Recommendations for Consideration by the U.S. Secretary of Labor on the Adoption and Use of Occupational Exposure Limits by Federal Agencies

Prepared by the
Federal Advisory Council on Occupational Safety and Health
(FACOSH)

Executive Summary

Because the Occupational Safety and Health Administration's (OSHA's) Permissible Exposure Limits (PELs) have remained unchanged since their adoption on May 29, 1971, and do not account for 40 years of advances in technology or the latest peer-reviewed published toxicological information, the Federal Advisory Council on Occupational Safety and Health (FACOSH) asked its Emerging Issues Subcommittee to analyze Federal agencies' use of PELs. The Subcommittee examined how Federal Executive Branch agencies use occupational exposure limits (OELs) published by other agencies, professional organizations, and other foreign or domestic entities.

The Subcommittee considered all aspects of controlling a potential hazardous chemical in the workplace including risk assessment approaches and the hierarchy of controls. The Subcommittee concluded that FACOSH should recommend that Executive Branch departments and agencies use the most protective and feasible OELs in Federal workplaces, notwithstanding the existence of a PEL for a given substance of concern; require contractors, subcontractors, recipients, and subrecipients to use the most protective and feasible OEL while working on behalf of the Federal government; and designate a person deemed to be competent by virtue of training and experience to make recommendations regarding acceptable chemical exposure risks, appropriate OELs, and employee exposure controls.

Introduction

Although the current PELs have existed unchanged since their adoption on May 29, 1971, scientific research is continually re-evaluating occupational exposure limits and their effectiveness in protecting workers. The Federal Advisory Council on Occupational Safety and Health (FACOSH) asked its Emerging Issues Subcommittee to evaluate the existing OSHA PELs, based on American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values (TLVs®) developed in 1968, and determine which, if any, should have their levels adjusted to be more protective of Federal workers. In addition, the Council asked the Subcommittee to propose mechanisms for implementing these PEL recommendations in federal agencies.

The Subcommittee examined the current situation with respect to how Federal Executive Branch agencies use OELs for risk management and control. Given that OSHA sets minimum standards for workplace safety and health and that the Federal government strives to exceed the minimum as a model employer, the Subcommittee determined that current PELs are not always adequate to protect Federal employees, or employees of contractors providing services to the Federal government.

In this paper, an OEL refers generically to one or more accepted exposure limits including the OSHA-regulated PELs, NIOSH Recommended Exposure Limits (RELs), ACGIH® TLVs®, the American Industrial Hygiene Association (AIHA®) Workplace Environmental Exposure Levels (WEELs™), or any occupational exposure limits set by other agencies, organizations, and foreign or domestic entities, such as Germany's Maximale Arbeitsplatz-Konzentration (MAK) limits. The Subcommittee reviewed a number of significant background documents, including Executive Order (EO) 12196 and other legal authorities, which provided information on workplace safety and health, occupational exposure limits, risk management, hazard assessment, and the requirements for protecting Federal civilian and contract employees.

Background

The Occupational Safety and Health Act of 1970 (the Act) created OSHA and provided the authority for the Agency to set standards regulating occupational safety and health. Section (6)(a) of the Act allowed the Secretary of Labor to, "*…by rule promulgate as an occupational safety and health standard any national consensus standard and any established Federal standard*…." Under this two-year authority,[1] OSHA adopted the current PELs, which were based on the ACGIH® TLVs® in effect in 1968. Since 1972 any changes or additions to PELs require following the formal rulemaking process, which has hindered attempts to add new PELs or update others.

Over time, advances in scientific knowledge have led to a greater understanding of adverse effects, and NIOSH and professional organizations like the ACGIH®[2] and AIHA®[3] have responded by issuing new or modifying existing OELs. When modified, more OEL values have

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[1] http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHACT&p_id=3360

[2] TLV's and Other Consensus Standards - Can OSHA enforce them? (AIHA®-ASSE) http://www.aiha.org/localsections/html/potche/news/AIHA_ASSE_Presentation_Consensus_Standards%20b.pdf

[3] AIHA®'s White Paper on Permissible Exposure Limits (PELs) http://www.aiha.org/news-pubs/govtaffairs/Documents/whitepaper02_PELs.pdf

decreased than have increased. For example, a comparison of the TLVs® from 1968 to 2011 reveals that over 200 TLVs® have decreased while only a half dozen have increased. A table comparing OSHA's PELs to other OELs is included as Appendix V.

It is unlikely that OSHA will promulgate significant numbers of new PELs. Federal agencies can address this lack of regulatory progress by applying risk management principles and alternative OELs to occupational exposures.

Process and Standards

As a mechanism to protect Federal employees, Federal agencies should use a risk assessment to determine whether a workplace exposure constitutes a hazard and then evaluate existing OELs to select the appropriate OEL.

Risk Assessment

A risk assessment considers all aspects of the potential hazard and risks in the workplace, including OELs, work procedures, and systems of work. If an agency's risk assessment concludes that employees could suffer negative effects from exposure to a given hazard, then the agency should follow a risk management strategy based on the hierarchy of controls to reduce or eliminate the hazard. The hierarchy of controls includes, in order of preference:

1. Eliminate the need to use the substance;
2. Substitute a less hazardous substance;
3. Implement engineering controls (i.e. local exhaust ventilation, barriers, etc.)
4. Implement work practice controls and training;
5. Implement administrative controls (i.e. work restrictions/job or task rotation); and in addition to these control methods, and only as a last resort:
6. Proper selection, fitting, and use of personal protective equipment.

Consideration of Existing OELs

Once a Federal agency has performed a risk assessment and proceeded through the hierarchy of controls to conclude that a specific substance cannot be eliminated from the workplace, then the agency must select an appropriate workplace OEL. The OEL selection process begins by examining existing substance-specific OELs. If an OSHA PEL exists, OSHA regulations require that employee exposures do not exceed that PEL. If OSHA does not have a PEL, then the examination must expand to other exposure limits such as, but not limited to, RELs or TLVs®. Of course, even if a PEL exists, other OELs may be more protective.

When examining OELs, the agency should be aware of the background of a given limit and the methods the defining organization used to select that limit. For protection from radioactive materials, the non-quantitative exposure limit is "ALARA" or As Low as Reasonably Achievable. For some situations, an ALARA approach would require either substituting a less-hazardous chemical into the existing process or changing the process entirely to eliminate the need for the chemical.

Previously, many NIOSH RELs for carcinogens were set based on the similar non-quantitative concept of Lowest Feasible Concentration (LFC). Some RELs were assigned values at the limits of detection for the analytical method in use at the time.

Currently, NIOSH bases its RELs on risk evaluations using human or animal health effects data, and on an assessment of what levels can be feasibly achieved by engineering controls and measured by analytical techniques. For all workplace hazards, including carcinogens, NIOSH tries to specify not only a no-effect exposure, but also exposure levels at which there may be residual risks.[4]

When selecting an appropriate OEL, the agency must consider the potential for mixed exposures, also referred to as cumulative risk. OSHA's Air Contaminants standard, 29 CFR 1910.1000, describes computation formulae for determining cumulative and mixed exposures. Cumulative exposure refers to different levels of exposure to the same substance while mixed exposure refers to combined exposures to more than one substance. An expert system known as "Mixie"[5] is a useful tool that can assist in applying the mixture formula for exposure combinations.

Another method for refining exposure strategies applies the generic principles of a control banding[6] or hazard banding approach. This approach categorizes ("bands") chemicals according to their toxicological characteristics. Hazard banding, developed by the United Kingdom's Health and Safety Executive (HSE) as part of a program known as *Control of Substances Hazardous to Health (COSHH) Essentials* and pioneered in the pharmaceutical industry, can be useful if no OEL exists. The HSE developed an expert system[7] as part of COSHH Essentials to guide the user through a series of questions leading to an appropriate control strategy.

Current Policies
Some Federal agencies already apply their own standards for OEL selection:

- **Department of State**
  Permissible exposure limits (PELs) for occupational exposure to toxic and hazardous materials and hazardous physical energies are those published by the Department of Labor under 29 CFR Part 1910. An exception is when the threshold limit value (TLV®), established by the American Conference of Governmental Industrial Hygienists (ACGIH®), is lower than the OSHA PEL. In this case, the TLV® becomes the exposure standard for the Department of State. If neither a PEL nor a TLV® exists, the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) becomes the Departmental exposure standard.

  15 FAM 952 EXPOSURE STANDARDS
  (CT:OBO-4; 12-21-2005)
  (Uniform State/USAID/Commerce/Agriculture)

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[4] This policy applies to all workplace hazards, including carcinogens, and is responsive to Section 20(a)(3) of the Occupational Safety and Health Act of 1970, which charges NIOSH to ". . .*describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience*."
[5] Mixie was developed by the Canadian L'Institut de Recherche Robert-Sauvé en Santé et en Sécurité du Travail (IRSST) and is available at: http://www.irsst.qc.ca/en/-tool-mixie-mixtures-of-substances-in-the-workplace-computer-based-tool-for-evaluating-the-chemical-risk-calculation-of-the-rm.html
[6] http://www.cdc.gov/niosh/topics/ctrlbanding/
[7] http://www.hse.gov.uk/coshh/essentials/index.htm

- **Department of Energy**
  § 851.23 Safety and health standards.

  (a) Contractors must comply with the following safety and health standards that are applicable to the hazards at their covered workplace:

  (1) Title 10 Code of Federal Regulations (CFR) 850, ‘‘Chronic Beryllium Disease Prevention Program.’’
  (2) Title 29 CFR, Parts 1904.4 through 1904.11, 1904.29 through 1904.33; 1904.44, and 1904.46, ‘‘Recording and Reporting Occupational Injuries and Illnesses.’’
  (3) Title 29 CFR, Part 1910, ‘‘Occupational Safety and Health Standards,’’ excluding 29 CFR 1910.1096, ‘‘Ionizing Radiation.’’
  (4) Title 29 CFR, Part 1915, ‘‘Shipyard Employment.’’
  (5) Title 29 CFR, Part 1917, ‘‘Marine Terminals.’’
  (6) Title 29 CFR, Part 1918, ‘‘Safety and Health Regulations for Longshoring.’’
  (7) Title 29 CFR, Part 1926, ‘‘Safety and Health Regulations for Construction.’’
  (8) Title 29 CFR, Part 1928, ‘‘Occupational Safety and Health Standards for Agriculture.’’
  (9) American Conference of Governmental Industrial Hygienists (ACGIH®), ‘‘Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices,’’ (2005) (incorporated by reference, see § 851.27) when the ACGIH® Threshold Limit Values (TLVs®) are lower (more protective) than permissible exposure limits in 29 CFR 1910. When the ACGIH® TLVs® are used as exposure limits, contractors must nonetheless comply with the other provisions of any applicable expanded health standard found in 29 CFR 1910.
  (10) American National Standards Institute (ANSI) Z88.2, ‘‘American National Standard for Respiratory Protection,’’ (1992) (incorporated by reference, see § 851.27).
  (11) ANSI Z136.1, ‘‘Safe Use of Lasers,’’ (2000) (incorporated by reference, see § 851.27).
  (12) ANSI Z49.1, ‘‘Safety in Welding, Cutting and Allied Processes,’’ sections 4.3 and E4.3 (1999) (incorporated by reference, see § 851.27).
  (13) National Fire Protection Association (NFPA) 70, ‘‘National Electrical Code,’’ (2005) (incorporated by reference, see § 851.27).
  (14) NFPA 70E, ‘‘Standard for Electrical Safety in the Workplace,’’ (2004) (incorporated by reference, see § 851.27).

  (b) Nothing in this part must be construed as relieving a contractor from complying with any additional specific safety and health requirement that it determines to be necessary to protect the safety and health of workers.

- **Department of Defense (by Service):**
  DoD: DoD requires compliance with the OSHA PELs as a part of policy requiring compliance with OSHA standards. The DoD Components (Military Services and Defense Agencies) are authorized to issue more stringent requirements to meet their needs. DoD policy provides procedures for developing Alternate or Supplemental Standards under 29 CFR 1960.

  Army: Army policy requires use of the most stringent of either OSHA PELs or ACGIH® TLVs® (Department of the Army Pamphlet 40-503, *Industrial Hygiene Program*, http://www.apd.army.mil/pdffiles/p40_503.pdf).

  Navy/Marine Corps: Uses standards in the following order of precedence:
  1. 1989 OSHA permissible exposure limits (PELs) (http://www-nehc.med.navy.mil/ih/ihfom.htm)
  2. Substance-specific OSHA standards
  3. Navy-developed standards
  4. American Conference of Governmental Industrial Hygienists (ACGIH®) threshold limit values (TLVs®)

  Air Force: For occupational health assessments, the industrial hygiene office ("Bioenvironmental Engineering") determines the appropriate Occupational and Environmental Exposure Limit (OEEL) using Air Force standards or the most appropriate exposure limit adopted from established, recognized standards (AIR FORCE MANUAL 48-155, *Occupational and Environmental Health Exposure Controls*, http://www.e-publishing.af.mil/shared/media/epubs/AFMAN48-155.pdf)

  1. ACGIH® TLVs®
  2. OSHA PELs
  3. Emergency Response Planning Guidelines (ERPGs)
  4. AIHA Workplace Environmental Exposure Levels (WEELs™)
  5. Technical Guide 230 (TG-230), Chemical Exposure Guidelines for Deployed Military Personnel

Limitations of Occupational Exposure Limits

An OEL can indicate the level of hazard posed by exposure to a specific substance but, by itself, cannot determine the likelihood of adverse health effects from that exposure. With regard to using TLVs® and biological exposure indices (BEIs®), ACGIH® notes that, "*TLVs® and BEIs® should NOT be adopted as standards without an analysis of other factors necessary to make appropriate risk management decisions. Any use of a TLV® or BEI® in a regulatory context should include a careful evaluation of the information in the written documentation and consideration of all other factors as required by the statutes which govern the regulatory process of the governmental body involved.*"[8]

[8] ACGIH® (2011): TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

OEL Selection
Federal agencies may use more protective exposure limits, beyond the PELs. However, they should use the full risk assessment process and be aware of the guidelines, considerations, and limitations of various exposure limits. To assist agencies in determining an appropriate OEL for a given situation, the Subcommittee recommends selecting a "competent person" to use a risk assessment[9] approach. See Appendix I for a sample decision logic.

Competent Person
Assessing chemical exposures in the workplace, evaluating exposure risk to employees, and making recommendations on acceptable employee chemical exposure levels based on the risk, requires a person who is competent to perform these activities. A person is deemed to be competent by way of training and/or experience.

A person possessing one of the following qualifications is considered competent for assessing chemical exposure risks, and making recommendations regarding acceptable chemical exposure risks, appropriate OELs, and employee exposure controls:

- Certification by an accredited body such as the American Board of Industrial Hygiene (ABIH) or the Board of Certified Safety Professionals (BCSP). A Certified Industrial Hygienist (CIH®) or Certified Safety Professional (CSP®) has not only met minimum requirements for education and experience but has also demonstrated a minimum level of knowledge through examination. These designations are uniquely dedicated to occupational safety and health.
- GS-0690-11 or above – by virtue of education, experience, and job complexity defined as such: Inspections cover the full range of industries, including such large and diverse industries as the automotive, plastic, and rubber industries. These industries pose a number of complex problems for the industrial hygienist, resulting from the size and diversity of work operations, the use of exotic chemicals, and the combinations of hazardous materials. The employee must adapt or modify past practices and research trends in the field in order to identify and evaluate a wide variety of occupational health hazards. Fatality investigation is complicated by the requirement to investigate conditions which existed prior to the accident and may have changed.
- Bachelor's degree in science or engineering (e.g. chemistry, biology, toxicology, public health, chemical/environmental engineering) from an accredited* institution and five years progressively more complex experience covering full spectrum of occupational health hazards (job experience complexity comparable to GS-0690-11).

  *Note: An accredited college/university is one accredited by a regional or national accrediting agency recognized by the U.S. Secretary of Education.

[9] Laszcz-Davis C, Boelter FW, Hearl F, Jayjock M, Perry L, Mclaughlin CF, O'Reilly M, Radcliffe RT, Stenzel M (2011). Human Health Risk Assessment. Chapter 18 in Patty's Industrial Hygiene, 6th Ed., Rose VE and Cohrssen B, Eds. Wiley, Hoboken NJ.

- Master's degree in science or engineering from an accredited institution and four years progressively more complex experience covering the full spectrum of occupational health hazards (job experience complexity comparable to GS-0690-11).

Other accredited certifications may also be indicators of competency in this regard. Some examples of such certifications include, but are not limited to: Professional Engineer (PE), particularly in chemical, environmental, or safety engineering; Certified Hazardous Materials Manager (CHMM); Qualified Environmental Professional (QEP); or certification by the American Board of Toxicology (ABT).

Legal Considerations

EO 12196, paragraph 1-201(d); The Act, Section 19(a); and 29 CFR 1960, Subpart C, all require that federal workplaces and working conditions be safe and healthful and free from recognized serious hazards. They also require agencies to comply with all applicable OSHA standards issued under Section 6 of the Act – or an approved alternate standard. 29 CFR 1960.16, *Compliance with OSHA Standards*, authorizes agencies to, "… *upon prior notification to the Secretary, prescribe and enforce more stringent permissible exposure levels or threshold limit values* …."

According to 29 CFR 1960.18, if there is no OSHA standard that applies to a particular worksite, job, condition, or other workplace exposure, an agency must implement an emergency temporary supplemental standard to protect its employees. Subsequent to implementing an emergency temporary supplemental standard, the agency must develop and implement a permanent supplemental standard to continue to assure a safe and healthful workplace and adequate employee protection.

Action

Given the requirements of the OSH Act, EO 12196, and 29 CFR Part 1960, and that current PELs are inadequate to protect Federal employees and Federal contractor employees, FACOSH recommends that:

1. The Secretary of Labor submit to the President a recommendation for an updated Executive Order to amend EO 12196,[10] *Occupational Safety and Health Programs for Federal Employees*, directing the heads of Executive Branch departments and agencies to require the use of the most protective occupational exposure limits (OELs) that are feasible[11], and are published by a recognized research or regulating body, in Federal

[10] http://www.archives.gov/federal-register/codification/executive-order/12196.html

[11] *Feasible* means that the OEL is both economically and technologically achievable. *Technologically feasible* means that there is a reasonable possibility that the agency will be able to meet the OEL in most of its operations by installing engineering controls and implementing work practice controls. *Technologically feasible* also includes being able to use analytical techniques to measure the chemical at the OEL. *Economically feasible* in the private sector means that complying with the OEL will not threaten an industry's long term profitability or substantially alter its competitive structure. For a Federal agency, *economically feasible* means that complying with the OEL will not require such resources as to threaten the agency's ability to fulfill its mission.

workplaces, notwithstanding the existence of a Permissible Exposure Limit (PEL) for a given substance of concern. The Secretary will publicize a list, updated every five years, of recognized research or regulating bodies whose OELs agencies must consider in complying with this requirement.

2. The Secretary of Labor include in the recommendation to the President that Federal Executive Branch departments and agencies, in procurement contracts, grants, and cooperative agreements, to the extent authorized by applicable statutory authority, require contractors, subcontractors, recipients, and subrecipients to use the most protective OELs that are feasible, regardless of minimum requirements, while carrying out work on behalf of the Federal government**.**

3. A person deemed to be competent by virtue of training and experience make recommendations regarding acceptable chemical exposure risks, appropriate OELs, and employee exposure controls. Recommendations on OELs may be based on factors such as toxicity of the chemical, length and frequency of exposure, analytical limit of detection, and technological and economic feasibility.

Sample language for an updated Executive Order is provided as Appendix II.

*Note: The language for the first two recommendations, including Footnote 11, (inside the shaded boxes, above) is the revised language unanimously approved by the Emerging Issues Subcommittee. Based on the revisions to the first two recommendations, the Subcommittee also revised the sample Executive Order referenced above and provided as Appendix II. The original language for both the two recommendations and sample Executive Order is provided in Appendix III.

Other Issues

In addition to examining the use of OELs in the Federal government, the FACOSH Emerging Issues Subcommittee identified other issues that may be of interest to FACOSH. They are as follows:

Occupational Exposure to Noise

- NIOSH has a recommended exposure limit (REL) for occupational noise exposure of 85 decibels, A-weighted, as an 8-hour time-weighted average (85 dBA as an 8-hr TWA) compared to OSHA's PEL of 90 dBA as an 8-hr TWA.[12] Since the measurement of decibels is a logarithmic rather than linear scale, the OSHA PEL is substantially less protective than the NIOSH REL.
- OSHA uses a 5-dB exchange rate instead of the 3-dB exchange rate that is supported by scientific evidence for assessing hearing impairment as a function of noise level and duration. In the Federal sector, DoD, the Environmental Protection Agency, and the National Aeronautic and Space Administration use the 3-dB exchange rate, as do nearly

[12] Criteria for a Recommended Standard: Occupational Noise Exposure (1998), NIOSH. http://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf

all other governments worldwide, including Canada, China, the United Kingdom, and Germany.[13]

Dispersible Engineered Nanomaterials (DENMs)

- OSHA defines nanomaterials as, "*materials that have been purposefully manufactured, synthesized, or manipulated to have a size with at least one dimension in the range of approximately 1 to 100 nanometers and that exhibit unique properties determined by their size*."
- Published scientific studies have indicated that at least some DENMs are biologically active, have produced toxicological reactions in the lungs of exposed experimental animals, and may readily penetrate intact human skin. While DENMs are truly an emerging issue and published results are not plentiful, scientists and Federal agencies, such as NIOSH, continue to conduct research to fully understand the potential health effects of exposure.
- Currently, both scientists and Federal agencies agree that DENM toxicity depends heavily on the physical and chemical properties of the nanoparticles, such as particle size and size distribution, agglomeration state, shape, crystal structure, chemical composition, surface area, surface chemistry, surface charge, and porosity, and that these properties may differ substantially from those of the same material in macro-scale form.[14]

Work-Related Musculoskeletal Disorders

- According to OSHA, a musculoskeletal disorder (MSD) is a disorder, "*of the muscles, nerves, tendons, ligaments, joints, cartilage or spinal discs that was not caused by a slip, trip, fall, motor vehicle accident or similar accident such as carpal tunnel and back pain*."[15] OSHA notes that MSDs are among the most commonly reported work-related injuries. Conservative estimates of the economic burden resulting from MSDs, as measured by compensation costs, lost wages, and lost productivity, are between $45 and $54 billion annually.[16]
- Most Executive Branch agencies report some level of awareness of MSDs, and DoD has issued a policy requiring the implementation of an Ergonomics Program.[17] However, OSHA does not have a standard that directly addresses the causes of MSDs or the improperly designed or performed jobs or activities in Federal workplaces, such as airports, warehouses, mailrooms, and other environments, that may contribute to MSDs.

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[13] TABLE 4-4 Worldwide Regulations for Exposures to Hazardous Noise in the Workplace, Technology for a Quieter America, National Academy of Engineering. http://www.nap.edu/openbook.php?record_id=12928&page=34

[14] Approaches to Safe Nanotechnology, 2005, NIOSH. http://www.cdc.gov/niosh/docs/2009-125/pdfs/2009-125.pdf

[15] http://www.gpo.gov/fdsys/pkg/FR-2011-05-17/pdf/2011-11965.pdf#page=1

[16] Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities (2001) Institute of Medicine (IOM)

[17] http://www.dtic.mil/whs/directives/corres/pdf/605501p.pdf

Ionizing Radiation

- The use of ionizing radiation in the Federal workplace has grown substantially in recent years. For example, the use of X-ray equipment and gamma-ray imaging devices to inspect luggage, packages, and other items has become widespread. Ionizing radiation is also used to neutralize harmful biological agents, including anthrax, as well as microorganisms in certain food.
- In 1971 OSHA adopted as its Ionizing Radiation standard the radioactive materials exposure limits that the Atomic Energy Commission (which preceded the Nuclear Regulatory Commission (NRC)) issued in 1969 (10 CFR Part 20, including Appendix B, Tables I and II). In general, the OSHA rule, 29 CFR 1910.1096, applies when an individual in a workplace does not fall under regulations provided by NRC or an equivalent Agreement State.[18] Much like 10 CFR 20, 29 CFR 1910.1096 specifies dose limits and training requirements for individuals who will work in restricted areas, etc. However, unlike 10 CFR 20, 29 CFR 1910.1096 is still based on limits and models promulgated in 1969.

Working in Extreme Temperatures

Heat

- OSHA reports that every year thousands of workers become sick from heat exposure on the job. And that workers exposed to hot and humid conditions are at risk of heat illness, especially those doing heavy work tasks or using bulky protective clothing and equipment.[19] OSHA has instituted the *Campaign to Prevent Heat Illness in Outdoor Workers* with extensive guidance and other information on preventing heat-related illness.[20] It has also compiled references to standards and technical procedures for assessing and controlling heat stress.[21]
- Although there is no standard for heat stress, OSHA[22] and DoD,[23] and other organizations such as ACGIH® and NIOSH,[24] have provided information and guidance.

Cold

- With regard to exposure to cold temperatures, OSHA's Fact Sheet, *Protecting Workers in Cold Environments*, states that prolonged exposure to freezing temperatures can result in health problems as serious as trench foot, frostbite, and hypothermia. And that wind chill, a combination of temperature and velocity, is a crucial factor to evaluate when working outside.[25]
- References reviewed indicate no clear standard limiting the amount of cold to which a person would be exposed. Instead, guidelines are provided for planning worker exposure to cold, including identifying clothing to be worn while working in cold environments.

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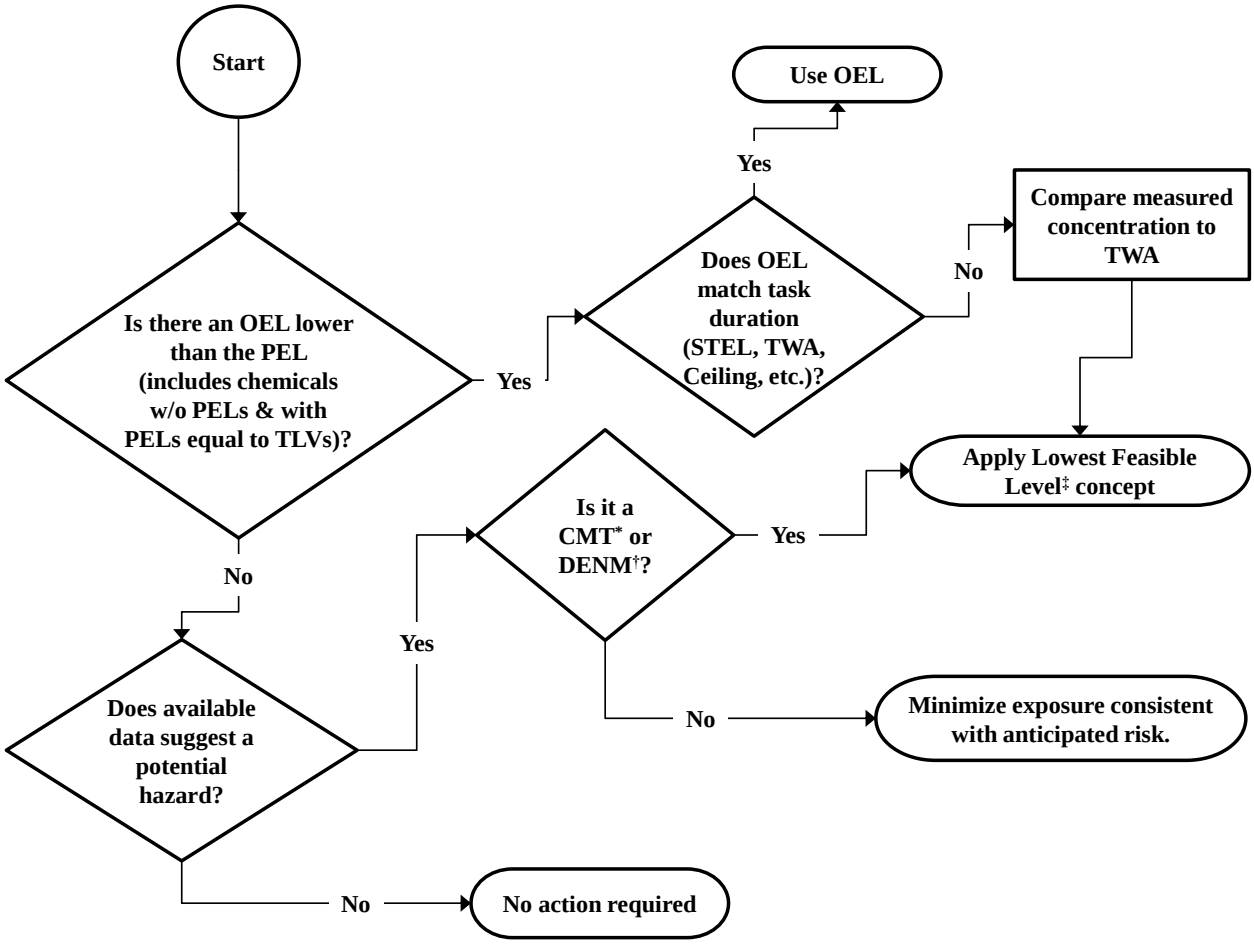
[18] http://www.nrc.gov/about-nrc/state-tribal/agreement-states.html
[19] http://www.osha.gov/SLTC/heatillness/edresources.html
[20] http://www.osha.gov/SLTC/heatillness/index.html
[21] http://www.osha.gov/SLTC/heatstress/index.html
[22] http://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_4.html
[23] Army TB MED 507, *Heat Stress Control and Heat Casualty Management*, http://phc.amedd.army.mil/topics/discond/hipss/Pages/HeatInjuryPrevention.aspx
[24] http://www.cdc.gov/niosh/86-113.html
[25] http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FACT_SHEETS&p_id=186

- NIOSH has developed guidance for preventing hypothermia, frostbite, trench foot, and chilblains along with web links to a variety of references from other organizations.[26]
- The Army issued TB MED 508, *Prevention and Management of Cold-Weather Injuries*, with broad guidance directed at the individual military service member, supervisors, commanders, and health staff. Guidance includes recommended insulating value of clothing to be worn based on air temperature and worker physical activity level.[27]

[26] http://www.cdc.gov/niosh/topics/coldstress
[27] http://phc.amedd.army.mil/topics/discond/cip/Pages/ColdCasualtiesInjuries.aspx

Appendix I –OEL Decision Logic



*Carcinogen, Mutagen, Teratogen

†Dispersible Engineered Nanomaterial

‡The Lowest Feasible Level concept involves evaluating the strengths and weaknesses of economic, technological, analytical, and environmental data and determining what level can be achieved for most operations most of the time, being cognizant of human health and business enterprise, which involves some risk in expectation of benefit.

Appendix II – Sample Executive Order Language

Executive Order 13###--Occupational safety and health programs for Federal employees – Revision to Executive Order 12196

Source: The provisions of Executive Order 12196 of Feb. 26, 1980, appear at 45 FR 12769, 3 CFR, 1980 Comp., p. 145, unless otherwise noted.

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 7902(c) of Title 5 of the United States Code and in accord with Section 19 of the Occupational Safety and Health Act of 1970, as amended (29 U.S.C. 668), it is ordered:

Section 1-201 in E.O. 12196 is hereby modified by inserting new paragraph (e) to read:

1-201. The head of each agency shall:

(e) with respect to control of exposure to substances of concern, require the use in Federal workplaces of the most protective, feasible occupational exposure limits as published by a recognized research or regulating body, notwithstanding the existence of a permissible exposure limit for a given substance of concern as may have been promulgated under Section 6 of the Act. The Secretary will publicize a list, updated every five years, of recognized research or regulating bodies whose limits agencies must consider in complying with this requirement.

Section 1-201 in E.O. 12196 is further modified by reassigning paragraphs letters as follows:

Paragraph (e) becomes (f); (f) becomes (g); (g) becomes (h); (h) becomes (i); (i) becomes (j); (j) becomes (k); (k) becomes (l); (l) becomes (m).

Appendix III – Original Language

Below is the original language for the first two recommendations and the relevant portion of the sample Executive Order.

Recommendations

1. The Secretary of Labor submit to the President a recommendation for an updated Executive Order to amend EO 12196,[28] *Occupational Safety and Health Programs for Federal Employees*, directing the heads of Executive Branch departments and agencies to require the use of the most protective, and technologically and economically feasible OELs as published by a recognized research or regulating body, in Federal workplaces, notwithstanding the existence of a PEL for a given substance of concern.
2. The Secretary of Labor include in the recommendation to the President that Federal Executive Branch departments and agencies, in procurement contracts, grants, and cooperative agreements, to the extent authorized by applicable statutory authority, require contractors, subcontractors, recipients, and subrecipients to use the most protective, technologically and economically feasible OEL while carrying out work on behalf of the Federal government**.** Contractors and grant applicants who propose to use the most protective OELs may be given preference for awards of contracts and grants, respectively.

Executive Order (relevant portion)

(e) with respect to control of exposure to toxic materials, require the use in Federal workplaces of the most protective, technologically and economically feasible occupational exposure limit as published by a recognized research or regulating body, notwithstanding the existence of a permissible exposure limit for a given substance as may have been promulgated under Section 6 of the Act.

[28] http://www.archives.gov/federal-register/codification/executive-order/12196.html

Appendix IV: Subcommittee Participants

The following list contains the names of FACOSH members, technical experts, and OSHA staff who actively participated on the Emerging Issues Subcommittee during its analysis of the current PELs.

FACOSH Members

Donald Bathurst, Chief Administrative Officer, U.S. Department of Homeland Security

William "Chico" McGill, Director, Government Employees Department, International Brotherhood of Electrical Workers

Milagro "Milly" Rodriguez, MPH, Occupational Health and Safety Specialist, American Federation of Government Employees

Special Agency Liaison

Frank Hearl, PE**,** Chief of Staff, National Institute of Occupational Safety and Health, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services

Technical Experts

John Seibert, CSP, Assistant for Safety, Health & Fire, Office of the Deputy Under Secretary of Defense (Installations & Environment), U.S. Department of Defense

Camille Carraway, CIH, Industrial Hygienist, U.S. Department of Homeland Security

Jason Capriotti, CIH, CSP, Industrial Hygienist, National Institute of Standards and Technology, U.S. Department of Commerce

Daniel Marsick, PhD, CIH, CSP, Industrial Hygienist, U.S. Department of Energy

Tony Pierpoint, PhD, CIH, Assistant Director, Safety and Health, U.S. Department of Homeland Security

Joseph Beres, CIH, CSP, PE, Industrial Hygienist, U.S. Department of State

Azita Mashayekhi, MHS, Staff Industrial Hygienist, International Brotherhood of Teamsters

Dennis Phelps, International Representative, International Brotherhood of Electrical Workers (IBEW)

Jeff Friday, National Counsel, National Treasury Employees Union

James R. Thornton, CIH, CSP, Director, Environmental Health and Safety, Newport News Shipbuilding, a Division of Huntington Ingalls Industries

OSHA Staff

Francis Yebesi, Director, Office of Federal Agency Programs, Occupational Safety and Health Administration, U.S. Department of Labor

Lorree Probert, Program Analyst, Office of Federal Agency Programs, Occupational Safety and Health Administration, U.S. Department of Labor

Loretta D. Schuman, PhD, MS, DABT, Senior Toxicologist, Office of Chemical Hazards (Nonmetals), Occupational Safety and Health Administration, U.S. Department of Labor

David Ward, CSP, Safety Specialist, Office of Federal Agency Programs, Occupational Safety and Health Administration, U.S. Department of Labor

Appendix V – Comparison of the OSHA PELs with Other OELs

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Acetaldehyde	75-07-0	HPV	200	25 C			50	100 C	·	✓
Acetic acid	64-19-7	HPV	10	10 and 40C	10	15 ST	10	20 ST	·	✓
Acetic anhydride	108-24-7	HPV	5	5C		5 C	5		·	✓
Acetone	67-64-1	HPV	1000	750 and 3000C	250		500	1000 ST	·	✓
Acetone cyanohydrin	75-86-5	HPV		4.7 C		4 C			✓	·
Acetonitrile	75-05-8	HPV	40	40	20		20	40 ST	·	✓
Acetophenone	98-86-2	HPV		10					·	✓
Acetylene tetrabromide	79-27-6		1	1					·	✓
Acetylsalicylic acid	50-78-2			5	5				✓	·
Acrolein		HPV	0.1	0.1	0.1	0.3 ST			·	✓
Acrylamide	79-06-1	HPV	0.3	0.03	0.03				✓	·
Acrylic acid	79-10-7	HPV		2	2				·	✓
Acrylic acid polymer	9003-04-7						0.05		✓	·
Acrylonitrile	107-13-1	HPV	2	2	1	10 C (15-min)			·	✓
Adipic acid	124-04-9	HPV		5					✓	·
Adiponitrile	111-69-3	HPV		2	4				·	✓
Aldicarb	116-06-3								✓	·
Aldrin	309-00-2		0.25	0.25	0.25		0.25	2 ST	✓	·
Allyl alcohol	107-18-6	HPV	2	2	2	4 ST			·	✓
Allyl chloride	107-05-1	HPV	1	1	1	2 ST			·	✓
Allyl glycidyl ether	106-92-3	HPV	10 C	5	5	10 ST			·	✓
Allyl propyl disulfide	2179-59-1		2	2	2	3 ST			·	✓
alpha-Methyl styrene	98-83-9	HPV	100 C	50	50	100 ST	50	100 ST	·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Aluminum - Alkyls, not otherwise specified (as Al)	7429-90-5			5 and 10					✓	·
Aluminum - Metal dust	7429-90-5		5 and 15	5 and 10	5 and 10		1.5 and 4		✓	·
Aluminum - Pyro powders (as Al)	7429-90-5			5 and 10	5				✓	·
Aluminum - Welding fumes (as Al)	7429-90-5			5 and 10	5				✓	·
Aluminum hydroxide	21645-51-2						1.5 and 4		✓	·
Aluminum oxide	1344-28-1		5 and 15	5 and 10			1.5 and 4		✓	·
Aminobenzoic acid p-	150-13-0								✓	·
Aminopyridine 2-	504-29-0		0.5	0.5	0.5				·	✓
Amitrole	61-82-5			0.2	0.2		0.2	1.6 ST	✓	·
Ammonia	7664-41-7		50	25	25	35 ST	20	40 ST	·	✓
Ammonium chloride - Fume	12125-02-9			10	10	20 ST			✓	·
Ammonium perfluorooctanoate	3825-26-1			0.01					✓	·
Ammonium persulfate (as S_2O_8)	7727-54-0								✓	·
Ammonium sulfamate	7773-06-0		5 and 15	5 and 10	5 and 10				✓	·
Aniline	62-53-3	HPV		2			2	4 ST	·	✓
Anisidine o-	90-04-0	HPV							·	✓
Anisidine o -	90-04-0	HPV	0.5		0.5				✓	·
Anisidine p-	104-94-9		0.5		0.5				✓	·
Antimony - Compounds (as Sb)	7440-36-0		0.5	0.5	0.5				✓	·
Antimony - Elemental	7440-36-0		0.5	0.5	0.5				✓	·
Antimony hydride [Stibine]	7803-52-3		0.1	0.1	0.1				·	✓
Antimony trioxide (as Sb)	1309-64-4		0.5		0.5				✓	·
ANTU	86-88-4		0.3	0.3	0.3				✓	·
Arsenic - Elemental	7440-38-2		0.01	0.01 and 0.2		0.002 C (15-min)			✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Arsenic - Inorganic compounds (as As)	7440-38-2		0.01	0.01		0.002 C (15-min)			✓	·
Arsenic - Organic compounds (as As)	7440-38-2		0.5	0.01 and 0.2					✓	·
Arsenic pentoxide (as As)	1303-28-2								✓	·
Arsenous acid, arsenic acid and salts (as As)	7778-39-2					0.002 C (15-min)			✓	·
Asphalt (Bitumen) fume	8052-42-4	HPV		5		5 C (15-min)			✓	·
Atrazine	1912-24-9	HPV		5	5		2	16 ST	✓	·
Azinphos-methyl - Vapor and Aerosol	86-50-0		0.2	0.2	0.2		0.2	1.6 ST	✓	·
Barium - Metal	7440-39-3			0.5					✓	·
Barium - Soluble compounds (as Ba)	7440-39-3		0.5	0.5	0.5		0.5	4 ST	✓	·
Barium chromate (as Cr)	10294-40-3								✓	·
Barium sulfate	7727-43-7		5 and 15	5 and 10	5 and 10		1.5 and 4		✓	·
Benomyl	17804-35-2	HPV	5 and 15	5 and 10					✓	·
Benzaldehyde	100-52-7	HPV							✓	·
Benzene	71-43-2	HPV	1	1	0.1	1 ST			·	✓
Benzo[a]pyrene	50-32-8		0.2		0.1				✓	·
Benzophenone	119-61-9	HPV							✓	·
Benzotrichloride	98-07-7	HPV							·	✓
Benzoyl chloride	98-88-4	HPV		0.2 C					·	✓
Benzoyl peroxide	94-36-0	HPV	5	5	5		5		✓	·
Benzyl acetate	140-11-4	HPV		10					·	✓
Benzyl alcohol	100-51-6	HPV							·	✓
Benzyl chloride	100-44-7	HPV	1	1		1 C (15-min)			·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Beryllium - Compounds (as Be)	7440-41-7		0.002	0.002 + 0.025 C		0.005 C			✓	·
Beryllium - Metal	7440-41-7		0.002	0.002 + 0.025 C		0.005 C			✓	·
beta-Chloroprene	126-99-8	HPV	25	10		1 C (15-min)			·	✓
Biphenyl	92-52-4	HPV	1	0.2	1				✓	·
Bis(2-dimethylaminoethyl) ether [DMAEE]	3033-62-3	HPV							·	✓
Bismuth telluride - Se-doped	1304-82-1			5 and 10	5				✓	·
Bismuth telluride - Undoped	1304-82-1		5 and 15	5 and 10	5 and 10				✓	·
Borates, tetra, sodium salts, Anhydrous	1330-43-4			5	1				✓	·
Borates, tetra, sodium salts, Decahydrate	1303-96-4			5	5				✓	·
Borates, tetra, sodium salts, Pentahydrate	12179-04-3			5	1				✓	·
Boron oxide	1303-86-2		15	10	10				✓	·
Boron trifluoride	7637-07-2		1 C	1 C		1 C			·	✓
Bromacil	314-40-9			1	10				✓	·
Bromine	7726-95-6		0.1	0.1 C	0.1	0.3 ST			·	✓
Bromine pentafluoride	7789-30-2			0.1	0.1				·	✓
Bromoform	75-25-2		0.5	0.5	0.5				·	✓
Butadiene 1,3-	106-99-0	HPV	1	1					·	✓
Butane	106-97-8	HPV		800	800		1000	4000 ST	·	✓
Butanol (+/-)-2-	15892-23-6								·	✓
Butanol n-	71-36-3	HPV	100	50C		50 C	100		·	✓
Butanol sec-	78-92-2	HPV	150	100	100	150 ST			·	✓
Butanol tert-	75-65-0	HPV	100	100	100	150 ST	20	80 ST	·	✓
Butoxyethanol 2-	111-76-2	HPV	50	25	5		10	20 ST	·	✓
Butoxyethoxy-ethanol 2-(2-)	112-34-5	HPV					67.5	100.5 ST	✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Butoxyethyl acetate 2-	112-07-2	HPV			5		10	20 ST	·	✓
Butyl acetate n-	123-86-4	HPV	150	150	150	200 ST	100	200 ST	·	✓
Butyl acetate sec-	105-46-4		200	200					·	✓
Butyl acetate tert-	540-88-5		200	200	200		20	80 ST	·	✓
Butyl acrylate n-	141-32-2	HPV		10	10		2	4 ST	·	✓
Butyl chromate (as CrO_3) tert-	1189-85-1		0.005	0.1 C					✓	·
Butyl glycidyl ether [BGE] n-	2426-08-6		50	25					·	✓
Butyl lactate n-	138-22-7			5					·	✓
Butyl mercaptan n-	109-79-5	HPV	10	0.5		0.5 C (15-min)	0.5	1 ST (resp)	·	✓
Butylamine n-	109-73-9	HPV	5 C	5C		5 C	2	4 ST	·	✓
Butylamine sec-	13952-84-6	HPV					2	4 ST	·	✓
Butylamine tert-	75-64-9	HPV							·	✓
Butylated hydroxytoluene [BHT] - Vapor & Aerosol	123-37-0								✓	·
Butylbenzoic acid 4-tert-	98-73-7						2	4 ST	✓	·
Butylcatechol 4-tert-	98-29-3	HPV							✓	·
Butylene oxide 1,2-	106-88-7	HPV							·	✓
Butylphenol o-sec-	89-72-5	HPV		5					·	✓
Butylphenol p-tert-	98-54-4	HPV					0.08	0.16 ST	·	✓
Butyltoluene p-tert-	98-51-1	HPV		1					·	✓
Butyraldehyde	123-72-8	HPV							·	✓
Cadmium - Metal & compounds (as Cd)	7440-43-9		0.005	0.005					✓	·
Calcium arsenate (as As)	7778-44-1					0.002 C (15-min)			✓	·
Calcium carbonate	471-34-1		5 and 15	5 and 10	5 and 10				✓	·
Calcium chromate (as Cr)	13765-19-0				0.001				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Calcium cyanamide	156-62-7			0.5	0.5		1	2 ST	✓	·
Calcium cyanide (as CN)	592-01-8		5			5 C			✓	·
Calcium hydroxide	1305-62-0		5 and 15	5	5				✓	·
Calcium oxide	1305-78-8		5	2	2				✓	·
Calcium silicate - Synthetic	1344-95-2		5 and 15	5 and 10	5 and 10				✓	·
Calcium sulfate	7778-18-9		5 and 15	5 and 10	5 and 10		1.5 and 4		✓	·
Caprolactam - Particulate	105-60-2	HPV		5			5	10 ST	✓	·
Caprolactam - Vapor	105-60-2	HPV		1	0.22	0.66 ST			·	✓
Captafol	2425-06-1				0.1				✓	·
Captan	133-06-2			5	5				✓	·
Carbaryl	63-25-2		5	5	5		5	20 ST	✓	·
Carbofuran	1563-66-2	HPV		0.1	0.1				✓	·
Carbon black	1333-86-4			3.5	0.1 and 3.5				✓	·
Carbon dioxide	124-38-9	HPV	5000	5000	5000	30,000 ST	5000	10,000 ST	·	✓
Carbon disulfide	75-15-0	HPV	20	4 and 30 C	1	10 ST	5	10 ST	·	✓
Carbon monoxide	630-08-0		50	25 and 200C	35	200 ST	30	30 ST	·	✓
Carbon tetrabromide	558-13-4			0.1	0.1	0.3 ST			·	✓
Carbon tetrachloride	56-23-5	HPV	10	2 and 200 C		2 ST (60-min)	0.5	1 ST	·	✓
Carbonyl fluoride	353-50-4			2	2	5 ST			·	✓
Catechol	120-80-9	HPV		5	5				·	✓
Cellulose	9004-34-6		5 and 15	5 and 10	5 and 10				✓	·
Cesium hydroxide	21351-79-1			2	2				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Chloramphenicol	56-75-7								✓	·
Chlordane	57-74-9			0.5	0.5		0.5	4 ST	✓	·
Chlordecone	143-50-0				0.001				✓	·
Chlorinated camphene	8001-35-2			0.5					✓	·
Chlorinated diphenyl oxide o-	31242-93-0		0.5	0.5	0.5				✓	·
Chlorine	7782-50-5		1 C	0.5		0.5 C (15-min)	0.5		·	✓
Chlorine dioxide	10049-04-4		0.1	0.1	0.1	0.3 ST	0.1		·	✓
Chloro-1,1,1,2-tetrafluoroethane 2-	2837-89-0	HPV							·	✓
Chloro-1,1-difluoroethane [FC-142b] 1-	75-68-3	HPV					1000	8000 ST	·	✓
Chloro-1-nitropropane 1-	600-25-9		20	2	2				·	✓
Chloro-1-propanol 2-	78-89-7								·	✓
Chloro-2-methyl-2,3-dihydroisothiazol-3-one 5-	26172-55-4						0.2	0.4 ST	✓	·
Chloro-2-propanol 1-	127-00-4								·	✓
Chloroacetic acid	79-11-8	HPV							·	✓
Chloroacetophenone 2-	532-27-4		0.05	0.05	0.05				·	✓
Chloroacetyl chloride	79-04-9	HPV		0.05	0.05				·	✓
Chlorobenzene	108-90-7	HPV	75	10			10	20 ST	·	✓
Chlorobenzylidene malononitrile o-	2698-41-1		0.05	0.05 C		0.05 C			·	✓
Chlorobromomethane	74-97-5	HPV	200	200	200				·	✓
Chlorodifluoromethane [FC-22]	75-45-6	HPV		1000	1000		500	4000 ST	·	✓
Chlorodiphenyl (42% chloride)	53469-21-9		1	1	0.001		1.1	8.8 ST	✓	·
Chlorodiphenyl (54% chloride)	11097-69-1		0.5	0.5	0.001		0.7	5.6 ST	✓	·
Chloroform	67-66-3	HPV	50 C	2			0.5	1 ST	·	✓
Chloroisopropyl) ether bis-(2-)	108-60-14								·	✓
Chloromethyl) ether bis	542-88-1			0.001					·	✓
Chloropentafluoroethane	76-15-3	HPV		1000	1000				·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Chloropicrin	76-06-2		0.1	0.1	0.1		0.1		·	✓
Chloropropionic acid 2-	598-78-7			0.1					·	✓
Chlorostyrene o-	2039-87-4			50	50	75 ST			·	✓
Chlorosulfonic acid	7790-94-5								✓	·
Chlorotoluene o-	95-49-8	HPV		50	50	75 ST			·	✓
Chlorotrifluoroethylene	79-38-9	HPV							·	✓
Chlorotrifluoromethane [FC-13]	75-72-9						1000	8000 ST	·	✓
Chlorpyrifos	2921-88-2			0.2	0.2	0.6 ST			✓	·
Chromic acid and Chromates (as CrO_3)	7738-94-5		0.1C	0.01 + 0.05 and 0.1 C	0.001				✓	·
Chromium - Metal	7440-47-3		1	0.5	0.5				✓	·
Chromium (II) compounds (as Cr)	7440-47-3		0.5	0.5	0.5				✓	·
Chromium (III) inorganic compounds (as Cr)	7440-47-3		0.5	0.5	0.5				✓	·
Chromium (IV) inorganic- insoluble (as Cr)	7440-47-3		0.1 C	0.5					✓	·
Chromium (VI) compounds (as Cr)	7440-47-3		0.005	0.005	0.001				✓	·
Chrysene	218-01-9		0.2		0.1				✓	·
Clopidol	2971-90-6		5 and 15	5 and 10	5 and 10	20 ST (total)			✓	·
Coal dust			2.4		1				✓	·
Coal dust - Anthracite									✓	·
Coal dust - Bituminous									✓	·
Coal Dust (containing < 5% SiO_2)			2.4	2					✓	·
Coal Dust (containing > 5% SiO_2)			Formula	0.1					✓	·
Coal tar pitch volatiles-as benzene-sol. Aerosol	65996-93-2	HPV	0.2	0.2	0.1				✓	·
Cobalt - Elemental / Metal	7440-48-4			0.02					✓	·
Cobalt - Inorganic compounds (as Co)	7440-48-4			0.02					✓	·
Cobalt carbonyl (as Co)	10210-68-1			0.1	0.1				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Cobalt hydrocarbonyl (as Co)	16842-03-8			0.1	0.1				✓	·
Coke oven emissions			0.15	0.15					✓	·
Copper - Dusts and/or mists (as Cu)	7440-50-8		1	1	1		0.1	0.2 ST	✓	·
Copper - Fume (as Cu)	7440-50-8		0.1	1	0.1				✓	·
Cotton dust - Raw				1			1.5		✓	·
Cotton dust - Textile Mill Waste Hs Op or Yarn Mnf			0.5	0.5					✓	·
Cotton dust - Textile slashing & weaving			0.75	0.75					✓	·
Cotton dust - Yarn mfg & wash operations			0.2	0.2					✓	·
Cresol - mixture of isomers	1319-77-3	HPV	5	5	2.3				·	✓
Cresol m-	108-39-4	HPV	5		2.3				·	✓
Cresol o-	95-48-7	HPV	5		2.3				·	✓
Cresol p-	106-44-5	HPV	5		2.3				·	✓
Crotonaldehyde	4170-30-3	HPV	2		2				·	✓
Crufomate	299-86-5			5	5	20 ST			✓	·
Cumene	98-82-8	HPV	50	50	50		50	200 ST	·	✓
Cumene hydroperoxide	80-15-9	HPV							·	✓
Cyanamide	420-04-2			2	2				✓	·
Cyanides (as CN)				5			2		✓	·
Cyanogen	460-19-5			10	10		5	10 ST	·	✓
Cyclohexane	110-82-7	HPV	300	300	300		200		·	✓
Cyclohexanol	108-93-0	HPV	50	50	50		50		·	✓
Cyclohexanone	108-94-1	HPV	50	25	25				·	✓
Cyclohexene	110-83-8		300	300	300				·	✓
Cyclohexylamine	108-91-8	HPV		10	10		10		·	✓
Cyclonite	121-82-4	HPV		1.5	1.5	3 ST			✓	·
Cyclopentadiene	542-92-7	HPV	75	75	75				·	✓
Cyclopentane	287-92-3	HPV		600	600				·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Cyhexatin	13121-70-5			5	5				✓	·
DDT [Dichlorodiphenyltrichloroethane]	50-29-3		1	1	0.5		1	8 ST	✓	·
Decaborane	17702-41-9		0.05	0.05	0.05	0.15 ST	0.05		·	✓
Decabromodiphenyl oxide	1163-19-5	HPV							✓	·
Decene 1-	872-05-9	HPV							·	✓
Demeton - Vapor & aerosol	8065-48-3		0.1	0.01	0.1				✓	·
Demeton-S-methyl - Vapor & aerosol	919-86-8								✓	·
Di(2-ethylhexyl)phthalate [DEHP]	117-81-7	HPV	5	5	5	10 ST	10	80	✓	·
Diacetone alcohol	123-42-2	HPV	50	50	50		20	40 ST	·	✓
Diallylamine	124-02-7	HPV							·	✓
Diazinon	333-41-5			0.1	0.1		0.1	0.2 ST	✓	·
Diazomethane	334-88-3		0.2	0.2	0.2				·	✓
Diborane	19287-45-7		0.1	0.1	0.1				·	✓
Dibromo-3-chloropropane 1,2-	96-12-8		0.001	0.001					·	✓
Dibutyl phenyl phosphate	2528-36-1	HPV		0.3					·	✓
Dibutyl phosphate	107-66-4		1	1	1	2 ST			·	✓
Dibutyl phthalate	84-74-2	HPV	5	5	5				✓	·
Dibutylamine	111-92-2	HPV							·	✓
Dibutylaminoethanol 2-N-	102-81-8			2	2				·	✓
Dichloro-1,1,1-trifluoroethane [FC-123] 2,2-	306-83-2	HPV							·	✓
Dichloro-1-fluoroethane 1,1-	1717-00-6	HPV							·	✓
Dichloro-1-nitroethane 1,1-	594-72-9		10 C	2	2				·	✓
Dichloro-2-butene 1,4-	764-41-0	HPV		0.005					·	✓
Dichloro-5,5-dimethyl hydantoin 1,3-	118-52-5	HPV	0.2	0.2	0.2	0.4 ST			✓	·
Dichlorobenzene o-	95-50-1	HPV	50 C	25 and 50C		50 C	10	20 ST	·	✓
Dichlorobenzene p-	106-46-7	HPV	75	10 and 200C					·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Dichlorodifluoromethane [FC-12]	75-71-8	HPV	1000	1000 and 6200C	1000		1000	2000 ST	·	✓
Dichloroethane 1,1-	75-34-3	HPV	100	100	100		100	200 ST	·	✓
Dichloroethyl ether	111-44-4	HPV	15 C	5	5	10 ST	10		·	✓
Dichloroethylene, cis-isomer 1-2	156-59-2		200		200		200	400 ST	·	✓
Dichloroethylene, sym-isomer 1-2	540-59-0		200	200	200		200	400 ST	·	✓
Dichloroethylene, trans-isomer 1,2-	156-60-5	HPV	200		200		200	400 ST	·	✓
Dichlorofluoromethane [FC-21]	75-43-4		1000	10	10		10	20 ST	·	✓
Dichloromethane	75-09-2	HPV	25	25					·	✓
Dichlorophenoxyacetic acid] 2,4-D [2,4-]	94-75-7	HPV	10	10	10		1	8 ST	✓	·
Dichloropropene 1,3-	542-75-6	HPV		1	1				·	✓
Dichloropropionic acid 2,2-	75-99-0			1	6				✓	·
Dichloropropionic acid sodium salt 2,2-	127-20-8								·	✓
Dichlorotetrafluoroethane [Cryofluorane]	76-14-2	HPV	1000	1000	1000		1000	8000 ST	·	✓
Dichlorvos	62-73-7	HPV		0.1			0.11	0.22 ST	·	✓
Dichlorvos [DDVP] - Vapor & Aerosol	62-73-7	HPV	1	0.1	1				✓	·
Dicrotophos - Vapor & Aerosol	141-66-2			0.25	0.25				✓	·
Dicyclopentadiene	77-73-6	HPV		5	5		0.5		·	✓
Dicyclopentadienyl iron	102-54-5		5 and 15	5 and 10	5 and 10				✓	·
Dieldrin	60-57-1		0.25	0.25	0.25		0.25	4 ST	✓	·
Diesel fuel - Vapor & aerosol	68334-30-5	HPV							✓	·
Diesel fuel No. 2 - Vapor & aerosol	68476-34-6	HPV							✓	·
Diesel fuel No. 4 - Vapor and aerosol	77650-28-3								✓	·
Diethanolamine	111-42-2	HPV		0.46					✓	·
Diethyl ketone	96-22-0	HPV		200	200				·	✓
Diethyl phthalate	84-66-2	HPV		5	5				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Diethylamine	109-89-7	HPV	25	5C	10	25 ST	5	10 ST	·	✓
Diethylaminoethanol 2-	100-37-8	HPV	10	2	10		5		·	✓
Diethylene triamine	111-40-0	HPV		1	1				·	✓
Difluorodibromomethane	75-61-6		100	100	100				·	✓
Difluoroethane 1,1-	75-37-6	HPV							·	✓
Diglycidyl ether [DGE]	2238-07-5		0.5 C	0.1	0.1				·	✓
Diisobutyl ketone	108-83-8	HPV	50	25	25				·	✓
Diisobutylene	107-39-1	HPV							·	✓
Diisopropylamine	108-18-9	HPV	5	5	5				·	✓
Dimethyl ether	115-10-6	HPV					1000	8000 ST	·	✓
Dimethyl ethylamine N,N-	598-56-1	HPV					2	4 ST	·	✓
Dimethyl phthalate	131-11-3	HPV	5	5	5				✓	·
Dimethyl sulfate	77-78-1	HPV	1	0.1	0.1				·	✓
Dimethyl terephthalate	120-61-6	HPV							✓	·
Dimethylacetamide N,N-	127-19-5	HPV	10	10	10		10	20 ST	·	✓
Dimethylamine	124-40-3	HPV	10	5	10		2	4 ST	·	✓
Dimethylaniline	121-69-7	HPV	5	5	5	10 ST			·	✓
Dimethylbutane 2,2-	75-83-2				100	510 C (15-min)	500	1000 ST	·	✓
Dimethylbutane 2,3-	79-29-8				100	510 C (15-min)	500	1000 ST	·	✓
Dimethyldichlorosilane	75-78-5	HPV							·	✓
Dimethylethoxysilane	14857-34-2			0.5					·	✓
Dimethylformamide	68-12-2	HPV	10	10	10		5	20 ST	·	✓
Dimethylhydrazine 1,1-	57-14-7		0.5	0.01		0.06 C (2-hr)			·	✓
Dinitolmide	148-01-6			5	5				✓	·
Dinitrobenzene m-	99-65-0		1	0.15					·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Dinitrobenzene o-	528-29-0	HPV	1	1	1				✓	·
Dinitrobenzene p-	100-25-4		1	1	1				✓	·
Dinitro-o-cresol	534-52-1		0.2	0.2	0.2				✓	·
Dinitrotoluene	25321-14-6	HPV	1.5	0.15	1.5				✓	·
Dinitrotoluene 2,4-	121-14-2	HPV			1.5				✓	·
Dinitrotoluene 3,5-	618-85-9				1.5				✓	·
Dioctyltin bis(2-ethylhexyl thioglycolate) (as Sn)	15571-58-1								✓	·
Dioctyltin bis(isooctyl maleate) (as Sn)	33568-99-9								✓	·
Dioctyltin bis(isooctyl thioglycolate) (as Sn)	26401-97-8								✓	·
Dioctyltin dichloride (as Sn)	3542-36-7								✓	·
Dioctyltin maleate (as Sn)	16091-18-2								✓	·
Dioctyltin oxide (as Sn)	870-08-6								✓	·
Dioxane 1,4-	123-91-1	HPV	100	25		1 C (30-min)	20	40 ST	·	✓
Dioxathion - Vapor & Aerosol	78-34-2			0.2	0.2				✓	·
Dioxolane 1,3-	646-06-0	HPV					100	200 ST	·	✓
Diphenyl ether / Biphenyl mixture (vapor)	8004-13-5		1		1				·	✓
Diphenylamine	122-39-4	HPV		10	10				✓	·
Dipropyl ketone	123-19-3			50	50				·	✓
Diquat	2764-72-9				0.5				✓	·
Disulfiram	97-77-8	HPV		2	2		2	16 ST	✓	·
Disulfoton - Vapor & Aerosol	298-04-4			0.1	0.1				✓	·
Diuron	330-54-1	HPV		10	10				✓	·
Divinyl benzene	1321-74-0	HPV		10	10				·	✓
DOWTHERM* Q									·	✓
Emery	1302-74-5		15 and 5	5 and 10			1.5 and 4		✓	·
Endosulfan	115-29-7			0.1	0.1				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Endrin	72-20-8		0.1	0.1	0.1		0.1	0.8 ST	✓	·
Enflurane	13838-16-9			2		2 C (60-min)	20	160 ST	·	✓
Epichlorohydrin	106-89-8	HPV		2					·	✓
EPN	2104-64-5		0.5	0.1	0.5		0.5	1 ST	✓	·
Ethanol	64-17-5	HPV	1000	1000	1000		500	1000 ST	·	✓
Ethanolamine	141-43-5	HPV	6	3	3	6 ST	2	4 ST	·	✓
Ethion	563-12-2			0.4	0.4				✓	·
Ethoxyethanol [EGEE] 2-	110-80-5	HPV	200	5	0.5		2	16 ST	·	✓
Ethoxyethoxy)ethanol 2-(2-	111-90-0	HPV							·	✓
Ethoxyethyl acetate [EGEEA] 2-	111-15-9	HPV	100	5	0.5		2	16 ST	·	✓
Ethyl acetate	141-78-6	HPV	400	400	400		400	800 ST	·	✓
Ethyl acrylate	140-88-5	HPV	25	5			5	10 ST	·	✓
Ethyl amyl ketone	541-85-5		25	25	25		10	20 ST	·	✓
Ethyl benzene	100-41-4	HPV	100	100	100	125 ST			·	✓
Ethyl bromide	74-96-4	HPV	200	5					·	✓
Ethyl butyl ketone	106-35-4		50	50	50		10	20 ST	·	✓
Ethyl chloride	75-00-3	HPV	1000	100					·	✓
Ethyl cyanoacrylate	7085-85-0	HPV							·	✓
Ethyl ether	60-29-7	HPV	400	400			400		·	✓
Ethyl formate	109-94-4		100	100	100		100		·	✓
Ethyl mercaptan	75-08-1	HPV	10 C	0.5		0.5 C (15-min)	0.5	1 ST	·	✓
Ethyl methyl ketoxime	96-29-7	HPV							·	✓
Ethyl silicate	78-10-4	HPV	100	10	10		10		·	✓
Ethyl tert-butyl ether [ETBE]	637-92-3	HPV							·	✓
Ethylamine	75-04-7	HPV	10	5C	10		5	10 ST	·	✓
Ethylene chlorohydrin	107-07-3			1 C		1 C	1		·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Ethylene dibromide	106-93-4	HPV	20	0.13 C	0.045	0.13 C (15-min)			·	✓
Ethylene dichloride	107-06-2	HPV	50	1 and 200C	1	2 ST			·	✓
Ethylene glycol	107-21-1	HPV		40 C			10	20 ST	·	✓
Ethylene glycol - Aerosol	107-21-1	HPV		40 C					✓	·
Ethylene oxide	75-21-8	HPV	1	1	0.1	5 C (10-min)			·	✓
Ethylenediamine	107-15-3	HPV	10	10	10				·	✓
Ethylenimine	151-56-4	HPV		0.5					·	✓
Ethylhexanoic acid - Vapor & aerosol 2-	149-57-5	HPV							✓	·
Ethylhexanol 2-	104-76-7	HPV					10		·	✓
Ethylmorpholine N-	100-74-3	HPV	20	5	5				·	✓
Fenamiphos	22224-92-6			0.1	0.1				✓	·
Fensulfothion	115-90-2			0.1	0.1				✓	·
Fenthion	55-38-9			0.2			0.2	0.4 ST	✓	·
Ferbam	14484-64-1		15	10	10				✓	·
Ferrous oxide	1345-25-1								✓	·
Ferrovanadium - dust	12604-58-9		1	1	1	3 ST			✓	·
Fibers, Synthetic Vitreous - Continuous fil. Glass					5				✓	·
Fibers, Synthetic Vitreous - Glass Wool Fibers				1	5				✓	·
Flour dust									✓	·
Fluorides (as F)			2.5	2.5	2.5		1	4 ST	✓	·
Fluorine	7782-41-4		0.1	0.1	0.1				·	✓
Fonofos	944-22-9			0.1	0.1				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Formaldehyde	50-00-0	HPV	0.75	0.75	0.016	0.1 C (15-min)	0.3	0.6 ST	·	✓
Formamide	75-12-7	HPV		10	10				·	✓
Formic acid	64-18-6	HPV	5	5	5		5	10 ST	·	✓
Furfural	98-01-1	HPV	5	2					·	✓
Furfuryl alcohol	98-00-0	HPV	50	10	10	15 ST			·	✓
Gallium arsenide	1303-00-0					0.002 C			✓	·
Gasoline	8006-61-9	HPV		300					·	✓
Germanium tetrahydride	7782-65-2			0.2	0.2				·	✓
Glutaraldehyde	111-30-8	HPV		0.2 C		0.2 C	0.5	0.1 ST	·	✓
Glycerin - mist	56-81-5	HPV	5 and 15	5 and 10					✓	·
Glycidol	556-52-5		50	2	25				·	✓
Glycidyl methacrylate	106-91-2	HPV							·	✓
Glyoxal	107-22-2	HPV							✓	·
Glyoxal - Vapor & Aerosol	107-22-2	HPV							✓	·
Grain dust (oat, wheat, barley)			10	10	4				✓	·
Graphite	7440-44-0	HPV	5 and 15						✓	·
Graphite - All forms except graphite fibers	7782-42-5		15 mmpcf[viii]	5 and 10			1.5 and 4		✓	·
Graphite - All forms except graphite fibers	7782-42-5		15 mmpcf	2.5			1.5 and 4		✓	·
Gypsum	13397-24-5		5 and 15	5 and 10					✓	·
Hafnium and compounds, as Hf	7440-58-6		0.5	0.5	0.5				✓	·
Halothane	151-67-7			2		2 C (60-min)	5	40 ST	·	✓
Heptachlor	76-44-8		0.5	0.05	0.5		0.05	0.4 ST	✓	·
Heptachlor epoxide	7024-57-3								✓	·
Heptane - All isomers									·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Heptane n-	142-82-5	HPV	500	400	85	440 C (15-min)	500		·	✓
Hexachlorobenzene [HCB]	118-74-1			0.025					✓	·
Hexachlorobutadiene	87-68-3			0.02	0.02				·	✓
Hexachlorocyclohexane alpha-	319-84-6						0.5	4 ST	✓	·
Hexachlorocyclohexane beta-	319-85-7						0.5	4 ST	✓	·
Hexachlorocyclopentadiene	77-47-4	HPV		0.01	0.01				·	✓
Hexachloroethane	67-72-1	HPV	1	1	1		1	2 ST	·	✓
Hexachloronaphthalene	1335-87-1		0.2	0.2	0.2				✓	·
Hexadiene 1,4-	592-45-0	HPV							·	✓
Hexafluoroacetone	684-16-2			0.1	0.1				·	✓
Hexafluoropropane 1,1,1,3,3,3-	690-39-1								·	✓
Hexamethylene diisocyanate [HDI] 1,6	822-06-0	HPV		0.005	0.005	0.02 C (10-min)	0.005		·	✓
Hexane n-	110-54-3	HPV	500	50	50		50	400 ST	·	✓
Hexane, other isomers excluding n-hexane				500	100	510 C (15-min)	500	1000 ST	·	✓
Hexanediol diacrylate 1,6-	13048-33-4	HPV							✓	·
Hexene 1-	592-41-6	HPV							·	✓
Hexyl acetate sec-	108-84-9		50	50	50				·	✓
Hexylene glycol	107-41-5	HPV		25 C		25 C	10	20 ST	·	✓
HFE-7100	163702-07-6								·	✓
Hydrazine	302-01-2		1	0.01		0.03 C (2-hr)			·	✓
Hydrazoic acid	7782-79-8						0.1	0.2 ST	·	✓
Hydrogen bromide	10035-10-6		3	3C		3 C	2		·	✓
Hydrogen chloride	7647-01-0		5 C	5C		5 C	2	4 ST	·	✓
Hydrogen cyanide (as CN)	74-90-8		10	4.7 C			1.9	3.8 ST	·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Hydrogen fluoride	7664-39-9		3		3	6 C (15-min)	1	2 ST	·	✓
Hydrogen peroxide	7722-84-1		1	1	1		0.5		·	✓
Hydrogen selenide	7783-07-5		0.05	0.05	0.05		0.006	0.048 ST	·	✓
Hydrogen sulfide	7783-06-4		20 C	10 + 50 C		10 C (10-min)	5	10 ST	·	✓
Hydrogenated terphenyls - Nonirradiated	61788-32-7	HPV		0.5	0.5				·	✓
Hydroquinone	123-31-9	HPV	2	2		2 C			✓	·
Hydroxypropyl acrylate 2-	999-61-1			0.5	0.5				·	✓
Indene	95-13-6			10	10				·	✓
Indium and compounds (as In)	7440-74-6			0.1	0.1				✓	·
Iodine	7553-56-2		0.1 C	0.1 C		0.1 C			·	✓
Iodoform	75-47-8			0.6	0.6				·	✓
Iron (II) oxide	1345-25-1								✓	·
Iron oxide [Fe_2O_3] - dust (as Fe)	1309-37-1		10	5 and 10	5				✓	·
Iron pentacarbonyl	13463-40-6			0.1			0.1	0.2 ST	·	✓
Iron salts - soluble (as Fe)				1	1				✓	·
Isoamyl alcohol	123-51-3		100	100	100	125 ST	20	80 ST	·	✓
Isobutane	75-28-5	HPV			800		1000	4000 ST	·	✓
Isobutyl acetate	110-19-0	HPV	150	150	150		100	200 ST	·	✓
Isobutyl alcohol	78-83-1	HPV	100	50	50		100		·	✓
Isobutylamine	78-81-9						2	4 ST	·	✓
Isobutyraldehyde	78-84-2	HPV							·	✓
Isobutyronitrile	78-82-0	HPV			8				·	✓
Isocyanuric acid	108-80-5	HPV							✓	·
Isooctane	540-81-1								·	✓
Isooctyl 2-propenoate	29590-42-9	HPV							·	✓
Isooctyl alcohol	26952-21-6			50	50				·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Isopentane	78-78-4	HPV	1000				1000	2000 ST	·	✓
Isopentyl acetate	123-92-2		100	100	100		50		·	✓
Isophorone	78-59-1	HPV	25	4	4		2	4 ST	·	✓
Isophorone diisocyanate	4098-71-9	HPV		0.005	0.005	0.02 ST	0.005	0.05 ST, 0.01 C	·	✓
Isophthalic acid	121-91-5	HPV							✓	·
Isoprene	78-79-5	HPV							·	✓
Isopropanol [Isopropyl alcohol]	67-63-0	HPV	400	400	400	500 ST	200	400 ST	·	✓
Isopropoxyethanol 2-	109-59-1			25			5	40 ST	·	✓
Isopropyl acetate	108-21-4	HPV	250	250			100	200 ST	·	✓
Isopropyl ether	108-20-3	HPV	500	250	500		200	400 ST	·	✓
Isopropyl glycidyl ether [IGE]	4016-14-2		50	50					·	✓
Isopropylamine	75-31-0	HPV	5	5			5	10 ST	·	✓
Isopropylaniline N-	768-52-5	HPV		2	2				·	✓
Kaolin	1332-58-7		5 and 15	2	5 and 10				✓	·
Kerosene	8008-20-6	HPV			100				✓	·
Ketene	463-51-4		0.5	0.5	0.5	1.5 ST			·	✓
Lead - elemental and inorganic compounds (as Pb)	7439-92-1		0.05	0.05					✓	·
Lead arsenate (as As)	7784-40-9		0.01	0.01		0.002 C			✓	·
Lead arsenate (as $As_2O_8Pb_3$)	3687-31-8			0.05					✓	·
Lead arsenate [$As_2O_8Pb_3$] (as As)	3687-31-8		0.01	0.05		0.002 C			✓	·
Lead chromate (as Cr)	7758-97-6		0.005	0.012 and 0.05	0.001				✓	·
Lead phosphate (as Pb)	7446-27-7		0.05						✓	·
Limonene d,l-	138-86-3								·	✓
Lindane	58-89-9		0.5	0.5	0.5		0.1	0.8 ST	✓	·
Liquified petroleum gas [L.P.G.]	68476-85-7	HPV	1000	1000	1000				·	✓
Lithium hydride	7580-67-8		0.025	0.025	0.025				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Lithium hydroxide	1310-65-2								✓	·
Lithium oxide	12057-24-8								✓	·
Magnesite	546-93-0		5 and 15		5 and 10				✓	·
Magnesium oxide - Fume	1309-48-4		15	10			4 (inhalable)	1.5 ST (resp)	✓	·
Malathion	121-75-5		15	10			15	60 ST	✓	·
Maleic anhydride	108-31-6	HPV	0.25	0.25	0.25		0.1	0.2 C	·	✓
Malononitrile	109-77-3				3				·	✓
Mancozeb	8018-01-7								✓	·
Manganese - Elemental & inorganic cmpds (as Mn)	7439-96-5		5 C	0.2	1	3 ST	0.02 (resp), 0.2 (inh)	0.16 ST(resp), 1.6 ST(inh)	✓	·
Manganese - Fume (as Mn)	7439-96-5		5 C	0.2	1	3 ST	0.02 (resp)	0.16 ST (resp)	✓	·
Manganese cyclopentadienyl tricarbonyl (as Mn)	12079-65-1		5 C	0.1	0.1				✓	·
Manganese tetroxide (as Mn)	1317-35-7		5 C	0.2					✓	·
m-Dinitrobenzene	99-65-0		1	1	1				✓	·
Melamine	108-78-1	HPV							✓	·
Mercaptobenzothiazole 2-	149-30-4	HPV					4		✓	·
Mercaptoethanol	60-24-2	HPV							·	✓
Mercury - Alkyl compounds (as Hg)	7439-97-6		0.1 C	0.025 and 0.1C	0.01	0.03 ST			✓	·
Mercury - Aryl compounds (as Hg)	7439-97-6		0.1 C	0.025 + 0.1 C		0.1 C			✓	·
Mercury - Elemental (as Hg)	7439-97-6		0.1 C	0.01 + .04 C	0.05		0.02	0.16 ST	✓	·
Mercury - Inorganic compounds (as Hg)	7439-97-6		0.1 C	0.01 + .04 C		0.1 C	0.02	0.16 ST	✓	·
Mesityl oxide	141-79-7	HPV	25	15	10		5	10 ST	·	✓
Metalworking fluids [MWF]					0.4				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Methacrylic acid	79-41-4	HPV		20	20				·	✓
Methanol	67-56-1	HPV	200	200 and 1000 C	200	250 ST	200	800 ST	·	✓
Methomyl	16752-77-5			2.5	2.5				✓	·
Methoxy-1-propanol 2-	1589-47-5						5	40 ST	·	✓
Methoxy-1-propyl acetate 2-	70657-70-4						5	40 ST	·	✓
Methoxy-2-propanol [PGME] 1-	107-98-2	HPV		100	100	150 ST	100	200 ST	·	✓
Methoxy-2-propyl acetate [PGMEA] 1-	108-65-6	HPV		100			50		·	✓
Methoxyacetic acid	625-45-6						1	8 ST	·	✓
Methoxychlor	72-43-5		15	10			15	120 ST	✓	·
Methoxyethanol 2-	109-86-4	HPV	25	5	0.1		1	8 ST	·	✓
Methoxyethyl acetate 2-	110-49-6		25	5	0.1		1	8 ST	·	✓
Methoxyethyl)ether bis (2-)	111-96-6	HPV		1			5	40 ST	·	✓
Methoxyphenol 4-	150-76-5	HPV		5	5				✓	·
Methoxypropyl) ether [DPGME] bis, (2-)	34590-94-8	HPV	100	100	100	150 ST	50		·	✓
Methoxypropylamine 3-	5332-73-0	HPV							·	✓
Methyl 2-cyanoacrylate	137-05-3			2	2	4 ST	2		·	✓
Methyl acetate	79-20-9	HPV	200	200	200	250 ST	100	400 ST	·	✓
Methyl acetylene	74-99-7	HPV	1000	1000	1000				·	✓
Methyl acetylene-propadiene mixture [MAPP]	59355-75-8		1000	1000	1000	1250 ST			·	✓
Methyl acrylate	96-33-3	HPV	10	10	10		5		·	✓
Methyl aniline N-	100-61-8		2	0.5	0.5		0.5	1 ST	·	✓
Methyl bromide	74-83-9	HPV	20 C	5C					·	✓
Methyl chloride	74-87-3	HPV	100	5 and 300 C			50	100 ST	·	✓
Methyl chloroacetate	96-34-4						1		·	✓
Methyl chloroform	71-55-6	HPV	350	350 and 800 C		350 C (15-min)	200		·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Methyl demeton	8022-00-2				0.5		4.8	9.6 ST	✓	·
Methyl ethyl ketone [MEK]	78-93-3	HPV	200	200	200	300 ST	200		·	✓
Methyl ethyl ketone peroxide [MEKP]	1338-23-4	HPV		0.2 C		0.2 C			·	✓
Methyl formate	107-31-3	HPV	100	100	100	150 ST	50	200 ST	·	✓
Methyl hydrazine	60-34-4		0.02 C	0.01 C		0.04 C (2-hr)			·	✓
Methyl iodide	74-88-4		5	2	2				·	✓
Methyl isoamyl ketone	110-12-3	HPV	100	50	50		10	20 ST	·	✓
Methyl isobutyl carbinol	108-11-2	HPV	25	25	25	40 ST	20		·	✓
Methyl isobutyl ketone	108-10-1	HPV	100	50	50	75 ST	20	40 ST	·	✓
Methyl isocyanate	624-83-9	HPV	0.02	0.02	0.02		0.01		·	✓
Methyl isopropyl ketone	563-80-4	HPV		200	200				·	✓
Methyl mercaptan	74-93-1	HPV	10 C	0.5		0.5 C (15-min)	0.5	1 ST	·	✓
Methyl mercury (as Hg)	22967-92-6		0.01		0.01				✓	·
Methyl methacrylate	80-62-6	HPV	100	100	100		50	100 ST	·	✓
Methyl n-amyl ketone	110-43-0	HPV	100	50	100				·	✓
Methyl n-butyl ketone	591-78-6		100	5	1		5	40 ST	·	✓
Methyl parathion	298-00-0			0.2	0.2				✓	·
Methyl pentane 2-	107-83-5	HPV			100	510 C (15-min)	500	1000 ST	·	✓
Methyl pentane 3-	96-14-0				100	510 C (15-min)	500	1000 ST	·	✓
Methyl propyl ketone	107-87-9	HPV	200	200	150				·	✓
Methyl silicate	681-84-5	HPV		1	1				·	✓
Methyl tert-butyl ether [MTBE]	1634-04-4	HPV		40			50	75 ST	·	✓
Methyl-2,3-dihydroisothiazol-3-one 2-	2682-20-4								✓	·
Methyl-2-pyrrolidinone 1-	872-50-4	HPV					20	40 ST	·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Methylacrylonitrile	126-98-7			1	1				·	✓
Methylal	109-87-5	HPV	1000	1000	1000		1000	2000 ST	·	✓
Methylamine	74-89-5	HPV	10	5	10		10		·	✓
Methylbutyl acetate 2-	624-41-9	HPV					50		·	✓
Methylcyclohexane	108-87-2		500	400	400		200	400 ST	·	✓
Methylcyclohexanol	25639-42-3		100	50	50				·	✓
Methylcyclohexanone o-	583-60-8		100	50	50	75 ST			·	✓
Methylcyclopentadienyl manganese tricarbonyl 2-	12108-13-3	HPV		0.2	0.2				✓	·
Methylene bis(4-cyclohexylisocyanate)	5124-30-1	HPV		0.005		0.01 C			·	✓
Methylene dianiline 4,4'-	101-77-9	HPV	0.01	0.01					·	✓
Methyltrichlorosilane	75-79-6	HPV							·	✓
Metribuzin	21087-64-9			5	5				✓	·
Mevinphos	7786-34-7		0.1	0.01	0.1	0.3 ST	0.093	0.186 ST	✓	·
Mica	12001-26-2			3	3				✓	·
Molybdenum - Elemental	7439-98-7		15	5					✓	·
Molybdenum - Insoluble compounds (as Mo)	7439-98-7		15	5 and 10					✓	·
Molybdenum - Soluble compounds (as Mo)	7439-98-7		5	5 and 10					✓	·
Monocrotophos - Vapor & Aerosol	6923-22-4			0.25	0.25				✓	·
Monooctyltin oxide (as Sn)	13356-20-2								✓	·
Monooctyltin trichloride (as Sn)	3091-25-6								✓	·
Monooctyltin tris (2-ethylhexyl thioglycolate (as S)	27107-89-7								✓	·
Monooctyltin tris(isooctyl thioglycolate) (as Sn)	26401-86-5								✓	·
Morpholine	110-91-8	HPV	20	20	20	30 ST	10	20 ST	·	✓
m-Terphenyl	92-06-8	HPV				5C			✓	·
m-Xylene alpha,alpha'-diamine	1477-55-0			0.1 C		0.1 C			✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Naled - Vapor & aerosol	300-76-5		3	3	3		1	2 ST	✓	·
Naphthalene	91-20-3	HPV	10	10	10	15 ST			·	✓
Naphthalene diisocyanate [NDI]	3173-72-6				0.005	0.02 C (10-min)			·	✓
n-Butyl glycidyl ether [BGE]	2426-08-6		270	135		30 C (15-min)			✓	·
Nickel - Elemental / Metal	7440-02-0		1	0.1 and 1	0.015				✓	·
Nickel - Insoluble inorganic compounds (as Ni)	7440-02-0		1	0.1 and 1	0.015				✓	·
Nickel - Soluble inorganic compounds (as Ni)	7440-02-0		1	0.1 and 1	0.015				✓	·
Nickel carbonyl (as Ni)	13463-39-3		0.001	0.001	0.001				·	✓
Nickel chloride (as Ni)	7718-54-9				0.015				✓	·
Nickel dioxide	12035-36-8				0.015				✓	·
Nickel oxide	11099-02-8		1		0.015				✓	·
Nickel sesquioxide	1314-06-3		1		0.015				✓	·
Nickel subsulfide (as Ni)	12035-72-2				0.015				✓	·
Nickel sulfate (as Ni)	7786-81-4		1		0.015				✓	·
Nickelous carbonate	3333-67-3				0.015				✓	·
Nickelous hydroxide (as Ni)	12054-48-7				0.015				✓	·
Nicotine	54-11-5		0.5	0.075	0.5				✓	·
Nitrapyrin	1929-82-4	HPV	5 and 15	5 and 10	5 and 10	20 ST			✓	·
Nitric acid	7697-37-2		2	2	2	4 ST			·	✓
Nitric oxide	10102-43-9		25	25	25				·	✓
Nitroaniline p-	100-01-6	HPV	1	3	3				✓	·
Nitrobenzene	98-95-3	HPV	1	1	1				·	✓
Nitrobutyl)morpholine 4-(2-)	2224-44-4						0.5	1 ST	·	✓
Nitrochlorobenzene p-	100-00-5	HPV	1	0.64					✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Nitroethane	79-24-3	HPV	100	100	100		100	400 ST	·	✓
Nitrogen dioxide	10102-44-0		5 C				0.5		·	✓
Nitrogen trifluoride	7783-54-2		10	10	10				·	✓
Nitroglycerin [NG]	55-63-0	HPV	0.2 C				0.01		·	✓
Nitromethane	75-52-5	HPV	100	2					·	✓
Nitropropane 1-	108-03-2	HPV	25	25	25		25	100 ST	·	✓
Nitropropane 2-	79-46-9	HPV	25	10					·	✓
Nitrotoluene m-	99-08-1	HPV	5	2	2				·	✓
Nitrotoluene o-	88-72-2	HPV	5	2	2				·	✓
Nitrotoluene p-	99-99-0	HPV	5	2	2				·	✓
Nitrous oxide	10024-97-2			50	25		100	200 ST	·	✓
Nonane - All isomers	111-84-2	HPV		200	200				·	✓
Octachloronaphthalene	2234-13-1		0.1	0.1	0.1	0.3 ST			✓	·
Octane - All isomers							500	1000 ST	·	✓
Octane n-	111-65-9	HPV	500	300	75	385 C (15-min)	500	1000 ST	·	✓
Octanol 1-	111-87-5	HPV							·	✓
Octene 1-	111-66-0	HPV							·	✓
Octyl-4-isothiazolin-3-one 2-	26530-20-1						0.05	0.1 ST	✓	·
Oil mist - mineral									✓	·
Osmium tetroxide	20816-12-0			0.0002					·	✓
Osmium tetroxide (as Os)	20816-12-0		0.002	0.002	0.002	0.006 ST			✓	·
Oxalic acid	144-62-7	HPV	1	1	1	2 ST			✓	·
Oxybis (benzenesulfonyl hydrazide) p,p'-	80-51-3	HPV							✓	·
Oxygen difluoride	7783-41-7		0.05	0.05 C		0.05 C			·	✓
Ozone - Heavy work	10028-15-6		0.1	0.1		0.1 C			·	✓
Ozone - Light work	10028-15-6		0.1	0.1		0.1 C			·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Ozone - Light, mod., or heavy workload =/< 2 hrs	10028-15-6		0.1	0.1		0.1 C			·	✓
Ozone - Moderate work	10028-15-6		0.1	0.1		0.1 C			·	✓
Paraffin wax -Fume	8002-74-2	HPV		2	2				✓	·
Paraquat	4685-14-7		0.5						✓	·
Paraquat dichloride	1910-42-5		0.5	0.1 and 0.5	0.1		0.1		✓	·
Paraquat dimethyl sulfate	2074-50-2		0.5	0.1 and 0.5					✓	·
Parathion	56-38-2		0.1	0.1	0.05		0.1	0.8 ST	✓	·
Particulates Not Otherwise			5 and 15	5 and 10					✓	·
Pentaborane	19624-22-7		0.005	0.005	0.005	0.015 ST	0.005	0.01 ST	·	✓
Pentachloroethane	76-01-7						5	10 ST	·	✓
Pentachloronaphthalene	1321-64-8		0.5	0.5	0.5				✓	·
Pentachloronitrobenzene	82-68-8	HPV							✓	·
Pentachlorophenol	87-86-5		0.5	0.5	0.5				✓	·
Pentaerythritol	115-77-5	HPV	5 and 15	5 and 10					✓	·
Pentaerythritol triacrylate	3524-68-3								✓	·
Pentafluoroethane 1,1,1,2,2-	354-33-6								·	✓
Pentafluoropropane 1,1,1,3,3-	460-73-1								·	✓
Pentane - All isomers							1000	2000 ST	·	✓
Pentane n-	109-66-0	HPV	1000	600	120	610 C (15-min)	1000	2000 ST	·	✓
Pentanol 1-	71-41-0	HPV							·	✓
Pentyl acetate	625-16-1						270		✓	·
Pentyl acetate - All isomers							50		·	✓
Pentyl acetate 1-	628-63-7	HPV	100	100	100		50		·	✓
Pentyl acetate 2-	626-38-0		125	125	125		50		·	✓
Pentyl acetate 3-	620-11-1						50		·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Pentyl acetate tert-	625-16-1								·	✓
Perchloromethyl mercaptan	594-42-3	HPV	0.1	0.1	0.1				·	✓
Perchloryl fluoride	7616-94-6		3	3	3	6 ST			·	✓
Perlite	93763-70-3		5 and 15	5 and 10	5 and 10				✓	·
Petroleum distillates [Naphtha]	8002-05-9				350				✓	·
Phenol	108-95-2	HPV	5	5	5	15.6 C (15-min)			·	✓
Phenothiazine	92-84-2	HPV		5	5				✓	·
Phenoxyethanol 2-	122-99-6	HPV					110	220 ST	✓	·
Phenyl ether - Vapor	101-84-8	HPV	1	1	1		1		·	✓
Phenyl ether / Biphenyl mixture - Vapor	8004-13-5		1		1				·	✓
Phenyl glycidyl ether [PGE]	122-60-1		10	0.1		1 C (15-min)			·	✓
Phenyl mercaptan	108-98-5	HPV		0.5		0.1 C (15-min)			·	✓
Phenylenediamine m-	108-45-2	HPV							✓	·
Phenylenediamine o-	95-54-5	HPV							✓	·
Phenylenediamine p-	106-50-3	HPV	0.1	0.1	0.1		0.1	0.2 ST	✓	·
Phenylhydrazine	100-63-0		5	5		0.14 C (2-hr)			·	✓
Phorate	298-02-2			0.05	0.05	0.2 ST			✓	·
Phosgene	75-44-5	HPV	0.1	0.1	0.1	0.2 C (15-min)	0.1	0.2 ST	·	✓
Phosphine	7803-51-2		0.3	0.3	0.3	1 ST	0.1	0.2 ST	·	✓
Phosphoric acid	7664-38-2		1	1	1	3 ST			✓	·
Phosphorus (yellow)	7723-14-0		0.1	0.1	0.1		0.05	0.1 ST	✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Phosphorus oxychloride	10025-87-3			0.1	0.1	0.5 ST	0.2		·	✓
Phosphorus pentachloride	10026-13-8		1	0.1	1		1		✓	·
Phosphorus pentasulfide	1314-80-3		1	1	1	3 ST	1		✓	·
Phosphorus pentoxide	1314-56-3						2	4 ST	✓	·
Phosphorus trichloride	7719-12-2		0.5		0.2	0.5 ST	0.5		·	✓
Phthalic anhydride	85-44-9	HPV	2	1	1				·	✓
Phthalodinitrile m-	626-17-5	HPV		5	5				✓	·
Picloram	1918-02-1		5 and 15	5 and 10					✓	·
Picoline 2-	109-06-8	HPV							·	✓
Picoline 3-	108-99-3								·	✓
Picoline 4-	108-89-4	HPV							·	✓
Picric acid	88-89-1		0.1	0.1	0.1				✓	·
Pindone	83-26-1		0.1	0.1	0.1				✓	·
Piperazine dihydrochloride	142-64-3			5	5				✓	·
Piperidine	110-89-4	HPV							·	✓
Plaster of Paris	26499-65-0		5 and 15	5 and 10					✓	·
Platinum - Metal	7440-06-4			1	1				✓	·
Platinum - Metal	7440-06-4			0.002	1				✓	·
Platinum - Soluble salts (as Pt)	7440-06-4		0.002	0.002 and 1	0.002			0.002 C	✓	·
Polyethylene glycol (s) [average MW 200-600]	25322-68-3						1000	8000 ST	✓	·
Polypropylene glycol (s)	25322-69-4								✓	·
Polyvinyl chloride [PVC]	9002-86-2						1.5 (resp)		✓	·
Portland cement	65997-15-1		5 and 15	5 and 10	5 and 10		5		✓	·
Potassium bromate	7758-01-2								✓	·
Potassium cyanide (as CN)	151-50-8		5			5 C (10-min)	5		✓	·
Potassium hydroxide	1310-58-3			2C		2 C			✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Potassium persulfate (as S_2O_8)	7727-21-1								✓	·
Propane	74-98-6	HPV	1000	1000	1000		1000	4000 ST	·	✓
Propanediol 1,2-	57-55-6	HPV							✓	·
Propanol n-	71-23-8	HPV		200	200	250 ST			·	✓
Propargyl alcohol	107-19-7	HPV		1	1		2	4 ST	·	✓
Propargyl bromide	106-96-7								·	✓
Propiolactone beta-	57-57-8			0.5					·	✓
Propionaldehyde	123-38-6	HPV							·	✓
Propionic acid	79-09-4	HPV		10	10	15 ST	10	20 ST	·	✓
Propionitrile	107-12-0	HPV			6				·	✓
Propoxur	114-26-1			0.5	0.5		2	16 ST	✓	·
Propoxyethanol 2-	2807-30-9	HPV					20	40 ST	·	✓
Propoxyethyl acetate 2-	20706-25-6						20	40 ST	·	✓
Propyl acetate n-	109-60-4	HPV	200	200	200	250 ST	100	200 ST	·	✓
Propyl nitrate n-	627-13-4		25	25	25	40 ST			·	✓
Propylene dichloride	78-87-5	HPV	75	75					·	✓
Propylene glycol dinitrate	6423-43-4	HPV		0.05	0.05		0.05		·	✓
Propylene imine	75-55-8		2	2	2				·	✓
Propylene oxide	75-56-9	HPV	100	20					·	✓
Pyrethrum	8003-34-7		5	5	5		5		✓	·
Pyridine	110-86-1	HPV	5	5	5				·	✓
Quinoline	91-22-5								·	✓
Quinone	106-51-4		0.1	0.1	0.1				·	✓
Resorcinol	108-46-3	HPV	10	10	10	20 ST			·	✓
Rhodium - Insoluble compounds (as Rh)	7440-16-6		0.1	0.001 and 0.1	0.1				✓	·
Rhodium - Metal	7440-16-6		0.1	0.001 and 0.1	0.1				✓	·
Rhodium - Soluble compounds (as Rh)	7440-16-6		0.001	0.001 and 0.1	0.001				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Ronnel [Fenchlorphos]	299-84-3		15	10	10				✓	·
Rosin core solder pyrolysis products		HPV		0.1	0.1				✓	·
Rotenone (commercial)	83-79-4		5	5	5				✓	·
Rouge - listing without CAS No.			5 and 15						✓	·
Rubber solvent (Naphtha)	8030-30-6	HPV	100	100	100				·	✓
Rubber solvent (Naphtha)	8030-30-6	HPV	100	100	100				·	✓
Selenium - Compounds (as Se)	7782-49-2		0.2	0.2	0.2				✓	·
Selenium - Elemental / Metal	7782-49-2		0.2	0.2	0.2		0.02	0.16 ST	✓	·
Selenium - Inorganic compounds (as Se)	7782-49-2		0.2	0.2			0.02	0.16 ST	✓	·
Selenium hexafluoride	7783-79-1		0.05	0.05	0.05				·	✓
Selenium hexafluoride (as Se)	7783-79-1			0.05			0.02	0.16 ST	✓	·
Selenium sulfide (as Se)	7446-34-6		0.2				0.02	0.16 ST	✓	·
Sesone	136-78-7		5 and 15	5 and 10	5 and 10				✓	·
Silica, Amorphous - Diatomaceous earth (calcined)	68855-54-9		Formula				0.3 (resp)		✓	·
Silica, Amorphous -- Fume	69012-64-2		Formula						✓	·
Silica, Amorphous -- Fused	60676-86-0		Formula	0.1	0.05		0.3 (resp)		✓	·
Silica, Amorphous -- Precipitated and gel	112926-00-8		Formula		6		4		✓	·
Silica, Amorphus - Diatomaceous Earth (uncalcined)	61790-53-2		Formula	3 and 6	6		4		✓	·
Silica, Amorphus - Diatomaceous Earth (uncalcined)	61790-53-2		Formula	6	6		4		✓	·
Silica, Crystalline -- Cristobalite	14464-46-1		Formula	0.05	0.05				✓	·
Silica, Crystalline -- Quartz	14808-60-7		Formula	0.3	0.05				✓	·
Silica, Crystalline -- Quartz	14808-60-7		Formula	0.1	0.05				✓	·
Silica, Crystalline -- Tridymite	15468-32-3		Formula	0.05	0.05				✓	·
Silica, Crystalline -- Tripoli	1317-95-9		Formula	0.1	0.05				✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Silicon	7440-21-3		5 and 15	5 and 10	5 and 10				✓	·
Silicon carbide	409-21-2		5 and 15	5 and 10	5 and 10				✓	·
Silicon tetrahydride [Silane]	7803-62-5			5	5				·	✓
Silver - Elemental / Metal	7440-22-4		0.01	0.01	0.01		0.1	0.8 ST	✓	·
Silver - Elemental / Metal	7440-22-4		0.01	0.01	0.01		0.1	0.8 ST	✓	·
Silver - Salts	7440-22-4		0.01	0.01			0.01	0.02 ST	✓	·
Silver - Salts	7440-22-4		0.01	0.01			0.01	0.02 ST	✓	·
Silver - Soluble compounds (as Ag)	7440-22-4		0.01	0.01	0.01				✓	·
Soapstone			20 mmpcf	3 and 6	3 and 6				✓	·
Sodium azide (as Sodium azide)	26628-22-8			0.1 C		0.3 C	0.2	0.4 ST	✓	·
Sodium bisulfite	7631-90-5			5	5				✓	·
Sodium cyanide (as CN)	143-33-9		5			5 C (10-min)	3.8		✓	·
Sodium diethyldithiocarbamate	148-18-5						2	4 ST	✓	·
Sodium fluoroacetate	62-74-8		0.05	0.05	0.05	0.15 ST	0.05	0.2 ST	✓	·
Sodium hydroxide	1310-73-2		2	2C		2 C			✓	·
Sodium metabisulfite	7681-57-4			5	5				✓	·
Sodium persulfate (as S_2O_8)	7775-27-1								✓	·
Sodium pyridinethione	15922-78-8						1	2 ST	✓	·
Sodium pyrithione	3811-73-2						1	2 ST	✓	·
Stannous oxide (as Sn)	21651-19-4			2	2				✓	·
Starch	9005-25-8		5 and 15	5 and 10	5 and 10				✓	·
Stearates									✓	·
Strontium chromate (as Cr)	7789-06-2		0.1 C	0.0005	0.001				✓	·
Strychnine	57-24-9		0.15	0.15	0.15				✓	·
Styrene - monomer	100-42-5	HPV	100	50 and 500 C	50	100 ST	20	40 ST	·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Subtilisins [Proteolytic enzymes]	1395-21-7			6.00E-05					✓	·
Succinonitrile	110-61-2				6				·	✓
Sucrose	57-50-1	HPV	5 and 15	5 and 10	5 and 10				✓	·
Sulfometuron methyl	74222-97-2			3.5					✓	·
Sulfotep [TEDP]	3689-24-5		0.2	0.2	0.2		0.1	0.2 ST	✓	·
Sulfur dioxide	7446-09-5		5	2	2	5 ST	0.5		·	✓
Sulfur hexafluoride	2551-62-4		1000	1000	1000		1000	8000 ST	·	✓
Sulfur monochloride	10025-67-9		1	1C		1 C			·	✓
Sulfur pentafluoride	5714-22-7		0.025	0.01 C		0.01 C			·	✓
Sulfuric acid	7664-93-9		1	1	1		0.1	0.1 ST, 0.2 C	✓	·
Sulfuryl fluoride	2699-79-8		5	5	5	10 ST			·	✓
Sulprofos	35400-43-2			1	1				✓	✓
Talc - Containing asbestos fibers			Use asbestos limit	0.1					✓	·
Talc - Containing no asbestos fibers	14807-96-6		20 mmpcf C	2	2				✓	·
Tantalum - Metal	7440-25-7		5	5	5		1.5 and 4		✓	·
Tantalum oxide - Dust (as Ta)	1314-61-0		5	5	5				✓	·
Tellurium - Compounds (as Te)	13494-80-9		0.1	0.1	0.1				✓	·
Tellurium - Metal	13494-80-9		0.1	0.1	0.1				✓	·
Tellurium hexafluoride	7783-80-4		0.02	0.02	0.02				·	✓
Temephos	3383-96-8		5 and 15	5 and 10	5 and 10				✓	·
TEPP [Tetraethyl pyrophosphate]	107-49-3		0.05	0.004	0.05		0.06	0.12 ST	✓	·
Terbufos - Vapor & aerosol	13071-79-9								✓	·
Terephthalic acid	100-21-0	HPV		10					✓	·
Terphenyl - Mixed isomers	26140-60-3	HPV		0.5 C					✓	·
Terphenyl m-	92-06-8	HPV				5 C			✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Terphenyl o-	84-15-1					5 C			✓	·
Terphenyl p-	92-94-4	HPV				5 C			✓	·
tert-Amyl methyl ether [TAME]	994-05-8	HPV							·	✓
tert-Pentane [Neopentane]	463-82-1	HPV					1000	2000 ST	·	✓
Tetrachloro-1,2-difluoroethane [FC-112] 1,1,2,2-	76-12-0		500	500	500		200	400 ST	·	✓
Tetrachloro-2,2-difluoroethane [FC-11 2a] 1,1,1,2-	76-11-9		500	500	500		200	400 ST	·	✓
Tetrachloroethane 1,1,2,2-	79-34-5	HPV	5	1	1		1	2 ST	·	✓
Tetrachloroethylene [Perchloroethylene]	127-18-4	HPV	100	25 and 300 C					·	✓
Tetrachloronaphthalene	1335-88-2		2	2	2				✓	·
Tetrachloropyridine 2,3,5,6-	2402-79-1	HPV							✓	·
Tetrachlorosilane	10026-04-7								·	✓
Tetraethyl lead (as Pb)	78-00-2	HPV	0.075	0.075	0.075		0.05	0.1 ST	✓	·
Tetraethylene glycol diacrylate	17831-71-9								✓	·
Tetrafluoroethane [HFC 134a] 1,1,1,2-	811-97-2	HPV					1000	8000 ST	·	✓
Tetrafluoroethylene	116-14-3	HPV							·	✓
Tetrahydrofuran	109-99-9	HPV	200	200	200	250 ST	50	100 ST	·	✓
Tetrahydrofurfuryl alcohol	97-99-4	HPV							·	✓
Tetramethyl lead (as Pb)	75-74-1		0.075	0.075	0.075		0.05	0.1 ST	✓	·
Tetramethyl succinonitrile	3333-52-6		0.5	0.5	0.5				·	✓
Tetranitromethane	509-14-8		1	0.005	1				·	✓
Tetrasodium pyrophosphate	7722-88-5			5	5				✓	·
Tetryl	479-45-8		1.5	1.5	1.5				✓	·
Thallium - Elemental	7440-28-0			0.1					✓	·
Thallium - Soluble compounds (as Tl)	7440-28-0		0.1	0.1	0.1				✓	·
Thimerosal	54-64-8		0.1 C			0.1 C			✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Thiobis(6-tert-butyl-m-cresol) 4,4'-	96-69-5	HPV	5 and 15	5 and 10	5 (resp), 10 (total)				✓	·
Thioglycolic acid	68-11-1	HPV		1	1				·	✓
Thiram	137-26-8	HPV	5	5	5		1	2 ST	✓	·
Tin - Inorganic compounds (as Sn)	7440-31-6		2	0.1	2				✓	·
Tin - Metal	7440-31-5		2		2				✓	·
Tin - Organic compounds (as Sn)	7440-31-6		0.1	0.1	0.1				✓	·
Tin dioxide (as Sn)	18282-10-5				2				✓	·
Titanium tetrachloride	7550-45-0								✓	·
Tolidine o-	119-93-7					0.02 C (60-min)			✓	·
Toluene	108-88-3	HPV	200	50 and 500C	100	150 ST	50	200 ST	·	✓
Toluene-2,4-diamine	95-80-7	HPV							·	✓
Toluene-2,4-diisocyanate [2,4-TDI]	584-84-9	HPV	0.02 C	0.005 and 0.02 C					·	✓
Toluenediamine - Mixed isomers	25376-45-8	HPV							·	✓
Toluenesulfonyl chloride p-	98-59-9								✓	·
Toluidine m-	108-44-1	HPV		2					·	✓
Toluidine o-	95-53-4	HPV	5	2					·	✓
Toluidine p-	106-49-0	HPV		2					·	✓
Tributyl phosphate	126-73-8	HPV	5	0.2	2.5		11	44 ST	✓	·
Tributyl tin benzoate (as TBTO)	4342-36-3						0.0021		·	✓
Tributyltin fluoride (as TBTO)	1983-10-4						0.0021		·	✓
Tributyltin linoleate (as TBTO)	24124-25-2						0.0021		·	✓
Tributyltin methacrylate (as TBTO)	2155-70-6						0.0021		·	✓
Tributyltin naphthenate (as TBTO)	85409-17-2						0.0021		·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Trichloro-1,2,2-trifluoroethane [FC-113] 1,1,2-	76-13-1	HPV	1000	1000 and 2000 C	1000	1250 ST	500	1000 ST	·	✓
Trichloroacetic acid	76-03-9			1	1				·	✓
Trichlorobenzene - All isomers	12002-48-1						5	10 ST	·	✓
Trichlorobenzene 1,2,3-	87-61-6	HPV					5	10 ST	·	✓
Trichlorobenzene 1,3,5-	108-70-3						5	10 ST	·	✓
Trichloroethane 1,1,2-	79-00-5	HPV	10	10	10		10	20 ST	·	✓
Trichloroethylene	79-01-6	HPV	100	25 and 300 C	25	2 C (60-min)			·	✓
Trichlorofluoromethane [FC-11]	75-69-4	HPV	1000	1000 C		1000 C	1000	2000 ST	·	✓
Trichloronaphthalene	1321-65-9		5	5	5				✓	·
Trichlorophenoxyacetic acid] 2,4,5-T [2,4,5-]	93-76-5		10	10	10		10	20 ST	✓	·
Trichloropropane 1,2,3-	96-18-4	HPV	50	10	10				·	✓
Trichlorosilane	10025-78-2								·	✓
Triethanolamine	102-71-6	HPV		5					✓	·
Triethoxysilane	998-30-1								·	✓
Triethylamine	121-44-8	HPV	25	1C			1	2 ST	·	✓
Triethylene glycol diacrylate	1680-21-3								✓	·
Triethylenetetramine	112-24-3	HPV							·	✓
Trifluorobromomethane [F-13B1]	75-63-8	HPV	1000	1000	1000		1000	8000 ST	·	✓
Trifluoroethane 1,1,1-	420-46-2								·	✓
Trifluoroethanol 2,2,2-	75-89-8	HPV							·	✓
Triglycidyl-s-triazinetrione 1,3,5-	2451-62-9	HPV							✓	·
Trimellitic anhydride	552-30-7	HPV		0.005 C	0.04		0.04		✓	·
Trimethoxysilane	2487-90-3	HPV							·	✓
Trimethyl benzene - Mixed isomers							20	40 ST	·	✓
Trimethyl benzene [Mesitylene] 1,3,5-	108-67-8	HPV			25		20	40 ST	·	✓
Trimethyl benzene 1,2,3-	526-73-8				25		20	40 ST	·	✓
Trimethyl benzene 1,2,4-	95-63-6	HPV			25		20	40 ST	·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Trimethyl phosphite	121-45-9	HPV		2	2				·	✓
Trimethylamine	75-50-3	HPV		5					·	✓
Trimethylchlorosilane	75-77-4	HPV							·	✓
Trimethylolpropane triacrylate	15625-89-5	HPV							✓	·
Trimethylolpropane trimethacrylate	3290-92-4	HPV							✓	·
Tri-n-butyltin chloride (as TBTO)	1461-22-9	HPV					0.0021		·	✓
Tri-n-butyltin)oxide [TBTO] (as TBTO) bis(	56-35-9	HPV					0.0021		·	✓
Trinitrotoluene [TNT] 2,4,6-	118-96-7		1.5	0.5	0.5				✓	·
Triorthocresyl phosphate	78-30-8		0.1	0.1	0.1				✓	·
Triphenyl amine	603-34-9			5	5				✓	·
Triphenyl phosphate	115-86-6	HPV	3	3	3				✓	·
Tungsten - Insoluble compounds (as W)	7440-33-7			1 and 5	5	10 ST			✓	·
Tungsten - Metal	7440-33-7			1 and 5	5	10 ST			✓	·
Tungsten - Soluble compounds (as W)	7440-33-7			5	1	3 ST			✓	·
Tungsten carbide - Containing > 0.3% nickel, as Ni	12070-12-1				0.015				✓	·
Tungsten carbide - Containing > 2% cobalt, as Co	12070-12-1				0.05				✓	·
Turpentine	8006-64-2	HPV	100	100	100				·	✓
Uranium - Compounds (as U)	7440-61-1			0.05 and 0.2					✓	·
Uranium (Natural) - Insoluble compounds (as U)	7440-61-1		0.05	0.05 and 0.2	0.2	0.6 ST	0.2	0.4 ST	✓	·
Uranium (Natural) - Soluble compounds (as U)	7440-61-1		0.25	0.05 and 0.2	0.05				✓	·
Urea	57-13-6	HPV							✓	·
Valeraldehyde n-	110-62-3	HPV		50	50				·	✓
Vanadium pentoxide - Dust (as V_2O_5)	1314-62-1		0.5 C	0.05					✓	·
Vanadium pentoxide - Fume (as V_2O_5)	1314-62-1		0.1 C	0.05					✓	·

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Vanadium pentoxide (as V_2O_5)	1314-62-1			0.05					✓	·
Vegetable oil - Mists			5 and 15	5 and 10	5 and 10				✓	·
Vinyl acetate	108-05-4	HPV		10		4 C (15-min)			·	✓
Vinyl bromide	593-60-2			5					·	✓
Vinyl chloride	75-01-4	HPV	1	1					·	✓
Vinyl cyclohexene 4-	100-40-3	HPV		0.1					·	✓
Vinyl cyclohexene dioxide	106-87-6			0.1	10				·	✓
Vinyl fluoride	75-02-5	HPV			1	5 C (15-min)			·	✓
Vinyl toluene [Methyl styrene] - Mixed isomers	25013-15-4	HPV	100	50	100		100	200 ST	·	✓
Vinylidene chloride	75-35-4	HPV		1			2	4 ST	·	✓
Vinylidene fluoride	75-38-7	HPV			1	5 C (15-min)			·	✓
Vinyltrichlorosilane	75-94-5	HPV							·	✓
Warfarin	81-81-2		0.1	0.1	0.1		0.02	0.16 ST	✓	·
Welding fumes - not otherwise specified				5					✓	·
Wood dust					1				✓	·
Wood dust - Beech & oak					1				✓	·
Wood dust - Birch, mahogany, teak, walnut					1				✓	·
Wood dust - Hardwood					1				✓	·
Wood dust - Softwood					1				✓	·
Wood dust - Western red cedar				2.5	1				✓	·
Xylene - Mixed isomers	1330-20-7	HPV		100 and 300 C			100	200 ST	·	✓
Xylene m-	108-38-3	HPV	100		100	150 ST	100	200 ST	·	✓
Xylene o-	95-47-6	HPV	100		100	150 ST	100	200 ST	·	✓

Chemical	CAS Number[i]	TSCA HPV[ii]	OSHA PEL[iii]	CA 8 hr PEL[iv]	REL[v] TWA	REL ST/C[vi]	MAK[vii] TWA	MAK ST/C	mg/m^3	PPM
Xylene p-	106-42-3	HPV	100		100	150 ST	100	200 ST	·	✓
Xylidine - Mixed isomers (Vapor & aerosol)	1330-73-8		5		2				·	✓
Yttrium - Compounds (as Y)	7440-65-5		1	1	1				✓	·
Yttrium - Metal	7440-65-5		1	1	1				✓	·
Zinc beryllium silicate (as Be)	39413-47-3		0.002			0.005 C			✓	·
Zinc chloride - Fume	7646-85-7		1	1	1	2 ST			✓	·
Zinc chromate (as Cr)	13530-65-9		0.1 C	0.01	0.001				✓	·
Zinc oxide - Dust	1314-13-2		5 and 15	5 and 10	5	15 C			✓	·
Zinc oxide - Fume	1314-13-2		5	5 and 10	5	10 C	1 (resp)	1 ST (resp)	✓	·
Zinc potassium chromate (as Cr)	11103-86-9		0.005	0.005	0.01				✓	·
Zinc stearate	557-05-1	HPV	5 and 15	10	5 and 10				✓	·
Zinc yellow (as Cr)	37300-23-5			0.01					✓	·
Zirconium - Compounds (as Zr)	7440-67-7		5	5	5	10 ST			✓	·
Zirconium - Elemental	7440-67-7			5			1		✓	·
Zirconium - Insoluble compounds (as Zr)	7440-67-7			5			1		✓	·

[i] CAS Registry: http://www.cas.org/expertise/cascontent/registry/index.html
[ii] HPV Chemical Hazard Characterizations: http://iaspub.epa.gov/oppthpv/hpv_hc_characterization.get_report?doctype=2
[iii] Title 29, Code of Federal Regulations (CFR) 1910, Occupational Safety and Health Standards, Subpart Z, Toxic and Hazardous Substances: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10147
[iv] California Code of Regulations, Title 8, Section 5155. Airborne Contaminants. Table AC-1 Permissible Exposure Limits For Chemical Contaminants: http://www.dir.ca.gov/title8/5155table_ac1.html
[v] NIOSH Pocket Guide to Chemical Hazards: http://www.cdc.gov/niosh/npg/pgintrod.html
[vi] Short Term/Ceiling
[vii] Deutsche Forschungsgemeinschaft (German Research Foundation, DFG), .Maximale Arbeitsplatz-Konzentrationen, MAK-Collection for Occupational Health and Safety, 2010. More information at: http://osha.europa.eu/en/topics/ds/oel/members.stm
[viii] Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques