

Occupational Safety and Health Administration

Permissible Exposure Limits – Annotated Tables

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Table Z-1

OSHA recognizes that many of its permissible exposure limits (PELs) are **Table Z-2** and inadequate for ensuring protection of worker health. Most of OSHA's PELs were issued shortly after adoption of the Occupational Safety and Health (OSH) Act in 1970, and have not been updated since that time. Section 6(a) of the OSH Act granted the Agency the authority to adopt existing Federal standards or national consensus standards as enforceable OSHA standards. Most of the PELs contained in the Z-Tables of 29 CFR 1910.1000 were adopted from the Walsh-Healy Public Contracts Act as existing Federal standards for general industry. These in turn had been adopted from the 1968 Threshold Limit Values (TLVs®) of the American Conference of Governmental Industrial Hygienists (ACGIH®). Some consensus standards from the American Standards Association were also adopted at that time, following the 6(a) procedures. Comparable PELs were adopted for shipyards (29 CFR 1915.1000) and construction (29 CFR 1926.55).

Since 1970, OSHA promulgated complete 6(b) standards including new PELs for 16 agents, and standards without PELs for 13 carcinogens.

Industrial experience, new developments in technology, and scientific data clearly indicate that in many instances these adopted limits are not sufficiently protective of worker health. This has been demonstrated by the reduction in allowable exposure limits recommended by many technical, professional, industrial, and government organizations, both inside and outside the United States. Many large industrial organizations have felt obligated to supplement the existing OSHA PELs with their own internal corporate guidelines. OSHA's Hazard Communication standard (1910.1200 Appendix D) requires that safety data sheets list not only the relevant OSHA PEL but also the ACGIH® TLV® and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet.

To provide employers, workers, and other interested parties with a list of alternate occupational exposure limits that may serve to better protect workers, OSHA has annotated the existing Z-Tables with other selected occupational exposure limits. OSHA has chosen to present a side-by-side table with the Cal/OSHA PELs, the NIOSH Recommended Exposure Limits (RELs) and the ACGIH® TLVs®s. The tables list air concentration limits, but do not include notations for skin absorption or sensitization.

OSHA's mandatory PELs in the Z-Tables remain in effect. However, OSHA recommends that employers consider using the alternative occupational exposure limits because the Agency believes that exposures above some of these alternative occupational exposure limits may be hazardous to workers, even when the exposure levels are in compliance with the relevant PELs.

- **California Division of Occupational Safety and Health (Cal/OSHA) Permissible Exposure Limits (PELs).**

Cal/OSHA has established an extensive list of PELs ([Cal/OSHA AC-1 Table](#)) that are enforced in workplaces under its jurisdiction. Cal/OSHA PELs are promulgated under statutory requirements for risk and feasibility that are no less protective than the OSH Act. Though not enforceable in establishments outside of Cal/OSHA's jurisdiction, the PELs can provide information on acceptable levels of chemicals in the workplace. Of all the states that have [OSHA-approved State Plans](#), California has the most extensive list of OELs.

- **National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs).**

NIOSH RELs are authoritative Federal agency recommendations established according to the legislative mandate for NIOSH to recommend standards to OSHA. RELs are intended to limit exposure to hazardous substances in workplace air to protect worker health. In developing RELs and other recommendations to protect worker health, NIOSH evaluates all available medical, biological, engineering, chemical, and trade information relevant to the hazard. NIOSH transmits its recommendations to OSHA for use in developing legally enforceable standards. NIOSH also publishes its recommendations in publicly available sources such as the [NIOSH Pocket Guide to Chemical Hazards](#), Criteria Documents, Current Intelligence Bulletins, Alerts, Special Hazard Reviews, Occupational Hazard Assessments, and Technical Guidelines.

- **ACGIH® Threshold Limit Values (TLVs®) and Biological Exposure Indices (BEIs®).**

ACGIH® is a private, not-for-profit, nongovernmental corporation. It is not a standards setting body. ACGIH® is a scientific association that develops recommendations or guidelines to assist in the control of occupational health hazards. TLVs® and BEIs® are health-based values and are not intended to be used as legal standards.

Threshold Limit Values (TLVs[®]) refer to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse effects.

Biological Exposure Indices (BEIs[®]) are guidance values for assessing biological monitoring results – concentrations of chemicals in biological media (e.g., blood, urine). BEIs[®] represent the levels of determinants that are most likely to be observed in specimens collected from healthy workers who have been exposed to chemicals in the same extent as workers with inhalation exposure at the TLV[®].

Since ACGIH[®] TLVs[®] and BEIs[®] are based solely on health factors, there is no consideration given to economic or technical feasibility. ACGIH[®] does not believe that TLVs[®] and BEIs[®] should be adopted as standards without an analysis of other factors necessary to make appropriate risk management decisions (e.g., control options, technical and economic factors, etc.).

For more information on TLVs[®], please go to <https://www.acgih.org/TLV/>. The TLVs[®] and BEIs[®] are copyrighted by ACGIH[®] and are not publicly available. However, they can be purchased in their entirety on the ACGIH[®] website at <https://www.acgih.org/store/>. Permission must be requested from ACGIH[®] to reproduce the TLVs[®] and BEIs[®]. Click [here](#) for permission request form.

The ACGIH[®] TLVs[®] are widely recognized as authoritative, and are required to be included on safety data sheets by the OSHA Hazard Communication Standard.

Annotated PELs Tables

OSHA's annotated PELs tables include a side-by-side comparison of OSHA PELs, Cal/OSHA PELs, NIOSH RELs and ACGIH[®] TLVs[®]. The TLVs[®] in the annotated tables are reprinted with permission from ACGIH[®]. See Important Note on ACGIH[®] TLVs[®], which is also reprinted with permission from ACGIH[®]. **Cal/OSHA, NIOSH, and ACGIH have OELs in addition to those listed in the annotated tables. The annotated tables contain links to the complete OEL lists from Cal/OSHA and NIOSH. TLVs[®] and BEI[®]s are not publicly available, but can be purchased on [ACGIH[®]'s website](#). For the most current OELs and information on notations such as skin absorption, users should consult complete listings and explanations from Cal/OSHA, NIOSH, and ACGIH.**

Each of the alternative lists of exposure limits is accompanied by extensive explanatory language on their source websites. These include averaging periods, size selective measures and similar information. In particular, ACGIH[®] provides an explanation of the use of TLVs[®] and access to *documentation*. For more information and *documentation*, consult with these organizations.



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