

**HARVARD INSTITUTES OF MEDICINE/
NEW RESEARCH BUILDING
CHEMICAL HYGIENE PLAN
FOR NON-HARVARD MEDICAL SCHOOL TENANTS**

Prepared By:

**Environmental Health & Engineering, Inc.
117 Fourth Avenue
Needham, MA 02494-2725**

EH&E Report 17893

February 2008

Reviewed January 2009

Reviewed May 2010

Reviewed September 2011

©2011 by Environmental Health & Engineering, Inc.
All rights reserved

TABLE OF CONTENTS

1.0 POLICY AND PURPOSE	1
1.1 POLICY.....	1
1.2 PURPOSE	1
2.0 RESPONSIBILITY, AUTHORITY, AND RESOURCES.....	2
2.1 CHEMICAL HYGIENE OFFICER	2
2.2 DEPARTMENT ADMINISTRATORS AND PRINCIPAL INVESTIGATORS	3
2.3 STAFF MEMBERS, VOLUNTEERS, AND STUDENTS	5
2.4 ENVIRONMENTAL HEALTH AND SAFETY OFFICE STAFF	5
3.0 CHEMICAL HYGIENE PLAN	7
3.1 DEVELOPMENT, IMPLEMENTATION, AND UPDATE.....	7
3.2 IDENTIFICATION AND CLASSIFICATION OF HAZARDOUS CHEMICALS.....	7
3.3 SELECTION OF REQUIRED CONTROL METHODS AND AUTHORITY FOR CHEMICAL USE	8
3.4 SPECIAL PROVISIONS FOR PARTICULARLY HAZARDOUS SUBSTANCES (CARCINOGENS, REPRODUCTIVE TOXINS, AND ACUTELY AND EXTREMELY TOXIC CHEMICALS)	9
3.5 ELIMINATION OR SUBSTITUTION	11
3.6 ENCLOSURE, ISOLATION, AND REGULATED AREAS.....	11
3.7 EDUCATION AND TRAINING	12
3.8 GENERAL WORK PRACTICES AND STANDARD OPERATING PROCEDURES FOR CHEMICALS OR CLASSES OF CHEMICALS	13
3.9 PERSONAL PROTECTIVE EQUIPMENT	18
3.10 VENTILATION, FUME HOODS, AND PROPER OPERATIONS.....	21
3.11 HOUSEKEEPING	22
3.12 SIGNS AND LABELS AND MATERIAL SAFETY DATA SHEETS	23
3.13 MONITORING AND PERSONAL ASSESSMENT.....	26
3.14 WASTE DISPOSAL	27
3.15 MEDICAL SURVEILLANCE.....	31
3.16 EXPOSURE REPORTING.....	32
3.17 EMERGENCY SITUATIONS	32
3.18 EMERGENCY EQUIPMENT	33

TABLE OF CONTENTS (CONTINUED)

3.19 OVERSIGHT, ANNUAL REVIEW, RECORDKEEPING, COMPLIANCE, AND ENFORCEMENT	33
4.0 LABORATORY STANDARD OPERATING PROCEDURES	34

LIST OF APPENDICES

Appendix A	National Fire Protection Association (NFPA) Signage
Appendix B	List of Carcinogens, Teratogens, Extraordinarily Hazardous Substances
Appendix C	Chemical Information Resources
Appendix D	Effective Use of Gloves
Appendix E	Chemical Storage Guidelines
Appendix F	List of Unstable Chemicals
Appendix G	Biohazard Labeling Requirements
Appendix H	User's Guide to Material Safety Data Sheets

LIST OF ABBREVIATIONS AND ACRONYMS

AL	action level
BFD	Boston Fire Department
CAS#	Chemical Abstract Service Number
CFR	Code of Federal Regulations
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
EH&S	Environmental Health and Safety
IARC	International Agency for Research on Cancer
HIM	Harvard Institutes of Medicine
LD	lethal dose
mg/kg	milligrams per kilogram
MSDS	material safety data sheet
NFPA	National Fire Protection Association
NTP	National Toxicity Program
NRB	New Research Building
OSHA	U.S. Occupational Safety and Health Administration
PEL	permissible exposure limit
PI	Principal Investigator
PPE	personal protective equipment
PPM	parts per million
SAA	Satellite Accumulation Area
SOP	standard operating procedures
STEL	short term exposure limit
TLV	threshold limit value
TWA	time weighted average

1.0 POLICY AND PURPOSE

1.1 POLICY

It is the policy of the Harvard Institutes of Medicine (HIM) and New Research Building (NRB) to provide a safe and healthy workplace in compliance with the Occupational Safety and Health Act of 1970 and with regulations of the Department of Labor, including 29 Code of Federal Regulations (CFR) 1910.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories* (known as the “Laboratory Standard”). The full standard, along with other U.S. Occupational Safety and Health Administration (OSHA) regulations pertaining to laboratory work, can be found by clicking on “Laboratories” at the following link: <http://www.osha.gov/comp-links.html>.

1.2 PURPOSE

This document presents the Chemical Hygiene Plan (CHP) required by the above mentioned regulations. The purpose of the CHP is to describe proper practices, procedures, equipment, and facilities for staff members, students, visitors, or other persons working in each laboratory of HIM/NRB to protect them from potential health hazards presented by chemicals used in the laboratory workplace and to keep exposures below specified limits. It is the responsibility of administration, research, and supervisory personnel to know and to follow the provisions of this plan. The Chemical Hygiene Officer (CHO) is responsible for developing, implementing, monitoring, and updating the plan annually. Affected departments are all those maintaining laboratories that contain and use hazardous chemicals, as defined by the regulations. A copy of the HIM/NRB CHP can be found on the HIM/NRB Environmental Health and Safety (EH&S) website: <http://www.himnrbehs.com/himnrbehs/chemicalSafety.asp>

2.0 RESPONSIBILITY, AUTHORITY, AND RESOURCES

2.1 CHEMICAL HYGIENE OFFICER

The CHO has the responsibility for overseeing the safety and health of the staff members conducting work in HIM/NRB laboratories and the visitors to HIM/NRB. The CHO will provide assistance to the Principal Investigators (PIs) in assigning responsibilities. The CHO for the HIM/NRB is the Manager of the Environmental Health and Safety (EH&S) Office.

2.1.1 Requirements—The OSHA *Occupational Exposure to Hazardous Chemicals in the Laboratory* (or “*Laboratory Standard*”) requires the designation of a CHO.

2.1.2 Definition—The CHO is an employee designated by the employer, who is qualified by training or experience to *provide technical guidance* in the development and implementation of the written CHP.

2.1.3 Duties—The CHO should assist each responsible PI in the facility to accomplish the following (where feasible):

1. Work with the PI to develop a CHP with appropriate standard operating procedures (SOPs) and to implement the plan at the individual laboratory level.
2. Work with the PI to monitor safe procurement, use, storage, and disposal of hazardous chemicals.
3. Assist the responsible PI with required safety audits and necessary documentation therein (which includes documentation of training).
4. Advise the PI concerning adequate facilities and procedures under the current regulations.
5. Seek ways to improve the Chemical Hygiene Program.
6. In addition, the CHO should be fully familiar with the contents of the OSHA Regulation 29 CFR 1910.1450, *Occupational Exposures to Hazardous Chemicals in Laboratories*.

2.1.4 Resources—The CHO may call upon the Harvard University Radiation Safety Officer, Department Administrators, and PIs to provide specific information concerning the laboratories.

2.2 DEPARTMENT ADMINISTRATORS AND PRINCIPAL INVESTIGATORS

Department Administrators and PIs should ensure that all safety policies and procedures outlined in the CHP are followed by laboratory personnel and that all staff under their direction are trained in safe work practices appropriate to their areas. PIs or their designees should ensure that the following duties are performed:

1. Prior to conducting experiments, notify the CHO if you will be working with hazardous chemicals to ensure proper procedures are in place prior to working with hazardous chemicals.
2. Assure that work is conducted in accordance with the CHP.
3. Identify the location of work areas where toxic substances and potential carcinogens will be used and maintain an inventory of these substances.
4. Obtain, review, and approve SOPs detailing all aspects of proposed research activities that involve hazardous agents.
5. Prepare SOPs for use of test/experimental substances when this use involves alternate procedures not specified in these guidelines. The SOP shall include a description of the alternate procedures and an assessment of alternate controls that will be used.
6. Define hazardous operations, designate safe practices, and select protective equipment.
7. Ensure that program and support staff receives instructions and training in safe work practices, use of personal protective equipment, and in procedures for dealing with accidents involving toxic substances.
8. Ensure that staff members fully understand the training received.
9. Ensure that all personnel obtain the medical examinations and protective equipment necessary for the safe performance of their job.

10. Monitor the safety performance of the staff to ensure that the required safety practices and techniques are being employed.
11. Coordinate with the HIM/NRB EH&S Office and Radiation Protection Office for workplace evaluations that include air samples, swipes, or other tests as appropriate to determine the amount and nature of airborne and/or surface contamination. The HIM/NRB EH&S Office or Radiation Protection Office will inform s of the results and use data to aid in the evaluation and maintenance of appropriate laboratory conditions.
12. Assist the HIM/NRB EH&S Office and the Radiation Protection Office when appropriate.
13. Periodically monitor and audit compliance status. Conduct formal laboratory inspections to ensure compliance with existing laboratory SOPs.
14. Prepare emergency procedures for dealing with accidents that may result in the unexpected exposure of personnel or the environment to a toxic substance.
15. Investigate accidents and report them to the CHO and/or the HIM/NRB EH&S Office. Include recommendations for procedures that will minimize the occurrence of a similar accident.
16. Report incidents to the CHO that cause: (1) personnel to be seriously exposed to hazardous chemicals or materials, such as may occur from accidental skin penetration, ingestion, or probable inhalation of a chemical, or (2) constitute a danger of environmental contamination.
17. Ensure that action is taken to correct work practices and conditions that may result in the release of toxic chemicals.
18. Properly dispose of unwanted and/or hazardous chemicals and other hazardous materials.
19. Document and maintain compliance with all local, state, and federal regulatory requirements. (The HIM/NRB EH&S Office will provide periodic updates.)
20. Make copies of the approved safety plan available to the program and support staff.
21. The PI or Department Administrator must appoint a representative to the HIM/NRB Safety Committee, which meets on a quarterly basis.

2.3 STAFF MEMBERS, VOLUNTEERS, AND STUDENTS

Staff members, as defined by the CHP, are those staff under the direction of the PI or Department Administrator, as defined by the Plan. Staff, not under the direction of the PI or Department Administrator, but who are in an area under their direction, are also subject to the CHP, including SOPs, in effect in that area. Non-staff members, such as volunteers and visiting scientists, are equally subject to the plan, as described below.

The primary responsibility of the staff member is to follow the procedures in the CHP and all SOPs. These include the following:

1. Understand and follow all laboratory SOPs.
2. Understand all training received.
3. Understand the function and proper use of all personal protective equipment. Wear personal protective equipment when mandated or necessary.
4. Report, in writing, any significant problems arising from the implementation of the SOPs.
5. Report all facts pertaining to every accident that results in exposure to toxic chemicals, as well as any unsafe actions or conditions that could result in any accident.
6. Contact the Department Administrator, the PI, the CHO, and/or the HIM/NRB EH&S Office if any of the above procedures are not clearly understood.

2.4 ENVIRONMENTAL HEALTH AND SAFETY OFFICE STAFF

The primary function of the HIM/NRB EH&S Office Staff is to assist the CHO in the safe operation of all aspects of the HIM/NRB facility.

The HIM/NRB EH&S Office serves a variety of other functions. These include:

1. Provide expert advice and consultation on safety issues.
2. Evaluate hazards and provide information on how to minimize them.
3. Provide advice regarding proper protective equipment and protective measures.
4. Assist in obtaining the proper gloves for laboratory operations.
5. Dispose of hazardous waste generated in accordance with all applicable regulations.

6. Conduct safety training.
7. Conduct laboratory safety inspections.
8. Liaison with regulatory agencies on the local, state, and federal levels, as well as non-regulatory accrediting groups.

For further information concerning the HIM/NRB EH&S Office, please call 617-432-2762.

3.0 CHEMICAL HYGIENE PLAN

3.1 DEVELOPMENT, IMPLEMENTATION, AND UPDATE

The CHO oversees the preparation of the CHP, specifically the SOPs for the laboratory. The CHO is responsible (per OSHA regulation) for ensuring that the plan meets the requirements set forth in the 29 CFR 1910.1450 and is fully implemented.

The CHO is responsible for ensuring that the CHP is reviewed on an annual basis and updated as necessary to accommodate changes in OSHA standard 29 CFR 1910.1450, departmental procedures, and personnel policy. In addition, the CHO will ensure that the CHP update includes procedures regarding new hazards and new processes as they are introduced.

The CHO will ensure that the CHP and updates are distributed or made available to those affected by the changes.

3.2 IDENTIFICATION AND CLASSIFICATION OF HAZARDOUS CHEMICALS

All laboratories must submit an inventory of their hazardous chemicals to the HIM/NRB EH&S Office on an annual basis as part of the Boston Fire Department's Emergency Signage (National Fire Protection Association [NFPA] 704 Diamond) program. Based on these lists, the HIM/NRB EH&S Office provides laboratory contacts with electronic copies of their laboratory's appropriately labeled NFPA Diamonds for placement at entrance doors into the laboratories (see Appendix A).

Hazardous chemicals can be classified into various categories (e.g., corrosive, reactive, flammable, toxic, etc.) and are labeled on the primary container as such. The definitions associated with these categories can be found at the following link:

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_i d=10100.

Alternate means of classifying and identifying hazardous chemicals include the following:

- Lists of known or suspect human carcinogens, prepared by the International Agency for Research on Cancer and the National Toxicology Program, are available through the HIM/NRB EH&S Office.
- The NFPA has categorized a wide variety of chemicals found in industrial settings. This list is available through the HIM/NRB EH&S Office.
- Material safety data sheets (MSDSs) are available by contacting the HIM/NRB EH&S Office. MSDSs are filed for reference by the HIM/NRB EH&S Office and are also available on the Internet. Laboratories should also maintain a complete file of MSDSs for chemicals used in the area. Each person working in the laboratory must be familiar with the MSDSs for chemicals used in the area prior to working in the area.
- When the human or animal median lethal dose (LD₅₀) for any given substance is less than 50 milligrams per kilogram (mg/kg) or if the permissible exposure limit (PEL) is less than 10 parts per million (ppm), and if the substance is not on the list in Appendix B,¹ then the CHO and PI or Department Administrator or designee will have to develop a specific standard operating procedure for this chemical.
- Manufacturers and manufacturers' associations have valuable information. See Appendix C for a list of Chemical Information Resources.

3.3 SELECTION OF REQUIRED CONTROL METHODS AND AUTHORITY FOR CHEMICAL USE

MSDSs for many chemicals used in laboratories indicate recommended limits (e.g., threshold limit value or TLV), OSHA-mandated limits (e.g., permissible exposure limit [PEL], short-term exposure limit [STEL], and action limit [AL]), or both, as exposure guidelines.

¹ For these compounds, a copy of the MSDS is sent to and filed in the EH&S Office. The PI is required to fill out a form outlining special precautions to be taken when this extremely hazardous substance is used (see Appendix B).

When such limits are stated, they will be used in the laboratories by the CHO and the HIM/NRB EH&S Office staff to assist in determining the safety precautions and control measures necessary when handling toxic materials.

A chemical fume hood certified by the HIM/NRB EH&S Office must be used when the following occurs:

- When working with a compound that has a reported TLV or PEL less than 50 ppm.
- If the LD₅₀ is less than 500 mg/kg or the median inhalation dose, LC₅₀, is less than 200 ppm.²
- When working with or handling toxic or malodorous materials (e.g., 2-mercaptoethanol) with moderate or high vapor pressure.

3.4 SPECIAL PROVISIONS FOR PARTICULARLY HAZARDOUS SUBSTANCES (CARCINOGENS, REPRODUCTIVE TOXINS, AND ACUTELY AND EXTREMELY TOXIC CHEMICALS)

When performing work with any carcinogen, reproductive toxin, substance with a high degree of acute toxicity, or chemical whose toxic properties are unknown, researchers are encouraged to consider the use of designated areas as a method of controlling personal exposures as well as minimizing the spread of contamination throughout the laboratory.

A designated area is a specific area within which use of particularly hazardous substances is restricted in order to minimize the potential for contamination and exposure to other areas of the laboratory. An appropriate designated area could be a chemical fume hood, a glove box, a designated portion of a laboratory such as a taped off area of bench space, or an entire room if it is specifically dedicated for that purpose.³ A designated area must be clearly posted with signs warning that a specific, extremely hazardous material is in use and that only those trained to work with it are allowed to enter the area while procedures using it are ongoing. The boundaries of the designated area must be clearly defined.

² These values should be used if a TLV or PEL is not available for the substance in question.

³ A designated area may be posted with a removable sign if work with extremely hazardous agents is not continuous in the laboratory.

The smallest amount of a chemical that is required by a procedure should be used, purchased, and stored. Whenever possible, material should be ordered in amounts equal to that required in a given procedure to avoid unnecessary weighing out of the material.

Spill procedures must be developed and posted in the designated area. Staff should be familiar with and have available materials that will inactivate the chemical.

Long-sleeved clothing and gloves known to be impermeable to the material must be worn whenever working in designated areas. Because decontamination of jewelry may be difficult, it is recommended that jewelry not be worn when working in a designated area.

The designated area must be decontaminated when work is completed.

Chemical waste generated in a designated area should be disposed of via a satellite accumulation area (SAA) situated within the designated area (please contact the HIM/NRB EH&S Office to set up an SAA). Liquid wastes must be put into screw-top containers that are compatible with the chemical. Contaminated solids may be collected in screw-top containers, containers with sealable funnels, or plastic bags, provided that the container or funnel remains sealed when waste is not being added to it. The container must be labeled with a hazardous waste label (available from the HIM/NRB EH&S Office), filled out with the chemical name(s), the type of hazard(s) (toxic, ignitable, corrosive, and/or reactive), and dated only when full. Hazardous waste must be removed from the laboratory within three days after filling the container; pickups should be requested immediately upon filling and dating the waste container. Pickup request instructions are written on the SAA sign provided by the HIM/NRB EH&S Office.

The HIM/NRB EH&S Office is available to assist in all aspects of setting up and maintaining designated areas, as well as decontamination of the areas once their use has ceased.

3.5 ELIMINATION OR SUBSTITUTION

The first step in evaluating the safety of a new experiment, process, or operation is to investigate the possibility of eliminating hazardous materials or substituting with less hazardous materials.⁴ When selecting alternate products, care must be taken that one hazard is not being substituted for another.

The particular process, experiment, or operation may also be modified to reduce the quantity of the hazardous material(s) necessary or limit the potential emission release rate or exposure time.⁵ The use of a secondary containment device, such as a pan, can also be helpful in preventing or minimizing the effects of chemical spills. The HIM/NRB EH&S Office should be consulted for advice at 617-432-2762.

3.6 ENCLOSURE, ISOLATION, AND REGULATED AREAS

3.6.1 Designated Areas

Reducing the potential for exposure to particularly hazardous chemicals can be achieved by restricting the use of the material to a designated area equipped with the proper control devices. This designated area can be a glove box, fume hood, bench, or an entire laboratory depending on the manipulations required. Hazardous substances are stored, used, and prepared for disposal only in designated areas. The designated area is identified by signs to alert others of the presence of a particularly hazardous material. For example:

Over balance area:

CAUTION: ACRYLAMIDE BALANCE

On glove box:

CAUTION: AFLATOXIN IN USE

⁴ As an example, instead of using an organic solvent or chromic acid-based material for washing glassware, one should substitute an aqueous-based detergent. Aromatic compounds (*e.g.*, benzene) and chlorinated hydrocarbons (*e.g.*, methylene chloride) in some experiments should be replaced with aliphatic compounds or non-chlorinated hydrocarbons.

⁵ For example, the use of micro scale techniques may be applicable in measuring boiling points of a material. Another example is the substitution of closed systems for open vessels.

Radiation signs are available from the Radiation Protection Office at 617-495-2060. Biohazard signs are available from the HIM/NRB EH&S Office at 617-432-2762.

In addition to establishing the physical boundaries that define the designated area, procedures used in a designated area have special provisions. These include storage, use of protective equipment, containment, equipment disposal, and decontamination procedures.

3.7 EDUCATION AND TRAINING

The CHO or appointed individual(s) shall provide information and training concerning the handling of hazardous chemicals in the laboratory. The HIM/NRB EH&S Office staff is available to assist in developing and implementing training procedures and policies.

Staff members shall be informed of the presence of hazardous chemicals when assigned to a work area and prior to new exposure situations. This information must include the following:

1. Contents of the OSHA *Laboratory Standard*.
2. Applicable details and location of the CHP.
3. Emergency and personal protective equipment training.
4. Physical and chemical properties of hazardous substances used in the workplace.
5. Proper handling of hazardous chemicals to minimize exposure.
6. Signs and symptoms of exposure associated with hazardous chemicals used in the workplace.
7. Availability of reference material, including MSDSs.

Training should be provided immediately for new staff members in the affected work area and annually thereafter for all personnel. The name of each person trained shall be recorded together with the training contents, date, and the trainer. For training options, go to the HIM/NRB EH&S Webpage at:

<http://www.himnrbehs.com/himnrbehs/training.asp>

It is the responsibility of the Department Administrator and the PI to assure that all staff members attend the required training sessions. It is the Department Administrator's responsibility to alert the HIM/NRB EH&S Office and the CHO of a new staff member. Further, if English is not the primary language spoken by a staff member, the Department Administrator should ensure that an interpreter accompanies the non-English speaking staff.

3.8 GENERAL WORK PRACTICES AND STANDARD OPERATING PROCEDURES FOR CHEMICALS OR CLASSES OF CHEMICALS

Before developing general work practices and standard operating procedures, it is important to consult the MSDS for the chemical. The following are general guidelines to be followed.

3.8.1 General Work Practices—Spills

1. **Eye Contact:** Eyes should be promptly flushed with water for 15 minutes. Medical help should be sought immediately after flushing.
2. **Skin Contact:** Contaminated clothing should be removed as quickly as possible and the affected area flushed with water for 15 minutes. Medical attention should be sought immediately after flushing.
3. **Clean up with no injury:** If no one is injured, the clean up of the spill should begin immediately. For assistance or advice, call the Operations Center at 617-432-1901.
4. **Clean up with injury:** If someone is injured, that person should seek medical assistance immediately. Clean up should be initiated by someone other than the injured person. For assistance or advice, call the Operations Center at 617-432-1901.

3.8.2 General Work Practices—Avoidance of Routine Exposure

1. Work with hazardous substances should be conducted in a chemical fume hood whenever possible.
2. Smelling chemicals to determine their identity should be avoided.

3. **Never** place your head inside of a chemical fume hood to check on an experiment.
4. Inspect gloves before use.⁶
5. Release of toxic chemicals, or dry ice, or compressed gases in cold or warm rooms must be avoided; these rooms contain recirculated atmospheres, which a release of these materials may result in a hazardous breathing environment.
6. Exhaust from an apparatus (e.g., vacuum pumps) that may discharge toxic chemicals should be vented into a fume hood or filter.
7. When transporting hazardous chemicals, use one or more of the following:
 - Carts designed to prevent bottles from spilling;
 - Secondary containment; or
 - Bottle carriers.

3.8.3 General Work Practices—Choice of Chemicals

1. Less toxic substances should be substituted in place of more toxic ones wherever possible.
2. Only those amounts necessary for immediate work should be ordered.

3.8.4 General Work Practices—Personal Hygiene

1. No eating (including chewing gum), drinking, smoking, or applying cosmetics is allowed. The use of contact lenses in the laboratory should be avoided.
2. Mouth pipetting of **any** substance is prohibited.
3. Hands must always be washed before leaving the laboratory. Solvents must never be used to wash hands.
4. Laboratory coats and safety glasses should be worn in the laboratory whenever there is a potential for exposure to infectious, chemical, or radiological hazards. Appropriate gloves must be worn when handling chemicals. Refer to Appendix D, “Effective Use of Gloves.” This equipment should not be worn in cafeterias, bathrooms, and conference areas to avoid cross contamination.

⁶ Up to 5% of all new and unused gloves have holes or tears in them.

5. Personal protective equipment should be cleaned with the appropriate disinfectant, disposed of, or laundered (in the case of laboratory coats) as appropriate, given the frequency and degree of contamination that it is subjected to.

3.8.5 General Work Practices—Appropriate Storage of Chemicals

1. Incompatible chemicals must be segregated (see Appendix E for Chemical Storage Guidelines).
2. Glass bottles must not be stored on high shelves or on the floor.
3. Chemicals should be stored in containers with which they are compatible.
4. All bottles must be labeled with the correct chemical name in English and using no abbreviations. Bottles should be dated upon receipt and again upon opening.

3.8.6 General Work Practices—Procedures for Flammable Chemicals

1. General Use and Handling
 - a. Flammable liquids are defined as those liquids with a flash point of 140 degrees Fahrenheit (°F) or less and having an absolute vapor pressure of not more than 40 pounds per square inch at 100 °F. Some examples commonly found at HIM/NRB are acetone, ethanol, ether, and xylene. All flammable liquids should be handled carefully.
 - b. Flammable substances should be handled only in areas free of ignition sources (e.g., away from electric ovens, burner flames, and hot surfaces).
 - c. Flammable substances should never be heated using an open flame. Heating mantles, oil baths, safety hot plates, and steam baths should be used. When heating either by steam bath or hot plate, use a filter or distilling flask as a receiver. Such distillations must be carried out in a fume hood.
 - d. Smoking is not permitted within the HIM/NRB.
 - e. Boiling chips or glass beads are helpful in distilling or evaporating flammable substances to prevent superheating and bumping.

- f. Ground cylinders or equipment when transferring flammables from one container to another. Contact the Operations Center at 617-432-1901 if there are questions about proper grounding.

2. Storage

- a. Bottles of volatile liquids should not be stored near heat sources or in direct sunlight.
- b. Quantities of flammable solvents stored in the laboratory should be kept to a minimum. The Boston Fire Department limits storage based on the type of liquid, the floor, where the solvents are stored, and the size of the laboratory (control area). Contact the HIM/NRB EH&S Office regarding the storage limits for your control area.
- c. Whenever possible, flammable liquids including spray and squeeze bottles should be stored in approved storage cabinets. Flammable liquids must never be stored on the floor.
- d. Adequate ventilation must be provided where flammable liquids are used.
- e. When flammable liquids are stored in a refrigerator, it must be a *Laboratory-Safe Refrigerator* (as defined in NFPA 45). These are approved for storing flammable liquids and have all electrical equipment mounted on the outside surface of the refrigerator.
- f. Flammable liquids must not be stored with chemicals that are considered to be incompatible with them (e.g., oxidizers, oxidizing acids, etc.).

3.8.7 General Work Practices—Procedures for Reactive Chemicals

Reactive materials include oxidizers, organic peroxides, explosives, air sensitive, shock sensitive, temperature sensitive, and those ranked 3 or 4 for reactivity by the NFPA (Appendix F). These materials are known as unstable materials by the Boston Fire

Department. Each laboratory is responsible for disposing of unstable materials prior to them becoming potentially explosive.

For peroxide-forming chemicals (e.g., ethyl and isopropyl ethers, tetrahydrofuran), containers should be dated upon opening and disposed of as hazardous waste by the expiration date or within six months, whichever is sooner.

All reactive materials must be handled with caution, personal protective equipment must be used, and, where possible, work should be done in a chemical fume hood.

3.8.8 General Work Practices—Procedures for Corrosive Chemicals

1. Extreme care must be exercised in handling and pouring corrosive materials. This includes: approved gloves, a laboratory coat, and safety glasses, safety goggles, or a face shield, as appropriate.
2. Corrosive chemicals should not be stored above laboratory bench level.
3. Corrosive materials should not be heated or handled in large, fragile containers (e.g., four-liter beakers) without providing a secondary containment to catch the contents in case of breakage.
4. Porcelain dishes should not be used as cleaning baths.
5. Strong alkalis should not be stored next to strong acids.
6. Oxidizing acids (e.g., nitric, sulfuric) and organic acids should be segregated from each other.
7. If strong acids or alkalis come in contact with skin or clothing, affected parts should be washed quickly and thoroughly with large quantities of water. If such materials are splashed in the eyes, they should be flushed thoroughly with a continuous stream of cold water for at least 15 minutes. In either case, medical attention should be sought immediately.

3.8.9 Special Procedures: Work with Formaldehyde

OSHA's formaldehyde standard, *Occupational Exposure to Formaldehyde*, 29 CFR 1910.1048, states that the eight-hour PEL time-weighted average (TWA) for people working with formaldehyde is 0.75 ppm. The STEL TWA for 15-minute exposure is 2.0 ppm.

The Hazard Warning for formaldehyde, including labeling requirements, falls under the OSHA *Hazard Communication Standard*. If formaldehyde is to be used by any individual in the laboratory, all staff should be informed of the health hazards of formaldehyde upon initial orientation to the work site.

3.9 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) is designed to prevent personal injury. Examples of PPE include safety glasses or goggles, face shields, safety shields, gloves, rubber aprons, laboratory coats, and protective creams. It is the responsibility of the Department Administrator and/or PI to ensure that laboratory staff is using necessary safety equipment.

The type and level of equipment can be determined with the aid of the CHO and the HIM/NRB EH&S Office. Use of PPE should only be considered after exercising all options for reducing the hazards. If in doubt about the potential danger of an experiment or activity, all available safety devices should be employed. Information on such devices can be obtained from the HIM/NRB EH&S Office upon request.

3.9.1 Respirators

Required use of a respirator is the responsibility of the Department Administrator, the PI (or their designee), the CHO, and the HIM/NRB EH&S Office. The HIM/NRB respirator policy must be followed when respiratory protection is required. All staff must follow these elements.

1. Less hazardous materials should be substituted for more hazardous materials.

2. Laboratory fume hoods or other engineering controls should be employed to control exposure.
3. If items 1 and 2 above have been considered but added protection is still deemed necessary, respirator type shall be selected on the basis of type of chemical exposure, level of exposure, and user medical examination.
4. Selection of a respirator type must be performed in consultation with the HIM/NRB EH&S Office.
5. A medical clearance is required for each staff member before a respirator is used routinely. A medical clearance can be obtained through the host institution's Occupational Health Services.
6. Appropriate fit testing and training shall be performed under the direction of the host institution for all negative pressure respirators before use.
7. The respirator user must regularly maintain and clean the respirator.
8. The respirator user must perform a negative and positive pressure check before each use.

3.9.2 Eye Protection

Eye protection must be worn in the laboratory whenever there is a potential for eye contact with hazardous liquids and/or particulates. The type of eye protection to be used shall be stated in the SOPs for the laboratory.

Goggles are recommended when working with volatile substances that irritate the eyes (e.g., chlorine, strong ammonia, irritating dusts) as well as for protection against splattering or splashing of hazardous materials. It is also advisable to wear a safety shield when distilling at high temperatures, under reduced pressures, or when distilling corrosive liquids. Safety glasses and goggles have only a limited application and do not offer full protection against all hazards. For particularly dangerous operations, full-face

shields of an approved type are to be worn in addition to the eye protection discussed above.

3.9.3 Protective Clothing

The use of protective clothing, including gloves, shall be determined by the Department Administrator or PI, with assistance from HIM/NRB EH&S Office as needed. When working with a potential hazardous material, protective clothing is required.

1. Protective clothing is chosen, with the aid of the HIM/NRB EH&S Office, on the basis of the chemical exposure and medical condition of the user.
2. Contaminated protective clothing must be disposed of properly.
3. Open-toed shoes or sandals shall not be worn in the laboratory.
4. Skin exposure should be minimized when working with hazardous materials.
5. Contaminated laboratory coats shall not be worn.

NOTE: Laboratory coats should not be worn in common areas

(Cafeterias, bathrooms, kitchen areas, outside, conference rooms, break rooms, etc.)

3.9.4 Protective Gloves

When handling toxic or hazardous chemicals, protective gloves are required. To protect against accidental spills or contamination, workers should refer to glove manufacturers' glove charts to select a glove appropriate for use with the reagent in question (see Appendix D for glove selection). There is no glove currently available that will protect against all chemicals for all types of tasks. If the gloves become contaminated, they should be removed and discarded as hazardous waste as soon as possible.

Staff members must remove at least one glove before leaving the immediate work site to prevent contamination of public areas (e.g., doorknobs, light switches, telephones, etc.).

Latex Alert: Latex (i.e., several protein antigens) has been shown to be a sensitizer. In order to best protect workers from becoming sensitized, powdered latex exam gloves are PROHIBITED in the HIM/NRB laboratories. Powder-free latex gloves may be used where appropriate.

NOTE: Latex gloves do not protect against every hazardous material.

3.9.5 Other Personal Protective Equipment

Other personal protective equipment shall be used as needed.

Safety shields are recommended for use whenever solvent or vacuum distillations are being run in glass equipment or whenever large glass vessels are subjected to a vacuum. Safety shields should also be used during reactions involving unknown characteristics or that contain toxic or radioactive materials (e.g., high-energy emitters such as ^{125}I or ^{32}P).

3.10 VENTILATION, FUME HOODS, AND PROPER OPERATIONS

Local exhaust ventilation is the primary method used to control inhalation exposures to hazardous substances. Other types of local exhaust include vented enclosures for large pieces of equipment or chemical storage and snorkel types of exhaust for capturing contaminants near the point of release.

A laboratory fume hood should be used when working with hazardous substances. A properly operating and correctly used fume hood will control the vapors released from volatile liquids, as well as unpropelled dusts and mists.

Do not make any modifications to hoods or ductwork without first calling the HIM/NRB EH&S Office at 617-432-2762.

A fume hood should not be used for large pieces of equipment unless the fume hood will be dedicated for this use, since it will change airflow patterns and render the fume hood unsafe for other uses. It is generally more effective to install a specially designed enclosure for large equipment so that the hood can be used for its intended purpose.

A fume hood should not be used for chemical or other miscellaneous storage, as this also restricts airflow. Chemicals should be stored in a sealed (following NFPA 45 requirements) chemical storage cabinet. All freestanding cabinets should have bungs in place and the doors should close properly.

The HIM/NRB EH&S Office oversees the fume hood program. Before you begin using a fume hood, check to see that the hood is labeled appropriately for use with toxic chemicals and has been certified within the last year. If a fume hood requires certification or if you have questions regarding fume hood operation, contact the HIM/NRB EH&S Office at 617-432-2762.

Some of the basic guidelines for working safely in a chemical fume hood include the following:

1. Work at least six inches behind the sash.
2. If it is necessary to store materials in a fume hood, they should be elevated so that air can pass under them.
3. Never put your head (or face) inside an operating fume hood to check on an experiment.
4. Work with the sash in the lowest position possible. The sash will act as a barrier and provide containment should a problem arise with the reaction.
5. Do not clutter the hood with bottles or equipment. Only materials actively in use should be in the fume hood.
6. Clean the grille along the bottom slot of the back of hood regularly so it does not become clogged with paper and dirt.
7. Do not dismantle or modify the physical structure of the hood or exhaust system in any way without first consulting the HIM/NRB EH&S Office.
8. Report any suspected hood malfunctions to the facilities operations center at 617-432-1901 and the HIM/NRB EH&S Office at 617-432-2762.

3.11 HOUSEKEEPING

It is essential for both safety and efficiency that the facilities be kept neat and orderly. Floors, shelves, and benches should be free from excessive storage and evidence of spills.

Care should be exercised when disposing of materials. Flammable or toxic materials should be collected for disposal as hazardous waste and, therefore, should not be placed in the regular waste stream.

General guidelines for good housekeeping include the following:

1. Storage or equipment must never block access to emergency equipment such as showers, eyewashes, fire extinguishers, fire alarm strobes, and exit routes.
2. Label all chemical containers with the identity of the contents and list the appropriate hazards.
3. All work areas should be kept clear of clutter.
4. All aisles, hallways, and stairs must be kept clear.
5. All chemicals should be returned to their proper storage area at the end of the day.
6. Liquid wastes should be kept in spill-proof containers and stored off the floor in an appropriate storage area.
7. ALWAYS BE PREPARED FOR SPILLS. Small spills should be cleaned up promptly using the spill kits located in the hallways. All clean up materials must be collected for disposal as hazardous waste.

3.12 SIGNS AND LABELS AND MATERIAL SAFETY DATA SHEETS

3.12.1 Emergency Signage

The Boston Fire Department (BFD) requires that each laboratory have appropriate signage to indicate the level of the hazard with respect to the chemicals stored in the laboratory. This signage takes the form of a diamond (NFPA 704 diamond), which is comprised of four smaller diamonds. Each smaller diamond is color-coded to represent a specific hazard classification: blue for health hazards, red for flammability hazards, yellow for reactivity hazards, and white for special classes of hazards. For more information on NFPA diamonds, refer to Appendix A.

Each small diamond contains a number from 0 to 4. A hazard level of 0 on the NFPA diamond represents no hazard while a hazard level of 4 on the NFPA diamond represents the highest hazard in that category. Fires and other emergencies may be dealt with more effectively and safely if the BFD is informed of the level of hazards in a specific area. The names and emergency phone numbers of the current Department Administrator or PI responsible for each laboratory area, including shared spaces, should also be posted. Laboratories are responsible for keeping their contact information current.

Signs are inspected annually by the HIM/NRB EH&S Office and are based upon the chemical inventories received from the laboratories. It is extremely important that contact names and chemicals are kept current. The BFD may choose not to enter a laboratory if the information provided appears to be out-of-date.

3.12.2 Other Signs

1. Radioactive or biohazardous substances used in laboratories require the posting of special signs.
2. *Eye Protection Required* signs are recommended at entrances to laboratories using acids and corrosive chemicals. Safety glasses for visitors must be provided.
3. Signs indicating the location of fire blankets, eyewash units, safety showers, fire extinguishers, and other safety devices are required.
4. Entrances to laboratories, storage areas, and associated facilities must have signs as necessary to warn emergency personnel and custodians of unusual or severe hazards.⁷

3.12.3 Chemical Container Labeling

All containers must be labeled with the chemical contents. The labels must be in English and have no abbreviations on them. Chemicals received from outside vendors or from internal stockrooms must have labels indicating the name, along with other physical and chemical data. Toxicity warning signs or symbols should be prominently visible on the labels.

All chemical containers that have been decanted from an original container must be labeled with the chemical name, the primary hazard(s), the name of the responsible person, their PI, and the date. The HIM/NRB EH&S Office can be contacted for further information regarding labels for this purpose.

All chemical waste containers must be labeled with the words *Hazardous Waste*, the full chemical name(s), the type of hazard (i.e., toxic, ignitable, corrosive, or reactive), the

⁷ Examples of severe or unusual hazards that may require signs are unstable chemicals, toxic or carcinogenic materials, water reactive chemicals, and radioactive materials.

responsible person, and the date the container became full. Labels are available from the HIM/NRB EH&S Office.

Labeling must be provided for chemicals synthesized in the laboratory or prepared by other processes, such as distillation or extraction. For information about obtaining hazard labels, please contact the HIM/NRB EH&S Office.

Chemicals developed in the laboratory must be assumed to be toxic if no data on toxicity are available. Suitable handling procedures must be prepared and implemented, including training of users in controls necessary to handle a material safely. If the substance is produced for another user outside of the laboratory, a MSDS and labels must be prepared and provided to such users in accordance with the OSHA *Hazard Communication* standard 29 CFR 1910.1200.

For information on the labeling of biohazardous materials, as required by the OSHA *Bloodborne Pathogen* standard 29 CFR 1910.1030, refer to Appendix G.

3.12.4 Material Safety Data Sheets

MSDSs are bulletins prepared by manufacturers to summarize the health and safety information associated with their products. The manufacturer or supplier should provide MSDSs for each chemical. A complete file of MSDSs should be maintained in the laboratory and must be accessible to any staff member or visiting professional. MSDSs may also be obtained from the MSDS tab on www.himnrbehs.com.

The following information is required by OSHA to be included in all MSDSs:

- Product identity.
- Reactivity hazards.
- Hazardous ingredients.
- Spill clean-up.
- Physical/chemical properties.
- Protective equipment.
- Fire and explosion hazards.

- Special precautions.
- Health hazards.

A user's guide to MSDSs can be found in Appendix H. Consult with the HIM/NRB EH&S Office to apply this general information to your work situation.

3.13 MONITORING AND PERSONAL ASSESSMENT

The HIM/NRB EH&S Office will perform exposure monitoring, when appropriate, in accordance with Paragraph (d) of OSHA 29 CFR 1910.1450. Other qualified consulting service providers may be employed by the HIM/NRB EH&S Office to conduct such monitoring. All monitoring results will be kept on file in the HIM/NRB EH&S Office. A report summarizing the results of the exposure monitoring will be provided to the HIM/NRB EH&S contact for the laboratory and made available to the person who participated in the exposure monitoring.

3.13.1 Staff Exposure Determination

- **Initial monitoring** will be performed if there is reason to believe that those exposure levels for a substance could routinely exceed the action level (or PEL in the absence of an action level).
- **Periodic monitoring** will be performed **if** the initial monitoring performed discloses staff exposure over the action level (or PEL in the absence of an action level). The staff member's institution shall immediately comply with the exposure monitoring provisions of the relevant standard.
- Monitoring may be terminated in accordance with the relevant standard.
- Within 15 working days after the receipt of any monitoring results, the staff members will be notified in writing of these results either individually or by posting the results in an appropriate location accessible to staff members.

Anyone with a reason to believe that exposure levels for a substance routinely exceed the action level, or PEL in the absence of an action level, may request that the HIM/NRB EH&S Office initiate the monitoring process.

It will be the responsibility of the CHO to ensure that periodic monitoring requirements are satisfied, when necessary.

The HIM/NRB EH&S Office and the CHO will maintain records in accordance with the record-keeping requirements of OSHA 29 CFR 1910.1450.

Individual hospitals shall establish and maintain, for each staff member, an accurate record of any measurements taken to monitor staff members' exposures and any medical consultation and/or examinations including tests or written opinions required by this standard. The individual hospitals shall ensure that such records are kept, transferred, and made available in accordance with OSHA 29 CFR 1910.20.

Records from monitoring done by other qualified services must be maintained by the CHO and the HIM/NRB EH&S Office.

3.14 WASTE DISPOSAL

Every effort should be made to dispose of hazardous waste in a proper, safe, and efficient manner. It is the responsibility of the individual generating the waste to properly identify and handle waste chemicals within the HIM/NRB facility.

The HIM/NRB EH&S Office maintains a "Main Accumulation Area" for the storage of chemical hazardous wastes transported from the laboratories.

The HIM/NRB EH&S Office maintains Satellite Accumulation Areas (SAAs) in the laboratories for the storage of chemical hazardous waste. Refer to Section 3 of the HIM/NRB EH&S Manual for information regarding the establishment of an SAA. The following guidelines must be followed at all SAAs.

- Once a waste container has been filled in the laboratory, it must be transported to the main accumulation area within three days.
- Waste chemicals stored in containers of one gallon or larger sizes shall be **break-resistant** whenever possible.
- Waste chemicals stored in breakable containers of one gallon or larger sizes shall be kept in **approved secondary containers**.
 - Break-resistant shall mean a container made of metal, plastic, plastic-coated glass or metal overpacks of glass.
 - An approved secondary container is a bottle carrier made of rubber, metal, or plastic with carrying handle(s) which is of large enough volume to hold the contents of the chemical container. Rubber or plastic should be used for acids/alkalines, and metal, rubber, or plastic for organic solvents.
- Wastes must be packaged and placed in containers in a manner that will allow them to be transported without the danger of spillage, explosion, or hazardous vapors escaping. Wastes that have not been properly packaged and identified will not be accepted for disposal.

3.14.1 Unknown Waste Chemicals

Every effort should be made by the Department Administrator or PI to identify unknown waste. It is the responsibility of the department to identify all chemicals. The Department Administrator or PI may need to question laboratory personnel, students, and volunteers, or send a sample to an analytical laboratory, to ascertain the contents of unknown wastes. All charges associated with the identification of an unknown waste will be paid by the laboratory/institution. Laboratory personnel must be constantly reminded to identify and label all wastes and project products. If unknown waste has been discovered and cannot be identified, immediately contact the HIM/NRB EH&S Office.

NOTE: Never mark a container “UNKNOWN”.

Label unknown waste streams with the words “Pending Analysis”.

3.14.2 Transportation

All hazardous waste will be collected from the laboratories and transported to the Main Accumulation Area by a representative of the HIM/NRB EH&S office.

3.14.3 Guidelines for Waste Reduction/Management

Procedures for waste disposal should be prepared **before** beginning a project. Waste must be labeled properly. Each department, group, or researcher must properly identify waste materials prior to disposal; inadvertent mixing of incompatible materials could have serious consequences.

Waste minimization is very important to protect the environment and also to reduce the disposal costs charged to the laboratory. The following suggestions should be considered in an effort to minimize the amount of waste generated by the laboratory.

- Order only and store the amount of material needed for the project or experiment. The BFD has severe restrictions on flammable liquid storage in laboratories.
- Use only the amount of material that is needed for conclusive results.
- Date containers upon receipt and again upon initial opening.
- Before disposing of unwanted, unopened, or uncontaminated chemicals, check with others at HIM/NRB who may be able to use them.
- On termination of a research project, all unused chemicals to be kept by the laboratory shall be labeled and dated. All chemicals for disposal must be in proper containers and labeled with the words *Hazardous Waste*, the chemical name, type of hazard (toxic, ignitable, corrosive, or reactive), and the date.

3.14.4 Types of Chemicals and their Disposal

Regulations prohibit the discharge of most organic solvents into the sewer system. Small amounts of water-soluble, non-flammable materials may be discharged down the drain. The HIM/NRB EH&S Office must be consulted to determine which chemicals can be disposed in this manner.

Chemical Class	Disposal
Organic solvents	<ul style="list-style-type: none"> ✓ Placed in suitable containers that prevent vapors or liquids from escaping ✓ Tightly cap ✓ Prominently label containers ✓ Disposed as hazardous waste
Mixtures of organic solvents	<ul style="list-style-type: none"> ✓ If compatible they can be combined in one container ✓ Container must have estimated percentages of each solvent in the mixture
Ether (di-ethyl) in cans	<ul style="list-style-type: none"> ✓ Do not move if over a year beyond the expiration date or beyond six months from the date of opening ✓ The HIN/NRB EH&S Office must be contacted immediately at 617-432-2762
Acids and alkaline solutions	<ul style="list-style-type: none"> ✓ Concentrated acids and caustics must be treated as hazardous waste ✓ Store in tightly capped and labeled containers
Inorganic and organic solids	<ul style="list-style-type: none"> ✓ If in original containers, may be sent to the HIM/NRB hazardous waste room
Mercury	<ul style="list-style-type: none"> ✓ Contact HIM/NRB EH&S Office to dispose of mercury containing equipment. ✓ Put broken mercury thermometers into a jar or secondary container for disposal as hazardous waste. ✓ Mercury spills must be cleaned up with assistance from the HIM/NRB EH&S Office in order to ensure that mercury contamination is not left behind. Contact the Facility Operations Center at 617-432-1901 for assistance.
Cyanide compounds, arsenic, lead, and heavy metal wastes	<ul style="list-style-type: none"> ✓ Place in bottles or containers ✓ Seal tightly ✓ Label, and place in the hazardous waste accumulation area
Alkali metals (e.g., sodium and potassium)	<ul style="list-style-type: none"> ✓ Place in a suitable container ✓ Cover with Nujol[®] (mineral oil) ✓ Label properly, seal and dispose as hazardous waste
Pyrophoric metals (e.g., magnesium, strontium, thorium, zirconium, and other pyrophoric chips and fine powders)	<ul style="list-style-type: none"> ✓ Place in a metal container ✓ Seal tightly ✓ Label, and send out as hazardous waste
Waste oil (e.g., vacuum pump oil or lubricating oils)	<ul style="list-style-type: none"> ✓ Collect in one-gallon containers or less ✓ Dispose of as toxic hazardous waste

The HIM/NRB EH&S Office may be consulted if there is any question concerning the toxicity or packaging of any toxic wastes.

3.14.5 Other Types of Wastes—Special Procedures Required

- **Gas cylinders** are to be returned to the proper vendor. Some small lecture bottles are of the non-returnable type and become a disposal problem when empty or near empty with a residual amount of gas. When ordering gases in lecture bottle size, be sure to order the gases in a returnable cylinder.

- **Controlled drugs** to be disposed of as waste **must not be sent to the waste accumulation area**. The handling, records, and disposal of controlled drugs are the responsibility of the department and must be conducted within Drug Enforcement Agency regulations.
- **Radioactive material** disposal is handled in accordance with procedures established by the Radiation Protection Office at 617-495-2060.
- **Biological waste and physically dangerous waste (sharps) must be placed in proper containers**. Contact the HIM/NRB EH&S Office, 617-432-2762, for proper disposal procedures.
- **Polychlorinated biphenyls** found in capacitors, transformers, equipment, and oil is the responsibility of the department. Information on possible disposal contractors can be obtained by calling the HIM/NRB EH&S Office.

3.15 MEDICAL SURVEILLANCE

Medical consultations/examinations are coordinated for HIM/NRB staff through the Institution's Occupational/ Health Services and the HIM/NRB EH&S Office under the following circumstances:

1. Whenever a staff member develops signs or symptoms potentially associated with a hazardous chemical to which the staff member may have been exposed in the laboratory.
2. Where exposure monitoring reveals an exposure level routinely above OSHA's action level or permissible exposure limit for an OSHA-regulated substance requiring such medical monitoring and medical surveillance.
3. Whenever an event occurs, such as a chemical spill, leak, or explosion that results in the likelihood of a hazardous exposure. First aid issues are handled by the Institution's Occupational Health Services during business hours or through the Emergency Room during off-hours.

4. Whenever a staff member is exposed to blood or visibly bloody fluids by a needle-stick, open cut, or splash to the face.

3.16 EXPOSURE REPORTING

Staff who believe they have had an exposure should contact the CHO or the HIM/NRB EH&S Office for evaluation.

If staff members exhibit adverse health effects, they should report immediately to the Institution's Occupational Health Services or the Emergency Room. The HIM/NRB EH&S Office will evaluate the situation and conduct air sampling, if necessary, to determine actual exposures. The results of all hazard evaluations and any air sampling data will be available to all occupants of the affected areas. The CHO or the HIM/NRB EH&S Office can be contacted directly for information. In addition, the results of any personal air sampling will be given to the individual and kept on file in the HIM/NRB EH&S Office.

3.17 EMERGENCY SITUATIONS

Emergencies that may occur in a laboratory include fire, explosion, chemical spill or release, or medical or other health threatening accidents. General procedures to be followed in any emergency are the following.

1. Assist person(s) involved. Remove person(s) from exposure to further injury or a life-threatening situation, if it can be done safely.
2. Notify nearby persons who may be affected and call the Operations Center at 617-432-1901 to report the emergency and seek assistance.
3. Evacuate the area until help arrives.
4. Wait for emergency responders and assist them in handling the emergency by providing all relevant information.
5. Assist in the follow-up investigation of the emergency.

For specific emergencies that may occur in the laboratory space (i.e., chemical spills, fire, explosion, etc.), refer to the specific procedures established by the laboratory and to the EH&S Procedures and Response Guidelines (flip charts) posted in your area.

3.18 EMERGENCY EQUIPMENT

In any emergency, it is critical that all staff members are familiar with the use and location of emergency equipment. These include fire extinguishers, fire alarms, safety showers, and eyewash stations.

All emergency equipment is on a preventive maintenance schedule. Fire alarms are tested periodically and extinguishers are inspected monthly by the building management entity. Safety showers on a quarterly basis and eyewash stations on a monthly basis are tested by the HIM/NRB EH&S Office.

3.19 OVERSIGHT, ANNUAL REVIEW, RECORDKEEPING, COMPLIANCE, AND ENFORCEMENT

The **HIM/NRB EH&S Office** is responsible for establishing and maintaining records for staff training, personal and environmental monitoring, and quantity of chemicals stored in the workplace. In practice, the CHO may assist with this work.

The **Principal Investigator and Department Administrator** enforce the CHP by making sure that the chemical hygiene rules are known and followed. The CHO advises and assists in this work and helps with documentation.

The **Chemical Hygiene Officer** will assist with chemical hygiene and housekeeping inspections. When there are significant changes in existing policies or work practices, an inspection will be conducted soon after the new process is implemented.

The **HIM/NRB EH&S Office** assists the CHO in the inspection process and in all related matters.

The **Chemical Hygiene Officer** annually reviews and updates the CHP.

4.0 LABORATORY STANDARD OPERATING PROCEDURES

Each laboratory inserts their individual SOPs in this section.

APPENDIX A

**NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
SIGNAGE**

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) LABELING SYSTEM

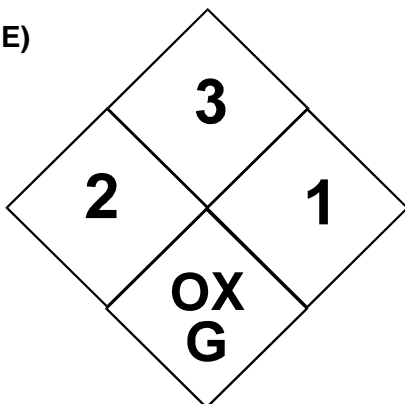
Signage based on the NFPA labeling system has been posted at the entrances to all laboratories and laboratory related facilities at HIM. Also, many chemical manufacturers include the NFPA rating system in the labeling of chemical containers. The following is an example of the NFPA labeling system.

FIRE HAZARD (RED)

- 0—will not burn
- 1—will ignite if preheated
- 2—will ignite if moderately heated
- 3—will ignite at most ambient conditions
- 4—burns readily at ambient conditions

HEALTH HAZARD (BLUE)

- 0—no more than ordinary combustibles in a fire
- 1—slightly hazardous
- 2—hazardous
- 3—extreme danger
- 4—deadly



REACTIVITY (YELLOW)

- 0—stable and not reactive with water
- 1—unstable if heated
- 2—violent chemical change
- 3—shock and heat may detonate
- 4—may detonate

SPECIFIC HAZARD

- OX—oxidizer
- ACID—acid
- ALK—alkali
- COR—corrosive
- W—use no water
- G—gas cylinder
- LN2—liquid nitrogen

APPENDIX B

**LIST OF CARCINOGENS, TERATOGENS,
EXTRAORDINARILY HAZARDOUS SUBSTANCES**

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
AF-2[2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide]	003688-53-7	AF-2[2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide]		2B	
ANTU	000086-88-4	ANTU		3	
Acetaldehyde	000075-07-0	Acetaldehyde		2B	2
Acetamide	000060-35-5	Acetamide		2B	
2-Acetylaminofluorene	000053-96-3	Acetylaminofluorene	X		2
Aciclovir	059277-89-3	Aciclovir		3	
Acidine orange	000494-38-2	Acidine orange		3	
Acriflavium chloride	008018-07-3	Acriflavium chloride		3	
Acrolein	000107-02-8	Acrolein		3	
Acrylamide	000079-06-1	Acrylamide		2A	2
Acrylic acid	000079-10-7	Acrylic acid		3	
Acrylic fibres	--	Acrylic fibres		3	
Acrylonitrile	000107-13-1	Acrylonitrile	X	2B	2
Acrylonitrile-butadiene-styrene copolymers	--	Acrylonitrile-butadiene-styrene copolymers		3	
Actinomycin D	000050-76-0	Actinomycin D		3	
Adriamycin	023214-92-8	Adriamycin		2A	2
Adriamycin (Doxorubicin hydrochloride)	025316-40-9	Adriamycin			2
Aflatoxin B1	001162-65-8	Aflatoxin B1		1	
Aflatoxin M1	006795-23-9	Aflatoxin M1		2B	
Aflatoxins	001402-68-2	Aflatoxins		1	1
Agaricine	002757-90-6	Agaricine		3	
Alcoholic beverages	--	Alcoholic beverages		1	1
Aldicarb	000116-06-3	Aldicarb		3	
Aldrin	000309-00-2	Aldrin		3	
Allyl chloride	000107-05-1	Allyl chloride		3	
Allyl isothiocyanate	000057-06-7	Allyl isothiocyanate		3	
Allyl isovalerate	002835-39-4	Allyl isovalerate		3	
Aluminium production	--	Aluminium production		1	
Amaranth	000915-67-3	Amaranth		3	
1-Amino-2-methylantraquinone	000082-28-0	Amino-2-methylantraquinone		3	2
4-Amino-2-nitrophenol	000119-34-6	Amino-2-nitrophenol		3	
2-Amino-4-nitrophenol	000099-57-0	Amino-4-nitrophenol		3	
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	000712-68-5	Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole		2B	
2-Amino-5-nitrophenol	000121-88-0	Amino-5-nitrophenol		3	
2-Amino-5-nitrothiazole	000121-66-4	Amino-5-nitrothiazole		3	
Amino-alpha-C (2-Amino-9h-pyrido[2,3-b]indole)	026148-68-5	Amino-alpha-C (2-Amino-9h-pyrido[2,3-b]indole)		2B	
5-Aminoacenaphthene	004657-93-6	Aminoacenaphthene		3	
2-Aminoanthraquinone	000117-79-3	Aminoanthraquinone		3	2
para-Aminoazobenzene	000060-09-3	Aminoazobenzene		2B	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
ortho-Aminoazotoluene	000097-56-3	Aminoazotoluene		2B	2
para-Aminobenzoic acid	000150-13-0	Aminobenzoic acid		3	
4-Aminodiphenyl	000092-67-1	Aminodiphenyl	X	1	1
2-Aminonaphthalene	000091-59-8	Aminonaphthalene			1
11-Aminoundecanoic acid	002432-99-7	Aminoundecanoic acid		3	
Amitrole	000061-82-5	Amitrole		2B	2
Ampicillin	000069-53-4	Ampicillin		3	
Amsacrine	051264-14-3	Amsacrine		2B	
Analgesic mixtures containing phenacetin	--	Analgesic mixtures containing phenacetin		1	1
Androgenic (anabolic) steroids	--	Androgenic (anabolic) steroids		2A	
Anesthetics, volatile	--	Anesthetics, volatile		3	
Angelicin polus ultraviolet A radiation	000523-50-2	Angelicin polus ultraviolet A radiation		3	
Aniline	000062-53-3	Aniline		3	
ortho-Anisidine	000090-04-0	Anisidine		2B	
para-Anisidine	000104-94-9	Anisidine		3	
o-Anisidine hydrochloride	000134-29-2	Anisidine hydrochloride		2B	2
Anthanthrene	000191-26-4	Anthanthrene		3	
Anthracene	000120-12-7	Anthracene		3	
Anthranilic acid	000118-92-3	Anthranilic acid		3	
Antimony trioxide production	001309-64-4	Antimony trioxide production		2B	
Antimony trisulfide	001345-04-6	Antimony trisulfide		3	
Apholate	000052-46-0	Apholate		3	
para-Aramid fibriis	024938-64-5	Aramid fibriis		3	
Aramite	000140-57-8	Aramite		2B	
Aroclor (under Polychlorinated Biphenyls)	--	Aroclor (under Polychlorinated Biphenyls)			2
Aroclor 1254	011097-69-1	Aroclor 1254			2
Aroclor 1260	011096-82-5	Aroclor 1260			2
Arsenic acid, calcium salt	010103-62-5	Arsenic acid, calcium salt		1	
Arsenic acid, calcium salt (2:3)	007778-44-1	Arsenic acid, calcium salt (2:3)		1	
Arsenic and compounds	007440-38-2	Arsenic and compounds	X	1	
Arsenic compounds, inorganic	--	Arsenic compounds, inorganic			1
Arsenic trioxide	001327-53-3	Arsenic trioxide		1	
Arsenious acid, monosodium salt	007784-46-5	Arsenious acid, monosodium salt		1	
Asbestos	001332-21-4	Asbestos	X	1	1
Asbestos, Actinolite	077536-66-4	Asbestos, Actinolite	X	1	
Asbestos, Amosite	012172-73-5	Asbestos, Amosite		1	
Asbestos, Anthophyllite	077536-67-5	Asbestos, Anthophyllite	X	1	
Asbestos, Chrysotile	012001-29-5	Asbestos, Chrysotile		1	
Asbestos, Crocidolite	012001-28-4	Asbestos, Crocidolite		1	
Asbestos, Tremolite	077536-68-6	Asbestos, Tremolite	X	1	
Atrazine	001912-24-9	Atrazine		3	
Auramine (technical-grade)	000492-80-8	Auramine (technical-grade)		2B	
Auramine, manufacture of	--	Auramine, manufacture of		1	
Aurothioglucose	012192-57-3	Aurothioglucose		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Azacitidine	000320-67-2	Azacitidine		2A	2
Azaserine	000115-02-6	Azaserine		2B	
Azathioprine	000446-86-6	Azathioprine		1	1
Aziridine	000151-56-4	Aziridine		2B	
2-(1-Aziridinyl)ethanol	001072-52-2	Aziridinyl)ethanol		3	
Aziridyl benzoquinone	000800-24-8	Aziridyl benzoquinone		3	
Azobenzene	000103-33-3	Azobenzene		3	
BCNU	000154-93-8	BCNU			2
Benz[a]acridine	000225-11-6	Benz[a]acridine		3	
Benz[a]anthracene	000056-55-3	Benz[a]anthracene		2A	2
Benz[c]acridine	000225-51-4	Benz[c]acridine		3	
Benzal chloride	000098-87-3	Benzal chloride		2B	
Benzene	000071-43-2	Benzene	X	1	1
Benzidine	000092-87-5	Benzidine	X	1	1
Benzidine-based dyes	000092-87-5	Benzidine-based dyes		2A	
Benzo(g,h,i)perylene	000191-24-2	Benzo(g,h,i)perylene		3	
Benzo[a]fluorene	000238-84-6	Benzo[a]fluorene		3	
Benzo[a]pyrene	000050-32-8	Benzo[a]pyrene		2A	2
Benzo[b]fluoranthene	000205-99-2	Benzo[b]fluoranthene		2B	2
Benzo[b]fluorene	000243-17-4	Benzo[b]fluorene		3	
Benzo[c]fluorene	000205-12-9	Benzo[c]fluorene		3	
Benzo[c]phenanthrene	000195-19-7	Benzo[c]phenanthrene		3	
Benzo[e]pyrene	000192-97-2	Benzo[e]pyrene		3	
Benzo[ghi]fluoranthene	000203-12-3	Benzo[ghi]fluoranthene		3	
Benzo[j]fluoranthene	000205-82-3	Benzo[j]fluoranthene		2B	2
Benzo[k]fluoranthene	000207-08-9	Benzo[k]fluoranthene		2B	2
Benzofuran	000271-89-6	Benzofuran		2B	
para-Benzoquinone dioxime	000105-11-3	Benzoquinone dioxime		3	
Benzotrichloride	000098-07-7	Benzotrichloride		2A	2
Benzoyl chloride	000098-88-4	Benzoyl chloride		3	
Benzoyl peroxide	000094-36-0	Benzoyl peroxide		3	
Benzyl acetate	000140-11-4	Benzyl acetate		3	
Benzyl chloride	000100-44-7	Benzyl chloride		2A	
Benzyl violet 4B	001694-09-3	Benzyl violet 4B		2B	
Beryl Ore	001302-52-9	Beryl Ore			2
Beryllium Phosphate	013598-15-7	Beryllium Phosphate			2
Beryllium aluminum alloy	012770-50-2	Beryllium aluminum alloy			2
Beryllium and beryllium compounds	007440-41-7	Beryllium and beryllium compounds		1	
Beryllium chloride	007787-47-5	Beryllium chloride			2
Beryllium fluoride	007787-49-7	Beryllium fluoride			2
Beryllium hydroxide	013327-32-7	Beryllium hydroxide			2
Beryllium oxide	001304-56-9	Beryllium oxide		1	2
Beryllium oxide carbonate	066104-24-3	Beryllium oxide carbonate		1	
Beryllium sulfate	013510-49-1	Beryllium sulfate		1	2
Beryllium sulfate tetrahydrate	007787-56-6	Beryllium sulfate tetrahydrate (1:1:4)		1	2

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
(1:1:4)					
Beryllium zinc silicate	039413-47-3	Beryllium zinc silicate		1	2
Betel quid with tobacco	--	Betel quid with tobacco		1	
Bis (2-chloroethyl) ether	000106-46-7	Bis (2-chloroethyl) ether		3	
Bis(1-aziridinyl) morpholinophosphine sulfide	002168-68-5	Bis(1-aziridinyl)morpholinophosphine sulfide		3	
Bis(2,3-epoxycyclopentyl)ether	002386-90-5	Bis(2,3-epoxycyclopentyl)ether		3	
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)	000494-03-1	Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)		1	
Bis(2-chloroisopropyl)ether	000108-60-1	Bis(2-chloroisopropyl)ether		3	
Bis(2-ethylhexyl) phthalate	000117-81-7	Bis(2-ethylhexyl) phthalate			2
2,2-Bis(bromomethyl)propane-1,3-diol	003296-90-0	Bis(bromomethyl)propane-1,3-diol		2B	
1,2-Bis(chloromethoxy)ethane	013483-18-6	Bis(chloromethoxy)ethane		3	
1,4-Bis(chloromethoxymethyl)benzene	056894-91-8	Bis(chloromethoxymethyl)benzene		3	
Bischloroethyl nitrosourea (BCNU)	000154-93-8	Bischloroethyl nitrosourea (BCNU)		2A	2
Bisphenol A diglycidyl ether	001675-54-3	Bisphenol A diglycidyl ether		3	
Bisulfites	--	Bisulfites		3	
Bitumens, extracts of steam-refined and air-refined	008052-42-4	Bitumens, extracts of steam-refined and air-refined		2B	
Bitumens, steam-refined, cracking-residue and air-refined	008052-42-4	Bitumens, steam-refined, cracking-residue and air-refined		3	
Bleomycins	011056-06-7	Bleomycins		2B	
Blue VRS	000129-17-9	Blue VRS		3	
Boot and shoe manufacture and repair	--	Boot and shoe manufacture and repair		1	
Bracken fern	--	Bracken fern		2B	
Brilliant blue FCF, disodium salt	003844-45-9	Brilliant blue FCF, disodium salt		3	
Bromochloroacetonitrile	083463-62-1	Bromochloroacetonitrile		3	
Bromodichloromethane	000075-27-4	Bromodichloromethane		2B	2
Bromoethane	000074-96-4	Bromoethane		3	
Bromoform	000075-25-2	Bromoform		3	
1,3-Butadiene	000106-99-0	Butadiene	X	2A	1
1,4-Butanediol dimethanesulfonate (Busulphan;Myleran)	000055-98-1	Butanediol dimethanesulfonate (Busulphan;Myleran)		1	1
n-Butyl acrylate	000141-32-2	Butyl acrylate		3	
Butylated hydroxyanisole (BHA)	025013-16-5	Butylated hydroxyanisole (BHA)		2B	2
Butylated hydroxytoluene (BHT)	000128-37-0	Butylated hydroxytoluene (BHT)		3	
beta-Butyrolactone	003068-88-0	Butyrolactone		2B	
gamma-Butyrolactone	000096-48-0	Butyrolactone, gamma		3	
C.I. Acid Red 114	006459-94-5	C.I. Acid Red 114		2B	
C.I. Basic Red 9	000569-61-9	C.I. Basic Red 9		2B	2
C.I. Direct blue 15	002429-74-5	C.I. Direct blue 15		2B	
CCNU	013010-47-4	CCNU			2
CI Acid Orange 3	006373-74-6	CI Acid Orange 3		3	
CI Pigment Red 3	002425-85-6	CI Pigment Red 3		3	
Cadmium	007440-43-9	Cadmium		1	1
Cadmium chloride	010108-64-2	Cadmium chloride			1
Cadmium compounds	007440-43-9	Cadmium compounds		1	1

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Cadmium oxide	001306-19-0	Cadmium fume (as Cd)			1
Cadmium sulfate (1:1)	010124-36-4	Cadmium sulfate (1:1)			1
Cadmium sulfide	001306-23-6	Cadmium sulfide			1
Caffeic acid	000331-39-5	Caffeic acid		2B	
Caffeine	000058-08-2	Caffeine		3	
Cantharidin	000056-25-7	Cantharidin		3	
Caprolactam	000105-60-2	Caprolactam		4	
Captafol	002425-06-1	Captafol		2A	
Captan	000133-06-2	Captan		3	
Carbaryl	000063-25-2	Carbaryl		3	
Carbazole	000086-74-8	Carbazole		3	
3-Carbethoxypsoralen	020073-24-9	Carbethoxypsoralen		3	
Carbon black	001333-86-4	Carbon black		2B	
Carbon tetrachloride	000056-23-5	Carbon tetrachloride		2B	2
Carmoisine	003567-69-9	Carmoisine		3	
Carpentry and joinery	--	Carpentry and joinery		2B	
Carrageenan, degraded	009000-07-1	Carrageenan, degraded		2B	
Carrageenan, native	009000-07-1	Carrageenan, native		3	
Catechol	000120-80-9	Catechol		2B	
Ceramic fibres	--	Ceramic fibres		2B	2
Chloral	000075-87-6	Chloral		3	
Chloral hydrate	000302-17-0	Chloral hydrate		3	
Chlorambucil	000305-03-3	Chlorambucil		1	1
Chloramphenicol	000056-75-7	Chloramphenicol		2A	
Chlordane	000057-74-9	Chlordane		2B	
Chlordecone (Kepone)	000143-50-0	Chlordecone (Kepone)		2B	2
Chlordimeform	006164-98-3	Chlordimeform		3	
Chlorendic acid	000115-28-6	Chlorendic acid		2B	2
Chlorinated drinking-water	--	Chlorinated drinking-water		3	
Chlorinated paraffins (C12, 60% Chlorine)	108171-26-2	Chlorinated paraffins (C12, 60% Chlorine)		2B	2
Chlorinated paraffins of average carbon chain length C12 and average degree of chlorination approximately 60%	--	Chlorinated paraffins of average carbon chain length C12 and average degree of chlorination approximately 60%		2B	
alpha-Chlorinated toluenes (Benzal chloride, Benzyl chloride, Benzotrichloride)and bonzoyl chloride (combined exposures)	--	Chlorinated toluenes (Benzyl chloride, Benzal chloride, Benzotrichloride)		2A	
2-Chloro-1,1,1-trifluoroethane (HCFC-133a)	000075-88-7	Chloro-1,1,1-trifluoroethane (HCFC-133a)		3	
1-Chloro-2-methyl propene	000513-37-1	Chloro-2-methyl propene		2B	2
3-Chloro-2-methylpropene	000563-47-3	Chloro-2-methylpropene		3	2
4-Chloro-metaphenylenediamine	005131-60-2	Chloro-metaphenylenediamine		3	
4-Chloro-o-toluidine hydrochloride	003165-93-3	Chloro-o-toluidine hydrochloride		2A	2
4-Chloro-ortho-phenylenediamine	000095-83-0	Chloro-ortho-phenylenediamine		2B	2
para-Chloro-ortho-toluidine	000095-69-2	Chloro-ortho-toluidine			2
para-Chloro-ortho-toluidine	000095-69-2	Chloro-ortho-toluidine		2A	
5-Chloro-ortho-toluidine	000095-79-4	Chloro-ortho-toluidine		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
para-Chloro-ortho-toluidine and its strong acid salts	000095-69-2	Chloro-ortho-toluidine and its strong acid salts		2A	
Chloroacetonitrile	000107-14-2	Chloroacetonitrile		3	
para-Chloroaniline	000106-47-8	Chloroaniline		2B	
Chlorobenzilate	000510-15-6	Chlorobenzilate		3	
Chlorodibromomethane	000124-48-1	Chlorodibromomethane		3	
Chlorodifluoromethane	000075-45-6	Chlorodifluoromethane		3	
Chloroethane	000075-00-3	Chloroethane		3	
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosoarea (Methyl-CCNU; Semustine)	013909-09-6	Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosoarea (Methyl-CCNU; Semustine)		1	1
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosoarea (CCNU)	013010-47-4	Chloroethyl)-3-cyclohexyl-1-nitrosoarea (CCNU)		2A	2
Chlorofluoromethane [HCFC-31]	000593-70-4	Chlorofluoromethane [HCFC-31]		3	
Chloroform	000067-66-3	Chloroform		2B	2
Chloromethyl methyl ether (technical-grade)	000107-30-2	Chloromethyl methyl ether (technical-grade)	X	1	1
Bis(chloromethyl)ether (technical grade)	000542-88-1	Chloromethyl)ether (technical grade)	X	1	1
Chloronitrobenzenes	000088-73-3	Chloronitrobenzenes		3	
Chloronitrobenzenes	000100-00-5	Chloronitrobenzenes		3	
Chloronitrobenzenes	000121-73-3	Chloronitrobenzenes		3	
Chlorophenoxy herbicides	--	Chlorophenoxy herbicides		2B	
Chloroprene	000126-99-8	Chloroprene		2B	2
Chloropropham	000101-21-3	Chloropropham		3	
Chloroquine	000054-05-7	Chloroquine		3	
Chlorothalonil	001897-45-6	Chlorothalonil		2B	
Chlorozotocin	054749-90-5	Chlorozotocin		2A	2
Cholesterol	000057-88-5	Cholesterol		3	
Chromate(1-), Hydroxyoctaoxidizincatedi-, Potassium	011103-86-9	Chromate(1-), Hydroxyoctaoxidizincatedi-, Potassium		1	
Chromium (III) compounds	--	Chromium (III) compounds		3	
Chromium (VI) chloride	014986-48-2	Chromium (VI) chloride		1	
Chromium (VI) compounds	--	Chromium (VI) compounds		1	
Chromium (VI) dioxychloride	014977-61-8	Chromium (VI) dioxychloride		1	
Chromium (III) oxide	001308-38-9	Chromium 99(III) oxide			
Chromium hexavalent compounds (under Chromium and Certain Chromium Compounds)	--	Chromium hexavalent compounds			1
Chromium(VI) oxide (1:3)	001333-82-0	Chromium(VI) oxide (1:3)		1	1
Chromium, metallic	007440-47-3	Chromium, metallic		3	
Chrysene	000218-01-9	Chrysene		3	
Chrysoidine	000532-82-1	Chrysoidine		3	
Ciclosporin	079217-60-0	Ciclosporin		1	
Ciclosporin	059865-13-3	Ciclosporin			1
Cimetidine	051481-61-9	Cimetidine		3	
Cinnamyl anthranilate	000087-29-6	Cinnamyl anthranilate		3	
Cinnamyl anthranilate	000087-29-6	Cinnamyl anthranilate		3	
Cisplatin	015663-27-1	Cisplatin		2A	2

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Citrinin	000518-75-2	Citrinin		3	
Citrus red no.2	006358-53-8	Citrus red no.2		2B	
Clofibrate	000637-07-0	Clofibrate		3	
Clomiphene citrate	000050-41-9	Clomiphene citrate		3	
Clonorchis sinensis (infection with)	--	Clonorchis sinensis (infection with)		2A	
Coal dust	--	Coal dust		3	
Coal gasification	--	Coal gasification		1	
Coal tar pitches	065996-93-2	Coal tar pitches		1	
Coal tars	008007-45-2	Coal tars		1	1
Cobalt and cobalt compounds	007440-48-4	Cobalt and cobalt compounds		2B	
Coffee (urinary bladder) (NB: There is some evidence of an inverse relationship between coffee drinking and cancer of the large bowel; coffee drinking could not be classified as to its carcinogenicity to other organs.)	--	Coffee		2B	
Coke oven emissions	--	Coke oven emissions	X		1
Coke production	--	Coke production	X	1	
Conjugated Estrogens	016680-47-0	Conjugated Estrogens			1
Continuous glass filament	--	Continuous glass filament		3	
Copper 8-hydroxyquinoline	010380-28-6	Copper 8-hydroxyquinoline		3	
Coronene	000191-07-1	Coronene		3	
Coumarin	000091-64-5	Coumarin		3	
Coumarin	000091-94-5	Coumarin		3	
Creosote (coal)	008001-58-9	Creosote		2A	1
para-Cresidine	000120-71-8	Cresidine		2B	2
Cresoate, wood	008021-39-4	Cresoate, wood			1
Cristobalite (under Silica, Crystalline (Respirable Size))	014464-46-1	Cristobalite			1
Crotonaldehyde	004170-30-3	Crotonaldehyde		3	
Cupferron	000135-20-6	Cupferron			2
Cycasin	014901-08-7	Cycasin		2B	
Cyclamates (Sodium cyclamate)	000139-05-9	Cyclamates (Sodium cyclamate)		3	
Cyclochlorotrine	012663-46-6	Cyclochlorotrine		3	
Cyclohexanone	000108-94-1	Cyclohexanone		3	
Cyclopenta(cd)pyrene	027208-37-3	Cyclopenta(cd)pyrene		3	
Cyclophosphamide	000050-18-0	Cyclophosphamide		1	1
Cyclophosphamide	006055-19-2	Cyclophosphamide		1	
Cyclosporin A	059865-13-3	Cyclosporin A		1	1
Cyclosporine A	059865-13-3	Cyclosporine A			1
D & C red no. 9	005160-02-1	D & C red no. 9		3	
DDT	000050-29-3	DDT		2B	2
DEHP	000117-81-7	DEHP			2
DEN	000055-18-5	DEN			2
DMN	000062-75-9	DMN			2
Dacarbazine	004342-03-4	Dacarbazine		2B	2
Danthron (Chrysazin; 1,8-Dihydroxyanthraquinone)	000117-10-2	Danthron (Chrysazin; 1,8-Dihydroxyanthraquinone)		2B	2

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Dapsone	000080-08-0	Dapsone		3	
Daunomycin	020830-81-3	Daunomycin		2B	
Decabromobiphenyl (Under Polybrominated Biphenyls)	013654-09-6	Decabromobiphenyl			2
Decabromodiphenyl oxide	001163-19-5	Decabromodiphenyl oxide		3	
Deltamethrin	052918-63-5	Deltamethrin		3	
Di(2-ethylhexyl) adipate	000103-23-1	Di(2-ethylhexyl) adipate		3	
Di(2-ethylhexyl) phthalate	000117-81-7	Di(2-ethylhexyl) phthalate		2B	2
Di(2-ethylhexyl) phthalate	000117-81-7	Di(2-ethylhexyl) phthalate		3	
Di-2-ethylhexyl adipate	000103-23-1	Di-2-ethylhexyl adipate		3	
Diacetylaminoazotoluene	000083-63-6	Diacetylaminoazotoluene		3	
N,N'-Diacetylbenzidine	000613-35-4	Diacetylbenzidine		2B	
Diallate	002303-16-4	Diallate		3	
1,4-Diamino-2-nitrobenzene	005307-14-2	Diamino-2-nitrobenzene		3	
1,2-Diamino-4-nitrobenzene	000099-56-9	Diamino-4-nitrobenzene		3	
2,4-Diaminoanisole (and its salts)	000615-05-4	Diaminoanisole (and its salts)		2B	
2,4-Diaminoanisole sulfate	039156-41-7	Diaminoanisole sulfate			2
4,4'-Diaminodiphenyl ether	000101-80-4	Diaminodiphenyl ether		2B	2
2,4-Diaminotoluene	000095-80-7	Diaminotoluene		2B	2
2,5-Diaminotoluene	000095-70-5	Diaminotoluene		3	
Diazepam	000439-14-5	Diazepam		3	
Diazomethane	000334-88-3	Diazomethane		3	
Dibenz(a,h)acridine	000226-36-8	Dibenz(a,h)acridine		2B	2
Dibenz[a,c]anthracene	000215-58-7	Dibenz[a,c]anthracene		3	
Dibenz[a,h]anthracene	000053-70-3	Dibenz[a,h]anthracene		2A	2
Dibenz[a,j]acridine	000224-42-0	Dibenz[a,j]acridine		2B	2
Dibenzo-para-dioxin	--	Dibenzo-para-dioxin		3	
Dibenzo[a,e]fluoranthene	005385-75-1	Dibenzo[a,e]fluoranthene		3	
Dibenzo[a,e]pyrene	000192-65-4	Dibenzo[a,e]pyrene		2B	2
Dibenzo[a,h]pyrene	000189-64-0	Dibenzo[a,h]pyrene		2B	2
Dibenzo[a,i]pyrene	000189-55-9	Dibenzo[a,i]pyrene		2B	2
Dibenzo[a,l]pyrene	000191-30-0	Dibenzo[a,l]pyrene		2B	2
7H-Dibenzo[c,g]carbazole	000194-59-2	Dibenzo[c,g]carbazole		2B	2
Dibenzo[h,rst]pentaphene	000192-47-2	Dibenzo[h,rst]pentaphene		3	
1,2-Dibromo-3-chloropropane (DBCP)	000096-12-8	Dibromo-3-chloropropane (DBCP)	X	2B	2
Dibromoacetonitrile	003252-43-5	Dibromoacetonitrile		3	
1,2-Dibromoethane	000106-93-4	Dibromoethane			2
2,3-Dibromopropan-1-ol	000096-13-9	Dibromopropan-1-ol		2B	
3,3'-Dichloro-4,4'-diaminodiphenyl ether	028434-86-8	Dichloro-4,4'-diaminodiphenyl ether		2B	
2,6-Dichloro-para-phenylenediamine	000609-20-1	Dichloro-para-phenylenediamine		3	
Dichloroacetic acid	000079-43-6	Dichloroacetic acid		3	
Dichloroacetonitrile	003018-12-0	Dichloroacetonitrile		3	
Dichloroacetylene	007572-29-4	Dichloroacetylene		3	
ortho-dichlorobenzene	000095-50-1	Dichlorobenzene		3	
m-Dichlorobenzene	000541-73-1	Dichlorobenzene, m		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
para-Dichlorobenzene	000106-46-7	Dichlorobenzene, para		2B	2
3,3'-Dichlorobenzidene	000091-94-1	Dichlorobenzidene	X	2B	2
3,3'-Dichlorobenzidine dihydrochloride	000612-83-9	Dichlorobenzidine dihydrochloride			2
Trans 1,4-dichlorobutene	000110-57-6	Dichlorobutene		3	
Dichlorodiphenyl trichloroethane	000050-29-3	Dichlorodiphenyl trichloroethane			2
1,2-Dichloroethane	000107-06-2	Dichloroethane		2B	2
Dichloromethane	000075-09-2	Dichloromethane		2B	2
1,2-Dichloropropane	000078-87-5	Dichloropropane		3	
1,3-Dichloropropene (technical-grade)	000542-75-6	Dichloropropene (technical-grade)		2B	2
Dichlorvos	000062-73-7	Dichlorvos		2B	
Dichromic acid, Diammonium salt	--	Dichromic acid, Diammonium salt		1	
Dicofol	000115-32-2	Dicofol		3	
Didanosine	069655-05-6	Didanosine		3	
N,N-Diehtyldithiocarbamic Acid 2-Chloroallyl Ester	000095-06-7	Diehtyldithiocarbamic Acid			2
Dieldrin	000060-57-1	Dieldrin		3	
Diepoxybutane	001464-53-5	Diepoxybutane			2
Diesel exhaust	--	Diesel exhaust		2A	
Diesel exhaust particulates	--	Diesel exhaust particulates			2
Diesel fuel marine	--	Diesel fuel marine		2B	
Diesel fuels, distillate (light)	--	Diesel fuels, distillate (light)		2B	
Diethanolamine	000111-42-2	Diethanolamine		3	
Diethyl sulfate	000064-67-5	Diethyl sulfate		2A	2
2,6-Diethylaniline	000579-66-8	Diethylaniline (2,6-)			
1,2-Diethylhydrazine	001615-80-1	Diethylhydrazine		2B	
Diethylnitrosamine	000055-18-5	Diethylnitrosamine			2
Diethylstilbesterol (DES)	000056-53-1	Diethylstilbesterol (DES)		1	1
Diglycidyl resorcinol ether	000101-90-6	Diglycidyl resorcinol ether		2B	2
Dihydrosafrole	000094-58-6	Dihydrosafrole		2B	
1,8-Dihydroxyanthraquinone	000117-10-2	Dihydroxyanthraquinone			2
Dihydroxymethylfuratrizine	000794-93-4	Dihydroxymethylfuratrizine		3	
Diisopropyl sulfate	002973-10-6	Diisopropyl sulfate		2B	
Dimethoxane	000828-00-2	Dimethoxane		3	
3,3'-Dimethoxybenzidine (ortho-Dianisidine)	000119-90-4	Dimethoxybenzidine (ortho-Dianisidine)		2B	2
3,3'-Dimethoxybenzidine-4,4'-diisocyanate	000091-93-0	Dimethoxybenzidine-4,4'-diisocyanate		3	
Dimethyl formamide	000540-73-8	Dimethyl formamide		3	
Dimethyl hydrogen phosphite	000868-85-9	Dimethyl hydrogen phosphite		3	
Dimethyl sulfate	000077-78-1	Dimethyl sulfate		2A	2
bis(Dimethylamino)benzophenone	000090-94-8	Dimethylamino)benzophenone			2
para-Dimethylaminoazobenzene	000060-11-7	Dimethylaminoazobenzene	X	2B	2
4-Dimethylaminoazobenzene	000060-11-7	Dimethylaminoazobenzene	X	2B	2
para-Dimethylaminoazobenzenediazosodium sulfonate	000140-56-7	Dimethylaminoazobenzenediazosodium sulfonate		3	
4,5'-Dimethylangelicin plus ultraviolet A radiation	004063-41-6	Dimethylangelicin plus ultraviolet A radiation		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
4,4'-Dimethylangelicin plus ultraviolet A radiation	022975-76-4	Dimethylangelicin plus ultraviolet A radiation		3	
N,n-Dimethylaniline	000121-69-7	Dimethylaniline		3	
3,3'-Dimethylbenzidine (o-Tolidine)	000119-93-7	Dimethylbenzidine (o-Tolidine)	2B		2
Dimethylcarbamoyl chloride	000079-44-7	Dimethylcarbamoyl chloride	2A		2
1,1-Dimethylhydrazine	000057-14-7	Dimethylhydrazine	2B		2
Dimethylnitrosamine	000062-75-9	Dimethylnitrosamine			2
1,4-Dimethylphenanthrene	022349-59-3	Dimethylphenanthrene		3	
Dimethylvinyl chloride	000513-37-1	Dimethylvinyl chloride			2
3,7-Dinitrofluorantene	105735-71-5	Dinitrofluorantene		2B	
3,9-Dinitrofluoranthene	022506-53-2	Dinitrofluoranthene		3	
1,6-Dinitropyrene	042397-64-8	Dinitropyrene	2B		2
1,8-Dinitropyrene	042397-65-9	Dinitropyrene	2B		2
Dinitrosopentamethylene tetramine	000101-25-7	Dinitrosopentamethylene tetramine		3	
2,4-Dinitrotoluene	000121-14-2	Dinitrotoluene	2B		
3,5-Dinitrotoluene	000618-85-9	Dinitrotoluene		3	
1,3-Dinitropropylene	075321-20-9	Dinitropropylene		3	
1,4-Dioxane	000123-91-1	Dioxane	2B		2
2,4'-Diphenyldiamine	000492-17-1	Diphenyldiamine		3	
Direct black 38	001937-37-7	Direct black 38			1
Direct blue 6	002602-46-2	Direct blue 6			1
Disperse blue 1	002475-45-8	Disperse blue 1	2B		2
Disperse yellow 3	002832-40-8	Disperse yellow 3		3	
Disulfiram	000097-77-8	Disulfiram		3	
Dithranol	001143-38-0	Dithranol		3	
Doxefazepam	040762-15-0	Doxefazepam		3	
Doxorubicin hydrochloride (Adriamycin)	025316-40-9	Doxorubicin hydrochloride (Adriamycin)			2
Droloxifene	082413-20-5	Droloxifene		3	
Dry cleaning, (occupational exposures in)	--	Dry cleaning, (occupational exposures in)	2B		
Dulcin	000150-69-6	Dulcin		3	
Dyes that Metabolize to Benzidine	--	Dyes that Metabolize to Benzidine			1
ENU	000759-73-9	ENU			2
Electric fields (extremely low-frequency)	--	Electric fields (extremely low-frequency)		3	
Electric fields (static)	--	Electric fields (static)		3	
Endrin	000072-20-8	Endrin		3	
Engine exhaust, gasoline	--	Engine exhaust, gasoline	2B		
Environmental Tobacco Smoke	--	Environmental Tobacco Smoke			1
Eosin	015086-94-9	Eosin		3	
Epichlorohydrin	000106-89-8	Epichlorohydrin	2A		2
3,4-Epoxy-6-methylcyclohexylmethyl-3,4-epoxy-6-methylcyclo-hexane carboxylate	000141-37-7	Epoxy-6-methylcyclohexylmethyl-3,4-epoxy-6-methylcyclo-hexane carboxylate		3	
1,2-Epoxybutane	000106-88-7	Epoxybutane	2B		
Cis-9, 10-epoxystearic acid	002443-39-2	Epoxystearic acid		3	
Epstein-Barr virus	--	Epstein-Barr virus		1	
Erionite	066733-21-9	Erionite		1	1

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Estazolam	029975-16-4	Estazolam		3	
Estra-1,2,5(10),7-tetraen-17-one, 3-(sulfooxy)-, sodium salt	016680-47-0	Estra-1,2,5(10),7-tetraen-17-one, 3-(sulfooxy)-, sodium salt			1
Estrogens (not conjugated)		Estrogens (not conjugated)			
Estradiol-17 beta	000050-28-2	Estradiol-17beta			2
Estrogens (not conjugated) Estrone	000053-16-7	Estrogens (not conjugated) Estrone			2
Estrogens (not conjugated)		Estrogens (not conjugated)			
Ethinylestradiol	000057-63-6	Ethinylestradiol			2
Estrogens (not conjugated) Mestranol	000072-33-3	Estrogens (not conjugated) Mestranol			2
Ethionamide	000536-33-4	Ethionamide		3	
Ethyl acrylate	000140-88-5	Ethyl acrylate		2B	
Ethyl carbamate	000051-79-6	Ethyl carbamate			2
Ethyl methanesulfonate	000062-50-0	Ethyl methanesulfonate		2B	2
Ethyl selenac	005456-28-0	Ethyl selenac		3	
Ethyl tellurac	020941-65-5	Ethyl tellurac		3	
n-Ethyl-N-nitrosourea	000759-73-9	Ethyl-N-nitrosourea		2A	2
Ethylbenzene	000100-41-4	Ethylbenzene		2B	
Ethylene	000074-85-1	Ethylene		3	
Ethylene dibromide	000106-93-4	Ethylene dibromide		2A	2
Ethylene dichloride	000107-06-2	Ethylene dichloride			2
Ethylene oxide	000075-21-8	Ethylene oxide	X	1	1
Ethylene sulfide	000420-12-2	Ethylene sulfide		3	
Ethylene thiourea	000096-45-7	Ethylene thiourea		2B	2
Ethyleneimine	000151-56-4	Ethyleneimine	X		
2-Ethylhexyl acrylate	000103-11-7	Ethylhexyl acrylate		3	
Etoposide	033419-42-0	Etoposide		2A	
Etoposide in combination with cisplatin and bleomycin	033419-42-0	Etoposide in combination with cisplatin and bleomycin			1
Eugenol	000097-53-0	Eugenol		3	
Evans blue	000314-13-6	Evans blue		3	
Fast green FCF	002353-45-9	Fast green FCF		3	
Fenvalerate	051630-58-1	Fenvalerate		3	
Ferbam	014484-64-1	Ferbam		3	
Ferric oxide	001309-37-1	Ferric oxide		3	
Firemaster BP-6 (under Polybrominated Biphenyls)	--	Firemaster BP-6			2
Firemaster FF-1	067774-32-7	Firemaster FF-1			2
Flat-glass and specialty glass (manufacture of)	--	Flat-glass and specialty glass (manufacture of)		3	
Fluometuron	002164-17-2	Fluometuron		3	
Fluoranthene	000206-44-0	Fluoranthene		3	
Fluorene	000086-73-7	Fluorene		3	
Fluorescent lighting	--	Fluorescent lighting		3	
Fluorides (inorganic, used in drinking-water]	--	Fluorides (inorganic, used in drinking-water]			3
5-Fluorouracil	000051-21-8	Fluorouracil		3	
Foreign bodies, implanted in tissues; Metallic chromium or titanium, cobalt-based, chromium-based and titanium-based alloys,	--	Foreign bodies, implanted in tissues; Metallic chromium or titanium, cobalt-based, chromium-based and titanium-based alloys, stainless steel and			3

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
stainless steel and depleted uranium		depleted uranium			
Foreign bodies, implanted in tissues; Metallic cobalt, metallic nickel and an alloy powder containing 66-67% nickel, 13-16% chromium and 7% iron	--	Foreign bodies, implanted in tissues; Metallic cobalt, metallic nickel and an alloy powder containing 66-67% nickel, 13-16% chromium and 7% iron		2B	
Foreign bodies, implanted in tissues; Metallic, prepared as thin smooth films	--	Foreign bodies, implanted in tissues; Metallic, prepared as thin smooth films		2B	
Foreign bodies, implanted in tissues; Polymeric, prepared as thin smooth films (with the exception of poly (glycolic acid)	--	Foreign bodies, implanted in tissues; Polymeric, prepared as thin smooth films (with the exception of poly (glycolic acid)		2B	
Formaldehyde (gas)	000050-00-0	Formaldehyde (gas)	X	2A	2
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	003570-75-0	Formylhydrazino)-4-(5-nitro-2-furyl)thiazole		2B	
Fowler's solution	001332-10-1	Fowler's solution		1	
Fuel oils, distillate (light)	--	Fuel oils, distillate (light)		3	
Fuel oils, residual (heavy)	--	Fuel oils, residual (heavy)		2B	
Furan	000110-00-9	Furan		2B	2
Furazolidone	000067-45-8	Furazolidone		3	
Furfural	000098-01-1	Furfural		3	
Furniture and cabinet making	--	Furniture and cabinet making		1	
Furosemide (Frusemide)	000054-31-9	Furosemide (Frusemide)		3	
Gasoline	008006-61-9	Gasoline		2B	
Gasoline	--	Gasoline		2B	
Gemfibrozil	025812-30-0	Gemfibrozil		3	
Glass filaments	--	Glass filaments		3	
Glasswool	--	Glasswool			2
Glu-P-1 (2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole)	067730-11-4	Glu-P-1 (2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole)		2B	
Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'-d]imidazole)	067730-10-3	Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'-d]imidazole)		2B	
Glycidaldehyde	000765-34-4	Glycidaldehyde		2B	
Glycidol	000556-52-5	Glycidol			2
Glycidol	000556-52-5	Glycidol		2A	
Glycidyl oleate	005431-33-4	Glycidyl oleate		3	
Griseofulvin	000126-07-8	Griseofulvin		2B	
Guinea green B	004680-78-8	Guinea green B		3	
Glycidyl stearate	007460-84-6	Glycidyl stearate		3	
Gyromitrin	016568-02-8	Gyromitrin		3	
HC blue 1	002784-94-3	HC blue 1		2B	
HC blue no. 2	033229-34-4	HC blue no. 2		3	
HC red no. 3	002871-01-4	HC red no. 3		3	
HC yellow no. 4	059820-43-8	HC yellow no. 4		3	
Haematite	001317-60-8	Haematite		3	
Haematite mining, underground, with exposure to radon	001317-60-8	Haematite mining, underground, with exposure to radon		1	
Hair coloring products (personal use of)	--	Hair coloring products (personal use of)		3	
Hairdresser or barber (occupational	--	Hairdresser or barber (occupational		2A	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
exposure as a)		exposure as a)			
Helicobacter pylori (infection with)	--	Helicobacter pylori (infection with)		1	
Hematite mining (underground) with exposure to radon	--	Hematite mining (underground) with exposure to radon		1	
Hepatitis B virus (chronic infection with)	--	Hepatitis B virus (chronic infection with)		1	
Hepatitis C virus (chronic infection with)	--	Hepatitis C virus (chronic infection with)		1	
Hepatitis D virus (chronic infection with)	--	Hepatitis D virus (chronic infection with)		3	
Heptachlor	000076-44-8	Heptachlor	2B		
Hexabromobiphenyl	067774-32-7	Hexabromobiphenyl			2
Hexachlorobenzene	000118-74-1	Hexachlorobenzene	2B		2
gamma-Hexachlorobenzene	000058-89-9	Hexachlorobenzene, gamma			2
Hexachlorobutadiene	000087-68-3	Hexachlorobutadiene		3	
Hexachlorocyclohexane (all isomers)	000608-73-1	Hexachlorocyclohexane (all isomers)	2B		2
alpha-Hexachlorocyclohexane	000319-84-6	Hexachlorocyclohexane, alpha			2
beta-Hexachlorocyclohexane	000319-85-7	Hexachlorocyclohexane, beta			2
Hexachlorocyclohexanes	--	Hexachlorocyclohexanes	2B		2
Hexachloroethane	000067-72-1	Hexachloroethane	2B		2
Hexachlorophene	000070-30-4	Hexachlorophene	3		
Hexamethylphosphoramide	000680-31-9	Hexamethylphosphoramide	2B		2
Hot mate	--	Hot mate	2A		
Human T-cell lymphotropic virus type I	--	Human T-cell lymphotropic virus type I		1	
Human T-cell lymphotropic virus type II	--	Human T-cell lymphotropic virus type II		3	
Human immunodeficiency virus type 1 (infection with)	--	Human immunodeficiency virus type 1 (infection with)		1	
Human immunodeficiency virus type 2 (infection with)	--	Human immunodeficiency virus type 2 (infection with)		2B	
Human papillomavirus type 16	--	Human papillomavirus type 16		1	
Human papillomavirus type 18	--	Human papillomavirus type 18		1	
Human papillomavirus type 31	--	Human papillomavirus type 31	2A		
Human papillomavirus type 33	--	Human papillomavirus type 33	2A		
Human papillomaviruses : some types other than 16, 18, 31 and 33	--	Human papillomaviruses : some types other than 16, 18, 31 and 33		2B	
Hycanthone mesylate	023255-93-8	Hycanthone mesylate		3	
Hydroxyurea	000127-07-1	Hydroxyurea		3	
Hydrazine	000302-01-2	Hydrazine	2B		2
Hydrazine sulfate	010034-93-2	Hydrazine sulfate			2
Hydrazobenzene	000122-66-7	Hydrazobenzene			2
Hydrochloric acid	007647-01-0	Hydrochloric acid		3	
Hydrochlorothiazide	000058-93-5	Hydrochlorothiazide		3	
Hydrogen peroxide	007722-84-1	Hydrogen peroxide		3	
Hydroquinone	000123-31-9	Hydroquinone		3	
4-Hydroxyazobenzene	001689-82-3	Hydroxyazobenzene		3	
8-Hydroxyquinoline	000148-24-3	Hydroxyquinoline		3	
Hydroxysenkirkine	026782-43-4	Hydroxysenkirkine		3	
Hypochlorite salts	--	Hypochlorite salts		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)	076180-96-6	IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)		2A	
Indeno[1,2,3-cd]pyrene	000193-39-5	Indeno[1,2,3-cd]pyrene		2B	2
Inorganic-acid mists, containing Sulfuric Acid	--	Inorganic-acid mists, containing Sulfuric Acid		1	
Insulation glass wool	--	Insulation glass wool			
Iron and steel founding	--	Iron and steel founding		1	
Iron sorbitol-citric acid complex	001338-16-5	Iron sorbitol-citric acid complex		3	
Iron-dextran complex	009004-66-4	Iron-dextran complex		2B	2
Iron-dextrin complex	009004-51-7	Iron-dextrin complex		3	
Isatidine	015503-86-3	Isatidine		3	
Isonicotinic acid hydrazide (Isoniazid)	000054-85-3	Isonicotinic acid hydrazide (Isoniazid)		3	
Isophosphamide	003778-73-2	Isophosphamide		3	
Isoprene	000078-79-5	Isoprene		2B	2
Isopropanol manufacture (strong acid process)	000067-63-0	Isopropanol manufacture (strong acid process)		1	
Isopropanol or Isopropyl alcohol	000067-63-0	Isopropanol or Isopropyl alcohol		3	
Isopropyl alcohol manufacture, strong-acid process	000067-63-0	Isopropyl alcohol manufacture, strong-acid process		1	
Isopropyl oils	--	Isopropyl oils		3	
Isosafrole	000120-58-1	Isosafrole		3	
Jacobine	006870-67-3	Jacobine		3	
Jet fuel	--	Jet fuel		3	
Kaempferol	000520-18-3	Kaempferol		3	
Kamachlor® 500	037317-41-2	Kamachlor® 500			2
Kaposi's sarcoma herpesvirus/human herpesvirus 8	--	Kaposi's sarcoma herpesvirus/human herpesvirus 8		2A	
Kepone®	000143-50-0	Kepone®			2
Lasiocarpine	000303-34-4	Lasiocarpine		2B	
Lauroyl peroxide	000105-74-8	Lauroyl peroxide		3	
Lead acetate	000301-04-2	Lead acetate			2
Lead and lead compounds	007439-92-1	Lead and lead compounds	X	2B	
Lead chromate (as Cr)	007758-97-6	Lead chromate (as Cr)			1
Lead phosphate	007446-27-7	Lead phosphate		2B	2
Lead, organo	000075-74-1	Lead, organo		3	
Lead, organo	000078-00-2	Lead, organo		3	
Leather goods manufacture	--	Leather goods manufacture		3	
Leather tanning and processing	--	Leather tanning and processing		3	
Light green SF	005141-20-8	Light green SF		3	
d-Limonene	005989-27-5	Limonene		3	
Lindane	000058-89-9	Lindane			2
Lindane and other hexachlorocyclohexane isomers	--	Lindane and other hexachlorocyclohexane isomers			2
Lumber and sawmill industries (including logging)	--	Lumber and sawmill industries (including logging)		3	
Luteoskyrin	021884-44-6	Luteoskyrin		3	
MBOCA	000101-14-4	MBOCA			2
MOPP and other combined chemotherapy including alkylating agents	--	MOPP and other combined chemotherapy including alkylating agents		1	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Magenta (containing CI basic red 9)	000632-99-5	Magenta (containing CI basic red 9)		2B	
Magenta, manufacture of	--	Magenta, manufacture of		1	
Malathion	000121-75-5	Malathion		3	
Maleic hydrazide	000123-33-1	Maleic hydrazide		3	
Malonaldehyde	000542-78-9	Malonaldehyde		3	
Maneb	012427-38-2	Maneb		3	
Mannomustine dihydrochloride	000551-74-6	Mannomustine dihydrochloride		3	
MeCCNU (see 1-(2-Chloroethyl)-3-(4-methylhexyl)-1-nitrosourea)	013909-09-6	MeCCNU			1
Mea-alpha-c (2-Amino-3-methyl-9H-pyrido[2,3-b]indole)	068006-83-7	Mea-alpha-c (2-Amino-3-methyl-9H-pyrido[2,3-b]indole)		2B	
Medphalan	013045-94-8	Medphalan		3	
Medroxyprogesterone acetate	000071-58-9	Medroxyprogesterone acetate		2B	
MelQ (2-Amino-3,4-dimethylimidazo[4,5f]quinoline)	077094-11-2	MelQ (2-Amino-3,4-dimethylimidazo[4,5f]quinoline)		2B	
MelQx (2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)	077500-04-0	MelQx (2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)		2B	
Melamine	000108-78-1	Melamine		3	
Melphalan	000148-82-3	Melphalan		1	1
6-Mercaptopurine	000050-44-2	Mercaptopurine		3	
Mercury and inorganic mercury compounds	007439-97-6	Mercury and inorganic mercury compounds		3	
Merphalan	000531-76-0	Merphalan		2B	
Mestranol (under Estrogens (not conjugated))	000072-33-3	Mestranol			2
Meta-cresidine	000102-50-1	Meta-cresidine		3	
Meta-phenylenediamine	000108-45-2	Meta-phenylenediamine		3	
Metabisulfites	--	Metabisulfites		3	
Methotrexate	000059-05-2	Methotrexate		3	
Methoxychlor	000072-43-5	Methoxychlor		3	
5-Methoxypsoralen	000484-20-8	Methoxypsoralen		2A	
8-Methoxypsoralen (Methoxsalen) plus UV radiation	--	Methoxypsoralen (Methoxsalen) plus UV radiation		1	
Methoxsalen (under Methoxsalen plus ultraviolet A radiation (PUVA))(methoxsalen not carcinogenic alone)	000298-81-7	Methoxypsoralen (Methoxsalen) plus ultraviolet A radiation		1	1
Methyl acrylate	000096-33-3	Methyl acrylate		3	
2-Methyl aziridine (Propyleneimine)	000075-55-8	Methyl aziridine (Propyleneimine)		2B	2
Methyl bromide	000074-83-9	Methyl bromide		3	
Methyl carbamate	000598-55-0	Methyl carbamate		3	
Methyl chloride	000074-87-3	Methyl chloride		3	
Methyl chloromethyl ether	000107-30-2	Methyl chloromethyl ether	X	1	1
Methyl iodide	000074-88-4	Methyl iodide		3	
Methyl mercury compounds	--	Methyl mercury compounds		2B	
Methyl methacrylate	000080-62-6	Methyl methacrylate		3	
Methyl methanesulfonate	000066-27-3	Methyl methanesulfonate		2A	2
Methyl parathion	000298-00-0	Methyl parathion		3	
Methyl red	000493-52-7	Methyl red		3	
Methyl selenac	000144-34-3	Methyl selenac		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Methyl tert-butyl ether (MTBE)	001634-04-4	Methyl tert-butyl ether		3	
2-Methyl-1-nitroanthraquinone (uncertain purity)	000129-15-7	Methyl-1-nitroanthraquinone (uncertain purity)		2B	
n-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)	000070-25-7	Methyl-N'-nitro-N-nitrosoguanidine (MNNG)		2A	2
n-Methyl-N-nitrosourea	000684-93-5	Methyl-N-nitrosourea		2A	2
n-Methyl-N-nitrosourethane	000615-53-2	Methyl-N-nitrosourethane		2B	
n-Methyl-n,4-dinitrosoaniline	000099-80-9	Methyl-n,4-dinitrosoaniline		3	
5-Methylangelicin plus ultraviolet A radiation	073459-03-7	Methylangelicin plus ultraviolet A radiation		3	
Methylazoxymethanol acetate	000592-62-1	Methylazoxymethanol acetate		2B	
Methylazoxymethanol and its acetate	000590-96-5	Methylazoxymethanol and its acetate		2B	
1-Methylchrysene	003351-28-8	Methylchrysene, 1-		3	
2-Methylchrysene	003351-32-4	Methylchrysene, 2-		3	
3-Methylchrysene	003351-31-3	Methylchrysene, 3-		3	
4-Methylchrysene	003351-30-2	Methylchrysene, 4-		3	
5-Methylchrysene	003697-24-3	Methylchrysene, 5-		2B	2
6-Methylchrysene	001705-85-7	Methylchrysene, 6-		3	
4,4'-Methylene bis(2-chloroaniline)(MBOCA)	000101-14-4	Methylene bis(2-chloroaniline) (MOCA)		2A	2
4,4'-Methylene bis(2-methylaniline)	000838-88-0	Methylene bis(2-methylaniline)		2B	
4,4'-Methylene bis(n,n-dimethyl)benzenamine	000101-61-1	Methylene bis(n,n-dimethyl)benzenamine		3	2
Methylene chloride	000075-09-2	Methylene chloride	X		2
Methylene chloride, see Dichloromethane	000075-09-2	Methylene chloride, see Dichloromethane	X		2
4,4'-Methylenedianiline	000101-77-9	Methylenedianiline	X	2B	2
4,4'-Methylenedianiline dihydrochloride	013552-44-8	Methylenedianiline dihydrochloride			2
4,4'-Methylenediphenyl diisocyanate	000101-68-8	Methylenediphenyl diisocyanate		3	
3-Methylfluoranthene	001706-01-0	Methylfluoranthene		3	
2-Methylfluoranthene	033543-31-6	Methylfluoranthene		3	
Methylglyoxal	000078-98-8	Methylglyoxal		3	
n-Methylolacrylamide	090456-67-0	Methylolacrylamide		3	
1-Methylphenanthrene	000832-69-9	Methylphenanthrene		3	
Methylthiouracil	000056-04-2	Methylthiouracil		2B	
Metronidazole	000443-48-1	Metronidazole		2B	2
Michler's ketone	000090-94-8	Michler's ketone			2
Mineral oil	008012-95-1	Mineral oil			1
Mineral oils, highly refined	--	Mineral oils, highly refined		3	
Mineral oils, untreated and mildly treated	--	Mineral oils, untreated and mildly treated		1	
Mirex	002385-85-5	Mirex		2B	2
Mitomycin C	000050-07-7	Mitomycin C		2B	
Mitoxantrone	065271-80-9	Mitoxantrone		2B	
Modacrylic fibres	--	Modacrylic fibres		3	
Monocrotaline	000315-22-0	Monocrotaline		2B	
Monuron	000150-68-5	Monuron		3	
Morpholine	000110-91-8	Morpholine		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone	003795-88-8	Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone		2B	
Musk embrette	000083-66-9	Musk embrette		3	
Musk xylene	000081-15-2	Musk xylene		3	
Mustard gas	000505-60-2	Mustard gas		1	1
Myleran® (see 1,4-Butanediol Dimethylsulfonate)	000055-98-1	Myleran®			1
NNK	064091-91-4	NNK			2
Nafenopin	003771-19-5	Nafenopin		2B	
1,50 Naphthalene diisocyanate	003173-72-6	Naphthalene diisocyanate		3	
2-Naphthylamine	000091-59-8	Naphthylamine	X	1	1
alpha-Naphthylamine	000134-32-7	Naphthylamine	X	3	
b-Naphthylamine	000091-59-8	Naphthylamine, b-			1
1,5-Naphthalenediamine	002243-62-1	Naphthalenediamine		3	
Neutrons	--	Neutrons		1	
Nickel acetate (under Nickel and certain Nickel compounds)	000373-02-4	Nickel acetate			2
Nickel carbonate (under Nickel and certain Nickel compounds)	003333-67-3	Nickel carbonate			2
Nickel carbonyl	013463-39-3	Nickel carbonyl			2
Nickel hydroxide under Nickel and certain Nickel Compounds)	012054-48-7	Nickel hydroxide			2
Nickel hydroxide (under Nickel and certain Nickel Compounds)	011113-74-9	Nickel hydroxide			2
Nickel oxide (under Nickel and certain Nickel compounds)	001313-99-1	Nickel oxide			2
Nickel, metallic and alloys	007440-02-0	Nickel, metallic and alloys		2B	2
Nickelocene (under Nickel and certain Nickel compounds)	001271-28-9	Nickelocene			2
Niridazole	000061-57-4	Niridazole		2B	
Nithiazide	000139-94-6	Nithiazide		3	
Nitrioltriacetic acid and its salts	000139-13-9	Nitrioltriacetic acid and its salts		2B	2
Nitrioltriacetic acid disodium salt monohydrate	023255-03-0	Nitrioltriacetic acid disodium salt monohydrate		2B	
Nitrioltriacetic acid monosodium salt	018994-66-6	Nitrioltriacetic acid monosodium salt		2B	
Nitrioltriacetic acid sodium salt	010042-84-9	Nitrioltriacetic acid sodium salt		2B	
Nitrioltriacetic acid trisodium salt monohydrate	018662-53-8	Nitrioltriacetic acid trisodium salt monohydrate		2B	
Nitrioltriacetic acid, disodium salt	015467-20-6	Nitrioltriacetic acid, disodium salt		2B	
Nitrioltriacetic acid, trisodium salt	005064-31-3	Nitrioltriacetic acid, trisodium salt		2B	
n-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide	000531-82-8	Nitro-2-furyl)-2-thiazolyl]acetamide		2B	
5-Nitro-o-anisidine	000099-59-2	Nitro-o-anisidine		3	
5-Nitro-o-toluidine	000099-55-8	Nitro-o-toluidine		3	
5-Nitroacenaphthene	000602-87-9	Nitroacenaphthene		2B	
o-Nitroanisole	000091-23-6	Nitroanisole			2
2-Nitroanisole	000091-23-6	Nitroanisole		2B	
9-Nitroanthracene	000602-60-8	Nitroanthracene		3	
7-Nitrobenz(a)anthracene	020268-51-3	Nitrobenz(a)anthracene		3	
Nitrobenzene	000098-95-3	Nitrobenzene		2B	
6-Nitrobenzo(a)pyrene	063041-90-7	Nitrobenzo(a)pyrene		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
4-Nitrobiphenyl	000092-93-3	Nitrobiphenyl	X	3	
6-Nitrochrysene	007496-02-8	Nitrochrysene		2B	2
Nitrofen, (technical-grade)	001836-75-5	Nitrofen, (technical-grade)		2B	2
3-Nitrofluoranthene	000892-21-7	Nitrofluoranthene		3	
2-Nitrofluorene	000607-57-8	Nitrofluorene		2B	
Nitrofural (Nitrofurazone)	000059-87-0	Nitrofural (Nitrofurazone)		3	
Nitrofurantoin	000067-20-9	Nitrofurantoin		3	
1-[(5-Nitrofurfurylidene)amino]-2-imidazolidinone	000555-84-0	Nitrofurfurylideneamino]-2-imidazolidinone		2B	
Nitrogen mustard	000051-75-2	Nitrogen mustard		2A	
Nitrogen mustard N-oxide	000126-85-2	Nitrogen mustard N-oxide		2B	
Nitronmethane	000075-52-5	Nitromethane		2B	
1-Nitronaphthalene	000086-57-7	Nitronaphthalene		3	
2-Nitronaphthalene	000581-89-5	Nitronaphthalene		3	
3-Nitroperylene	020589-63-3	Nitroperylene		3	
2-Nitropropane	000079-46-9	Nitropropane		2B	2
1-Nitropyrene	005522-43-0	Nitropyrene		2B	2
4-Nitropyrene	057835-92-4	Nitropyrene		2B	2
2-Nitropyrene	000789-07-1	Nitropyrene		3	
n-Nitroso-N-methyl-Urea	000684-93-5	Nitroso-N-methyl-Urea			2
n-Nitroso-n-ethylurea	000759-73-9	Nitroso-n-ethylurea			2
n'-Nitrosoanabasine	037620-20-5	Nitrosoanabasine		3	
n'-Nitrosoantabine	071267-22-6	Nitrosoantabine		3	
n-Nitrosobutylbutanolamine	003817-11-6	Nitrosobutylbutanolamine			2
n-Nitrosobutylcarboxypropylamine	038252-74-3	Nitrosobutylcarboxypropylamine			2
n-Nitrosodi-n-butylamine	000924-16-3	Nitrosodi-n-butylamine		2B	2
n-Nitrosodi-n-propylamine	000621-64-7	Nitrosodi-n-propylamine		2B	2
n-Nitrosodiethanolamine	001116-54-7	Nitrosodiethanolamine		2B	2
N-Nitrosodiethanolamine	001116-54-7	Nitrosodiethanolamine		2B	
n-Nitrosodiethylamine	000055-18-5	Nitrosodiethylamine		2A	2
n-Nitrosodimethylamine	000062-75-9	Nitrosodimethylamine, n-	X	2A	2
p-Nitrosodiphenylamine	000156-10-5	Nitrosodiphenylamine		3	
n-Nitrosodiphenylamine	000086-30-6	Nitrosodiphenylamine, n-		3	
n-Nitrosofolic acid	029291-35-8	Nitrosofolic acid		3	
n-Nitrosoguvacine	055557-01-2	Nitrosoguvacine		3	
n-Nitrosoguvacoline	055557-02-3	Nitrosoguvacoline		3	
n-Nitrosohydroxyproline	030310-80-6	Nitrosohydroxyproline		3	
4-(n-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	064091-91-4	Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)		2B	2
4-(n-Nitrosomethylamino)-4-(3-pyridyl)-1 butanal (NNA)	064091-90-3	Nitrosomethylamino)-4-(3-pyridyl)-1 butanal (NNA)		3	
3-(n-Nitrosomethylamino)propionaldehyde	085502-23-4	Nitrosomethylamino)propionaldehyde		3	
3-(n-Nitrosomethylamino)propionitrile	060153-49-3	Nitrosomethylamino)propionitrile		2B	
n-Nitrosomethylethylamine	010595-95-6	Nitrosomethylethylamine		2B	
n-Nitrosomethylvinylamine	004549-40-0	Nitrosomethylvinylamine		2B	2
n-Nitrosomorpholine	000059-89-2	Nitrosomorpholine, n-		2B	2

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
n'-Nitrosornicotine	016543-55-8	Nitrosornicotine		2B	2
n-Nitrosopiperidine	000100-75-4	Nitrosopiperidine, n-		2B	2
n-Nitrosoproline	007519-36-0	Nitrosoproline		3	
n-Nitrosopyrrolidine	000930-55-2	Nitrosopyrrolidine		2B	2
n-Nitrososarcosine	013256-22-9	Nitrososarcosine		2B	2
Nitrotoluene	000099-08-1	Nitrotoluene		3	
Nitrotoluenes	000085-72-2	Nitrotoluenes		3	
Nitrotoluenes	000099-99-0	Nitrotoluenes		3	
Nitrovin	000804-36-4	Nitrovin		3	
Non-arsenical insecticides (occupational exposures in spraying and application of)	--	Non-arsenical insecticides		2A	
Norethisterone	000068-22-4	Norethisterone			2
Nylon 6	025038-54-4	Nylon 6		3	
Ochratoxin A	000303-47-9	Ochratoxin A		2B	2
Oestradiol mustard	022966-79-6	Oestradiol mustard		3	
Oestrogen therapy, postmenopausal	--	Oestrogen therapy, postmenopausal		1	
Oestrogen-progestogen therapy, postmenopausal	--	Oestrogen-progestogen therapy		2B	
Oestrogens, nonsteroidal	--	Oestrogens, nonsteroidal		1	
Oestrogens, steroidal	--	Oestrogens, steroidal		1	
Oil gas, compressed	--	Oil gas, compressed		3	
Oil orange SS	002646-17-5	Oil orange SS		2B	
Opisthorchis felineus (infection with)	--	Opisthorchis felineus (infection with)		3	
Opisthorchis viverrini (infection with)	--	Opisthorchis viverrini (infection with)		1	
Oral contraceptives, combined	--	Oral contraceptives, combined		1	
Oral contraceptives, sequential	--	Oral contraceptives, sequential		1	
Orange G	001936-15-8	Orange G		3	
Orange I	000523-44-4	Orange I		3	
Orthophenylphenol	000090-43-7	Orthophenylphenol		3	
Oxazepam	000604-75-1	Oxazepam		2B	
4,4-Oxydianiline	000101-80-4	Oxydianiline			2
Oxymetholone	000434-07-1	Oxymetholone			2
Oxyphenbutazone	000129-20-4	Oxyphenbutazone		3	
PAHs (see Polycyclic aromatic hydrocarbons)	--	PAHs			2
PBBs (see Polybrominated biphenyls)	--	PBBs			2
PCBs, see Polychlorinated biphenyls	001336-36-3	PCBs, see Polychlorinated biphenyls			
Paint manufacture (occupational exposure in)	--	Paint manufacture (occupational exposure in)		3	
Painter (occupational exposure as a)	--	Painter (occupational exposure as a)		1	
Palygorskite (attapulgate) (long fibres, > 5 micrometers)	012174-11-7	Palygorskite (attapulgate) (long fibres, > 5 micrometers)		2B	
Palygorskite (attapulgate) (short fibres, < 5 micrometers)	012174-11-7	Palygorskite (attapulgate) (short fibres, < 5 micrometers)		3	
Panfuran S (containing dihydroxymethylfuratrizine)	000794-93-4	Panfuran S (containing dihydroxymethylfuratrizine)		2B	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Paracetamol (acetaminophen)	000103-90-2	Paracetamol (acetaminophen)		3	
Parasorbic acid	010048-32-5	Parasorbic acid		3	
Parathion	000056-38-2	Parathion		3	
Patulin	000149-29-1	Patulin		3	
Penicillic acid	000090-65-3	Penicillic acid		3	
Pentachloroethane	000076-01-7	Pentachloroethane		3	
Pentachloronitrobenzene	000082-68-8	Pentachloronitrobenzene		3	
Perchloroethylene, see Tetrachloroethylene	000127-18-4	Perchloroethylene, see Tetrachloroethylene			2
Permethrin	052645-53-1	Permethrin		3	
Perylene	000198-55-0	Perylene		3	
Petasitenine	060102-37-6	Petasitenine		3	
Petroleum refining (occupational exposures in)	--	Petroleum refining (occupational exposures in)		2A	
Petroleum solvents	--	Petroleum solvents		3	
Phenacetin	000062-44-2	Phenacetin	2A		2
Phenanthrene	000085-01-8	Phenanthrene		3	
Phenazopyridine hydrochloride	000136-40-3	Phenazopyridine hydrochloride		2B	2
Phenelzine sulfate	000156-51-4	Phenelzine sulfate		3	
Phenicarbazide	000103-03-7	Phenicarbazide		3	
Phenobarbital	000050-06-6	Phenobarbital		2B	
Phenol	000108-95-2	Phenol		3	
Phenolphthalein	000077-09-8	Phenolphthalein			2
Phenolphthalein	000077-09-8	Phenolphthalein	2B		
Phenoxybenzamine hydrochloride	000063-92-3	Phenoxybenzamine hydrochloride		2B	2
Phenyl glycidyl ether	000122-60-1	Phenyl glycidyl ether		2B	
n-Phenyl-2-naphthylamine	000135-88-6	Phenyl-2-naphthylamine		3	
Phenylbutazone	000050-33-9	Phenylbutazone		3	
para-Phenylenediamine	000106-50-3	Phenylenediamine		3	
Phenytoin	000057-41-0	Phenytoin		2B	2
PhIP (2-Amino-1-methyl-6-phenyl- imidazo[4,5-b]pyridine)	105650-23-5	PhIP (2-Amino-1-methyl-6-phenyl- imidazo[4,5-b]pyridine)		2B	
Pickled vegetables (traditional in Asia)	--	Pickled vegetables (traditional in Asia)		2B	
Picloram	001918-02-1	Picloram		3	
Piperazine estrone sulfate (under Conjugated Estrogens)	007280-37-7	Piperazine estrone sulfate			1
Piperonyl butoxide	000051-03-6	Piperonyl butoxide		3	
Polyacrylic acid	009003-01-4	Polyacrylic acid		3	
Polybrominated biphenyl (FF-1)	067774-32-7	Polybrominated biphenyl (FF-1)		2B	2
Polybrominated biphenyl (Firemaster BP-6)	--	Polybrominated biphenyl (Firemaster BP- 6)		2B	2
Polybrominated biphenyls (PBBs)	059536-65-1	Polybrominated biphenyls (PBBs)		2B	2
Polychlorinated biphenyl (Aroclor 1254)	011097-69-1	Polychlorinated biphenyl (Aroclor 1254)		2A	2
Polychlorinated biphenyl (Aroclor 1260)	011096-82-5	Polychlorinated biphenyl (Aroclor 1260)			2
Polychlorinated biphenyls [PCBs]	001336-36-3	Polychlorinated biphenyls [PCBs]		2A	2
Polychlorinated dibenzo-para- dioxins (other than 2,3,7,8- Tetrachlorodibenzo-para-dioxin	--	Polychlorinated dibenzo-para-dioxins (other than 2,3,7,8-Tetrachlorodibenzo- para-dioxin		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Polychlorinated dibenzofurans	--	Polychlorinated dibenzofurans		3	
Polychlorophenols and their sodium salts (mixed exposures)	--	Polychlorophenols and their sodium salts (mixed exposures)		2B	
Polychloroprene	009010-98-4	Polychloroprene		3	
Polycyclic aromatic hydrocarbons	--	Polycyclic aromatic hydrocarbons			2
Polyethylene	009002-88-4	Polyethylene		3	
Polymethyl methacrylate	009011-14-7	Polymethyl methacrylate		3	
Polymethylene polyphenyl isocyanate (PAPI)	009016-87-9	Polymethylene polyphenyl isocyanate (PAPI)		3	
Polypropylene	009003-07-0	Polypropylene		3	
Polystyrene	009003-53-6	Polystyrene		3	
Polytetrafluoroethylene	009002-84-0	Polytetrafluoroethylene		3	
Polyurethane foams	009009-54-5	Polyurethane foams		3	
Polyvinyl acetate	009003-20-7	Polyvinyl acetate		3	
Polyvinyl alcohol	009002-89-5	Polyvinyl alcohol		3	
Polyvinyl chloride	009002-86-2	Polyvinyl chloride		3	
Polyvinyl pyrrolidone	009003-39-8	Polyvinyl pyrrolidone		3	
Ponceau 3R	003564-09-8	Ponceau 3R		2B	
Ponceau MX	003761-53-3	Ponceau MX		2B	
Ponceau SX	004548-53-2	Ponceau SX		3	
Potassium bis(2-hydroxyethyl)dithiocarbamate	023746-34-1	Potassium bis(2-hydroxyethyl)dithiocarbamate		3	
Potassium bromate	007758-01-2	Potassium bromate		2B	
Potassium chromate (VI)	007789-00-6	Potassium chromate (VI)		1	
Potassium dichromate (VI)	007778-50-9	Potassium dichromate (VI)		1	
Prazepam	002955-38-6	Prazepam		3	
Prednimustine	029069-24-7	Prednimustine		3	
Prednisone	000053-03-2	Prednisone		3	
Printing inks	--	Printing inks		3	
Printing processes (occupational exposures in)	--	Printing processes (occupational exposures in)		2B	
Procarbazine hydrochloride	000366-70-1	Procarbazine hydrochloride		2A	2
Proflavine salts	--	Proflavine salts		3	
Progesterone	000057-83-0	Progesterone			2
Progestins	--	Progestins		2B	
Progestogen-only contraceptives	--	Progestogen-only contraceptives		2B	
Pronetalol hydrochloride	000051-02-5	Pronetalol hydrochloride		3	
1,3-Propane sultone	001120-71-4	Propane sultone		2B	2
Propham	000122-42-9	Propham		3	
beta-Propiolactone	000057-57-8	Propiolactone	X	2B	2
b-Propiolactone	000057-57-8	Propiolactone, b-	X	2B	2
n-Propyl carbamate	000627-12-3	Propyl carbamate		3	
Propylene	000115-07-1	Propylene		3	
Propylene oxide	000075-56-9	Propylene oxide		2B	2
Propylenimine	000075-55-8	Propylenimine			2
Propylthiouracil	000051-52-5	Propylthiouracil		2B	2
Ptaquiloside	087625-62-5	Ptaquiloside		3	
Pyrene	000129-00-0	Pyrene		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Pyridine	000110-86-1	Pyridine		3	
Pyrido(3,4-c)psoralen	085878-62-2	Pyrido(3,4-c)psoralen		3	
Pyrimethamine	000058-14-0	Pyrimethamine		3	
Quartz (under Silica, Crystalline (Respirable Size))	014808-60-7	Quartz (under Silica,			1
Quercetin	000117-39-5	Quercetin		3	
para-Quinone	000106-51-4	Quinone		3	
Quintozene	000082-68-8	Quintozene		3	
Radon and its decay products	010043-92-2	Radon and its decay products		1	1
Reserpine	000050-55-5	Reserpine		3	2
Resorcinol	000108-46-3	Resorcinol		3	
Retrosine	000480-54-6	Retrosine		3	
Rhodamine 6G	000989-38-8	Rhodamine 6G		3	
Rhodamine B	000081-88-9	Rhodamine B		3	
Riddelliine	023246-96-0	Riddelliine		3	
Rifampicin	013292-46-1	Rifampicin		3	
Ripazepam	026308-28-1	Ripazepam		3	
Rock (stone) wool	--	Rock (stone) wool		3	
Rockwool	--	Rockwool		2B	
Rubber industry	--	Rubber industry		1	
Rugulosin	023537-16-8	Rugulosin		3	
Saccharated iron oxide	008047-67-4	Saccharated iron oxide		3	
Saccharin and its salts	000081-07-2	Saccharin and its salts		3	
Safrole	000094-59-7	Safrole		2B	2
Salted fish (Chinese style)	--	Salted fish (Chinese style)		1	
Scarlet red	000085-83-6	Scarlet red		3	
Schistosoma haematobium (infection with)	--	Schistosoma haematobium (infection with)		1	
Schistosoma japonicum (Infection with)	--	Schistosoma japonicum (Infection with)		2B	
Schistosoma mansoni (infection with)	--	Schistosoma mansoni (infection with)		3	
Selenium and selenium compounds	007782-49-2	Selenium and selenium compounds		3	
Selenium sulfide	007446-34-6	Selenium sulfide			2
Semicarbazide hydrochloride	000563-41-7	Semicarbazide hydrochloride		3	
Seneciophylline	000480-81-9	Seneciophylline		3	
Senkirkine	002318-18-5	Senkirkine		3	
Sepiolite	015501-74-3	Sepiolite		3	
Shale-oils	068308-34-9	Shale-oils		1	
Shikimic acid	000138-59-0	Shikimic acid		3	
Silica, Crystalline (Respirable Size)	014464-46-1	Silica, Crystalline (Respirable Size)			1
Silica, Crystalline (Respirable Size)	014808-60-7	Silica, Crystalline (Respirable Size)			1
Silica, amorphous	007631-86-9	Silica, amorphous		3	
Silica, crystalline (inhaled in the form of quartz or cristobalite from occupational sources)	014808-60-7	Silica, crystalline		1	
Simazine	000122-34-9	Simazine		3	
Slag wool	--	Slag wool		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Slagwood	--	Slagwood		2B	
Smokeless Tobacco	--	Smokeless Tobacco			1
Sodium Equilin Sulfate (under Conjugated Estrogens)	016680-47-0	Sodium Equilin Sulfate			1
Sodium Estrone Sulfate (under Conjugated Estrogens)	000438-67-5	Sodium Estrone Sulfate			1
Sodium chlorite	007758-19-2	Sodium chlorite		3	
Sodium diethyldithiocarbamate	000148-18-5	Sodium diethyldithiocarbamate		3	
Sodium ortho-phenylphenate	000132-27-4	Sodium ortho-phenylphenate		2B	
Solar Radiation and Exposure to Sunlamps and Sunbed	--	Solar Radiation			1
Solar radiation	--	Solar radiation		1	
Soots	--	Soots		1	1
Spirolactone	000052-01-7	Spirolactone		3	
Sterigmatocystin	010048-13-2	Sterigmatocystin		2B	
Streptozotocin	018883-66-4	Streptozotocin		2B	2
Strong Inorganic Acid Mists Containing Sulfuric Acid	--	Strong Inorganic Acid Mists			1
Strontium Chromate (under Chromium Hexavalent Compounds)	007789-06-2	Strontium Chromate			1
Styrene	000100-42-5	Styrene		2B	
Styrene-7,8-oxide	000096-09-3	Styrene-7,8-oxide		2A	
Styrene-acrylonitrile copolymers	009003-54-7	Styrene-acrylonitrile copolymers		3	
Styrene-butadiene copolymers	009003-55-8	Styrene-butadiene copolymers		3	
Succinic anhydride	000108-30-5	Succinic anhydride		3	
Sudan I	000872-07-9	Sudan I		3	
Sudan II	003118-97-6	Sudan II		3	
Sudan III	000085-86-9	Sudan III		3	
Sudan brown RR	006416-57-5	Sudan brown RR		3	
Sudan red 7B	006368-72-5	Sudan red 7B		3	
Sulfafurazole (Sulfisoxazole)	000127-69-5	Sulfafurazole (Sulfisoxazole)		3	
Sulfallate	000095-06-7	Sulfallate		2B	2
Sulfamethoxazole	000723-46-6	Sulfamethoxazole		3	
Sulfites	--	Sulfites		3	
Sulfur dioxide	007446-09-5	Sulfur dioxide		3	
Sulfuric acid	007664-93-9	Sulfuric acid		1	
Sunset yellow FCF	002783-94-0	Sunset yellow FCF		3	
Surgical implants, orthopaedic implants and devices, of complex composition, cardiac pacemakers, dental materials, ceramic materials	--	Surgical implants		3	
Surgical implants, female breast reconstruction, silicone	--	Surgical implants		3	
Symphytine	022571-95-5	Symphytine		3	
TCDD	001746-01-6	TCDD			1
Talc (containing asbestos fibers)	--	Talc (containing asbestos fibers)		1	
Talc (containing no asbestos fibers)	014807-96-6	Talc (containing no asbestos fibers)		3	
Talc containing asbestiform fibres	--	Talc containing asbestiform fibres		1	
Tamoxifen	010540-29-1	Tamoxifen		1	1

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Tannic acid and tannins	001401-55-4	Tannic acid and tannins		3	
Tars	--	Tars			1
Tea	--	Tea		3	
Temazepam	000846-50-4	Temazepam		3	
Teniposide	029767-20-2	Teniposide		2A	
Terpene polychlorinates (Strobane)	008001-50-1	Terpene polychlorinates (Strobane)		3	
2,2',5,5'-Tetrachlorbenzidine	015721-02-5	Tetrachlorbenzidine		3	
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)	001746-01-6	Tetrachlorodibenzo-para-dioxin (TCDD)		1	1
1,1,1,2-Tetrachloroethane	000630-20-6	Tetrachloroethane		3	
1,1,2,2-Tetrachloroethane	000079-34-5	Tetrachloroethane		3	
Tetrachloroethylene	000127-18-4	Tetrachloroethylene		2A	2
Tetrachlorvinphos	022248-79-9	Tetrachlorvinphos		3	
Tetrafluoroethylene	000116-14-3	Tetrafluoroethylene		3	2
Tetrakis(hydroxymethyl)phosphonium salts	--	Tetrakis(hydroxymethyl)phosphonium salts		3	
Tetranitromethane	000509-14-8	Tetranitromethane		2B	2
Textile manufacturing industry (work in)	--	Textile manufacturing industry (work in)		2B	
Theobromine	000083-67-0	Theobromine		3	
Theophylline	000058-55-9	Theophylline		3	
Thioacetamide	000062-55-5	Thioacetamide		2B	2
4,4'-Thiodianiline	000139-65-1	Thiodianiline		2B	
Thioruracil	000141-90-2	Thioruracil		3	
Thiotepa	000052-24-4	Thiotepa		1	1
Thiourea	000062-56-6	Thiourea		2B	2
Thiourea, 1-naphthalenyl-	000086-88-4	Thiourea, 1-naphthalenyl-		3	
Thiram	000137-26-8	Thiram		3	
Thorium dioxide	001314-20-1	Thorium dioxide			1
Titanium dioxide	013463-67-7	Titanium dioxide		3	
Tobacco Smoke, Environmental	--	Tobacco Smoke, Environmental			1
Tobacco products, smokeless	--	Tobacco products, smokeless		1	1
Tobacco smoke	--	Tobacco smoke		1	1
Toluene	000108-88-3	Toluene		3	
Toluene diisocyanate	026471-62-5	Toluene diisocyanates		2B	2
ortho-Toluidine	000095-53-4	Toluidine		2A	
o-Toluidine hydrochloride	000636-21-5	Toluidine hydrochloride			2
ortho-Toluidine	000095-53-4	Toluidine, ortho		2B	2
Toremifene	089778-26-7	Toremifene		3	
Toxaphene (Polychlorinated camphenes)	008001-35-2	Toxaphene (Polychlorinated camphenes)		2B	2
Toxins derived from Fusarium graminearum, F. culmorum and F. crookwellense	--	Toxins derived from Fusarium graminearum, F. culmorum and F. crookwellense		3	
Toxins derived from Fusarium moniliforme	--	Toxins derived from Fusarium moniliforme		2B	
Toxins derived from Fusarium sporotricoides	--	Toxins derived from Fusarium sporotricoides		3	
Treosulphan	000299-75-2	Treosulphan		1	
Triaziquone	000068-76-8	Triaziquone		3	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Trichlorfon	000052-68-6	Trichlorfon		3	
Trichlormethine (trimustine hydrochloride)	000817-09-4	Trichlormethine (trimustine hydrochloride)		2B	
Trichloroacetic acid	000076-03-9	Trichloroacetic acid		3	
Trichloroacetonitrile	000545-06-2	Trichloroacetonitrile		3	
1,1,1-Trichloroethane	000071-55-6	Trichloroethane		3	
1,1,2-Trichloroethane	000079-00-5	Trichloroethane		3	
Trichloroethylene	000079-01-6	Trichloroethylene	2A		2
2,4,6-Trichlorophenol	000088-06-2	Trichlorophenol			2
1,2,3-Trichloropropane	000096-18-4	Trichloropropane	2A		2
Tridymite (under Silica, Crystalline (Respirable Size))	015468-32-3	Tridymite			1
Triethanolamine	000102-71-6	Triethanolamine		3	
Trimustine hydrochloride	000817-09-4	Triethylamine (Trimustine hydrochloride)		2B	
Triethylene glycol diglycidyl ether	001954-28-5	Triethylene glycol diglycidyl ether		3	
Trifluralin	001582-09-8	Trifluralin		3	
2,4,6-Trimethyl aniline	000088-05-1	Trimethyl aniline		3	
4,4',6-Trimethylagnelicin plu ultraviolet A radiation	090370-29-9	Trimethylagnelicin plu ultraviolet A radiation		3	
2,4,5-Trimethylaniline	000137-17-7	Trimethylaniline		3	
4,5',8-Trimethylpsoralen	003902-71-4	Trimethylpsoralen		3	
2,4,6-Trinitrotoluene (TNT)	000118-96-7	Trinitrotoluene (TNT)		3	
Triphenylene	000217-59-4	Triphenylene		3	
2,4,6-Tris(1-aziridinyl)-s-triazine	000051-18-3	Tris(1-aziridinyl)-s-triazine		3	
Tris(1-aziridinyl)phosphine Sulfide (Thiotepa)	000052-24-4	Tris(1-aziridinyl)phosphine Sulfide			1
Tris(1-aziridinyl)phosphine oxide	000545-55-1	Tris(1-aziridinyl)phosphine oxide		3	
Tris(2,3-dibromopropyl)phosphate	000126-72-7	Tris(2,3-dibromopropyl)phosphate	2A		2
Tris(2-methyl-1-aziridinyl)phosphine oxide	000057-39-6	Tris(2-methyl-1-aziridinyl)phosphine oxide		3	
1,2,3-Tris(chloromethoxy)propane	038571-73-2	Tris(chloromethoxy)propane		3	
Tris-(2-chloroethyl) phosphate	000115-96-8	Tris-(2-chloroethyl) phosphate		3	
Tris-(aziridinyl)-para-benzoquinone	000068-76-8	Tris-(aziridinyl)-para-benzoquinone		3	
Trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)	062450-06-0	Trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)		2B	
Trp-P-2(3-Amino-1-methyl-5H-pyrido[4,3-b]indole)	062450-07-1	Trp-P-2(3-Amino-1-methyl-5H-pyrido[4,3-b]indole)		2B	
Trypan blue	000072-57-1	Trypan blue	2B		
UDMH	000057-14-7	UDMH			2
Ultraviolet radiation A	--	Ultraviolet radiation A	2A		
Ultraviolet radiation B	--	Ultraviolet radiation B	2A		
Ultraviolet radiation C	--	Ultraviolet radiation C	2A		
Uracil mustard	000066-75-1	Uracil mustard		2B	
Urethane	000051-79-6	Urethane		2B	2
Vat yellow 4	000128-66-5	Vat yellow 4		3	
Vinblastine sulfate	000143-67-9	Vinblastine sulfate		3	
Vincristine sulfate	002068-78-2	Vincristine sulfate		3	
Vinyl acetate	000108-05-4	Vinyl acetate		2B	
Vinyl bromide	000593-60-2	Vinyl bromide		2A	

LIST OF CARCINOGENS, TERATOGENS, EXTRAORDINARILY HAZARDOUS SUBSTANCES

Chemical Name	CAS #	Alternate Name	OSHA	IARC	NTP
Vinyl chloride	000075-01-4	Vinyl chloride	X	1	1
Vinyl chloride-vinyl chloride copolymers	009003-22-9	Vinyl chloride-vinyl chloride copolymers		3	
4-Vinyl cyclohexene	000100-40-3	Vinyl cyclohexene		2B	
Vinyl fluoride	000075-02-5	Vinyl fluoride		2A	
Vinyl toluene	025013-15-4	Vinyl toluene		3	
n-Vinyl-2-pyrrolidine	000088-12-0	Vinyl-2-pyrrolidine		3	
4-Vinylcyclohexene diepoxide	000106-87-6	Vinylcyclohexene diepoxide		2B	2
4-Vinylcyclohexene diepoxide	000107-87-6	Vinylcyclohexene diepoxide		2B	
Vinylidene chloride	000075-35-4	Vinylidene chloride		3	
Vinylidene chloride-vinyl chloride copolymers	009011-06-7	Vinylidene chloride-vinyl chloride copolymers		3	
Vinylidene fluoride	000075-38-7	Vinylidene fluoride		3	
Vitamin K substances	012001-79-5	Vitamin K substances		3	
Welding fumes	--	Welding fumes		2B	
Wollastonite	013983-17-0	Wollastonite		3	
Wood dust	--	Wood dust		1	
X- and Gamma-Radiation	--	X- and Gamma-Radiation		1	
Xylene	001330-20-7	Xylene		3	
2,3-Xylidine	000095-68-4	Xylidine		3	
2,5-Xylidine	000095-78-3	Xylidine		3	
2,4-Xylidine	000095-68-1	Xylidine		3	
2,6-Xylidine (2,6-Dimethylaniline)	000087-62-7	Xylidine (2,6-Dimethylaniline)		2B	
Yellow AB	000085-84-7	Yellow AB		3	
Yellow OB	000131-79-3	Yellow OB		3	
Zalcitabine	007481-89-2	Zalcitabine		2B	
Zectran	000315-18-4	Zectran		3	
Zeolites other than erionite (clinoptilolite, phillipsite, mordenite, non-fibrous Japanese zeolite, synthetic zeolites)	001318-02-1	Zeolites other than erionite (clinoptilolite, phillipsite, mordenite, non-fibrous Japanese zeolite, synthetic zeolites)		3	
Zidovudine (AZT)	030516-87-1	Zidovudine		2B	
Zinc chromate (VI) hydroxide	015930-94-6	Zinc chromate (VI) hydroxide		1	
Zinc chromate (VI) hydroxide	013530-65-9	Zinc chromate (VI) hydroxide		1	1
Zineb	012122-67-7	Zineb		3	
Ziram	000137-30-4	Ziram		3	
Zirconium tetrachloride	010026-11-6	Zirconium tetrachloride		2A	

APPENDIX C
CHEMICAL INFORMATION RESOURCES

CHEMICAL INFORMATION RESOURCES

Laboratory workers requiring health and safety information regarding substances they plan to use or are using, may obtain this information from the following sources:

- Container label
- HIM EH&S Office, Department Administrator or Principal Investigator
- Material Safety Data Sheet (obtained from the chemical manufacturer)
- Manufacturer's technical service department
- American Chemical Society
(800) 227-5558
1155 Sixteenth Street, NW
Washington, DC 20036
www.acs.org
- American Petroleum Institute
(202) 682-8000
1220 L Street, NW
Washington, DC 20005
www.api.org
- American Chemistry Council
(703) 741-5000
1300 Wilson Blvd.
Arlington, VA 22209
www.americanchemistry.com
- Compressed Gas Association
(703) 788-2700
4221 Walney Road, Fifth Floor
Chantilly, VA 20151
www.cganet.com
- U.S. Department of Labor
Occupational Safety and Health Administration (OSHA)
(800) 321-OSHA
200 Constitution Avenue, NW
Washington, DC 20210
www.osha.gov

- Occupational Safety and Health Administration (OSHA), Region I
(617) 565-9860
JFK Federal Building Room E340
Boston, MA 02203
www.osha.gov
- Massachusetts Executive Office of Labor and Workforce Development
Division of Occupational Safety
(617) 969-7178
1001 Watertown Street, Second Floor
West Newton, MA 02165
www.mass.gov/dos
- Massachusetts Department of Public Health
Bureau of Environmental Health
(617) 624-5757
250 Washington Street, Seventh Floor
Boston, MA 02108
www.mass.gov/dph/environmental_health
- Massachusetts Department of Environmental Protection
(617) 292-5568
One Winter Street
Boston, MA 02108
Regional Department
(978) 694-3200
205B Lowell Street
Wilmington, MA 01887
www.mass.gov/dep
- National Institute for Occupational Safety and Health (NIOSH)
Education and Information Division
(800) 232-8328
4676 Columbia Parkway
Cincinnati, OH 45226
www.cdc.gov/niosh

NIOSH Recommendations for Chemical Protective Clothing Webpage:
<http://www.cdc.gov/niosh/ncpc/ncpc2.html>

The HIM EH&S Office is available to all staff.

APPENDIX D
EFFECTIVE USE OF GLOVES

EFFECTIVE USE OF GLOVES

REASONS FOR WEARING GLOVES

The hands are the part of the body most likely to come into contact with chemicals. Skin contact can result in dermatitis that is caused by a chemical or allergic irritation of the skin. In addition, some chemicals penetrate the skin and can cause illness in other parts of the body. Wearing gloves protects workers from skin irritation and other effects of chemical exposure.

CHOOSING THE RIGHT GLOVES

Material safety data sheets detail appropriate gloves for use with each chemical. In addition, chemical compatibility charts for specific glove materials can be obtained from the glove manufacturer. The chart at the end of this appendix is an example of a compatibility chart. Choosing the proper gloves includes selecting the right thickness, heavy gloves for more protection and light gloves for delicate work.

EFFECTIVE USE OF GLOVES

Improper removal of gloves can be a source of contamination. The procedure, which works for thin gloves that may have to be changed often, is as follows.

1. Using the fingers of one gloved hand, pinch the material of the other glove at the base of the palm and peel off the glove.
2. Continue to hold the glove.
3. With the ungloved hand, reach about an inch under the other glove on the palm side of the wrist, pinch, and peel off the other glove.
4. Both gloves have now been removed without skin contact and the contaminated sides of the gloves are facing in.
5. Gloves used with highly toxic materials should be disposed as hazardous waste before leaving the work area.

Studies have shown that up to 5% of new gloves have holes in them. Substances leaking through gloves are held in contact with skin, increasing absorption into the body. Gloves that have been improperly selected or have holes in them can sometimes be worse than no gloves at all. Gloves used for dangerous chemicals can be tested for leaks by filling them with air and immersing them in water. This should not be done with PVA laminated gloves, since they may not be water-resistant. If certain types of gloves consistently leak, the manufacturer should be notified.

EFFECTIVE USE OF GLOVES RESOURCES

NIOSH Recommendations for Chemical Protective Clothing Webpage:

<http://www.cdc.gov/niosh/ncpc/ncpc2.html>

CHEMICAL RESISTANCE CHART

The degree of protection required on a given job is known only by you. This chemical resistance or permeation chart developed by our laboratory or from data published by manufacturers of resins, rubber or polymers can only serve as a guide.

Degradation or permeation will occur at some time depending on the degree of exposure. You must determine this by testing. That is why we offer our Performance Rated Order (PRO) Program. Ask your distributor for complete details.

CHEMICAL	NITRILE	NATURAL RUBBER	PVC	NEOPRENE
Acetaldehyde	F	F	F	E
Acetic Acid	G	G	G	E
Acetone	P	G	P	G
Acrylonitrile	P	F	P	P
Aluminum Chloride	E	E	E	E
Ammonium Fluoride 40%	E	E	E	E
Ammonium Hydroxide	F	G	E	E
Amyl Acetate	P	F	P	NR
Amyl Alcohol	G	G	-	E
Aniline	P	P	G	G
Animal Fats	E	P	G	E
Aqua Regia	F	G	G	G
Battery Acid	S	G	E	E
Benzaldehyde	P	F	F	NR
Benzene	F	P	P	NR
Benzyl Alcohol	P	P	-	E
Benzyl Chloride	P	P	-	P
Bkzane	E	P	P	E
Butyl Acetate	P	P	P	NR
Butyl Alcohol	E	E	G	E
Butyl Cellosolve*	E	E	-	F
Butyraldehyde	P	P	G	-
Calcium Hypochlorite	G	G	-	F
Carbolic Acid	P	P	-	F
Carbon Disulfide	G	NR	NR	NR
Carbon Tetrachloride	G	P	P	NR
Caster Oil	E	E	F	E
Cellosolve* Acetate	F	G	-	F
Cellosolve* Solvent	G	E	-	E
Chlorine (dry)	P	P	-	F
Chlorine (wet)	F	F	-	NR
Chloroacetone	P	P	-	NR
Chloroform	P	P	P	NR
Chloroacetylene	P	NR	NR	NR
Chlorothene* VG	F	NR	P	NR
Chromic Acid	P	P	G	NR
Citric Acid	E	E	E	E
Cottonseed Oil	E	P	G	G
Cresote	G	P	G	F
Cutting Oil	E	F	F	E
Cyclohexane	E	P	F	NR
Cyclohexanol	G	P	F	E
Diacetone Alcohol	P	P	P	G
Dibenzoyl	P	P	-	NR
Dibutyl Phthalate	P	P	-	F
Diethylamine	F	F	F	P
Di-Isobutyl Ketone	P	G	P	P
Di-Isocyanate	G	P	F	P
Dimethyl Formamide	F	P	P	G
Dimethyl Sulfoxide, DMSO	E	E	F	E
Dioxane	P	P	P	NR
Dyesulf	S	E	E	E
Electroless Copper (MacDermid 9048)	E	E	E	E

Chlorothene* is a registered trademark of the Dow Chemical Corp.

Select the coating with the highest rating in the Physical Properties Chart on the right, then check the Chemical Resistance Charts below.

Key to chart:

- E Excellent
- G Good
- F Fair
- P Poor
- Blank (-) Insufficient data
- NR Not recommended

CHEMICAL	NITRILE	NATURAL RUBBER	PVC	NEOPRENE
Electroless Nickel (MacDermid V60/61)	E	E	E	E
Epoxy Resins	E	E	E	E
Ethyl Acetate	P	P	P	E
Ethyl Alcohol	E	E	G	E
Ethyl Ether	F	P	P	E
Ethyl Formate	P	P	P	G
Ethylene Dichloride	P	P	P	NR
Ethylene Glycol	E	F	F	F
Ethylene Trichloride	P	P	-	NR
Fluorine	F	F	-	NR
Formaldehyde	F	F	G	E
Formic Acid 90%	F	E	E	E
Freon TF	E	NR	NR	G
Furfural	P	P	P	G
Gasoline	F	P	P	NR
Glycerin	E	E	F	E
Hexane	E	P	F	E
Hydraulic Fluid-Petroleum Base	E	P	G	G
Hydraulic Fluid-Ester Base	P	P	P	NR
Hydrazine 65%	E	G	E	E
Hydrobromic Acid	P	E	-	-
Hydrochloric Acid 38%	G	G	G	E
Hydrochloric Acid 10%	E	E	E	E
Hydrofluoric Acid 46%	F	F	F	E
Hydroper Peroxide 30%	F	F	F	E
Hydroquinone	F	G	F	E
Insecticides	S	E	E	E
Isobutyl Alcohol	G	E	G	E
Iso-Octane	E	P	P	E
Isopropyl Alcohol	G	E	G	E
Kerosene	E	P	F	E
Lacquer Thinner	G	NR	F	F
Lactic Acid	E	E	G	E
Lard	E	P	-	F
Laurel Acid 36% EtOH	E	G	F	E
Linoleic Acid	E	P	G	E
Linseed Oil	E	P	F	E
Lubricating Oils (Petroleum)	E	P	-	G
Maleic Acid	P	P	G	E
Methyl Acetate	P	P	-	G
Methyl Alcohol	E	E	E	E
Methyl Bromide	G	F	P	NR
Methyl Cellosolve	F	P	-	E
Methylene Chloride	P	P	P	NR
Methyl Ethyl Ketone (M.E.K.)	P	G	P	P
Methyl Formate	P	P	-	NR
Methyl Isobutyl Ketone	P	F	F	NR
Methylamine	F	F	F	E
Methyl Methacrylate	P	P	F	NR
Mineral Oil	E	P	F	G
Mineral Spirits, Rule 66	E	NR	F	G
Monoethanolamine	P	G	G	E
Morpholine	P	F	G	P
Muriatic Acid	G	G	G	G

PHYSICAL PROPERTIES	NITRILE	NATURAL RUBBER	PVC	NEOPRENE
Abrasion Resistance	E	G	G	G
Cut Resistance	E	E	P	E
Puncture (snag) Resistance	E	E	G	E
Flexibility	E	E	G	G
Heat Resistance	G	F	P	G
Ozone Resistance	F	P	E	E
Tensile Strength	E	E	F	E
Dry Grip	E	E	E	E
Wet Grip	G	E	E	F

NOTE: Products in these categories vary in capabilities. Laboratory tests are necessary for specific recommendations.

CHEMICAL	NITRILE	NATURAL RUBBER	PVC	NEOPRENE
Naphtha	E	P	P	G
Nitric Acid - Concentrated 70%	P	P	F	G
Nitric Acid - Diluted 10%	F	F	G	E
Nitric Acid - Red Fuming	P	P	P	NR
Nitric Acid - White Fuming	NR	NR	P	NR
Nitrobenzene	F	P	P	NR
Nitromethane	P	P	P	G
Nitropropane 95.5%	NR	E	NR	G
Octyl Alcohol	G	G	F	E
Oleic Acid	F	P	F	E
Olive Oil	E	P	F	G
Oxalic Acid	G	G	G	E
PCB's	F	P	P	-
Paint Remover	G	F	P	F
Palmitic Acid Saturated	G	G	G	E
Paraffins	F	P	NR	F
Perchloric Acid 60%	P	P	P	E
Perchloroethylene	F	P	P	NR
Peutla	E	F	E	G
Phenol	P	P	G	E
Phosphoric Acid	G	G	P	E
Pickling Solution	P	P	G	F
Picric Acid	G	G	G	E
Pine Oil	G	P	F	P
Plating Solutions - Chrome	E	G	E	-
Potassium Hydroxide 50%	G	G	E	E
Printing Ink	E	G	F	E
Propane	E	P	F	E
Propyl Acetate	P	P	F	P
Propyl Alcohol	E	E	G	E
Propylene Oxide	P	P	-	NR
Rubber Solvent	E	NR	NR	G
Silicon Etch	NR	NR	F	G
Skydrol 500	P	P	P	NR
Sodium Hydroxide 50%	G	E	E	E
Sodium Hypochlorite	G	G	-	G
Soybean Oil	E	P	-	E
Stearic Acid	G	G	G	G
Standard Solvent	E	P	F	E
Styrene	P	P	P	NR
Sulfuric Acid (diluted)	G	G	G	G
Sulfuric Acid (conc.) 95%	P	P	F	F
Tannic Acid 65%	F	F	F	F
Tetrahydrofuran	P	P	P	NR
Toluene	F	P	P	NR
Toluene Di-isocyanate	P	P	P	NR
Trichloroethylene	F	P	P	NR
Triethanol Amine	F	G	G	E
Trinitrotoluene	P	P	F	G
Tung Oil	E	P	F	E
Turbine Oil	G	P	P	G
Turpentine	E	P	F	NR
Vegetable Oil	E	P	F	E
Vinyl Chloride	-	-	-	NR
Xylene	F	P	P	NR

Cellosolve* is a registered trademark of the Union Carbide Corp.

APPENDIX E
CHEMICAL STORAGE GUIDELINES

CHEMICAL STORAGE GUIDELINES

The following information is designed to aid in proper chemical storage in the HIM/NRB laboratories. Chemicals are to be stored according to the following hazard classes. Storing all classes together alphabetically is prohibited. Chemicals may be organized alphabetically once they are segregated according to hazard class.



Oxidizers: Incompatible with **flammables** and organics.

Common Oxidizers—Ammonium persulfate, silver nitrate, silver nitrite, hydrogen peroxide, potassium permanganate, sodium dichromate.



Toxic: Poisons

Common Toxics—Arsenic compounds, cyanides, osmium tetroxide, formaldehyde, formalin, naphthalene, chloroform, acrylamide.



Flammables: Incompatible with **oxidizers**. Ignitable/flammable chemicals must be stored in a **flammable cabinet**. Flammable chemicals requiring refrigeration must be stored in a refrigerator rated for flammable storage.

Common Flammables—Ethanol, methanol, acetone, benzene, ethyl acetate, butanol, alcohols, furans, toluene, Sigmacote, TEMED, paraformaldehyde (flammable solid)



Corrosive: Three kinds of Corrosives: **Bases, Organic Acids, and Inorganic Acids**. All 3 of these corrosives have this pictogram; however, must be separated from each other.

Common Bases—sodium hydroxide, potassium hydroxide, developer.

Common Organic Acids—acetic acid, glacial acetic acid, phenol, formic acid.

Common Inorganic Acids—sulfuric acid, hydrochloric acid, perchloric acid, nitric acid, chromic acid.



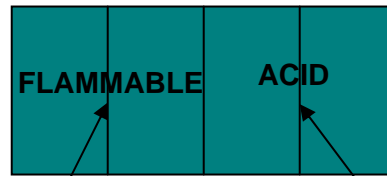
Irritants: chemicals producing irritation. Often, the majority of chemicals in a dry chemical storage area in HIM/NRB laboratories.

Common Irritants—Sodium carbonate, sodium bicarbonate, Trizma, putrescine, antifoam.

Chemical Storage Shelving

Irritants
Oxidizers
Toxic
Corrosive

Chemical Fume Hood



Flammable

Corrosive Storage –
Segregate inorganic acids, organic acids, and bases.

APPENDIX F
LIST OF UNSTABLE CHEMICALS



Reactive Material Services

AZIDE COMPOUNDS

Azide compounds (RN3) are derivatives of hydrogen azide (HN3). There are both inorganic and organic derivatives. They vary widely in their stability and some members of both classes are unstable and potentially explosive. Azide compounds also display significant human toxicity, primarily due to the evolution of hydrogen azide.

Ammonium azide	Diazonium nitrates (dry)
Azido guanidine picrate (dry)	Diazonium perchlorates (dry)
5-Azido-1-hydroxy tetrazole	Diphenyl Phosphoryl Azide
Azido hydroxy tetrazole (mercury & silver salts)	1,3-Diazopropane
3-Azido-1,2-propylene glycol dinitrate	N,N'-Dichlorazodicarbonamidine (salts of) (dry)
Azidodithiocarbonic acid	Hydrazine azide
Azidoethyl nitrate	Hydrazoic acid solutions >10%
Azidotrimethyltin	Hydrogen azide
Azotetrazole (dry)	Iodine azide (dry)
Benzoyl Azide	Lead Azide (dry)
Benzyl Azide	Mercuric azide
Bromine azide	Mercurous azide
Chlorine azide	Nitrobenzoyl Azide
Copper amine azide	Silver azide (dry)
Cupric azide	Sodium Azide
Cuprous azide	Tert-butoxy Carbonyl Azide
p-Diazidobenzene	Tetraazido benzene quinone
1,2-Diazidoethane	Tetrazoyl azide (dry)
1,1'-Diazoaminonaphthalene	Tosyl Azide
Diazoaminotetrazole (dry)	Trimethylsilylazide
Diazodinitrophenol (dry)	Tri-n-butyl ammonium azide
Diazidiphenylmethane	p-Xylyl diazide

The above list is not a complete listing of all unstable azides. In addition, even stable azides can become unstable under certain conditions.

MONO AND DINITRO COMPOUNDS

The main issues associated with mono and dinitro compounds are that some are considered potentially explosive or shock sensitive when dry and/or need to be wetted

- dinitroglycoluril or dingu
- dinitronaphthalene
- dinitrophenol
- dinitrophenolates, alkali metals
- dinitrophenyl hydrazine
- dinitroresorcinol
- dinitroaminophenol or picramic acid
- dinitrosobenzene
- N,N-dinitroso-N,N-dimethylterephthalamide
- N,N-dinitrosopentamethylenetetramine

This list is not all inclusive of all chemicals which could be highly hazardous. The listed chemicals are substances which Clean Harbors as a matter of its own health & safety protocols have analyzed handling in the context of its particular facilities and processes. The List is not intended to be utilized or relied upon by others for any other purpose and is a representation of specific materials Clean Harbors has determined to be materials which require special handling by its personnel only or as a company we will not accept



Reactive Material Services

nitrocellulose
nitroguanidine or picrite
nitrosoguanidine
nitrostarch
nitrourea
sodium dinitro-o-cresolate
sodium picramate
urea nitrate

TRI AND MULTINITRATED COMPOUNDS

The main issue with these compounds is that **all are considered potentially explosive or shock sensitive under various conditions** (e.g., dry, contaminated, etc.)

ammonium picrate
hexanitrodiphenylamine or dipicrylamine or hexyl
hexanitrostilbene
trinitro-m-cresol
trinitroaniline or picramide
trinitroanisole
trinitrobenzene
trinitrobenzenesulfonic acid or picrylsulfonic acid
trinitrobenzoic acid
trinitrofluorenone
trinitronaphthalene
trinitrophenetole
trinitrophenol or picric acid
trinitrophenylmethylnitramine or tetryl
trinitroresorcinol or styphnic acid
trinitrotoluene or TNT
various picrates

PEROXIDE FORMING MATERIALS

GROUP I MATERIALS

These materials form peroxides that may explode even without being concentrated.

CHEMICAL	SYNONYMS	DESCRIPTION
Isopropyl ether	Diisopropyl Ether, Diisopropyl Oxide	Colorless Liquid
Diethyl Ketene	2 ethyl 1 butene 1 one	Liquid
Divinyl Ether	Vinyl Ether, Divinyl Oxide	Liquid
Potassium Metal	Potassium	Silver White Metal
Potassium Amide		Solid
Sodium Amide	Sodamide	White crystalline powder
Sodium Ethoxyacetylde		
Vinylidene Chloride	1,1,-dichloroethylene 1,1-dichloroethane	Colorless Liquid

This list is not all inclusive of all chemicals which could be highly hazardous. The listed chemicals are substances which Clean Harbors as a matter of its own health & safety protocols have analyzed handling in the context of its particular facilities and processes. The List is not intended to be utilized or relied upon by others for any other purpose and is a representation of specific materials Clean Harbors has determined to be materials which require special handling by its personnel only or as a company we will not accept



Reactive Material Services

GROUP II MATERIAL

Peroxide hazard on concentration. Distillation or most likely evaporation.

CHEMICAL	SYNONYMS	DESCRIPTION
p- dioxane	1,4 dioxane, diethylene dioxide	Colorless liquid
Ethyl ether	Ether, diethyl ether, ethoxyethane	
Tetrahydrofuran	Butylenes oxide, diethylene oxide	
Acetal	1,1 diethoxyethane, diethyl acetal	
Cumene	Isopropyl benzene	
Cyclohexene	1,2,3,4 tetrahydrobenzene	
Cyclopentene		
Diacetylene	Beacetylene	Gas
Ethylene glycol dimethyl ether	1,2, dimethoxy ethane, glyme, monoglyme	Liquid
Furan	Divinylene oxide	Water white liquid
Methyl actylene	Allylene, propyne	Colorless gas or liquid
Methyl cyclopentane		
Tetrahydronaphthalene	Tetraline	
Vinyl ethers	Ethyl vinyl ether, methyl vinyl ether	
Other unlisted ethers	Call in for evaluation	
Diethylene glycol dimethyl ether	Diglyne	
Acetaldehyde	Ethanal, ethyl aldehyde	

GROUP III MATERIALS

Peroxide hazard due to peroxide initiation of polymerization. All materials in Group III with the exception of material stored as a liquid (the peroxide forming potential increase and certain of these monomers, especially butadiene, chloroprene, and tetrafluoroethylene). These materials should be considered a Group I material.

CHEMICAL	SYNONYMS	DESCRIPTION
1,3 butadiene	Vinylethylene, divinyl	Colorless gas
Chlorobutadiene	Chloroprene	Colorless liquid
Chlorotrifluoroethylene	Trifluorochloroethylene, genetone 1113	Gas
Tetrafluoroethylene	Perfluoroethylene	Colorless gas
Vinyl acetate		Colorless liquid
Vinyl acetylene	Buten-3-yne	Colorless gas or liquid
Vinyl chloride	Chloroethylene, ethylene monochloride	Colorless gas or liquid
Vinyl pyridine		Colorless liquid

This list is not all inclusive of all chemicals which could be highly hazardous. The listed chemicals are substances which Clean Harbors as a matter of its own health & safety protocols have analyzed handling in the context of its particular facilities and processes. The List is not intended to be utilized or relied upon by others for any other purpose and is a representation of specific materials Clean Harbors has determined to be materials which require special handling by its personnel only or as a company we will not accept



Reactive Material Services

NFPA CLASS 4 OXIDIZER

Oxidizers that fall under the Class 4 NFPA (National Fire Prevention Association) oxidizer category require special evaluation consideration due to their potential for reactivity and shock sensitivity when contaminated or exposed to thermal or physical shock.

- Tetranitromethane
- Ammonium Perchlorate
- Guanidine Nitrate
- Hydrogen Peroxide >90%
- Ammonium Permanganate

ORGANIC PEROXIDES

Organic peroxides can be highly reactive and dangerous compounds if mistreated or mishandled. The main hazard associated with organic peroxides is decomposition. The main causes of peroxide decomposition are Heat, Fire, Friction, Shock and Contamination. Many organic peroxides require temperature controls (e.g., refrigerated vehicle) per DOT regulations when being transported or have been classified as subsidiary explosive compounds per DOT.

2,5-Dimethyl-2,5-Di(2-ethylhexanoylperoxy) Hexane
2,5-Bis(tert-butylperoxy)_2,5-dimethyl-3-hexyne
tert-butyl peroctoate w/ 1,1-di(tert-butyl-peroxy)-3,3,5-trimethylcyclohexane
Tert Amyl-Peroxy-2-ethylhexanoate
Benzoyl peroxide
tert-butyl peroxy-2-ethylhexanoate (50%)
D-(4-tert-butylcyclohexyl) peroxydicarbonate
Dicumyl Peroxide
MEK Peroxide (45%)
MEK Peroxide
Di-tert-Butyl Peroxide
tert-Butyl peroxybenzoate
1,1 Di(tert-butylperoxy)-3,3,5 trimethylcyclohexane in Dibutyl Phthalate
Di-tert-butyl peroxide
Di-Butylcyclohexyl peroxydicarbonate
t-butyl peroxybutane
Di-t-Amyl peroxy-cyclohexane
t-Amyl peroxyethylhexanoate
t-Amyl peroxyneoheptanoate
t-Amyl peroxy-pivalate
t-Amyl peroxyneodecanoate
t-Butyl Cumyl Peroxide
t-Butyl peracetate
Methyl Ethyl Ketone Peroxide
t-Butyl peroctoate

This list is not all inclusive of all chemicals which could be highly hazardous. The listed chemicals are substances which Clean Harbors as a matter of its own health & safety protocols have analyzed handling in the context of its particular facilities and processes. The List is not intended to be utilized or relied upon by others for any other purpose and is a representation of specific materials Clean Harbors has determined to be materials which require special handling by its personnel only or as a company we will not accept



Reactive Material Services

Amyl Peroxyacetate
t-Butyl hydroperoxide
Dimethyl dibenzoylperoxyhexane
Ethyl amyloperoxybutyrate
t-Butyl peroxyethylhexanoate
t-Butyl peroxyisopropylcarbonate
t-Butylperoxytrimethylcyclohexane
Dimethylhexane diperoxyethylhexanoate
Dimethyl butylperoxyhexane
Butyl peroxydiisopropylbenzene
Cyclohexanone Peroxide
Butyl hydroxyethylperoxide

PERCHLORIC ACID

Perchloric acid (HClO_4) is a highly corrosive and oxidizing material. It is also a highly reactive material if in contact with incompatibles. Perchloric acid can explode on contact with many organics and can form potentially explosive metal perchlorates if mixed with metals. It is also forbidden to transport in concentrations $>72\%$.

Perchloric Acid $>72\%$

Contaminated Perchloric Acid

Decontamination Perchloric Acid fume hoods and spill type releases

AZO COMPOUNDS

Azo compounds have a wide variety of hazards. These hazards include:

- temperature sensitive
- flammable solids
- shock and friction sensitive
- poisonous solids.

The only way to determine the hazard associated with each type of compound is to review each on a case by case basis using MSDS's and/or chemical references.

Azobisisobutyronitrile (VAZO 64)

2,2-azobis(2,4-dimethyl-4-methoxyvaleronitrile)

2,2-azobis(2-methylbutyronitrile)

2,2-azobis(2,4-dimethylvaleronitrile)

ADDITIONAL DOT FORBIDDEN MATERIAL

Azotetrazole (dry)

Benzene diazonium chloride (dry)

Benzene diazonium nitrate (dry)

Benzoxidiazoles (dry)

p-Diazidobenzene

1,2-Diazidoethane

1,1'-Diazoaminonaphthalene

Diazoaminotetrazole (dry)

This list is not all inclusive of all chemicals which could be highly hazardous. The listed chemicals are substances which Clean Harbors as a matter of its own health & safety protocols have analyzed handling in the context of its particular facilities and processes. The List is not intended to be utilized or relied upon by others for any other purpose and is a representation of specific materials Clean Harbors has determined to be materials which require special handling by its personnel only or as a company we will not accept



Reactive Material Services

Diazodinitrophenol (dry)
Diazidiphenylmethane
Diazonium nitrates (dry)
Diazonium perchlorates (dry)
1,3-Diazopropane
N,N'-Dichlorazodicarbonamidine (salts of) (dry)
Hexanitroazoxy benzene
Hexanitrodiphenylamine
Mercuric Oxycyanide
Methazoic acid
Naphthalene diazonide
Nitrates of diazonium compounds
6-Nitro-4-diazotoluene-3-sulfonic acid (dry)
m-Nitrobenzene diazonium perchlorate
2,4,6-Trinitro-1,3-diazobenzene
p-Xylyl diazide

OTHER DOT EXPLOSIVES

Acetylides of heavy metals
Ammonium Nitrate explosive mixtures
Ammonium Perchlorate
Black Powder
Cyclonite
Cyclotetramethylenetetranitamine (HMX)
Cyclotrimethylenetrinitamine (RDX)
Dipicrylamine
Erythritol Tetranitrate
Fulminates of heavy metals
Lead Styphnate
Mannitol Hexanitrate
Nitroglycerine
Organic Nitramines
Perchlorate explosive mixtures
Pentaerythritol tetranitrate
Picrate explosives
Picryl chloride
Tetranitrocarbazole
Tetrazole explosives
Trinitrobenzoic acid
Unknown Explosives

This list is not all inclusive of all chemicals which could be highly hazardous. The listed chemicals are substances which Clean Harbors as a matter of its own health & safety protocols have analyzed handling in the context of its particular facilities and processes. The List is not intended to be utilized or relied upon by others for any other purpose and is a representation of specific materials Clean Harbors has determined to be materials which require special handling by its personnel only or as a company we will not accept

APPENDIX G

BIOHAZARDOUS LABELING REQUIREMENTS

BIOHAZARD LABELING GUIDELINES

The following minimum instructions and/or guidelines are to be used in implementing the labeling or color coding requirements set forth by the U.S. Occupational Safety and Health Administration (OSHA) *Bloodborne Pathogens Standard*.

Warning labels must be predominantly fluorescent orange or orange-red against contrasting background colors and contain the Biohazard Symbol and the word *biohazard*.

Item	Biohazard Label	Red Container	See Exemptions
Regulated waste container (sharps and/or non-sharps)	X	X	
Reusable contaminated sharps Container (i.e., surgical tools in soaking tray)	X	X	
Refrigerators, freezers, centrifuges, etc. holding blood or other potentially infectious materials	X		
Specimens and regulated wastes shipped from the laboratories to other facilities for service or disposal	X	X	
Contaminated Laundry	X	X	X
Contaminated laundry sent to another facility that does not use Standard Precautions	X	X	
Containers used to store, transport, or ship blood	X	X	
Individual specimen containers of blood or other potentially infectious material that remains within the lab	X	X	X
Blood or blood products for clinical use			X
Contaminated equipment that needs service (i.e., dialysis equipment or suction device)	X (on the contaminated portion)		

BIOHAZARD LABELING EXEMPTIONS

As a general rule, further labels are not required under the following circumstances.

1. Blood, blood components, or products labeled as to contents and released for transfusion or other clinical use.
2. Red bags or red containers are used instead.
3. Individual containers of blood or other potentially infectious material (OPIM) placed within a labeled container for shipping, storage, transport, or disposal.
4. Regulated wastes that have been decontaminated.
5. Specimen containers retained within a facility that observes Standard Precautions (i.e., HIM/NRB).
6. Alternate labeling or color-coding for contaminated laundry containers within a facility that observes Standard Precautions (i.e., HIM/NRB).
7. For drawn blood or during lab procedures on blood samples, individual containers of blood or OPIM do not require labels **provided** the larger containers into which they are placed for storage, transport, shipment, or disposal are labeled (i.e., test tube racks, trays, or holders).

APPENDIX H

USER'S GUIDE TO MATERIAL SAFETY DATA SHEETS

USER'S GUIDE TO MATERIAL SAFETY DATA SHEETS

Material safety data sheets (MSDSs) are prepared by manufacturers to summarize the health and safety information about their products.

TO OBTAIN MSDSs

- Ask your Department Administrator, Principal Investigator, or Chemical Hygiene Officer for the location of the MSDS file.
- Call the Harvard Institutes of Medicine/New Research Building (HIM/NRB) Environmental Health and Safety (EH&S) Office at 617-432-2762.
- Call the manufacturer.
- Consult the HIM/NRB EH&S Website:
<http://www.himnrbehs.com/himnrbehs/msds.asp>

Listed below is the most important information that U.S. Occupational Safety and Health Administration (OSHA) requires on MSDSs. For assistance with interpreting and applying this information, consult with the HIM/NRB EH&S Office.

COMPONENTS OF AN MSDS

Identity

- Trade name used on the label and inventory list.
- Manufacturer's name, address, and emergency telephone number.
- Preparation and revision dates.

Hazardous Ingredients

- CHEMICAL and COMMON NAMES of all the hazardous components
- MAXIMUM OCCUPATIONAL LIMITS OF EXPOSURE

OSHA PEL: Permissible exposure limit (PEL)—eight-hour time-weighted average (TWA); this is an upper limit, enforceable by law, above which no worker can be exposed.

OSHA STEL: 15 – 60 minutes, a regulatory upper short-term exposure limit (STEL).
ACGIH TLV: (American Conference of Governmental Industrial Hygienists threshold limit value) Eight-hour TWA; usually equal to or lower than the PEL, but a recommended upper limit only; also more current in terms of toxicological data.

These are not proven safe levels of exposure. If the exposure limit is not listed, do not assume that a chemical is safe. Contact the EH&S Office.

- PERCENTAGE OF THE MIXTURE (optional). The percentages do not usually add up to 100%, since only the hazardous ingredients have to be listed. This is NOT a trade secret recipe.

Physical/Chemical Characteristics

- VAPOR PRESSURE—a measure of a liquid's tendency to evaporate.
- VAPOR DENSITY—a vapor or gas that is lighter or heavier than air.
- APPEARANCE AND ODOR—depending upon your senses to detect or identify hazardous materials can be very dangerous.

The EH&S Office considers these properties as well as how you work with a hazardous material to evaluate the risk.

Fire and Explosion Hazard Data

- FLASH POINT—the lowest temperature at which a liquid gives off enough vapors, which when mixed with air, can be easily ignited by a spark. The lower the flash point, the greater the risk of fire or explosion. Remember that it is the vapors that burn, not the liquid.

Reactivity Data

- Reactivity, in this context, is the tendency for a material to chemically change or breakdown and to become more dangerous. Precautions include:

- CONDITIONS TO AVOID—such as light or heat.
- MATERIALS TO AVOID—for example, sodium and water will react vigorously to generate hydrogen, creating a fire hazard.

Health Hazard Data

- If you need health hazard information that is not on an MSDS, contact the HIM/NRB EH&S Office.
- ROUTES OF ENTRY—how a hazardous material can enter your body (e.g., inhalation, skin absorption, and ingestion).
- SHORT-TERM HEALTH EFFECTS (ACUTE)—symptoms may be felt immediately after the first brief contact (e.g., burns, watery eyes, sore throat).
- LONG-TERM HEALTH EFFECTS (CHRONIC)—symptoms may be felt after repeated contact with the same hazardous material over a long period of time.
- REFERENCES that list a chemical as a carcinogen or potential carcinogen.
- SIGNS AND SYMPTOMS OF EXPOSURE.
- MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE.
- EMERGENCY AND FIRST AID PROCEDURES.

If you are concerned about a chemical exposure you may have had, notify the HIM/NRB EH&S Office.

Precautions for Safe Handling and Use

- SPILL AND LEAK PROCEDURES—The HIM/NRB EH&S Office can advise you on specific procedures and proper protective equipment.
- WASTE DISPOSAL—Contact the HIM/NRB EH&S Office for information on the disposal of a particular chemical. To schedule a pick up of hazardous waste, call the HIM/NRB EH&S Office at 617-432-2762.

Control Measures

- The HIM/NRB EH&S Office can answer specific questions regarding ventilation and personal protective equipment for normal working conditions and emergencies. Suitable control measures are based on how a material is used.