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PLAINTIFF'S EXHIBIT
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Documentation of the Threshold Limit Values for Substances in Workroom Air. A separate companion piece to the Airborne TLVs is issued by ACGM under this title. This publication gives the pertinent scientific information and data with reference to literature sources that were used to base each limit. Each documentation also contains a statement defining the type of response against which the limit is safeguarding the worker. For a better understanding of the TLVs it is essential that the Documentation be consulted when the TLVs are beingused.

Information concerning the availability of copies of the Documentation of the Threshold Limit Values for Substances in Workroom Air should be directed to the Secretary-Treasurer.

Threshold limit Values of Airborne Contaminants

Adopted By

ACGIH

For 1971

Time-weighted averages permit excursions above the limit provided they are compensated by equivalent excursions below the limit during the workday. In some instances it may be permissible to calculate the average concentration for a workweek rather than for a workday. The degree of permissible excursion is related to the magnitude of the threshold limit value of a particular substance as given in Appendix C. The relationship between threshold limit and permissible excursion is a rule of thumb and in certain cases may not apply, The amount by which threshold limits 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 decision as to whether a hazardous condition exists.

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 committe holds to the opinion that limits 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.

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.

These limits are intended for use in the practice of industrial hygiene and should be interpreted and applied only by a person trained in this discipline. They are not intended for use, or for modification for use, (1) as a relative index of hazard or toxicity, (2) in the evaluation or control of community air pollution or air pollution nuisances, (3) in estimating the toxic potential of continuous uninterrupted exposures, (4) as proof or disproof of an existing disease or physical condition, or (5) for adoption by countries whose working conditions differ from those in the United States of America and where substances and processes differ.

Ceiling vs Time-Weighted Average Limits. Although the time-weighted average concentration provides the most satisfactory, practical way of monitoring airborne agents for compliance with the limits, there are certain substances for which it is inappropriate. In the latter

group are substances which are predominantly fast acting and whose threshold limit is more appropriately based on this particular response. Substances with this type of response are best controlled by a ceiling "C" limit that should not be exceeded. It is implicit in these definitions that the manner of sampling to determine compliance with the limits for each group must differ; a single brief sample, that is applicable to a "C" Limit, is not appropriate to the time-weighted limit; here, a sufficient number of samples are needed to permit a time-weighted average concentration throughout a complete cycle of operations or throughout the work shift.

Whereas the ceiling limit places a definite boundary which concentrations should not be permitted to exceed, the time-weighted average limit requires an explicit limit to the excursions that are permissible above the listed values. The magnitude of these excursions may be pegged to the magnitude of the threshold limit by an appropriate factor shown in Appendix C. It should be noted that the same factors are used by the Committee in making a judgment whether to include or exclude a substance for a "C" listing.

"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. This attention-calling designation is intended to suggest

appropriate measures for the prevention of cutaneous absorption so that the threshold limit is not invalidated.

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

Nuisance Dusts. 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. The nuisance 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 nuisance dusts has the following characteristics: 1) The architecture of the air spaces remains intact. 2) Collagen (scar tissue) is not formed to a significant extent. 3) The tissue reaction is potentially reversible.

Excessive concentrations of nuisance dusts in the workroom air may seriously reduce visibility (iron oxide), may cause unpleasant deposits in the eyes, ears and

nasal passages (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 threshold limit of $10mg/M^3$, or 30 mppcf, of total dust < 1%SiO_2, whichever is less, is recommended for substances in these categories and for which no specific threshold limits 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 threshold limit has not yet been adopted. Some "inert" particulates are given in Appendix D.

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 percent by volume under normal atmospheric pressure (equivalent to a partial pressure, pO_2 of 135 mm Hg). 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. Specific examples are listed in Appendix E.

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 threshold limit may be altered. Most of these stresses act adversely to increase the toxic response of a substance. Although most threshold limits 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 over-time extending the workweek more than 25%, might be considered gross deviations. In such instances judgment must be exercised in the proper adjustments of the threshold limit values.

"Notice of Intent." At the beginning of each year, proposed actions of the Committee for the forthcoming year are issued in the form of a "Notice of Intent." This Notice provides not only an opportunity for comment, but solicits suggestions of substances to be added to the list. The suggestions should be accompanied by substantiating evidence. The list of Intended Changes follows the Adopted Values in the TLV booklet.

Legal Status. By publication in the Federal Register (Vol. 36, No. 105, May 29, 1971) the "Threshold Limit Values for 1970" are now ,official federal standards for industrial air, except for the American National Standards and except for certain values for mineral dusts.

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ADOPTED VALUES
(In Alphabetical Order)

Substance	ppm[a]	mg/M3[b]
Abate	--	10
** Acetaldehyde		
Acetic acid	10	25
** Acetic anhydride		
Acetone	1,000	2,400
Acetonitrile	40	70
* 2-Acetylaminofluorene-Skin	--	A[1]
Acetylene	E	--
Acetylene dichloride, see 1, 2 - Dichloroethylene	--	--
Acetylene tetrabromide	1	14
Acrolein	0.1	0.25
Acrylamide-Skin	--	0.3
Acrylonitrile-Skin	20	45
Aldrin-Skin	--	0.25
Allyl alcohol-Skin	2	5
Allyl chloride	1	3
**C Allyl glycidyl ether (AGE)		
Allyl propyl disulfide	2	12
Alundum (Al_2O_3)	--	D
* 4-Aminodiphenyl-Skin	--	A[1]
2-Aminoethanol, see Ethanolamine	--	--
2-Aminopyridine	0.5	2
**Ammonia		
Ammonium sulfamate (Ammate)	--	10
n-Amyl acetate	100	525
sec-Amyl acetate	125	650
Aniline-Skin	5	19

Footnotes (a thru h) see Page 28

*1971 Addition
**See Notice of Intended Changes

Substance	ppm[a]	mg/M3[b]
Anisidine (o, p-isomers) -Skin	--	0.5
Antimony & compounds (as Sb)	--	0.5
ANTU (alpha naphthyl thiourea)	--	0.3
Argon	E	--
Arsenic & Compounds (as As)	--	0.5
Arsine	0.05	**0.2**
*Asphalt (petroleum) fumes	--	5
Azinphos methyl-Skin	--	**0.2**
Barium (soluble compounds)	--	0.5
C Benzene (benzol)- Skin	25	**80**
Benzidine-Skin	--	A[1]
p-Benzoquinone, see Quinone	--	--
Benzoyl peroxide	--	5
Benzyl chloride	1	5
Beryllium	--	0.002
Biphenyl, see Diphenyl	--	--
Boron oxide	--	lo
Boron tribromide	1	lo
C Boron trifluoride	1	3
Bromine	0.1	**0.7**
Bromine pentafluoride	0.1	0.7
Bromoform-Skin	0.5	5
Butadiene (1, 3-. butadiene)	1,000	**2,200**
Butanethiol, see Butyl mercaptan	--	--
2-Butanone	**200**	**590**
2-Butoxy ethanol (Butyl Cellosolve) -Skin	50	**240**
Butyl acetate (n-butyl acetate)	150	710

Capital letters refer to Appendices

*1971 Addition

Substance	ppm[a]	mg/M3[b]
sec-Butyl acetate	**200**	950
tert-Butyl acetate	200	950
Butyl alcohol	100	300
sec-Butyl alcohol	150	**450**
tert-Butyl alcohol	100	300
C Butylamine-Skin	5	15
C tert-Butyl chromate (as CrO_3) -Skin	--	0.1
n-Butyl glycidyl ether (BGE)	50	**270**
Butyl mercaptan	0.5	**1.5**
p-tert-Butyltoluene	10	60
Cadmium (Metal dust and soluble salts)	--	**0.2**
C Cadmium oxide fume (as Cd)	--	**0.1**
Calcium carbonate	--	**D**
Calcium arsenate	--	1
Calcium oxide	--	5
**Camphor (Synthetic)		
Carbaryl (Sevin®)	--	5
Carbon black	--	3.5
Carbon dioxide	5,000	9,000
Carbon disulfide-Skin	20	60
Carbon monoxide	50	55
Carbon tetrachloride -Skin	10	65
Cellulose (paper fiber)	--	**D**
Chlordane-Skin	--	**0.5**
Chlorinated camphene -Skin	--	0.5
Chlorinated diphenyl oxide	--	0.5
Chlorine	1	3
Chlorine dioxide	**0.1**	**0.3**
C Chlorine trifluoride	0.1	**0.4**
C Chloroacetaldehyde	1	3
α-Chloroacetophenone (phenacylchloride)	0.05	0.3

Capital letters refer to Appendices

**See Notice of Intended Changes