TLVs®
Threshold Limit Values for Chemical Substances in the Work Environment Adopted by ACGIH

with Intended Changes for 1987-88

1986-87 CHEMICAL SUBSTANCES TLV COMMITTEE

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INTRODUCTION TO THE CHEMICAL SUBSTANCES

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. Smoking of tobacco may act synergistically with airborne chemicals encountered in the workplace, e.g., asbestos.

Individuals may also be hypersusceptible or otherwise unusually responsive to some industrial chemicals because of genetic factors, age, personal habits (smoking, other drugs), medication, or previous exposures. Such workers may not be adequately protected from adverse health effects from certain chemicals at concentrations at or below the threshold limits. An occupational physician should evaluate the extent to which such workers require additional protection.

Threshold limits are based on the best available information from industrial experience, from experimental human and animal studies, and, when possible, from a combination of the three. The basis on which the values are established may differ from substance to substance; protection against impairment of health may be a guiding factor for some, whereas reasonable freedom from irritation, narcosis, nuisance or other forms of stress may form the basis for others.

The amount and nature of the information available for establishing a TLV varies from substance to substance; consequently, the precision of the estimated TLV is also subject to variation and the latest *Documentation* should be consulted in order to assess the extent of the data available for a given substance.

These limits are intended for use in the practice of industrial hygiene as guidelines or recommendations in the control of potential health hazards and for no other use, e.g., in the evaluation or control of community air pollution nuisances, in estimating the toxic potential of continuous, uninterrupted exposures or other extended work periods, as proof or disproof of an existing disease or physical condition, or adoption by countries whose working conditions differ from those in the United States of America and where substances and processes differ. These limits *are not* fine lines between safe and dangerous concentration nor are they a relative index of toxicity, and *should not* be used by anyone untrained in the discipline of industrial hygiene.

The Threshold Limit Values, as issued by ACGIH, are recommendations and should be used as guidelines for good practices.

Example B.1: Air contains 0.15 mg/m³ of lead (TLV, 0.15) and 0.7 mg/m³ of sulfuric acid (TLV, 1).

$$\frac{0.15}{0.15} = 1; \qquad \frac{0.7}{1} = 0.7$$

Threshold limit is not exceeded.

C. ***TLV for mixtures of mineral dusts.*** For mixtures of biologically active mineral dusts the general formula for mixtures given in A.2 may be used.

APPENDIX D
Some Nuisance Particulates[m]

TLV-TWA, 10 mg/m³[e,n]

α-Alumina (Al_2O_3)	Portland cement
Calcium carbonate	Rouge
Calcium silicate	Silicon
Calcium sulfate	Silicon carbide
Cellulose (paper fiber)	Starch
Emery	Stearates
Glycerin mist	Sucrose
Gypsum	Titanium dioxide
Kaolin	Vegetable oil mists
Limestone	(except castor oil,
Magnesite	cashew nut or similar
Marble	irritant oils)
Mineral wool fiber	‡Zinc stearate
Pentaerythritol	Zinc oxide dust
Plaster of Paris	

(e) The value is for total dust containing no asbestos and < 1% crystalline silica
(n) As defined in the Introduction
‡ See Notice of Intended Changes.

APPENDIX E
Some Simple Asphyxiants[m]

Acetylene	Ethylene	Methane	Propylene
Argon	Helium	Neon	
Ethane	Hydrogen	Propane	

(n) As defined in the Introduction.

APPENDIX F
Particle Size-Selective Sampling Criteria for Airborne Particulate Matter

For chemical substances present in inhaled air as suspensions of solid particles or droplets, the potential hazard depends on particle size as well as mass concentration because of: 1) effects of particle size on deposition site within the respiratory tract, and 2) the tendency for many occupational diseases to be associated with material deposited in particular regions of the respiratory tract.

ACGIH has recommended particle size-selective TLVs for crystalline silica for many years in recognition of the well established association between silicosis and respirable mass concentrations. It now has embarked on a re-examination of other chemical substances encountered in particulate form in occupational environments with the objective of defining: 1) the size-fraction most closely associated for each substance with the health effect of concern, and 2) the mass concentration within that size fraction which should represent the TLV.

The Particle Size-Selective TLVs (PSS-TLVs) will be expressed in three forms, e.g.,

a. *Inspirable Particulate Mass TLVs (IPM-TLVs)* for those materials which are hazardous when deposited anywhere in the respiratory tract.
b. *Thoracic Particulate Mass TLVs (TPM-TLVs)* for those materials which are hazardous when deposited anywhere within the lung airways and the gas-exchange region.
c. *Respirable Particulate Mass TLVs (RPM-TLVs)* for those materials which are hazardous when deposited in the gas-exchange region.

The three particulate mass fractions described above are defined in quantitative terms as follows:

a. Inspirable Particulate Mass consists of those particles that are captured according to the following collection efficiency regardless of sampler orientation with respect to wind direction:

$$E = 50(1 + \exp[-0.06\, d_a]) \pm 10; \quad \text{for } 0 < d_a \leq E\ 100\ \mu m$$

Collection characteristics for $d_a > 100\ \mu m$ are presently unknown. E is collection efficiency in percent and d_a is aerodynamic diameter in μm.

b. Thoracic Particulate Mass consists of those particles that penetrate a separator whose size collection efficiency is described by a cumulative lognormal function with a median aerodynamic diameter of 10 μm ± 1.0 μm and with a geometric standard deviation of 1.5 (± 0.1).
c. Respirable Particulate Mass consists of those particles that penetrate a separator whose size collection efficiency is

described by a cumulative lognormal function with a median aerodynamic diameter of 3.5 μm ± 0.3 μm and with a geometric standard deviation of 1.5 (± 0.1). This incorporates and clarifies the previous ACGIH Respirable Dust Sampling Criteria.

These definitions provide a range of acceptable performance for each type of size-selective sampler. Further information is available on the background and performance criteria for these particle size-selective sampling recommendations.[1]

References

1. ACGIH. *Particle Size-Selective Sampling in the Workplace*. 80 pp. Cincinnati, Ohio (1984).

APPENDIX G
Chemical Substances and Other Issues Under Study

Information, data especially, and comments are solicited to assist the Committee in its deliberations and in the possible development of draft documents. Draft documentations are used by the Committee to decide what action, if any, to recommend on a given question.

Chemical Substances

Acetomethylchloride
Acetophenone
Acids and bases
Adiponitrile
Allyl chloride
Bentonite
Benzyl acetate
Borax and boron compounds
Bromochloromethane
Bromodichloromethane
Bromoform
2-t-Butylozo-2-hydroxy-5-methylhexane
Carbon monoxide
Ceramic fibers
Chromium
Dibutyl phenyl phosphate
Dichlorodiphenyl sulfone
Dichlorocyclopentadiene
2,4-D (2,4-Dichlorophenoxy acetic acid)
1,3-Dichloropropene
Dichlorvos
Diglycidyl resorcinol ether
Dinitrotoluene
Diphenyl carbonate
Epichlorohydrin
2-Ethyl hexanoic acid
Formaldehyde
Gasoline (unleaded)
Graphite fibers
Hexachlorocyclopentadiene
Hexamethylene diamine
Hydrazines
Jet, petroleum and diesel fuels
Inorganic acids
Inorganic gases
Inorganic lead
Malathion
Methyl bromide
Methylene diamine
4,4'-Methylene dianiline
Methyl hydrazines
Mineral wool fibers
Naled
Nitromethane
Pentachlorophenol
Perchloroethylene
Persulfates
Petroleum solvents
o-Phenylenediamine
Propylene dichloride
Terephthalic acid
1,1,1,2-Tetrachloro-2,2-difluoroethane
1,1,2,2-Tetrachloro-1,2-difluoroethane
1,1,2,2-Tetrachloroethane
Tobacco smoke
Trichloroethylene
Vinyl cyclohexene

Other Issues

1. Solubility.
2. Dusts and fumes.
3. Should the TLVs currently expressed as "total dust" be changed to "inspirable particulate mass," as defined in Appendix F without changing the numerical value?
4. Application of TLVs to altered work schedules.