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Dear HSIA Health & Science Committee Members:

At the June 19 HSIA H&S committee meeting, I agreed to obtain information on the recent American Congress of Governmental Industrial Hygienists (ACGIH) proposal for changes on exposure levels for perchloroethylene and trichloroethylene. A copy of the ACGIH report from their annual meeting taken from the June 10, 1992 issue of the BNA Occupational Safety & Health Reporter, is enclosed. Both of these materials are included in the Notice of Intended Changes (NIC) that came out of this meeting.

The TLV Committee proposals are:

Material	TWA (ppm) Present	TWA (ppm) Proposed	STEL (ppm) Present	STEL (ppm) Proposed	Carcinogen Class. Present	Carcinogen Class. Proposed
Perchloroethylene	50	25	200	100	----	A3
Trichloroethylene	50	50	200	100	----	A5

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As shown, the STELs for both materials and the TLV for perchloroethylene have been lowered. These actions were presumably taken as a result of ACGIH's review of information on these materials, although I do not know specifically what information caused the changes. The carcinogen classifications for these materials are based on the recently adopted ACGIH method (see page 80 of the enclosed report) and are roughly consistent with HSIA positions on the unlikely potential of these materials to cause carcinogenicity in humans. I believe that trichloroethylene is the first material to be placed in ACGIH's A5 classification (not suspected as a human carcinogen). This classification will probably cause a great deal of comment to ACGIH during the NIC comment period. Substances are now usually on the list of Notices of Intended Changes for 2 years before the changes are adopted by ACGIH.

Dr. Doull, Chairman of the ACGIH TLV Committee, is out of the country until early July. I will contact him when he returns for details of how these decisions were reached.

Sincerely,

James A. Barter, Ph.D., D.A.B.T.

:dvr

c: K. Daye
R. Yuravage
E. Kennah
K. Lee

Perhaps in response to these charges, Brooks said in his letter to OSHA that the state plan "desires and intends to provide federal OSHA with all information necessary to allow federal OSHA to properly monitor our program." He said the state "will continue to cooperate with federal OSHA to achieve the best possible workplace protection" for its workers, and "will continue to share ideas with federal OSHA toward a goal of improving worker protection across the nation."

Brooks was defeated in the May Democratic primary election. Brooks' tenure will end in January 1992, when a new labor commissioner takes office (21 OSHR 1642, 1643).

Regulatory Policy

METZENBAUM SCORES BUSH ADMINISTRATION ON MORATORIUM, CITES 'CONSTITUTIONAL' ISSUE

The Bush administration's regulatory moratorium "raises serious constitutional issues" and "may represent a conscious effort to subvert the will of Congress," Sen. Howard Metzenbaum (D-Ohio) said June 2.

In a sharply worded speech on the floor of the Senate, Metzenbaum took President Bush to task for the moratorium, which began in January and has been extended through the end of August.

"This deregulatory binge may be an effort to line the pockets of the president's business supporters," Metzenbaum said. "It may be an effort to salvage the president's re-election campaign in the face of a dwindling approval rating. But whatever the motivation, one thing is clear: the American people are paying the price."

Metzenbaum, chairman of the Senate Labor and Human Resources Subcommittee on Labor, charged that the moratorium and accompanying regulatory review have delayed or weakened important health, safety, and environmental regulations.

Metzenbaum said the pain and suffering caused by the moratorium are "very real." He further called on Bush and Vice President Dan Quayle—who is spearheading the regulatory freeze—to end "this dangerous charade."

The Ohio Democrat made no specific proposals in his floor speech concerning a congressional response to the moratorium. A Metzenbaum aide told BNA that, while a lawsuit has been considered, there is little case law in that area on which to guide opponents of administration policy. At this point, no further action is planned, the aide said.

Bring Issue To Light

"He wanted to bring this issue to light because it hasn't received a lot of attention from people up here," the aide said, referring to Capitol Hill lawmakers.

According to Metzenbaum, the freeze has affected pending rules across the regulatory spectrum. In the area of occupational health and safety, he cited studies by watchdog organizations Public Citizen and OMB Watch that estimated a 90-day freeze on pending regulations would result in 293 worker deaths and 1.3 million workplace injuries and illnesses.

The administration has insisted that the moratorium would not affect regulations designed to protect workers or public health and safety. But administration critics, including Metzenbaum, contend that has not been the case.

Metzenbaum said Public Citizen and OMB Watch concluded that some 43 health, safety, and environmental rules have been delayed, three more have been issued in weakened form, and three others killed outright.

The administration has delayed or weakened OSHA regulations for hazards such as worker entry into confined spaces, environmental rules required under the Clean Air Act amendments of 1990, nutrition labeling requirements by the Food and Drug Administration, and labeling standards for children's toys by the Consumer Product Safety Commission, according to Metzenbaum.

"The president claims his regulatory moratorium will save billions of dollars," Metzenbaum said. "The administration has yet to substantiate that figure. What's clear, however, is that it doesn't include the cost of deregulation in human lives and in the health of American citizens."

'No Sense'

"The president's moratorium makes no sense as a matter of policy," he added. "But it also raises serious constitutional issues."

The Ohio Democrat said the moratorium seeks to block the execution and implementation of dozens of regulatory statutes enacted by Congress, which could be a violation of Article II of the Constitution. That article charges the president with ensuring that the laws are faithfully executed.

"Even if few regulations are officially delayed, the diversion of resources for the required review of all existing and proposed rules frustrates the will of Congress as expressed in countless laws," he asserted.

Metzenbaum said that if Bush could delay regulations for seven months, then "what's to stop him from doing it for his entire term of office?"

Formaldehyde

ACGIH ADOPTS STRICT CEILING LIMIT, REJECTING INDUSTRY PUSH FOR LOOSER TLV

BOSTON—The American Conference of Governmental Industrial Hygienists June 2 adopted a strict recommended ceiling limit concentration for formaldehyde, rejecting an industry push for a less stringent threshold limit value.

The conference approved a new ceiling limit TLV of 0.3 parts formaldehyde per million parts air, a much stricter limit than the Occupational Safety and Health Administration's regulatory standard of 0.75 ppm as an eight-hour time-weighted average.

TLVs are recommended workplace exposure limits for hundreds of hazardous substances set by the conference, a body of industrial hygienists affiliated with governmental organizations. The limits do not carry the force of regulation, but they have served as a reference point for establishing regulatory standards, particularly by federal OSHA.

ACGIH adopted the formaldehyde TLV along with limits for a number of other substances during its annual membership meeting at the American Industrial Hygiene Conference (see related article in this issue).

The conference's decision comes a little more than a year after the Formaldehyde Institute, a trade group representing producers and users of formaldehyde, threatened to sue ACGIH over the strict limit (20 OSHR 1575). Formaldehyde formerly carried a TLV of 1 ppm as a time-weighted average.

The institute contended that health effects stemming from formaldehyde exposure did not warrant such a reduction and that achieving the limit would have a severe economic impact on employers.

Sara Schotland, a Washington, D.C., attorney representing the Formaldehyde Institute, told BNA June 8 the institute

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had not officially heard of the ACGIH decision and had no comment.

Controversial Move

The controversy over ACGIH's move to lower the TLV for formaldehyde prompted the conference to delay action for a year. It had originally been scheduled to go to a vote of the full conference membership in May 1991. However, ACGIH agreed to let the formaldehyde industry continue to argue its case for a less strict limit and take up the matter again this year.

According to Bill Wagner, ACGIH executive secretary, the new limit will be published in the conference's 1992-93 edition of TLVs, probably by the end of August. In addition to adopting the 0.3 ppm ceiling limit, ACGIH eliminated the old eight-hour time-weighted average and 2 ppm short-term limit.

At the industrial hygiene conference, John Doull of the University of Kansas, chairman of the the conference's Chemical Substances TLV Committee, said the committee rejected the industry's argument and took issue particularly with the economic issue.

"We agree that [cost] is a major issue, but the mandate of the TLV committee is not to consider economics or any other consideration other than health," Doull said.

Dennis Paustenbach, an industrial hygienist who headed a task force to review formaldehyde literature for the industry-backed Industrial Health Foundation, outlined the institute's case for a less stringent TLV before the industrial hygiene conference.

Paustenbach said that, rather than adopt a ceiling limit, ACGIH should adopt a 0.3 ppm time-weighted average, a limit he contended would protect 90 percent of the exposed population from sensory irritation.

Flawed Papers

According to Paustenbach, compliance with a ceiling limit costs 10 times as much money as compliance with a time-weighted average. In addition, he said, a number of the pivotal papers on which the conference's TLV committee based its ceiling limit recommendation were flawed.

Paustenbach said the committee did a good job in reviewing the literature on formaldehyde within the panel's time constraints. "But we needed to take apart each study to see how strongly they could stand on their own," he added.

After his task force finished its literature review, Paustenbach said, it determined that only 17 of the 120 papers reviewed by ACGIH were useful for setting an occupational exposure limit. The task force found numerous problems with data contained in other papers, he added.

The task force concluded the cancer risk at concentrations of 0.3 ppm is negligible, and that evidence of sensory irritation at concentrations below 0.3 ppm was uncertain, according to Paustenbach. Study subjects reported irritation with the same frequency whether they were exposed to formaldehyde at 0.3 ppm or to clean ambient air, he said.

Chemicals

ACGIH REVERSES ITS POSITION ON MBOCA, PROPOSES CHANGES TO OTHER THRESHOLD VALUES

BOSTON—The American Conference of Governmental Industrial Hygienists June 2 reversed its proposal to classify the chemical substance MBOCA as a known human carcinogen and instead recommended retaining the chemical's designation as a suspected cancer-causing agent.

ACGIH will retain the proposed designation of 4,4'-methylene bis(2 chloroaniline) as an A2 suspected carcinogen on its notice-of-intended change list for one year. The conference's full membership will decide whether to adopt the recommendation in 1993.

The conference decided to take that action at its annual membership meeting held in conjunction with the American Industrial Hygiene Conference.

ACGIH members acted on MBOCA and dozens of other substances for which they proposed or adopted threshold limit values or biological exposure indices. The complete TLV and BEI lists are published in the Full Text section of this issue.

MBOCA has carried the A2 designation, along with a 0.01 parts per million threshold limit value with a skin notation, since the early 1970s. But based on new evidence concerning the substance's carcinogenicity, the conference's Chemical Substances TLV Committee recommended in 1990 to reclassify MBOCA as a known carcinogen with no threshold limit value.

The recommendation was based largely on an epidemiologic study by the National Institute for Occupational Safety and Health, according to John Doull, chairman of the ACGIH panel.

Speaking at the industrial hygiene conference, Doull said the TLV committee met again in 1991 to review the matter and determined that the NIOSH data were inconclusive. Workers involved in the NIOSH study who contracted bladder cancer also had been exposed to other substances in addition to MBOCA, he said.

George T. Bryan, representing the Polyurethane Manufacturers Association, told the industrial hygiene conference that current epidemiologic data do not support an A1 classification for MBOCA. Concerning the NIOSH study, Bryan said the workers may have come into contact with as many as 15 or 16 known or suspected carcinogens, including five other bladder carcinogens.

Moreover, he said the workers involved had low-grade lesions and there was no evidence of recurring disease five years after removal of the lesions. That prompted Bryan to conclude "there is little evidence of a causal link between exposure to MBOCA and bladder cancer."

The full conference membership will vote on whether to retain the current classification and TLV for MBOCA at the next membership meeting in May 1993 in New Orleans.

In total, ACGIH proposed TLVs for 44 substances this year, including several chemicals which were held over from the 1991 notice-of-intended change list. Substances remain on the notice list for at least one year to allow for review of the proposed changes.

Among those held over from the 1991 list are the following: asbestos, benzene, cadmium and its compounds, epichlorohydrin, heptachlor and heptachlor epoxide, hydrazine, methyl hydrazine, nickel, nickel carbonyl, nickel sulfide, nitromethane, and triethanolimine.

New Limits Proposed

New limits were proposed for acetaldehyde, acetophenone, acetic anhydride, adipic acid, adiponitrile, arsenic, arsenic trioxide production, benz[a]anthracene, benzyl acetate, *n*-Butyl-acetate, tert-Butyl-alcohol, *p*-tert-Butyl-toluene, carbon tetrachloride, cobalt, *p*-Dichlorobenzene, and 1,4-2-Dichloro-2-butene.

Also, diethylamine, diquat, ethylamine, manganese, oil mist, perchloroethylene, rosin core solder, sodium perfluoroacetate, terephthalic acid, tetranitromethane, trichloroethylene, triethanolamine, trimellitic anhydride, and vinyl acetate.

TLVs were adopted for some 22 substances, including a controversial ceiling limit for formaldehyde (see related article in this issue). The other substances are: benzo[b]-fluoranthene, caprolactum, carbon monoxide, catechol, o-Dichlorobenzene, 1-1-Dichloroethane, dimethylamine, dinitrotoluene, ethyl bromide, hexachloroethane, 1,6-Hexanediamine, kaolin, methylamine, perfluoroisobutylene, silica fume, silica fused, strontium chromate, tin, toluene, trimethylamine, and 4-Vinyl cyclohexene.

ACGIH also adopted biologic exposure indices for chlorobenzene and proposed BEIs for 10 other substances. The conference also adopted TLVs for physical agents, including hand-arm vibration syndrome and heat stress.

The annual reports of the TLV and BEI committees are published in the Full Text section of this issue.

Synthetic Fibers

MANVILLE SAYS STUDY ADDS TO EVIDENCE THAT FIBERGLASS IS NOT HUMAN CARCINOGEN

BOSTON—The Manville Corp. June 2 unveiled preliminary results from a new study that the company says "strengthen the weight of scientific evidence" that fiberglass does not cause cancer in humans.

Manville and other fiberglass products manufacturers are promoting the study as part of a campaign to sever the link between their products and cancer. The study was launched by the companies in 1989 in response to the International Agency for Research on Cancer's decision to designate fiberglass as a possible human carcinogen.

The IARC designation, which ultimately led to fiberglass products carrying cancer-warning labels to inform workers and the public of potential hazards, was based on studies in which the fibers were surgically implanted into the bodies of rats.

Industry officials contend that such studies do not accurately reflect human exposure conditions. As a result, the industry undertook an inhalation study that exposed rats to two types of glass fibers representing 90 percent of fiberglass used in the United States, according to Manville officials.

The study was managed and underwritten by the fiberglass industry trade group Thermal Insulation Manufacturers Association Inc. Preliminary results were released at the American Industrial Hygiene Conference. A final report is expected in the fall.

"These animal studies are significant because they strengthen the weight of the evidence for the safety of fiberglass," Thomas Hesterberg, one of the study's principal authors, said. Hesterberg is a senior toxicologist for a Manville subsidiary, Schuller International Inc.

Hesterberg and other industry officials said the findings could provide the basis for an appeal to IARC to reconsider the carcinogen designation.

In a letter to Schuller customers, Robert Anderson, the company's senior vice president for science and technology, said the results of the inhalation study and other studies "will provide the scientific and regulatory community with the necessary data to begin reassessing the potential risk associated with inhaling fiber glass."

Mixed Reaction

Reacting to the study, Sheldon Samuels of the Workplace Health Fund told BNA that the Manville study "is encouraging, but not definitive. What we need is a thorough epidemiologic study, and that has not been done."

Samuels noted that this study examined only two types of fiberglass and that other forms which mimic asbestos are carcinogenic to the degree that the fibers persist in the lung. "We're hopeful that we have found a less risky substitute for asbestos, but this does not mean an automatic exoneration for fiberglass," he said.

Bill Kojola, associate director for occupational health with the Laborers' Health & Safety Fund, agreed that the industry study should be regarded as a negative study in terms of carcinogenicity. "It doesn't provide any ammunition to argue that it is a carcinogen," Kojola told BNA.

Kojola works on synthetic fiber issues for the fund, a joint labor-management project affiliated with the Laborers International Union of North America. He said union health officials are more concerned at this point with the health effects of refractory ceramic fibers, which have produced tumors in animal inhalation studies.

In describing the fiberglass study at the industrial hygiene conference, Hesterberg said rats were exposed to the two types of glass fibers over a two-year period at doses equivalent to exposure levels of 30 fibers per cubic centimeter of air, 150 f/cc, and 240 f/cc. No lung fibrosis or mesotheliomas were observed and there was no statistically significant increase in lung tumors when compared with a control group of rats exposed to filtered air, he said.

The only exposure-related finding in the study was the presence of cellular changes in the lungs that are thought to be reversible and which did not progress after six months of exposure, according to Hesterberg.

The Schuller toxicologist said researchers used state-of-the-art technology for the study, developing fine glass fibers that approximate the size of airborne fibers in the workplace. The same technology was used in an earlier study involving refractory ceramic fibers and asbestos, both of which induced an elevation in lung tumors, according to Hesterberg.

Industry Campaign

As part of their campaign to reassess fiberglass, industry officials have presented their findings to the Occupational Safety and Health Administration and the Environmental Protection Agency.

John Martonik, OSHA's deputy director of health standards programs, told BNA the agency is still reviewing the data and is not yet prepared to offer its interpretation of the study.

OSHA requires fiberglass products to carry cancer-warning labels, having determined in May 1991 that several epidemiologic studies involving exposed workers were positive for carcinogenicity (21 OSHR 230). Such warnings are required under the agency's hazard communication standard, even if OSHA does not specifically regulate a substance as a carcinogen.

OSHA also will propose an exposure limit for fiberglass as part of its air contaminants rulemaking for the construction, maritime, and agriculture industries, which is due to be published June 12. The agency is expected to propose a 1 f/cc exposure limit, according to sources.

OSHA's labeling decision actually had little practical effect on the industry, since manufacturers already had decided to label their products for cancer hazards to take advantage of safe harbor provisions in California's toxics law, Proposition 65.

Prop 65 bases its list of cancer-causing substances on IARC designations. By labeling their products, manufacturers are protected from liability for failure to warn users about potential hazards.

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Methylene Chloride

OSHA REOPENS RULEMAKING RECORD, SETS HEARINGS FOR SEPTEMBER, OCTOBER

The rulemaking record for the Occupational Safety and Health Administration's proposed rule controlling exposure to methylene chloride was reopened by OSHA in a June 9 *Federal Register* notice (57 FR 24438).

At the same time, the agency announced public hearings scheduled for Sept. 16 in Washington, D.C., and Oct. 14 in San Francisco.

OSHA said the proposed rule published in November 1991 raised a number of serious questions during the original five-month comment period that closed April 6. The agency said it would accept further comments on the proposal through Aug. 24.

OSHA's notice reopening the comment period and establishing the hearing dates is published in the Full Text section of this issue.

OSHA said it also expects to receive comments from the agency's Advisory Committee on Construction Safety and Health, which in May met for the first time since the proposal was published (21 OSHR 1694). The advisory committee formed a working group on methylene chloride, and OSHA said the panel expects to make formal recommendations at its next meeting in late July.

In the hearing notice, OSHA restated and elicited testimony on a number of questions that were raised in the proposal. Among the issues addressed are the use of pharmacokinetic data in estimating risk from methylene chloride exposure, interpretation of the epidemiologic data, engineering control technology and work practices in degreasing operations, and substitution of other products for methylene chloride.

OSHA is proposing to reduce the permissible exposure limit for methylene chloride from 500 parts methylene chloride per million parts air to 25 ppm and establish an action level of 12.5 ppm, a short-term limit of 125 ppm, and other protective measures. The agency estimates the standard will cover 186,000 workers.

The public hearings are scheduled to begin at 9:30 a.m. Sept. 16 in the auditorium, Frances Perkins Department of Labor Building, 200 Constitution Ave. N.W., Washington, D.C. 20210, and at 9:30 a.m. Oct. 14 in the Coit Room, Holiday Inn, Financial District, 750 Kearny St., San Francisco, Calif. 94108.

Persons who wish to appear at the hearings must send quadruplicate notices of intention to appear, postmarked by Aug. 24, to Tom Hall, OSHA Division of Consumer Affairs, Docket H-71, Room N-3647, U.S. Department of Labor, 200 Constitution Ave. N.W., Washington, D.C., 20210; (202) 523-8615. Notices may be transmitted by facsimile machine to (202) 523-5986, provided the original and three copies are sent to the above address. For further information on the hearings, contact Hall.

Testimony and documentary evidence must be submitted to OSHA's Division of Consumer Affairs and be postmarked by Aug. 24 for the Washington, D.C., hearing and by Sept. 22 for the San Francisco hearing.

Written comments on OSHA's proposed rule must be postmarked by Aug. 24 and sent in quadruplicate to the Docket Officer, Docket H-71, Room N-2625, at the above Department of Labor address; (202) 523-7894. Comments of 10 or fewer pages may be sent by facsimile machine to (202) 523-5046

For further information on the proposed rule, contact James Foster, Office of Public Affairs, Room N-3647, at the above Department of Labor address; (202) 523-8151.

Asbestos

OSHA REMOVES NON-ASBESTIFORM MINERALS FROM STANDARDS, TO REGULATE AS PARTICULATES

Non-asbestiform varieties of tremolite, anthophyllite, and actinolite are no longer regulated under the Occupational Safety and Health Administration's asbestos standards, but will be handled as particulates, OSHA said in a June 8 *Federal Register* announcement (57 FR 24310).

OSHA said it took that action because substantial evidence is lacking to conclude that the non-asbestiform minerals pose the same type or magnitude of health threat as asbestos.

OSHA's move is effective retroactively to May 29, the agency said. The agency will regulate the non-asbestiform minerals as particulates not otherwise regulated—part of its air contaminants standard in Table Z-1-A at 29 CFR 1910.1000 (Reference File, 31:8105).

OSHA's notice establishing the final rule for non-asbestiform minerals is published in the Full Text section of this issue.

The particulates standard carries a permissible exposure limit of 15 milligrams per cubic meter of air (total dust) and 5 mg/m³ (respirable dust). That is a less stringent exposure limit than the one contained in OSHA's asbestos standards, and the particulates standard does not require a number of other protective measures mandated by the comprehensive asbestos rules.

Responding to OSHA's decision, John Moran, safety and health director for the Laborers National Health & Safety Fund, told BNA June 9 that his organization was "shocked" at the agency's move. Asked if labor organizations would challenge the decision, Moran said the Laborers were considering their options.

Safety and health officers for the building and construction trades are scheduled to meet June 18, and the deregulation of non-asbestiform minerals likely will be a topic for discussion, he said.

The non-asbestiform minerals had been included in the 1986 revisions to OSHA's asbestos standards initially promulgated in 1972. But after a challenge by R.T. Vanderbilt Co., which mines and mills talc containing the minerals, OSHA stayed asbestos provisions concerning the non-asbestiform minerals.

While it reviewed the matter, OSHA regulated the minerals under the less stringent 1972 asbestos regulations. OSHA's action removes the stay of the 1986 asbestos standards and places the minerals under the category of particulates.

The Labor Department touted the action on non-asbestiform minerals as a major cost-savings to the economy in a recent report to President Bush on its regulatory moratorium and review of pending rulemakings (22 OSHR 5). The department estimates the move would save $73.6 million annually and affect approximately 600,000 workers in the construction, paint, tile, and pottery industries.

For further information, contact James F. Foster, Director of Information and Consumer Affairs, Occupational Safety and Health Administration, U.S. Department of Labor, Room N-3649, 200 Constitution Ave. N.W., Washington, D.C. 20210; (202) 523-8151.

Full Text

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS' REPORT ON 1992-1993 PROPOSED AND CURRENT CHANGES TO TLV AND BEI LIST

Annual Reports of the Committees on Threshold Limit Values and Biological Exposure Indices

Chemical Substances TLV Committee

Report to the ACGIH Membership for Approval at the Annual Membership Meeting; June 2, 1992; Boston, Massachusetts

Notice of Intended Changes for 1992–1993

These substances, with their corresponding values, comprise those for which either a limit has been proposed for the first time, for which a change in the "Adopted" listing has been proposed, or for which retention on the Notice of Intended Changes has been proposed. In all cases, the proposed limits should be considered trial limits that will remain in the listing for a period of at least one year. If after one year 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 proposed substances and their values.

Substance [CAS#]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
†Acetaldehyde [75-07-0]	C 25,A3	C 45,A3	—	—
†Acetophenone [98-86-2]	10	49	—	—
†Acetic anhydride [108-24-7]	5	21	—	—
†Adipic acid [124-04-9]	—	5	—	—
†Adiponitrile [111-69-3]–Skin	2	8.8	—	—
†Arsenic, elemental [7440-38-2], and inorganic compounds (except Arsine), as As	—	0.1, A1	—	—
†Arsenic trioxide production	Delete listing; included in listing for Arsenic, elemental and inorganic compounds (except Arsine)			
Asbestos, all forms [1332-21-4]	—	0.2 f/cc,[f] A1	—	—
†Benz[a]anthracene [56-55-3]	A2	A2	—	—
Benzene [71-43-2]–Skin	0.1,A1	0.3,A1	—	—
†Benzyl acetate [140-11-4]	10,A3	61,A3	—	—
†n-Butyl acetate [123-86-4]	20	95	—	—
†tert-Butyl alcohol [75-65-0]	100	303	—	—
†p-tert-Butyl toluene [98-51-1]	1	6.1	—	—
Cadmium [7440-43-9] and compounds, as Cd	—	0.01,A2, Total dust 0.002,A2, Respirable fraction[f]		
†Carbon tetrachloride [56-23-5]–Skin	5,A3	31,A3	10,A3	63,A3
†Cobalt, elemental [7440-48-4], and inorganic compounds, as Co	—	0.02,A3	—	—
†p-Dichlorobenzene [106-46-7]	10,A3	60,A3	—	—
†1,4-Dichloro-2-butene [764-41-0]–Skin	0.005,A2	0.025,A2	—	—
†Diethylamine [109-89-7]–Skin	5	15	15	45
1,1-Dimethylhydrazine [57-14-7]–Skin	0.01,A2	0.025,A2	—	—
†Diquat [231-36-7]–Skin	—	0.5, Total dust 0.1, Respirable fraction[f]		—
Epichlorohydrin [106-89-8]–Skin	0.1,A2	0.38,A2	—	—
†Ethylamine [75-04-7]	5	9.2	15	27.6
Heptachlor and heptachlor epoxide [76-44-8]–Skin	—	0.05,A2	—	—
Hexachlorobenzene [118-74-1]–Skin	—	0.025,A2	—	—
Hydrazine [302-01-2]–Skin	0.01,A2	0.013,A2	—	—
†Manganese, elemental [7439-96-5], and inorganic compounds, as Mn	—	0.2	—	—
†4,4'-Methylene bis(2-chloroaniline) [101-14-4]–Skin	0.01,A2	0.11,A2	—	—
Methyl hydrazine [60-34-4]–Skin	0.01,A2	0.019,A2	—	—
Nickel, elemental [7440-02-0], insoluble and soluble compounds, as Ni	—	0.05,A1	—	—
Nickel carbonyl [13463-39-3], as Ni	Delete listing; included in listing for Nickel, elemental, insoluble and soluble compounds			
Nickel sulfide roasting, fume & dust, as Ni	Delete listing; included in listing for Nickel, elemental, insoluble and soluble compounds			

Substance [CAS#]	TWA ppm[a]	TWA mg/m³[b]	STEL ppm[a]	STEL mg/m³[b]
Nitromethane [75-52-5]	20	50	—	—
†Oil mist, mineral				
Severely refined	—	5	—	—
Mildly refined, containing benzene soluble polycyclic aromatic hydrocarbons		0.2,A1	—	—
†Perchloroethylene [127-18-4]	25,A3	170,A3	100,A3	685,A3
†Rosin core solder decomposition products, as resin acids–colophony [8050-09-7]	Sensitizer		—	—
†Sodium perfluoroacetate [62-74-8]–Skin	—	0.05	—	—
†Terephthalic acid [100-21-0]	—	10	—	—
†Tetranitromethane [509-14-8]	0.005,A2	0.04,A2	—	—
†Trichloroethylene [79-01-6]	50,A5	269,A5	100,A5	537,A5
†Triethanolamine [102-71-6]	—	5	—	—
†Trimellitic anhydride [552-30-7]	—	C 0.04	—	—
†Vinyl acetate [108-05-4]	10,A3	35,A3	15,A3	53,A3

† 1992–1993 Revision or Addition to the Notice of Intended Changes.
(a) Parts of vapor or gas per million parts of air by volume at 25°C and 760 torr.
(b) Milligrams of substance per cubic meter of air.
(f) Fibers longer than 5 μm and with an aspect ratio equal to or greater than 3:1 as determined by the membrane filter method at 400–450X magnification (4-mm objective) phase contrast illumination.
(i) This TLV is for the respirable fraction of dust for the substance listed. The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the "c" paragraphs of Appendix D.
A Refers to Appendix A, Carcinogens, in the TLV/BEI Booklet.
C Denotes Ceiling Limit.

Notice of Intended Change — 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 the 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.

The Chemical Substances TLV Committee 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. The Committee is now re-examining 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:

a) Inhalable 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 in accordance with the following equations:[1,2]

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

$$SI(d) = 50\% \times (1 + e^{-0.06d}) \quad \text{for } 0 < d \leq 100\ \mu m$$

where: SI(d) = the collection efficiency for particles with aerodynamic diameter d in μm

b) Thoracic Particulate Mass consists of those particles that are captured according to the following collection efficiency:

$$ST(d) = SI(d)\,[1 - F(x)]$$

where: $x = \dfrac{\ln(d/\Gamma)}{\ln(\Sigma)}$

$\Gamma = 11.64\ \mu m$

$\Sigma = 1.5$

F(x) = the cumulative probability function of a standardized normal variable, x

c) Respirable Particulate Mass consists of those particles that are captured according to the following collection efficiency:

$$SR(d) = SI(d)\,[1 - F(x)]$$

where F(x) has the same meaning as above with $\Gamma = 4.25\ \mu m$ and $\Sigma = 1.5$

Collection efficiencies representative of several sizes of particles in each of the respective mass fractions are shown in Tables I, II, and III. References 2 and 3 provide documentation for the respective algorithms representative of the three mass fractions.

The most significant change in this proposal is the increase in the median cut point for a respirable dust sampler from 3.5 μm to 4.0 μm; this is in accord with the proposed International Standards Organization/European Standardization Committee (ISO/CEN) protocol[3] which has been recommended to the European Economic Community. For some particle size distributions, the revised criterion is expected to register a larger dust concentration.[4]

References

1. American Conference of Governmental Industrial Hygienists: Particle Size-Selective Sampling in the Workplace ACGIH,Cincinnati, OH (1985).

2. Soderholm, S.C.: Proposed International Conventions for Particl Size-Selective Sampling Ann. Occup. Hyg. 33:301–320(1989).

3. European Standardization Committee: Size Fraction Definitions for Measurement of Airborne Particles in the Workplace. CEN/TC137/WG3/N66 (E), draft version (1990).

4. Soderholm, S C.: Why Change ACGIH's Definition of Respirable Dust? Appl Occup. Env. Hyg. 6(4):248–250 (1991).

Table I. Inhalable

Particle Aerodynamic Diameter (µm)	Inhalable Particulate Mass (IPM) (%)
0	100
1	97
2	94
5	87
10	77
20	65
30	58
40	54.5
50	52.5
100	50

Table II. Thoracic

Particle Aerodynamic Diameter (µm)	Thoracic Particulate Mass (TPM) (%)
0	100
2	94
4	89
6	80.5
8	67
10	50
12	35
14	23
16	15
18	9.5
20	6
25	2

Table III. Respirable

Particle Aerodynamic Diameter (µm)	Respirable Particulate Mass (RPM) (%)
0	100
1	97
2	91
3	74
4	50
5	30
6	17
7	9
8	5
10	1

Transfers to the Adopted List for 1992–1993

Substance [CAS #]	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³
Benzo[b]fluoranthene [205-99-2]	—	A2	—	—
Caprolactam [105-60-2]				
Dust	—	1	—	3
Vapor	5	23	10	46
Carbon monoxide [630-08-0]	25	29	—	—
Catechol [120-80-9]–Skin	5	23	—	—
o-Dichlorobenzene [95-50-11]	25	150	50	301
1,1-Dichloroethane [75-34-3]	100	405	—	—
Dimethylamine [124-40-3]	5	9.2	15	27.6
Dinitrotoluene [25321-14-6]–Skin	—	0.15,A2	—	—
Ethyl bromide [74-96-4]–Skin	5,A2	22,A2	—	—
Formaldehyde [50-00-0]	C 0.3,A2	C 0.37,A2	—	—
Hexachloroethane [67-72-1]–Skin	1,A2	9.7,A2	—	—
1,6-Hexanediamine [124-09-4]	0.5	2.3	—	—
Kaolin [1332-58-7]	—	2, Respirable dust[1]	—	—
Methylamine [74-89-5]	5	6.4	15	19
Perfluoroisobutylene [382-21-8]	C 0.01	C 0.082	—	—
Silica fume (amorphous) [69012-64-2]	—	2, Respirable dust[1]	—	—
Silica fused (amorphous) [60676-86-0]	—	0.1,Respirable dust[1]	—	—
Strontium chromate [7789-06-2], as Cr	—	0.0005,A2	—	—
Tin, organic compounds as Sn–Skin	—	0.1	—	0.2
Toluene [108-88-3]–Skin	50	147	—	—
Trimethylamine [75-50-3]	5	12	15	36
4-Vinyl cyclohexene [100-40-3]	0.1,A2	0.4,A2	—	—

Transfer to Adopted: Appendix A — Carcinogens

The Chemical Substances Threshold Limit Values (TLV) Committee has been aware of the increasing public concern over chemicals or industrial processes that cause or contribute to increased risk of cancer in workers. More sophisticated methods of bioassay, as well as the use of sophisticated mathematical models that extrapolate the levels of risk among workers, have led to differing interpretations as to which chemicals or processes should be categorized as human carcinogens and what the maximum exposure levels should be. The goal of the Committee has been to synthesize the available information in a manner that will be useful to practicing industrial hygienists, without overburdening them with needless details.

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 immediate 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, five categories of carcinogens are designated in this booklet:

A1—*Confirmed Human Carcinogen*: The agent is carcinogenic to humans based on the weight of evidence from epidemiologic studies of, or convincing clinical evidence in, exposed humans.

A2—*Suspected Human Carcinogen*: The agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are considered relevant to worker exposure. Available epidemiologic studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans.

A3—*Animal Carcinogen*: The agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

A4 — *Not Classifiable as a Carcinogen*: There are inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals.

A5 — *Not Suspected as a Human Carcinogen*: The agent is not suspected to be a human carcinogen on the basis of properly conducted epidemiologic studies in humans. These studies have sufficiently long follow-up, reliable exposure histories, sufficiently high dose, and adequate statistical power to conclude that exposure to the agent does not convey a significant risk of cancer to humans. Evidence suggesting a lack of carcinogenicity in experimental animals will be considered if it is supported by other relevant data.

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 and A3 carcinogens, worker exposure by all routes should be carefully controlled to levels as low as reasonably achievable (ALARA) below the TLV. Refer to the Documentation of the Threshold Limit Values, Appendix A, "Identification and Classification of Carcinogens," for a more complete description and derivation of these designations.

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

- Acetone
- Acetomethylchloride
- Aluminum alkyls
- Antimony
- Attapulgite/Palygorskite/Sepiolite
- Bentonite
- Borax and boron compounds
- Bromine
- Bromochloromethane
- Bromodichloromethane
- Bromoform
- 1,2,3,4-Butanetetracarboxylic acid
- n-Butyl alcohol
- sec-Butyl alcohol
- n-Butyl glycidyl ether (BGE)
- 2-t-Butylazo-2-hydroxy-5-methylhexane
- Carbon disulfide
- Chlorodiphenyls (42% & 54% chlorine)
- Chromium
- Copper fume
- Cristobalite
- Cyanamide
- Cyclohexylamine
- Diatomaceous earth
- Dichlorocyclopentadiene
- Dichlorodiphenyl sulfone
- 1,2-Dichloroethane
- 2,4-D (2,4-Dichlorophenoxy acetic acid)
- 1,3-Dichloropropene
- Dichlorvos
- Dimethyl acetamide
- Dimethylformamide
- Dimethyl disulfide
- Divinyl benzene
- Emery
- EPN
- 2-Ethoxyethanol (EGEE)
- 2-Ethoxyethyl acetate (EGEEA)
- Ethyl chloride
- 2-Ethyl hexanoic acid
- Fibrous glass dust (Man-made mineral fibers)
- Gallium arsenide
- Gasoline (unleaded)
- Glutaraldehyde
- Glycidol
- Glycol ethers
- Graphite fibers
- Hexachlorocyclopentadiene
- Hydrogen bromide
- Isopropyl glycidyl ether
- Jet, petroleum, and diesel fuels
- Lead, inorganic
- Lead, organic compounds
- Malathion
- Man-made mineral fibers
- Mercury
- 2-Methoxyethanol (EGME)
- 2-Methoxyethyl acetate (EGME)
- Methyl acrylate
- Methyl alcohol
- Methyl bromide
- Methyl n-butyl ketone
- Methyl propyl ketone
- α-Methyl styrene
- Methylene chloride
- Methylene diamine
- 4,4'-Methylene dianiline
- Methyl tert-butyl ether
- Mineral spirits
- Naled
- Particulates Not Otherwise Classified (PNOC)
- Pentachlorophenol
- Pentane
- 2,4-Pentanedione
- Perlite
- Persulfates
- Petroleum solvents
- Phenyl glycidyl ether
- Phosphates (including mining)
- Potash
- Propylene dichloride
- Styrene
- Sulfometuron-methyl
- Tantalum
- 1,1,2,2-Tetrachloroethane
- Tetrahydrofuran
- Tetrakis (hydroxymethyl) phosphonium chloride
- Tetrakis (hydroxymethyl) phosphonium sulfate
- Tetrasodium pyrophosphate (Phosphates)
- Tobacco smoke
- Tridymite
- Triethylamine
- Tripropylene glycol
- Trona
- Uranium
- Vanadium

Other Issues

1. Excursion Limit and Short-Term Exposure Limit (STEL).
2. Reproductive effects.

Committee activities for 1991–1992 included:

1. Two stated plenary committee meetings: September 23–24, 1991, Cincinnati, OH; March 23–24, 1992, Orlando, FL.
2. Committee/Subcommittee meetings with interested parties for presentation of new/substantive data for: Asbestos, Benzene, Cadmium and compounds, Epichlorohydrin, Formaldehyde, Mercury, 4,4'-Methylene bis(2-chloroaniline), Nickel and compounds, Triethanolamine, Trimellitic anhydride, 4-Vinylcyclohexene, Vinyl acetate.
3. New committee members: Günter Oberdörster, Ph.D., Department of Biophysics, Environmental Health Sciences Center, University of Rochester; Roger P. Smith, Ph.D., Department of Pharmacology and Toxicology, Dartmouth Medical School.
4. Presentations by members of the Committee and ACGIH

Staff on the history of TLV development; ACGIH policy for the role of TLVs; TLV documentation development process; and technical, scientific, and socioeconomic issues confronting the Committee. Presentations made: Professional Development Courses at the American Industrial Hygiene Conference & Exposition and the Professional Conference on Industrial Hygiene; University of Cincinnati Medical Center, Institute of Environmental Health.

Biological Exposure Indices

Report to the ACGIH Membership for Approval at the Annual Membership Meeting; June 2, 1992; Boston, Massachusetts

Biological Exposure Indices (BEIs) are reference values intended as guidelines for the evaluation of potential health hazards in the practice of industrial hygiene. BEIs represent the levels of determinants that are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. TLVs serve as a reference value. The determinant can be the chemical itself or its metabolite(s), or a characteristic reversible biochemical change induced by the chemical. The measurement can be made in exhaled air, urine, blood, or other biological specimens collected from the exposed worker. Based on the determinant, the specimen chosen, and the time of sampling, the measurement indicates either the intensity of a recent exposure, an average daily exposure, or a chronic cumulative exposure. BEIs do not indicate a sharp distinction between hazardous and nonhazardous exposures.

Notice of Intent to Establish BEIs for 1992–1993

Airborne Chemical [CAS #]

Determinant	Sampling Time	BEI	Notation
†Acetone [67-43-1]			
Acetone in urine	End of shift	100 mg/L	B,Ns
Arsenic and soluble compounds including arsine [7784-42-1]			
Inorganic arsenic metabolites in urine	End of workweek	50 µg/g creatinine	B
Cadmium			
Cadmium in urine	Not critical	5 µg/g creatinine	B
Cadmium in blood	Not critical	5 µg/L	B
Carbon monoxide [630-08-0]			
Carboxyhemoglobin in blood	End of shift	3.5% of hemoglobin	B,Ns
Carbon monoxide in end-exhaled air	End of shift	20 ppm	B,Ns
†2-Ethoxyethanol (EGEE) [110-80-5] and †2-Ethoxyethyl acetate (EGEEA) [111-15-9]			
2-Ethoxy acetic acid in urine	End of shift at end of workweek	100 mg/g creatinine	
Mercury			
Total inorganic mercury in urine	Preshift	35 µg/g creatinine	B
Total inorganic mercury in blood	End of shift at end of workweek	15 µg/L	B
Methyl isobutyl ketone [108-10-1] (MIBK)			
MIBK in urine	End of shift	2 mg/L	
Toluene [108-88-3]			
o-Cresol in urine	End of shift	1 mg/g creatinine	Ns
Trichloroethylene [79-01-6]			
Trichloroethylene in blood			Sq

†1992–1993 revision or addition.

Definition of Notations

B Notation — The determinant is usually present in a significant amount in biological specimens collected from subjects who have not been occupationally exposed. Such background levels are included in the BEI value.

Ns Notation — The determinant is nonspecific since it is observed after exposure to some other chemicals. These nonspecific tests are preferred because they are easy to use and usually offer a better correlation with exposure than specific tests. In such instances, a BEI for a specific, less quantitative biological determinant is recommended as a confirmatory test.

Sq Notation — The determinant is an indicator of exposure to the chemical, but the quantitative interpretation of the measurement is ambiguous (semiquantitative). These determinants should be used as a screening test if a quantitative test is not practical or as a confirmatory test if the quantitative test is not specific and the origin of the determinant is in question.

Transfers to the Adopted List for 1992–1993

Airborne Chemical [CAS #]

Determinant	Sampling Time	BEI	Notation
Chlorobenzene [108-90-7]			
Total 4-chlorocatechol in urine	End of shift	150 mg/g creatinine	Ns
Total p-chlorophenol in urine	End of shift	25 mg/g creatinine	Ns

Chemical Substances and Other Issues Under Study to Establish Biological Exposure Indices

Chemical Substances

Antimony
Benzene
2-Butoxyethanol
Cobalt
Dichlorobenzene
N,N-Dimethylacetamide (DMAC)
Formaldehyde
Lead
2-Methoxyethanol
2-Methoxyethyl acetate
4,4'-Methylene bis (2-chloroaniline) [MOCA]
Methylene chloride
Nickel
Perchloroethylene
Polychlorinated biphenyls
Synthetic pyrethrins
Toluene, under study due to proposed adoption of revised TLV (50 ppm; STEL deleted).
Vanadium

Other Issues

1. Quality control.
2. Effect of medication and illness on biological levels.
3. Control of biological measurements of exposures to mixtures by BEIs.
4. Biological monitoring strategy.

5. Development of BEI documentations tabled due to insufficient databases on:

Acrylonitrile	Malathion
Alkylating agents	Manganese
Beryllium	PCB
Ethanol*	Propylene glycol dinitrate
2,4-D Herbicide	Selenium
Hydrazine	

*A BEI not recommended because of interference from consumption of alcoholic beverages.

Committee activities for 1991–1992 included:

1. Two stated plenary committee meetings: November 10–12, 1991, Key Biscayne, FL; March 19–21, 1992, Orlando, FL.
2. Procedures for the BEI Committee regarding revision of chemical substance TLVs: Notification of a proposed change in a chemical substance TLV for which a BEI exists, or is under study to establish a BEI, will initiate a BEI Committee review of the proposed TLV and the placement of the existing BEI on the list of "Chemical Substances Under Study to Establish Biological Exposure Indices." If the revised TLV for which there is a BEI is transferred to the adopted list of TLVs, the existing BEI will carry a notation indicating that the BEI is under review because of a change in the TLV and the BEI will remain so listed until the Committee completes its review and an action is recommended.
3. Committee membership: Gerald L. Kennedy, Jr., Haskell Laboratory, E.I. du Pont de Nemours & Co., Inc., retired as a consultant to the Committee; Joseph J. Saady, Ph.D., Medical College of Virginia Hospitals, Virginia Commonwealth University, was appointed to the Committee; John Rosenberg, M.D., California Department of Health Services, was appointed Vice Chair of the Committee.
4. Revision and updating of BEI documentations for the 6th edition of the Documentation volume were completed and published.
5. Policy on establishing BEIs for monitoring of industrial chemicals in exhaled air was reviewed and new procedures were published in *Applied Occupational and Environmental Hygiene* 6(9):802–804, September 1991.
6. A description of pharmacokinetic models used in setting BEIs was incorporated in the "Introduction" to the BEI Documentations, 6th edition, and will be published in *Applied Occupational and Environmental Hygiene.*

Physical Agents TLV Committee

Report to the ACGIH Membership for Approval at the Annual Membership Meeting; June 2, 1992; Boston, Massachusetts

Notice of Intended Changes for 1992–1993

These physical agents, 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 one year. If after one year no evidence comes to light that questions the appropriateness of the values herein, the values will be reconsidered for the "Adopted" list. This notice provides not only an opportunity for comment but also solicits suggestions of physical agents to be added to the list. The suggestions should be accompanied by substantiating evidence. † = 1992–1993 Revision or Addition.

Introduction To The Physical Agents

The following statement is to be added to the "Introduction" following "Physical and Chemical Factors":

> †*Mutagenicity, Carcinogenicity, and Adverse Reproductive Effects.* The Physical Agents TLV Committee is examining the data related to mutagenicity, cancer, and adverse reproductive effects of physical agents. For example, it has been clearly demonstrated that ionizing radiation is a cause of cancer in humans. Likewise, ultraviolet (UV) radiation shows mutagenic and carcinogenic effects in the skin. Heat stress, infrared energy, RF hyperthermia, and whole-body vibration have been associated with adverse reproductive effects.
>
> More speculative is the scientific literature suggesting a connection between exposure to radiofrequency (RF), sub-RF energy, and/or magnetic fields with cancer. Neither an etiologic role nor a risk analysis is established for these agents.
>
> The Physical Agents TLV Committee will continue to examine the bioeffects literature relating to cancer and adverse reproductive effects.

Cold Stress

Note 1 for Table 3. The first sentence is revised to read:

† "1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of 10 minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light . . . (Step 5)."

Ionizing Radiation

The following statement is proposed as the replacement for the 1991–1992 TLV Booklet recommendation for Ionizing Radiation:

† *Ionizing Radiation Statement*

The Physical Agents TLV Committee accepts the occupational exposure guidance of the National Council on Radiation Protection and Measurements (NCRP) for ionizing radiation. For the purposes of this TLV, ionizing radiation includes particulate and electromagnetic radiations having an energy exceeding 12.4 electron volts (eV) [1 eV = 1.6×10^{-19} joule(J)]. Animal and human studies have shown that exposure to ionizing radiation can result in carcinogenic, teratogenic, or mutagenic effects, as well as other sequelae. The scientific literature is summarized in critical reviews by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), and the Biological Effects of Ionizing Radiation (BEIR) Committee of the U.S. National Academy of Science. The NCRP has formulated occupational exposure guidance that limits the risk of carcinogenesis and mutagenesis; further guidance is available regarding exposure of the pregnant woman to limit the *in utero* dose to the fetus. The TLV Committee also strongly recommends that all occupational exposure be minimized.

The NCRP and the International Commission on Radiological Protection (ICRP) disseminate information and recommendations about radiation protection and related issues, including the development of basic concepts. Their occupational exposure guidance is provided in NCRP Report No. 91 (Recommendations on Limits for Exposure to Ionizing Radiation) and ICRP Report No. 60 ("The 1990 Recommendations of the ICRP"). Other ICRP and NCRP reports address specific areas of radiation protection and, collectively, provide an excellent basis for establishing a radiation control program.

Lasers

A number of changes in the TLVs for lasers are recommended for 1992, including a slight modification of the NIC from 1991. These changes introduce one new correction factor, C_C, which permits higher values for the TLVs at wavelengths between 1150 nm and 1400 nm. In addition, the TLVs at infrared wavelengths for pulsed lasers have been increased between 1400 nm and 2600 nm. The limiting apertures required for measuring laser radiation have also been revised, and a new statement on dealing with multiple-point laser sources has also been provided.

The initial paragraph on page 100 of the 1991–1992 TLV/BEI Booklet remains. Revisions are proposed for the remaining text on page 100, for Table 1 on page 100, and for the first 10 lines on page 101 (up to "Repetitively Pulsed Exposures"). Figure 1 on page 101 remains.

† *Limiting Apertures*

The TLVs expressed as radiant exposure or irradiance in this section may be averaged over an aperture of 1 mm, 3.5 mm, or 7 mm, depending upon the exposure condition as given in Table 1.

† *Extended Sources*

The TLVs for "extended sources" are obtained through the use of a correction factor C_E provided at the bottom of Table 2 and are only applied at wavelengths in the retinal hazard region (400–1400 nm) for sources that subtend a linear angle greater than α_{min} and less than α_{max} = 100 mrad. The angle α_{min} is defined as:

α_{min} = 1.5 mrad for t < 0.7 s,

$\alpha_{min} = 2 \cdot t^{3/4}$ mrad for 0.7 s < t < 10 s, and

α_{min} = 11 mrad for t > 10 s.

Normally, a laser source is not an "extended source," and the TLVs in Table 2 can be applied directly without C_E. Any sources whose centers are separated by an angle greater than α_{min} are treated as extended sources; examples would be some large laser diode arrays.

† *Correction Factors A, B, C (C_A, C_B, C_C)*

The TLVs for ocular exposure in Table 2 are to be used as given for all wavelength ranges. The TLVs for wavelengths between 700 nm and 1400 nm are to be increased by the factor C_A (to account for reduced absorption of melanin) as given in Figure 1. For certain exposure times at wavelengths between 550 nm and 700 nm, a correction factor C_B (to account for reduced photochemical sensitivity for retinal injury) must be applied. The correction factor C_C is applied from 1150 to 1400 nm to account for pre-retinal absorption of the ocular media.

The TLVs for skin exposure are given in Table 3. The TLVs are to be increased by a factor C_A as shown in Figure 1 for wavelengths between 700 nm and 1400 nm. To aid in the determination for exposure durations requiring calculations of fractional powers, Figures 2 and 3 may be used.

[Delete the current Table 1 (page 100) as this will no longer be needed and replace with a new Table 1 as given below.]

†TABLE 1. Limiting Apertures Applicable to Laser TLVs (mm)

Spectral Region	Duration	Eye	Skin
180 nm – 400 nm	1 ns to 0.25 s	1 mm	3.5 mm
180 nm – 400 nm	0.25 s to 30 ks	3.5 mm	3.5 mm
400 nm – 1400 nm	1 ns to 0.25 s	7 mm	3.5 mm
400 nm – 1400 nm	0.25 s to 30 ks	7 mm	3.5 mm
1400 nm – 0.1 mm	1 ns to 0.25 s	1 mm	3.5 mm
1400 nm – 0.1 mm	0.25 s to 30 ks	3.5 mm	3.5 mm
0.1 mm – 1.0 mm	1 ns to 30 ks	11 mm	11 mm

†Insert the following correction factor C_C in Table 2 in the entries for IR-A as follows:

IR–A	1050 nm to 1400 nm	10^{-9} to 5×10^{-5}	$5\ C_C \times 10^{-4}$ J/cm^2
	1050 nm to 1400 nm	5×10^{-5} to 10^3	$9\ C_C\ (t^{3/4})$ J/cm^2
	700 nm to 1400 nm	10^3 to 3×10^4	$320\ C_A \cdot C_C$ μW/cm^2
IR–B&C	1.401 μm to 1.5 μm	10^{-9} to 10^{-3}	0.1 J/cm^2
	1.401 μm to 1.5 μm	10^{-3} to 10	$0.56t^{1/4}$ J/cm^2
	1.501 μm to 1.8 μm	10^{-9} to 10	1.0 J/cm^2
	1.801 μm to 2.6 μm	10^{-9} to 10^{-3}	0.1 J/cm^2
	1.801 μm to 2.6 μm	10^{-3} to 10	$0.56t^{1/4}$ J/cm^2
	2.601 μm to 10^3 μm	10^{-9} to 10^{-7}	10 mJ/cm^2 J/cm^2
	2.601 μm to 10^3 μm	10^{-7} to 10	$0.56t^{1/4}$ J/cm^2
	1.400 μm to 10^3 μm	10 to 3×10^4	100 mW/cm^2

Table 2

†To the current footnote for Table 2, which refers to correction factors C_A etc., add the following:

C_C = 1.0 from 700 nm to 1150 nm;

$C_C = 10^{0.0181(\lambda - 1150\ nm)}$ for wavelengths greater than 1150 and less than 1200 nm;

C_C = 8.0 from 1200 to 1400 nm.

NOTE: For extended-source laser radiation (e.g., diffuse reflection viewing) at wavelengths between 400 nm and 1400 nm, the intrabeam viewing TLVs can be increased by the following correction factor C_E provided that the angular subtense of the source (measured at the viewer's eye) is greater than α_{min} (e.g., greater than 1.5 mrad for t < 0.7 s; $\alpha_{min} = 2 \cdot t^{3/4}$ mrad for 0.7 s < t < 10 s, and α_{min} = 11 mrad for t > 10 s).

The value of C_E is equal to 1.0 for all angles α less than α_{min} and is never less than 1.0.

$C_E = (\alpha/\alpha_{min})$ for $\alpha_{min} < \alpha < \alpha_{max}$ = 100 mrad

$C_E = \alpha^2/(\alpha_{min} \cdot \alpha_{max})$ for $\alpha > \alpha_{max}$ = 100 mrad.

for α expressed in mrad.

The angle of 100 mrad may also be referred to as α_{max} at which point the TLVs may be expressed as a constant radiance and the last equation can be rewritten in terms of radiance L.

L_{TLV} = 8.5 x 10^3 x ($TLV_{pt\ source}$) J(cm^2 • sr) for t < 0.7 s

$L_{TLV} = (6.4 \times 10^3\ t^{3/4}) \times (TLV_{pt\ source})$ J(cm^2 • sr) for 0.7 s < t < 10 s

$L_{TLV} = (1.2 \times 10^3) \times (TLV_{pt\ source})$ J(cm^2 • sr) (or expressed in W(cm^2 • sr) as applicable) for t > 10 s

The measurement aperture should be placed at a distance of 100 mm or greater from the source.

Transfers to the Adopted List for 1992–1993

Hand–Arm (Segmental) Vibration Syndrome (HAVS)

Paragraph 1 on page 86 of the 1991–1992 TLV/BEI Booklet has been adopted:

The TLVs in Table 1 refer to component acceleration levels and durations of exposure that represent conditions under which it is believed that nearly all workers may be exposed repeatedly without progressing beyond Stage 1 of the Stockholm Workshop Classification System for Vibration-induced White Finger (VWF), also known as Raynaud's Phenomenon of Occupational Origin (Table 2). Since there is a paucity of dose–response relationships for VWF, these recommendations have been derived from epidemiological data from forestry, mining, and metal working. These values should be used as guides in the control of hand–arm vibration exposure; because of individual susceptibility, they should not be regarded as defining a boundary between safe and dangerous levels.

Heat Stress

Paragraph 2 on page 91 of the 1991–1992 TLV/BEI Booklet has been adopted.

Where there is a requirement for protection against other harmful substances in the work environment and additional personal protective clothing and equipment must be worn, a correction to the WBGT TLV values, as presented in Table 4, must be applied.

Table 4 on page 98 has been adopted.

TABLE IV. TLV WBGT Correction Factors In °C for Clothing

Clothing Type	Clo Value*	WBGT Correction
Summer work uniform	0.6	0
Cotton coveralls	1.0	–2
Winter work uniform	1.4	–4
Water barrier, permeable	1.2	–6

*Clo: Insulation value of clothing. One clo unit = 5.55 kcal/m^2/hr of heat exchange by radiation and convection for each °C of temperature difference between the skin and adjusted dry bulb temperature.

Note: Deleted from Table 4 are trade names and "fully encapsulating suit, gloves, boots, & hood," including its Clo value of 1.2 and WBGT correction of –10.

Lasers

The footnotes to Table 2 on pages 103–104 of the 1991–1992 TLV/BEI Booklet were adopted:

C_A - See Fig. 1: C_B = 1 for λ = 400 to 549 nm;
$C_B = 10^{[(0.015(\lambda - 550)]}$ for λ = 550 to 700 nm; T_1 = 10 s for λ = 400 to 549 nm; $T_1 = 10 \times 10^{[0.02(\lambda - 550)]}$ for λ = 550 to 700 nm.
Change Under Study: 1.536–1.544 µm, 1.0 ns to 1.0 µs, 1.0 J/cm^2.

Note: For extended-source laser radiation (e.g., diffuse reflection viewing) at wavelengths between 400 and 1400 nm, the intrabeam viewing TLVs can be increased by the following correction factor (C.F.) provided that the angular subtense of the source (measured at the viewer's eye) is greater than α_{MIN} (e.g., greater than 3.5 mrad for t < 3.2 s, or greater than 11 mrad for t > 10 s) and less than 0.1 radian, i.e., less than 100 mrad. Calculated correction factors should therefore never be less than 1.0.

C.F. = (α/3.5 mrad) for all exposure times less than 3.2 s
C.F. = (α/1.1 t mrad) for exposure duration for 3.2 s $\leq$ t $\leq$ 10 s
C.E. = (α/11 mrad) for exposure duration > 10 s.

However, for t > 10 s and less than 10^4 s, the radiance must not exceed 2.1 x C_B x 10^2 J/cm^2/sr to protect the retina against photochemical injury for 400 to 700 nm. For wavelengths > 700 nm, only the third correction factor is applied.

The extended source limits can also be expressed as values of integrated radiance Lp for exposure durations less than 3.2 s:

TLV Lp = 1.04 x 10^2/sr/C.F. ($EL_{pt\ source}$) for 3.5 mrad $\leq \alpha \leq$ 100 mrad

TLV or EL Lp = 3.7 x 10^3 ($EL_{pt\ source}$) J/(cm^2 • sr) for α > 100 mrad

No correction factor can be applied at UV wavelengths less than 400 nm or infrared wavelengths greater than 1400 nm.

Physical Agents Under Study

The Physical Agents TLV Committee has examined the current literature on the following agents and has not found sufficient data upon which to propose a TLV. However, these agents will remain under study during the coming year to examine new evidence indicating the need and feasibility for establishing a proposed TLV. Comments and suggestions, accompanied by substantive documentation, are solicited and should be forwarded to the Executive Director, ACGIH.

1. Laser radiation with pulse durations less than 1 ns.
2. Vibration. Whole-body.
3. Pressure Variations.
4. Electromagnetic Pulses and Radiofrequency Radiation (RFR). Peak power limits.
5. Physical Agents as Carcinogens — Known and Suspect.

Committee activities for 1991–1992 included:

1. Two stated Committee meetings: October 27–28, 1991, Richland, WA; March 29–31, 1992, Aberdeen, MD.
2. Revision and updating of Physical Agents documentations for the 6th edition of the Documentation volume were completed and published.
3. Committee participation and ACGIH cosponsorship of the Thirtieth Hanford Symposium, Richland, WA, on "Current Topics in Occupational Health."
4. Joint meeting of the Physical Agents Committee with the U.S. Army Environmental Hygiene Agency, Bioacoustics Division, Aberdeen Proving Grounds, MD, and international experts on noise-induced hearing loss.

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