



HUMBOLDT STATE UNIVERSITY

CHEMICAL HYGIENE PLAN

Developed by HSU Environmental Health & Safety
in partial fulfillment of the
California Code of Regulations Title 8, §5191
Occupational Exposure to Hazardous Chemicals in Laboratories

Effective 7/1/12

Humboldt State University
Chemical Hygiene Plan

- I. REGULATORY AUTHORITY
- II. ADMINISTERING AGENCY
- III. POLICY
- IV. PURPOSE
- V. SCOPE
- VI. RESPONSIBILITIES, TITLE 8 CCR, §5919 (e)(3)(G)
- VII. STANDARD OPERATING PROCEDURES, TITLE 8 CCR, §5919 (e)(3)(A)
- VIII. CONTROL MEASURES AND EQUIPMENT, TITLE 8 CCR, §5919 (e)(3)(B)
- IX. MEDICAL CONSULTATION AND MONITORING, TITLE 8 CCR, §5919 (e)(3)(F)
- X. PARTICULARLY HAZARDOUS SUBSTANCES, TITLE 8 CCR, §5919 (e)(3)(H)
- XI. TRAINING, TITLE 8 CCR, §5919 (e)(3)(D)
- XII. APPROVAL PROCEDURES, TITLE 8 CCR, §5919 (e)(3)(E)
- XIII. PROCUREMENT AND GIFTS
- XIV. UPSET CONDITIONS/SPILLS, RELEASES AND ACCIDENTS
- XV. HAZARDOUS WASTE MANAGEMENT
- XVI. RECORDS AND RECORDKEEPING
- XVII. CHANGES TO THE UNIVERSITY CHEMICAL HYGIENE PLAN
- XVIII. DEFINITIONS

- APPENDIX A: Select Carcinogens
- APPENDIX B: Cal/OSHA Permissible Exposure Limits for Chemical Contaminants
- APPENDIX C: Title 8 CCR, §5191 – Occupational Exposure to Chemicals in Laboratories
- APPENDIX D: Chemical Compatibility Chart
- APPENDIX E: Peroxide-Forming Chemicals
- APPENDIX F: Laboratory Inspection Checklist
- APPENDIX G: PPE Selection Guide
- APPENDIX H: Select Agents and Toxins List

I. REGULATORY AUTHORITY

- a. U.S. authority is codified in the Code of Federal Regulations, Title 29, §1910.1450
- b. California State authority is codified in the California Code of Regulations, Title 8, §5191 (see APPENDIX C)
 - i. Unless otherwise indicated, California regulations shall supersede Federal regulations.

II. ADMINISTERING AGENCY

- a. The administering agency for occupational health and safety in California is the Department of Industrial Relations, Occupational Health and Safety Administration (Cal/OSHA)
 - i. Under the Section 18 of the Occupational Safety and Health Act (1970), U.S. states and territories are permitted to adopt federally approved occupational safety and health plans. These plans, **which replace federal OSHA enforcement** and receive partial funding from the federal government, are required to be at least as effective in protecting workers as OSHA.
 - ii. They are also required to cover public sector employees (federal OSHA does not cover such workers).

III. POLICY

- a. It is the commitment of Humboldt State University to maintain a safe and healthful environment for its students, faculty, staff, and visitors. Based on principles of occupational safety, industrial hygiene, academic excellence, and fiscal responsibility, the University will promote comprehensive injury and illness prevention, and hazardous materials management programs. University operations shall be conducted in compliance with applicable regulations and accepted practices for health, safety and environmental protection. (from the HSU IIPP)

IV. PURPOSE

- a. OSHA (State and Federal), recognizing the unique characteristics of the laboratory workplace, has tailored a standard for occupational exposure to hazardous chemicals in laboratories. This standard is often referred to as the "Laboratory Standard". Under this standard, a laboratory is required to produce a Chemical Hygiene Plan (CHP) which addresses the specific hazards found in its location, and its approach to them.
- b. This document is designed to facilitate implementation of the CHP at the campus level.
- c. Lab specific SOPs will be developed and appended to each CHP to make it more than more functional as a lab specific CHP. There will be no dept. specif CHP's.

V. SCOPE

- a. The Laboratory Standard applies to all employers engaged in the laboratory use of hazardous chemicals. (see Laboratory Use of Hazardous Chemicals in definitions).
- b. The Laboratory Standard does not apply to:
 - i. Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant regulations in Title 8, California Code of Regulations, even if such use occurs in a laboratory.
 - ii. Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:
 1. Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and
 2. Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

VI. RESPONSIBILITIES

- a. The ultimate responsibility for establishing and maintaining effective policies regarding environmental health and safety issues rests with the University President. General policies which govern the activities and responsibilities of the environmental health and safety program are thereby established under the authority of the President.
- b. EH&S shall provide direct support to each area requiring a CHP by providing the following services:
 - i. Interpretation of and guidance pertaining to, the Cal /OSHA Laboratory Standard.
 - ii. Conduct periodic safety inspections of laboratory spaces.
 - iii. Conduct safety training as required by this CHP.
 - iv. Provide guidance in all aspects concerning safe laboratory design.
 - v. Provide guidance in all aspects of safe chemical use and management.
 - vi. Provide guidance in all aspects of selection of Personal Protective Equipment (PPE)
 - vii. Serve as the principal point of contact with outside enforcement agencies.
- c. The Chemical Hygiene Officer (CHO) shall be responsible for the creation, implementation and oversight of the CHP.
 - i. The EH&S Specialist shall be the CHO and shall have the authority to enforce the requirements set forth in this plan.
 - ii. Departments may designate an internal Chemical Hygiene Coordinator (CHC). The departmental CHC shall work with the CHO to develop, implement and maintain the plan as a working document.
- d. The Deans shall be responsible for implementing the CHP within each college.
- e. Department Chairs shall be responsible to ensure that all employees in their departments comply with the requirements of this CHP.
- f. All affected employees shall be responsible for complying with this CHP.

VII. STANDARD OPERATING PROCEDURES, TITLE 8 CCR, §5919 (e)(3)(A)

- a. General Rules
 - i. Know how to access Safety Data Sheets (SDS) for all hazardous chemicals in the laboratory.
 - ii. Know how to access the chemical inventory
 - iii. Be aware of the chemical hazards as determined from the SDS and other appropriate references.
 - iv. Wear appropriate personal protective equipment whenever working with chemicals.
 - v. Understand appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures and proper waste disposal.
 - vi. Know the location and proper use of emergency equipment (e.g., fire extinguishers, emergency eyewash and shower).
 - vii. Use proper personal hygiene practices including washing hands after handling chemicals and before leaving the laboratory. The use of gloves does not preclude the need to wash hands.
 - viii. If chemicals have been spilled in the eyes or on the body, flush in the eyewash/safety shower for at least fifteen minutes. Seek medical attention.
 - ix. When working with flammable chemicals, be certain there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release of liquid spill.
 - x. Be alert to unsafe conditions and correct them or report them as soon as they are detected.
 - xi. Know how and where to properly store chemicals when not in use.
 - xii. Always consider using a less-hazardous chemical in the process.
 - xiii. Do not bring food, beverages, tobacco, or apply cosmetics in chemical use or storage areas.

- xiii. Do not use glassware which is damaged and unsafe.
- b. Working Alone
 - i. Working alone in certain circumstances, situations, or environments is unsafe and requires special arrangements to minimize potential hazards.
 - ii. Work of a clearly hazardous nature (e.g., tasks involving high energy, toxic, flammable, cryogenic, or high pressure materials) must not be conducted alone.
 - iii. Hazardous activities must be scheduled during hours when another worker capable of helping in an emergency is present (within earshot).
- c. Unattended Operations
 - i. When possible, do not leave hazardous chemical processes unattended.
 - ii. If a hazardous chemical process must be left unattended, access must be restricted to authorized persons only.
 - iii. Post a notification including chemical process and emergency contact information on the door or near the process.
 - iv. Provide for proper ventilation. Conduct operations with hazardous or odiferous chemicals in fume hoods.
- d. Personal Hygiene
 - i. Wash promptly whenever a chemical has contacted the skin.
 - ii. Avoid the inhalation of chemical vapors.
 - iii. Do not use mouth suction to pipette anything; use mechanical pipettes.
 - iv. Wash well with soap and water prior to leaving the lab.
- e. Personal Protective Equipment (as required by CalOSHA standards and in accordance with American National Standards Institute [ANSI] performance standards.)
 - i. Eye protection is required to be worn in all areas when there is a risk of receiving eye injuries such as punctures, abrasions, contusions, or burns as a result of contact with flying particles, hazardous substances, projections or injurious light rays. Safety glasses must have side shields and meet the ANSI Z87.1 (1989) standard for impact resistance.
 - ii. Safety glasses shall be supplemented with goggles and/or face shields when there is a likelihood of splashed chemicals or flying particles (e.g., when pouring or mixing chemicals and handling cryogens).
 - iii. Lab coats or aprons should be worn when performing a chemical process or procedure which may result in contamination of the clothing with hazardous chemicals.
 - iv. Gloves must be available and resistant to the type of chemical being used. Nitrile gloves (6-8 mils) are acceptable for most laboratory work where the intended use is to prevent incidental contact with hazardous materials. Processes where there is direct chemical contact require the user to consult the SDS or compatibility guides provided by the glove manufacturer. An example of a glove compatibility guide is included in Appendix G.
 - v. Inspect gloves prior to use to ensure they are in good condition.
 - vi. Wear closed-toe footwear in the laboratory, not sandals or other open-toed footwear.
 - vii. Long hair and loose clothing must be confined.
 - viii. Carefully inspect all protective equipment before using. Do not use defective protective equipment.
- f. Housekeeping
 - i. Access to emergency equipment, showers, eyewashes, aisles and exits shall never be blocked by anything.
 - ii. Keep all work areas, especially laboratory benches, clean and free of clutter.
 - iii. Chemical containers must be labeled with the identity of the contents and the hazards of the material.

- iv. All hazardous chemicals shall be closed and stored properly when not in use.
 - v. Wastes shall be properly labeled and containers should be closed and kept in the appropriate storage location.
 - vi. Clean up spilled chemicals promptly. Contact with dried residue of some chemicals can cause irritation or burns to the skin.
- g. Chemical Storage
- i. Properly segregate incompatible chemicals (Appendix D).
 - ii. Corrosive, flammable and toxic liquids should be stored below eye level.
 - iii. Properly dispose of unneeded or outdated chemicals.
 - iv. Do not exceed the capacity of refrigerators or storage cabinets recommended by the manufacturer.
- h. Chemicals of Moderate, Chronic or Acute Toxicity
- i. A chemical is considered toxic if it exerts harmful effects on a biological mechanism. The SDS will provide information on the toxicity of chemicals.
 - ii. When working with volatile liquids, gases, or dispersible powders the process may result in the chemical's becoming airborne. A chemical fume hood or other local exhaust ventilation must be used.
 - iii. Wear appropriate gloves and a lab coat.
 - iv. Always practice good personal hygiene.
 - v. Ensure that two people are present when the work involves materials that are highly toxic or of unknown toxicity.
- i. Flammable Liquids
- i. Flammable liquid cabinets must be used if greater than 10 gallons of flammable liquids are stored in the laboratory.
 - ii. Ensure flammable liquid storage cabinets are labeled.
 - iii. Chemicals with a flash point less than 140 °F should be stored in a flammable liquid storage cabinet or designated flammable storage location.
 - iv. Place flammable liquid storage cabinets away from sources of ignition.
 - v. Store only compatible material inside the cabinet.
 - vi. Do not store paper or other combustible material in a flammable liquid storage cabinet.
- j. Corrosive Liquids
- i. Personnel using corrosive liquids shall prevent contact with the eyes and skin by wearing safety glasses or goggles, chemical resistant gloves and a lab coat or apron.
 - ii. Fuming and concentrated acids shall be handled in a chemical fume hood.
 - iii. Do not pour water into acid. Slowly add the acid to the water and stir.
 - iv. Know the location of the nearest eyewash and safety shower before beginning a procedure.
- k. Compressed Gas Cylinders
- i. Cylinders of compressed gas shall be stored in areas where they are protected from external heat sources such as flame impingement, intense radiant heat, electric arc, or high temperature steam lines.
 - ii. Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 feet from highly combustible materials such as oil or excelsior. Assigned storage spaces shall be located where cylinders will not be damaged by passing or falling objects, or subject to tampering by unauthorized persons.
 - 1. Note: Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways.
 - iii. Cylinders shall not be kept in unventilated enclosures such as lockers and cupboards.
 - 1. Exception: Cylinders of fire suppressant gases.

- iv. Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials (especially oil or grease) a minimum distance of 20 feet or by a non-combustible barrier at least 5 feet high, or a minimum of 18 inches (46 centimeters) above the tallest cylinder and having a fire-resistance rating of at least one hour.
- v. Compressed gas cylinders shall be stored or transported in a manner to prevent them from creating a hazard by tipping, falling or rolling. Liquefied fuel-gas cylinders shall be stored or transported in a position so that the safety relief device is in direct contact with the vapor space in the cylinder at all times.
- vi. All cylinders which are designed to accept valve protection devices shall be equipped with such devices when the cylinders are not in use or connected for use.
- vii. Unless cylinders are secured on a special truck or rack, regulators shall be removed and valve-protection devices, when provided for, shall be put in place before cylinders are moved.
- viii. Compressed gas cylinders in portable service shall be conveyed by suitable trucks to which they are securely fastened; and all gas cylinders in service shall be securely held in substantial racks or secured to other rigid structures so that they will not fall or be knocked over.
 1. Exception: When it is not practicable to transport cylinders by truck, nor to bring in racks to point of operation, as in some construction work, cylinders may be carried in, and properly secured in an adequate manner. For short distances, cylinders may be moved by tilting and rolling them on their bottom edges.
- ix. Valve protection devices shall not be used for lifting cylinders.
 1. Exception: Valve protection devices may be used for manual lifting if they were designed for that purpose.
- x. Bars shall not be used under valves or valve protection caps to pry cylinders loose when frozen to the ground or otherwise fixed; the use of warm (not boiling) water is recommended.
 1. Note: Valve protection devices are designed to protect cylinder valves from damage.
- xi. Cylinder valves shall be closed before moving cylinders.
- xii. Cylinder valves shall be closed when work is finished.
- xiii. Valves of empty cylinders shall be closed.
- xiv. Cylinders shall not be dropped or struck or permitted to strike each other violently.
- xv. Cylinder valves not provided with fixed hand-wheels shall have keys or handles on valve spindles or stems while cylinders are in service. In multiple cylinder installations only one key or handle is required for each manifold.
- xvi. Leaking regulators, cylinder valves, hose, piping systems, apparatus and fittings shall not be used.
 1. Note: (1) Cylinder valves shall not be tampered with nor should any attempt be made to repair them. If trouble is experienced, the supplier should be sent a report promptly indicating the character of the trouble and the cylinder's serial number. Supplier's instructions as to its disposition shall be followed.
 2. Note: (2) Complete removal of the stem from a diaphragm-type cylinder valve shall be avoided.
- xvii. Cylinders shall never be used as rollers or supports, whether full or empty.
- xviii. Cylinders must not be placed where they might form part of an electric circuit.
- xix. No one shall use a cylinder's contents for purposes other than those intended by the supplier.

- xx. Cylinders. Employers must ensure that the in-plant transfer, handling, storage, and the use of acetylene in cylinders comply with the provisions of CGA G-1-2003 Acetylene, Eleventh Edition which is hereby incorporated by reference.
- xxi. When flammable gas lines or other parts of equipment are being purged of air or gas, open lights or other sources of ignition shall not be permitted near uncapped openings.
- I. Reactive Chemicals
 - i. All personnel who have management authority over laboratory operations must identify and evaluate the use of all reactive chemicals in the work area to determine the extent of the hazard and to evaluate the controls necessary to safeguard employee health.
 - ii. Laboratory managers must ensure that laboratory workers understand the hazards of reactive chemicals and are aware of proper handling and storage procedures. This information is available on the SDS for the chemical.
 - iii. The labels of peroxide-forming chemicals shall be marked with the date of receipt.
 - iv. Peroxide-forming chemicals shall be disposed of, or tested, prior to the end of their shelf life (Appendix E).
- ii. Cryogenic Materials
 - i. Cryogenic fluids shall be stored or handled only in containers designed for such use.
 - ii. When personal contact with a cryogenic fluid is possible, (as when preparing cold baths or dispensing liquid nitrogen), a full-face shield should be worn in addition to goggles.
 - iii. Wearing of watches, rings, or other items that may trap the cryogenic material should be avoided.
 - iv. When gloves are worn while handling cryogenic materials, they should be dry, impervious and loose enough to be easily tossed off the hands.
 - v. Cryogenic materials shall be dispensed and used in areas with good ventilation.

VIII. CONTROL MEASURES AND EQUIPMENT, TITLE 8 CCR, §5919 (e)(3)(B)

Chemical safety is achieved by being continually aware of chemical hazards and by keeping chemicals under control using safe work practices, engineering safeguards (such as hoods), and other protective measures. All laboratory personnel should be alert to recognize the malfunction of engineering, and other safeguards, and shall report through their supervisor to EH&S or Plant Operations any unsafe conditions and/or accidents.

The organizational unit shall always design safety procedures into a potentially hazardous process. Only when engineering controls, such as fume hoods and glove boxes, are determined to be insufficient will personal protective equipment, administrative controls, and other corrective measures be considered to achieve permissible levels of exposure.

- a. Exposure Control
 - i. Control measures shall be established to ensure that no worker is exposed to airborne concentrations of hazardous materials equal to, or greater than, the permissible exposure limits (PEL) (or action limits if they exist for the material in question) established by Cal/OSHA.
 - ii. The Chemical Hygiene Officer shall perform qualitative or quantitative personal exposure monitoring, as necessary, to verify that employee exposures are less than published limits.
 - iii. Organizational units shall take the steps necessary to eliminate, or reduce to the lowest practical level, worker exposure to contaminants by inhalation, ingestion, absorption, etc.
 - 1. The overriding philosophy pertaining to employee exposure shall be ALARA (As Low As Reasonably Achievable)

- iv. Workers, Laboratory Supervisors, or heads of organizational units, may request industrial hygiene monitoring of work areas from the Office of Environmental Health & Safety.

b. Ventilation

Each laboratory or chemical storage area must be provided with ventilation of sufficient quality and quantity to provide comfort to the occupants and control ordinary odors generated by human activity. The general laboratory ventilation system is not designed to protect the worker from airborne chemical hazards. Any chemical process which generates hazardous or odiferous vapors, gasses, aerosols or particulates must be performed in a fume hood.

- i. Fume hood sashes should be closed except when necessary to adjust the apparatus inside the hood or to conduct a chemical procedure.
- ii. Fume hoods must provide an average linear face velocity of 100 feet per minute with a minimum of 70 feet per minute at any one location. If the hood is unable to attain the required face velocity, the sash will be lowered until a satisfactory velocity is achieved. The hood shall be marked indicating the maximum sash height.
- iii. The hood fan shall be kept in operation whenever a chemical is inside the hood, whether or not any work is being performed in the hood.
- iv. Fume hoods should not be used as storage areas for chemicals, apparatus, or other materials. Excessive storage reduces the ability of the hood to contain airborne contaminants.
 - 1. Exception: Hoods may be used for extended chemical storage with EH&S approval.
- v. The performance of all fume hoods shall be evaluated at least annually. Ensure the fume hood has an inspection tag indicating the maximum sash height. If the tag is not present, contact EH&S.
- vi. By January 1, 2008, hoods shall have been equipped with a quantitative airflow monitor that continuously indicates whether air is flowing into the exhaust system during operation. The quantitative airflow monitor shall measure either the exact rate of inward airflow or the relative amount of inward airflow. Examples of acceptable devices that measure the relative amount of inward airflow include: diaphragm pressure gauges, inclined manometers, and vane gauges. The requirement for a quantitative airflow monitor may also be met by an airflow alarm system if the system provides an audible or visual alarm when the airflow decreases to less than 80% of the airflow required in ii above.

c. Emergency Eyewashes and Safety Showers

- i. Emergency eyewashes and safety showers are required in areas where splash hazards to corrosives, eye irritants or chemicals that are toxic via skin and/or eye contact exist. They must be in accessible locations that require no more than ten (10) seconds for the injured person to reach.
- ii. Access to eyewash fountains and safety showers must not be restricted or blocked in any way.
- iii. Eyewash fountains must be activated at least once per semester by the user and the activity documented on the inspection tag.
- iv. Safety showers must be activated monthly by Plant Operations and the activity documented on the inspection tag.

d. Hazard Identification

- i. Labels: Whenever possible, chemicals shall be stored in their original container with label integrity maintained. Re-containing chemicals is discouraged. If chemicals are to be re-

contained, the label on the new container must include the complete chemical name and an indication of the hazards.

- ii. Small containers and vials with chemically compatible contents may be stored in a secondary container which is labeled with a description of the contents and the hazards.
- iii. If the chemical is produced exclusively for the laboratory of origin, the Laboratory Supervisor will determine if it is a hazardous chemical in accordance with the CalOSHA Hazard Communication Standard, Title 8, §5194. If it is a hazardous chemical, the Laboratory Supervisor will provide and document training on its proper handling and storage.
- iv. If the chemical produced is transferred to a user outside this University, the Laboratory Supervisor will comply with the HSU Hazard Communication Program, including labeling and preparation of the SDS.
- v. Solutions of known hazardous chemicals produced in a laboratory/chemical handling area must be labeled with the name(s) and hazard characteristic(S) in English, and dated.
 1. If the identity of the contents of a solution is unknown, then words describing the properties of the solution should be used.

IX. Medical Consultation and Monitoring, Title 8 CCR § 5191 (e)(3)(F)

Certain employees are required to participate in the Medical Monitoring Program due to known exposures to chemical or physical agents. In addition, an opportunity to receive medical consultation at the employer's expense shall be provided to workers under the following circumstances:

- a. An employee develops any signs or symptoms thought to arise from chemical exposure.
- b. After a major chemical release, accident, or incident which may have resulted in an employee being exposed to a chemical.
- c. The supervisor, Laboratory Supervisor, or Chemical Hygiene Officer has determined that a chemical has exceeded the permissible exposure limit and the worker has been exposed.

Requests for medical consultation and/or monitoring should be made to the Office of Environmental Health & Safety. Medical monitoring records shall be maintained in accordance with the University Employee Medical Monitoring Program, allowing employee access as required by law.

X. Particularly Hazardous Substances, Title 8 CCR, §5191 (e)(3)(H)

The OSHA Laboratory Standard defines particularly hazardous substances as:

- Carcinogens – A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may become evident only after a long latency period.
- Reproductive Toxins – Reproductive toxins are substances that have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance.
- Substances with a High Acute Toxicity – High acute toxicity includes any chemical that falls within any of the following OSHA-defined categories:
 - A chemical with a median lethal dose (LD50) of 50 mg or less per kg of body weight when administered orally to certain test populations.
 - A chemical with an LD50 of 200 mg less per kg of body weight when administered by continuous contact for 24 hours to certain test populations.
 - A chemical with a median lethal concentration (LC50) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when

administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner.

Particularly hazardous substances also include material identified as "select agents" by the United States Department of Agriculture (USDA) and/or the Department of Health and Human Services. These agents have very strict controls for acquisition, storage and use under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. HSU has submitted a Statement of Non-Possession to the Centers for Disease Control and Prevention. Any future use of these agents must be approved by EH&S prior to acquisition. A list of these agents is included in Appendix H.

Any work activity involving a particularly hazardous substance should be evaluated by an experienced Laboratory Supervisor in consultation with the Chemical Hygiene Officer to ensure that proper controls are in place and that appropriate, area-specific training may be given. The following points must be addressed prior to working with any of these agents:

a. Laboratory Evaluation

- i. Establish the "Designated Area".
- ii. Establish the need for employee exposure monitoring.
- iii. Establish the need for medical surveillance.
- iv. Establish the need for specialized training.
- v. Identify the controls and personal protective equipment needed.

b. Establishment of Designated Areas

- i. Designated areas shall be posted as such.
- ii. Access to the designated area shall be restricted to trained personnel ware of the potential hazards associated with the materials and all necessary safety precautions.

c. Use of Containment Devices and Protective Equipment

- i. Wear appropriate PPE such as gloves, safety glasses, and lab coat.
- ii. Read the SDS for the chemicals used: know special precautions to be taken.
- iii. All work which may result in an airborne hazard shall be conducted in hoods or glove boxes which have been tested and approved by the office of EH&S.
- iv. All PPE, including lab coats, shall be removed before leaving the designated area.

d. Decontamination Procedures

- i. Decontaminate the area when work is complete.
- ii. Clean up spills promptly in a manner which does not create an airborne hazard.
- iii. All materials shall be decontaminated before being moved from the designated area.
- iv. Wash thoroughly prior to leaving the area, and after any procedure using chemicals in this classification.

XI. Training, Title 8 CCR, §5191 (e)(3)(D)

The goal of the training program is to ensure that all potentially at-risk individuals are adequately informed about the work in the laboratory/chemical handling area, its risks, and what to do if an accident occurs. Every worker should know the location and proper use of personal protective equipment and basic emergency response procedures. All Laboratory Workers and Supervisors must

be trained in laboratory safety and the content of the Chemical Hygiene Plan prior to assignment, whenever a new hazard is introduced, and at least every five years.

a. Training Responsibilities

i. Environmental Health & Safety

1. EH&S shall provide and document training, including but not limited to, the following subject areas: (Training will be offered in classroom sessions or on-line Computer Based Training.)
 - a. The content and requirements of the Cal/OSHA Laboratory Standard, TITLE 8 § 5191 (Appendix C).
 - b. The content of the University Chemical Hygiene Plan.
 - c. Occupational exposure limits established by Cal/OSHA (PELs, STELs, Ceiling Limits).
 - d. Selection and limitations of Personal Protective Equipment.
 - e. The use of Material Safety Data Sheets.
 - f. Use of engineering controls.
 - g. Disposal of hazardous waste.

ii. Laboratory Supervisor

1. The Laboratory Supervisor for the laboratory shall provide and document training including, but not limited to, the following subject areas:
 - a. The location of MSDS's for chemicals used or stored in the lab.
 - b. The hazards associated with the chemicals.
 - c. The appropriate PPE for the hazards present in the laboratory.
 - d. The location of emergency equipment including eyewash, safety showers, telephone, etc.
 - e. Procedures for the operation of laboratory equipment which may be hazardous to operate or uses hazardous materials.
 - f. Laboratory waste disposal procedures.
 - g. Chemical storage locations.

XII. Approval Procedures, Title 8 CCR, §5191 (e)(3)(E)

- a. A particular laboratory operation, or use of a particular chemical, requires prior approval from the Office of Environmental Health & Safety whenever:
 - i. A chemical listed in Appendix A is used in a manner which may result in a risk of employee exposure.
 - ii. The Laboratory Supervisor believes it is likely that the permissible exposure limit of a chemical as listed in Appendix B may be exceeded or when the probability for injury is high.
- b. The request for performing work of this nature shall be initiated by notifying the CHO in writing. The request shall include:
 - i. The name of the person responsible for overseeing operations involving the particular operation and/or chemical.
 - ii. A brief description of procedures and chemicals that will be used.
 - iii. The time frame during which the operations will be occurring.
 - iv. The location where the operations will occur.
- c. The CHO will review the request and then contact the responsible person to discuss further details.

- d. Incidents Requiring Stoppage of Process
 - i. The process/procedure must be stopped and reviewed with the Chemical Hygiene Officer whenever any of the following occur:
 - 1. A worker requests professional medical attention as a result of injury or illness resulting from exposure to chemicals.
 - 2. A Laboratory Supervisor believes that there is a failure of any safeguard which may result in endangerment to persons in the area. Approval for restarting a chemical process is not required when safeguards are repaired or replaced and the Laboratory Supervisor judges that the safety of individuals is not compromised.
 - 3. The Laboratory Supervisor becomes aware of a new chemical or toxicological hazard for a chemical being used in the work area and this increased hazard may endanger workers if there are insufficient or inappropriate safeguards present in the work area.
 - 4. There is a major chemical spill (see Section XIV).

XIII. Procurement and Gifts

- a. The Laboratory Supervisor shall ensure that appropriate storage and/or controls are in place, in accordance with Section XII of the Chemical Hygiene Plan, prior to the purchase, loan, or receipt of a gift of a chemical listed in Appendix A.
- b. Transfer of chemicals listed in Appendix A between organizational units shall also require prior consideration of storage and controls.
- c. Special Cases
 - i. Radioactive Chemicals and Radionuclides
 - 1. All radioactive chemicals and radionuclides subject to licensing requirements shall be procured, handled, stored, and disposed of in accordance with the University Radiation Safety Manual. The Radiation Safety Manual is posted on the EH&S website.
 - ii. FDA Controlled Substances and Controlled Precursors
 - 1. All FDA controlled substances will be procured, handled, stored and disposed of in accordance with all federal, state, and local laws. Contact EH&S for guidance on compliance with the applicable laws.
 - iii. Explosives
 - 1. In the planning phase before starting any work involving explosives EH&S shall be informed. Work shall not proceed until written approval has been obtained from the Dean, Department Chair, Chemical Hygiene Officer, and the campus Chief of Police. It should be noted that the Federal Alcohol, Tobacco, and Firearms Agency; Department of Transportation; and state and local fire codes may regulate the use of some explosive materials. The Chemical Hygiene Officer will review the chemical inventory for potentially explosive materials and explicitly address the safe storage, handling, and use of these materials.

XIV. Upset Conditions/Spills, Releases and Accidents

Only persons who have been properly trained are authorized to contain and clean up major spills or releases involving hazardous materials. Spills of this magnitude require the assistance of off-campus support.

a. Minor Chemical Spill

A minor chemical spill is one that laboratory personnel can safely handle if all of the following conditions are met:

- i. The hazards of the material(s) are known, and appropriate precautions can be taken to prevent personal exposure.
- ii. There is no potential of a release to the environment.
- iii. There are no personal injuries as a result of the spill.
- iv. The cleanup procedures are known and the proper equipment (e.g., PPE and spill cleanup materials) is available.
- v. The spill can be cleaned up safely by two people in one hour or less.
- vi. The spill is consistent with the chemical hazards and volumes usually encountered by an individual in the laboratory where the spill occurs.

b. Major Chemical Spill

- i. Immediately warn others in the vicinity and exit the room, closing the door behind you.
- ii. Pull the building fire alarm to begin an evacuation of the building.
 1. Direct people away from the incident area.
- iii. Call 911 or extension 5555.
- iv. Do not re-enter the area until authorized to do so by the proper authority.

c. Preparing for Emergencies

The Laboratory Supervisor shall periodically inspect safety and emergency equipment and shall report to the appropriate person or office any observed problems. If another organizational unit is responsible for maintaining or periodically inspecting safety and emergency equipment and the Laboratory Supervisor observes that there is a deficiency, the Laboratory Supervisor will, through the appropriate University channels, request that the observed problems be remedied.

- i. Workers will know the location of the emergency eyewash station and safety shower before starting work in the laboratory/chemical handling area.
- ii. Laboratories shall be prepared for hazards resulting from loss of any utility service or severe weather. Loss of the water supply or electricity, for example, can render safety showers, eyewash stations, and safety override systems inoperative. In such cases, all hazardous laboratory/chemical handling activities will be secured and cease until service is restored.
- iii. All records of major spills, releases and accidents will be kept by the Office of Environmental Health & Safety, in accordance with the University Injury and Illness Prevention Program, as well as in the organizational unit office.

XV. Hazardous Waste Management Title 22 CCR, Div. 4.5

a. General Requirements:

- i. Handle hazardous waste in accordance with the University's Guidelines for Hazardous Waste Management. (see the Hazardous Waste Generator's Manual on the EH&S website)
- ii. Do not mix incompatible chemicals.
- iii. All waste must be stored in compatible, leak-proof containers and labeled, at a minimum, with the following:
 1. The words: "HAZARDOUS WASTE"
 2. Generator's name,
 3. The accumulation start date
 - a. The first day accumulation began or the date that the chemical was determined to be a waste.

4. Location of the waste
 5. Physical state of the waste
 6. Composition of the waste
 7. Appropriate hazard warnings
- iv. It is the responsibility of the waste generator to identify and label hazardous wastes appropriately. All hazardous waste tracking and regularly scheduled waste pickups, from defined collection areas, will be coordinated by the Hazardous Materials Coordinator (X3302)..
 - v. NO HAZARDOUS LABORATORY/CHEMICAL WASTE SHALL BE PLACED IN THE SANITARY DRAIN OR IN TRASH CANS. NO HAZARDOUS LABORATORY/CHEMICAL WASTE SHALL BE PLACED IN STORM DRAINS.
 - vi. Check with the Laboratory Supervisor for identification and appropriate disposal of hazardous waste.
 - vii. Before disposing of unwanted chemicals, check with others in the organizational unit who may be able to use them.
 - viii. Make sure all samples and products scheduled for disposal are properly identified, contained, and labeled. Do not leave them for others to clean up.

XVI. Records and Recordkeeping

- a. General Requirements:
 - i. Worker medical monitoring records shall be maintained in accordance with the California State University Employee Medical Monitoring Program Manual.
 - ii. Accident/incident records shall be maintained in the organizational unit, as well as by the Office of Environmental Health & Safety.
 - iii. Employee training records required by this document shall be maintained in the department IIPP.

XVII. Changes to the University Chemical Hygiene Plan

- a. Faculty, administrators, or staff can propose changes to the University Chemical Hygiene Plan. The proposed changes are submitted to the Chemical Hygiene Officer.
- b. The Chemical Hygiene Officer will review the proposed changes and communicate their decision to the individual proposing the changes.
- c. All approved changes will be forwarded to all organizational units operating under the CHP.

XVIII. Definitions:

action level - A concentration designated in CCR Title 8 §5155 for a specific substance, calculated as an eight (8) hour time-weighted average, that initiates certain required activities such as exposure monitoring and medical surveillance.

acute effect - Symptom of exposure to a hazardous material that soon appears after a short-term exposure, coming quickly to a crisis.

acute exposure - A single, brief exposure to a large dose of a toxic substance. Adverse health effects are evident soon after exposure.

acute toxicity - Adverse biological effects of a single dose of a toxic agent.

administrative controls - Methods of controlling exposures to contaminants by job rotation, work assignment or time away from the contaminant.

Cal/OSHA California Occupational Safety and Health Administration. - This agency develops and enforces occupational safety and health standards for most industry and business in the state of California.

ceiling limit - The maximum allowable exposure limit for an airborne chemical, which is not to be exceeded even momentarily. See also PEL and TLV.

Chemical Hygiene Coordinator - A person designated by a Department, who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene & Safety Plan.

Chemical Hygiene Officer - A person designated by the employer, who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene & Safety Plan.

Chemical Hygiene and Safety Plan - A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in the particular workplace.

chronic exposure - Repeated exposure or contact with a toxic substance over a long period. Adverse biological effects from chronic exposure develop slowly, last a long time, and frequently recur.

chronic effect - Symptom of exposure to a hazardous material that develops slowly after many exposures, or that recurs often.

chronic toxicity - Adverse biological effect of repeated doses or long-term exposure to a toxic agent.

combustible - Able to catch on fire and burn.

combustible gas - A gas that burns, including the fuel gases, hydrogen, hydrocarbon, carbon monoxide, or a mixture of these.

combustible liquid - Any liquid having a flashpoint at or above 100°F but below 200°F.

compressed gas - A gas or mixture of gases in a container having an absolute pressure of 40 or more psi at room temperature.

corrosive - A chemical that causes visible destruction of, or irreversible changes in, living tissue by chemical action at the site of contact, or that has a severe corrosion rate on structural materials.

decomposition - The breakdown of a material into a simpler compound by chemical reaction, decay, heat, or other process.

designated area - An area that may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of it, or a device such as a hood.

explosive - A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

flammable - A flammable substance is one that will catch on fire and burn rapidly under ordinary conditions; for example, liquids with a flash point below 100°F and solids that ignite readily. Note the Uniform Fire Code uses a cut-off of 140°F, which qualifies more liquids as "flammable."

flashpoint - The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.

fume hood - A ventilation device enclosed on five sides with a moveable sash, constructed and maintained to allow chemical manipulations to be conducted inside the enclosure while preventing or minimizing the escape of air contaminants into the worker's breathing zone.

general ventilation - Also known as general exhaust ventilation, this is a system of ventilation consisting of either natural- or mechanically-induced fresh air movements to mix with and dilute contaminants in the workroom air. This is not the recommended type of ventilation to control contaminants that are highly toxic, when there may be corrosion problems from the contaminant, when the worker is close to where the contaminant is being generated, and where fire or explosion hazards are generated close to sources of ignition (See LOCAL EXHAUST VENTILATION).

hazard warning - The words, pictures, and symbols, or a combination thereof, that appear on a label and indicate the hazards of the substance in the container.

hazardous chemical - A chemical, or mixture of chemicals, that can produce adverse physical effects (e.g., fire, explosion) or health effects (e.g., dermatitis, cancer).

health hazards - Substances for which there is evidence, from at least one scientific study, that acute or chronic health effects may occur in exposed persons. These chemicals include carcinogens, toxic agents, reproductive toxins (mutagens and teratogens), irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.

hazardous material - Any substance or compound that has the capability of producing adverse effects on the health and safety of humans.

incompatible - The term applies when two substances cannot be mixed together without the possibility of a dangerous reaction.

ignitable - A solid, liquid or compressed gas that has a flash point of less than 140°F. Ignitable materials may be regulated by the EPA.

ignition temperature - The lowest temperature at which a substance will ignite and continue to burn. The lower the ignition temperature, the more likely the substance is to be a fire hazard.

inhibitor - A substance that is added to another to prevent the occurrence of an undesirable chemical reaction.

laboratory - A facility where the "use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory use of hazardous chemicals - Handling or use of such chemicals in which all of the following conditions are met:

- (1) Chemical manipulations are carried out on a "laboratory scale";
- (2) Multiple chemical procedures or chemicals are used;
- (3) The procedures involved are not part of a production process, nor in any way simulate a production process; and
- (4) "Protective laboratory practices and equipment" are available and in common use industry-wide to minimize the potential for employee exposure to hazardous chemicals.

local exhaust - A ventilation method for removing contaminated air at the point where the contaminants are generated (e.g., a fume hood).

mutagen - A substance capable of causing damage to genes and chromosomes, particularly those of sperm or egg cells, resulting in mutations.

oxidizer - A material that causes the ignition of combustible materials without an external source of ignition. When mixed with combustible materials, an oxidizer increases the rate of burning of these materials when the mixtures are ignited. Oxidizers usually contain their own oxygen, and can, therefore, burn in an oxygen-free atmosphere, are usually very unstable or reactive, and pose a serious fire hazard.

Permissible Exposure Limit (PEL) - An exposure limit that is published and enforced by OSHA as a legal standard. PEL may be either a time-weighted-average (TWA), exposure limit (8-hour), a 15-minute short term exposure limit (STEL), or a ceiling (C). The PELs are found in Tables Z- 1, Z-2, or Z-3 of OSHA regulations 1910.1000. (See also TLV).

personal protective equipment - Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are, but not limited to, respirators, gloves, and chemical splash goggles.

principal investigator - Person who is responsible for the design, conduct or reporting of research.

reactivity - A substance's susceptibility to undergoing a chemical reaction or change that may result in dangerous side effects, such as explosions, burning, and corrosive or toxic emissions. The conditions that cause the reaction, such as heat, other chemicals, and dropping, will usually be specified as "Conditions to Avoid" when a chemical's reactivity is discussed on an SDS.

reproductive toxins - Chemicals that affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

select carcinogen - Any substance that meets one of the following criteria

- (i) It is regulated by OSHA as a carcinogen; or
- (ii) It is listed under the category, "known to be carcinogenic," in the "Annual Report on Carcinogens," published by the National Toxicology Program (NTP) (latest edition); or
- (iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or (iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogenic" by NTP, and causes statistically significant tumor incidence in experimental animals.

suspect carcinogen - A substance that might cause cancer in humans but has not yet been proven to do so.

systemic poison - A substance that has a toxic effect upon several organ systems of the body.

target organ effects - Effects on specific organs of the body caused by exposure to a hazardous chemical.

teratogen - An agent or substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to that substance.

TWA Time Weighted Average: - The exposure limit averaged over a normal 8-hour workday or 40-hour workweek.

toxic substance - A substance that causes harmful biological effects after either short-term or long-term exposure.

toxicity - A relative measure of the adverse biological effects that can result from exposure to a harmful substance.

unstable - A chemical is unstable if it tends to decompose or undergo other undesirable chemical changes during normal handling or storage.

ventilation - Circulation and exchange of air and the method by which this is accomplished.

volatile - A term used for a liquid that evaporates at room temperature. Very volatile liquids, such as gasoline, form vapors (evaporate) quickly and are a breathing hazard.

water-reactive - A chemical that reacts with water to release a flammable or toxic gas.

Appendix A

Select Carcinogens (revised June 2002)

- (beta)-propiolactone
- [(5-nitrofurfurylidene)amino]-2-imidazolidinone N-N- [4(5-nitro-2-furyl)-2-thiazolyl]acetamide
- 1-(2-chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)
- 1-(2-chloroethyl)-3(4-methylcyclohexyl)-1-nitrosourea (methyl-CCNU)
- 1-amino-2-methylantraquinone
- 1(2-chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)
- 1,4-dioxane
- 1,4-butanediol dimethanesulphonate (Myleran)
- 2-acetylaminofluorene
- 2-amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole
- 2-aminoanthraquinone
- 2-methyl-1-nitroanthraquinone (uncertain purity)
- 2-methylaziridine
- 2-methylaziridine (propyleneimine)
- 2-naphthylamine
- 2-nitropropane
- 3-(n-nitrosomethylamino)propionitrile
- 3-chloro-2-methylpropene
- 3,3'-dimethylbenzidine
- 3,3'-dichloro-4,4'-diaminodiphenyl ether
- 3,3'-dichlorobenzidine
- 3,3'-dichlorobenzidine dihydrochloride
- 3,3'-dimethoxybenzidine (ortho-dianisidine)
- 3,3'-dimethylbenzidine (ortho-tolidine)
- 4-(n-nitrosomethylamino)-1(3-pyridyl)-1-butanone (NNK)
- 4-aminobiphenyl
- 4-chloro-o-phenylenediamine
- 4-dimethylaminoazobenzene
- 4-nitrobiphenyl
- 4,4'-diaminodiphenyl ether
- 4,4'-methylene bis(2-chloroaniline) (MOCA or MBOCA)
- 4,4'-methylene bis(2-methylaniline)
- 4,4'-methylenebis(n,n-dimethyl)benzenamine
- 4,4'-methylenedianiline
- 4,4'-methylenedianiline dihydrochloride
- 4,4'-oxydianiline
- 4,4'-thiodianiline
- 5-methoxypsoralen
- 5-methylchrysene
- 5-nitro-o-anisidine
- 5-nitroacenaphthene
- 7h-dibenzo(c,g)carbazole
- 7H-dibenzo[c,g]carbazole
- 8-methoxypsoralen (methoxsalen) plus ultraviolet radiation
- 1,1-dimethylhydrazine

- 1,1-dimethylhydrazine
- 1,2-dibromo-3-chloropropane
- 1,2-dibromoethane (EDB)
- 1,2-dichloroethane
- 1,2-diethylhydrazine
- 1,2-dimethylhydrazine
- 1,3-butadiene
- 1,3-dichloropropene (technical grade)
- 1,3-propane sultone
- 1,4-dichlorobenzene
- 1,4-dioxane
- 2,4-diaminoanisole
- 2,4-diaminoanisole sulfate
- 2,4-diaminotoluene
- 2,4,6-trichlorophenol
- 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
- a-alpha, C (2-amino-9H-pyrido[2,3-b]indole)
- acetaldehyde
- acetamide
- acrylamide AF-2 [2{2-furyl}-3-(5-nitro-2-furyl) acrylamide]
- Acrylonitrile
- adriamycin
- aflatoxins
- alpha-chlorinated toluenes
- alpha-naphthylamine
- amitrole
- analgesic mixtures containing phenacetin
- androgenic (anabolic) steroids
- aramite
- arsenic and arsenic compounds
- asbestos
- auramine, technical-grade
- azaserine
- azathioprine
- b-propiolactone
- benz(a)anthracene
- benz[a]anthracene
- benzene
- benzidine
- benzidine and its salts
- benzidine-based dyes
- benzo(a)pyrene
- benzo(b)fluoranthene
- benzo(j)fluoranthene
- benzo(j)fluoranthene
- benzo(k)fluoranthene
- benzo[a]pyrene
- benzo[b]fluoranthene

- benzo[k]fluoranthene
- benzotrichloride
- benzyl violet 4B
- beryllium and beryllium compounds
- beta-butyrolactone
- beta-naphthylamine
- beta-propiolactone
- betel quid with tobacco
- bis(chloromethyl) ether
- chloromethyl methyl ether (technical grade)
- chloromethyl ether (technical grade)
- bischloroethyl nitrosourea
- bischloroethyl nitrosourea (BCNU)
- bitumens, extracts of steam-refined and air-refined
- bleomycins
- bracken fern
- butylated hydroxyanisole (BHA)
- C.1. Basic Red 9 monohydrochloride
- cadmium and cadmium compounds
- carbon tetrachloride
- carbon-black extracts
- carpentry and joinery
- carrageenan, degraded
- chlorambucil
- chloramphenicol
- chlordecone (kepone)
- chlorendic acid
- chlorinated paraffins (C12 60% chlorine)
- chloroform
- chlorophenols
- chlorophenoxy herbicides
- chromium compounds, hexavalent
- cisplatin
- Citrus Red No. 2
- coal gasification
- coal-tar pitches
- conjugated estrogens
- creosotes
- cupferron
- cycasin
- cyclophosphamide
- dacarbazine
- daunomycin
- DDT
- di(2-ethylhexyl)phthalate
- dibenz(a,h)acridine
- dibenz(a,h)anthracene
- dibenz(a,j)acridine

- dibenzo(a,e)pyrene
- dibenzo(a,h)pyrene
- dibenzo(a,i)pyrene
- dibenzo(a,l)pyrene
- dichloromethane (methylene chloride)
- diepoxybutane
- diethyl sulfate
- diethylstilboestrol
- diethylstilbestrol
- diglycidyl resorcinol ether
- dihydrosafrole
- dimethyl sulfate
- dimethylcarbamoyl chloride
- dimethylvinyl chloride
- Direct Black 38
- Direct Blue 6
- erionite
- epichlorohydrin
- estrogens (not nonjugated): estradiol-17(beta)
- estrogens (not nonjugated): estrone
- estrogens (not nonjugated): ethinylestradiol
- estrogens (not nonjugated): mestranol
- ethyl acrylate
- ethyl methanesulphonate 2'-2-formylhydrazino(-4'-5nitro-2-furyl) thiazole
- ethylene dibromide
- ethylene oxide
- ethylene thiourea
- ethyleneimine
- formaldehyde
- glu-P-1 (2-amino-6-methyldipyrido[1,2-a:3', 2'-d]imidazole)
- glu-P-2 (2-aminodipyrido[1,2-a:3', 2'-d]imidazole)
- glycidaldehyde
- griseofulvin
- hexachlorobenzene
- hexachlorobutadiene
- hexachlorocyclohexanes
- hexamethylphosphoramide
- hydrazine
- hydrazine sulfate
- hydrazobenzene
- indeno(1,2,3-cd)pyrene
- 5-methychrysene
- IQ (2-amino-3-methylimidazo[4,5-f]quinoline)
- iron dextran complex
- kepone (chlordecone)
- lasiocarpine
- lead phosphate
- lead and lead compounds, inorganic

- lindane and other hexachlorocyclohexane isomers
- meA-alpha-C (2-amino-3-methyl-9H-pyrido[2,3-b]indole)
- medroxyprogesterone acetate
- Melphalan
- Merphalan
- Methoxsalen with ultra-violet A therapy (PUVA)
- methyl chloromethyl ether
- methyl methanesulphonate
- methylazoxymethanol
- methylazoxymethanol acetate
- methylthiouracil
- Metronidazole
- Michler's ketone
- mineral oils, untreated and mildly-treated
- mirex
- Mitomycin C
- monocrotaline
- mustard gas (sulphur mustard)
- N'-nitrosornicotine
- N,N'-diacetylbenzidine
- N,N-bis(2-chloroethyl)-2-naphthylamine (chlornaphazine)
- N-ethyl-N-nitrosourea
- N-methyl-N'-nitro-n-nitrosoguanidine (MNNG)
- N-methyl-N-nitrosourea
- N-methyl-N-nitrosourethane
- N-nitroso-N-ethylurea
- N-nitroso-N-methylurea
- N-nitrosodi-N-butylamine
- N-nitrosodi-N-propylamine
- N-nitrosodiethanolamine
- N-nitrosodiethylamine
- N-nitrosodimethylamine
- N-nitrosomethylethylamine
- N-nitrosomorpholine
- N-nitrosornicotine
- N-nitrosopiperidine
- N-nitrosopyrrolidine
- N-nitrososarcosine
- nafenopin
- niridazole
- nickel and nickel compounds
- nitrilotriacetic acid
- nitrofen (technical-grade)
- nitrogen mustard
- nitrogen mustard hydrochloride
- nitrogen mustard n-oxide
- norethisterone
- o-aminoazotoluene

- o-anisidine hydrochloride
- o-toluidine
- o-toluidine hydrochloride
- oestrogen replacement therapy
- oestrogens, nonsteroidal
- oestrogens, steroidal
- oil orange SS
- ortho-aminoazotoluene
- ortho-anisidine
- ortho-toluidine
- oxymetholone
- p-cresidine
- p-nitrosodiphenylamine
- panfuran S (containing dihydroxymethylfuratrizine)
- para-aminoazobenzene
- para-chloro-ortho-toluidine
- para-cresidine
- para-dichlorobenzene
- para-dimethylaminoazobenzene
- trans-2-[(dimethylamino)methylimino]-5-[2(5-nitro-2-furyl)vinyl]-1,3,4-oxadiazole
- phenacetin
- phenazopyridine hydrochloride
- phenobarbital
- phenoxybenzamine hydrochloride
- phenytoin
- polybrominated biphenyls
- polychlorinated biphenyls
- polyvinyl chloride
- Ponceau 3R
- Ponceau MX
- potassium bromate
- procarbazine hydrochloride
- progesterone
- 1,3-propane sultone
- progestins
- propylene oxide
- propylthiouracil
- reserpine
- saccharin
- safrole
- selenium sulfide
- shale-oils
- silica, crystalline
- sodium ortho-phenylphenate
- sterigmatocystin
- streptozotocin
- styrene

- styrene oxide
- sulfallate
- tetrachloroethylene (perchloroethylene)
- thioacetamide
- thiourea
- thorium dioxide
- toluene diisocyanate
- toxaphene (polychlorinated camphenes)
- Treosulphan
- tris(1-aziridinyl)phosphine sulfide (Thiotepa)
- tris(2,3-dibromopropyl) phosphate
- trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)
- trp-P-2 (3-Amino-1-methyl-5H-pyrido[4,3-b]indole)
- Trypan Blue
- uracil mustard
- urethane
- vinyl bromide
- vinyl chloride
- vinyl cyclohexane dioxide
- xylicidine

APPENDIX B

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical

Abstracts Registry Number ^(a)

Skin ^(b)	Name ^(c)	PEL ^(d)			STEL ^(e)	
		ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M ^{3(f)}
	75070 Acetaldehyde	25	45	C		
	64197 Acetic acid	10	25	40 ppm	15	37
	108247 Acetic Anhydride	5	20	C		
	67641 Acetone	500	1200	3000 ppm	750	1780
	75868 Acetone cyanohydrin as CN	4.7	5	C		
S	75058 Acetonitrile	40	70		60	105
	98862 Acetophenone	10	49			
S	53963 2-Acetylaminofluorene; N-fluoren-2-yl acetamide; see Section 5209					12
	74862 Acetylene	(h)				
	540590 Acetylene dichloride; see 1,2-Dichloroethylene					
	79276 Acetylene tetrabromide; 1,1,2,2-tetrabromoethane	1	14			
	79345 Acetylene tetrachloride; see 1,1,2,2-Tetrachloroethane					
	50782 Acetylsalicylic acid (Aspirin)		5			
S	107028 Acrolein	0.1	0.25	C		
S	79061 Acrylamide	--	0.03			
S	79107 Acrylic acid	2	5.9			
S	107131 Acrylonitrile; see Section 5213	2	4.5			
	124049 Adipic acid	--	5			
S	111693 Adiponitrile	2	8.8			
S	309002 Aldrin; 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-endo-1,2-exo-5,8-dimethanonaphthalene	--	0.25			
S	107186 Allyl alcohol	0.5	1.25		4	10
	107051 Allyl chloride	1	3		2	6
S	106923 Allyl glycidyl ether; AGE	0.2	0.93			
	2179591 Allyl propyl disulfide	2	12		3	18
	1344281 Alumina; see Particulates not otherwise regulated					
	Aluminum, alkyls (not otherwise classified)	--	2			
	Aluminum soluble salts	--	2			
	Aluminum metal and oxide	--				
	Total dust	--	10			
	Respirable fraction ⁽ⁿ⁾	--	5 ⁽ⁿ⁾			
	Aluminum pyro powders	--	5			
	Aluminum welding fumes	--	5			
	300925 Aluminum distearate	--	10			
	7047849 Aluminum stearate	--	10			
	637127 Aluminum tristearate	--	10			
	1300738 Aminodimethylbenzene; see Xylidene					
S	92671 4-Aminodiphenyl; see Section 5209					
	141435 2-Aminoethanol; see Ethanolamine					
	91598 2-Aminonaphthalene; see beta-Naphthylamine, Section 5209					
	504290 2-Aminopyridine	0.5	2			
	61825 Amitrole	--	0.2			
	7664417 Ammonia	25	18		35	27
S	3825261 Ammonium perfluorooctanoate	--	00.1			

Footnotes (a) through (u) at end of Table AC-1

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)			STEL ^(e)	
			ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M ^{3(f)}
12125029		Ammonium chloride fume	--	10		--	20
1002897		Ammonium stearate	--	10			
7773060		Ammonium sulfamate	--				
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
620111		3-Amyl acetate; See Pentyl acetate					
628637		n-Amyl acetate; See Pentyl acetate					
626380		sec-Amyl acetate (all isomers and mixtures); See Pentyl acetate					
625161		tert-Amyl acetate; See Pentyl acetate					
62533	S	Aniline	2	7.6			
29191524	S	Anisidine (ortho and para isomers)	0.1	0.5			
		Antimony and compounds, as Sb	--	0.5			
86884		ANTU; 1-(1-naphthyl)-2-thiourea; Bantu; Rattrack	--	0.3			
7440371		Argon	(h)				
7440382		Arsenic and inorganic arsenic compounds; see also Section 5214		0.01			
		Arsenic, organic compounds, as As	--	0.2			
7784421		Arsine; AsH ₃	0.05	0.2			
1332-21-4		Asbestos (including actinolite, amosite anthophyllite, chrysotile, crocidolite, and tremolite); see Section 5208					
8052424		Asphalt (petroleum) fumes	--	5			
1912249		Atrazine	--	5			
86500	S	Azinphos methyl; o,o-dimethyl S-(4-oxo-1,2,3-benzotriazin-3(4H)-ylmethyl) phosphorodithio ate	--	0.2			
3333526	S	2,2'-Azobisisobutyronitrile decomposition product, see Tetramethyl succinonitrile					
7440393		Barium, soluble compounds, as Ba	--	0.5			
7727437		Barium sulfate; see Particulates not otherwise regulated					
17804352		Benomyl					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
71432	S	Benzene; see also Section 5218	1			5	--
92875	S	Benzidine; 4,4'-diaminobiphenyl, see Section 5209					
71432		Benzol; see Benzene					
106514		D-Benzoquinone; see Quinone					
98884		Benzoyl chloride	0.2	1.1	C		
94360		Benzoyl peroxide; dibenzoyl peroxide	--	5			
140114		Benzyl acetate	10	61			
100447		benzyl chloride; alpha-chlorotoluene	1	5			
7440417		Beryllium, and beryllium compounds as Be	--	0.0002	0.025mg/M ³	--	
92524		Biphenyl; diphenyl; phenylbenzene	0.2	1.5			
542881		Bis(chloromethyl) ether, see bis-Chloromethyl ether, Section 5209					
3033623	S	Bis (Dimethylaminoethyl) ether (DMAEE)	0.05	0.328		0.15	0.983
1304821		Bismuth telluride					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
		Bismuth telluride (selenium-doped)	--	5			
		Borates, tetra, sodium salts					
		Anhydrous	--	5			
		Decahydrate	--	5			
		Pentahydrate	--	5			
1303862		Boron oxide	--	10			
10294334		Boron tribromide	1	10	C		
7637072		Boron trifluoride	1	3	C		
314409		Bromacil	1	10			
7726956		Bromine	0.1	0.7	C		
7789302		Bromine pentafluoride	0.1	0.7			
74975		Bromochloromethane; see Chlorobromomethane					
74964		Bromoethane; see Ethyl bromide					
75252	S	Bromoform; tribromomethane	0.5	5			
74839		Bromomethane, see Methyl bromide					
106945	S	1-bromopropane, n-propyl bromide	5	25			
75638		Bromotrifluoromethane; see Trifluorobromomethane					
106990		1,3-Butadiene (see also section 5201)	1	2.2		5	11
106978		Butane	800	1,900			
109795		1-Butanethiol; see Butyl mercaptan					
71363		1-Butanol; see n-Butyl alcohol					
78933		2-Butanone; see Methyl ethyl ketone					
111762	S	2-Butoxyethanol (EGBE)	20	97			
123864		n-Butyl acetate	150	710		200	950
105464		sec-Butyl acetate	200	950			
540885		tert-Butyl acetate	200	950			
141322		Butyl acrylate	2	11			
71363	S	n-Butyl alcohol; 1-butanol	50	150	C		
78922		sec-Butyl alcohol	100	305			
75650		tert-Butyl alcohol	100	300		150	450
109739	S	Butylamine	5	15	C		
1189851	S	tert-Butyl chromate; di-tert-butyl chromate, as CrO ₃ as Cr	--	0.1 0.005	C		
		(see also Sections 1532.2, 5206 & 8359)					
2426086		n-Butyl glycidyl ether; BGE; 1-butoxy-2,3-epoxypropane	25	135			
138227		n-Butyl lactate	5	25			
109795		n-Butyl mercaptan	0.5	1.5			
89725	S	o-sec-Butylphenol	5	30			
98511		p-tert-Butyltoluene	1	6.1		20	120
7440439		Cadmium metal dust, as Cd (see also Sections 1532 & 5207)	--	0.005			
		Cadmium, soluble salts, as Cd (see also Sections 1532 & 5207)	--	0.005			
1306190		Cadmium oxide fume, as Cd (see also Sections 1532 & 5207)	--	0.005			
7778441		Calcium arsenate; see Arsenic, inorganic (see					

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
		also Section 5214)					
471341		Calcium carbonate; see Particulates not otherwise regulated		--			
156627		Calcium cyanamide	--	0.5			
1305620		Calcium hydroxide	--	5			
1305788		Calcium oxide	--	2			
		Calcium silicate; see Particulates not otherwise regulated					
1344952		Calcium silicate (synthetic); see Particulates not otherwise regulated					
1592230		Calcium stearate	--	10			
7778189		Calcium sulfate; see Particulates not otherwise regulated					
76222		Camphor (synthetic)	--	2			
105602		Caprolactam dust	--	1		--	3
105602		Caprolactam vapor	5	20		10	40
2425061	S	Captafol	--	0.1			
133062		Captan	--	5			
63252		Carbaryl; 1-naphthyl N-methylcarbamate	--	5			
1563662		Carbofuran	--	0.1			
1333864		Carbon black	--	3.5			
124389		Carbon dioxide	5,000	9,000		30,000	54,000
75150	S	Carbon disulfide	1	3	30 ppm	12	36
630080		Carbon monoxide	25	29	200 ppm		
558134		Carbon tetrabromide	0.1	1.4		0.3	4
56235	S	Carbon tetrachloride	2	12.6	200 ppm	10	63
75445		Carbonyl chloride; see Phosgene					
353504		Carbonyl fluoride	2	5		5	15
120809	S	Catechol; pyrocatechol	5	20			
9004346		Cellulose (paper fiber); see Particulates not otherwise regulated					
21351791		Cesium hydroxide		2			
57749	S	Chlordane; 1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane	--	0.5			
8001352	S	Chlorinated camphene; toxaphene	--	0.5		--	1
		Chlorinated diphenyl oxide	--	0.5			
7782505		Chlorine	0.5	1.5		1	3
10049044		Chlorine dioxide	0.1	0.3		0.3	0.9
7790912		Chlorine trifluoride	0.1	0.4	C		
107200		Chloroacetaldehyde	1	3	C		
78955	S	Chloroacetone	1	3.8	C		
532274		alpha-Chloroacetophenone; phenacyl chloride	0.05	0.3			
79049	S	Chloroacetyl chloride	0.05	0.2		0.15	0.69
108907		Chlorobenzene; monochlorobenzene	10	46			
2698411	S	o-Chlorobenzylidene malononitrile; OCBM	0.05	0.4	C		
74975		Chlorobromomethane; bromochloromethane	200	1,050			
126998	S	2-Chloro-1,3-butadiene; see Chloroprene					
75456		Chlorodifluoromethane; Fluorocarbon 22	1,000	3,500			
53469219	S	Chlorodiphenyl (42% chlorine)	--	1			
11097691	S	Chlorodiphenyl (54% chlorine)	--	0.5			
106898		1-Chloro-2,3-epoxypropane; see Epichlorohydrin					
75003		Chloroethane; see Ethyl chloride					
107073		2-Chloroethanol; see Ethylene chlorohydrin					

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)			STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M ^{3(f)}
75014		Chloroethylene, see Vinyl chloride, Section 5210					
67663		Chloroform; trichloromethane	2	9.78			
74873		Chloromethane, see Methyl chloride					
107302		Chloromethyl methyl ether; see Methyl chloromethyl ether, Section 5209					
542881		bis-Chloromethyl ether, see also Section 5209	0.001	0.005			
100005		1-Chloro-4-nitrobenzene; see p-Nitrochlorobenzene					
600259		1-Chloro-1-nitropropane	2	10			
76153		Chloropentafluoroethane	1,000	6,320			
76062		Chloropicrin; trichloronitromethane	0.1	0.7			
126998	S	Chloroprene; 2-chloro-1,3-butadiene	10	36			
598787	S	2-Chloropropionic acid	0.1	0.44			
2039874		o-Chlorostyrene	50	285		75	428
95498	S	o-Chlorotoluene	50	250			
1929824		2-Chloro-6-(trichloromethyl)pyridine; see Nitrapyrin					
2921882	S	Chlorpyrifos	--	0.2			
		Chromite ore processing (chromate), as Cr (see also Sections 1532.2, 5206 & 8359)	--	0.005			
7440473		Chromium metal	--	0.5			
		Chromium (II) compounds, as Cr	--	0.5			
		Chromium (III) compounds, as Cr	--	0.5			
		Chromium (VI) compounds, as Cr (see also Sections 1532.2, 5206 & 8359)	--	0.005	0.1mg/M ³		
14977618		Chromyl chloride	0.025	0.15			
2971906		Clopidol	--				
		Total dust	--	10			
		Respirable fraction	--	5			
		Coal (Bituminous) dust					
		<5% quartz, respirable fraction ⁽ⁿ⁾	--	0.9			
		>5% quartz, respirable fraction ⁽ⁿ⁾	--	0.1			
		Coal tar pitch volatiles ⁽ⁱ⁾	--	0.2			
7440484		Cobalt, metal fume and dust, as Co	--	0.020			
		Cobalt carbonyl, as Co	--	0.1			
16842038		Cobalt hydrocarbonyl, as Co	--	0.1			
		Coke oven emissions, see Section 5211		0.15			
7440508		Copper metal fume, as Cu	--	0.1			
		Copper salts, dusts and mists, as Cu	--	1			
		Corundum, see Particulates not otherwise regulated					
		Cotton dust, see also Section 5190	--	1 ⁽ⁱ⁾			
1319773	S	Cresol (all isomers)	5	22			
123739	S	Crotonaldehyde; beta-methylacrolein			0.3		
4170303							
299865		Crufomate	--	5			
98828	S	Cumene; isopropylbenzene	50	245			
420042		Cyanamide	--	2			
	S	Cyanide, as CN	--	5			
460195		Cyanogen	10	20			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
506774		Cyanogen chloride	0.3	0.6	C		
110827		Cyclohexane	300	1,050			
108930	S	Cyclohexanol	50	200			
108941	S	Cyclohexanone	25	100			
110838		Cyclohexene	300	1,015			
108918	S	Cyclohexylamine	10	40			
121824	S	Cyclonite; RDX; cyclotrimethylenetrinitramine	--	0.07			
542927		Cyclopentadiene	75	200			
287923		Cyclopentane	600	1,720			
13121705		Cyhexatin; tricyclohexyltin hydroxide		5			
94757		2,4-D;2,4-dichlorophenoxyacetic acid	--	10			
50293	S	DDT; 1,1,1-trichloro-2,2-bis-(p-chlorophenyl)ethane	--	1			
62737		DDVP, see Dichlorvos					
17702419	S	Decaborane	0.05	0.3		0.15	0.9
8065483	S	Demeton; a mixture of o,o-diethyl o-2(ethylthio)ethyl phosphorothioate and o,o'-diethyl S-2(ethylthio)ethyl phosphorothioate	0.01	0.1			
123422		Diacetone alcohol; 4-hydroxy-4-methyl-2-pentanone	50	240			
107153		1,2-Diaminoethane; see Ethylenediamine					
		Diatomaceous earth; see Silica-amorphous					
333415	S	Diazinon; o,o-diethyl o-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate	--	0.1			
334883		Diazomethane	0.2	0.4			
94360		Dibenzoyl peroxide; see Benzoyl peroxide					
19287457		Diborane	0.1	0.1			
2528361	S	Dibutyl phenyl phosphate	0.3	3.5			
96128		1,2-Dibromo-3-chloropropane; DBCP; see Section 5212	.001	.01			
75616		Dibromodifluoromethane; see Difluorodibromomethane					
106934	S	1,2-Dibromomethane; see Ethylene dibromide, Section 5219					
102818	S	2-N-Dibutylaminoethanol	2	14			
107664		Dibutyl phosphate	1	5		2	10
84742		Dibutyl phthalate	--	5			
7572294		Dichloroacetylene	0.1	0.4	C		
95501	S	o-Dichlorobenzene	25	150	50 ppm		
106467		p-Dichlorobenzene; 1,4-dichlorobenzene	10	60	200 ppm	110	675
91941	S	3,3'-Dichlorobenzidine; 4,4'-diamino-3,3'-dichlorobiphenyl; see Section 5209					
764410	S	1,4 -Dichloro-2-butene	0.005	0.025			
75718		Dichlorodifluoromethane	1000	4950	6200 ppm		
118525		1,3-Dichloro-5,5-dimethyl hydantoin	--	0.2		--	0.4
75343		1,1-Dichloroethane	100	400			
107062		1,2-Dichloroethane, see Ethylene dichloride					
75354		1,1-Dichloroethylene; see Vinylidene chloride					

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
540590		1,2-Dichloroethylene; acetylene dichloride	200	790			
111444	S	Dichloroethyl ether; bis(2-chloroethyl) ether	5	30		10	60
75434		Dichlorofluoromethane; Fluorocarbon 21	10	42			
75092		Dichloromethane; see Methylene chloride					
594729		1,1-Dichloro-1-nitroethane	2	10			
78875		1,2-Dichloropropane; see Propylene dichloride					
542756	S	Dichloropropene	1	5			
75990		2,2-Dichloropropionic acid	1	6			
76142		1,2-Dichlorotetrafluoroethane; Fluorocarbon 114	1,000	7,000			
62737	S	Dichlorvos (DDVP); 2,2-dichlorovinyl dimethyl phosphate	0.1	1			
141662	S	Dicrotophos	--	0.25			
5124301		Dicyclohexylmethane-4,4'-diisocyanate; see Methylene bis-(4-cyclohexylisocyanate)					
77736		Dicyclopentadiene	5	30			
102545		Dicyclopentadienyl iron	--				
		Total dust	--	10			
		Respirable fraction ^(h)	--	5			
60571	S	Dieldrin; 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-exo-5,8-dimethanonaphthalene	--	0.25			
111422	S	Diethanolamine	0.46	2			
109897	S	Diethylamine	5	15	C		
112367	S	Diethylene glycol diethyl ether, Ethyl diglyme	5	33			
111966	S	Diethylene glycol dimethyl ether, Diglyme	1	5.5		5	27
100378	S	2-(Diethylamino) ethanol	2	9.6			
123911		1,4-Diethylene dioxide; see p-Dioxane					
111400	S	Diethylenetriamine	1	4			
60297		Diethyl ether; see Ethyl ether					
117817		Di-(2-ethylhexyl) phthalate; see Di-sec-octyl phthalate					
96220		Diethyl ketone	200	705		300	1057
84662		Diethyl phthalate	--	5			
75616		Difluorodibromomethane; dibromodifluoromethane	100	860			
2238075		Diglycidyl ether; DGE; bis(2,3-epoxypropyl) ether	0.1	0.5			
123319		p-Dihydroxybenzene; see Hydroquinone					
108838		Diisobutyl ketone; 2,6-dimethyl-4-heptanone	25	150			
108189	S	Diisopropylamine	5	20			
108203		Diisopropyl ether; see Isopryl ether					
109875		Dimethoxymethane; see Methylal					
127195	S	Dimethylacetamide	10	35			
124403		Dimethylamine	5	9.2		15	27.6
60117		4-Dimethylaminoazobenzene, see Section 5209					
1300738		Dimethylaminobenzene; see Xylidene					
121697	S	N,N-Dimethylaniline; dimethylphenylamine	5	25		10	50
1330207		Dimethylbenzene; see Xylene					

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	EL ^(d)		STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M^{3(f)}
		108849 1,3-Dimethylbutyl acetate; see sec-Hexyl acetate				
300765		o,o-Dimethyl o-(1,2-dibromo-2,2-dichloroethyl) phosphate; see Naled				
14857342		Dimethylethoxysilane	0.5	2.1		1.5 6.4
68122	S	Dimethylformamide; DMF	10	30		
108838		2,6-Dimethyl-4-heptanone; see Diisobutyl ketone				
57147	S	1,1-Dimethylhydrazine	0.01	0.025		
67641		Dimethyl ketone; see Acetone				
62759		N,N-Dimethylnitrosamine; see N-Nitrosodimethylamine, Section 5209				
131113		Dimethyl phthalate	--	5		
77781	S	Dimethyl sulfate; methyl sulfate	0.1	0.5		
148016		Dinitolmide; 3,5-Dinitro-o-toluamide	--	5		
528290, 99650, 100254	S	Dinitrobenzene (all (isomers) ortho, meta and para isomers)	0.15	1		
534521	S	4,6-Dinitro-o-cresol; 2-methyl-4,6-dinitrophenol	--	0.2		
25321146	S	2,4-Dinitrotoluene	--	0.15		
123911	S	p-Dioxane; 1,4-dioxacyclohexane; 1,4-diethylene dioxide	0.28	1.0		
78342	S	Dioxathion	--	0.2		
92524		Diphenyl; see Biphenyl				
122394		Diphenylamine; N-phenylaniline	--	10		
101688		Diphenylmethane diisocyanate; see Methylene bis(phenylisocyanate)				
123193		Dipropyl ketone	50	235		
34590948	S	Dipropylene glycol methyl ether	100	600		150 900
85007		Diquat; 1,1'-ethylene-2,2'-dipyridinium dibromide	--			
		Total dust	--	0.5		
		Respirable fraction ^(m)				
117817		Di-sec-octyl phthalate; bis(2 ethylhexyl) phthalate	--	5		--
97778		Disulfiram	--	2		
298044	S	Disulfoton; o,o-diethyl S-2-(ethylthio)ethyl phosphorodithioate	--	0.1		
128370		2,6-Di-tert-butyl-p-cresol	--	10		
330541		Diuron	--	10		
68122		DMF; see Dimethylformamide				
57147		DMH; see 1,1-Dimethylhydrazine				
1321740		Divinyl benzene	10	50		
		Dust, nuisance dust and particulates, see Particulates not otherwise regulated				
12415348		Emery; see Particulates not otherwise regulated				
115297	S	Endosulfan; 6,7,8,9,10,10-hexachloro-				

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
		1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,					
		3-benzodioxathiepin-3-oxide	--		0.1		
72208	S	Endrin; 1,2,3,4,10,10-hexachloro-6,7-epoxy-					
		1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-endo-5,					
		8-dimethanonaphthalene	--		0.1		
13838169		Enflurane	2		15		
106898	S	Epichlorohydrin; 1-chloro-2,					
		3-epoxypropane	0.05		0.19		
2104645	S	EPN; o-ethyl o-(p-nitrophenyl)					
		phenylphosphonothioate	--		0.1		
75569		1,2-Epoxypropane; see Propylene oxide					
556525		2,3-Epoxypropanol; see Glycidol					
74840		Ethane	(h)		--		
75081		Ethanethiol; see Ethyl mercaptan					
64175		Ethanol; see Ethyl alcohol					
141435		Ethanolamine; 2-aminoethanol	3	8		6	15
563122	S	Ethion	--		0.4		
110805	S	2-Ethoxyethanol	5	18			
111159	S	2-Ethoxyethyl acetate	5	27			
141786		Ethyl acetate	400	1,400			
140885	S	Ethyl acrylate	5	20		25	100
64175		Ethyl alcohol; ethanol	1,000	1,900			
75047	S	Ethylamine	5	9.2	C		
541855		Ethyl sec-amyl ketone; 5-methyl-3-heptanone	25	130			
100414		Ethylbenzene	100	435		125	545
74964	S	Ethyl bromide	5	22			
106354		Ethyl butyl ketone; 3-heptanone	50	230		75	345
75003	S	Ethyl chloride; chloroethane	100	264			
7085850		Ethyl cyanoacrylate	0.2	1.02			
673923		Ethyl tert-butyl ether	5	21			
74851		Ethylene	(h)		--		
107073	S	Ethylene chlorohydrin; 2-chloroethanol	1	3	C		
107153		Ethylenediamine; 1,2-diaminoethane	10	25			
106934	S	Ethylene dibromide; 1,2-dibromoethane,					
		see Section 5219	0.13	1	C		
107062		Ethylene dichloride; 1,2-dichloroethane	1	4	200 ppm	2	8
107211		Ethylene glycol (vapor)	40	100	C		
629141	S	Ethylene glycol diethyl ether, 1,2-diethoxyethane	5	24			
110714	S	Ethylene glycol dimethyl ether,	1	3.7		5	18
		1,2-dimethoxyethane, Glyme					
628966	S	Ethylene glycol dinitrate		(k)		--	0.1
110805	S	Ethylene glycol monoethyl ether, see					
		2-Ethoxyethanol					
109864	S	Ethylene glycol monomethyl ether, see					
		2-Methoxyethanol					
110496	S	Ethylene glycol monomethyl ether acetate;					
		see 2-Methoxyethyl acetate					
151564	S	Ethyleneimine; see also Section 5209	0.5	1			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
75218		Ethylene oxide; see Section 5220	1	2		5	
60297		Ethyl ether	400	1,200		500	1500
109944		Ethyl formate	100	300			
75343		Ethylidene chloride; see 1,1-Dichloroethane					
16219753		Ethylidene norbornene	5	25	C		
75081		Ethyl mercaptan; ethanethiol	0.5	1			
78933		Ethyl methyl ketone; see Methyl ethyl ketone					
100743	S	N-Ethylmorpholine; 4-ethyl-1, 4-tetrahydrooxazine	5	23			
78104		Ethyl silicate; tetraethyl silicate	10	85			
22224926	S	Fenamiphos		0.1			
115902		Fensulfothion	--	0.1			
55389	S	Fenthion	--	0.2			
14484641		Ferbam; ferric N,N-dimethylthiocarbamate	--	10			
12604589		Ferrovandium dust	--	1		--	3
14808607		Fibrous glass, see Glass					
		Flour dust		0.5 ^(s)			
		Fluorides, as F	--	2.5			
7782414		Fluorine	0.1	0.2			
75694		Fluorocarbon 11; see Trichlorofluoromethane					
75718		Fluorocarbon 12; see Dichlorodifluoromethane					
75434		Fluorocarbon 21; see Dichlorofluoromethane					
75456		Fluorocarbon 22; see Chlorodifluoromethane					
76120		Fluorocarbon 112; see 1,1,2,2-Tetrachloro- 1,2-difluoroethane					
76131		Fluorocarbon 113; see 1,1,2-Trichloro-1,2,2- trifluoroethane					
		Fluorocarbon 114; see 1,2- Dichlorotetrafluoroethane					
75694		Fluorotrichloromethane; see Trichlorofluoromethane					
944229	S	Fonofos	--	0.1			
50000		Formaldehyde, see Section 5217	0.75	--		2	--
75127	S	Formamide	10	18			
64186		Formic acid	5	9		10	19
98011	S	Furfural	2	8			
98000	S	Furfuryl alcohol	10	40		15	60
8006619		Gasoline	300	900		500	1500
7782652		Germanium tetrahydride	0.2	0.6			
		Glass, fibrous		1.0 f/cc _(q)			
111308		Glutaraldehyde ⁽ⁱ⁾	0.05	0.2	C		
56815		Glycerin mist; see Particulates not otherwise regulated					
123944		Glyceryl stearate	--	10			
556525		Glycidol; 2,3-epoxy-1-propanol	2	6.1			
111762		Glycol monobutyl ether; see 2-Butoxyethanol					
110805		Glycol monoethyl ether; see 2-Ethoxyethanol					
109864		Glycol monoethyl ether; see 2-Methoxyethanol					
107222		Glyoxal, 1,2-ethanedione		0.1 ^{(s), (u)}			

Footnotes (a) through (u) at end of Table AC-1

Page 10

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
		Grain dust (oat, wheat, barley)	--	10			
7782425		Graphite, natural respirable dust		2.5			
		Graphite, synthetic					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
13397245		Gypsum; Calcium sulfate dihydrate; see Particulates not otherwise regulated					
7440586		Hafnium	--	0.5			
151677		Halothane	2	16			
822060		HDI; see Hexamethylene diisocyanate					
7440597		Helium	(h)	--			
76448	S	Heptachlor; 1,4,5,6,7,8,8-hepta-chloro- 3a,4,7,7a-tetrahydro-4,7-methanoindene	--	0.05			
142825		n-Heptane	400	1,600		500	2000
118741	S	Hexachlorobenzene	--	0.002			
87683	S	Hexachlorobutadiene	0.02	0.24			
77474		Hexachlorocyclopentadiene	0.01	0.11			
67721	S	Hexachloroethane; perchloroethane	1	10			
1335871	S	Hexachloronaphthalene	--	0.2			
684162	S	Hexafluoroacetone; 1,1,1,3,3,3-hexafluoro- 2-propanone	0.1	0.7			
822060		Hexamethylene diisocyanate; HDI	0.005	0.034			
110543	S	n-Hexane	50	180			
		Hexane, other isomers	500	1800		1000	3600
124094		1,6-Hexanediamine	0.5	2.3			
591786		2-Hexanone; see Methyl butyl ketone					
592416		1-Hexene	50	180			
108101		Hexone; see Methyl isobutyl ketone					
108849		sec-Hexyl acetate; 4-methyl-2-pentyl acetate; 1,3-dimethyl-butyl acetate	50	300			
107415		Hexylene glycol	25	125	C		
302012	S	Hydrazine	0.01	0.013			
10035106		Hydrobromic acid; see Hydrogen bromide					
7647010		Hydrochloric acid; see Hydrogen chloride					
74908		Hydrocyanic acid; see Hydrogen cyanide					
7664393		Hydrofluoric acid; see Hydrogen fluoride					
1333740		Hydrogen	(h)	--			
61788327		Hydrogenated terphenyls	0.5	5			
10035106		Hydrogen bromide	3	10	C		
7647010		Hydrogen chloride; muriatic acid	5	7	C		
74908	S	Hydrogen cyanide	4.7	5	C		
7664393	S	Hydrogen fluoride, as F	0.4	0.33		1	0.83
7722841		Hydrogen peroxide, as H ₂ O ₂	1	1.4			
7783075		Hydrogen selenide, as Se	0.05	0.2			
7783064		Hydrogen sulfide	10	14	50 ppm	15	21
123319		Hydroquinone; 1,4-benzenediol	--	2			
999611	S	2-Hydroxypropyl acrylate	0.5	3			
95136		Indene	10	48			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
7440746		Indium	--	0.1			
		Indium compounds	--	0.1			
7553562		Iodine	0.1	1	C		
75478		Iodoform	0.6	10			
4098719		IPDI; see Isophorone diisocyanate					
1309371		Iron oxide fume	--	5			
13463406		Iron pentacarbonyl, as Fe	0.1	0.8		0.2	1.6
		Iron salts, soluble, as Fe	--	1			
123922		Isoamyl acetate; 3-methylbutyl acetate; see Pentyl acetate					
123513		Isoamyl alcohol; 3-methylbutanol	100	360		125	450
110190		Isobutyl acetate; 2-methylpropyl acetate	150	700			
78831		Isobutyl alcohol; 2-methylpropanol	50	150			
26675467		Isoflurane	2	15			
26952216	S	Isooctyl alcohol	50	270			
78591		Isophorone; 3,5,5-trimethyl-2-cyclohexene-1-one	4	23			
4098719	S	Isophorone diisocyanate; IPDI	0.005	0.045		0.02	--
109591		Isopropoxyethanol	25	105			
108214		Isopropyl acetate	250	950		310	1185
67630		Isopropyl alcohol	400	980		500	1225
75310		Isopropylamine	5	12		10	24
768525	S	N-isopropylaniline	2	10			
108203		Isopropyl ether; diisopropyl ether	250	1,050			
4016142		Isopropyl glycidyl ether; IGE; 1,2-epoxy-3-isopropoxypropane	50	240		75	360
1332587		Kaolin; (respirable dust containing no asbestos and <1% crystalline silica)	--	2			
463514		Ketene; ethenone	0.5	0.9		1.5	3
		Lead arsenate, see Sections 5214 and 5198					
7758976		Lead chromate, as Pb	--	0.02			
		as Cr	--	0.005			
		(see also Section 5198, 1532.1, 1532.2, 5206 & 8359)					
		Lead (metallic) and inorganic compounds, dust and fume, as Pb (see also Section 5198)	--	0.05			
78002		Lead tetraethyl, see Tetraethyl lead					
75741		Lead tetramethyl, see Tetramethyl lead					
1317653		Limestone; calcium carbonate; see Particulates not otherwise regulated					
58899	S	Lindane; 1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer	--	0.5			
7580678		Lithium hydride	--	0.025			
		L.P.G.; liquefied petroleum gas	1,000	1,800			
4485125		Lithium stearate	--	10			
13717005		Magnesite; magnesium carbonate; see Particulates not otherwise regulated					
1309484		Magnesium oxide fume, as Mg	--	10			
557040		Magnesium stearate	--	10			
121755	S	Malathion; o,o-dimethyl S-1(1,2-					

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
		dicarboethoxyethyl) phosphorodithioate	--	10			
108316		Maleic anhydride; cis-butenedioic anhydride	0.1	0.4			
		Manganese and compounds, as Mn	--	0.2			
7439965		Manganese fume, as Mn	--	0.2		--	3
12079651	S	Manganese, cyclopentadienyl-tricarbonyl, as Mn	--	0.1			
		Manganese tetroxide	--	0.2			
		Marble; calcium carbonate; see Particulates not otherwise regulated					
101779	S	MDA; see 4,4'-Methylene dianiline					
101688		MDI; see Methylene bis(phenylisocyanate)					
7439976	S	Mercury alkyls, as Hg	--	0.01	0.04 mg/M ³	--	0.03
7439976	S	Mercury, metallic and inorganic compounds as Hg	--	0.025	0.1 mg/M ³		
7439976	S	Mercury aryl compounds as Hg	--	0.01	C		
108678		Mesitylene; see 1,3,5-Trimethylbenzene					
141797		Mesityl oxide; 4-methyl-3-pentene-2-one	15	60		25	100
79414	S	Methacrylic acid	20	70			
74828		Methane	(h)	--			
74931		Methanethiol; see Methyl mercaptan					
67561		Methanol; see Methyl alcohol					
16752775	S	Methomyl	--	2.5			
72435		Methoxychlor; 1,1,1-trichloro-2, 2-bis(p-methoxyphenyl)ethane	--	10			
109864	S	2-Methoxyethanol	5	16			
110496		2-Methoxyethyl acetate	5	24			
76380		Methoxyflurane	2	13			
150765		4-Methoxyphenol	--	5			
79209		Methyl acetate	200	610		250	760
74997		Methyl acetylene; propyne	1,000	1,650			
		Methyl acetylene-propadiene mixture; MAPP	1,000	1,800		1250	2250
96333	S	Methyl acrylate	10	35			
126987	S	alpha-Methylacrylonitrile	1	3			
624419		2-Methylbutyl acetate; see Pentyl acetate					
109875		Methylal; dimethoxymethane	1,000	3,100			
67561	S	Methyl alcohol; methanol	200	260	1000 ppm	250	325
74895		Methylamine	5	6.4		15	19
108112		Methyl amyl alcohol; see Methyl isobutyl carbinol					
110430		Methyl n-amyl ketone; 2-heptanone	50	235			
100618	S	N-Methylaniline; monomethylaniline	0.5	2			
95534		o-Methylaniline; see o-Toluidine					
74839	S	Methyl bromide	1	3.88	20 ppm		
591786	S	Methyl n-butyl ketone; 2-hexanone	1	4		10	40
74873		Methyl chloride	50	105	300 ppm	100	210
71556		Methyl chloroform; 1,1,1-trichloroethane	350	1900	800 ppm	450	2450
107302		Methyl chloromethyl ether; see Section 5209					
75058		Methyl cyanide; see Acetonitrile					
137053		Methyl 2-cyanoacrylate	0.2	0.908		4	

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
108872		Methylcyclohexane	400	1,600			
25639423		Methylcyclohexanol (meta- and para-isomer mixture)	50	235			
583608	S	o-Methylcyclohexanone	50	230		75	345
12108133	S	2-Methylcyclopentadienyl manganese tricarbonyl, as Mn	--	0.2			
8022002	S	Methyl demeton; a mixture of o,o-dimethyl o-(2-(ethylthio)ethyl) phosphorothioate and o,o-dimethyl S-(2-(ethylthio)-ethyl) Phosphorothioate	--	0.5			
101144	S	4,4'-Methylene bis(2-chloroaniline), see also Section 5215	--	0.01			
5124301		Methylene bis(4-cyclohexylisocyanate); hydrogenated MDI	0.005	0.054			
101688		Methylene bis(phenylisocyanate); MDI; diphenylmethane diisocyanate	0.005	0.051			
75092		Methylene chloride; dichloromethane (see also section 5202)	25	87		125	435
101779	S	4,4'-Methylene dianiline; MDA (see also Sections 1535 and 5200)	0.01	0.08		0.1	0.8
78933		Methyl ethyl ketone; MEK; 2-butanone; ethyl methyl ketone	200	590		300	885
1338234		Methyl ethyl ketone peroxide	0.2	1.5	C		
107313		Methyl formate	100	250		150	375
60344	S	Methyl hydrazine; monomethyl hydrazine	0.01	0.019			
74884	S	Methyl iodide	2	10			
110123		Methyl isoamyl ketone	50	234			
108112	S	Methyl isobutyl carbinol; 4-methyl-2-pentanol; methyl amyl alcohol	25	100		40	165
108101		Methyl isobutyl ketone; Hexone	50	205		75	300
624839	S	Methyl isocyanate	0.02	0.05			
563804		Methyl isopropyl ketone	200	705			
74931		Methyl mercaptan	0.5	1			
80626		Methyl methacrylate; methyl 2-methyl-2-propenoate	50	205		100	410
298000	S	Methyl parathion; o,o-dimethyl o-(p-nitrophenyl) phosphorothioate	--	0.2			
107879		Methyl propyl ketone; 2-pentanone	200	700		250	875
681845		Methyl silicate; tetramethyl silicate	1	6			
98839		alpha-Methylstyrene; 1-methyl-1-phenylethene	50	240		100	485
77781		Methyl sulfate; see Dimethyl sulfate					
1634044		Methyl tert-butyl ether; MTBE	40	144			
78944	S	Methyl vinyl ketone	0.05	0.14	C		
21087649		Metribuzin	--	5			
7786347	S	Mevinphos; 2-carbomethoxyl-1-propen-2-yl dimethyl phosphate	0.01	0.1		0.03	0.3
		Mica, see Silicates					

Footnotes (a) through (u) at end of Table AC-1

Page 14

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)			STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M ^{3(f)}
7439987		Mineral wool fiber; see Particulates not otherwise regulated Molybdenum, insoluble compounds, as Mo	--				
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	3			
		Molybdenum, soluble compounds, as Mo	--	0.5 ⁽ⁿ⁾			
6923224		Monocrotophos	--	0.25			
100618		Monomethylaniline; see N-Methylaniline					
60344		Monomethylhydrazine; see Methyl hydrazine					
110918	S	Morpholine; tetrahydro-4H-1, 4-oxazine	20	70		30	105
7647010		Muriatic acid; see Hydrogen chloride					
300765	S	Naled; o,o-dimethyl o- (1,2-dibromo-2,2-dichloroethyl) phosphate	--	3			
8030317		Naphtha, coal tar	100	400			
91203		Naphthalene	10	50		15	75
134327		alpha-Naphthylamine; 1-naphthylamine, see Section 5209					
91598		beta-Naphthylamine; 2-naphthylamine, see Section 5209					
63252		1-Naphthyl N-methylcarbamate; see Carbaryl					
25551284		Naphthalene diisocyanate; NDI	0.01	0.085	C		
7440019		Neon	(h)				
13463393		Nickel carbonyl; Ni (CO) ₄	0.001	0.007			
7440020		Nickel metal, as Ni	--	0.5			
		Nickel, insoluble compounds, as Ni	--	0.1			
		Nickel, soluble compounds, as Ni	--	0.05			
12035722		Nickel subsulfide	--	0.05			
54115	S	Nicotine; 1-methyl-2-(3-pyridyl)-pyrrolidine	0.075	0.5			
1929824		Nitrapyrin	--				
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
7697372		Nitric acid	2	5		4	10
10102439		Nitric oxide; NO	25	30			
100016	S	p-Nitroaniline	--	3			
98953	S	Nitrobenzene	1	5			
100005	S	p-Nitrochlorobenzene; 1-chloro-4-nitrobenzene	0.1	0.64			
92933		4-Nitrodiphenyl, see Section 5209					
79243		Nitroethane	100	310			
7727379		Nitrogen	(h)	--			
10102440		Nitrogen dioxide				1	1.8
		Nitrogen tetroxide; N ₂ O ₄ ; see Nitrogen dioxide					
7783542		Nitrogen trifluoride	10	29			
55630	S	Nitroglycerin		(k)		--	0.1
75525		Nitromethane	2	5			
108032		1-Nitropropane	25	90			
79469		2-Nitropropane	10	35			
62759		N-Nitrosodimethylamine, see Section 5209					
1321126,	S	Nitrotoluene	2	11			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
99081, 88722, 99990 76062		Nitrotrichloromethane; see Chloropicrin					
10024972		Nitrous oxide	50	90			
111842		Nonane	200	1,050			
		Nuisance particulates, see Particulates not otherwise regulated					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
2234131	S	Octachloronaphthalene	--	0.1		--	0.3
111659		Octane	300	1,450		375	1800
8012951		Oil (mineral) mist, particulate	--	(5) ^(l)			
		Oil (vegetable) mists (except castor, cashew nut or similar irritant oils); see Nuisance particulates					
		Organic arsenic compounds; see Arsenic, organic					
20816120		Osmium tetroxide, as Os	0.0002	0.002		0.0006	0.006
144627		Oxalic acid	--	1		--	2
7783417		Oxygen difluoride	0.05	0.1	C		
10028156		Ozone	0.1	0.2		0.3	0.6
8002742		Paraffin wax fume	--	2			
1910425, 2074502	S	Paraquat, total particulates	--	0.5			
1910425, 2074502	S	Paraquat, respirable sizes	--	0.1 ⁽ⁿ⁾			
56382	S	Parathion; o,o-diethyl o-(p-nitrophenyl) phosphorothioate	--	0.1			
		Particulates not otherwise regulated					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
		Particulate polycyclic; aromatic hydrocarbons (PPAH) see Coal tar pitch volatiles					
		PCB; see Chlorodiphenyl					
87865	S	PCP; see Pentachlorophenol					
19624227		Pentaborane	0.005	0.01		0.015	0.03
1321648	S	Pentachloronaphthalene	--	0.5			
87865	S	Pentachlorophenol; PCP	--	0.5			
115775		Pentaerythritol; tetrakis- (hydroxymethyl)methane; tetra-methylolmethane; see Particulates not otherwise regulated					
109660		Pentane	600	1,800			
107879		2-Pentanone; see Methyl propyl ketone					
628637; 626380; 123922; 625161; 620111;		Pentyl acetate	50	266		100	532

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)			STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M ^{3(f)}
624419							
67721		Perchloroethane; see Hexachloroethane					
127184		Perchloroethylene	25	170	300 ppm	100	685
594423		Perchloromethyl mercaptan; trichloromethanethiol	0.1	0.8			
7616946		Perchloryl fluoride; ClO ₃ F	3	14		6	28
382218		Perfluoroisobutylene	0.01	0.082	C		
		Perlite					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
108952	S	Phenol	5	19			
92842	S	Phenothiazine; dibenzothiazine	--	5			
106503	S	p-Phenylenediamine	--	0.1			
101848		Phenyl ether, vapor	1	7			
100425		Phenylethylene; see Styrene					
122601	S	Phenyl glycidyl ether, PGE;1,2-epoxy- 3-phenoxypropane	0.1	0.6			
100630	S	Phenylhydrazine	5	20		10	45
108985		Phenyl mercaptan	0.5	2			
638211		Phenylphosphine	0.05	0.25	C		
298022	S	Phorate; o,o-diethyl S-(ethylthio)methyl phosphorodithioate	--	0.05		--	0.2
75445		Phosgene; carbonyl chloride; COCl ₂	0.1	0.4			
7803512		Phosphine; PH ₃	0.3	0.4		1	1
7664382		Phosphoric acid	--	1		--	3
7723140		Phosphorus, yellow	--	0.1			
10025873		Phosphorus oxychloride	0.1	0.6			
10026138		Phosphorus pentachloride	0.1	1			
1314803		Phosphorus pentasulfide; P ₂ S ₅	--	1		--	3
7719122		Phosphorus trichloride	0.2	1.5		0.5	3
85449		Phthalic anhydride	1	6			
626175		m-Phthalodinitrile	--	5			
1918021		Picloram	--				
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
88891	S	Picric acid; 2,4,6-trinitrophenol	--	0.1			
83261		Pindone; 2-pivalyl-1, 3-indandione		0.1			
142643		Piperazine dihydrochloride	--	5			
26499650		Plaster of Paris; calcium sulfate hemihydrate; see Particulates not otherwise regulated					
7440064		Platinum, metal	--	1			
		Platinum, soluble salts, as Pt	--	0.002			
		Polychlorobiphenyls, see Chlorodiphenyl					
		Polytetrafluoroethylene, decomposition products	--	(m)			
		Portland Cement; see Particulates not otherwise regulated					
1310583		Potassium hydroxide; caustic potash	--	2	C		
593293		Potassium stearate	--	10			
74986		Propane	1000	1800 ^(h)			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	ppm ^(e)	mg/M ^{3(f)}
107197	S	Propargyl alcohol; 2-propyn-1-ol	1	2		
57578		beta-Propiolactone, see Section 5209	0.5	1.5		
79094		Propionic acid	10	30		
114261		Propoxur; 2-isopropoxyphenyl N-methyl carbamate		0.5		
109604		n-Propyl acetate	200	840	250	1050
71238	S	n-Propyl alcohol	200	500	250	625
115071		Propylene	(h)	--		
78875		Propylene dichloride; 1,2-dichloropropane	75	350	110	510
6423434	S	Propylene glycol dinitrate; PGDN	0.05	0.3		
107982	S	Propylene glycol monomethyl ether	100	360	150	540
108656	S	Propylene glycol monomethyl ether acetate	100	541	150	811
75558	S	Propyleneimine; 2-methylaziridine	2	5		
75569		Propylene oxide; 1,2-epoxy-propane	2	4.75		
627134		n-Propyl nitrate	25	107	40	170
74997		Propyne; see Methylacetylene				
8003347		Pyrethrum	--	5		
110861		Pyridine	5	15		
106514		Quinone	0.1	0.4		
121824		RDX; see Cyclonite				
		Refractory ceramic fiber		0.2f/cc ^(q)		
108463		Resorcinol	10	45	20	90
7440166		Rhodium, metal	--	0.1		
		Insoluble compounds, as Rh	--	0.1		
		Soluble salts, as Rh	--	0.001		
		299843 Ronnel; o,o-dimethyl o-(2,4,5-				
		-- 10 trichlorophenyl) phosphorothioite				
		Rosin core solder, pyrolysis products,				
		as formaldehyde	--	0.1		
83794		Rotenone, commercial	--	5		
1309371		Rouge; see Particulates not otherwise regulated				
		Rubber solvent (Naphtha)	400	1,600		
		Selenium compounds, as Se	--	0.2		
7783791		Selenium hexafluoride	0.05	0.4		
136787		Sesone; sodium 2,4-dichloro-phenoxyethyl sulfate				
		Total dust	--	10		
		Respirable fraction ⁽ⁿ⁾	--	5		
61790532		Silica, amorphous				
		Diatomaceous earth				
		Total dust	--	6		
		Respirable fraction ⁽ⁿ⁾	--	3		
		Precipitated and gel	--	6		
		Silica, crystalline				
14464461		Cristobalite, respirable dust	--	0.05		
14808607		Quartz, respirable dust	--	0.1		
14808607		Quartz, total dust	--	0.3		
60676860		Silica, fused, respirable dust	--	0.1		

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
15468323		Tridymite, respirable dust	--	0.05			
1317959		Tripoli, respirable dust	--	0.1			
12001262		Silicates (<1% crystalline silica)					
		Mica (respirable dust)	--	3			
		Soapstone, total dust	--	6			
		Soapstone, respirable dust	--	3			
		Talc (containing asbestos); see Section 5208					
14807966		Talc (containing no asbestos fibers), respirable dust	--	2			
		Tremolite (containing no asbestos fibers), respirable dust	--	2			
7440213		Silicon; see Particulates not otherwise regulated					
409212		Silicon carbide; SiC; see Particulates not otherwise regulated					
7803625		Silicon tetrahydride; silane	5	7			
7440224		Silver metal, as Ag	--	0.01			
		Silver, soluble compounds, as Ag	--	0.01			
		Soapstone, see Silicates					
26628228	S	Sodium azide	0.1	0.3	C		
7631905		Sodium bisulfite	--	5			
136787		Sodium 2,4-dichlorophenoxyethyl sulfate; see Sesone					
62748	S	Sodium fluoroacetate	--	0.05		--	0.15
1310732		Sodium hydroxide; caustic soda	--	2	C		
7681574		Sodium metabisulfite	--	5			
822162		Sodium stearate	--	10			
9005258		Starch; see Particulates not otherwise regulated					
7789062		Strontium chromate, as Cr (see also Sections 1532.2, 5206 & 8359)	--	0.0005			
		Stearates; see specific compound					
7803523		Stibine; SbH ₃	0.1	0.5			
8052413		Stoddard solvent	100	525			
57249		Strychnine	--	0.15			
100425	S	Styrene (monomer); phenylethylene	50	215	500 ppm	100	425
9014011		Subtilisins (as pure crystalline proteolytic enzymes)	--				0.00006 ^(r)
57501		Sucrose; see Particulates not otherwise regulated					
74222972		Sulfometuron methyl	--	3.5			
3689245	S	Sulfotep; tetraethyl dithionopyrophosphate		0.2			
7446095		Sulfur dioxide	2	5		5	10
2551624		Sulfur hexafluoride	1,000	6,000			
7664939		Sulfuric acid	--	0.1		--	3
10025679		Sulfur monochloride; S ₂ Cl ₂	1	6	C		
5714227		Sulfur pentafluoride; S ₂ F ₁₀	0.01	0.1	C		
7783600		Sulfur tetrafluoride	0.1	0.4	C		
2699798		Sulfuryl fluoride; SO ₂ F ₂	5	20		10	40
35400432		Sulprofos		1			
93765		2,4,5-T; 2,4,5-trichlorophenoxyacetic acid Talc; see Silicates	--	10			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
7440257		Tantalum metal dust, as Ta	--	5			
1314610		Tantalum oxide dust, as Ta	--	5			
78308		TCP; see Triorthocresyl phosphate					
584849		TDI; see Toluene-2,4-diisocyanate					
3689245	S	TEDP; see Sulfotep					
		Tellurium and compounds, as Te	--	0.1			
7783804		Tellurium hexafluoride	0.02	0.2			
3383968		Temephos; o,o,o',o'-tetramethyl o,o'-thiodi-p-phenylene phosphorothioate					
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
107493	S	TEPP; tetraethyl pyrophosphate;	0.004	0.05			
100210		Terephthalic acid	--	10			
		Terphenyls	0.5	5	C		
79276		1,1,2,2-Tetrabromoethane; see Acetylene tetrabromide					
76119		1,1,1,2-Tetrachloro-2,2-difluoroethane	500	4170			
76120		1,1,2,2-Tetrachloro-1,2-difluoroethane; fluorocarbon 112	500	4,170			
79345	S	1,1,2,2-Tetrachloroethane; acetylene tetrachloride	1	7			
127184		Tetrachloroethylene; see Perchloroethylene					
56235		Tetrachloromethane; see Carbon tetrachloride					
1335882	S	Tetrachloronaphthalene	--	2			
3689245		Tetraethyl dithionopyrophosphate; see Sulfotep					
78002	S	Tetraethyl lead; tetraethylplumbane, as Pb	--	0.075			
107493		Tetraethyl pyrophosphate; see TEPP					
109999		Tetrahydrofuran	200	590		250	735
75741	S	Tetramethyl lead; tetramethylplumbane, as Pb	--	0.075			
115775		Tetramethylolmethane; see Pentaerythritol					
3333526	S	Tetramethyl succinonitrile (decomposition product of 2,2'-azobisisobutyronitrile)	0.5	3			
137268		Tetramethyl thiuram disulfide, see Thiram					
509148		Tetranitromethane	0.005	0.04			
7722885		Tetrasodium pyrophosphate	--	5			
479458	S	Tetryl; 2,4,6-trinitrophenylmethylnitramine	--	1.5			
	S	Thallium, soluble compounds, as Tl	--	0.1			
109999		THF; see Tetrahydrofuran					
96695		4,4'-Thiobis(6-tert-butyl-m-cresol)	--				
		Total dust	--	10			
		Respirable fraction ⁽ⁿ⁾	--	5			
68111	S	Thioglycolic acid	1	3.8			
7719097		Thionyl chloride	1	5	C		
137268		Thiram; bis(dimethylthiocarbamoyl) disulfide	--	5			
	S	Tin, organic compounds, as Sn	--	0.1		--	0.2
21651194		Tin, tin oxide and inorganic compounds, except SnH ₄ , as Sn	--	2			
13463677		Titanium dioxide, as Ti; see Particulates					

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		Ceiling ^(g)	STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}		ppm ^(e)	mg/M ^{3(f)}
		not otherwise regulated					
137268		TMTD; see Thiram					
118967		TNT; see 2,4,6-Trinitrotoluene					
108883	S	Toluene; toluol	10	37	500 ppm	150	560
584849		Toluene-2,4-diisocyanate; TDI	0.005	0.04	0.02 ppm	0.02	0.15
108441	S	m-Toluidine	2	9			
95534	S	o-Toluidine; o-methylaniline	2	9			
106490	S	p-Toluidine	2	9			
8001352		Toxaphene; see Chlorinated camphene					
115866		TPP; see Triphenyl phosphate					
		Tremolite, nonasbestiform; see Silicates					
75252		Tribromomethane; see Bromoform					
126738		Tributyl phosphate	0.2	2.5			
76039		Trichloroacetic acid	1	5			
120821		1,2,4-Trichlorobenzene	5	40	C		
50293		1,1,1,-Trichloro-2,2-bis(p-chlorophenyl)ethane; see DDT					
71556		1,1,1-Trichloroethane; see Methyl chloroform					
79005	S	1,1,2-Trichloroethane	10	45			
79016		Trichloroethylene; trichloroethene	25	135	300 ppm	100	537
75694		Trichlorofluoromethane; Fluorocarbon 11	1,000	5,600	C		
67663		Trichloromethane; see Chloroform					
594423		Trichloromethanethiol; see Perchloromethyl mercaptan					
1321659	S	Trichloronaphthalene	--	5			
76062		Trichloronitromethane; see Chloropicrin					
93765		2,4,5-Trichlorophenoxyacetic acid see 2,4,5-T					
96184		1,2,3-Trichloropropane	10	60			
76131		1,1,2-Trichloro-1,2,2- trifluoroethane	1000	7600	2000 ppm	1250	9500
78308		Tricresyl phosphate; see Triorthocresyl phosphate					
13121705		Tricyclohexyltin hydroxide; see Cyhexatin					
102716		Triethanolamine	--	5			
121448	S	Triethylamine	1	4.1	C		
112492	S	Triethylene glycol dimethyl ether, Triglyme	5	36			
75638		Trifluorobromomethane	1,000	6,100			
2451629		1,3,5-Triglycidyl-s-triazinetriene		0.005			
552307		Trimellitic anhydride	0.005	0.04	C		
75503		Trimethylamine	5	12		15	36
		Trimethylbenzene, all isomers	25	125			
121459		Trimethyl phosphite	2	10			
88891		2,4,6-Trinitrophenol; see Picric acid					
479458		2,4,6-Trinitrophenylmethyl nitramine; see Tetryl					
118967	S	2,4,6-Trinitrotoluene; TNT	--	0.5			
78308	S	Triorthocresyl phosphate	--	0.1			
603349		Triphenylamine	--	5			

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)		STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	ppm ^(e)	mg/M ^{3(f)}
115866	S	Triphenyl phosphite; TPP	--	3		
7440337		Tungsten metal, as W	--	5		
		Tungsten, insoluble compounds, as W	--	5	--	10
		Tungsten, soluble compounds, as W	--	1	--	3
8006642		Turpentine	100	560		
		Uranium (natural), insoluble compounds, as U	--	0.2	--	0.6
		Uranium (natural), soluble compounds, as U	--	0.05		
110623		Valeraldehyde	50	175		
1314621		Vanadium pentoxide (V ₂ O ₅), respirable dust and fume	--	0.05 ⁽ⁿ⁾		
75014	S	VC; see Vinyl chloride, Section 5210 Vegetable oil mists (except castor, cashew nut or similar irritant oils); see Particulates not otherwise regulated				
108054		Vinyl acetate	10	30	15	45
100425		Vinylbenzene; see Styrene				
593602		Vinyl bromide; bromoethylene	0.1	0.44		
75014	S	Vinyl chloride, see Section 5210	1			
107131	S	Vinyl cyanide, see Acrylonitrile, Section 5213				
100403	S	4-Vinyl cyclohexene	0.1	0.4		
106876	S	Vinyl cyclohexene dioxide	0.1	0.57		
75025		Vinyl fluoride	0.2	0.38		
75354		Vinylidene chloride; 1,1-dichloroethylene	1	4		
75387		Vinylidene fluoride	100	262		
25013154		Vinyltoluene	50	240		
8030306		VM & P (Varnish Makers and Painters) Naphtha 81812 Warfarin; 3-(alpha-acetonyl-benzyl)-4- -- 0.1 hydroxycoumarin	300	1,350	400	1800
		Welding fumes; total particulates (see also individual constituents)	--	5		
		Wood dust All soft and hard woods, except Western red cedar	--		--	10
		Wood dust, Western red cedar--	--	2.5		
1330207		Xylene; xylol; dimethylbenzene	100	435	300 ppm	655
1477550	S	m-Xylene-a,a'-diamine	--	0.1	C	
1300738	S	Xylidine; aminodimethylbenzene	0.5	2.5		
		Yttrium compounds, as Y	--	1		
7646857		Zinc chloride fume	--	1	--	2
13530659		Zinc chromate, as Cr (see also Sections 1532.2, 5206 & 8359)	--	0.005		
15930946		Zinc chromate hydroxide, as Cr (see also Sections 1532.2, 5206 & 8359)	--	0.005		
1314132		Zinc oxide fume	--	5	--	10
		Zinc oxide dust, see Particulates not otherwise regulated				
11103869		Zinc potassium chromate, as Cr (see also Sections 1532.2, 5206 & 8359)	--	0.005		
557051		Zinc stearate	--	10		

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Chemical Abstracts Registry

Number ^(a)	Skin ^(b)	Name ^(c)	PEL ^(d)			STEL ^(o)	
			ppm ^(e)	mg/M ^{3(f)}	Ceiling ^(g)	ppm ^(e)	mg/M ^{3(f)}
37300235		Zinc yellow, as Cr					
--		0.005 (see also Sections 1532.2, 5206 & 8359)					
		Zirconium compounds, as Zr		--	5		-- 10

S

Footnotes to Table AC-1

(a) The Chemical Abstracts Service Registry Number is a designation used to identify a specific compound or substance regardless of the naming system; these numbers were obtained from the Desk Top Analysis Tool for the Common Data Base and from the Chemical Abstracts Indexes.

(b) Refer to section 5155(d) for the significance of the Skin notation.

(c) Trade Names Removed from Table AC-1.

Trade Name	Chemical/Generic Name
Abate	see Temephos
Ammate	see Ammonium Sulfamate
Aqualin	see Acrolein
Arasan	see Thiram
Azodrin	see Moncrotophos
Baygon	see Propoxur
Bidrin	see Dicrotophos
Butyl Cellosolve	see 2-Butoxyethanol
Cellosolve	see 2-Ethoxyethanol
Cellosolve Acetate	see 2-Ethoxyethyl acetate
Compound 1080	see Sodium Fluoracetate
Coyden	see Clopidol
Crag Herbicide	see Sesone
Cythion	see Malathion
Dasanit	see Fensulfothion
Delnav	see Dioxathion
Dibrom	see Naled
Difolatan	see Captafol
Disyston	see Disulfoton
Dowtherm A	see Phenylether and Biphenyl
Dursban	see Chloropyrifos
Dyfonate	see Fonofos
Fermate	see Ferbam
Freons	see Fluorocarbons
Furadan	see Carbofuran
Guthion	see Azinphos Methyl
Korlan	see Ronnel
Lannate	see Methomyl
Mariate	see Methoxychlor
MLT	see Malathion
Moxie	see Methoxychlor
Nialate	see Ethion
Nankor	see Ronnel
Phosdrin	see Mevinphos
Pival	see Pindone

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Plictran	see Cyhexatin
Santobrite	see Pentachlorophenol
Sevin	see Carbaryl
Systox	see Demeton
Teflon	see Polytetrafluoroethylene
Thimet	see Phorate
Thiodan	see Endosulfan
Tordon	see Picloram
Trolene	see Ronnel
Vapona	see Dichlorvos
Weedone 638	see 2, 4-D
Zoalene	see Dinitolmide

(d) For the definition and the application of the Permissible Exposure Limit (PEL), refer to section 5155(b) and (c)(1).

(e) Parts of gas or vapor per million parts of air by volume at 25°C and 760mm Hg pressure.

(f) Milligrams of substance per cubic meter of air at 25°C and 760mm Hg pressure.

(g) Refer to section 5155(b) and (c)(3) for the significance of the Ceiling notation. A "C" notation in this column means the values given in the PEL columns are ceiling values. A numerical entry in this column represents a ceiling value in addition to the TWA values.

(h) A number of gases and vapors, when present in high concentrations, act primarily as asphyxiants without other adverse effects. A concentration limit is not included for each material because the limiting factor is the available oxygen. (Several of these materials present fire or explosion hazards.)

(i) Coal tar pitch volatiles (benzene or cyclohexane-soluble fraction) include fused polycyclic hydrocarbons (some of which are known carcinogens) which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the "coal tar pitch volatiles" standard.

(j) This standard applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and ginning. It does not apply to cotton gins, cottonseed oil industry, or operations covered by section 5190.

(k) A PEL of 0.05 ppm shall apply to exposures involving a mixture of ethylene glycol dinitrate and nitroglycerin.

(l) As sampled by method that does not collect vapor.

(m) Thermal decomposition of the fluorocarbon chain in air leads to the formation of oxidized products containing carbon, fluorine and oxygen. An index of exposure to these products is possible through their alkaline hydrolysis followed by a quantitative determination of fluoride content. No particular concentration limit is specified pending evaluation of the toxicity of the products but concentrations should be kept below the sensitivity of the analytical method.

TABLE AC-1
PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

(n) The concentration and percentage of the particulate used for this limit are determined from the fraction passing a size selector with the following characteristics:

<i>Percent Passing Selector</i>
100
97
91
74
50
30
17
9
5
1

(o) Refer to sections 5155(b) and (c)(2) for the definition and application of the Short Term Exposure Limit (STEL).

(p) (Reserved)

(q) Fibers per cubic centimeter of air at 25°C and 760mm Hg pressure. To be considered a fiber for this limit the glass particle must be longer than 5µm, have a length to diameter ratio of three or more, and have a diameter less than 3µm. The National Institute for Occupational Safety and Health (NIOSH), Method 7400, Issue 2, August 15, 1994, which is hereby incorporated by reference, shall be used for measuring airborne fiber concentrations.

(r) Compliance with the subtilisins PEL is assessed by sampling with a high volume sampler (600-800 liters per minute) for at least 60 minutes.

(s) The concentration and percentage of the particulate used for this limit are determined from the fraction passing a size selector with the following characteristics:

<i>Aerodynamic Diameter in Micrometers (unit density sphere)</i>	
0	.....
1	.....
2	.....
3	.....
4	.....
5	.....
6	.....
7	.....
8	.....
10	.....

<i>Percent Passing Selector</i>
100
97
94
87
77

65
58
54.5
52.2
50

*Aerodynamic Diameter
in Micrometers
(unit density sphere)*

0	.....
1	.....
2	.....
5	.....
10	.....
20	.....
30	.....
40	.....
50	.....
100	.....

Footnotes (a) through (u) at end of Table AC-1

TABLE AC-1

PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

Footnotes (a) through (u) at end of Table AC-1

Page 26

(t) Glutaraldehyde can cause occupational asthma and skin sensitization responses such as contact dermatitis. Exposure related symptoms may include one or more of the following: shortness of breath, chest tightness, wheeze, cough, skin rash, hives, and irritation of the nose, throat, skin or eye. Hazard communication training required by sections 5191 or 5194 shall address these health hazards and symptoms along with the measures taken by the employer to evaluate and control exposures that can include medical evaluations, exposure monitoring, ventilation systems, work practices, and personal protective equipment. The communication system required by section 3203 shall inform employees where to report possible health symptoms and where to ask questions, report concerns, and receive information about the employer's evaluation and control measures.

(u) This PEL applies to the sum of the exposures to the substance in the vapor state and from the particulate fraction specified in footnote (s) in this table.

Note: Authority cited: Section 142.3, Labor Code. Reference: Sections 142.3 and 144.6, Labor Code.

Appendix C

Industry Safety Orders

Group 16. Control of Hazardous Substances

Article 109. Hazardous Substances and Processes

§5191. Occupational Exposure to Hazardous Chemicals in Laboratories.

(a) Scope and application.

(1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(2) Where this section applies, it shall supersede, for laboratories, the requirements of Title 8 of the California Code of Regulations Section 5190 and Article 110, Regulated Carcinogens of the General Industry Safety Orders, except as follows:

(A) The requirement to limit employee exposure to the specific exposure limit.

(B) When that particular regulation states otherwise, as in the case of Section 5209(c)(6).

(C) Prohibition or prevention of eye and skin contact where specified by any health regulation shall be observed.

(D) Where the action level (or in the absence of an action level, the exposure limit) is exceeded for a regulated substance with exposure monitoring and medical surveillance requirements.

(E) The "report of use" requirements of Article 110, (Section 5200 et. seq.) Regulated Carcinogens regulations.

(F) Section 5217 shall apply to anatomy, histology and pathology laboratories.

(3) This regulation shall not apply to:

(A) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant regulations in Title 8, California Code of Regulations, even if such use occurs in a laboratory.

(B) Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1. Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

2. Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b) Definitions

Action level. A concentration designated in Title 8, California Code of Regulations for a specific substance, calculated as an eight (8)-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Carcinogen (see "select carcinogen").

Chemical Hygiene Officer. An employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan. A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that

(1) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular work place and

(2) meets the requirements of subsection 5191(e).

Chief. The Chief of the Division of Occupational Safety and Health.

Combustible liquid. Any liquid having a flashpoint at or above 100° F (37.8° C), but below 200° F (93.3° C) except any mixture having components with flashpoints of 200° F (93.3° C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Compressed gas.

(1) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70° F (21.1° C); or

(2) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130° F (54.4° C) regardless of the pressure at 70° F (21.1° C); or

(3) A liquid having a vapor pressure exceeding 40 psi at 100° F (37.8° C) as determined by ASTM D-323-72.

Designated area. An area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

Emergency. Any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee. An individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Explosive. A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable. A chemical that falls into one of the following categories:

(1) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(2) "Gas, flammable" means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air greater than 12 percent by volume, regardless of the lower explosive limit.

(3) "Liquid, flammable" means any liquid having a flashpoint below 100° F (37.8° C), except any mixture having components with flashpoints of 100° F (37.8° C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(4) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in 29 CFR 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint. The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(1) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100° F (37.8° C), or that do not contain suspended solids, and do not have a tendency to form a surface film under test; or

(2) Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens closed tester), Z11.7 - 1979 (ASTM D 93-79) for liquids with a viscosity equal to or greater than 45 SUS at 100° F (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(3) Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)). Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

Hazardous chemical. A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

Appendices A and B of the Hazard Communication Standard (Section 5194) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this regulation.

Laboratory. A facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale. Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood. A device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosure on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals. Handling or use of such chemicals in which all of the following conditions are met:

- (1) Chemical manipulations are carried out on a "laboratory scale";
- (2) Multiple chemical procedures or chemicals are used;
- (3) The procedures involved are not part of a production process, nor in any way simulate a production process; and
- (4) "Protective laboratory practices and equipment" are available and in common use industry-wide to minimize the potential for employee exposure to hazardous chemicals.

Medical consultation. A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Organic peroxide. An organic compound that contains the bivalent -o-o- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer. A chemical other than a blasting agent or explosive as defined in Section 5237(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard. A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Protective laboratory practices and equipment. Those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive toxins. Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Select carcinogen. Any substance which meets one of the following criteria:

- (1) It is regulated by Cal/OSHA as a carcinogen; or
- (2) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (1985 edition); or
- (3) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (Volumes 1-48 and Supplements 1-8); or
- (4) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - (A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
 - (B) After repeated skin application of less than 300 mg/kg of body weight per week; or
 - (C) After oral dosages of less than 50 mg/kg of body weight per day.

Unstable (reactive). A chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Water-reactive. A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(c) Exposure limits. For laboratory uses of Cal/OSHA regulated substances, the employer shall ensure that laboratory employees' exposures to such substances do not exceed the exposure limits specified in Title 8, California Code of Regulations, Group 16, Section 5139 et seq., of the General Industry Safety Orders.

(d) Employee exposure determination

(1) Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance exceed the action level (or in the absence of an action level, the exposure limit). The person supervising, directing or evaluating the monitoring shall be competent in industrial hygiene practice.

(2) Periodic monitoring. If the initial monitoring prescribed by subsection 5191(d)(1) discloses employee exposure over the action level (or in the absence of an action level, the exposure limit), the employer shall immediately comply with the exposure monitoring provisions of the relevant regulation.

(3) Termination of monitoring. Monitoring may be terminated in accordance with the relevant regulation.

(4) Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

(e) Chemical hygiene plan.

(1) Where hazardous chemicals as defined by this regulation are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

(A) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(B) Capable of keeping exposures below the limits specified in subsection 5191(c).

(2) The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Chief.

(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(A) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals:

(B) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(C) A requirement that fume hoods comply with Section 5154.1, that all protective equipment shall function properly and that specific measures shall be taken to ensure proper and adequate performance of such equipment;

(D) Provisions for employee information and training as prescribed in subsection 5191(f);

(E) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(F) Provisions for medical consultation and medical examinations in accordance with subsection 5191(g);

(G) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene officer and, if appropriate, establishment of a Chemical Hygiene Committee; and

(H) Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate;

1. Establishment of a designated area;
2. Use of containment devices such as fume hoods or glove boxes;
3. Procedures for safe removal of contaminated waste; and
4. Decontamination procedures.

(4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

Note: Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan.

(f) Employee information and training.

(1) The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area. Information and training may relate to an entire class of hazardous substances to the extent appropriate.

(2) Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

(3) Information. Employees shall be informed of:

(A) The contents of this regulation and its appendices which shall be available to employees;

(B) The location and availability of the employer's Chemical Hygiene Plan;

(C) The exposure limits for Cal/OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable Cal/OSHA regulation;

(D) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(E) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

(4) Training.

(A) Employee training shall include;

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

2. The physical and health hazards of chemicals in the work area; and

3. The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

(B) The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

(g) Medical consultation and medical examinations.

(1) The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances;

(A) Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

(B) Where exposure monitoring reveals an exposure level above the action level (or in the absence of an action level, the exposure limit) for a Cal/OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

(C) Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

(2) All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

(3) Information provided to the physician. The employer shall provide the following information to the physician;

(A) The identity of the hazardous chemical(s) to which the employee may have been exposed;

(B) A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

(C) A description of the signs and symptoms of exposure that the employee is experiencing, if any.

(4) Physician's written opinion.

(A) For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following;

1. Any recommendation for further medical follow-up;

2. The results of the medical examination and any associated tests, if requested by the employee;

3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and

4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

(B) The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

(h) Hazard identification.

(1) With respect to labels and material safety data sheets;

(A) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

(B) Employers shall maintain in the workplace any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees during each work shift when they are in their work area(s).

(2) The following provisions shall apply to chemical substances developed in the laboratory;

(A) If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in subsection 5191(b). If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under subsection 5191(f).

(B) If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement subsection 5191(e).

(C) If the chemical substance is produced for commercial purposes by another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (Section 5194) including the requirements for preparation of material safety data sheets and labeling.

(i) Use of respirators.

Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of Section 5144.

(j) Recordkeeping.

(1) The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this regulation.

(2) The employer shall ensure that such records are kept, transferred, and made available in accordance with Section 3204.

(k) Dates

(1) Employers shall have developed and implemented a written Chemical Hygiene Plan no later than October 31, 1991.

(2) Subsection (a) (2) shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

(l) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

NOTE: Authority cited: Sections 142.3 and 9020, Labor Code. Reference: Sections 142.3, 9004(d), 9009 and 9020, Labor Code.

[Appendix A](#)

[Appendix B](#)

HISTORY

1. New section filed 3-25-91; operative 4-24-91 (Register 91, No. 17).
2. Editorial correction of printing errors (Register 92, No. 33).
3. Change without regulatory effect amending Appendix B subsections (b)1. and (c)1. filed 12-28-92 pursuant to section 100, title 1, California Code of Regulations (Register 93, No. 1).
4. Editorial correction of Appendix A subsection D.11.(b) (Register 95, No. 24).

APPENDIX D

Chemical Compatibility Chart

Below is a chart adapted from the CRC Laboratory Handbook which groups various chemicals into 23 groups with examples and incompatible chemical groups. This chart is by no means complete but it will aid in making decisions about storage. For more complete information please refer to the SDS for the specific chemical.

Group	Name	Example	Incompatible Groups
1	Inorganic Acids	Hydrochloric acid, Hydrofluoric acid, Nitric acid, Sulfuric acid	2,3,4,5,6,7,8,10,13,14,16,17,18,19,21,22,23
2	Organic Acids	Acetic acid, Butyric acid, Formic acid, Propionic acid	1,3,4,7,14,16,17,18,19,22
3	Caustics (Bases)	Sodium hydroxide, Ammonium hydroxide solution	1,2,6,7,8,13,14,15,16,17,18,20,23
4	Amines and Alkanolamines	Aminoethylethanolamine, Aniline Diethanolamine, Diethylamine Ethylenediamine, Monoethanolamine Triethanolamine, Triethylamine Triethylenetetramine	1,2,5,7,8,13,14,15,16,17,18,23
5	Halogenated Compounds	Carbon tetrachloride, Chlorobenzene Chloroform, Methylene chloride Carbon Tetrachloride, 1,2,4-Trichlorobenzene 1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane	1,3,4,11,14,17
6	Alcohols, Glycols & Glycol Ether	1,4-Butanediol, Butanol (any isomer) Diethylene glycol, Ethyl alcohol Ethyl butanol, Ethylene glycol Furfuryl alcohol, Isoamyl alcohol Methyl alcohol, Propylene glycol	1,7,14,16,20,23
7	Aldehydes & Acetaldehyde	Acrolein, Butyraldehyde, Formaldehyde Paraformaldehyde, Propionaldehyde	1,2,3,4,6,8,15,16,17,19,20,23
8	Ketones	Acetone, Acetophenone, Diisobutyl ketone, Methyl ethyl ketone	1,3,4,7,19,20
9	Saturated Hydrocarbons	Cyclohexane, Heptane, Paraffins Pentane, Petroleum ether	20
10	Aromatic Hydrocarbons	Benzene, Ethyl benzene, Naphtha Toluene, Xylene	1, 20
11	Olefins	Butylene, 1-Decene, 1-Dodecene Ethylene, Turpentine	1, 5, 20
12	Petroleum Oils	Asphalt, Gasolines, Mineral Oil	20
13	Esters	Amyl acetate, Butyl acetates Ethyl acetate	1,3,4,19,20

14	Monomers – Polymerizable Esters	Acrylic acid, Acrylonitrile, Butadiene Acrylates	1,2,3,4,5,6,15,16,19,20,21,23
15	Phenols	Cresote, Cresols, Phenol	3,4,7,14,16,19,20
16	Alkylene Oxides	Ethylene oxide, Propylene oxide	1,2,3,4,6,7,14,15,17,18,19,23
17	Cyanohydrins	Acetone cyanohydrin Ethylene cyanohydrin	1,2,3,4,5,7,16,19,23
18	Nitriles	Acetonitrile, Adiponitrile	1,2,3,4,16,23
19	Ammonia	Ammonia gas, Ammonium Hydroxide	1,2,7,8,13,14,15,16,17,20,23
20	Halogens	Chlorine, Fluorine	3,6,7,8,9,10,11,12,13,14,15,19,21,22
21	Ethers	Diethyl Ether, THF	1, 14, 20
22	Phosphorus	Phosphorus, Elemental	1, 2, 3, 20
23	Acid Anhydrides	Acetic anhydride, Propionic anhydride	1,3,4,6,7,14,16,17,18,19

APPENDIX E

Peroxide-Forming Chemicals

TABLE 1. COMMON PEROXIDE-FORMING COMPOUNDS

Group A- Chemicals that form explosive levels of peroxides without concentration.

(Safe storage time after opening - 3 months)

Chemical Name	CAS Number	Synonym(s)
1,1-Dichloroethylene	75-35-4	Vinylidene Chloride
2-Chloro-1,3-Butadiene	126-99-8	Chloroprene
Butadiene	106-99-0	
Divinyl Acetylene	821-08-9	
Isopropyl Ether	108-20-3	
Tetrafluoroethylene	116-14-3	
Vinyl Ether	109-93-3	Divinyl ether

Group B-Chemicals that form explosive levels of peroxides on concentration

(Safe storage time after opening - 12 months)

Chemical Name	CAS Number	Synonym(s)
2-Butanol	78-92-2	
2-Cyclohexanol	822-67-3	
2-Hexanol	626-93-7	
2-Pentanol	6032-29-7	
3-Methyl-1-Butanol	123-51-3	Isoamyl alcohol
4-Heptanol	589-55-9	
4-Methyl-2-Pentanol	108-11-2	
Acetal	105-57-7	
Acetaldehyde	75-07-0	
alpha-Methyl-Benzyl Alcohol	98-85-1	Phenyl Ethanol
Benzyl Alcohol	100-51-6	
Cyclohexanol	108-93-0	
Cyclohexene	110-83-8	
Cyclooctene	931-87-3	
Cyclopentene	42-29-0	
Decahydronaphthalene	91-17-8	
Diacetylene	460-12-8	
Dicyclopentadiene	77-73-6	
Dioxane	123-91-1	1,4 Dioxane
Ethylene Glycol Dimethyl Ether	110-71-4	Diethylene Glycol Dimethyl Ether and Glyme
Ethyl Ether	60-29-7	Diethyl Ether
Furan	110-71-4	
Isopropyl Benzene	98-82-8	Cumene
Methylcyclopentane	96-37-7	
Methyl Isobutyl Ketone	108-10-1	

Penten-1-ol	821-09-0	
Propyne	74-99-7	Methyl Acetylene
Tetrahydrofuran	109-99-9	
Tetrahydronaphthalene	119-64-2	

Group C- Chemicals which may autopolymerize as a result of peroxide accumulation

(Safe storage time after opening: inhibited chemicals- 12 months; uninhibited chemicals: - 24 hours)

Note: Do not store inhibited chemicals in this group under inert atmospheres

Chemical Name	CAS Number	Synonym(s)
1,1-Dichloroethylene	75-35-4	Vinylidene Chloride
2-Chloro-1,3-Butadiene (1,3)	126-99-8	Chloroprene
Acrylic Acid (2)	79-10-7	
Acrylonitrile (2)	107-13-1	
Butadiene (1,3)	106-99-0	
Buten-3-yne	689-97-4	Vinyl acetylene & Butenyne
Chlorotrifluoroethylene	79-38-9	
Methyl Methacrylate (2)	80-62-6	
Phenethyl Alcohol	60-12-8	Phenyl Ethanol
Styrene	100-42-5	
Tetrafluoroethylene	116-14-3	
Vinyl Acetate	108-05-4	
Vinyl Chloride	75-01-4	Monochloroethylene

1. When stored as a liquid monomer
2. Although these form peroxides, no explosions involving these monomers have been reported
3. Also stored as a gas in gas cylinders.

APPENDIX F

General Lab Self-Inspection Checklist

Building: _____ Room: _____ Date: _____
Completed By: _____
Y=Satisfactory Situation N= Needs Improvement N/A=Not Applicable

1.0 HAZARDOUS MATERIALS

Y N N/A

1.1 Hazard Communication

- All containers are legibly labeled with full chemical names and the hazard of the material. Containers of nonhazardous substances (e.g., water) are labeled explicitly to avoid confusion and stock solutions are properly identified (e.g. buffers labeled and marked with the words “buffer”).
- A written chemical inventory is maintained and MSDS’s are readily available to employees for all chemicals used or stored in the lab.

1.2 Control

- Hazardous substances are separated according to chemical compatibility.
- Containers of peroxide-forming chemicals are dated upon receipt and disposed of or tested within manufacturer’s suggested expiration dates.
- All chemical containers are capped and sealed, except when actively adding or removing materials from them.
- Chemical storage areas are routinely inspected for leaks and evidence of container deterioration.
- Chemical waste is contained and labeled according to the campus hazardous waste guidelines.
- Containers are labeled with the initial date of accumulation, with the words “Hazardous Waste,” with the waste’s physical state, hazardous properties (e.g. flammable), full product names, and appropriate percentages.
- Biohazardous waste is contained in red bags that are labeled as Biohazardous. Sharps are stored in rigid, red, biohazard containers.
- Animal carcasses and/or infectious tissues are properly contained and disposed of in a timely manner.
- Incidental spills are cleaned up in a timely manner and benches and equipment are cleaned/decontaminated as often as necessary to prevent unnecessary exposure to chemical or biological agents.
- Access to safety equipment (e.g., safety shower, eyewash), aisles and exits remain free of obstructions.
- Safety equipment is present and inspected regularly.

1.3 Storage of Flammable/Combustible Liquids

- Flammable liquids in quantities in excess of 10 gallons are stored in an NFPA- approved flammable liquid storage cabinet.
- All flammable liquid cabinets are free of combustible materials (cardboard, paper, etc.).

2.0 HEALTH AND SAFETY TRAINING

Employees have documented training on:

- Campus Chemical Hygiene Plan and how to access MSDSs.
- Laboratory specific hazards and locations, emergency equipment and emergency procedures.

APPENDIX G

Chemical Resistant Gloves

Nitrile gloves (6 – 8 mils) are acceptable for most laboratory work where the intended use is to prevent incidental contact with hazardous materials. Processes where there is direct contact with chemical require the user to consult the SDS or the information present below for guidance. Glove selection guides are available for specific gloves at most manufacturer’s websites.

Gloves	Material	Chemical Resistance	
		Recommended	Not Recommended
Butyl	Synthetic Rubber	Aldehydes, ketones, esters, glycol ethers, polar organic solvents	Aliphatic, aromatic and chlorinated solvents
Neoprene	Synthetic Rubber	Oxidizing acids, bases, alcohols, oils, fats, aniline, phenol, glycol ethers	Chlorinated solvents
Nitrile	Synthetic Rubber	Oils, greases, acids, caustics, aliphatic solvents	Aromatic solvents, many ketones, esters, many chlorinated solvents
PVA	Poly-Vinyl Alcohol	A wide range of aliphatic, aromatic and chlorinated solvents, ketones (except acetone), esters, ethers	Acids, alcohols, bases, water
PVC	Poly-Vinyl Chloride	Strong acids and bases, salts, other aqueous solutions, alcohols, glycol ethers	Aliphatic, aromatic and chlorinated solvents, aldehydes, ketones, nitrocompunds
Viton	Fluoroelastimer	Aromatic, aliphatic and chlorinated solvents, and alcohols	Some ketones, esters, amines
Silver Shield	Laminate	Wide range of solvents, acids and bases	
Latex	Natural Rubber	Weak Acids, Weak bases, alcohols, aqueous solutions	Oils, greases and organics

Glove Manufacturers	
Company Name	Website
Ansell Protective Products	http://www.ansellpro.com/us/products/sub.asp?category=chem_res
Best Gloves	http://www.bestglove.com
MAPA Professional	http://www.mapaglove.com/ce/ChemicalSearch.asp
Safeskin	http://www.safeskin.com/ChemResist/direct.asp

APPENDIX H

Select Agents and Toxins List

The following biological agents and toxins have been determined to have the potential to pose a severe threat to both human and animal health, to plant health, or to animal and plant products. An attenuated strain of a select agent or an inactive form of a select toxin may be excluded from the requirements of the Select Agent Regulations. The list of excluded agents and toxins can be found at:

<http://www.selectagents.gov/Select%20Agents%20and%20Toxins%20Exclusions.html>.

HHS SELECT AGENTS AND TOXINS

Abrin	Rickettsia prowazekii
Botulinum neurotoxins	Rickettsia rickettsii
Botulinum neurotoxin producing species of Clostridium	Saxitoxin
Cercopithecine herpesvirus 1 (Herpes B virus)	Shiga-like ribosome inactivating proteins
Clostridium perfringens epsilon toxin	Shigatoxin
Coccidioides posadasii/Coccidioides immitis	South American Haemorrhagic Fever viruses
Conotoxins	Flexal
Coxiella burnetii	Guanarito
Crimean-Congo haemorrhagic fever virus	Junin
Diacetoxyscirpenol	Machupo
Eastern Equine Encephalitis virus	Sabia
Ebola virus	Staphylococcal enterotoxins
Francisella tularensis	T-2 toxin
Lassa fever virus	Tetrodotoxin
Marburg virus	Tick-borne encephalitis complex (flavi) viruses
Monkeypox virus	Central European Tick-borne encephalitis
Reconstructed replication competent forms of the 1918 pandemic influenza virus containing any portion of the coding regions of all eight gene segments (Reconstructed 1918 Influenza virus)	Far Eastern Tick-borne encephalitis
Ricin	Kyasanur Forest disease
	Omsk Hemorrhagic Fever
	Russian Spring and Summer encephalitis
	Variola major virus (Smallpox virus)
	Variola minor virus (Alastrim)
	Yersinia pestis

OVERLAP SELECT AGENTS AND TOXINS

Bacillus anthracis
Brucella abortus
Brucella melitensis
Brucella suis
Burkholderia mallei (formerly Pseudomonas mallei)
Burkholderia pseudomallei (formerly Pseudomonas pseudomallei)
Hendra virus
Nipah virus
Rift Valley fever virus
Venezuelan Equine Encephalitis virus

USDA VETERINARY SERVICES (VS) SELECT AGENTS

African horse sickness virus
African swine fever virus
Akabane virus
Avian influenza virus (highly pathogenic)
Bluetongue virus (exotic)
Bovine spongiform encephalopathy agent
Camel pox virus
Classical swine fever virus
Ehrlichia ruminantium (Heartwater)
Foot-and-mouth disease virus
Goat pox virus
Japanese encephalitis virus
Lumpy skin disease virus
Malignant catarrhal fever virus
(Alcelaphine herpesvirus type 1)
Menangle virus

Mycoplasma capricolum subspecies
capripneumoniae
(contagious caprine pleuropneumonia)
Mycoplasma mycoides subspecies mycoides
small
colony (Mmm SC) (contagious bovine
pleuropneumonia)
Peste des petits ruminants virus
Rinderpest virus
Sheep pox virus
Swine vesicular disease virus
Vesicular stomatitis virus (exotic): Indiana
subtypes
VSV-IN2, VSV-IN3
Virulent Newcastle disease virus 1

USDA PLANT PROTECTION AND QUARANTINE

(PPQ) SELECT AGENTS AND TOXINS

Peronosclerospora philippinensis (Peronosclerospora
sacchari)
Phoma glycinicola (formerly Pyrenochaeta glycines)
Ralstonia solanacearum race 3, biovar 2
Rathayibacter toxicus
Sclerophthora rayssiae var zeae
Synchytrium endobioticum
Xanthomonas oryzae
Xylella fastidiosa (citrus variegated chlorosis strain)