POLICY STATEMENT ON THE USES OF TLVs AND BEIs

The Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) are developed as guidelines to assist in the control of health hazards. These recommendations or guidelines are intended for use in the practice of industrial hygiene, to be interpreted and applied only by a person trained in this discipline. They are not developed for use as legal standards, and the American Conference of Governmental Industrial Hygienists (ACGIH) does not advocate their use as such. However, it is recognized that in certain circumstances individuals or organizations may wish to make use of these recommendations or guidelines as a supplement to their occupational safety and health program. The ACGIH will not oppose their use in this manner, if the use of TLVs and BEIs in these instances will contribute to the overall improvement in worker protection. However, the user must recognize the constraints and limitations subject to their proper use and bear the responsibility for such use.

The introductions to the TLV/BEI booklet and the TLV/BEI Documentation provide the philosophical and practical bases for the uses and limitations of the TLVs and BEIs. To extend those uses of the TLVs and BEIs to include other applications, such as use without the judgment of an industrial hygienist, application to a different population, development of new exposure/recovery time models, or new effect endpoints, stretch the reliability and even viability of the data base for the TLV or BEI as evidenced by the individual documentations.

It is not appropriate for individuals or organizations to impose on the TLVs or the BEIs their concepts of what the TLVs or BEIs should be or how they should be applied or to transfer regulatory standards requirements to the TLVs or BEIs.

The Policy Statement on the Uses of TLVs/BEIs was approved by the Board of Directors of ACGIH on March 1, 1988.

1990-1991

Threshold Limit Values for Chemical Substances in the Work Environment

Adopted by ACGIH
with Intended Changes
for 1990-91

Contents

Special Note: The year of most recent adoption of a TLV, or change thereto, is listed in parentheses after the substance in the adopted list.

ST0105876

INTRODUCTION TO THE CHEMICAL SUBSTANCES

Threshold Limit Values (TLVs) 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 health effects. 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 is harmful for several reasons. Smoking may act to enhance the biological effects of chemicals encountered in the workplace and may reduce the body's defense mechanisms against toxic substances.

Individuals may also be hypersusceptible or otherwise unusually responsive to some industrial chemicals because of genetic factors, age, personal habits (smoking, alcohol, or 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.

TLVs 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 TLV *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.

They *should* not be used by anyone untrained in the discipline of industrial hygiene.

The TLVs, as issued by the American Conference of Governmental Industrial Hygienists, are recommendations and should be used as guidelines for good practices. In spite of the fact that serious injury is not believed likely as a result of exposure to the threshold limit concentrations, the best practice is to maintain concentrations of all atmospheric contaminants as low as is practical.

The American Conference of Governmental Industrial Hygienists disclaims liability with respect to the use of TLVs.

Notice of Intended Changes. At the beginning of each year, proposed actions of the Chemical Substances TLV Committee for the forthcoming year are issued in the form of a "Notice of Intended Changes." This Notice provides an opportunity for comment and *solicits suggestions of substances to be added to the list. The suggestions should be accompanied by substantiating evidence.* The "Notice of Intended Changes" is presented after the Adopted Values in this section (and in the other two sections) of the booklet. Values listed in parenthesis in the "Adopted" list are to be used during the period in which a proposed change for that Value is listed in the Notice of Intended Changes.

Definitions. Three categories of Threshold Limit Values (TLVs) are specified herein, as follows:

***a)** Threshold Limit Value–Time-Weighted Average (TLV–TWA)*—the time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

***b)** Threshold Limit Value–Short-Term Exposure Limit (TLV–STEL)*—the concentration to which workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency, and provided that the daily TLV–TWA is not exceeded. It is not a separate independent exposure limit; rather, it supplements the time-weighted average (TWA) limit where there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature. STELs are recommended only where toxic effects have been reported from high short-term exposures in either humans or animals.

A STEL is defined as a 15-minute TWA exposure which should not be exceeded at any time during a workday even if the 8-hour TWA is within the TLV–TWA. Exposures above the TLV–TWA up to the STEL should not be longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures in this range. An averaging period other than 15 minutes may be recommended when this is warranted by observed biological effects.

c) *Threshold Limit Value–Ceiling (TLV–C)*—the concentration that should not be exceeded during any part of the working exposure.

In conventional industrial hygiene practice if instantaneous monitoring is not feasible, then the TLV–C can be assessed by sampling over a 15-minute period except for those substances that may cause immediate irritation when exposures are short.

For some substances, e.g., irritant gases, only one category, the TLV–Ceiling, may be relevant. For other substances, one or two categories may be relevant, depending upon their physiologic action. It is important to observe that if any one of these types of TLVs is exceeded, a potential hazard from that substance is presumed to exist.

The Chemical Substances TLV Committee holds to the opinion that TLVs based on physical irritation should be considered no less binding than those based on physical impairment. There is increasing evidence that physical irritation may initiate, promote, or accelerate physical impairment through interaction with other chemical or biologic agents.

Time-Weighted Average (TWA) vs Ceiling (C) Limits. TWAs permit excursions above the TLV provided they are compensated by equivalent excursions below the TLV–TWA during the workday. In some instances, it may be permissible to calculate the average concentration for a workweek rather than for a workday. The relationship between the TLV and permissible excursion is a rule of thumb and in certain cases may not apply. The amount by which the TLVs may be exceeded for short periods without injury to health 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 effects are cumulative, the frequency with which high concentrations occur, and the duration of such periods. All factors must be taken into consideration in arriving at a decision as to whether a hazardous condition exists.

Although the TWA concentration provides the most satisfactory, practical way of monitoring airborne agents for compliance with the TLVs, there are certain substances for which it is inappropriate. In the latter group are substances which are predominantly fast acting and whose TLV is more appropriately based on this particular response. Substances with this type of response are best controlled by a ceiling limit that should not be exceeded. It is implicit in these definitions that the manner of sampling to determine noncompliance with the limits for each group must differ; a single, brief sample, that is applicable to a ceiling limit, is not appropriate to the TWA; here, a sufficient number of samples are needed to permit a TWA concentration throughout a complete cycle of operations or throughout the workshift.

Whereas the ceiling limit places a definite boundary that concentrations should not be permitted to exceed, the TWA requires an explicit limit to the excursions that are permissible above the listed TLVs. It should be noted that the same factors are used by the Chemical Substances TLV Committee in determining the magnitude of the value of the STELs, or whether to include or exclude a substance for a ceiling listing.

Excursion Limits. For the vast majority of substances with a TLV–TWA, there is not enough toxicological data available to warrant a STEL. Nevertheless, excursions above the TLV–TWA should be controlled even where the 8-hour TLV–TWA is within recommended limits. Earlier editions of the TLV list included such limits whose values depended on the TLV–TWAs of the substance in question.

While no rigorous rationale was provided for these particular values, the basic concept was intuitive: in a well-controlled process exposure, excursions should be held within some reasonable limits. Unfortunately, neither toxicology nor collective industrial hygiene experience provide a solid basis for quantifying what those limits should be. The approach here is that the maximum recommended excursion should be related to variability generally observed in actual industrial processes. In reviewing large numbers of industrial hygiene surveys conducted by the National Institute for Occupational Safety and Health, Leidel, Busch, and Crouse[1] found that short-term exposure measurements were generally lognormally distributed with geometric standard deviations mostly in the range of 1.5 to 2.0.

While a complete discussion of the theory and properties of the lognormal distribution is beyond the scope of this section, a brief description of some important terms is presented. The measure of central tendency in a lognormal description is the antilog of the mean logarithm of the sample values. The distribution is skewed, and the geometric mean is always smaller than the arithmetic mean by an amount which depends on the geometric standard deviation. In the lognormal distribution, the geometric standard deviation (sd_g) is the antilog of the standard deviation of the sample value logarithms and 68.26% of all values lie between m_g/sd_g and $m_g \times sd_g$.

If the short-term exposure values in a given situation have a geometric standard deviation of 2.0, 5% of all values will exceed 3.13 times the geometric mean. If a process displays a variability greater than this, it is not under good control and efforts should be made to restore control. This concept is the basis for the following excursion limit recommendations which apply to those TLV–TWAs that do not have STELs:

> *Excursions in worker exposure levels may exceed 3 times the TLV–TWA for no more than a total of 30 minutes during a workday, and under no circumstances should they exceed 5 times the TLV–TWA, provided that the TLV–TWA is not exceeded.*

The approach is a considerable simplification of the idea of the lognormal concentration distribution but is considered more convenient to use by the practicing industrial hygienist. If exposure excursions are maintained within the recommended limits, the geometric standard deviation of the concentration measurements will be near 2.0 and the goal of the recommendations will be accomplished.

When the toxicological data for a specific substance are available to establish a STEL, this value takes precedence over the excursion limit regardless of whether it is more or less stringent.

"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 by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

Little quantitative data are available describing absorption of vapors and gases through the skin. The rate of absorption is a function of the concentration to which the skin is exposed.

Substances having a skin notation and a low TLV may present a problem at high airborne concentrations, particularly if a significant area of the skin is exposed for a long period of time. Protection of the respiratory tract, while the rest of the body surface is exposed to a high concentration, may present such a situation.

Biological monitoring should be considered to determine the relative contribution of dermal exposure to the total dose.

This attention-calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the TLV is not invalidated.

Mixtures. Special consideration should be given also to the application of the TLVs in assessing the health hazards that may be associated with exposure to mixtures of two or more substances. A brief discussion of basic considerations involved in developing TLVs for mixtures and methods for their development, amplified by specific examples, are given in Appendix C.

Respirable and Total Dust. For solid substances and liquified mists, TLVs are expressed in terms of total dust, except where the term "respirable dust" is used. See Appendix D, Particle Size-Selective Sampling Criteria for Airborne Particulate Matter, for the definition of respirable dust.

Particulates Not Otherwise Classified (PNOC). In contrast to fibrogenic dusts which cause scar tissue to be formed in lungs when inhaled in excessive amounts, so-called "nuisance" dusts have a long history of little adverse effect on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. Such dusts have also been called (biologically) "inert" dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lung when inhaled in sufficient amount. However, the lung-tissue reaction caused by inhalation of PNOCs has the following characteristics: 1) the architecture of the air spaces remains intact; 2) collagen (scar tissue) is not formed to a significant extent; and 3) the tissue reaction is potentially reversible.

Excessive concentrations of PNOCs in the workroom air may seriously reduce visibility; may cause unpleasant deposits in the eyes, ears, and nasal passages (e.g., Portland cement dust); or cause injury to the skin or mucous membranes by chemical or mechanical action *per se* or by the rigorous skin cleansing procedures necessary for their removal.

A TLV–TWA of 10 mg/m³ of total dust containing no asbestos and < 1% crystalline silica is recommended for substances in these categories and for which no specific TLVs have been assigned. This limit, for a normal workday, does not apply to brief exposures at higher concentrations. Neither does it apply to those substances which may cause physiologic impairment at lower concentrations but for which a TLV has not yet been adopted. The separate nuisance dust appendix was deleted in favor of individual entries in the Adopted listing for those substances formerly carried in this appendix.

Simple Asphyxiants — "Inert" Gases or Vapors. A number of gases and vapors, when present in high concentrations in air, act primarily as simple asphyxiants without other significant physiologic effects. A TLV may not be recommended for each simple asphyxiant because the limiting factor is the available oxygen. The minimal oxygen content should be 18% by volume under normal atmospheric pressure (equivalent to a partial pressure, pO_2 of 135 torr). Atmospheres deficient in O_2 do not provide adequate warning and most simple asphyxiants are odorless. Several simple asphyxiants present an explosion hazard. Account should be taken of this factor in limiting the concentration of the asphyxiant. The separate appendix, which contained examples of some asphyxiants, has been deleted. Those substances formerly carried in that appendix continue as alphabetical entries in the Adopted listing.

Physical Factors. It is recognized that such physical factors as heat, ultraviolet and ionizing radiation, humidity, abnormal pressure (altitude), and the like may place added stress on the body so that the effects from exposure at a TLV may be altered. Most of these stresses act adversely to increase the toxic response of a substance. *Although most TLVs have built-in safety factors to guard against adverse effects to moderate deviations* from normal environments, the safety factors of most substances are not of such a magnitude as to take care of gross deviations. For example, continuous work at temperatures above 90°F, or overtime extending the workweek more than 25%, might be considered gross deviations. In such instances, judgment must be exercised in the proper adjustments of the TLVs.

Unlisted Substances. Many substances present or handled in industrial processes do not appear on the TLV list. In a number of instances, the material is rarely present as a particulate, vapor, or other airborne contaminant, and a TLV is not necessary. In other cases, sufficient information to warrant development of a TLV, even on a tentative basis, is not available to the Chemical Substances TLV Committee. Other substances, of low toxicity, could be classified as Particulates Not Otherwise Classified.

In addition, there are some substances of not inconsiderable toxicity that have been omitted primarily because only a limited number of workers (e.g., employees of a single plant) are known to have potential exposure to possibly harmful concentrations.

Unusual Work Schedules. Application of TLVs to workers on work schedules markedly different from the conventional 8-hour day, 40-hour week requires particular judgement in order to provide, for such workers, protection equal to that provided to workers on conventional workshifts.

As tentative guidance, field hygienists are referred to the "Brief and Scala model" and the "OSHA model," both of which are described and explained at length in Patty.[2]

The Brief and Scala model reduces the TLV proportionately for both increased exposure time and reduced recovery (non-exposure) time, and it is the more conservative of the two models. The OSHA model classifies air contaminants by type of toxic effect and recommends different adjustment procedures for the exposure limits (including zero adjustment) on that basis.

The two models are generally intended to apply to work schedules longer than 8 hours/day or 40 hours/week. The models should not be used to justify very high exposures as "allowable" where the exposure periods are short (e.g., exposure to 8 times the TLV-TWA for one hour and zero exposure during the remainder of the shift). In this respect, the general limitations on TLV excursions and STELs should be applied to avoid inappropriate use of the models with very short exposure periods or shifts.

Since adjusted TLVs do not have the benefit of historical use and long-time observation, medical supervision during initial use of adjusted TLVs is advised. In addition, the hygienist should avoid unnecessary exposure of workers even if a model shows such exposures to be "allowable" and should not use models to justify higher-than-necessary exposures.

Both the OSHA and the Brief and Scala models are easier to use than some of the more complex models based on pharmacokinetic actions. However, hygienists thoroughly familiar with such models may find them more appropriate in specific instances. Use of such models usually requires knowledge of the biological half-life of each substance, and some models require additional data.

Short workweeks can allow workers to have two full-time jobs, perhaps with similar exposures, and may result in overexposure even if neither job by itself entails overexposure. Hygienists should be alert to such situations.

Conversion of TLVs in ppm to mg/m³. TLVs for gases and vapors are usually established in terms of parts per million of substance in air by volume (ppm). For convenience to the user, these TLVs are also listed here in terms of milligrams of substance per cubic meter of air (mg/m³). The conversion is based on 760 torr barometric pressure and 25°C (77°F), giving a conversion equation of:

$$\text{TLV in mg/m}^3 = \frac{(\text{TLV in ppm})\ (\text{gram molecular weight of the substance})}{24.45}$$

Resulting values are rounded to two significant figures below 100 and to three significant figures above 100. This is not done to give any converted value a greater precision than that of the original TLV, but to avoid increasing or decreasing the TLV significantly merely by the conversion of units.

The above equation may be used to convert TLVs to any degree of precision desired. When converting TLVs to mg/m³ units for other temperatures and pressures, the reference TLVs should be used as a starting point. These are the values expressed in ppm, except for benomyl, caprolactam, and sodium azide, which are established in terms of mg/m³. Also, when converting values expressed as an element (e.g., as Fe, as Ni), the molecular value of the element should be used, not that of the entire compound.

In making conversions for substances with variable molecular weights, appropriate molecular weights have been estimated or assumed (see the TLV *Documentation*).

Operational Guidelines. The ACGIH Board of Directors has adopted operational guidelines for the Chemical Substances TLV Committee. These guidelines prescribe: charge, authority, policies, membership, organization, and operating procedures. The policies include the appeals procedures. Copies of the guidelines document are available from the ACGIH Publications Office at a cost of $5 per copy. The guidelines were also published in the March 1988 issue of *Applied Industrial Hygiene.* These guidelines permit public input.

References

1. Leidel, N.A.; Busch, K.A.; Crouse, W.E.: Exposure Measurement, Action Level and Occupational Environmental Variability. DHEW (NIOSH) Pub. No. 76-131 (December 1975).
2. Paustenbach, D.J.: Occupational Exposure Limits, Pharmacokinetics, and Unusual Work Schedules. In: Patty's Industrial Hygiene and Toxicology, 2nd ed., Vol. 3A, The Work Environment, Chap. 6, pp. 111–277. L.J. Cralley and L.V. Cralley, Eds. John Wiley and Sons, Inc., New York (1985).

NOTE: In the interest of keeping this book as compact as possible, the footnotes for the adopted values appear on the fold-out of the back cover.

All pertinent footnotes relating to the materials in this booklet now appear on the fold-out of the back cover.

	ADOPTED VALUES			
	TWA		STEL	
Substance [CAS #]	ppm[a]	mg/m³[b]	ppm[a]	mg/m³[b]
•Acetaldehyde [75-07-0] (1976)	100	180	150	270
Acetic acid [64-19-7] (1976)	10	25	15	37
Acetic anhydride [108-24-7] (1976)	C 5	C 21	—	—
•Acetone [67-64-1] (1982)	750	1780	1000	2380
•Acetonitrile [75-05-8] (1976)	40	67	60	101
Acetylene [74-86-2] (1981)	—[c]	—	—	—
Acetylene dichloride, *see* 1,2-Dichloroethylene				
Acetylene tetrabromide [79-27-6] (1986)	1	14	—	—
Acetylsalicylic acid (Aspirin) [50-78-2] (1980)	—	5	—	—
Acrolein [107-02-8] (1976)	0.1	0.23	0.3	0.69
▪Acrylamide [79-06-1] — Skin (1987)	—	0.03,A2	—	—
•Acrylic acid [79-10-7] — Skin (1990)	2	5.9	—	—
•▪Acrylonitrile [107-13-1] — Skin (1984)	2,A2	4.3,A2	—	—
•▪Aldrin [309-00-2] — Skin (1986)	—	0.25	—	—
Allyl alcohol [107-18-6] — Skin (1976)	2	4.8	4	9.5
▪Allyl chloride [107-05-1] (1976)	1	3.0	2	6.0
Allyl glycidyl ether (AGE) [106-92-3] (1976)	5	23	10	47
Allyl propyl disulfide [2179-59-1] (1976)	2	12	3	18
α-Alumina, *see* Aluminum oxide				
Aluminum [7429-90-5], as Al				
Metal dust (1986)	—	10	—	—
Pyro powders (1979)	—	5	—	—
Welding fumes (1979)	—	5	—	—
Soluble salts (1979)	—	2	—	—
Alkyls (NOC[d]) (1979)	—	2	—	—
Aluminum oxide [1344-28-1], as Al (1986)	—	10[e]	—	—

Substance [CAS #]	ADOPTED VALUES TWA ppm[a]	TWA mg/m^3[b]	STEL ppm[a]	STEL mg/m^3[b]
•4-Aminodiphenyl [92-67-1] — Skin (1972)	—	A1	—	—
2-Aminoethanol, *see* Ethanolamine				
2-Aminopyridine [504-29-0] (1986)	0.5	2.0	—	—
3-Amino-1,2,4-triazole, *see* Amitrole				
•Amitrole [61-82-5] (1986)	—	0.2	—	—
Ammonia [7664-41-7] (1976) ..	25	17	35	24
Ammonium chloride fume [12125-02-9] (1976)	—	10	—	20
Ammonium perfluorooctanoate [3825-26-1] (1988)	—	0.1	—	—
Ammonium sulfamate [7773-06-0] (1986)	—	10	—	—
Amosite, *see* Asbestos				
n-Amyl acetate [628-63-7] (1987)	100	532	—	—
sec-Amyl acetate [626-38-0] (1987)	125	665	—	—
••Aniline [62-53-3] and homologues — Skin (1986)	2	7.6	—	—
•Anisidine [29191-52-4] (o-, p-isomers) — Skin (1977) ...	0.1	0.50	—	—
Antimony [7440-36-0] and compounds, as Sb (1980)	—	0.5	—	—
•Antimony trioxide [1309-64-4]				
Handling and use, as Sb (1978)	—	0.5	—	—
Production (1980)	—	A2	—	—
ANTU [86-88-4] (1986)	—	0.3	—	—
Argon [7440-37-1] (1981)	—[c]	—	—	—
••Arsenic [7440-38-2] and soluble compounds, as As (1980)	—	0.2	—	—
Arsenic trioxide production [1327-53-3] (1980)	—	A2	—	—
•Arsine [7784-42-1] (1977)	0.05	0.16	—	—
••Asbestos[f]				
• Amosite [12172-73-5] (1980)		0.5 fiber/cc, A1		
• Chrysotile [12001-29-5] (1980)		2 fibers/cc, A1		
• Crocidolite [12001-28-4] (1980)		0.2 fiber/cc, A1		
• Other forms (1980)		2 fibers/cc, A1		
Asphalt (petroleum) fumes [8052-42-4] (1987)	—	5	—	—
Atrazine [1912-24-9] (1983) ...	—	5	—	—
•Azinphos-methyl [86-50-0] — Skin (1986)	—	0.2	—	—

Substance [CAS #]	ADOPTED VALUES TWA ppm[a]	TWA mg/m^3[b]	STEL ppm[a]	STEL mg/m^3[b]
Barium [7440-39-3], soluble compounds, as Ba (1977)	—	0.5	—	—
Barium sulfate [7727-43-7] (1986)	—	10[e]	—	—
Benomyl [17804-35-2] (1986) ..	0.84	10	—	—
‡••Benzene [71-43-2] (1987)	(10,A2)	(32,A2)	—	—
•Benzidine [92-87-5] — Skin (1982)	—	A1	—	—
p-Benzoquinone, *see* Quinone				
Benzoyl peroxide [94-36-0] (1977)	—	5	—	—
•Benzo(a)pyrene [50-32-8] (1976)	—	A2	—	—
•Benzyl chloride [100-44-7] (1977)	1	5.2	—	—
••Beryllium [7440-41-7] and compounds, as Be (1979)	—	0.002,A2	—	—
Biphenyl [92-52-4] (1987)	0.2	1.3	—	—
Bismuth telluride [1304-82-1] (1986)	—	10	—	—
Se-doped (1986)	—	5	—	—
Borates, tetra, sodium salts [1303-96-4]				
Anhydrous (1977)	—	1	—	—
Decahydrate (1977)	—	5	—	—
Pentahydrate (1977)	—	1	—	—
Boron oxide [1303-86-2] (1986)	—	10	—	—
Boron tribromide [10294-33-4] (1986)	C 1	C 10	—	—
Boron trifluoride [7637-07-2] (1977)	C 1	C 2.8	—	—
Bromacil [314-40-9] (1986) ...	1	11	—	—
Bromine [7726-95-6] (1976) ...	0.1	0.66	0.3	2.0
Bromine pentafluoride [7789-30-2] (1986)	0.1	0.72	—	—
Bromochloromethane, *see* Chlorobromomethane				
Bromoform [75-25-2] — Skin (1977)	0.5	5.2	—	—
•1,3-Butadiene [106-99-0] (1986)	10,A2	22,A2	—	—
Butane [106-97-8] (1981)	800	1900	—	—
Butanethiol, *see* Butyl mercaptan				
2-Butanone, *see* Methyl ethyl ketone (MEK)				
2-Butoxyethanol (EGBE) [111-76-2] — Skin (1987) ...	25	121	—	—
n-Butyl acetate [123-86-4] (1976)	150	713	200	950
sec-Butyl acetate [105-46-4] (1987)	200	950	—	—

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Substance [CAS #]	TWA ppm[a]	TWA mg/m^3[b]	STEL ppm[a]	STEL mg/m^3[b]
tert-Butyl acetate [540-88-5] (1987)	200	950	—	—
Butyl acrylate [141-32-2] (1978)	10	52	—	—
n-Butyl alcohol [71-36-3] — Skin (1977)	C 50	C 152	—	—
§sec-Butyl alcohol [78-92-2] (1990)	100	303	—	—
tert-Butyl alcohol [75-65-0] (1976)	100	303	150	455
Butylamine [109-73-9] — Skin (1976)	C 5	C 15	—	—
•tert-Butyl chromate, as CrO_3 [1189-85-1] — Skin (1977)	—	C 0.1	—	—
•n-Butyl glycidyl ether (BGE) [2426-08-6] (1981)	25	133	—	—
n-Butyl lactate [138-22-7] (1977)	5	30	—	—
Butyl mercaptan [109-79-5] (1977)	0.5	1.8	—	—
o-sec-Butylphenol [89-72-5] — Skin (1980)	5	31	—	—
p-tert-Butyltoluene [98-51-1] (1976)	10	61	20	121
‡••Cadmium [7440-43-9] dusts and salts, as Cd (1976)	—	(0.05)	—	—
‡Cadmium oxide [1306-19-0] Fume, as Cd (1974)	—	(C 0.05)	—	—
Production (1983)	—	(0.05)	—	—
Calcium carbonate [1317-65-3] (1986)	—	10[e]	—	—
Calcium cyanamide [156-62-7] (1986)	—	0.5	—	—
Calcium hydroxide [1305-62-0] (1978)	—	5	—	—
Calcium oxide [1305-78-8] (1978)	—	2	—	—
‡Calcium silicate [1344-95-2] (1974)	—	10[e]	—	—
Calcium sulfate [7778-18-9] (1986)	—	10[e]	—	—
Camphor, synthetic [76-22-2] (1976)	2	12	3	19
‡Caprolactam [105-60-2] Dust (1974)	—	(1)	—	(3)
Vapor (1974)	(4.3)	(20)	(8.6)	(40)
Captafol [2425-06-1] — Skin (1977)	—	0.1	—	—
Captan [133-06-2] (1986)	—	5	—	—

Substance [CAS #]	TWA ppm[a]	TWA mg/m^3[b]	STEL ppm[a]	STEL mg/m^3[b]
Carbaryl [63-25-2] (1986)	—	5	—	—
Carbofuran [1563-66-2] (1977)	—	0.1	—	—
•Carbon black [1333-86-4] (1986)	—	3.5	—	—
Carbon dioxide [124-38-9] (1986)	5000	9000	30,000	54,000
••Carbon disulfide [75-15-0] — Skin (1986)	10	31	—	—
••Carbon monoxide [630-08-0] (1976)	50	57	400	458
Carbon tetrabromide [558-13-4] (1976)	0.1	1.4	0.3	4.1
••Carbon tetrachloride [56-23-5] — Skin (1986)	5,A2	31,A2	—	—
Carbonyl chloride, see Phosgene				
Carbonyl fluoride [353-50-4] (1981)	2	5.4	5	13
Catechol [120-80-9] (1977)	5	23	—	—
Cellulose (paper fiber) [9004-34-6] (1986)	—	10	—	—
Cesium hydroxide [21351-79-1] (1977)	—	2	—	—
§•Chlordane [57-74-9] — Skin (1990)	—	0.5	—	—
•Chlorinated camphene [8001-35-2] — Skin (1976)	—	0.5	—	1
§Chlorinated diphenyl oxide [31242-93-0] (1990)	—	0.5	—	—
Chlorine [7782-50-5] (1989)	0.5	1.5	1	2.9
Chlorine dioxide [10049-04-4] (1976)	0.1	0.28	0.3	0.83
Chlorine trifluoride [7790-91-2] (1977)	C 0.1	C 0.38	—	—
Chloroacetaldehyde [107-20-0] (1977)	C 1	C 3.2	—	—
Chloroacetone [78-95-5] — Skin (1989)	C 1	C 3.8	—	—
α-Chloroacetophenone [532-27-4] (1977)	0.05	0.32	—	—
‡Chloroacetyl chloride [79-04-9] (1980)	(0.05)	(0.23)	—	—
‡Chlorobenzene [108-90-7] (1950)	(75)	(345)	—	—
o-Chlorobenzylidene malononitrile [2698-41-1] — Skin (1983)	C 0.05	C 0.39	—	—
§Chlorobromomethane [74-97-5] (1990)	200	1060	—	—
2-Chloro-1,3-butadiene, see β-Chloroprene				

Substance [CAS #]	TWA ppm	TWA mg/m^3	STEL ppm	STEL mg/m^3
	ADOPTED VALUES			
§Chlorodifluoromethane [75-45-6] (1990)	1000	3540	—	—
§•Chlorodiphenyl (42% chlorine) [53469-21-9] — Skin (1990)	—	1	—	—
§••Chlorodiphenyl (54% chlorine) [11097-69-1] — Skin (1990)	—	0.5	—	—
1-Chloro-2,3-epoxy propane, *see* Epichlorohydrin				
2-Chloroethanol, *see* Ethylene chlorohydrin				
Chloroethylene, *see* Vinyl chloride				
••Chloroform [67-66-3] (1986)	10,A2	49,A2	—	—
•bis(Chloromethyl) ether [542-88-1] (1981)	0.001, A1	0.0047, A1	—	—
•Chloromethyl methyl ether [107-30-2] (1983)	A2	A2	—	—
1-Chloro-1-nitropropane [600-25-9] (1981)	2	10	—	—
Chloropentafluoroethane [76-15-3] (1981)	1000	6320	—	—
§Chloropicrin [76-06-2] (1990)	0.1	0.67	—	—
••β-Chloroprene [126-99-8] — Skin (1980)	10	36	—	—
o-Chlorostyrene [2039-87-4] (1976)	50	283	75	425
§o-Chlorotoluene [95-49-8] (1990)	50	259	—	—
2-Chloro-6-(trichloromethyl) pyridine, *see* Nitrapyrin				
§Chlorpyrifos [2921-88-2] — Skin (1990)	—	0.2	—	—
•Chromite ore processing (Chromate), as Cr (1978)	—	0.05,A1	—	—
Chromium [7440-47-3] Metal (1981)	—	0.5	—	—
Chromium (II) compounds, as Cr (1981)	—	0.5	—	—
Chromium (III) compounds, as Cr (1981)	—	0.5	—	—
◂••Chromium (VI) compounds, as Cr				
◂•Water soluble (1981)	—	0.05	—	—
• Certain water insoluble (1981)	—	0.05,A1	—	—
••Chromyl chloride [14977-61-8] (1982)	0.025	0.16	—	—
•Chrysene [218-01-9] (1981)	A2	A2	—	—
Chrysotile, *see* Asbestos				
§Clopidol [2971-90-6] (1990)	—	10	—	—

Substance [CAS #]	TWA ppm	TWA mg/m^3	STEL ppm	STEL mg/m^3
	ADOPTED VALUES			
Coal dust (1987)	—	2,(e) Respirable fraction		
••Coal tar pitch volatiles [65996-93-2], as benzene solubles (1981)	—	0.2,A1	—	—
•Cobalt [7440-48-4], as Co Metal dust & fume (1987)	—	0.05	—	—
Cobalt carbonyl [10210-68-1], as Co (1983)	—	0.1	—	—
Cobalt hydrocarbonyl [16842-03-8], as Co (1983)	—	0.1	—	—
Copper [7440-50-8] Fume (1977)	—	0.2	—	—
Dusts & mists, as Cu (1986)	—	1	—	—
Cotton dust, raw (1986)	—	0.2(f)	—	—
•Cresol [1319-77-3], all isomers — Skin (1977)	5	22	—	—
Cristobalite, *see* Silica — Crystaline				
Crocidolite, *see* Asbestos				
•Crotonaldehyde [4170-30-3] (1987)	2	5.7	—	—
§Crufomate [299-86-5] (1990)	—	5	—	—
Cumene [98-82-8] — Skin (1987)	50	246	—	—
Cyanamide [420-04-2] (1977)	—	2	—	—
Cyanides [151-50-8; 143-33-9], as CN — Skin (1977)	—	5	—	—
Cyanogen [460-19-5] (1977)	10	21	—	—
Cyanogen chloride [506-77-4] (1980)	C 0.3	C 0.75	—	—
Cyclohexane [110-82-7] (1987)	300	1030	—	—
Cyclohexanol [108-93-0] — Skin (1977)	50	206	—	—
Cyclohexanone [108-94-1] — Skin (1987)	25	100	—	—
Cyclohexene [110-83-8] (1977)	300	1010	—	—
Cyclohexylamine [108-91-8] (1977)	10	41	—	—
§Cyclonite [121-82-4] — Skin (1990)	—	1.5	—	—
Cyclopentadiene [542-92-7] (1987)	75	203	—	—
Cyclopentane [287-92-3] (1987)	600	1720	—	—
Cyhexatin [13121-70-5] (1986)	—	5	—	—
2,4-D [94-75-7] (1986)	—	10	—	—
••DDT (Dichlorodiphenyl-trichloroethane) [50-29-3] (1986)	—	1	—	—

Substance [CAS #]	ADOPTED VALUES TWA ppm[a)]	TWA mg/m^3[b)]	STEL ppm[a)]	STEL mg/m^3[b)]
Decaborane [17702-41-9]—Skin (1976)	0.05	0.25	0.15	0.75
•Demeton [8065-48-3]—Skin (1986)	0.01	0.11	—	—
Diacetone alcohol [123-42-2] (1987)	50	238	—	—
1,2-Diaminoethane, *see* Ethylenediamine				
Diatomaceous earth, *see* Silica—Amorphous				
•Diazinon [333-41-5]—Skin (1986)	—	0.1	—	—
•Diazomethane [334-88-3] (1977)	0.2	0.34	—	—
Diborane [19287-45-7] (1977)	0.1	0.11	—	—
1,2-Dibromoethane, *see* Ethylene dibromide				
2-N-Dibutylaminoethanol [102-81-8]—Skin (1986)	2	14	—	—
*Dibutyl phenyl phosphate [2528-78-7]—Skin (1990)	0.3	3.5	—	—
Dibutyl phosphate [107-66-4] (1976)	1	8.6	2	17
Dibutyl phthalate [84-74-2] (1987)	—	5	—	—
•Dichloroacetylene [7572-29-4] (1977)	C 0.1	C 0.39	—	—
o-Dichlorobenzene [95-50-1]—Skin (1977)	C 50	C 301	—	—
p-Dichlorobenzene [106-46-7] (1977)	75	451	110	661
•3,3'-Dichlorobenzidine [91-94-1]—Skin (1976)	—	A2	—	—
Dichlorodifluoromethane [75-71-8] (1986)	1000	4950	—	—
1,3-Dichloro-5,5-dimethyl hydantoin [118-52-5] (1976)	—	0.2	—	0.4
•1,1-Dichloroethane [75-34-3] (1976)	200	810	250	1010
1,2-Dichloroethane, *see* Ethylene dichloride				
1,1-Dichloroethylene, *see* Vinylidene chloride				
1,2-Dichloroethylene [540-59-0] (1987)	200	793	—	—
Dichloroethyl ether [111-44-4]—Skin (1976)	5	29	10	58
Dichlorofluoromethane [75-43-4] (1980)	10	42	—	—
Dichloromethane, *see* Methylene chloride				
1,1-Dichloro-1-nitroethane [594-72-9] (1986)	2	12	—	—

Substance [CAS #]	ADOPTED VALUES TWA ppm[a)]	TWA mg/m^3[b)]	STEL ppm[a)]	STEL mg/m^3[b)]
1,2-Dichloropropane, *see* Propylene dichloride				
•Dichloropropene [542-75-6]—Skin (1986)	1	4.5	—	—
2,2-Dichloropropionic acid [75-99-0] (1980)	1	5.8	—	—
Dichlorotetrafluoroethane [76-14-2] (1986)	1000	6990	—	—
•Dichlorvos [62-73-7]—Skin (1986)	0.1	0.90	—	—
Dicrotophos [141-66-2]—Skin (1977)	—	0.25	—	—
Dicyclopentadiene [77-73-6] (1977)	5	27	—	—
Dicyclopentadienyl iron [102-54-5] (1986)	—	10	—	—
••Dieldrin [60-57-1]—Skin (1986)	—	0.25	—	—
Diethanolamine [111-42-2] (1980)	3	13	—	—
Diethylamine [109-89-7] (1981)	10	30	25	75
2-Diethylaminoethanol [100-37-8]—Skin (1977)	10	48	—	—
Diethylene triamine [111-40-0]—Skin (1977)	1	4.2	—	—
Diethyl ether, *see* Ethyl ether				
Di(2-ethylhexyl)phthalate, *see* Di-sec-octyl phthalate				
Diethyl ketone [96-22-0] (1981)	200	705	—	—
Diethyl phthalate [84-66-2] (1987)	—	5	—	—
Difluorodibromomethane [75-61-6] (1986)	100	858	—	—
•Diglycidyl ether (DGE) [2238-07-5] (1981)	0.1	0.53	—	—
Dihydroxybenzene, *see* Hydroquinone				
Diisobutyl ketone [108-83-8] (1977)	25	145	—	—
Diisopropylamine [108-18-9]—Skin (1977)	5	21	—	—
Dimethoxymethane, see Methylal				
Dimethyl acetamide [127-19-5]—Skin (1986)	10	36	—	—
Dimethylamine [124-40-3] (1977)	10	18	—	—
Dimethylaminobenzene, *see* Xylidene				
•Dimethylaniline [121-69-7] (N,N-Dimethylaniline)—Skin (1976)	5	25	10	50
Dimethylbenzene, *see* Xylene				

		ADOPTED VALUES			
		TWA		STEL	
Substance	[CAS #]	ppm[a]	mg/m^3[b]	ppm[a]	mg/m^3[b]
•Dimethyl carbamoyl chloride	[79-44-7] (1978)	A2	A2	—	—
Dimethyl-1,2-dibromo-2,2-dichloroethyl phosphate, see Naled					
•Dimethylformamide	[68-12-2] — Skin (1986)	10	30	—	—
2,6-Dimethyl-4-heptanone, see Diisobutyl ketone					
‡••1,1-Dimethylhydrazine	[57-14-7] — Skin (1976)	(0.5,A2)	(1.2,A2)	—	—
Dimethylnitrosoamine, see N-Nitrosodimethylamine					
Dimethylphthalate	[131-11-3] (1986)	—	5	—	—
•Dimethyl sulfate	[77-78-1] — Skin (1977)	0.1,A2	0.52,A2	—	—
Dinitolmide	[148-01-6] (1976)	—	5	—	—
•Dinitrobenzene	[528-29-0; 99-65-0; 100-25-4] (all isomers) — Skin (1986)	0.15	1.0	—	—
Dinitro-o-cresol	[534-52-1] — Skin (1986)	—	0.2	—	—
3,5-Dinitro-o-toluamide, see Dinitolmide					
•••Dinitrotoluene	[25321-14-6] — Skin (1986)	—	1.5	—	—
••Dioxane	[123-91-1] — Skin (1986)	25	90	—	—
•Dioxathion	[78-34-2] — Skin (1977)	—	0.2	—	—
Diphenyl, see Biphenyl					
Diphenylamine	[122-39-4] (1986)	—	10	—	—
Diphenylmethane diisocyanate, see Methylene bisphenyl isocyanate					
Dipropylene glycol methyl ether	[34590-94-8] — Skin (1976)	100	606	150	909
Dipropyl ketone	[123-19-3] (1981)	50	233	—	—
Diquat	[85-00-7] (1986)	—	0.5	—	—
••Di-sec-octyl phthalate	[117-81-7] (1976)	—	5	—	10
Disulfiram	[97-77-8] (1986)	—	2	—	—
Disulfoton	[298-04-4] (1986)	—	0.1	—	—
2,6-Di-tert-butyl-p-cresol	[128-37-0] (1987)	—	10	—	—
Diuron	[330-54-1] (1977)	—	10	—	—
Divinyl benzene	[1321-74-0] (1980)	10	53	—	—
Emery	[1302-74-5] (1986)	—	10[e]	—	—

		ADOPTED VALUES			
		TWA		STEL	
Substance	[CAS #]	ppm[a]	mg/m^3[b]	ppm[a]	mg/m^3[b]
Endosulfan	[115-29-7] — Skin (1986)	—	0.1	—	—
Endrin	[72-20-8] — Skin (1986)	—	0.1	—	—
Enflurane	[13838-16-9] (1986)	75	566	—	—
Enzymes, see Subtilisins					
‡••Epichlorohydrin	[106-89-8] — Skin (1986)	(2)	(7.6)	—	—
•EPN	[2104-64-5] — Skin (1986)	—	0.5	—	—
1,2-Epoxypropane, see Propylene oxide					
2,3-Epoxy-1-propanol, see Glycidol					
Ethane	[74-84-0] (1981)	—[c]	—	—	—
Ethanethiol, see Ethyl mercaptan					
Ethanol, see Ethyl alcohol					
Ethanolamine	[141-43-5] (1978)	3	7.5	6	15
•Ethion	[563-12-2] — Skin (1977)	—	0.4	—	—
•2-Ethoxyethanol (EGEE)	[110-80-5] — Skin (1984)	5	18	—	—
2-Ethoxyethyl acetate (EGEEA)	[111-15-9] — Skin (1984)	5	27	—	—
Ethyl acetate	[141-78-6] (1977)	400	1440	—	—
•Ethyl acrylate	[140-88-5] (1990)	5,A2	20,A2	15,A2	61,A2
Ethyl alcohol	[64-17-5] (1977)	1000	1880	—	—
Ethylamine	[75-04-7] (1977)	10	18	—	—
Ethyl amyl ketone	[541-85-5] (1977)	25	131	—	—
•Ethyl benzene	[100-41-4] (1976)	100	434	125	543
‡Ethyl bromide	[74-96-4] (1976)	(200)	(891)	(250)	(1110)
Ethyl butyl ketone	[106-35-4] (1987)	50	234	—	—
Ethyl chloride	[75-00-3] (1986)	1000	2640	—	—
Ethylene	[74-85-1] (1981)	—[c]	—	—	—
Ethylene chlorohydrin	[107-07-3] — Skin (1977)	C 1	C 3.3	—	—
Ethylenediamine	[107-15-3] (1977)	10	25	—	—
•Ethylene dibromide	[106-93-4] — Skin (1982)	A2	A2	—	—
••Ethylene dichloride	[107-06-2] (1986)	10	40	—	—
Ethylene glycol	[107-21-1] Vapor and mist (1981)	C 50	C 127	—	—
•Ethylene glycol dinitrate	[628-96-6] — Skin (1985)	0.05	0.31	—	—
Ethylene glycol methyl ether acetate, see 2-Methoxyethyl acetate					
•Ethylene oxide	[75-21-8] (1984)	1,A2	1.8,A2	—	—

Substance [CAS #]	TWA ppm[a]	TWA mg/m^{3}[b]	STEL ppm[a]	STEL mg/m^{3}[b]
••Ethylenimine [151-56-4] — Skin (1977)	0.5	0.88	—	—
Ethyl ether [60-29-7] (1976)	400	1210	500	1520
Ethyl formate [109-94-4] (1987)	100	303	—	—
Ethylidene chloride, *see* 1,1-Dichloroethane				
Ethylidene norbornene [16219-75-3] (1977)	C 5	C 25	—	—
Ethyl mercaptan [75-08-1] (1986)	0.5	1.3	—	—
N-Ethylmorpholine [100-74-3] — Skin (1986)	5	24	—	—
Ethyl silicate [78-10-4] (1986)	10	85	—	—
•Fenamiphos [22224-92-6] — Skin (1984)	—	0.1	—	—
•Fensulfothion [115-90-2] (1977)	—	0.1	—	—
•Fenthion [55-38-9] — Skin (1983)	—	0.2	—	—
Ferbam [14484-64-1] (1986)	—	10	—	—
Ferrovanadium dust [12604-58-9] (1983)	—	1	—	3
•Fibrous glass dust (1978)	—	10	—	—
•Fluorides, as F (1977)	—	2.5	—	—
•Fluorine [7782-41-4] (1976)	1	1.6	2	3.1
Fluorotrichloromethane, *see* Trichlorofluoromethane				
•Fonofos [944-22-9] — Skin (1977)	—	0.1	—	—
‡••Formaldehyde [50-00-0] (1985)	(1,A2)	(1.2,A2)	(2,A2)	(2.5,A2)
Formamide [75-12-7] — Skin (1988)	10	18	—	—
‡Formic acid [64-18-6] (1967)	5	9.4	(—)	(—)
•Furfural [98-01-1] — Skin (1987)	2	7.9	—	—
Furfuryl alcohol [98-00-0] — Skin (1982)	10	40	15	60
•Gasoline [8006-61-9] (1982)	300	890	500	1480
Germanium tetrahydride [7782-65-2] (1986)	0.2	0.63	—	—
Glass, fibrous or dust, *see* Fibrous glass dust				
Glutaraldehyde [111-30-8] (1979)	C 0.2	C 0.82	—	—
Glycerin mist [56-81-5] (1981)	—	10[h]	—	—
Glycidol [556-52-5] (1987)	25	76	—	—
Glycol monoethyl ether, *see* 2-Ethoxyethanol				
Grain dust (oat, wheat, barley) (1986)	—	4[i]	—	—
‡Graphite (natural) [7782-42-5] (1987)	—	(2.5[j], Respirable dust)		
‡Graphite (synthetic) [7782-42-5] (1971)	—	(10[h])	—	—
Gypsum, *see* Calcium sulfate				

Substance [CAS #]	TWA ppm[a]	TWA mg/m^{3}[b]	STEL ppm[a]	STEL mg/m^{3}[b]
Hafnium [7440-58-6] (1986)	—	0.5	—	—
Halothane [151-67-7] (1988)	50	404	—	—
Helium [7440-59-7] (1981)	—[c]	—	—	—
‡•Heptachlor [76-44-8] — Skin (1986)	—	(0.5)	—	—
Heptane [142-82-5] (n-Heptane) (1976)	400	1640	500	2050
2-Heptanone, *see* Methyl n-amyl ketone				
3-Heptanone, *see* Ethyl butyl ketone				
•Hexachlorobutadiene [87-68-3] — Skin (1982)	0.02,A2	0.21,A2	—	—
Hexachlorocyclopentadiene [77-47-4] (1986)	0.01	0.11	—	—
‡Hexachloroethane [67-72-1] (1989)	(1)	(9.7)	—	—
Hexachloronaphthalene [1335-87-1] — Skin (1986)	—	0.2	—	—
Hexafluoroacetone [684-16-2] — Skin (1986)	0.1	0.68	—	—
Hexamethylene diisocyanate [822-06-0] (1988)	0.005	0.034	—	—
•Hexamethyl phosphoramide [680-31-9] — Skin (1978)	A2	A2	—	—
•Hexane (n-Hexane) [110-54-3] (1982)	50	176	—	—
• Other isomers (1982)	500	1760	1000	3500
2-Hexanone, *see* Methyl n-butyl ketone				
Hexone, *see* Methyl isobutyl ketone				
sec-Hexyl acetate [108-84-9] (1977)	50	295	—	—
Hexylene glycol [107-41-5] (1977)	C 25	C 121	—	—
‡••Hydrazine [302-01-2] — Skin (1977)	(0.1,A2)	(0.13,A2)	—	—
Hydrogen [1333-74-0] (1981)	—[c]	—	—	—
Hydrogenated terphenyls [37275-59-5] (1977)	0.5	4.9	—	—
Hydrogen bromide [10035-10-6] (1986)	C 3	C 9.9	—	—
Hydrogen chloride [7647-01-0] (1977)	C 5	C 7.5	—	—
•Hydrogen cyanide [74-90-8] — Skin (1980)	C 10	C 11	—	—
Hydrogen fluoride [7664-39-3], as F (1986)	C 3	C 2.6	—	—

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Substance [CAS #]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
Hydrogen peroxide [7722-84-1] (1986)	1	1.4	—	—
Hydrogen selenide [7783-07-5], as Se (1977)	0.05	0.16	—	—
•Hydrogen sulfide [7783-06-4] (1976)	10	14	15	21
Hydroquinone [123-31-9] (1987)	—	2	—	—
4-Hydroxy-4-methyl-2-pentanone, see Diacetone alcohol				
2-Hydroxypropyl acrylate [999-61-1] — Skin (1980)	0.5	2.8	—	—
Indene [95-13-6] (1987)	10	48	—	—
Indium [7440-74-6] & compounds, as In (1986)	—	0.1	—	—
Iodine [7553-56-2] (1977)	C 0.1	C 1.0	—	—
Iodoform [75-47-8] (1986)	0.6	10	—	—
Iron oxide fume (Fe_2O_3) [1309-37-1], as Fe (1986)	B2	5	—	—
Iron pentacarbonyl [13463-40-6], as Fe (1982)	0.1	0.23	0.2	0.45
Iron salts, soluble, as Fe (1986)	—	1	—	—
Isoamyl acetate [123-92-2] (1987)	100	532	—	—
Isoamyl alcohol [123-51-3] (1976)	100	361	125	452
§Isobutyl acetate [110-19-0] (1990)	150	713	—	—
Isobutyl alcohol [78-83-1] (1987)	50	152	—	—
Isooctyl alcohol [26952-21-6]—Skin (1982)	50	266	—	—
Isophorone [78-59-1] (1977)	C 5	C 28	—	—
Isophorone diisocyanate [4098-71-9] — Skin (1988)	0.005	0.045	—	—
Isopropoxyethanol [109-59-1] (1987)	25	106	—	—
Isopropyl acetate [108-21-4] (1976)	250	1040	310	1290
Isopropyl alcohol [67-63-0] (1976)	400	983	500	1230
Isopropylamine [75-31-0] (1976)	5	12	10	24
N-Isopropylaniline [768-52-5] — Skin (1986)	2	11	—	—
Isopropyl ether [108-20-3] (1976)	250	1040	310	1300

Substance [CAS #]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
•Isopropyl glycidyl ether (IGE) [4016-14-2] (1976)	50	238	75	356
Kaolin [1332-58-7] (1986)	—	10[e]	—	—
Ketene [463-51-4] (1976)	0.5	0.86	1.5	2.6
••Lead [7439-92-1], inorg. dusts & fumes, as Pb (1986)	—	0.15	—	—
Lead arsenate [7784-40-9], as $PbHAsO_4$ (1985)	—	0.15	—	—
‡•Lead chromate [7758-97-6], (as Cr) (1977)	—	(0.05,A2)	—	—
Limestone, see Calcium carbonate				
•Lindane [58-89-9]— Skin (1986)	—	0.5	—	—
Lithium hydride [7580-67-8] (1977)	—	0.025	—	—
L.P.G. (Liquified petroleum gas) [68476-85-7] (1987)	1000	1800	—	—
Magnesite [546-93-0] (1986)	—	10[e]	—	—
Magnesium oxide fume [1309-48-4] (1977)	—	10	—	—
•Malathion [121-75-5] — Skin (1977)	—	10	—	—
Maleic anhydride [108-31-6] (1977)	0.25	1.0	—	—
Manganese [7439-96-5], as Mn				
• Dust & compounds (1988)	—	5	—	—
Fume (1979)	—	1	—	3
Manganese cyclopentadienyl tricarbonyl [12079-65-1], as Mn—Skin (1986)	—	0.1	—	—
Marble, see Calcium carbonate				
Mercury [7439-97-6], as Hg—Skin				
Alkyl compounds (1980)	—	0.01	—	0.03
All forms except alkyl Vapor (1982)	—	0.05	—	—
• Aryl & inorganic compounds (1982)	—	0.1	—	—
•Mesityl oxide [141-79-7] (1981)	15	60	25	100
Methacrylic acid [79-41-4] (1981)	20	70	—	—
Methane [74-82-8] (1981)	—[d]	—	—	—
Methanethiol, see Methyl mercaptan				
Methanol, see Methyl alcohol				
•Methomyl [16752-77-5] (1977)	—	2.5	—	—

		ADOPTED VALUES			
		TWA		STEL	
Substance	[CAS #]	ppm[a)]	mg/m^3[b)]	ppm[a)]	mg/m^3[b)]
Methoxychlor	[72-43-5] (1977)	—	10	—	—
•2-Methoxyethanol (EGME)	[109-86-4] — Skin (1984)	5	16	—	—
2-Methoxyethyl acetate (EGMEA)	[110-49-6] — Skin (1984)	5	24	—	—
4-Methoxyphenol	[150-76-5] (1982)	—	5	—	—
Methyl acetate	[79-20-9] (1976)	200	606	250	757
§Methyl acetylene	[74-99-7] (1990)	1000	1640	—	—
Methyl acetylene-propadiene mixture (MAPP)	(1976)	1000	1640	1250	2050
Methyl acrylate	[96-33-3] — Skin (1977)	10	35	—	—
Methylacrylonitrile	[126-98-7] — Skin (1986)	1	2.7	—	—
Methylal	[109-87-5] (1987)	1000	3110	—	—
Methyl alcohol	[67-56-1] — Skin (1976)	200	262	250	328
Methylamine	[74-89-5] (1977)	10	13	—	—
Methyl amyl alcohol, *see* Methyl isobutyl carbinol					
Methyl n-amyl ketone	[110-43-0] (1987)	50	233	—	—
•N-Methyl aniline	[100-61-8] — Skin (1986)	0.5	2.2	—	—
••Methyl bromide	[74-83-9] — Skin (1986)	5	19	—	—
•Methyl n-butyl ketone	[591-78-6] — Skin (1981)	5	20	—	—
••Methyl chloride	[74-87-3] — Skin (1981)	50	103	100	207
••Methyl chloroform	[71-55-6] (1976)	350	1910	450	2460
Methyl 2-cyanoacrylate	[137-05-3] (1976)	2	9.1	4	18
Methylcyclohexane	[108-87-2] (1987)	400	1610	—	—
Methylcyclohexanol	[25639-42-3] (1987)	50	234	—	—
o-Methylcyclohexanone	[583-60-8] — Skin (1976)	50	229	75	344
2-Methylcyclopentadienyl manganese tricarbonyl	[12108-13-3], as Mn — Skin (1986)	—	0.2	—	—

		ADOPTED VALUES			
		TWA		STEL	
Substance	[CAS #]	ppm[a)]	mg/m^3[b)]	ppm[a)]	mg/m^3[b)]
•Methyl demeton	[8022-00-2] — Skin (1986)	—	0.5	—	—
Methylene bisphenyl isocyanate (MDI)	[101-68-8] (1988)	0.005	0.051	—	—
••Methylene chloride	[75-09-2] (1988)	50,A2	174,A2	—	—
‡•••4,4'-Methylene bis(2-chloroaniline)	[101-14-4] — Skin (1974)	(0.02,A2)	(0.22,A2)	—	—
Methylene bis(4-cyclohexylisocyanate)	[5124-30-1] (1988)	0.005	0.054	—	—
•4,4'-Methylene dianiline	[101-77-9] — Skin (1986)	0.1,A2	0.81,A2	—	—
•Methyl ethyl ketone (MEK)	[78-93-3] (1978)	200	590	300	885
Methyl ethyl ketone peroxide	[1338-23-4] (1977)	C 0.2	C 1.5	—	—
Methyl formate	[107-31-3] (1976)	100	246	150	368
5-Methyl-3-heptanone, *see* Ethyl amyl ketone					
‡••Methyl hydrazine	[60-34-4] — Skin (1976)	(C 0.2,A2)	(C 0.38,A2)	—	—
••Methyl iodide	[74-88-4] — Skin (1986)	2,A2	12,A2	—	—
Methyl isoamyl ketone	[110-12-3] (1982)	50	234	—	—
Methyl isobutyl carbinol	[108-11-2] — Skin (1976)	25	104	40	167
Methyl isobutyl ketone	[108-10-1] (1981)	50	205	75	307
Methyl isocyanate	[624-83-9] — Skin (1977)	0.02	0.047	—	—
Methyl isopropyl ketone	[563-80-4] (1981)	200	705	—	—
•Methyl mercaptan	[74-93-1] (1977)	0.5	0.98	—	—
Methyl methacrylate	[80-62-6] (1987)	100	410	—	—
•Methyl parathion	[298-00-0] — Skin (1986)	—	0.2	—	—
•Methyl propyl ketone	[107-87-9] (1976)	200	705	250	881
Methyl silicate	[681-84-5] (1986)	1	6	—	—

Substance [CAS #]	TWA ppm[a)]	TWA mg/m^3[b)]	STEL ppm[a)]	STEL mg/m^3[b)]
	ADOPTED VALUES			
α-Methyl styrene [98-83-9] (1981)	50	242	100	483
Metribuzin [21087-64-9] (1984)	—	5	—	—
•Mevinphos [7786-34-7] — Skin (1976)	0.01	0.092	0.03	0.27
Mica [12001-26-2] (1986)	—	3,[j] Respirable dust		
Mineral wool fiber (1974)	—	10[e]	—	—
Molybdenum [7439-98-7], as Mo				
Soluble compounds (1986)	—	5	—	—
Insoluble compounds (1986)	—	10	—	—
Monochlorobenzene, *see* Chlorobenzene				
Monocrotophos [6923-22-4] (1977)	—	0.25	—	—
‡Morpholine [110-91-8] — Skin (1966)	20	71	(30)	(107)
•Naled [300-76-5] — Skin (1986)	—	3	—	—
Naphthalene [91-20-3] (1976)	10	52	15	79
•β-Naphthylamine [91-59-8] (1972)	—	A1	—	—
Neon [7440-01-9] (1981)	—[c]	—	—	—
•Nickel [7440-02-0]				
‡Metal (1966)	—	(1)	—	—
‡Insoluble compounds, as Ni (1974)	—	(1)	—	—
‡••Soluble compounds, as Ni (1976)	—	(0.1)	—	—
‡••Nickel carbonyl [13463-39-3], as Ni (1977)	(0.05)	(0.12)	—	—
‡••Nickel sulfide roasting, fume & dust, as Ni (1978)	—	(1,A1)	—	—
Nicotine [54-11-5] — Skin (1986)	—	0.5	—	—
Nitrapyrin [1929-82-4] (1982)	—	10	—	20
Nitric acid [7697-37-2] (1976)	2	5.2	4	10
•Nitric oxide [10102-43-9] (1986)	25	31	—	—
•p-Nitroaniline [100-01-6] — Skin (1982)	—	3	—	—
•Nitrobenzene [98-95-3] — Skin (1986)	1	5	—	—
•p-Nitrochlorobenzene [100-00-5]—Skin (1988)	0.1	0.64	—	—
•4-Nitrodiphenyl [92-93-3] (1976)	—	A1	—	—
Nitroethane [79-24-3] (1986)	100	307	—	—
Nitrogen [7727-37-9] (1989)	—[c]	—	—	—
•Nitrogen dioxide [10102-44-0] (1981)	3	5.6	5	9.4
•Nitrogen trifluoride [7783-54-2] (1986)	10	29	—	—
•Nitroglycerin (NG) [55-63-0] — Skin (1985)	0.05	0.46	—	—
‡Nitromethane [75-52-5] (1986)	(100)	(250)	—	—
1-Nitropropane [108-03-2] (1986)	25	91	—	—
•2-Nitropropane [79-46-9] (1987)	10,A2	36,A2	—	—
•N-Nitrosodimethylamine [62-75-9] — Skin (1972)	—	A2	—	—
•Nitrotoluene [88-72-2; 99-08-1; 99-99-0] — Skin (1982)	2	11	—	—
Nitrotrichloromethane, *see* Chloropicrin				
Nitrous oxide [10024-97-2] (1989)	50	90	—	—
Nonane [111-84-2] (1976)	200	1050	—	—
Nuisance particulates, *see* Particulates Not Otherwise Classified (PNOC)				
Octachloronaphthalene [2234-13-1] — Skin (1976)	—	0.1	—	0.3
Octane [111-65-9] (1976)	300	1400	375	1750
Oil mist, mineral (1976)	—	5[h]	—	10
Osmium tetroxide [20816-12-0], as Os (1976)	0.0002	0.0016	0.0006	0.0047
Oxalic acid [144-62-7] (1976)	—	1	—	2
Oxygen difluoride [7783-41-7] (1986)	C 0.05	C 0.11	—	—
Ozone [10028-15-6] (1989)	C 0.1	C 0.20	—	—
Paraffin wax fume [8002-74-2] (1987)	—	2	—	—
Paraquat [4685-14-7], respirable sizes (1978)	—	0.1	—	—
••Parathion [56-38-2] — Skin (1986)	—	0.1	—	—
Particulate polycyclic aromatic hydrocarbons (PPAH), *see* Coal tar pitch volatiles				
Particulates Not Otherwise Classified (PNOC) (1986)	—	10	—	—
Pentaborane [19624-22-7] (1976)	0.005	0.013	0.015	0.039

Substance [CAS #]	ADOPTED VALUES TWA ppm[a)]	mg/m³[b)]	STEL ppm[a)]	mg/m³[b)]
Pentachloronaphthalene [1321-64-8] (1986)	—	0.5	—	—
•Pentachlorophenol [87-86-5] — Skin (1986)	—	0.5	—	—
Pentaerythritol [115-77-5] (1986)	—	10	—	—
•Pentane [109-66-0] (1976)	600	1770	750	2210
2-Pentanone, *see* Methyl propyl ketone				
•••Perchloroethylene [127-18-4] (1984)	50	339	200	1370
Perchloromethyl mercaptan [594-42-3] (1977)	0.1	0.76	—	—
Perchloryl fluoride [7616-94-6] (1976)	3	13	6	25
Precipitated silica, *see* Silica — Amorphous				
Perlite [93763-70-3] (1986)	—	10[e)]	—	—
Petroleum distillates, *see* Gasoline; Stoddard solvent; VM&P naphtha				
Phenacyl chloride, *see* α-Chloroacetophenone				
•Phenol [108-95-2] — Skin (1987)	5	19	—	—
Phenothiazine [92-84-2] — Skin (1986)	—	5	—	—
•N-Phenyl-beta-naphthylamine [135-88-6] (1979)	A2	A2	—	—
‡p-Phenylenediamine [106-50-3] — (Skin) (1966)	—	0.1	—	—
Phenyl ether [101-84-8], vapor (1976)	1	7	2	14
Phenylethylene, *see* Styrene, monomer				
••Phenyl glycidyl ether (PGE) [122-60-1] (1982)	1	6.1	—	—
‡••Phenylhydrazine [100-63-0] — Skin (1985)	(5,A2)	(22,A2)	(10,A2)	(44,A2)
•Phenyl mercaptan [108-98-5] (1978)	0.5	2.3	—	—
Phenylphosphine [638-21-1] (1977)	C 0.05	C 0.23	—	—
Phorate [298-02-2] — Skin (1976)	—	0.05	—	0.2
Phosdrin, *see* Mevinphos				
Phosgene [75-44-5] (1978)	0.1	0.40	—	—
Phosphine [7803-51-2] (1976)	0.3	0.42	1	1.4
Phosphoric acid [7664-38-2] (1976)	—	1	—	3

Substance [CAS #]	ADOPTED VALUES TWA ppm[a)]	mg/m³[b)]	STEL ppm[a)]	mg/m³[b)]
Phosphorus (yellow) [7723-14-0] (1986)	—	0.1	—	—
§Phosphorus oxychloride [10025-87-3] (1990)	0.1	0.63	—	—
Phosphorus pentachloride [10026-13-8] (1980)	0.1	0.85	—	—
Phosphorus pentasulfide [1314-80-3] (1976)	—	1	—	3
Phosphorus trichloride [7719-12-2] (1982)	0.2	1.1	0.5	2.8
Phthalic anhydride [85-44-9] (1987)	1	6.1	—	—
m-Phthalodinitrile [626-17-5] (1977)	—	5	—	—
§Picloram [1918-02-1] (1990)	—	10	—	—
•Picric acid [88-89-1] (1990)	—	0.1	—	—
Pindone [83-26-1] (1987)	—	0.1	—	—
Piperazine dihydrochloride [142-64-3] (1982)	—	5	—	—
2-Pivalyl-1,3-indandione, *see* Pindone				
Plaster of Paris, *see* Calcium sulfate				
Platinum [7440-06-4] Metal (1981)	—	1	—	—
Soluble salts, as Pt (1981)	—	0.002	—	—
Polychlorobiphenyls, *see* Chlorodiphenyls				
Polytetrafluoroethylene decomposition products (1972)	—	B1	—	—
Portland cement [65997-15-1] (1986)	—	10[e)]	—	—
Potassium hydroxide [1310-58-3] (1977)	—	C 2	—	—
•Propane [74-98-6] (1981)	—[c)]	—	—	—
•Propane sultone [1120-71-4] (1977)	A2	A2	—	—
Propargyl alcohol [107-19-7] — Skin (1987)	1	2.3	—	—
•β-Propiolactone [57-57-8] (1987)	0.5,A2	1.5,A2	—	—
§Propionic acid [79-09-4] (1990)	10	30	—	—
Propoxur [114-26-1] (1987)	—	0.5	—	—
n-Propyl acetate [109-60-4] (1976)	200	835	250	1040
n-Propyl alcohol [71-23-8] — Skin (1976)	200	492	250	614
Propylene [115-07-1] (1976)	—[d)]	—	—	—

Substance [CAS #]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
	ADOPTED VALUES			
Propylene dichloride [78-87-5] (1976)	75	347	110	508
•Propylene glycol dinitrate [6423-43-4] — Skin (1985)	0.05	0.34	—	—
Propylene glycol monomethyl ether [107-98-2] (1976)	100	369	150	553
•Propylene imine [75-55-8] — Skin (1983)	2,A2	4.7,A2	—	—
•Propylene oxide [75-56-9] (1981)	20	48	—	—
•n-Propyl nitrate [627-13-4] (1978)	25	107	40	172
Propyne, *see* Methyl acetylene				
Pyrethrum [8003-34-7] (1981)	—	5	—	—
Pyridine [110-86-1] (1987)	5	16	—	—
Pyrocatechol, *see* Catechol				
Quartz, *see* Silica — Crystaline				
Quinone [106-51-4] (1987)	0.1	0.44	—	—
RDX, *see* Cyclonite				
Resorcinol [108-46-3] (1976)	10	45	20	90
•Rhodium [7440-16-6]				
•Metal (1982)	—	1	—	—
•Insoluble compounds, as Rh (1984)	—	1	—	—
•Soluble compounds, as Rh (1984)	—	0.01	—	—
Ronnel [299-84-3] (1977)	—	10	—	—
Rosin core solder pyrolysis products, as formaldehyde (1987)	—	0.1	—	—
Rotenone (commercial) [83-79-4] (1987)	—	5	—	—
Rouge (1986)	—	10[e]	—	—
•Rubber solvent (Naphtha) (1977)	400	1590	—	—
Selenium [7782-49-2] and compounds, as Se (1977)	—	0.2	—	—
Selenium hexafluoride [7783-79-1], as Se (1979)	0.05	0.16	—	—
Sesone [136-78-7] (1986)	—	10	—	—
Silane, *see* Silicon tetrahydride				
Silica — Amorphous				
•Diatomaceous earth (uncalcined) [61790-53-2] (1986)	—	10[e]	—	—

Substance [CAS #]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
	ADOPTED VALUES			
•Precipitated silica [112926-00-8] (1987)	—	10[e]	—	—
•Silica gel [112926-00-8] (1987)	—	10[e]	—	—
•Silica — Crystalline				
Cristobalite [14464-46-1] (1986)	—	0.05,[j] Respirable dust		
•Quartz [14808-60-7] (1986)	—	0.1,[j] Respirable dust		
‡•Silica, fused [60676-86-0] (1985)	—	0.1,[j] Respirable dust		
Tridymite [15468-32-3] (1986)	—	0.05,[j] Respirable dust		
•Tripoli [1317-95-9] (1985)	—	0.1,[j] of contained respirable quartz		
Silicon [7440-21-3] (1986)	—	10[e]	—	—
Silicon carbide [409-21-2] (1986)	—	10[e]	—	—
Silicon tetrahydride [7803-62-5] (1983)	5	6.6	—	—
Silver [7440-22-4]				
•Metal (1981)	—	0.1	—	—
Soluble compounds, as Ag (1981)	—	0.01	—	—
Soapstone				
Respirable dust (1985)	—	3[j]	—	—
Total dust (1985)	—	6[e]	—	—
Sodium azide [26628-22-8] (1977)	C 0.11	C 0.29	—	—
Sodium bisulfite [7631-90-5] (1980)	—	5	—	—
Sodium 2,4-dichloro-phenoxyethyl sulfate, *see* Sesone				
Sodium fluoroacetate [62-74-8] — Skin (1976)	—	0.05	—	0.15
Sodium hydroxide [1310-73-2] (1977)	—	C 2	—	—
Sodium metabisulfite [7681-57-4] (1980)	—	5	—	—
Starch [9005-25-8] (1986)	—	10	—	—
Stearates[f] (1988)	—	10	—	—
Stibine [7803-52-3] (1986)	0.1	0.51	—	—
•Stoddard solvent [8052-41-3] (1987)	100	525	—	—
Strychnine [57-24-9] (1986)	—	0.15	—	—
•Styrene, monomer [100-42-5] — Skin (1981)	50	213	100	426

Substance [CAS #]	ADOPTED VALUES TWA ppm[a]	TWA mg/m^3[b]	STEL ppm[a]	STEL mg/m^3[b]
Subtilisins [1395-21-7] (Proteolytic enzymes as 100% pure crystalline enzyme) (1977)	—	C0.00006[m]	—	—
Sucrose [57-50-1] (1986)	—	10	—	—
-Sulfotep [3689-24-5] — Skin (1986)	—	0.2	—	—
•Sulfur dioxide [7446-09-5] (1986)	2	5.2	5	13
Sulfur hexafluoride [2551-62-4] (1986)	1000	5970	—	—
Sulfuric acid [7664-93-9] (1989)	—	1	—	3
Sulfur monochloride [10025-67-9] (1986)	C 1	C 5.5	—	—
Sulfur pentafluoride [5714-22-7] (1986)	C 0.01	C 0.10	—	—
Sulfur tetrafluoride [7783-60-0] (1986)	C 0.1	C 0.44	—	—
Sulfuryl fluoride [2699-79-8] (1976)	5	21	10	42
Sulprofos [35400-43-2] (1984)	—	1	—	—
Systox, *see* Demeton				
2,4,5-T [93-76-5] (1986)	—	10	—	—
Talc (containing no asbestos fibers) [14807-96-6] (1983)	—	2,[j] Respirable dust		
•Talc (containing asbestos fibers) (1985)	Use asbestos TLV-TWA.[e]			
Tantalum [7440-25-7], metal and oxide [1314-61-0] dusts (1988)	—	5	—	—
TEDP, *see* Sulfotep				
Tellurium [13494-80-9] and compounds, as Te (1977)	—	0.1	—	—
Tellurium hexafluoride [7783-80-4], as Te (1977)	0.02	0.10	—	—
-Temephos [3383-96-8] (1986)	—	10	—	—
-TEPP [107-49-3] — Skin (1986)	0.004	0.047	—	—
Terphenyls [26140-60-3] (1980)	C 0.5	C 4.7	—	—
1,1,1,2-Tetrachloro-2,2-difluoroethane [76-11-9] (1986)	500	4170	—	—
1,1,2,2-Tetrachloro-1,2-difluoroethane [76-12-0] (1986)	500	4170	—	—

Substance [CAS #]	ADOPTED VALUES TWA ppm[a]	TWA mg/m^3[b]	STEL ppm[a]	STEL mg/m^3[b]
•1,1,2,2-Tetrachloroethane [79-34-5] — Skin (1986)	1	6.9	—	—
Tetrachloroethylene, *see* Perchloroethylene				
Tetrachloromethane, *see* Carbon tetrachloride				
Tetrachloronaphthalene [1335-88-2] (1986)	—	2	—	—
•Tetraethyl lead [78-00-2], as Pb — Skin (1986)	—	0.1[e]	—	—
Tetrahydrofuran [109-99-9] (1976)	200	590	250	737
•Tetramethyl lead [75-74-1], as Pb — Skin (1986)	—	0.15[e]	—	—
Tetramethyl succinonitrile [3333-52-6] — Skin (1986)	0.5	2.8	—	—
Tetranitromethane [509-14-8] (1977)	1	8	—	—
Tetrasodium pyrophosphate [7722-88-5] (1980)	—	5	—	—
•Tetryl [479-45-8] (1986)	—	1.5	—	—
Thallium [7440-28-0] Soluble compounds, as Tl — Skin (1977)	—	0.1	—	—
4,4'-Thiobis(6-tert-butyl-m-cresol) [96-69-5] (1986)	—	10	—	—
Thioglycolic acid [68-11-1] — Skin (1978)	1	3.8	—	—
Thionyl chloride [7719-09-7] (1986)	C 1	C 4.9	—	—
•Thiram [137-26-8] (1990)	—	1	—	—
Tin [7440-31-5]				
Metal (1982)	—	2	—	—
Oxide & inorganic compounds, except SnH_4, as Sn (1982)	—	2	—	—
‡Organic compounds, as Sn — Skin (1965)	—	0.1	—	(—)
Titanium dioxide [13463-67-7] (1986)	—	10[e]	—	—
-•o-Tolidine [119-93-7] — Skin (1982)	A2	A2	—	—
-Toluene [108-88-3] (1976)	100	377	150	565
•Toluene-2,4-diisocyanate (TDI) [584-84-9] (1983)	0.005	0.036	0.02	0.14
-•o-Toluidine [95-53-4] — Skin (1984)	2,A2	8.8,A2	—	—

Substance [CAS #]	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³
•m-Toluidine [108-44-1] — Skin (1986)	2	8.8	—	—
•p-Toluidine [106-49-0] — Skin (1986)	2,A2	8.8,A2	—	—
Toluol, *see* Toluene				
Toxaphene, *see* Chlorinated camphene				
Tributyl phosphate [126-73-8] (1986)	0.2	2.2	—	—
Trichloroacetic acid [76-03-9] (1980)	1	6.7	—	—
1,2,4-Trichlorobenzene [120-82-1] (1978)	C 5	C 37	—	—
1,1,1-Trichloroethane, *see* Methyl chloroform				
••1,1,2-Trichloroethane [79-00-5] — Skin (1986)	10	55	—	—
•••Trichloroethylene [79-01-6] (1984)	50	269	200	1070
Trichlorofluoromethane [75-69-4] (1982)	C 1000	C 5620	—	—
Trichloromethane, *see* Chloroform				
Trichloronaphthalene [1321-65-9] — Skin (1986)	—	5	—	—
Trichloronitromethane, *see* Chloropicrin				
1,2,3-Trichloropropane [96-18-4] — Skin (1987)	10	60	—	—
1,1,2-Trichloro-1,2,2-trifluoroethane [76-13-1] (1976)	1000	7670	1250	9590
Tricyclohexyltin hydroxide, *see* Cyhexatin				
Tridymite, *see* Silica—Crystaline				
Triethylamine [121-44-8] (1983)	10	41	15	62
Trifluorobromomethane [75-63-8] (1986)	1000	6090	—	—
Trimellitic anhydride [552-30-7] (1981)	0.005	0.039	—	—
Trimethylamine [75-50-3] (1983)	10	24	15	36
Trimethyl benzene [25551-13-7] (1987)	25	123	—	—
Trimethyl phosphite [121-45-9] (1986)	2	10	—	—
2,4,6-Trinitrophenol, *see* Picric acid				
2,4,6-Trinitrophenylmethylnitramine, *see* Tetryl				
•••2,4,6-Trinitrotoluene (TNT) [118-96-7] — Skin (1986)	—	0.5	—	—

Substance [CAS #]	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³
Triorthocresyl phosphate [78-30-8] — Skin (1986)	—	0.1	—	—
Triphenyl amine [603-34-9] (1980)	—	5	—	—
Triphenyl phosphate [115-86-6] (1986)	—	3	—	—
Tripoli, *see* Silica—Crystaline				
Tungsten [7440-33-7], as W				
Insoluble compounds (1976)	—	5	—	10
Soluble compounds (1976)	—	1	—	3
Turpentine [8006-64-2] (1987)	100	556	—	—
•Uranium (natural) [7440-61-1] Soluble & insoluble compounds, as U (1978)	—	0.2	—	0.6
n-Valeraldehyde [110-62-3] (1978)	50	176	—	—
Vanadium, as V_2O_5 [1314-62-1] Respirable dust & fume (1982)	—	0.05	—	—
Vegetable oil mists (1972)	—	10	—	—
•Vinyl acetate [108-05-4] (1976)	10	35	20	70
Vinyl benzene, *see* Styrene				
••Vinyl bromide [593-60-2] (1980)	5,A2	22,A2	—	—
••Vinyl chloride [75-01-4] (1980)	5,A1	13,A1	—	—
Vinyl cyanide, *see* Acrylonitrile				
•Vinyl cyclohexene dioxide [106-87-6] — Skin (1977)	10,A2	57,A2	—	—
••Vinylidene chloride [75-35-4] (1984)	5	20	20	79
Vinyl toluene [25013-15-4] (1981)	50	242	100	483
•VM & P Naphtha [8032-32-4] (1987)	300	1370	—	—
Warfarin [81-81-2] (1987)	—	0.1	—	—
Welding fumes (NOC) (1977)	—	5,B2	—	—
•Wood dust (certain hard woods as beech & oak) (1981)	—	1	—	—
• Soft wood (1981)	—	5	—	10
•Xylene [1330-20-7; 95-47-6; 108-38-3; 106-42-3] (o-, m-, p-isomers) (1976)	100	434	150	651
m-Xylene α,α'-diamine [1477-55-0] — Skin (1977)	—	C 0.1	—	—

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Substance [CAS #]	ADOPTED VALUES TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
*‡Xylidine (mixed isomers) [1300-73-8] — Skin (1990)	0.5,A2	2.5,A2	—	—
Yttrium [7440-65-5] metal & compounds, as Y (1988)	—	1	—	—
Zinc chloride fume [7646-85-7] (1976)	—	1	—	2
‡Zinc chromates [13530-65-9; 11103-86-9; 37300-23-5], as Cr (1988)	—	0.01,A1	—	—
Zinc oxide [1314-13-2]				
Fume (1976)	—	5	—	10
Dust (1976)	—	10[e]	—	—
Zirconium [7440-67-7] and compounds, as Zr (1976)	—	5	—	10

SPECIAL NOTICE

On page 39, under "Notice of Intended Changes," the carcinogen designation for Benzene should read "A1" under both "ppm" and "mg/m³."

Please change the entry for Benzene to read

†Benzene [71-43-2] — Skin 0.1,A1 0.3,A1 — —

NOTICE OF INTENDED CHANGES
(for 1990-91)

These substances, with their corresponding values, comprise those for which either a limit has been proposed for the first time, or for which a change in the "Adopted" listing has been proposed. In both cases, the proposed limits should be considered trial limits that will remain in the listing for a period of at least two years. If, after two years no evidence comes to light that questions the appropriateness of the values herein, the values will be reconsidered for the "Adopted" list. Documentation is available for each of these substances.

Substance [CAS #]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
†Benzene [71-43-2] — Skin	0.1,A1	0.3,A1	—	—
†Cadmium [7440-43-9] and compounds, as Cd	—	0.01,A2, Total Dust 0.002,A2, Respirable fraction[j]		
Calcium chromate [13765-19-0], as Cr	—	0.001,A2	—	—
Calcium silicate (synthetic) [1344-95-2]	—	10[e]	—	—
†Caprolactam [105-60-2]				
Dust	—	1	—	3
Vapor	5	23	10	46
Chloroacetyl chloride [79-04-9] — Skin	0.05	0.23	0.15	0.69
Chlorobenzene [108-90-7]	10	46	—	—
2-Chloropropionic acid [598-78-7] — Skin	0.1	0.44	—	—
1,1-Dimethylhydrazine [57-14-7] — Skin	0.01,A2	0.025,A2	—	—
†Epichlorohydrin [106-89-8] — Skin	0.1,A2	0.38,A2	—	—
†Ethyl bromide [74-96-4] — Skin	5,A2	22,A2	—	—
Formaldehyde [50-00-0]	C 0.3,A2	C 0.37,A2	—	—
Formic acid [64-18-6]	5	9.4	10	19
Graphite (all forms except graphite fibers) [7782-42-5]	—	2,[j] Respirable dust		
†Heptachlor and heptachlor epoxide [76-44-8] — Skin	—	0.05,A2	—	—

Substance [CAS #]	TWA ppm[a)]	TWA mg/m[3b)]	STEL ppm[a)]	STEL mg/m[3b)]
†Hexachloroethane [67-72-1]	1,A2	9.7,A2	—	—
Hydrazine [302-01-2]—Skin	0.01,A2	0.013,A2	—	—
Lead chromate [7758-97-6]				
as Pb	—	0.05,A2	—	—
as Cr	—	0.012,A2	—	—
†4,4'-Methylene bis(2-chloroaniline) [101-14-4]—Skin	A1	A1	—	—
Methyl hydrazine [60-34-4]—Skin	0.01,A2	0.019,A2	—	—
Morpholine [110-91-8]—Skin	20	71	—	—
Nickel [7440-02-0]				
Metal	—	0.05,A1	—	—
Insoluble compounds, as Ni	—	0.05,A1	—	—
Soluble compounds, as Ni	—	0.05,A1	—	—
Nickel carbonyl [13463-39-3], as Ni	Delete listing; nickel listing above applies.			
Nickel sulfide roasting, fume & dust, as Ni	Delete listing; nickel listing above applies.			
†Nitromethane [75-52-5]	20	50	—	—
Pentachloronitrobenzene [82-68-8]	—	0.5	—	—
†Perfluoroisobutylene [382-21-8]	C 0.01	C 0.082	—	—
m-Phenylenediamine [108-45-2]	—	0.1	—	—
o-Phenylenediamine [95-54-5]	—	0.1,A2	—	—
p-Phenylenediamine [106-50-3]	—	0.1	—	—
Phenylhydrazine [100-63-0]—Skin	0.1,A2	0.44,A2	—	—
Silica fume (amorphous) [69012-64-2]	—	0.2,[i)] Respirable dust		1[i)]
†Silica, fused (amorphous) [60676-86-0]	—	0.1,[i)] Resipirable dust		
Strontium chromate [7789-06-2], as Cr	—	0.001,A2	—	—
Tin, organic compounds, as Sn—Skin	—	0.1	—	0.2
†Triethanolamine [102-71-6]	0.5,A2	3.1,A2	—	—

ADOPTED APPENDICES

APPENDIX A
Carcinogens

The Chemical Substances Threshold Limit Values Committee classifies certain substances found in the occupational environment as either confirmed or suspected human carcinogens. The present listing of substances that have been identified as carcinogens takes two forms: those for which a TLV has been assigned and those for which environmental and exposure conditions have not been sufficiently defined to assign a TLV. Where a TLV has been assigned, it does not necessarily imply the existence of a biological threshold; however, if exposures are controlled to this level, we would not expect to see a measurable increase in cancer incidence or mortality.

The TLV Committee considers information from the following kinds of studies to be indicators of a substance's potential to be a carcinogen in humans: epidemiology studies, toxicology studies, and, to a lesser extent, case histories. Scientific debate over the existence of biological thresholds for carcinogens is unlikely to be resolved in the near future. Because of the long latent period for many carcinogens, and for ethical reasons, it is often impossible to base timely risk-management decisions on results from human studies.

In order to recognize the qualitative differences in research results, two categories of carcinogens are designated in this booklet:

A1—*Confirmed Human Carcinogens.* Substances, or substances associated with industrial processes, recognized to have carcinogenic potential.

and

A2—*Suspected Human Carcinogens.* Chemical substances, or substances associated with industrial processes, which are suspect of inducing cancer, based on either limited epidemiological evidence or demonstration of carcinogenesis in one or more animal species by appropriate methods.

Exposures to carcinogens must be kept to a minimum. Workers exposed to A1 carcinogens without a TLV should be properly equipped to eliminate to the fullest extent possible all exposure to the carcinogen. For A1 carcinogens with a TLV and for A2 carcinogens, worker exposure by all routes should be carefully controlled to levels as low as reasonably achievable (ALARA) below the TLV. Please see the *Documentation of the Threshold Limit*

Values, Appendix A, "Identification and Classification of Carcinogens," for a more complete description and derivation of these designations.

APPENDIX B
Substances of Variable Composition

B1. *Polytetrafluoroethylene* decomposition products.* Thermal decomposition of the fluorocarbon chain in air leads to the formation of oxidized products containing carbon, fluorine, and oxygen. Because these products decompose in part by hydrolysis in alkaline solution, they can be quantitatively determined in air as fluoride to provide an index of exposure. No TLV is recommended pending determination of the toxicity of the products, but air concentration should be minimal. (*Trade names: Algoflon, Fluon, Teflon, Tetran)

B2. *Welding Fumes — Total Particulate (NOC)
TLV-TWA, 5 mg/m³**

Welding fumes cannot be classified simply. The composition and quantity of both are dependent on the alloy being welded and the process and electrodes used. Reliable analysis of fumes cannot be made without considering the nature of the welding process and system being examined; reactive metals and alloys such as aluminum and titanium are arc-welded in a protective, inert atmosphere such as argon. These arcs create relatively little fume, but they do create an intense radiation which can produce ozone. Similar processes are used to arc-weld steels, also creating a relatively low level of fumes. Ferrous alloys also are arc-welded in oxidizing environments that generate considerable fume and can produce carbon monoxide instead of ozone. Such fumes generally are composed of discreet particles of amorphous slags containing iron, manganese, silicon, and other metallic constituents depending on the alloy system involved. Chromium and nickel compounds are found in fumes when stainless steels are arc-welded. Some coated and flux-cored electrodes are formulated with fluorides and the fumes associated with them can contain significantly more fluorides than oxides. Because of the above factors, arc-welding fumes frequently must be tested for individual constituents that are likely to be present to determine whether specific TLVs are exceeded. Conclusions based on total fume concentration are generally adequate if no toxic elements are present in welding rod, metal, or metal coating and conditions are not conducive to the formation of toxic gases.

Most welding, even with primitive ventilation, does not produce exposures inside the welding helmet above 5 mg/m³. That which does, should be controlled.

APPENDIX C
Threshold Limit Values for Mixtures

When two or more hazardous substances which act upon the same organ system are present, their combined effect, rather than that of either individually, should be given primary consideration. In the absence of information to the contrary, the effects of the different hazards should be considered as additive. That is, if the sum of the following fractions,

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \cdots \frac{C_n}{T_n}$$

exceeds unity, then the threshold limit of the mixture should be considered as being exceeded. C_1 indicates the observed atmospheric concentration and T_1 the corresponding threshold limit (see Example A.1 and B.1).

Exceptions to the above rule may be made when there is a good reason to believe that the chief effects of the different harmful substances are not in fact additive, but *independent* as when purely local effects on different organs of the body are produced by the various components of the mixture. In such cases the threshold limit ordinarily is exceeded only when at least one member of the series (C_1/T_1 + or + C_2/T_2, etc.) itself has a value exceeding unity (see Example B.1).

Synergistic action or potentiation may occur with some combinations of atmospheric contaminants. Such cases at present must be determined individually. Potentiating or synergistic agents are not necessarily harmful by themselves. Potentiating effects of exposure to such agents by routes other than that of inhalation are also possible, e.g., imbibed alcohol and inhaled narcotic (trichloroethylene). Potentiation is characteristically exhibited at high concentrations, less probably at low.

When a given operation or process characteristically emits a number of harmful dusts, fumes, vapors or gases, it will frequently be only feasible to attempt to evaluate the hazard by measurement of a single substance. In such cases, the threshold limit used for this substance should be reduced by a suitable factor, the magnitude of which will depend on the number, toxicity, and relative quantity of the other contaminants ordinarily present.

Examples of processes that are typically associated with two or more harmful atmospheric contaminants are welding, automobile repair, blasting, painting, lacquering, certain foundry operations, diesel exhausts, etc.

Examples of TLVs for Mixtures

A. *Additive effects.* The following formulae apply only when the components in a mixture have similar toxicologic effects; they should not be used for mixtures with widely differing reactivities, e.g.,

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hydrogen cyanide and sulfur dioxide. In such case, the formula for Independent Effects (B) should be used.

1. General case, where air is analyzed for each component, the TLV of mixture =

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} + \ldots = 1$$

Note: It is essential that the atmosphere be analyzed both qualitatively and quantitatively for each component present in order to evaluate compliance or noncompliance with this calculated TLV.

Example A.1: Air contains 400 ppm of acetone (TLV, 750 ppm), 150 ppm of sec-butyl acetate (TLV, 200 ppm) and 100 ppm of methyl ethel ketone (TLV, 200 ppm).

Atmospheric concentration of mixture = 400 + 150 + 100 = 650 ppm of mixture.

$$\frac{400}{750} + \frac{150}{200} + \frac{100}{200} = 0.53 + 0.75 + 0.5 = 1.78$$

Threshold Limit is exceeded.

2. Special case when the source of contaminant is a liquid mixture and the atmospheric composition is *assumed* to be similar to that of the original material, e.g., on a time-weighted average exposure basis, all of the liquid (solvent) mixture eventually evaporates. When the percent composition (by weight) of the liquid mixture is known, the TLVs of the constituents must be listed in mg/m³. TLV of mixture =

$$\frac{1}{\frac{f_a}{TLV_a} + \frac{f_b}{TLV_b} + \frac{f_c}{TLV_c} + \cdots \frac{f_n}{TLV_n}}$$

Note: In order to evaluate compliance with this TLV, field sampling instruments should be calibrated, in the laboratory, for response to this specific quantitative and qualitative air-vapor mixture, and also to fractional concentrations of this mixture, e.g., 1/2 the TLV; 1/10 the TLV; 2 × the TLV; 10 × the TLV; etc.)

Example A.2: Liquid contains (by weight):

50% heptane: TLV = 400 ppm or 1600 mg/m³
1 mg/m³ ≡ 0.25 ppm

30% methyl chloroform: TLV = 350 ppm or 1900 mg/m³
1 mg/m³ ≡ 0.18 ppm

20% perchloroethylene: TLV = 50 ppm or 335 mg/m³
1 mg/m³ ≡ 0.15 ppm

$$\text{TLV of Mixture} = \frac{1}{\frac{0.5}{1600} + \frac{0.3}{1900} + \frac{0.2}{335}}$$

$$= \frac{1}{0.00031 + 0.00016 + 0.0006}$$

$$= \frac{1}{0.00107} = 935 \text{ mg/m}^3$$

of this mixture

50% or (935)(0.5) = 468 mg/m³ is heptane
30% or (935)(0.3) = 281 mg/m³ is methyl chloroform
20% or (935)(0.2) = 187 mg/m³ is perchloroethylene

These values can be converted to ppm as follows:

heptane: 468 mg/m³ × 0.25 = 117 ppm
methyl chloroform: 281 mg/m³ × 0.18 = 51 ppm
perchloroethylene: 187 mg/m³ × 0.15 = 29 ppm

TLV of mixture = 117 + 51 + 29 = 197 ppm, or 935 mg/m³

B. *Independent effects.* TLV for mixture =

$$\frac{C_1}{T_1} = 1;\ \frac{C_2}{T_2} = 1\ \ \frac{C_3}{T_3} = 1; \text{ etc.}$$

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

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

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

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 $\pm 1.0\ \mu m$ 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 $\pm 0.3\ \mu m$ 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. American Conference of Governmental Industrial Hygienists: *Particle Size-Selective Sampling in the Workplace*. Pub. No. 0830. ACGIH, Cincinnati, OH (1984).

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

Acetaldehyde
Acetomethylchloride
Acetophenone
Adipic acid
Adiponitrile
Aluminum alkyls
Arsenic
Bentonite
Benzyl acetate
Borax and boron compounds
Bromine
Bromine pentafluoride
Bromochloromethane
Bromodichloromethane
Bromoform
1,2,3,4-Butanetetracarboxylic acid
n-Butyl acetate
n-Butyl glycidyl ether (BGE)
2-t-Butylazo-2-hydroxy-5-methylhexane
Carbon disulfide
Carbon monoxide
Chlorodiphenyls (42% & 54% chlorine)
Chromium
Chrysene
Cobalt
Copper fume
Cristobalite
Cyanamide
Cyanides
Diatomaceous earth
Dichlorocyclopentadiene
Dichlorodiphenyl sulfone
1,1-Dichloroethane
1,2-Dichloroethane
2,4-D (2,4-Dichlorophenoxy acetic acid)
1,3-Dichloropropene
Dichlorvos
Diethylamine
Dimethylamine
Dimethyl acetamide
Dimethyl formamide
Dimethyl disulfide
Dinitrotoluene
Emery
EPN
2-Ethyl hexanoic acid
Fibrous glass dust
Gallium arsenide
Gasoline (unleaded)
Glutaraldehyde
Glycol ethers
Graphite fibers
Hexachlorobenzene
Hexachlorocyclopentadiene
Hexamethylene diamine
Hydrogen bromide
Jet, petroleum, and diesel fuels
Inorganic lead
Kaolin
Malathion
Manganese
Man-made mineral fibers
Mercury
2-Methoxyethanol
Methyl bromide
Methylene chloride
Methylene diamine
4,4'-Methylene dianiline

Methyl tert-butyl ether
Mineral spirits
Naled
Particulates Not Otherwise Classified (PNOC)
Pentachlorophenol
2,4-Pentanedione
Perchloroethylene
Perlite
Persulfates
Petroleum solvents
Phosphate (including mining)
Potash
Propylene dichloride
Silane
Silica, fumed (amorphous)
Silica, fused (amorphous)
Sulfur monochloride
Sulfur tetrafluoride
Sulfuryl fluoride
Tantalum
Terphenyls
Terephthalic acid
1,1,2,2-Tetrachloroethane
Tetrakis (hydroxymethyl) phosphonium chloride
Tetrakis (hydroxymethyl) phosphonium sulfate
Tetranitromethane
Tetrasodium pyrophosphate
Tobacco smoke
Toluene
Trichloroethylene
Tridymite
Triethylamine
Trimellitic anhydride
Trona
Vinyl cyclohexene
Uranium

Other Issues

1. Excursion limit and Short-Term Exposure Limit (STEL).
2. A working group has been formed to review classification systems for carcinogens that are used by other organizations/agencies.

1989-90 CHEMICAL SUBSTANCES TLV COMMITTEE

Ernest Mastromatteo, M.D., University of Toronto—*Chair*
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