

TES OF INDUSTRIAL HEALTH

ly depend a great deal on the com-
almr as well as on the ph
tor the nurse. It is no reflecti
paricularly, but not all people,
physicians, can take tension with
a satisfactory way. However, I know
where a nurse has been taught to ta
and does an excellent job under
supervision of a physician.
question is, "Can Plano goggles also
on of the eyes, specifically conjunctiv

that you are speaking of the corne
no goggles, such as would meet
the American Standards Association
categorically no, they could not caus
irritation or any other kind of irrita
eyes. You can answer that question
ally when it is put to you by saying
safety glasses that meet the standa
merican Standards Association are far
t optically than the safety windshield
es and trucks. Yet you never hear of
loping allergies of the eyelids or of the
ties when they spend 9 or 10 hours
eir vacation driving their automobiles
through the windshield all that time.

ment by Dr. Edmund B. Spaeth

to that first question of Dr. Foote's, I
legitimize that was given to us in
u, t, first as to the advisability of
ng tension. It was in reference to our
urveys there. We were advised that it
nwise to permit a nurse to take tension
circumstances.

r shows the delightful inconsistency of
rofession. We were advised relative to
of tension in the hospitals that a nurse
ion is no different from a nurse doing
ic or a diagnostic or a routine procedure
king a blood pressure reading with a
nometer. So I have added to Dr.
abt.

Threshold Limit Values for 1957

*Adopted at the 19th Annual Meeting of the American
Conference of Governmental Industrial Hygienists
St. Louis, April 20-23, 1957*

Values are given in the following tabulation for the maximum average atmos-
pheric concentration of contaminants to which workers may be exposed for an
eight-hour working day without injury to health.

These values are based on the best available information from industrial ex-
perience, from experimental studies, and, when possible, from a combination of
the two. They are not fixed values but are reviewed annually by the Committee
on Threshold Limits for changes, revisions, or additions as further information
becomes available. Threshold limits should be used as guides in the control of
health hazards and should not be regarded as fine lines between safe and dangerous
concentrations. They represent only conditions under which it is felt that workers
may be repeatedly exposed, day after day, without adverse effect on their health.
The figures listed refer to weighted average concentrations of an eight-hour work-
ing shift rather than a maximum which is not to be exceeded even momentarily.
The amount by which these figures may be exceeded for short periods during the
workday depends upon a number of factors, such as the nature of the contaminant,
whether very high concentrations even for short periods produce acute poisoning,
whether the results are cumulative, the frequency with which high values occur
and for what periods of time. All must be taken into consideration in arriving at
a decision as to whether a hazardous situation is deemed to exist.

These values are not intended for use, or for modification for use, in the
evaluation or control of community air pollution or air-pollution nuisances.

The Committee welcomes the suggestion of substances to be added to the list
and also comments, references, or reports of experience with these materials.

Received for publication May 23, 1957.

RECOMMENDED VALUES

Gases and Vapors

SUBSTANCE	Approx. Mg.		SUBSTANCE	Approx. Mg.	
	PPM* per Cu. M.†			PPM* per Cu. M.†	
Acetaldehyde	200	360	Benzene (benzol)	25	80
Acetic acid	10	25	Benzyl chloride	1	5
Acetic anhydride	5	20	Bromine	1	7
Acetone	1,000	2,400	Butadiene		
Acrolein	0.5	1.2	(1,3-butadiene)	1,000	2,200
Allyl alcohol	5	12	Butanone (methyl		
(x) Allyl chloride	5	15	ethyl ketone)	250	740
Allyl propyl disulfide	2	12	Butyl acetate		
Ammonia	100	70	(n-butyl acetate)	200	950
Amyl acetate	200	1,050	Butyl alcohol		
Amyl alcohol			(n-butanol)	100	300
(isoamyl alcohol)	100	360	Butylamine	5	15
Aniline	5	19	Butyl cellosolve		
Arsine	0.05	0.2	(2-butoxyethanol)	50	240

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THRESHOLD LIMIT

SUBSTANCE	Approx. Mg. PPM* per Cu. M.†	Approx. Mg. PPM* per Cu. M.†
Carbon dioxide	5,000	9,000
Carbon disulfide	20	60
Carbon monoxide	100	110
Carbon tetrachloride	25	160
Cellosolve (2-ethoxyethanol)	200	740
Cellosolve acetate (2-ethoxyethyl acetate)	100	540
Chlorine	1	3
Chlorine trifluoride	0.1	0.4
Chlorobenzene (monochlorobenzene)	75	350
Chloroform (trichloromethane)	100	490
1-Chloro-1-nitropropane	20	100
(x) Chloropicrin	1	7
Chloroprene (2-chloro- 1,3-butadiene)	25	90
Cresol (all isomers)	5	22
Cyclohexane	400	1,400
Cyclohexanol	100	410
Cyclohexanone	100	400
Cyclohexene	400	1,350
Cyclopropane	400	690
(x) Decaborane	0.05	0.3
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone)	50	240
Diborane	0.1	0.1
o-Dichlorobenzene	50	300
Dichlorodifluoromethane	1,000	4,950
1,1-Dichloroethane	100	400
1,2-Dichloroethane (ethylene dichloride)	100	400
1,2-Dichloroethylene	200	790
Dichloroethyl ether	15	90
Dichloromonofluoro- methane	1,000	4,200
1,1-Dichloro-1- nitroethane	10	60
Dichlorotetrafluoroethane	1,000	7,000
Diethylamine	25	75
Difluorodibromomethane	100	860
Diisobutyl ketone	50	290
Dimethylaniline (N-dimethylaniline)	5	25
Dimethylsulfate	1	5
Dioxane (diethylene dioxide)	100	360
Ethyl acetate	400	1,400
(x) Ethyl acrylate	25	100
Ethyl alcohol (ethanol)	1,000	1,900
Ethylamine	25	45
Ethylbenzene	200	870
Ethyl bromide	200	890
Ethyl chloride	1,000	2,600
Ethyl ether	400	1,200

SUBSTANCE	Approx. Mg. PPM* per Cu. M.†	Approx. Mg. PPM* per Cu. M.†
Ethyl formate	100	300
Ethyl silicate	100	850
Ethylene chlorohydrin	5	16
Ethylenediamine	10	30
Ethylene dibromide (1,2-dibromoethane)	25	190
Ethylene imine	5	9
Ethylene oxide	50	90
Fluorine	0.1	0.2
Fluorotrichloromethane	1,000	5,600
Formaldehyde	5	6
(x) Furfural	5	20
Gasoline	500	2,000
Heptane (n-heptane)	500	2,000
Hexane (n-hexane)	500	1,800
Hexanone (methyl butyl ketone)	100	410
Hexone (methyl isobutyl ketone)	100	410
Hydrazine	1	13
Hydrogen bromide	5	17
Hydrogen chloride	5	7
Hydrogen cyanide	10	11
Hydrogen fluoride	3	2
Hydrogen peroxide, 90%	1	1.4
Hydrogen selenide	0.05	0.2
Hydrogen sulfide	20	30
Iodine	0.1	1
Isophorone	25	140
Isopropylamine	5	12
Mesityl oxide	50	200
Methyl acetate	200	610
Methyl acetylene	1,000	1,650
(x) Methyl acrylate	10	35
Methyl alcohol (methanol)	200	260
Methyl bromide	20	80
Methyl cellosolve (2-methoxyethanol)	25	80
Methyl cellosolve acetate (ethylene glycol mono- methyl ether acetate)	25	120
Methyl chloride	100	210
Methylal (dimethoxy- methane)	1,000	3,100
Methyl chloroform (1,1,1-trichloroethane)	500	2,700
Methylcyclohexane	500	2,000
Methylcyclohexanol	100	470
Methylcyclohexanone	100	460
Methyl formate	100	250
Methyl isobutyl carbinol (methyl amyl alcohol)	25	100
Methylene chloride (dichloromethane)	500	1,750
Naphtha (coal tar)	200	800
Naphtha (petroleum)	500	2,000

SUBSTANCE	THRESHOLD LIMIT
Nickel carbonyl	
(x) Nitric acid	
p-Nitroaniline	
Nitrobenzene	
Nitroethane	
Nitrogen dioxide	
Nitroglycerin	
Nitromethane	
2-Nitropropane	
Nitrotoluene	
Octane	
Ozone	
Pentane	
Pentanone (methyl propyl ketone)	
Perchloroethylene (tetrachloroethylene)	
Phenol	
Phenylhydrazine	
Phosgene (carbonyl chloride)	
Phosphine	
Phosphorus trichloride	
Propyl acetate	
Propyl alcohol (isopropyl alcohol)	
Propyl ether (isopropyl ether)	

* Parts of vapor or gas
† Approximate milligrams
(x) These values appear

SUBSTANCE	THRESHOLD LIMIT
Aldrin (1,2,3,4,10,10-he 1,4,4a,5,8,8a-hexahydr dimethanonaphthalene	
Ammate (ammonium Antimony	
(x) ANTU (alpha-naphth Arsenic	
Barium (soluble comp Cadmium oxide fume	
(x) Calcium arsenate Chlordane (1,2,4,5,6,7,8 octachloro-3a,4,7,7a-t 4,7-methanoindane)	
(x) Chlorinated camphene Chlorinated diphenyl Chlorodiphenyl (42% (x) Chlorodiphenyl (54% Chromic acid and chrom Crag herbicide (sodium dichlorophenoxy] eth sulfate)	

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Approx. Mg.
PPM* per Cu. M.†

.....	100	300
.....	100	850
ldrin	5	16
.....	10	30
le	25	190
.....	5	9
.....	50	90
.....	0.1	0.2
thane	1,000	5,600
.....	5	6
.....	5	20
ne)	500	2,000
ne)	500	2,000
e)	500	1,800
l	100	410
.....	100	410
.....	1	1.3
.....	5	17
e	5	7
.....	10	11
.....	3	2
e, 90%	1	1.4
e	0.05	0.2
.....	20	30
.....	0.1	1
.....	25	140
.....	5	12
.....	50	200
.....	200	610
.....	1,000	1,650
.....	10	35
.....	200	260
.....	20	80
nd)	25	80
acetate	25	120
l mono-	100	210
etate)	100	210
oxy-	1,000	3,100
m	500	2,700
thane)	500	2,000
.....	100	470
ol	100	460
one	100	250
arbinol	25	100
icohol)	500	1,750
le	200	800
ne)	500	2,000
ar)	500	2,000
um)	500	2,000

THRESHOLD LIMIT VALUES

SUBSTANCE	Approx. Mg. PPM* per Cu. M.†	Approx. Mg. PPM* per Cu. M.†
Nickel carbonyl	0.001	0.007
(x) Nitric acid	5	25
p-Nitroaniline	1	6
Nitrobenzene	1	5
Nitroethane	100	310
Nitrogen dioxide	5	9
Nitroglycerin	0.5	5
Nitromethane	100	250
2-Nitropropane	50	180
Nitrotoluene	5	30
Octane	500	2,350
Ozone	0.1	0.2
Pentane	1,000	2,950
Pentanone (methyl propyl ketone)	200	700
Perchloroethylene (tetrachloroethylene)	200	1,350
Phenol	5	19
Phenylhydrazine	5	22
Phosgene (carbonyl chloride)	1	4
Phosphine	0.05	0.07
Phosphorus trichloride	0.5	3
Propyl acetate	200	840
Propyl alcohol (isopropyl alcohol)	400	980
Propyl ether (isopropyl ether)	500	2,100

* Parts of vapor or gas per million parts of air by volume.

† Approximate milligrams per cubic meter of air.

(x) These values appeared on the tentative list for 1956.

SUBSTANCE	Approx. Mg. PPM* per Cu. M.†	Approx. Mg. PPM* per Cu. M.†
Propylene dichloride (1,2-dichloropropane)	75	350
Propylene imine	25	60
Pyridine	10	30
Quinone	0.1	0.4
Stibine	0.1	0.5
Stoddard solvent	500	2,900
Styrene monomer (phenylethylene)	100	420
Sulfur dioxide	5	13
Sulfur hexafluoride	1,000	6,000
Sulfur monochloride	1	6
Sulfur pentafluoride	0.025	0.25
p-Tertiarybutyltoluene	10	60
1,1,2,2-Tetrachloroethane	5	35
(x) Tetrahydrofuran	200	590
Tetranitromethane	1	8
Toluene (toluol)	200	750
o-Toluidine	5	22
Trichloroethylene	200	1,050
Trifluoromonobromo- methane	1,000	6,100
Turpentine	100	560
Vinyl chloride (chloroethylene)	500	1,300
Xylene (xylol)	200	870

Toxic Dusts, Fumes, and Mists

SUBSTANCE	Mg. per Cu. M.†	SUBSTANCE	Mg. per Cu. M.†
Aldrin (1,2,3,4,10,10-hexachloro- 1,4,4a,5,8,8a-hexahydro-1,4,5,8- dimethanonaphthalene)	0.25	Cyanide (as CN)	5
Ammonate (ammonium sulfamate)	15	2,4-D (2,4-dichlorophenoxyacetic acid)	10
Antimony	0.5	(x) DDT (2,2-bis[p-chlorophenyl]-1,1,1- trichloroethane)	1
(x) ANTU (alpha-naphthyl-thiourea)	0.3	Dieldrin (1,2,3,4,10,10-hexachloro- 6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro- 1,4,5,8-dimethano-naphthalene)	0.25
Arsenic	0.5	(x) Dinitrobenzene	1
Barium (soluble compounds)	0.5	Dinitrotoluene	1.5
Cadmium oxide fume	0.1	Dinitro-o-cresol	0.2
(x) Calcium arsenate	0.1	EPN (O-ethyl O-p-nitrophenyl thionobenzenephosphonate)	0.5
Chlordane (1,2,4,5,6,7,8,8- octachloro-3a,4,7,7a-tetrahydro- 4,7-methanoindane)	2	(x) Ferbam (ferric dimethyl dithiocarbamate)	15
(x) Chlorinated camphene, 60%	0.5	Ferrovanadium dust	1
Chlorinated diphenyl oxide	0.5	Fluoride	2.5
Chlorodiphenyl (42% chlorine)	1	(x) HETP (hexaethyl tetraphosphate)	0.1
(x) Chlorodiphenyl (54% chlorine)	0.5	Hydroquinone	2
Chromic acid and chromates (as CrO ₃)	0.1	Iron oxide fume	15
Crag herbicide (sodium 2-[2,4- dichlorophenoxy] ethanol hydrogen sulfate)	15	Lead	0.2

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THRESHOLD

SUBSTANCE	Mg. per Cu. M.†	SUBSTANCE	Mg. per Cu. M.†
(x) Lead arsenate	0.15	TEDP (tetraethyl dithionopyrophosphate)	0.2
Lindane (hexachlorocyclohexane, gamma isomer)	0.5	TEPP (tetraethyl pyrophosphate) ..	0.05
Magnesium oxide fume	15	Tellurium	0.1
Malathion (O,O-dimethyl dithiophos- phate of diethyl mercaptosuccinate) .	15	Tetryl (2,4,6-trinitrophenyl- methylnitramine)	1.5
Manganese	6	(x) Thiram (tetramethyl thiuram disulfide)	5
Mercury	0.1	(x) Thallium (soluble compounds)	0.1
Mercury (organic compounds)	0.01	Titanium dioxide	15
Methoxychlor (2,2-di- <i>p</i> -methoxyphenyl- 1,1,1-trichloroethane)	15	Trichloronaphthalene	5
Molybdenum		Trinitrotoluene	1.5
(soluble compounds)	5	Uranium	
(insoluble compounds)	15	(soluble compounds)	0.05
(x) Nicotine	0.5	(insoluble compounds)	0.25
Parathion (O,O-diethyl O- <i>p</i> - nitrophenyl thiophosphate)	0.1	Vanadium	
Pentachloronaphthalene	0.5	(V ₂ O ₅ dust)	0.5
Pentachlorophenol	0.5	(V ₂ O ₅ fume)	0.1
Phosphorus (yellow)	0.1	(x) Warfarin (3-[α acetylbenzyl]-4- hydroxycoumarin)	0.5
Phosphorus pentachloride	1	Zinc oxide fumes	15
Phosphorus pentasulfide	1	Zirconium compounds (as Zr)	5
Picric acid	0.1	Radioactivity: For permissible concentrations of radio- isotopes in air, see "Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Per- missible Concentrations in Air and Water," Handbook 52, U. S. Department of Commerce, National Bureau of Standards, March, 1953. In addition, see "Permissible Dose from External Sources of Ionizing Radiation," Handbook 59, U. S. Department of Commerce, National Bureau of Standards, Sept. 24, 1954.	
(x) Pyrethrum	2	Revision of the two publications mentioned above is in progress.	
(x) Rotenone	5		
Selenium compounds (as Se)	0.1		
Sodium hydroxide	2		
(x) Sodium fluoroacetate (1080)	0.1		
(x) Strychnine	0.15		
Sulfuric acid	1		

† Milligrams of dust, fume, or mist per cubic meter of air.

(x) These values appeared on the tentative list for 1956.

Mineral Dusts

SUBSTANCE	MPPCF‡	SUBSTANCE	MPPCF‡
Aluminum oxide	50	Silica	
Asbestos	5	high (above 50% free SiO ₂)	5
Dust (nuisance, no free silica)	50	medium (5 to 50% free SiO ₂)	20
Mica (below 5% free silica)	20	low (below 5% free SiO ₂)	50
Portland cement	50	Silicon carbide	50
Talc	20	Soapstone (below 5% free SiO ₂)	20

‡ Millions of particles per cubic foot of air.

TENTATIVE VALUES

SUBSTANCE	Approx. Mg. PPM per. Cu. M.	SUBSTANCE	Approx. Mg. PPM per. Cu. M.
Acetylene tetrabromide	1 14	(x) Chlorobromomethane	400 2,100
Allyl glycidyl ether (AGE) ..	10 45	(CIBrCH ₃)	
Beryllium	2γ/m ³	Diglycidyl ether (DGE)	10 55
Boron trifluoride	1 3	Dimethyl formamide	20 60
n-Butyl glycidyl		Dipropyleneglycolmethylether .	100 600
ether (BGE)	50 270	(x) Ethyl mercaptan	250 640
(x) Butyl mercaptan	10 35	(x) Furfuryl alcohol	50 200
Chloroacetaldehyde	1 3	Glycidol	50 150

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Mg. per
Cu. M.

phosphate)	0.05
phenyl-	0.1
thiuram	1.5
compounds)	5
	0.1
	15
	5
	1.5
ls)	0.05
urals)	0.25
	0.5
	0.1
tonylbenzyl]-4-	0.5
	15
ls (as Zr)	5

missible concentrations of radium. Permissible Amounts of in Body and Maximum Per. Air and Water," Handbook 52, Commerce, National Bureau of In addition, see "Permissible ces of Ionizing Radiation," tment of Commerce, National 24, 1952

licar mentioned above is in

MPPCF

SiO ₂)	5
SiO ₂)	20
SiO ₂)	50
	50
ee SiO ₂)	20

Approx. Mg.
PPM|| per. Cu. M.

400	2,100
10	55
20	60
100	600
250	640
50	200
50	150

THRESHOLD LIMIT VALUES

SUBSTANCE	Approx. Mg. PPM per. Cu. M.
Isopropyl glycidyl ether (IGE)	50 240
Lithium hydride	25γ/m ³
(x) Methyl mercaptan	50 100
α Methyl styrene	100 480
Monomethyl aniline	2 9
Paradichlorobenzene	75 450
(x) Perchloromethyl mercaptan	0.1 0.8
Phenyl glycidyl ether (PGE)	50 310

SUBSTANCE	Approx. Mg. PPM per. Cu. M.
Propylene oxide	100 240
Tertiary butyl alcohol	100 300
(x) Toluene-2,4-diisocyanate	0.1 0.7
Triethyl amine	25 100
Vinyl toluene	100 480
Yttrium and inorganic compounds	5 5
Xylidine	5 25
(*) Teflon decomposition products	0 0
(*) Pentaborane (B ₅ H ₉)	0 0

1 Parts of vapor or gas per million parts of air by volume.

2 Approximate milligrams per cubic meter of air.

(x) These values appeared on the tentative list for 1956.

* Until more data are forthcoming, it is important that atmospheric concentrations of these materials to which workers are exposed must be kept as near 0 as possible.

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