaptan)-----			
Ethanolamine -----	3		6
Ethion (NialateR) - Skin -----			0.4
2-Ethoxyethanol (see			
Cellosolves: Ethyl Cellosolve) -			
Skin -----			
2-Ethoxyethylacetate (see			
Cellosolves: Ethyl Cellosolve Acetate) -			
Skin -----			
Ethyl acetate -----	400		1,400
Ethyl acrylate - Skin -----	25		100
Ethyl alcohol (ethanol) -----	1,000	1,900	
Ethylamine -----	10		18
Ethyl sec-amyl ketone (5-methyl-3-			
heptanone) -----	25		130
Ethyl benzene -----	100		435
Ethyl bromide -----	200		890
Ethyl butyl ketone (3-Heptanone) -----	50		230
Ethyl chloride -----	1,000	2,600	
Ethyl ether -----	400		1,200
Ethyl formate -----	100		300
Ethyl mercaptan -----	0.5		1
Ethyl silicate -----	100		850
C Ethylene chlorohydrin - Skin -----	1		3
Ethylenediamine -----	10		25
Ethylene dibromide (see 1, 2-Dibromoethane) -----			
Ethylene dichloride (see 1, 2-Dichloroethane) -----			
Ethylene glycol, particulate -----			10
Ethylene glycol, vapor -----	100		260
C Ethylene glycol dinitrate and/or Nitroglycerin - Skin 0.2 -			
Ethylene glycol monomethyl ether ace-tate (see Cellosolves: Methyl cellosolve			
acetate) - Skin -----			
Ethylene oxide -----	50		90
Ethylenimine - Skin -----	0.5		1
Ethylidene chloride (see			
1, 1-Dichloroethane) -----			
C Ethylidene norbornene -----	5		25
N-Ethylmorpholine - Skin -----	20		94
Fensulfothion (Dasanit) -----			0.1
Ferbam -----			10
Ferrovandium dust -----			1
Substance ppma mg/m3b			
Fluoride (as F) -----			2.5
Fluorine -----	1		2
Fluorotrichloromethane -----	1,000	5,600	
C Formaldehyde -----	2		3

Formamide -----	20		30	
Formic acid -----	5		9	
Furfural - Skin -----	5		20	
Furfuryl alcohol -----	5		20	
Germanium tetrahydride -----	0.2		0.6	
Glutaraldehyde, activated and unactivated -----	0.3		1.2	
Glycidol (2, 3-Epoxy-1-propanol) -----	50		150	
Glycol monoethyl ether (see 2-Ethoxyethanol) -----				
GuthionR (see Azinphosmethyl) -----				
Hafnium -----			0.5	
Heptachlor - Skin -----			0.5	
Heptane (n-heptane) -----	400		1,640	
Hexachlorocyclopentadiene -----	0.01		0.11	
Hexachloroethane - Skin -----	1		10	
Hexachloronaphthalene - Skin -----		0.2		
Hexafluoroacetone -----	0.1		0.7	
Hexane (n-hexane) -----	100		350	
2-Hexanone (Methylbutyl ketone) - Skin -----		25		102
Hexone (Methyl isobutyl ketone) - Skin -----	100		410	
sec-Hexyl acetate -----	50		300	
C Hexylene glycol -----	25		120	
Hydrazine - Skin -----	1		1.3	
Hydrogen bromide -----	3		10	
C Hydrogen chloride -----	5		7	
C Hydrogen cyanide - Skin -----	10		11	
Hydrogen fluoride -----	3		2	
Hydrogen peroxide -----	1		1.4	
Hydrogen selenide -----	0.05		0.2	
C Hydrogen sulfide -----	10		15	
Hydrogenated terphenyls -----	0.5			
Hydroquinone -----			2	
Indene -----	10		45	
Indium and compounds, as In -----			0.1	
C Iodine -----	0.1		1	
Iodoform -----	0.2		3.2	
Iron oxide fume -----			5	
Iron pentacarbonyl -----	0.01		0.08	
Iron salts, soluble, as Fe -----			1	
Isoamyl acetate -----	100		525	
Isoamyl alcohol -----	100		360	
Isobutyl acetate -----	150		700	
Isobutyl alcohol -----	50		151	
C Isophorone -----	5		25	
Isopropyl acetate -----	250		950	
Isopropyl alcohol - Skin -----	400		980	
Isopropylamine -----	5		12	

Isopropyl ether -----	250	1,050	
Isopropyl glycidyl ether (IGE) -----	50	240	
Ketene -----	0.5	0.9	
Lead, inorg., fumes and dusts, as Pb -----		0.15	
Lead arsenate, as Pb -----		0.15	
Lindane - Skin -----		0.5	
Lithium hydride -----		0.025	
L.P.G. (Liquefied petroleum gas) -----	1,000	1,800	
Magnesium oxide fume -----		10	
Malathion - Skin -----		10	
Maleic anhydride -----	0.25	1	
C Manganese and compounds, as Mn -----		5	
Manganese cyclopentadienyl tricarbonyl (as Mn) - Skin ----		0.1	
Mercury (Alkyl compounds) - Skin, as 44			
Hg -----	0.001	0.01	
Mercury (All forms except alkyl) as Hg ----		0.05	
Mesityl oxide -----	25	100	
Methanethiol, (see Methyl mercaptan) -----			
Methoxychlor -----		10	
2-Methoxyethanol (see Cellosolves: Methyl cellosolve) Skin -----			
Methyl acetate -----	200	610	
Methyl acetylene (propyne) -----	1,000	1,650	
Methyl acetylene-propadiene mixture (MAPP) -----	1,000	1,800	
Methyl acrylate - Skin -----	10	35	
Methyl acrylonitrile - Skin -----	1	3	
Methylal (dimethoxymethane) -----	1,000	3,100	
Methyl alcohol (methanol) - Skin -----	200	260	
Methylamine -----	10	12	
Methyl amyl alcohol (see Methyl isobutyl carbinol) -----			
Methyl 2-cyanoacrylate -----	2	8	
Methyl isoamyl ketone -----	100	475	
Methyl n-amyl ketone (2-Heptanone) -----	100	465	
Methyl bromide - Skin -----	15	60	
Methyl butyl ketone (see 2-Hexanone) -----			
Methyl cellosolve - 2-Methoxyethanol (see Cellosolves: Methyl cellosolve) -----			
Methyl cellosolve acetate - Ethylene glycol monomethyl ether acetate (see Cellosolves: Methyl cellosolve acetate) -----			
Substance		ppma	mg/m3b
Methyl chloride -----	100	210	

Methyl chloroform -----	350		1,900
Methylcyclohexane -----	400		1,600
Methylcyclohexanol -----	50		235
o-Methylcyclohexanone - Skin -----	50		230
Methylcyclopentadienyl manganese tri- carbonyl (as Mn) - Skin -----	0.1		0.2
Methyl demeton - Skin -----			0.5
Methyl ethyl ketone (MEK) 2-Butanone -----	200		590
C Methyl ethyl ketone peroxide -----	0.2		1.5
Methyl formate -----	100		250
Methyl iodide - Skin -----	5		28
Methyl isobutyl carbinol - Skin -----	25		100
Methyl isobutyl ketone (see Hexone) -----			
Methyl isocyanate - Skin -----	0.02		0.05
Methyl mercaptan -----	0.5		1
Methyl methacrylate -----	100		410
Methyl parathion - Skin -----			0.2
Methyl propyl ketone (see 2-Pentanone) -----			
C Methyl silicate -----	5		30
C a-Methyl styrene -----	100		480
C Methylene bisphenyl isocyanate (MDI) -----	0.02		0.2
Methylene chloride (dichloromethane) -----		100	360
C Methylene bis (4-cyclohexylisocyanate) -	0.01		0.11
Molybdenum (as Mo),soluble compounds -----			5
Insoluble compounds -----			10
Monomethyl aniline - Skin -----	2		9
C Monomethyl hydrazine - Skin -----	0.2		0.35
Morpholine - Skin -----	20		70
Naphthalene -----	10		50
Nickel carbonyl -----	0.05		0.35
Nickel, metal and insoluble compounds (as Ni) -----			1
Nickel, soluble salts (as Ni)-----			0.1
Nicotine - Skin -----			0.5
Nitric acid -----		2	5
Nitric oxide -----	25		30
p-Nitroaniline - Skin -----	1		6
Nitrobenzene - Skin -----	1		5
p-Nitrochlorobenzene - Skin -----			1
Nitroethane -----	100		310
C Nitrogen dioxide -----	5		9
Nitrogen trifluoride -----	10		29
Nitroglycerin - Skin -----	0.2		2
Nitromethane -----	100		250
1-Nitropropane -----	25		90
2-Nitropropane -----	25		90
Nitrotoluene - Skin -----	5		30
Nitrotrichloromethane (see Chloropicrin) -----			
Nonane -----	200		1,050

Substance		ppma	mg/m ³ b
Octachloronaphthalene - Skin -----			0.1
Octane -----	300		1,380
Oil mist, particulate -----			5
Osmium tetroxide, as Os -----	0.0002		0.002
Oxalic acid -----			1
Oxygen difluoride -----	0.05		0.1
Ozone -----	0.1		0.2
Paraffin wax fume -----			2
Paraquat (respirable size) -----			0.1
Parathion - Skin -----			0.1
Pentaborane -----	0.005	0.01	
Pentachloronaphthalene - Skin -----			0.5
Pentachlorophenol - Skin -----			0.5
Pentane -----	600		1,680
2-Pentanone -----	200		700
Perchloroethylene - Skin -----	100		670
Perchloromethyl mercaptan -----	0.1		0.8
Perchloryl fluoride -----	3		14
Phenol - Skin -----	5		19
Phenothiazine - Skin -----			5
p-Phenylene diamine - Skin -----			0.1
Phenyl ether (vapor) -----	1		7
Phenyl ether-Diphenyl mixture (vapor) -----	1		7
henylethylene (see Styrene) -----			
Phenyl glycidyl ether (PGE) -----	10		60
Phenylhydrazine - Skin -----	5		22
C Phenylphosphine -----	0.05		0.25
Phorate (ThimetR) - Skin -----			0.05
Phosdrin (MevinphosR) - Skin -----	0.01		0.1
C Phosgene (carbonyl chloride) -----	0.05		0.2
Phosphine -----	0.3		0.4
Phosphoric acid -----			1
Phosphorus (yellow) -----			0.1
Phosphorus pentachloride -----			1
Phosphorus pentasulfide -----			1
Phosphorus trichloride -----	0.5		3
Phthalic anhydride -----	1		6
Picloram (TordonR) -----			10
Picric acid - Skin -----			0.1
PivalR (2-Pivalyl-1, 3-indandione) -----			0.1
Platinum (Soluble Salts) as Pt -----			0.002
Polychlorobiphenyls (see Chlorodiphenyls) -----			
C Potassium hydroxide -----			2
Propargyl alcohol - Skin -----	1		2

n-Propyl acetate -----	200	840
Propyl alcohol - Skin -----	200	500
n-Propyl nitrate -----	25	110
Propylene dichloride (1, 2-Dichloropropane)-----	350	
C 1, 2-Propylene glycol dinitrate - Skin -----	0.05	0.35

Substance ppma mg/m3b

Propylene glycol monomethyl ether -----	100	360
Propylene imine - Skin -----	2	5
Propylene oxide -----	100	240
Propyne (see Methylacetylene) -----		
Pyrethrum -----		5
Pyridine -----	5	15
Quinone -----	0.1	0.4
RDX - Skin -----		1.5
Resorcinol -----	10	45
Rhodium, Metal fume and dusts (as Rh) -----		0.1
Soluble salts -----		0.001
Ronnel -----		10
Rosin Core Solder pyrolysis products (as formaldehyde) -----		0.1
Rotenone (commercial) -----		5
Selenium compounds (as Se) -----		0.2
Selenium hexafluoride (as Se) -----	0.05	0.4
SevinR (see Carbaryl) -----		
Silane (see Silicon tetrahydride) -----		
Silicon tetrahydride (Silane) -----	0.5	0.7
Silver, metal and soluble compounds (as Ag) - -		0.01
C Sodium azide -----	0.1	0.26
Sodium fluoroacetate (1080) - Skin -----		0.05
C Sodium hydroxide -----		2.0
Stibine -----	0.1	0.5
Stoddard solvent -----		100 -
Strychnine -----		0.15
Styrene, monomer (Phenylethylene) -----	100	420
C Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme) -----		0.00006
Succindialhyde (see Glutaraldehyde) -----		
Sulfur dioxide -----	5	13
Sulfur hexafluoride -----	1,000	6,000
Sulfuric acid -----		1
Sulfur monochloride -----	1	6
Sulfur pentafluoride -----	0.025	0.25
Sulfur tetrafluoride -----	0.1	0.4

Sulfuryl fluoride -----	5		20
Systox (see DemetonR) -----			
2, 4, 5-T -----			10
Tantalum -----			5
TEDP - Skin -----			0.2
Tellurium -----			0.1
Tellurium hexafluoride (as Te) -----	0.02		0.2
TEPP - Skin -----	0.004	0.05	

Substance		ppma	mg/m3b
C Terphenyls -----	1		9
1, 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		35
Tetrachloroethylene (see Perchloroethylene) -----			
Tetrachloromethane (see Carbon tetrachloride) -----			
Tetrachloronaphthalene - Skin -----			2
Tetraethyl lead (as Pb) - Skin -----			0.100
Tetrahydrofuran -----	200		590
Tetramethyl lead (as Pb) - Skin -----			0.150
Tetramethyl succinonitrile - Skin -----	0.5		3
Tetranitromethane -----	1		8
Tetryl (2, 4, 6-trinitrophenyl- methylnitramine) – Skin -----			1.5
Thallium (soluble compounds) - Skin (as Tl) -----			0.1
4, 4'-Thiobis (6-tert. butyl m-cresol)-----			10
ThiramR -----			5
Tin (inorganic compounds, except SnH4 and SnO2) as Sn			2
Tin (organic compounds) - Skin (as Sn) -----			0.1
Toluene (toluol) - Skin -----	100		375
C Toluene-2, 4-diisocyanate (TDI) -----	0.02		0.14
o-Toluidine -----	5		22
Toxaphene (see Chlorinated camphene) -----			
Tributyl phosphate -----			5
1, 1, 1-Trichloroethane (see Methyl chloroform) -----			
1, 1, 2-Trichloroethane - Skin -----	10		45
Trichloroethylene -----	100		535
Trichloromethane (see Chloroform) -----			
Trichloronaphthalene - Skin -----			5
1, 2, 3-Trichloropropane -----	50		300
1, 1, 2-Trichloro 1, 2, 2-trifluoro-ethane -----	1,000	7,600	
Triethylamine -----	25		100
Tricyclohexyltin hydroxide (PlictranR) ---			5
Trifluoromonobromomethane -----	1,000	6,100	
Trimethyl benzene -----	25		120
2, 4, 6-Trinitrophenol (see Picric acid) -----			
2, 4, 6-Trinitrophenyl-methylnitramine(see Tetryl) -----			

C 2, 4, 6-Trinitrotoluene (TNT) - Skin -----	0.05		0.5
Triorthocresyl phosphate -----			0.1
Triphenylamine -----			5
Triphenyl phosphate -----			3
Tungsten & compounds, as W			
Soluble -----			1
Insoluble -----			5
Substance		ppma	mg/m3b
Turpentine -----	100		560
Uranium (natural) soluble & insoluble compounds, as U -----			0.2
Vanadium (V2O5), as V			
Dust -----			0.5
C Fume -----			0.05
Vinyl acetate -----			10 30
Vinyl benzene (see Styrene) -----			
Vinyl bromide -----	250		100
Vinyl chloride -----	1		2.5
Vinyl cyanide (see Acrylonitrile) -----			
Vinylidene chloride -----	10		40
Vinyl toluene -----	100		480
Warfarin -----			0.1
Wood dust (nonallergenic) -----			5
Xylene (o-, m-, p-isomers) - Skin -----	100		435
C m-Xylene a, a'-diamine -----			0.1
Xylidine - Skin -----	5		25
Yttrium -----			1
Zinc chloride fume -----			1
Zinc oxide fume -----			5
Zirconium compounds (as Zr) -----			5

a Parts of vapor or gas per million parts of contaminated air by volume at
25°C and 760mm. Hg. pressure.

b Approximate milligrams of substance per cubic meter of air.
R Registered Trade Name.

MINERAL DUSTS

Substance

SILICA, SiO2

Crystalline

Quartz ----- TLV in mppcf:

$$\frac{300}{\% \text{ quartz} + 10}$$

TLV for respirable dust in mg/m3:

$$\frac{10 \text{ mg/m}^3}{\% \text{ Respirable quartz} + 2}$$

Cristobalite ----- Use one-half the value calculated from the count or respirable mass formulae for quartz.

Tridymite ----- Use one-half the value calculated from formulae for quartz.

Silica, fused ----- Use quartz formulae.

Tripoli ----- Use quartz formulae.

Silica, amorphous including natural Diatomaceous Earth ----- 20 mppcf
1 mg/m3 Respirable dust

LESS THAN 1% QUARTZ

- Asbestos, all forms ----- 2 fibers/cc > 5µm in length
- Graphite (natural) ----- 15 mppcf*
- Mica ----- 20 mppcf*
- Mineral wool fiber ----- 30 mppcf*
- Perlite ----- 30 mppcf*
- Portland Cement ----- 30 mppcf*
- Soapstone ----- 20 mppcf*
- Talc (nonasbestiform) ----- 20 mppcf*
- Talc (fibrous) use Asbestos limit.
- Tremolite, see Asbestos

COAL DUST

(bituminous) 2 mg/m3 (respirable dust fraction << 5% quartz). If > 5% quartz, use respirable mass formula.

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

*** Or 5 mg/m³ for respirable dust.**

NUISANCE PARTICULATES

30 mppcf or 5 mg/m³ of respirable dust << 1% quartz

Conversion factors:

mppcf X 35.3 = million particles per cubic meter

= particles per c.c.

SOME NUISANCE PARTICULATES

TLV, 30 mppcf or 5 mg/m³ (respirable)

Alundum (Al₂O₃)
Calcium carbonate
Calcium silicate
Cellulose (paper fiber)
Portland Cement
Corundum (Al₂O₃)
Emery
Glass, fibrous or dust
Glycerin Mist
Graphite (synthetic)
Gypsum
Vegetable oil mists
(except castor,
cashew nut, or
similar irritant)

Kaolin
Limestone
Magnesite
Marble
Mineral Wool Fiber
Pentaerythritol
Plaster of Paris
Rouge
Silicon
Silicon Carbide
Starch
Sucrose
Tin Oxide
Titanium Dioxide
Zinc Stearate (oils)
Zinc oxide dust

SOME SIMPLE ASPHYXIANTS*

Acetylene
Argon
butane
Ethane
Ethylene
Helium

Hydrogen
Methane
Neon
Nitrous oxide
Propane

***The minimal oxygen shall not be less than 19% under normal atmospheric pressure.**

CARCINOGENS

Substances in industrial use that have proven carcinogenic in man, or have induced cancer in animals under appropriate experimental conditions:

4-Aminodiphenyl (p-Xenylamine)*
Antimony trioxide
Arsenic trioxide production
Asbestos, all forms
Benzidine production*
beta-Naphthylamine*
bis (chloromethyl) ether
Chromite ore processing
Nickel sulfide roasting, fume & dust
4-Nitrodiphenyl*
Particulate Polycyclic Aromatic Hydrocarbons
Sulfur dioxide
Vinyl chloride

Industrial substances suspect of carcinogenic potential for man:

Benzene Hexamethyl phosphoramidate
Benz(a)pyrene Hydrazine
Beryllium 4,4'-Methylene bis(2-chloroaniline)
Cadmium oxide production 4,4'-Methylene dianiline
Chloroform Methyl methacrylate
Chromates of lead & zinc Monomethyl hydrazine
3, 3'-Dichlorobenzidine Nitrosamines
Dimethylcarbonyl chloride Propane sulfone
1, 1-Dimethyl hydrazine beta-Propiolactone
Dimethyl sulfate Thallium
Epichlorhydrin Vinyl cyclohexene dioxide

For the above, worker exposure by all routes should be carefully controlled.

Cigarette smoking can enhance the incidence of respiratory cancers from these substances or processes.

*** No exposure or contact by any route - respiratory, skin or oral, as detected by the most sensitive methods - should be permitted.**

"No exposure or contact" means hermitizing the process or operation by the best practicable engineering methods. The worker should be properly equipped to insure virtually no contact with the carcinogen.

EXPLANATORY NOTE - Guide for Collecting and Measuring Samples:

1) At least three atmospheric samples, spaced at intervals to yield an average measurement of exposure over the entire cycle of operation under test shall be collected in the breathing zone of the employee or wherever such exposures are suspected.

2) For the purposes of this code, the sampling and analysis of contaminated air and the interpretation of the data in relation to the recommended threshold limit values shall be done using established sampling and analysis procedures.

3) Temporary concentrations in excess of the recommended threshold limit values shall not be permitted if exposure to such concentrations for a period of one hour or less may result in an adverse effect on health.

4) For the purpose of the above recommended threshold limit values respirable dust shall be considered all dust below ten (10) microns in size and seventy-five (75) percent below five (5) microns.

APPENDIX III

LOWER EXPOSURE LIMITS TABLE (LEL)
 TOXIC CONCENTRATION, FLASH POINT, BOILING POINT,
 EXPLOSIVE LIMITS AND VAPOR DENSITY
 OF COMMON FLAMMABLE AND TOXIC LIQUIDS AND GASES

Substance	Threshold Limit Value ppm	Flash Point* °F	Boiling Point °F	Flammable Limits		Vapor Density Air = 1
				LOWER %	UPPER %	
Acetone	1000	0	134	2.6	12.8	2.0
Amyl Acetate	100	77	300	1.1	7.5	4.5
C Benzol (benzene)-skin	10	12	176	1.3	7.1	2.8
n Butyl acetate	150	72	260	1.7	7.6	4.0
n Butyl alcohol (butanol)-skin	50	84	243	1.4	11.2	2.6
Butyl cellosolve (2-butoxy ethanol)	50	141	340	1.1	10.6	
Carbon tetrachloride-skin	10	none	170	none	none	5.3
Cellosolve (2-ethoxyethanol)	200	104	275	2.6	15.7	3.0
Cellosolve acetate (2-ethoxyethyl acetate)	100	124	313	1.7	—	4.6
Chlorobenzene (monochlorobenzene)	75	85	270	1.3	7.1	3.9
Chloroform (trichloromethane)	10	none	142	none	none	4.0
Cyclohexane	300	-4	179	1.3	8.0	2.9
Cyclohexanone	50	111	313	1.1@212°F	—	3.4
1, 2-Dichloroethylene	200	43	140	9.7	12.8	3.4
Ethyl acetate	400	24	171	2.2	11.0	3.0
Ethyl alcohol (ethanol)	1000	55	173	3.3	19.0	1.6
Ethyl ether	400	-49	95	1.9	48.0	2.6
Ethylene dichloride (1, 2-dichloroethane)	50	56	183	6.2	16.0	3.4
n Heptane	400	25	208	1.0	6.7	3.5
n Hexane	100	-22	156	1.1	7.5	3.0
Methane	—	Gas	-259	5.3	14.0	0.6
Methyl acetate	200	14	140	3.1	16.0	2.8

Methyl alcohol (methanol)-skin	200	52	147	6.7	36.0	1.1
Methyl butyl ketone (2-hexanone)-skin	25	79	262	1.2	8.0	3.5
Methyl cellosolve (2-methoxyethanol)-skin	25	105	255	2.5	14.0	2.6
Methyl cellosolve acetate-skin	25	111	292	1.7	8.2	4.1
Methyl chloroform (1, 1, 1 trichloroethane)	350	—**	165	10.5	15.5	4.6
Methyl ethyl ketone (2-butanone)	200	21	176	1.8	10.0	2.5
Methyl isobutyl ketone (hexone)-skin	100	73	244	1.4	7.5	3.5
Methyl propyl ketone (2-pentanone)	200	45	216	1.5	8.2	3.0
Methylene chloride (dichloromethane)	100	none	104	—	—	2.9
Natural Gas	—	Gas	—	3.8-6.5	13-17	—
Perchloroethylene (tetrachloroethylene)-skin	100	none	249	—	—	5.7
Petroleum distillates						
Naphtha	—	under 100	212 - 320	0.9	6.0	4.3
Safety solvent	—	100 & over	300 - 400	0.8	5.0	—
C Isophorone	5	184	419	0.8	3.8	4.8
Isopropyl acetate	250	40	194	1.8	8.0	3.5
Isopropyl alcohol-skin	400	53	181	2.0	12.0	2.1
Styrene monomer (phenylethylene)	100	90	295	1.1	6.1	3.6
Toluol (toluene)-skin	100	40	232	1.2	7.1	3.1
Trichloroethylene	100	90	189	12.5	90.0	4.5
Turpentine	100	95	300	0.8	—	4.7
Xylol (xylene)-skin	100	63	291	1.1	7.0	3.7

* Closed Cup (The temperature at which a vapor will ignite if it is in a closed container in contrast to an open container.)

** Non-flammable under ordinary conditions of temperature and pressure

FLASH POINT—is the temperature at which vapors given off by flammable solvent will burn with a flash but will not continue to burn until more solvent has evaporated.

LOWER EXPLOSIVE LIMIT—is the lowest concentration of flammable vapor that will “flash” when ignited. The energy of the explosion is at a minimum because the mixture is “lean”.

UPPER EXPLOSIVE LIMIT—is the richest concentration of vapors that will flash when ignited. The energy of the explosion is low because the mixture is too “rich”. Concentrations of vapors above or below the explosive limits will not burn.

VAPOR DENSITY—is the weight of the vapors of a solvent compared with air. For example, all flammable solvent vapors are heavier than air and will tend to fall to the floor and accumulate in low places. Some gases are lighter than air and will rise—example, methane.

- (H) Installations or constructions built or contracted for prior to the effective date of this rule shall be deemed to comply with the provisions of these requirements if such installations or constructions comply either with the provisions of these requirements or with the provisions of any applicable specific requirement which was in effect at the time contracted for or built.