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Patty's Industrial Hygiene and Toxicology

Volume III
THEORY AND RATIONALE OF INDUSTRIAL HYGIENE PRACTICE

LESTER V. CRALLEY, Ph.D.
LEWIS J. CRALLEY, Ph.D.
Editors

Contributors

E. W. Arp, Jr.
K. A. Busch
K. J. Caplan
I. S. Chapman
W. C. Cooper
J. V. Crable
L. V. Cralley
L. J. Cralley
J. C. Davis
P. M. Eller
R. L. Fischoff
F. G. Freiberger
P. J. Gehring
J. C. Cuignard
R. L. Harris, Jr.
B. J. Held
V. H. Hill
S. M. Horvath
N. A. Leidel
J. R. Lynch
C. R. McHenry
M. H. Munsch
R. L. Potter
C. H. Powell
K. S. Rao
R. C. Thomas
R. L. Thomas
R. S. Waritz

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EARL W. ARP, Jr., Ph.D., A
Clemson, South Carolina.

KENNETH A. BUSCH, Chi
Health, Department of Healtl

KNOWLTON J. CAPLAN, 1

JOHN S. CHAPMAN, L1.D
Dallas. Dallas. Texas.

W. CLARK COOPER, M.D.

JOHN V. CRABLE, Chief. N
Health, Department of Healtl

LESTER V. CRALLEY, Ph.D.
America, Pittsburgh, Pennsyl

LEWIS J. CRALLEY, Ph.D.,
Institute for Occupational Sa
Ohio.

JEFFERSON C. DAVIS, 11.1
San Antonio, Texas

PETER M. ELLER, Ph.D., 11
Health, Department of Health

ROBERT L. FISCHOFF, D
Bethesda, Maryland

FRED C. FREIBERCER, Safet
ness Machines Corporation, B

PERRY J. CEHRINC, D.V.?
mental Research, DOW Chem

JOHN C. CUICNARD, M
Michaud Station, New Orlean

ROBERT L. HARRIS, Jr., I
Carolina, Chapel Hill. North

Contributors

EARL W. ARP, Jr., Ph.D., Associate Professor, Department of Industrial Management, Clemson University, Clemson, South Carolina.

KENNETH A. BUSCH, Chief, Statistical Services Branch, National Institute for Occupational Safety and Health, Department of Health, Education and Welfare, Cincinnati, Ohio

KNOWLTON J. CAPLAN, Industrial Health Engineering Associates, Inc., Hopkins, Minnesota

JOHN S. CHAPMAN, M.D., Professor of Internal Medicine, University of Texas Health Science Center at Dallas, Dallas, Texas.

W. CLARK COOPER, M.D., Occupational Medical Consultant, Berkeley, California

JOHN V. CRABLE, Chief, Measurements Research Branch, National Institute for Occupational Safety and Health, Department of Health, Education and Welfare, Cincinnati, Ohio

LESTER V. CRALLEY, Ph.D., Formerly Manager of Environmental Health Services, Aluminum Company of America, Pittsburgh, Pennsylvania

LEWIS J. CRALLEY, Ph.D., Formerly Director, Division of Epidemiology and Special Services, National Institute for Occupational Safety and Health, Department of Health, Education and Welfare, Cincinnati, Ohio

JEFFERSON C. DAVIS, M.D., Colonel, USAFMC, Aerospace Medical Division, Brooks Air Force Base, San Antonio, Texas

PETER M. ELLER, Ph.D., Measurements Research Branch, National Institute for Occupational Safety and Health, Department of Health, Education and Welfare, Cincinnati, Ohio

ROBERT L. FISCHOFF, Division Industrial Hygienist, International Business Machines Corporation, Bethesda, Maryland

G. FREIBERGER, Safety Engineering/Emergency Control Program Administrator, International Business Machines Corporation, Bethesda, Maryland

PERRY J. GEHRING, D.V.M., Ph.D., Director, Toxicology Research Laboratory, Health and Environmental Research, DOW Chemical, U.S.A., Midland, Michigan

JOHN C. GUIGNARD, M.B., Ch.B., Research Medical Officer, Naval Medical Research Laboratory, Michaud Station, New Orleans, Lousiana

ROBERT L. HARRIS, Jr., Ph.D., Director, Occupational Health Studies Group, University of North Carolina, Chapel Hill, North Carolina

BRUCE J. HELD, Leader, Safety Science Group, Lawrence Livermore Laboratory, University of California, Livermore, California

VAUGHN H. HILL, Consultant—Acoustics, Formerly, Applied Technology Division, E. I. duPont de Nemours and Company, Inc., Wilmington, Delaware

STEVEN M. HORVATH, Ph.D., Director and Professor, Institute of Environmental Stress University of California, Santa Barbara, California

NELSON A. TEIDEL, Chief. Technical Evaluation and Review Branch. National Institute for Occupational Safety and Health, Department of Health, Education and Welfare, Rockville, Maryland

JEREMIAH R. LYNCH, Research and Environmental Health Division, Medical Department EXXON Corporation, Linden, New Jersey

CHARLES R. McHENRY, Manager, Environmental Health and Safety. XEROX Corporation, East Rochester, New York

MARTHA HARTLE MUNSCH, J.D., Reed Smith Shaw and McClay, Pittsburgh, Pennsylvania

ROBERT L. POTTER, J.D., Professor of Law, School of Law, University of Pittsburgh, Pittsburgh, Pennsylvania

CHARLES H. POWELL, Sc.D., Manager. Health Services Administration, PPG Industries Inc., Pittsburgh, Pennsylvania

K. S. RAO, Ph.D., Toxicology Research Laborarory, Health and Environmental Research, DOW Chemical, U.S.A., Midland, Michigan

ROBERT C. THOMAS, Ph.D., H-4 Group Leader, Mammalian Biology. University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico

RANDI L. THOMAS, Mammalian Biology, University of California. Los Alamos Scientific Laboratory, Los Alamos, New Mexico

RICHARD S. WARITZ, Ph.D., Senior Toxicologist, Hercules incorporated, Wilmington, Delaware

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evaluation of relatively few working environments; however others such as synergism apply to a much wider segment of the working population, and all can cause the development of erroneous information.

6 WORKROOM ENVIRONMENTAL EXPOSURE LIMIT

Any procedure or evaluation of worker exposure to noxious chemicals carries the assumption that at some level of exposure there will be some type of biologic effect, and it is necessary at some level of exposure to initiate engineering or administrative control of that exposure.

The development of such exposure guides had been based on their use by a competent industrial hygienist familiar with daily exposure levels, an understanding of the basis of the exposure limit, and a subjective evaluation of all factors to determine the appropriate control action necessary.

A number of exposure limits that do not have the status of law have been used for many years in the United States; these include the Hygienic Guide Series of the AIHA, the standards of the American National Standards Institute (ANSI), 2.37 Committee, the TLVs for Chemical Substances of the ACGIH, the standards of the National Academy of Sciences–National Research Council (NAS–NRC) and NIOSH, as well as the legal standards developed by OSHA, MSHA, and some state authorities where the basis for regulating is not derived from federal law, as in Pennsylvania. These limits include time-weighted averages, ceiling values, maximum peaks above ceiling, short-term limits, and emergency exposure limits. Richard S. Brief, in *Basic Industrial Hygiene—A Training Manual,* developed a table covering most of these standards (Table 8.1).

Both ACGIH TLVs and the ANSI 2.37 guidelines have been adopted, at least in part, as OSHA standards **(3).** Neither of these exposure guides will fill the requirement for standards as outlined in the Occupational Safety and Health Act, but they were promulgated as OSHA standards either as national consensus standards **(ANSI)** or as established federal standards (ACGIH TLVs) because they had already been adopted as federal standards under the Walsh-Haely Act. In cases where there were both federal standards and national consensus standards, the Secretary of Labor was to promulgate the standard that assured the greatest protection to the employee. The ANSI standards as consensus standards were adopted in preference to the TLVs of ACGIH when there was a choice to be made.

The largest list of environmental exposure limits has been developed by the ACGIH's Chemical Agent Threshold Limit Committee, then adopted by the membership of that organization. The ACGIH publishes a new list of TLVs each year, including revisions to already existing TLVs, and adds chemical compounds when it has determined that limits are needed because of exposures in the workplace. It has been estimated that approximately **95** percent of the exposures in industry in the United States is covered by an ACGIH TLV. Any new TLVs or any changes in the limits are publicly announced

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to the ACGIH membership and are placed on a tentative list of TLVs to allow interested professionals to present additional information and comment on the proposed limit.

The ACGIH TLVs have been adopted in other countries, even though the organization has strongly opposed the use of its TLVs in countries where working conditions differ from those in the United States (28). ACGIH also pointed out that the TLVs should be interpreted only by a person trained in industrial hygiene; and the TLVs should not be used as a relative index of hazard, or toxicity, for the evaluation or control of community air pollutants, for evaluating toxic *effect,* for continuous uninterrupted exposures or for other extended periods, or to verify or disprove the existence of a physical condition or disease (28).

This wide acceptance of ACGIH TLVs has resulted in these limits being used as the basic working standard for the measurement, evaluation, and control of workplace hazards for many years. The important differences between these suggested guides and the legal standards being developed by OSHA involve the ability of a professional committee of ACGIH to act in a reasonably short time to subjectively evaluate data and to propose TLVs, and for the industrial hygienist, who uses the TLVs, to exercise professional judgment in evaluating a work hazard.

The preface to the TLVs for Chemical Substances in workroom air should be read each year for the minor changes that occur in the preface from year to year. The following quotation from the 1977 TLV list (28) of chemical substances gives a good indication of how the TLV Committee believes that the TLVs should be used, and their intent.

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

A separate ACGIH publication, "The Documentation of Threshold Limit Values for Substances in Workroom Air," gives the rationale for the TLV and quotes the primary references used to support the TLV. This publication and supplements to the documentation are published at irregular intervals; in the interim periods the annual proceedings of ACGIH contain the recommendations and discussions of the TLV by the membership of ACGIH at the time of their adoption at the annual meeting. The basis for the TLVs may be epidemiologic studies in industrial, clinical experience, or animal studies.

REFERENCES

1. **Occupational Safety & Health Act, Public Law 91-596 S2193, 91st Congress, December 29, 1970, Superintendent of Documents, Government Printing Office, Washington, D.C.**