BUFFALO STATE COLLEGE

CHEMICAL HYGIENE PLAN

ENVIRONMENTAL HEALTH & SAFETY

April 2015

Chemical Hygiene Plan
Review/Modification Form

Review Date:_____ Type: ____Annual
____Department Request
____New Procedure
____Other

Department: (if applicable)
_____

Person(s) conducting review/modifications:
_____ _____
_____ _____

*All modifications must be approved by the Chemical Hygiene Committee prior to implementation.

Modifications

Section name and number: _____
Page: _____ Description of modifications:
_____
_____
_____
_____
(Use additional sheets if required. Attach copy of draft modification to this form)

New Additions:

New section name and number: _____
Page: _____ Description of modifications: _____
_____
_____
(Use additional sheets if required. Attach copy of draft modification to this form)

Review Comments: _____
_____
_____

**Insure distribution of this form to all Plan Holders as per distribution list in Department of Environmental Health & Safety master copy.

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I. PREFACE

The Buffalo State College Office of Environmental Health & Safety in conjunction with the Chemical Hygiene Committee has prepared this Chemical Hygiene Plan. This Plan is intended to set a uniform standard for health and safety in College laboratories and meets the requirements set forth in the OSHA/PESH Laboratory Standard 29CFR1910.1450. See Appendix A.

The standard requires every laboratory supervisor to formulate and implement a chemical hygiene program including work procedures and policies to insure that laboratory employees are protected from all potentially hazardous chemicals used in their work areas. Adoption of this plan will insure those requirements are met.

Additionally, this plan includes guidelines for handling chemicals and chemical waste in an environmentally responsible manner meeting state and federal regulations set forth by the New York State Department of Environmental Conservation and the United States Environmental Protection Agency.

II. IMPLEMENTATION

A.) Responsibility

Implementation of the Chemical Hygiene Plan is the responsibility of the department chairperson. Overall effectiveness of the program is dependent upon cooperation among administrators, faculty, and staff. The department chair shall use this program as a guide to insure our laboratories operate safely and are in compliance with all applicable regulations.

In addition to this plan departments are encouraged to reference "Prudent Practices for Handling Hazardous Chemicals in Laboratories" from National Academy Press, the Buffalo State College Environmental Health and Safety Hazardous Waste Disposal policy and procedure, and the Quick Reference Hazardous Waste Management Flip Chart.

Responsibility for chemical hygiene at Buffalo State College rests with all levels of the administration. A unified effort is necessary for the success of this program.

B.) Insuring Laboratory Safety

The department chairperson is responsible for insuring a safe working environment. A departmental designee is to be chosen, having a background relevant to the activities and safety issues of the department. This person will be referred to as the **Department Safety Officer**. Essential to an effective departmental safety program is the combined knowledge of the Chemical Hygiene Plan, the HAZCOM/GHS standard and the NYS Right-to-Know Program. Please notify the CHO of the chosen designee.

This Department has assigned _____ Date: _____ to act as the Department Safety Officer.

The responsibilities of this person are to:

1. Work with administrators and other employees to develop and implement appropriate laboratory safety and hygiene policies and practices specific to their area;

2. Assist project directors in developing the needed precautions to insure safe facilities;

3. Review new research protocols, techniques and proposed uses of hazardous chemicals to make sure that appropriate facilities exist for their use while

maintaining a safe working environment. If necessary, the Chemical Hygiene Committee may be included in this review process.

The responsibility for initiating and overseeing a research project rests with the Laboratory Director or Principal Investigator. They shall insure that projects under their supervision are conducted in such a manner that the safety and health of all personnel associated, either directly or indirectly, with the project are not potentially jeopardized. Specifically, the Laboratory Director or Principal Investigator must make certain that:

A. All personnel are aware of, and practice, appropriate safety precautions;

B. Adequate emergency equipment is available and in working condition;

C. Training in the use of emergency equipment has been provided;

D. Information on special or unusual hazards in non-routine procedures has been provided;

E. An appropriate safety orientation has been given to new or casual project participants;

F. Appropriate safety plans and emergency procedures have been developed and are followed.

To insure safe conditions for laboratory-personnel, this laboratory safety program also includes:

1. **Regular and frequent safety inspections performed by the laboratory supervisor or principal investigator.** Each lab shall be inspected at least quarterly by this individual. Environmental Health and Safety inspects the laboratories annually; these inspections are documented and kept in the Environmental Health and Safety Office. An example of an acceptable laboratory inspection record is contained in Appendix B.

2. **Disposal procedures,** which insure the removal of waste chemicals at regular intervals; (Hazardous Waste Policies and Procedures and the Quick Reference Hazardous Waste Management Flip Chart)

3. **Safety training programs,** which insure that, all personnel are trained in the proper use of laboratory equipment, emergency equipment, and work procedures. (Training is the responsibility of the individual departments and

documentation sent to the Chemical Hygiene Officer for review by the Chemical Hygiene Committee);

4. **Annual Fume Hood Inspections** are completed by Environmental Health & Safety.

All accidents and near accidents should be carefully investigated and analyzed by each individual Department Safety Officer to prevent possible reoccurrence. The results of such findings and the corresponding recommendations for the prevention of similar occurrences should be documented and distributed to those who might benefit. The intent is not to find fault or fix blame, but rather to contribute towards a safer work environment. Situations, procedures, or conditions, which place any person or the environment at risk of injury or damage, shall be reported to the Environmental Health and Safety Office at ext. 4038. All such operations shall be ceased until such time as modifications can be implemented to minimize such risks.

C.) Chemical Hygiene Committee

A Chemical Hygiene Committee shall be formed to:

1. Ensure that all conditions as described in the Chemical Hygiene Plan are provided for through formal inspections by committee members, Environmental Health and Safety, and outside consultants singularly or in conjunction with one another.

2. Review and implement modifications to the Chemical Hygiene Plan.

3. Review new processes, experiments and research projects that are referred to the committee.

4. Investigate and review all chemical exposure incidents.

5. Review training records.

The Chemical Hygiene Committee shall consist of personnel from a cross section of all departments covered by this plan. The committee shall meet on a quarterly basis. The committee may be called to meet for an emergency situation.

Laboratory operations, procedures and activities that require approval from the Chemical Hygiene Committee include:

1. Operations involving particularly hazardous materials (i.e. reproductive toxins, select carcinogens, compounds with a high degree of acute toxicity as identified in Appendix C ,D & E).

2. Operations that incorporate new equipment, procedures or a modification in the facility design.

3. Activities which have led to chemical releases or personal injuries in the past.

All meetings are to be documented, with accurate records as to meeting proceedings and description of actions to be taken by the committee. Copies of these minutes will be forwarded the committee members and to the Deans of the respective departments.

Actions that directly affect a department will be reviewed with the Dean of the department prior to implementation. However, actions that are required to abate situations which in the committee's opinion are immediate threats to the health, safety or the environment, will be implemented immediately upon discovery of the situation.

CHEMICAL HYGIENE COMMITTEE MEMBERS

The Members of the Chemical Hygiene Committee for the period between January 2014 and December 2014 will be as follows:

Name	Department	Phone
David Miller - Chair	Environmental Health & Safety	x6113
Jeffrey Hammer - CHO, CHMM	Environmental Health & Safety	x6128
Rebecca Ploeger	Art Conservation	x4646
Jennifer Jackson	Biology	x4628
Daniel Potts	Biology	x5007
Zeki Al-Saigh	Chemistry	x5101
Anne Marie Sokol	Chemistry	x5135
Susan Daniel	Great Lakes Center	x5423
Mark Severson (or designee)	Dean of Natural and Social Sciences	x6434

III. GENERAL REQUIREMENTS FOR PERSONAL AND LABORATORY SAFETY

A. Introduction

The most important rule to insure a safe work environment is that everyone involved in laboratory operations - from the highest administrative level to support staff - must be safety minded. **Safety awareness can become part of the workplace attitude through repeated discussions, in-service training, as well as the sincere and demonstrated support of senior faculty, administrators, and staff.** It is in everyone's best interest to carry out their own work in accordance with good health and safety practices.

While it is impossible to design a set of rules which encompasses all possible hazards and occurrences, some general guidelines which experience has proven useful to avoid accidents or reduce injuries in the laboratory are given in this program. Incorporated by reference, "Prudent Practices for Handling Hazardous Chemicals in Laboratories." - National Academy Press also gives excellent guidance.

B. General Guidelines

Everyone in a laboratory should observe the following rules:

1. **Understand and apply the safety rules** and procedures that apply to any work being performed. Determine the potential hazards (physical, chemical, biological or radiological) and the appropriate safety precautions to be followed, before beginning any new task.

2. **Be familiar with emergency procedures** by knowing the location of and how to use available emergency equipment, as well as how to obtain help when needed.

3. **Know the various types of protective equipment** available. Use the proper type of personal protective equipment for the given job.

4. **Be alert to unsafe conditions** and work practices. Call attention to them so that appropriate corrections can be implemented as soon as possible.

5. **Do not consume food, beverages or smoke** in areas where chemicals are being used or stored. Application of cosmetics or related products in all laboratories is prohibited.

6. **Avoid hazards to the environment** by following appropriate waste disposal policies and procedures.

7. Be certain that all chemicals are correctly and clearly **labeled.** Post the designated **warning signs** or labels when specific hazards, such as radiation, flammable materials, biological hazards or other hazardous conditions exist.

8. Check all burners and gas outlets to ensure that they are off before leaving the laboratory. **Do not place gas burners by open windows or in a draft. No gas burner shall be left unattended while in operation.**

9. Remain out of the area of a fire, chemical spill or personal injury unless your assistance is required to help meet the emergency.

10. Use laboratory equipment only for its designated purpose.

11. Carefully position and secure equipment. Take the necessary steps to avoid the accidental jarring of an apparatus or piece of equipment. Use caution in handling hot objects.

12. The use of head phones and personal electronic devices is **prohibited** unless the instructor deems it part of the lab.

13. **Think, act, and encourage safety.**

C. Health and Hygiene Guidelines

The following health practices should be observed:

1. Contact lens/Eye (Face) Protection: Appropriate eye protection, such as safety glasses, goggles, and/or a face shield is required and should be selected to mitigate the hazards in the lab. Face shields must be worn when handling caustic materials.

   It is the responsibility of each laboratory supervisor to develop an appropriate contact lens policy. The policy should be reviewed by the chemical hygiene committee and communicated to all persons using the lab. It should be noted that, in the event that a chemical is splashed into the eye, a contact lens may serve to trap and concentrate the chemical; thereby increasing the potential for eye damage. In some cases, the lens may dissolve or in some way become ''glued" to the eye. Contact lenses should not be worn when handling methylene chloride, 1,2-dibromo-3-chloropropane, acrylonitrile, ethylene oxide, and methylenedianiline.

   "Soft" contact lenses can absorb organic solvent vapors and thus potentially damage the eye. There are some exceptional situations in which contact lenses must be worn for therapeutic reasons. In these situations, employees

who MUST wear contact lenses MUST inform their supervisor so that appropriate safety precautions can be observed, and the proper equipment can be ordered.

2. Clothing/Protective Apparel: Use protective apparel, such as gloves, lab coats, and other special clothing or footwear as needed.

   Avoid wearing neckties, dangling accessories, scarves, etc. in the laboratory. Wearing shorts, tank tops, halters, or clothing that exposes a large amount o of unprotected skin must be avoided. It is imperative that the possibility of skin contact with chemicals be minimized. Do not wear clothing with a high percentage of acetate, or other highly flammable material. **Laboratory coats should be worn in the lab and removed when out of the lab.** The intent of the rule is to reduce the transfer of micro-organisms. Shoes should be comfortable, with slip- resistant soles and should cover the entire foot (lace or loafer type). Sandals or shoes with open toes or high heels are prohibited.

3. Loose Hair/Beards: Confine long hair and loose clothing when in the laboratory. Hair shall be secured back and off the shoulders in such a manner as to prevent it from coming into contact with contaminated materials or surfaces and also to prevent shedding of organisms into the work area. This is especially true in bacteriology. It is also important to keep hair out of moving machinery, such as a centrifuge. Men with beards must observe the same precautions. Long beards are a danger in regard to moving equipment and all beards are a source of bacterial contamination. Facial hair prevents proper sealing when wearing respirators and, therefore, is not allowed for workers whose work requires the use of respiratory protection.

4. Pipetting: **Do not mouth pipette** chemicals or use mouth suction to start a siphon. There are many commercially available pipetting aids for these purposes.

5. Chemical Exposure: Avoid exposure to gases, vapors, particulates, and aerosols. Use a fume hood whenever such exposure is likely. Appropriate safety equipment must be used when work is not conducted under a fume hood. Minimize your exposure to chemicals by protecting the appropriate route(s) of entry (inhalation, ingestion, injection, and absorption). **Do not attempt to identify chemicals by smell or taste**.

Note: The use of respiratory protection is prohibited prior to review by the Environmental Health and Safety Department.

6. Hand washing: Wash your hands frequently and thoroughly during the day before eating or smoking and before leaving the laboratory. **Avoid the use of solvents for washing the skin.** Solvents tend to remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent facilitates absorption of toxic chemicals or has a potential health effect itself.

7. Exits and aisles: All routes of egress must be unobstructed in any way. Equipment, chairs, supplies or trash are not permitted in exit routes or areas. Doors to the laboratory should be kept locked and closed when not in use. Doors must not be blocked, bolted or obstructed in any way to block egress. **All aisle ways shall be at least three feet wide.**

8. Good housekeeping: There is a definite relationship between safety performance and orderliness in the laboratory. Where housekeeping standards are lax, safety performance deteriorates. The work area must be kept clean, with chemicals and equipment properly labeled and stored. Other standards to maintain are: rags contaminated with flammable solvents will be discarded in self-closing metal containers; do not hang clothing on or near radiators, steam pipes, heating instruments, or open flames; do not allow trash to accumulate in any area, it should be discarded daily; decorations hanging from lights and instruments are prohibited; needles and syringes must be discarded in a sharps container conspicuously labeled to ensure safe handling when discarded. Syringes should be discarded uncapped to minimize handling and, thus, avoid unnecessary cuts and punctures and exposure to contaminated fluids; cleanup will follow the completion of any experiment or, at the very least, at the end of each day; spilled chemicals must be cleaned up immediately and disposed of properly; all personnel must be informed of cleanup procedures; These procedures must be performed promptly.

9. Glassware: Accidents involving glassware are a leading cause of laboratory injuries. The following guidelines should be common practice in all labs: **Do not use broken or chipped glassware.** Discard it as designated waste and order new; do not leave pipets sticking out of bottles, flasks or beakers. Do not attempt to remove stoppers on glass tubing by forcing, if they are stuck, cut them off. **Glass blowing and other artistic endeavors are prohibited.** Decontaminate glass exposed to possible infectious agents; broken glass and sharp objects must be disposed of in sharps containers and/or broken glassware containers as to prevent accidental cuts and punctures. **Disposal of broken glass along with paper and trash is a hazard to the custodial**

staff. Heated glass containers should be handled with an insulated glove. Any vacuum-jacketed glass apparatus is to be handled with extreme care to prevent implosions; use only the proper equipment for vacuum related work. Laboratory glassware should be disposed of as designated waste even after thermal or chemical decontamination.

10. Avoiding cuts and punctures: Put away sharp tools when not in use; Do not cover kitchen knives or sharp tools located on a desk or table with cloth; Never try to catch sharp objects, if it starts to fall, let it go and then pick it up or sweep it up; Avoid "digging into" wastebaskets.

    A major hazard to employees is hypodermic syringes. **DO NOT RECAP SYRINGES.** Accidental needle punctures can cause infection and transmit disease. Persons at greatest risk are clinical staff, laboratory personnel, and housekeeping personnel. All needle cuts and punctures must be treated immediately. All needle cuts and punctures **must** be reported to a supervisor at which time an incident report must be filed. Do not wait to seek medical attention in the case of cuts and punctures. The incidence of needle punctures can be reduced by: Care in handling and use; Disposing of uncapped syringes into a sharps container.

11. Laboratory equipment maintenance: Good equipment maintenance is important to maintain a safe and efficient work environment. Equipment must be inspected and maintained regularly. Service schedules depend on both the possibilities and consequences of failure. Maintenance plans must include a lock-out/tag-out procedure to ensure that a device out of service cannot be restarted until repaired.

D. Laboratory Ventilation

The best way to prevent or reduce exposure to airborne substances is to control their escape into the work environment by the use of hoods and other ventilation systems.

1. Local exhaust ventilation

   Local exhaust ventilation is a system designed to exhaust contaminants captured near their source without allowing them to escape and disperse into the laboratory atmosphere. Laboratory hoods are used to prevent harmful dusts, mists, fumes, as well as toxic gases and vapors from entering the laboratory. Lab hoods offer other types of protection as well. A hood sash correctly lowered places a physical barrier between the worker and the chemical reaction system. This physical barrier will provide protection from

hazards such as chemical splashes, spills, sprays, fires and minor explosions from an uncontrolled reaction.

2. Biological hoods

A Biological hood is useful in areas where a ducted chemical hood is not available or is dedicated to another purpose. **These devices should only be used under the conditions for which they are designed.** The operation manual should be consulted prior to using such a hood and provisions should be made to ensure that the unit is properly maintained and serviced.

3. Trunks / Snorkels / Extract Arms

Trunks / snorkles / extract arms are designed to exhaust contaminants captured near their source without allowing them to escape and disperse into the laboratory atmosphere. These units are used to prevent harmful dusts, mists, fumes, as well as toxic gases and vapors from entering the laboratory.

4. Glove boxes

A glove box is a sealed container that is designed to allow one to manipulate objects where a separate atmosphere is desired. Built into the sides or front of the glove box are gloves arranged in such a way that the user can place their hands into the gloves and perform tasks inside the box without breaking containment. Part or all of the box is usually transparent to allow the user to see what is being manipulated. Two types of gloveboxes exist: one allows a person to work with hazardous substances, such as radioactive materials or infectious disease agents; the other allows manipulation of substances that must be contained within a very high purity inert atmosphere, such as argon or nitrogen.

5. Modifications

Any modification of the existing ventilation system is permitted only if the proper function of the system is not compromised, and the laboratory environment continues to be protected from toxic airborne substances. **Modifications must be approved by Environmental Health and Safety.**

6. Quality

Air flow through the laboratory should be relatively uniform throughout the laboratory with no high velocity or static areas. Air flow into and within a

fume hood should be uniform. **The measured face velocity at the fume hood sash shall be 100 feet per minute with the sash approximately twelve (12) inches above the fully closed position.** The Chemical Hygiene Officer or designee checks this annually. Each laboratory should have a negative air pressure so that chemical odors do not escape into the hallways. Laboratories and rooms are checked when there is a suspected problem.

7. Inspection and maintenance

The ventilation system must be evaluated on installation. That same system must be inspected annually thereafter and when there is a reported problem by Environmental Health and Safety. Inspections should include all the associated equipment as well as a review of the operation, exposure level measurements and air flow measurements. It is the responsibility of the Principal Investigator/Researcher to **IMMEDIATELY report those hoods that do not meet minimum specifications.** The Chemical Hygiene Officer can assist in this area. These hoods shall not be used until they meet the minimum specifications.

8. Installation and maintenance

With proper design, use and maintenance of ventilation systems, an effective control of occupational health hazards can be achieved. Consulting engineers and vendors should be chosen from those having broad experience in designing ventilation systems for health hazard control. Plans for modification or new installations must be reviewed and approved by Environmental Health and Safety.

9. Work practices for laboratory hoods

A properly designed hood in a properly ventilated room can provide adequate protection when certain work practices are followed. The following work practices must be adhered to in order for a hood to perform capably and to provide maximum protection to the worker:

a. Conduct all operations, which may generate air contamination at or above the Threshold Limit Value inside the hood.

b. Keep all apparatus at least six inches back from the face of the hood. A stripe on the bench surface is a good idea.

c. Do not put your head in the hood when contaminants are being generated.

d. Do not use the hood as a waste disposal mechanism.

e. Do not store chemicals or apparatus in the hood.

f. Keep the hood sash closed as much as possible.

g. Keep the slots in the hood baffles free of obstruction by apparatus or containers.

h. Minimize foot traffic past the face of the hood.

i. Keep laboratory doors closed.

j. Do not remove hood sash or panels.

k. Do not place electrical receptacles or other ignition source inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.

l. Use appropriate barricade if there is a chance of explosion or eruption.

m. Provide maintenance for the hood exhaust system and the building supply system.

n. Working sash height should be labeled.

E. Protective Apparel and Equipment

A variety of specialized clothing and equipment is available for use in the laboratory. The proper use of these items will minimize or eliminate exposure to the hazards associated with most laboratory procedures. **All laboratory personnel must be familiar with the location and proper use of protective apparel, safety equipment and emergency procedures.** Refer to Appendix F for guidelines in selection, use and care of personal protective equipment. Each laboratory should include:

1. Protective apparel and equipment recommended for the substances being handled.

2. An accessible drench-type safety shower, or a means of providing flushing for chemical splashes as an immediate first aid treatment.

3. An eyewash station.

4. A carbon dioxide fire extinguisher or fire extinguisher appropriate for the types of fire hazards present in the laboratory. Be aware that combustible metals require specialized fire fighting materials (Class D fires).

5. A chemical spill kit for small spills. Spill kits must be purchased by individual laboratories. Contact Environmental Health and Safety for guidelines in how to choose the most appropriate kit.

6. Access to a fire alarm and a telephone for emergency use.

F. Systems Under Pressure

1. Reactions must never be carried out in an apparatus that is NOT designed to withstand pressure.

2. All pressurized apparatus MUST have an appropriate relief device.

3. Heat must never be added to an apparatus, which is not designed to withstand heating.

4. If a reaction system cannot be vented directly, an inert gas purge and bubbler system should be used to avoid pressure build up.

G. Warning Signs and Labels

Policies

Area designations: In most routine laboratories, there are no "high risk" areas except in the chemical and biological hoods and in the storage area. The technical work areas will be considered to be "moderate risk" and restricted to laboratory personnel. Administrative and clerical areas are to be considered "low risk" areas and are not restricted.

Posting

All laboratories are posted with the Laboratory Door Emergency Response sign. This sign gives detailed information to lab personnel and emergency responders about possible hazards within the room.

1. The signs and symbols have been established for special situations (i.e. radioactivity hazard, biological hazard, fire hazard, and laser operation). The signs are reviewed annually and are updated as necessary when the hazards change.

2. **Hazardous Waste containers must be labeled** to indicate the type of waste so it can be properly disposed of. Refer to SUNY Buffalo State Chemical Waste Disposal Policy and Procedures.

3. **It is the duty of laboratory supervisors to ensure that all chemicals are labeled** in accordance with SUNY Buffalo State policy and procedure as well as the Hazard Communications Standard/Right to Know Program.

Signs: Signs are posted at the entrance of the laboratory

Type of hazard: Biological, Radiological, Carcinogenic hazards, Flammable Materials, etc.

Type of caution required: Authorized personnel only, Flammable, Keep fire away, no smoking, high voltage, etc.

Labels

1. Labels with appropriate warnings will be affixed to all hazardous materials in addition to required labels indicating content.

2. All reagent kits and materials must be labeled in regard to: Content, Concentration (if applicable), Date received, (or prepared), Date placed in service, Storage requirements.

3. All hazardous materials must also be labeled in regard to: caution required, type of hazard (poison, irritant, inhalant, carcinogen), precautions (do not pipet, avoid skin contact, do not inhale, use only in enclosed area, use only in ventilated area, etc.), instructions in case of accident (wash immediately), these instructions should be on the manufacturers label when received. This regulation refers to stock solutions or bottles used for more than one shift.

The Hazard Identification System of the National Fire Protection Association will be used. Ref: Hazardous Chemical Data (NFPA No. 49), Manual of Hazardous Chemical Reactions (NFPA 49M), Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids (NFPA No. 325M) and Recommended System for Identification of the Fire Hazard of Materials (NFPA No. 704M). Refer to Appendix G Hazard Identification Labels.

H. Unattended Operations

On many occasions, it is necessary to carry out laboratory experiments overnight or run equipment continuously. In these situations, it is necessary to plan for interruptions in utilities, such as electricity or water. Such unattended operations must be designed safely, and contingencies provided for potential problems and hazards that may result. Appropriate signs indicating that a particular laboratory operation is in progress must be posted with the name and phone number of the person to contact in an emergency.

I. Working Alone/Lab Security

It is always wise to **avoid working in a laboratory alone.** If this is not possible, arrange with a co-worker to check in with you periodically. On nights, weekends, and holidays, individuals who must work alone in a laboratory may contact University Police and arrange for an officer on patrol to check in at your lab.

If you are injured while working alone in a laboratory after normal business hours, on the weekends or holidays, call University Police at x6333 for assistance.

Experiments known to be extremely hazardous will not be undertaken by individuals working alone in the laboratory. Under these unusual conditions, special rules and safety precautions will be developed to ensure safe working conditions. The laboratory supervisor, in cooperation with the department's Chemical Hygiene Plan Designee, will determine what experiments have this need and the special precautions to be taken. For the protection of employees, equipment, supplies, and the public, laboratories will be closed and locked. Security within the lab is also important. **Locked storage cabinets are advised for sensitive or expensive supplies, equipment, chemicals, syringes and needles.** Lockable storage areas or lockers for securing personal property are advised. Computers, scientific equipment and research data can be the object of theft, vandalism or damage from fire or utility failure. Appropriate cabinetry designed to protect these items, should be considered. Upon request, University Police can assist laboratories with crime prevention recommendations.

If you observe suspicious persons or activities in your area, contact University Police and an officer will be sent to investigate. Also, **report all thefts or other crimes immediately**. Information from these reports is used to adjust patrol activities and may prevent further problems.

J. Policy for Termination of Laboratory Use of Hazardous Materials

Proper disposition of all hazardous materials used in laboratories is the **responsibility of the principal investigator or researcher to whom a laboratory is assigned.** Ultimate responsibility for hazardous materials management lies with each department. Proper disposition of hazardous materials is required whenever a responsible individual leaves the College or transfers to a different laboratory. ("Responsible individual" can include faculty, staff, post-doctoral and graduate students.)

CLOSEOUT PROCEDURES FOR HAZARDOUS MATERIALS IN LABORATORIES

The following procedures should be completed when the responsible individual leaves the College or transfers to a different laboratory.

CHEMICALS: Assure that all containers of chemicals are labeled with the name of the chemical. All containers must be securely closed. Beakers, flasks, evaporating dishes, etc. should be emptied. Hazardous chemical wastes must not be sewered or trashed; they must be collected for disposal. Check refrigerators, freezers, fume hoods and bench tops as well as storage cabinets for chemical containers.

Determine which chemicals are usable and transfer responsibility for these materials to another party who is willing to take charge of them. If a new user cannot be found, the materials should be disposed.

All other chemicals should be prepared for disposal. This process may take quite some time and should be started at least a month before departure from the laboratory. Chemical pickup should be completed before the laboratory is vacated. Waste collection may take a week after notification that waste is ready for pickup.

Wash off fume hood surfaces and counter tops.

Notify Department Chair when laboratory has been cleared.

CONTROLLED SUBSTANCES: Permits are issued by the US Drug Enforcement Agency (DEA) and are issued to individual researchers. There is no central record of permit holders.

Abandonment of a controlled substance is a violation of the DEA permit under which it was held.

Permission to transfer ownership of a controlled substance to another individual must be received from DEA.

Notify Department Chair of disposition of controlled substances.

GAS CYLINDERS: Remove gas connections, replace cylinder caps, and return cylinders to suppliers.

If cylinders are non-returnable, contact Environmental Health & Safety.

ANIMAL TISSUE: Animal tissue can be disposed of by contacting Environmental Health & Safety for assistance.

Liquid preservative usually needs to be disposed as a hazardous waste. Contact Environmental Health & Safety for assistance. Do not assume that the preservative can be sewered.

If appropriate disposal is uncertain, contact Environmental Health and Safety.

Defrost and clean refrigerators and freezers if they are empty.

If samples need to be saved, locate appropriate person to take responsibility for them and notify Department Chair.

MICROORGANISMS AND CULTURES: If an autoclave is available, decontaminate waste and dispose in regular trash.

If material cannot be decontaminated, place in biohazard bag for incineration.

Clean incubators, drying or curing ovens, refrigerators and freezers.

If samples need to be saved, locate appropriate person to take responsibility for them and notify Department Chair.

RADIOACTIVE MATERIALS: Prior to closeout of a radioactive materials use area and/or a radioactive materials user permit, it is the responsibility of the department and the authorized radioactive materials user to assure that the following steps have been completed.

Package all radioactive materials (stock vials, sealed sources, lead containers/shields, and wastes) and label them in accordance with Radiation Safety procedures for pickup as radioactive waste, or for transfer to another permitted use area.

Prior to the transfer, notify the Radiation Safety Officer to obtain authorization for the transfer and to assure that the new use area is properly posted and permitted by Radiation Safety.

Arrange for pickup of all radioactive wastes through the RSO.

Following removal of all radioactive wastes and stock materials, perform a contamination survey (and if appropriate a Geiger Mueller instrument survey) of all former storage and use areas within the laboratory or under the permit to be closed out. NOTE: Areas of potential residual contamination include refrigerators/ freezers, centrifuges, water baths, hoods, sinks, floor areas under waste containers, etc. Also, if there are contaminated areas or equipment in the laboratory, they must be decontaminated. A closeout survey must be made of the decontaminated areas and the results included in the above survey.

Provide the Department Chair and the RSO with a copy of the final contamination survey.

Schedule the closeout survey by the RSO. Do not allow further use of room until the RSO closeout survey is complete and the door posting is removed by RSO. The Department is responsible for immediate notification of the RSO if the above steps have not been completed.

MIXED HAZARDS: Occasionally it is necessary to dispose of materials that contain more than one of these hazards. Contact the Department of Environmental Health and Safety for assistance.

EQUIPMENT: If laboratory equipment is to be left for the next occupant, clean or decontaminate it before departing the laboratory. If exhaust or filtration equipment has been used with extremely hazardous substances or organisms, alert Environmental Health and Safety.

If laboratory equipment is to be discarded, be aware that capacitors, transformers, mercury switches, mercury thermometers, radioactive sources and chemicals must be removed before disposal. Contact Environmental Health and Safety for assistance.

Equipment potentially contaminated with radioisotopes should be surveyed by Radiation Safety.

SHARED STORAGE AREAS: One of the most problematic situations is the sharing of storage units such as refrigerators, freezers, cold rooms, stock rooms, waste collection areas, etc., particularly if no one has been assigned to manage the unit. Departing researchers must carefully survey any shared facility in order to locate and appropriately dispose of their hazardous materials.

REGULATORY IMPACT: Mishandling of hazardous materials **can result in citations and possible fines to the College.**

IV. Chemical Procurement, Distribution, and Storage

Good chemical hygiene practices begin with the personnel who order chemicals and those who approve the purchase orders. **People must be aware of the potential hazards associated with the substances ordered.** They also need to consider if the laboratory facilities and staff are available to handle these materials.

Before a compound is received, information on its proper handling, storage and disposal should be given to everyone involved, including stockroom personnel. No container will be accepted without an adequate identifying label.

Storage in stockrooms or storerooms depends on the quantity of chemicals in the area and the nature of their hazards. Toxic substances should be segregated in a well-identified area with local exhaust ventilation. Facilities for water-sensitive chemicals must be designed to prevent accidental contact with water. Cylinders of compressed gases should be stored in well ventilated, dry areas and properly secured. Maintaining a central storage area for flammable chemicals will minimize the fire hazard.

Highly toxic chemicals and materials in opened containers must be placed in unbreakable secondary containers. Periodic examination of stored chemicals to determine whether the chemical or its container has deteriorated is prudent. Stockrooms and storeroom should not be used as preparation or repackaging areas. These facilities at Buffalo State College are open during normal working hours and are controlled by Stockroom Manager.

The method of transporting chemicals from the stockroom to the laboratory should reflect the quantity and hazard of the chemicals. When chemicals are hand carried, the chemical container must be placed in an outside container or bucket. The cover cap on compressed gas cylinders should not be removed until the cylinder is in place and ready for use. Hand trucks are used for transporting cylinders. The cylinders must be strapped in place during transport and, again, when they are set up in the laboratory.

Chemical storage in laboratories must be carefully planned. Restricted quantities may interfere with laboratory activities. Unrestricted amounts can lead to accumulations of toxic, flammable, reactive and other hazardous compounds that could pose a safety threat not only to the laboratory, but the entire facility. Compatibility of materials must be addressed.

Every chemical in the laboratory should have a definite storage location and be returned to that location after each use. Storing chemicals on bench tops is unwise. These compounds are not protected from potential exposure to fire and are easily knocked over. Storage in hoods should be avoided, because this practice interferes with the air flow in the hood. The best storage areas are those which prevent exposure of chemicals to heat

or direct sunlight. Periodic inventories of laboratory chemicals will show which items are unneeded, unused or which have deteriorated. These materials can then be properly disposed of or sent back to the stockroom.

A. Storage

The correct storage of chemicals has become increasingly important to maintain a safe working environment, particularly when the number of chemicals in use increases and their possible toxicity becomes known. Problems related to chemical storage can be significantly reduced by following the principles of LIMITING and SEGREGATING the chemicals.

General Storage Rules:

1. **Toxic substances should be segregated** from other chemicals in a well-identified area with local exhaust ventilation.

2. Chemicals, which are considered highly toxic, carcinogenic, or otherwise hazardous should be placed in an unbreakable secondary container, properly labeled and stored in a locked cabinet.

3. **All chemicals should be stored in secure areas.** Access to chemical storage areas should be restricted in order to prevent theft and unauthorized use as well as to insure accurate inventory and ordering control. Lack of chemical control results in inefficient operations, and places liability for exposure incidents and other injury from unauthorized use, on the College and its employees.

4. Stored chemicals should be examined routinely for deterioration, container integrity and possible replacement.

5. The amount of chemicals being stored should be as small as practical.

6. **Storage on bench tops, for more than one shift, and in hoods is prohibited.** This is aimed to keep the work area clear of clutter and avoid potential accidents. Adequate hood space should be maintained for experimental procedures.

7. Do not store bottles on the floor or on carts.

8. Exposure of chemicals to heat and direct sunlight should be avoided.

9. A periodic chemical inventory should be conducted with unneeded chemicals given to Environmental Health and Safety for disposal or distribution on campus.

B. Transport

Transporting hazardous substances from one location to another location is a serious safety and health problem. Employees other than those knowledgeable about their use and the handling of leaks or spills could be unduly exposed through carelessness or neglect. For these reasons, extra precautions are not only prudent, but necessary. **The transportation of any chemical to an off-campus location must be approved by the Department of Environmental Health and Safety.**

Large quantities of chemicals are used by various campus departments, especially flammable solvents. Since these chemicals are used in significant quantities, they are received at the Clinton Center stockroom. The necessity to transport these chemicals from one location to another result in a serious potential hazard. Several liters of flammables are frequently wheeled through hallways, on and off elevators, and past classrooms. Even a minor leak or spill of a flammable liquid in an elevator or open area could result in a serious fire or explosion hazard. Volatiles should be sealed to prevent leakage of vapors into the campus environment during transport (i.e. liquid scintillation fluid).

Since such chemical transport is unavoidable, it is essential that unbreakable materials such as Nalgene jugs or other containers approved for flammables are to be used to transport bulk amounts of flammable liquids (such as ethanol). Ideally, chemicals such as acetone should be kept in their original metal cans. The lids for such containers should be inspected to insure their integrity and a suitable cart should be used to help transport these chemicals safely. Flammable chemicals supplied in glass containers should be protected with bottle carriers. This is especially true for corrosive materials or noxious organics, such as formaldehyde. The stockroom will not deliver substances that are not in their original shipping containers. The original label must be maintained on all chemical containers. The following procedures are to be followed by College personnel:

1. **A cart in stable and good condition with flanged sides is always to be used when transporting chemicals.** The cart is to carry only a quantity that can be handled safely. It is preferable that the chemicals be in an appropriate box or pail to contain leakage of materials.

2. All persons transporting hazardous chemicals shall keep spill clean-up equipment (i.e. spill pillow or absorbents, gloves, etc.) on the cart to deal with an emergency spill situation.

3. Environmental Health and Safety is to be notified of all instances involving a chemical spill.

C. Designated Area/Approval

Laboratories working with carcinogens, reproductive toxins, or substances which have a high degree of acute toxicity must establish a "Designated Area." A designated area may be an entire laboratory, an area of the laboratory or a device such as the laboratory hood. **The purpose of the "designated area" is to focus attention on the fact that a particularly hazardous substance is being used** and to ensure, when necessary, that appropriate protective measures are being observed by employees and students working in or near the vicinity. "Designated Areas" must be appropriately identified.

The role of each Chemical / Biological Hygiene Plan Designee is to review new procedures and/or protocols introduced by department members, Principal Users/Researchers or students to assure that the proper facilities exist for safe handling of chemical involved in the new procedure. Procedures and/or protocols, which must be reviewed, are those that contain chemicals that fall into one of the three categories listed below. The designee shall make sure that safety equipment is in working order and to advise the investigator of safety issues that need to be addressed before the experiment can begin. The designee must familiarize him/herself with the appropriate SDS(s) before the recommendations can be made. All members of the Chemical / Biological Hygiene Committee shall act as a resource in the event questions and/or problems arise.

In addition, **the Principal investigators/researchers, students and involved department members** must also review the regulations prior to using any chemical that falls into a category listed below. The corresponding SDS must be reviewed to make sure that the appropriate equipment (working fume hood, safety goggles, gloves, respirators, etc.) is available to ensure their employees and any other employees possibly affected are working in a safe environment. The specific categories are:

1. A newly introduced hazardous chemical(s) substance of moderate chronic or high acute toxicity. (See Appendix E)

2. Working with a substance known to be a reproductive toxin (See Appendix C).

3. Working with the 25 OSHA regulated chemicals listed on page 31.

V. WORK AREA MONITORING

For most laboratory environments, regular monitoring of airborne toxic chemical concentrations is neither necessary nor practical under normal operating conditions. However, such monitoring may be justified when testing or redesigning ventilation systems or when a highly toxic substance is used or stored regularly. Some distillations or titrations, if required to be performed outside of hood enclosures, may also require monitoring to insure that safe airborne chemical concentrations are maintained.

Laboratory Instructors are responsible for initiating exposure monitoring, as well as enforcing regular hygiene procedures, housekeeping programs, and equipment maintenance inspections.

Housekeeping, chemical hygiene practices, care and use of personal protective equipment, and fume hoods shall be inspected on a continual basis.

Monitoring shall be implemented immediately in areas where personnel have developed symptoms of overexposure to hazardous materials. Similarly, every exposure incident will be investigated by the Chemical Hygiene Committee to determine the unsafe conditions or actions that led to the accident. Corrective actions to prevent future exposures must be developed and implemented by the laboratory instructor.

Results of all work area monitoring shall be kept for a period of 40 years from the date of monitoring.

Only NVLAP approved Laboratories will be used for the analysis of work area monitoring samples.

All personnel, who are utilizing the work area during monitoring, shall be informed of the results of such monitoring in writing. Said personnel will also be informed of their right to receive medical consultation, at no charge, in the event of chemical exposure.

VI. HAZARD IDENTIFICATION

1. **Hazard Identification is a key element in any effective health and safety program.**

   In general, the following procedures should be followed as a minimum guideline:

   A. Labels on incoming containers must not be removed or defaced.

   B. Shipments of new chemicals must be accompanied by a current Safety Data Sheet (SDS). Copies of the new SDS's are to be forwarded to Environmental Health & Safety.

   C. SDS's received are maintained in binders and are readily accessible to all employees. The SDS's are located in CCTR 213 and each department shall maintain a SDS file and chemical inventory.

   D. All substances developed in laboratories will have the precursor chemicals SDS's on file.

   E. A complete chemical inventory list will be maintained by the department and updated as needed.

   F. All instructors will identify and discuss potentially hazardous materials with all students working in that instructor's lab at the beginning of each lab. Standard operating procedures as developed by the department will also be discussed.

2. **Chemicals in the Laboratory**

   Whenever possible, a less hazardous or toxic chemical should be substituted.

   A. Classification

      1. Caustic or Corrosive: Acids and alkalies may cause burns of skin, mouth, or eyes, and may also cause damage to equipment and storage areas.

      2. Poisons/Toxic Chemicals: Almost any substance in quantity can be poisonous. For these purposes, a poison will be classified as a substance that may cause death or serious effects if relatively small

amounts are inhaled, ingested, or come in contact with the skin (such as concentrated phenols). Poisons may be gas, liquid or solid.

3. Carcinogens: Substances designated by OSHA as carcinogenic require special handling. Refer to Appendix D.

4. Flammables: Materials, either solid, liquid or gaseous, may ignite and burn vigorously in the presence of static electricity, sparks or flame.

5. Explosives/Reactives: Materials that may explode under special circumstances. Example: Crystalized Picric Acid.

All dangerous chemicals must be labeled to indicate the name of the chemical and the type of hazard, and must conform to the requirements of the Hazard Communication Standard and Right-To-Know Laws. These are some examples of commercially available signs:

1. Need for caution - Caution
2. Type of hazard - Irritant
3. Precautions to be observed - Avoid Skin Contact, Do not Pipet
4. Instructions in case of emergency - Wash Exposed Area Immediately

B. Acute and Chronic Exposure

Recommended handling procedures for chemicals begin with an assumption that, even for substances with no known significant hazards, it is prudent to observe good laboratory practices. Minimize exposure by working in an exhaust hood, wearing eye protection as well as a laboratory coat or apron.

The toxicity of a substance is determined by its ability to damage or interfere with the structure or function of living tissue. An acute exposure is one which can cause damage as the result of a single or short duration exposure. Chronic exposure is one which causes damage after repeated or long duration exposure, or becomes evident only after a long period of latency.

Specific regulations have been established by the Occupational Safety and Health Administration (OSHA) regarding the handling of certain compounds designated as carcinogenic. Anyone contemplating work or who are working with materials on this list should consult the regulations and the chemicals SDS for the necessary working conditions, spill and leak procedures,

personal protective equipment necessary and health and safety information. During the annual Right-To-Know training, you should notify the trainer that your working conditions include a new substance that is carcinogenic. In case of exposure, your record will be kept for forty years. Periodic medical examinations may be needed to monitor health conditions.

The Federal Government has issued very detailed regulations for the 25 chemicals listed below. Any laboratory personnel who use or handle any of these chemicals should contact EH & S for detailed information:

2-Acetylaminofluorene
Acrylonitrile
4-Aminodiphenyl
Asbestos
Benzidine
Bis-Chloromethyl Ether
Coke Oven Emissions
Coal Tar Pitch Volatiles
Cotton Dust
1,2 Dibromo-Chloropropane
3,3 Dichlorobenzidine
(and its salts)
Formaldehyde
4-Dimethylaminoazobenzene
Ethyleneimine
Ethylene Oxide
Inorganic Arsenic
Lead
Methyl Chloromethyl Ether
Alpha-Napthylamine
Beta-Napthylamine
4-Nitrobiphenyl
4-Nitrosodimethylamine
Beta-Propiolactone
Vinyl Chloride

As with any chemical, it is imperative that the Safety Data Sheet be consulted before using, for proper handling precautions and correct actions to be taken.

3. Chemical Hazards

A number of routine procedures in a laboratory involve the use of corrosive, toxic, reactive or flammable chemicals. These chemicals should be appropriately labeled to indicate the hazards. Read the chemical labels and observe the precautions.

A. Caustic and Corrosive

Contact with the skin or eyes, represents the greatest risk when dealing with corrosives. Match the hazard presented by the material being used with protective equipment recommended by the SDS. Always wear resistant gloves and eye protection when dealing with corrosives. In some cases, this may also include respiratory protection.

If quantities of acids or alkalies are being used, use a shield or barrier of some kind, or work in a sink so that breaks or spills can be controlled. Wear aprons, gloves, and eye protection devices when handling highly corrosive materials. Do not pipet by mouth. Do not sniff reagents. For dilutions: Use great care and add reagents SLOWLY. **Always add acid to WATER,** never water to acid. Allow acid to run down the side of the container and mix slowly by gentle rotation. Avoid overheating.

Storage of Corrosives:

1. Store caustic and corrosive materials near the floor to minimize danger of bottles falling from shelves.

2. Separate containers to facilitate handling. Organic acids (acetic acid) should be stored separately from strong oxidizing agents (sulfuric, nitric, or perchloric acids or perchlorates and permanganates) to prevent interaction of fumes and corrosion in storage cabinets. Do not store organic solvents and flammables with acids or alkali.

3. Acid bottle carriers should be used for containers over 1 quart or 1 liter in size.

Handling:

1. **Plan ahead for problems:** make yourself aware of the nearest eyewash station and safety shower in your work location. Wear a suitable apron, resistant gloves, and appropriate eye protection when handling corrosive materials.

2. If acids or alkalies are used, **some form of containment to control breaks and spills must be employed.** Included among these methods are bench top spill diapers and resistant trays.

3. Never pipet by mouth. Use a mechanical or vacuum assisted pipet aid.

4. **Become aware of the methods, materials and procedures for cleaning up corrosive spills.** In the event of a significant spill beyond your immediate ability to control, notify Environmental Health and Safety.

General First Aid Considerations for Corrosives:

In the event that a corrosive contacts the skin, remove any contaminated clothing and immediately flush the area with copious amounts of tap water - using care not to rub or damage the skin. Notify your supervisor and seek medical attention, as needed. In the event that a corrosive chemical contacts the eyes, they must be immediately flushed with large amounts of clean water, including under the eyelids for at least fifteen minutes. Seek immediate medical attention. If a corrosive material is ingested, do not induce vomiting. Contact University Police and Seek immediate medical attention.

B. Toxic Chemicals

1. Isolate, segregate and clearly label all toxic chemicals.

2. Highly toxic substances should be stored in an unbreakable container and in a locked cabinet.

3. Adequate room ventilation must be provided at the worksite area. A fume hood must be used whenever possible.

4. The appropriate personal protective equipment must be worn as directed by the label or SDS. If in doubt, contact Environmental Health and Safety.

5. Limit exposure time.

6. Practice good personal hygiene: hand washing, wearing a lab coat, NO SMOKING OR EATING IN THE AREA.

C. Carcinogens

Carcinogens are a class of toxic chemical capable of increasing the risk of cancer(s) through exposure, usually over time. Teratogens are toxic chemicals capable of causing an increased risk of birth defects in children of exposed workers. Prudent practices need to be used in dealing with known or suspected carcinogens. The key is to reduce your exposure to these chemicals to within the accepted guidelines and to the lowest possible level through good work habits and common sense.

In many cases, the greatest potential harm is a result of repeated or prolonged exposure to these chemicals. Other behaviors, such as diet and cigarette smoking, can contribute to the synergistic effects of carcinogenic materials. Plan ahead for potential problems when using carcinogenic compounds. A protocol should exist for handling, storing, disposal and emergency procedures to be followed.

Be aware that certain toxic/carcinogenic chemicals may require special record-keeping for personal exposure or under provisions of the OSHA Subpart "Z" Substance List. Refer to Appendix H

D. Flammables

Flammable chemicals represent a major safety concern at the College because of the immediate physical danger that these materials present to all employees. Our primary interest is in reducing the chance of a fire involving these materials. In addition, many flammable chemicals have associated health risks.

Organic solvents are the most commonly encountered flammable chemicals in the College laboratories. Organic solvents produce vapors capable of mixing with air and only require an ignition source to start a fire. The proper storage and handling of flammable chemicals is essential to fire prevention.

Storage of Flammables:

1. Quantities of one gallon or more must be stored in a safety can. If a reagent must be stored in glass for purity, the glass container may be placed in a bottle carrier to lessen the danger of breakage.

2. Small quantities (working amounts) may be stored on open shelves, but bulk storage (more than 10 gallons) must be in a flammable storage cabinet.

3. Do not store ether in a closed area such as a refrigerator, unless the refrigerator is explosion-proof. Do not store flammables in cold rooms.

4. Do not store flammables in areas exposed to direct sunlight.

Refrigeration and Cooling Equipment:

The use of domestic refrigerators for the storage of flammable laboratory solvents is prohibited at the College.

According to the National Fire Protection Standard 99 107.2.s Class I Flammable Liquids should be stored in appropriately labeled explosion proof refrigerators. Only explosion-proof refrigeration equipment that has been approved by an authorized testing laboratory (such as a FM or UL) are to be used. Explosion-proof refrigeration equipment is designed to protect against ignition of flammable vapors.

Every laboratory refrigerator should be clearly labeled to indicate whether or not it is acceptable for storage of a flammable material. The required labels are available through Environmental Health and Safety.

E. Reactives

Reactive chemicals are characterized by their tendency to release large amounts of energy under certain conditions. They react very quickly and produce byproducts that can be potentially harmful. Included in the reactive category are explosives, water reactive materials, air sensitive materials and mixtures of oxidizing and reducing agents.

Handling and Storage:

1. Know the specific properties of the materials you will be working with prior to initiating your work.

2. Insure adequate protection against shock, extremes in temperature, other reactive chemicals, and sources of potential ignition.

3. Segregate oxidizers from reducers. Store reactive chemicals according to their primary hazard classification.

4. Isolate reactive chemicals from toxic materials and flammables.

Ensure that everyone in the work place is aware of the hazards associated with any reactive chemicals that you are using, and that the necessary course of action is understood. This should include what to do in the event of a spill, special fire protection equipment that may be required, and antidotes that may be needed.

4. Bacteriologic Hazards

A. Introduction

The laboratory director and supervisor are responsible for bacteriologic hazards from the time a specimen is received until the time of permanent disposal. Insure that biohazardous and potentially biohazardous materials are handled and discarded in accordance with the College's Bloodborne Pathogen Policy.

This section will cover handling within the laboratory up to the final disposal. Environmental Health and Safety is responsible for the review of handling procedures and disposal practices of infectious material. Supervisors are responsible for enuring proper implementation of the colleges Blood Borne Pathogen program. The program is available through the Environmental Health and Safety office.

B. Route of Infection

Infections may be spread by several routes. The actual occurrence of an infection depends on both the virulence of the infection agent and the susceptibility of the host.

1. Aerosol Production: Droplets and aerosols may be formed by simply removing caps, cotton plugs, or swabs from tubes. Heating liquids or needles too rapidly, placing a hot platinum loop in a cool liquid, and discharging liquids from a pipette into a beaker all cause airborne contamination problems. Breakage of tubes in centrifuges and petri dishes are also considered serious accidents, which can cause aerosols of infectious agents.

2. Ingestion: This route of infection can occur through accidental swallowing, failure to wash hands after handling specimens or cultures, and by handling of cigarettes, food or drink. Strict rules regarding smoking, eating or drinking in laboratories shall be obeyed.

3. Direct inoculation: Needles, broken glass or animal bites may permit direct inoculation.

4. Skin contact: Some very virulent organisms, and others not so virulent, can enter through small cuts or scratches, or through conjunctiva of the eye.

C. Handling of Specimens

WEAR GLOVES when processing specimens and putting up cultures, wash hands afterwards. If specimens must be centrifuged, they MUST BE COVERED by a sealed cap to prevent aerosol formation. Specimens for fungus culture and other potential biohazard should be placed and handled in a certified biologic safety cabinet. Do not use an uncertified cabinet.

D. Processing Specimens

ALL CULTURES ARE POTENTIAL PATHOGENS - USE CAREFUL TECHNIQUES AT ALL TIMES. Follow the listed precautions below:

1. Do not wave the loop in the air when contaminated with a sample.
2. Tuberculosis, viral and fungal specimens and cultures should be handled and processed in an approved biological safety cabinet.
3. Needles and loops should be cooled so as not to cause spattering of material.
4. Benches should be disinfected in the morning before work is begun and in the afternoon after work is finished.

E. Disposal of Contaminated Material

Specimens, culture plates, and tubes must be autoclaved prior to discarding. If autoclaving is impractical, use an active disinfectant and double red bag. Bags should be changed when they are half-filled. Both inner and outer bags should be sealed separately and securely to prevent leakage. DO NOT PLACE SHARP, BROKEN GLASS OR OTHER ITEMS WHICH CAN CAUSE TEARS INTO AUTOCLAVE BAGS. Label the outer bag to clearly indicate the nature of the biological hazard, how to handle it, and who to notify in case of accident or spillage. Materials or containers, which are to be reused, should be autoclaved prior to cleaning. Place them in a sealed and clearly labeled container to minimize hazard to others prior to sterilization. Any breakage of bags or leakage of contaminated materials should be reported to the laboratory supervisor and Environmental Health and Safety for instructions and monitoring for the safe clean-up of spilled material.

5. Identifying Hazardous Materials and Hazardous Waste

In order to comply with Environmental Protection Agency, Occupational Safety and Health Administration, New York State Department of Environmental Conservation, and New York State Department of Health rules and regulations on hazardous materials, this procedure will define hazardous materials in the College community.

A. Definition

Any chemical or chemical mixture, which has one or more of the characteristic properties listed below:

Physical Hazards	Health Hazards
Combustible liquids	Irritants
Flammable aerosols	Cutaneous hazards
Flammable gases	Toxic agents
Flammable liquids	Highly toxic agents
Flammable solids	Corrosive materials
Oxidizers	Eye hazards
Pyrophoric materials	Agents that act on the blood
Compressed gases	Sensitizers
Explosives	Carcinogens
Organic Peroxides	Hepatotoxins
Unstable materials	Reproductive toxins
Water-reactive materials	Neurotoxins
	Agents that damage the lungs

Examples of Materials that may be Hazardous

Adhesives	Monomers
Aerosols	Office copier chemicals
Anodizing agents	Paints
Battery fluids	Pesticides
Catalysts	Photographic chemicals
Cleaning agents (all types)	Photoresists
Degreasing solvents	Printing inks

Detergents
Electrolytes
Electroplating chemicals
Etching baths
Foaming resins
Fuels (all types)
Industrial oils
Janitorial supplies
Lacquers
Process chemicals
Resin ingredients
Shellacs
Soaps
Solvents (organic)
Surfactants
Varnishes
Treatment

Any chemical, or mixture of chemicals, can be assumed to be hazardous. The above listed materials may be considered hazardous until a determination proves otherwise.

The presence of certain elements in the chemical names of materials will suggest the probable existence of hazards. A list of the key elements for this purpose is given below. Not all compounds containing these elements are hazardous, but many are. Also, some of the elements in themselves are hazardous in addition to imparting hazardous properties to compounds that contain them.

Elements Whose Presence Signals Potential Hazards

Aluminum
Antimony
Arsenic
Barium
Beryllium
Bromine
Cadmium
Manganese
Mercury
Molybdenum
Nickel
Platinum
Rhodium
Selenium
Silicon
Lead
Chlorine
Chromium
Cobalt
Copper
Hafnium
Indium
Iodine
Silver
Tellurium
Thallium
Tin
Tungsten
Uranium
Yttrium
Zirconium
Fluorine

The presence of certain words and word fragments in the names of chemicals can indicate possible hazards. Below is a list of some of these. Not every chemical whose name contains these words or word fragments is hazardous, but most are.

Words and Word Fragments that Signal Potential Hazards

Acid	Brom	Hydroxide	Nitroso
Acryl	Caustic	Isocyanate	Perox
Alcohol	Chlor	Ketone	Phenol
Aldehyde	Chrom	Mercaptan	Sulfide
Allyl	Cyan	Nitrate	Thio
Amino	Ether	Nitrite	
Anhydride	Glycol	Nitro	
Amine	Dimethyl	Pyridine	

EPA regulations (40 CFR, Part 261.20) classify a waste as hazardous by: 1) specifically including it on one of four lists, and 2) defining four characteristics the generator can use to determine whether a waste is hazardous. The four EPA characteristics are:

1. Ignitibility

   a. Liquids, other than aqueous solutions containing less than 24% alcohol by volume, that have a flash point below 60 degrees Fahrenheit.

   b. Materials other than liquids that are capable, under standard temperature and pressure, of causing fire by friction, absorption of moisture, or spontaneous chemical changes, and when ignited, burn so vigorously and persistently as to create hazard.

   c. Flammable compressed gases as defined by U.S. Department of Transportation (DOT) regulations 49 CFR 173.300. This definition includes gases that form flammable mixtures.

   d. Oxidizers, as defined by DOT regulation: a substance, such as a chlorate, permanganate, inorganic peroxide, or nitrate, which readily yields oxygen to stimulate the combustion of organic matter.

2. Corrosivity

Aqueous solutions that have a pH equal to or less than 2 or equal to or greater than 12.5 are corrosive. A characteristic for corrosive solids is not specified in the regulations, and therefore, a solid need not be classified as an EPA-regulated corrosive waste.

3. Reactivity

This classification includes substances that react with water violently or to produce toxic gases or explosive mixtures. Also substances that are unstable, explosive, and contain cyanide or sulfide that generate toxic gases when exposed to a pH in the range of 1 - 14.

4. Toxicity

This characteristic is defined by a prescribed test procedure for waste.

Questions concerning whether or not a waste is hazardous waste should be directed to the Environmental Health and Safety Office.

VII. ACCIDENTS AND SPILLS

HAZARDOUS MATERIAL SPILL RESPONSE PROCEDURES

A. Introduction

Chemical spills may pose an immediate threat to the health and well being of faculty, staff, students and visitors. A spilled hazardous chemical may present the danger of exposure to toxic or corrosive substances, a potential for fire, or explosion. An effective spill response and contingency plan goes a long way toward first preventing spills, and secondly for establishing concise procedures for the response to chemical spill incidents and the safe and efficient clean-up of those spills.

B. Spill Prevention Planning

This section of the Chemical Hygiene Plan will serve as a guide to departments in the formulation of their own spill response program. It is imperative that specified personnel within each department review the chemical hazard potential in their

department and then formulate an effective program based on the idiosyncrasies of that department. In this way, department personnel will be more aware of their chemical hazard potential and the associated spill procedures, than if a generic plan were distributed for use.

The Environmental Health and Safety Department is available to assist all departments in this endeavor. A spill response program should take the following items into account:

1. The potential area in which a spill could occur (e.g., storage areas, hallways, laboratories.)

2. The quantity of chemicals which could be involved.

3. Chemical and physical properties of the substance (e.g., vapor pressure, incompatibilities, phase, etc.).

4. Hazardous properties (e.g., flammable, toxic, corrosive, water/air reactive, infectious, etc.).

5. Personal protective equipment and spill clean-up material requirements and location.

C. Spill Control Station

A spill control station should be established for each department engaged in the handling and/or use of hazardous chemicals, infectious agents and radioactive substances.

At the minimum, a spill control station should contain the following materials:

1. Personal protective equipment (PPE) which offers the proper protection from the hazard. In areas where multiple chemical hazards are present, personal protective equipment shall be chosen based on that which is protective of the most hazardous chemical.

   Multiple sets of PPE shall be maintained at the station at all times. Replacement of any used PPE shall occur immediately after completion of the spill cleanup.

   Personal Protective Equipment may include:

a. Splash resistant goggles
b. Face Shield
c. Chemical resistant apron or tyvek suit
d. Nitrile Gloves
e. Nitrile Booties
f. Latex Rubber gloves
g. Dust Masks
h. 1/2 Face Respirator (authorization and approval for the use of respiratory equipment of any kind must be granted by the environmental Health and Safety office prior to use.)

2. Neutralizers for acids and bases.

3. Decontamination agents for infectious and radioactive spills.

4. Absorbent material for flammable and hazardous liquids. These should include: booms, pads and "speedy dry", or vermiculite.

If you deal with chemicals such as formaldehyde or mercury, it is necessary to have Spill-x-FP Formaldehyde Polymerize and Mercury Absorbent respectively.

EVERYONE IN YOUR DEPARTMENT MUST KNOW THE LOCATION OF THE SPILL CONTROL STATION AND HAVE BEEN INSTRUCTED ON THE USE OF THE CONTENTS.

D. Response Procedures

WHEN A SPILL OCCURS

1. Attend to any person who has been injured or contaminated.

   a. If contamination has occurred, lead the person to the nearest emergency eyewash or shower station in a safe area and rinse the effected area for at least 15 minutes.

2. Inform people in the immediate area of the spill.

3. Evacuate non-essential personnel from the spill area.

a. Insure that equipment and flame producing devices are shut off as personnel leave their work area.

4. **Notify University Police (6333).** Be prepared to give the following information:

   a. Location
   b. Extent of Injuries
   c. Name of Chemical Causing contamination
   d. Current status of the spill

5. If qualified to do so, assess the nature of the hazards associated with the spilled material. Refer to the chemicals Safety Data Sheet (SDS). Plan your response accordingly and contact your supervisor and/or the Environmental Health and Safety office for assistance.

6. If qualified to do so, secure the required personal protective equipment and spill kit. If possible, two people should respond to clean up the spilled material. The following sections offer guidelines for handling different types of spills. A spill response plan shall be drawn up by each department to adequately handle spill situations which may be unique to their area. Always consult the SDS for appropriate spill clean-up technical procedure.

HAZARDOUS MATERIAL SPILL

1. Notify the University Police (6333).

2. Barricade the area of the spill, close all doors, place warning signs and barricade tape and evacuate non-essential personnel.

3. In some cases the air supply to the affected area may have to be shut down to maintain negative pressure and prevent migration of fumes to other areas. In other cases windows should be opened.

4. Only qualified persons with gloves, coveralls, eye protection, and appropriate respiratory protection shall be permitted to handle a toxic substance of small magnitude. Massive or highly toxic spills require special equipment and response techniques. Outside Emergency response team personnel may be

required in such situations. Evacuation of the area, the whole floor, or the building must be considered if the occupants are in peril.

5. Consult the SDS for the proper cleaning and decontamination technique.

6. Liquid spills must be contained using booms or spill socks and should then be recovered by the use of absorbent material or by manual or mechanical collection appropriate for the nature of the spill. The entire area must be decontaminated before anyone is allowed back to do normal work.

7. Used protective clothing and protective devices are to be considered contaminated materials and shall be disposed of as hazardous waste.

8. All spill clean-up debris shall be placed in double plastic bags at least 3 mil thick each and sealed. The waste should then be placed into approved drums with a positive sealing cover. The drum should then be labeled with a Hazardous Waste label, stating the description of the material and the accumulation start date. Disposal of these materials will be coordinated through Environmental Health and Safety.

FLAMMABLE SPILLS

1. Remove all ignition sources. Inform persons in the area that there has been a flammable spill.

2. Refer to the procedure for hazardous material spill.

NOTE: Do not mop area with water until all liquid has been soaked up by the absorbent. Wringing a mop saturated with a flammable liquid could cause ignition.

CAUSTIC SPILL

1. If clothing is contaminated, it should be immediately removed and the affected area flushed with water. If a caustic should splash into the eye, the eye should be flushed at the nearest eye wash station for a minimum of 15 minutes. Emergency Medical Services shall be requested through University Police.

2. Refer to procedures for hazardous material spills.

ACID SPILL

1. Hydrofluoric Acid should be cleaned up with a hydrofluoric acid spill kit. Fuming Sulfuric, Nitric, and strong oxidizing acids will cause the fabric of the spill-pads and booms to deteriorate. Use Sodium Bicarbonate as an acid neutralizer.

2. If clothing is contaminated, it should be removed and the effected area flushed with water for at least 15 minutes. If an acid should splash into the eye, the eye should be flushed as above. Emergency medical services shall be requested through the University Police immediately in such cases.

3. Refer to the procedure for hazardous material spill.

MERCURY SPILL

Mercury is commonly used in many of our laboratory apparatus. The properties of mercury allow it to enter the body through the lungs by inhalation, the skin through absorption, or the digestive tract through ingestion. Of these routes of entry, inhalation is the most common route of entry. While acute poisoning due to short term exposure is uncommon, chronic poisoning due to long-term exposure to low levels of mercury can easily occur. When spilled, mercury breaks into tiny beads which can lodge in cracks in the floor or penetrate porous materials, making clean up difficult. Inadequate spill cleanup may leave residual mercury which can vaporize and cause mercury poisoning over a period of time.

In the event of a mercury spill:

1. In case of a small spill, use a Mercury Spill kit. The kit will consist of:
   - A hand operated suction pump with a 40 ml. reservoir
   - Mercury absorbent sponges
   - Absorbent powder
   - Protective glasses and a disposal bag

2. Do not vacuum or attempt to mop up mercury as this will spread mercury droplets across a wider area and increase the amount that can become airborne. Barricade the area and alert persons in the area of the spill.

3. In the event of a large mercury spill during working hours (Mon.-Fri, 8:00AM - 4:00PM) notify the Environmental Health and Safety Office for spill clean-up assistance. During non-working hours, call University Police to contact Environmental Health and Safety.

Spill kits are readily available through multiple sources. Contact Environmental Health and Safety for ordering information.

a. Put on the gloves and protective glasses

b. Spread the absorbent powder over the exposed mercury

c. Clean up all visible droplets of mercury. This is accomplished by aspirating the droplet with the hand vacuum in the kit. A syringe can also be used to accomplish this on small spills. In some cases, small amounts of mercury can be picked up with adhesive tape or a sponge device designed to pick up Mercury and deposit it in a collection container. Insure that this container is labeled and that personnel can identify the contents without having to handle the container.

d. Decontaminate the surfaces. Spilled mercury tends to break up into micro droplets and can get into cracks and crevices. Surface decontamination should be accomplished by applying one of the chemicals available to coat the mercury droplets (HgX or sulfur compounds) or to react with the mercury (Hg Absorb), forming an amalgam; these chemicals virtually eliminate mercury vaporization. Some surfaces cannot be decontaminated (very porous materials) and may need to be disposed of as hazardous waste.

e. Area monitoring is necessary to ensure that decontamination is complete and that the area is safe for occupancy. In spills involving small quantities of mercury, area monitoring shall not be required.

f. Have your department contact the Environmental Health and Safety Department to pick up the used spill kit, dispose of the mercury contaminated equipment, and monitor air for residual mercury if required.

BIOLOGICAL SPILLS

Laboratories or clinical areas handling highly infectious agents must have specific plans for handling accidents. Procedures for such circumstances are beyond the scope of this manual. Reference to each department's guidelines should be reviewed prior to working with these substances.

In General:

1. Dry Spills (e.g., overturned or broken culture plates with no significant aerosol formation:

   - Don personal protective equipment (latex gloves, safety glasses, apron or tyvek)

   - Flood area with disinfectant solution (e.g., water/bleach 20:1)

   - Soak up the disinfectant and contaminated material with an absorbent material and dispose of in a plastic bag or sealed container. Insure that the container is labeled properly in accordance with state and federal guidelines.

   - Decontaminate all surfaces again with the disinfectant solution after removal of all debris.

   - Arrange for an approved incinerator or autoclave to accept and destroy all contaminated materials. Request assistance from the Environmental Health and Safety office, if needed.

2. Liquid Spills:

   - Don personal protective equipment (Latex gloves, face shield and tyvek suit).

   - If significant aerosols were formed, the area should be evacuated for one hour or special respiratory devices should be worn by trained personnel during clean-up.

   - Cover the spill with an absorbent. Special precautions should be taken to avoid splashing of the material.

   - Remove and dispose of material as above.

RADIATION INCIDENTS

Any suspected radiation incidents should be immediately reported to University Police at extension 6333 and Environmental Health and Safety at extension 6128.

Do not attempt to remediate any radiation leaks. The area should be evacuated and posted until such time as an adequate assessment of the radiation release can be performed.

Prepare a roster of all individuals who were in the immediate vicinity of the leak and give this information to the Colleges Radiation Safety Officer.

CYLINDER RUPTURE/LEAKAGE

1. If a flammable or oxidizing compressed gas cylinder is leaking, immediately remove all ignition sources. If a cryogenic liquid, make sure that the fluid does not seep into a piece of equipment where rapid thermal expansion could cause an explosion.

2. Contact University Police at extension 6333.

3. Barricade the area and evacuate all non-essential personnel.

VIII. LABORATORY WASTE DISPOSAL

A. Introduction

SUNY Buffalo State is committed to the safe and lawful handling and disposal of laboratory waste. Laboratory supervisors are personally responsible for compliance with all state and federal regulations regarding waste materials generated in their labs. Environmental Health and Safety manages a comprehensive waste management program and any questions should be directed to that office.

B. Radioactive Waste

Radioactive materials must be discarded by the Radiation Safety Officer - never placed radioactive material in the normal trash. Consult the Radiation Safety Manual for procedures or call the Radiation Safety Officer (x6128).

C. Biological Waste

All specimens and contaminated (infectious) material originating from all laboratories (culture plates, petri dishes) are to be placed in autoclavable bags. When two thirds full, the bag is tied and brought to the autoclave room in the area. Temperature monitors (autoclave tape) are attached to each bag before it is placed in the autoclave.

D. Sharp Laboratory Waste

Capillary tubes, needles, scalpels, razor blades, and other disposable metallic items which may be potentially contaminated (infectious) must be placed in "SHARPS" containers. Special precautions must be taken to prevent injury or infection to personnel handling these materials. Discarding these items in plastic bags is prohibited.

Broken Glass:

Broken glass, whether contaminated or not, can be very hazardous to employees handling containers. Special precautions are taken to prevent injury or possible exposure to infection as a result of a cut from broken glass. Broken glass is to be placed in a suitable plastic/cardboard box clearly labeled as "Sharp Objects".

Boxes are sealed and placed in appropriate trash bins for removal by housekeeping personnel and transporting to the dumpster.

E. **Animal Carcasses (Non-Radioactive)**

Animal carcasses are to be placed in a plastic bag and firmly tied. Call the Environmental Health and Safety office for further instruction (where to bring the bags, etc.). Radioactive carcasses will not be accepted by Environmental Health and Safety. Contact the Radiation Safety Officer for proper disposal methods.

F. **Hazardous Chemical Waste**

The College's Hazardous Waste Disposal Policies and Procedures document details this program and should be available in every laboratory. Additionally, Environmental Health and Safety's Quick Reference Hazardous Waste Management Flip Chart should be posted in every laboratory.

All hazardous chemical waste must be managed in accordance with the documents listed above.

IX. MEDICAL PROGRAM

Any laboratory personnel who works with hazardous chemicals has the right to receive medical attention, including any follow-up examination which the examining physician determines to be necessary, under the following circumstances.

1. Whenever a lab worker develops signs or symptoms associated with a hazardous chemical to which they were exposed in the laboratory.

2. When exposure monitoring reveals an exposure level routinely above the permissible exposure level.

3. Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure.

4. Note: Students can be treated for minor injuries. Appendix I is the Student Injury Report Form.

X. TRAINING AND INFORMATION

All laboratory personnel must be informed of the contents of OSHA's standard 1910. 1450 "Occupational exposure to hazardous chemicals in laboratories" and the location and availability of the Laboratory Safety Guide/Chemical Hygiene Plan. Information and training is to be provided at the time of an employee's initial assignment, and prior to assignments involving new exposure situations. Refresher information must be provided on a routine basis and retraining shall be conducted every year.

Employees must be informed of the permissible exposure limits for OSHA regulated substances and other hazardous chemicals, and the signs and symptoms associated with exposure to hazardous chemicals (Appendix H). Additional information and reference material can be obtained through the Environmental Health and Safety office on the hazards, safe handling, storage and disposal of specific chemicals. The Right-to-Know training must be applicable to the details of the laboratory Safety Guide/Chemical Hygiene Plan which will include, but not be limited to:

1. Methods and observations that may be used to detect the presence or release of hazardous chemicals.

2. The physical and health hazards of chemicals found in the laboratory and the various means by which laboratory personnel can protect themselves from these hazards.

3. Detailed information on the Hazard Communication Standard encompasses GHS and the New York State "Right-to Know" Law including training, label requirements, SDS requirements, employee rights and record retention.

4. Those employees who are required to work on a newly proposed research project reviewed by the Chemical Hygiene Committee and was found to involve chemicals that are hazardous to personnel involved in their use shall undergo specific training regarding that chemical(s).

5. Any employee who uses hazardous substances in the work place in such a manner that the employee may be exposed to the substance under normal conditions of work or in a reasonably foreseeable emergency, such as spills, fires, explosions, equipment failure, etc. will be subject to attend an annual training program on Handling of Hazardous Materials. At that point the specific Safety Data Sheets will be reviewed along with proper safety procedures and precautions including emergency procedures for spills, fires, disposal and first aid.

To comply with New York State Labor Law, Article 28, during employee training or at other scheduled times, each employee will be provided with a list of Subpart Z (refer to appendix H) substances (29 CFR Part 1910) which has been determined from the chemical inventory conducted in their department. Departments using Subpart Z substances must compile a list providing (1) Employee Name, (2) Home Address, (3) Social Security Number, (4) Department, (5) Job Title, (6) Date and Subpart Z chemicals used. These employee records shall be kept on file in the Environmental Health and Safety Office and be made available to each affected employee, former employee, designated physician, or representative, and the Commissioner of Health, upon request. Records shall be maintained during employment and forty years thereafter.

XI. LABELING

A. Requirements

The Federal Hazard Communication Standard (GHS) 1910.1200 requires that all chemicals sold in the United States contain the following information: the Product Identifier (name or number), Signal words (i.e. Danger or Warning), Hazard Statement (i.e. Highly Flammable Liquid & Vapor), Red bordered diamond shape pictograms (i.e. skull & crossbones or flame), Precautionary Statement (including specific prevention, response, storage and disposal statements) and the name, address, telephone number of the distributor, manufacturer, importer or other responsible party . These labels should not be removed or defaced as long as a chemical is in its original container. See Appendix J for GHS information on the specific labeling information, pictograms and SDS section classification.

All containers containing chemicals (regardless of hazard) must be labeled during use or storage. A chemical that has been transferred from its original container to another must be labeled.

A unique and increasingly common labeling system being used by various chemical manufacturers and which may also appear on a Safety Data Sheet is the National Fire Protection Association (NFPA) labeling system. The elegance of this system is that, regardless of the education or background of the employee, the extent of the hazard is easily recognizable. See Appendix G

Each diamond of a NFPA label addresses a specific area of concern to the employee. The blue diamond is devoted to health effects, the red diamond concerns flammability, the yellow diamond represents the reactivity, and the white diamond is reserved for special notices. A hazard rating index is used to represent the extent of the hazard for each of the colored diamonds. The scale ranges from 0 through 4 and there are no other numbers to be used. The hazard ratings 0-1 indicate a non-hazardous or slightly hazardous chemical. A hazard rating of 2, 3 or 4 indicates a moderate (2), significant (3), or highly hazardous (4) chemical.

B. Portable Containers

Portable containers into which hazardous chemicals are transferred from labeled containers and which are intended only for the immediate use of the employee performing the transfer are exempt from the labeling requirements of the College. Hazardous chemicals left in portable containers beyond the employee's work shift must be labeled according to the standard. This labeling exemption is intended to prevent the ineffective use of labels for certain activities, such as the few ounces of a pesticide or fertilizer

placed in a hand-held spray applicator. However, labels may be appropriate for any container where confusion may subsequently occur if it is not properly labeled.

XII. ELECTRICAL SAFETY

The increased reliance on electrically powered analytical equipment in the laboratory is unique to modern science. Such equipment is now being used for heating, cooling, agitation or mixing, as well as for analytical instruments. Associated with this reliance is the creation of a new set of potential hazards in the laboratory.

A. General Instructions

1. All 11OV outlets in laboratories are to be of the standard design that accepts a three prong plug and provides a ground circuit.

2. All AC-powered electrical devices used in the laboratory must be provided with either a 3-conductor (ground) power cord or must be marked "double insulated" by the manufacturer.

3. All frayed or damaged line cords must be placed out of service and replaced before the equipment is put into use.

4. Electrical cords should be plugged into the wall and unplugged by pulling on the plug itself, never by pulling on the power cord.

5. Turn electrical power switches to the OFF position before either connecting or disconnecting the plug from the outlet.

6. Tape may not be applied to power cords except to provide additional protection from abrasion. Splices are not permitted in power cords. All cuts, abraded or otherwise damaged power cords must be replaced.

7. Do not handle electrical devices with wet hands or standing on a wet floor.

8. Electrical equipment is to be carefully located so as to minimize the possibility that water or chemicals could accidentally be spilled on it.

9. Report shocks immediately. Small shocks often precede major shocks and a light tingle may indicate potential trouble.

10. DO NOT work on or attempt to repair any instrument while it is plugged in. An exception is the adjustment of instruments that require adjustments while plugged in. In this case, be sure hands are dry, remove all jewelry (watches and rings) and proceed with caution.

B. Static Electricity and Spark Hazards

Static electricity is a potential hazard in the laboratory due to its ability (under some conditions) to accumulate to voltages great enough to ignite flammable vapors.

Protection from static electricity in handling flammable and other chemicals is obtained by the proper grounding and bonding of containers and equipment. In some cases, a blanket of an appropriate inert gas is needed. Some common potential sources of sparks and electrostatic discharges are:

1. Metal tanks and containers.

2. Plastic laboratory aprons.

3. High pressure gas cylinders upon discharge.

4. Brush motors.

5. Areas with low relative humidity.

XIII. FIRE PREVENTION AND CONTROL

A. Prevention

1. Be aware of ignition sources: open flames, heating elements, and spark gaps (motors, light switches, friction and static).

2. Do not use flammable liquids in presence of ignition sources, and conversely, keep ignition sources away from areas where flammable liquids are used and/or stored. Keep flammable liquids away from combustibles (paper, wood, cloth, etc.).

3. Flammable liquids give off vapors which can burn or explode.

   a. Store quantities of one gallon or more in Flammable Safety Cabinets.

b. Bulk Storage should be in approved flammable safety cabinets.
c. Store in-use chemicals in well ventilated areas but avoid large quantity storage under fume hoods.

4. Do not store any flammable liquids in areas exposed to direct sunlight.

5. Do not store flammables in non-explosion proof refrigerators or cold rooms.

6. Festive decorations are restricted to paned decorations on glass. Hanging decorations are prohibited.

B. Priorities - Code Word RACE

1. Remove, if possible, person(s) in immediate danger.

2. Activate Alarm from nearest alarm box. Contact University Police at X6333.

3. Confine fire by closing doors, windows, hood sashes and transoms.

4. Extinguish fire with appropriate fire extinguishers if possible, only if you have had the proper training and feel confident in doing so.

C. Evacuation

1. If there is a fire alarm, all personnel are to evacuate the building.

2. Office areas and laboratories shall evacuate the building, WALK - DO NOT RUN, following instructions given by University Police to assemble on sidewalk outside the building. Report anyone not accounted for to University Police or the Fire Department (Use stairways, NEVER USE ELEVATORS).

3. No one is to be allowed back into the building until the all clear signal is given by the fire department, University Police or Environmental Health and Safety.

D. Fire Control Methods

Flammable liquids

1. Dry chemical extinguishers are usually needed for safe and effective control of burning liquids. Carbon Dioxide (CO_2) will be effective only on a small fire. **DO NOT USE WATER** - it only increases the chance of spreading the fire.

2. If a flammable liquid is spilled but has not ignited, a nonflammable absorbent (such as sand) may be used to prevent spreading and reduce the fire hazard. A dry chemical ABC extinguisher should be available in case of fire.

Electrical

1. Do not use a water extinguisher unless the source of power has been shut off.
2. Shut off the power, if possible.
3. An ABC extinguisher can be used.

Gas

1. Shut off the gas source, if possible.
2. Main gas shut off valves should be labeled and kept clear in labs where they are available.

Fire Safety Equipment

1. Sand or absorbent materials are useful in controlling the spread of spilled liquids.

2. Fire blankets may be used to smother a clothing fire by wrapping the victims or rolling them on the ground. Fire blankets may also be wrapped around a person who has to pass through a burning area.

3. Emergency Showers may be used to extinguish a clothing fire.

4. Insulated gloves may be used to move or handle a small burning object, hot vessels, valves or handles.

5. Fire extinguishers are inspected monthly by Environmental Health & Safety to ensure effectiveness. Directions for use are on the extinguishers and should be reviewed by all lab personnel. Contact Environmental Health & Safety to arrange for fire safety training.

GLOSSARY

The following is a summary of important terms which can be found in OSHA regulations, chemical labels, Material Safety Data Sheets (MSDS's) and other sources which provide safety information to employees. Supervisors and employees may wish to review and become familiar with these definitions.

Action Level: A concentration designated in 29 CFR part 1910 for a specific substance, calculated as an 8-hour, time-weighted average, which initiates certain requirements (i.e. exposure monitoring and medical surveillance).

Adhesive: An adhesive is any substance applied to the surfaces of materials that binds them together and resists separation. The term "adhesive" may be used interchangeably with glue, cement, mucilage, or paste.

Area Monitoring: Taking samples of the air in a work place to find out how much dust or chemical material is in the air.

Carcinogen: A material capable of causing cancer.

Chemical Hygiene Officer: An employee who is designated by the employer, and who is qualified by training and experience, to provide guidance in the development and implementation of the Chemical Hygiene Plan.

Contaminant: Something that is not wanted where it is. For example, sand in paint is a contaminant. Dust and fumes in the air are contaminants.

Corrosive: A chemical material that can quickly burn skin, eyes, throat, lungs or other body tissues if it touches them.

Dermal: Has to do with the skin. For example, skin contact with an acid may cause a dermal burn.

Dermatitis: Inflammation of the skin. It may be seen as redness, swelling or a rash.

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

Dose-Response: The relationship between the amount of a chemical material you are exposed to, the length of time you are exposed, and the effect it has on the body.

Egress: The way out. An exit.

Evaporation: Change from a liquid to a vapor. For example, you may use a solvent to clean metal. When the metal dries, the liquid seems to disappear, but it is now in the air as a vapor. It has evaporated.

Exposure:	Contact with a chemical. (See Overexposure).
Flashpoint:	The lowest temperature at which a liquid gives off enough vapors to make a mixture in the air that will burn. The lower the flashpoint of a chemical, the greater the fire hazard.
Halogenated Hydrocarbon:	A chemical material that has carbon plus one or more of these elements: chlorine, fluorine, bromine, or iodine.
Hazardous Material:	A chemical material that can cause illness or injury if used the wrong way.
Hydrocarbon:	A chemical material made up of carbon and hydrogen.
Local Exhaust:	A ventilation system that removes dust, fumes or other contaminants at the source.
mg/m3:	Milligrams of particles in each cubic meter of air. This is a way of measuring the amount of material in the air, especially dusts, fumes and particles.
MSDS:	Material Safety Data Sheet. It tells about what's in the product and about possible hazards.
Olfactory:	Has to do with the sense of smell.
Oral:	Has to do with the mouth.
Overexposure:	Exposure to a chemical material which may cause illness or injury. Such effects generally occur at levels above standards.
PEL:	Permissible Exposure Limit. It is the standard set by the Occupational Safety and Health Administration (OSHA). PEL is the legal limit for exposure to a chemical, normally given in parts per million or milligrams per cubic meter of air.
PH:	A scale to show how corrosive a chemical material is in water. The scale goes from 9 to 14. The middle point, 7, is neutral, like pure water. Chemicals with a pH less that 7 are acids, like sulfuric acid. Chemicals with a pH greater than 7 are caustic or alkaline, like sodium hydroxide (also called caustic soda). The further away from 7, the stronger a chemical material is. A difference of one point on the pH scale means an increase or decrease of ten times in strength. For example, a chemical material with a pH of 13 is ten times more caustic than a chemical material with a pH of 12.
PPE:	Personal Protective Equipment. Items that serve as barriers between you and chemical materials, like gloves, goggles, respirators or clothing.
PPM:	Parts per Million. The amount of a compound or vapor in the air is often described this way.
Pulmonary:	Has to do with the lungs.

Reproductive Toxin: Chemicals that affect reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Respirable Particulate: Tiny particles of solids in the air. They are so small you can't see them. Because they are so small, they can go into the deepest parts of your lungs if you breathe them.

Risk: The chance of getting harmed, either now or later.

Route of Entry: The path by which things get into your body, especially the way toxic materials can enter. There are three main routes of entry. You can breathe something in (inhalation). It can get in through your mouth (ingestion). It can get in through your skin (absorption).

Select Carcinogens: Substances that are regulated by OSHA as a carcinogen are listed under the category "known to be carcinogens" in the Annual Report on Carcinogens published by the national Toxicology Program. They are listed in Group 1 by the International Agency for Research on Cancer Monographs (IARC), or are listed in either Group 2A or 2B by IARC.

Smoke: Tiny particles in the air as a result of incomplete burning.

Solution: A mixture in which on chemical material is dissolved in another.

Solvents: Liquids used to dissolve things like grease and oils. Solvents are often used in cleaning operations, or in paints and adhesives.

Suspect Carcinogens: A material which is believed to be capable of causing cancer, but for which there is limited scientific evidence.

TLV: Threshold Limit Value. This level is set by the American Conference of Governmental Industrial Hygienists and updated every year. TLV is the limit of exposure to a chemical.

Transfer Container: Any container other than the shipping container. A safety can is an example of a transfer container.

TWA: Time Weighted Average. The average level of exposure over time.

Unknown Toxicity: Indicated the hazard properties of material, often newly developed in the laboratory, have not been determined.

APPENDICES

Appendix A – OSHA Regulation 29CFR1910.1450

§1910.1450 Occupational exposure to hazardous chemicals in laboratories.

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

(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(i) For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

(iii) Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements, paragraphs (d) and (g)(1)(ii) of this section shall apply.

(3) This section shall not apply to:

(i) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

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

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

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

(b) *Definitions*—

Action level means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Carcinogen (see *select carcinogen*).

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the

position description or job classification that the designated indvidual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

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

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

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

Hazardous chemical means any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (§1910.1200).

Health hazard means a chemical that is classified as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in appendix A of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definition of "simple asphyxiant").

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

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

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

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

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

(i) Chemical manipulations are carried out on a "laboratory scale;"

(ii) Multiple chemical procedures or chemicals are used;

(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and

(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

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

Mutagen means chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard (§1910.1200) shall be considered mutagens for purposes of this section.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: Explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid, or gas); self reactive; pyrophoric (gas, liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in appendix B of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definitions of "combustible dust" and "pyrophoric gas").

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

Reproductive toxins mean chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§1910.1200) shall be considered reproductive toxins for purposes of this section.

Select carcinogen means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

(c) *Permissible exposure limits.* For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

(d) *Employee exposure determination*—(1) *Initial monitoring.* The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

(2) *Periodic monitoring.* If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

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

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

(e) *Chemical hygiene plan—General.* (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan.)

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

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

(ii) Capable of keeping exposures below the limits specified in paragraph (c) of this section.

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

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

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

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

(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

(iv) Provisions for employee information and training as prescribed in paragraph (f) of this section;

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

(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

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

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

(A) Establishment of a designated area;

(B) Use of containment devices such as fume hoods or glove boxes;

(C) Procedures for safe removal of contaminated waste; and

(D) Decontamination procedures.

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

(f) *Employee information and training.* (1) The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

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

(3) *Information.* Employees shall be informed of:

(i) The contents of this standard and its appendices which shall be made available to employees;

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

(iii) The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

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

(v) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, safety data sheets received from the chemical supplier.

(4) *Training.* (i) Employee training shall include:

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

(B) The physical and health hazards of chemicals in the work area; and

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

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

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

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

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

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

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

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

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

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

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

(4) *Physician's written opinion.* (i) For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

(A) Any recommendation for further medical follow-up;

(B) The results of the medical examination and any associated tests;

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

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

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

(h) *Hazard identification.* (1) With respect to labels and safety data sheets:

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

(ii) Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

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

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

(ii) If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

(iii) If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of safety data sheets and labeling.

(i) *Use of respirators.* Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

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

(2) The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.20.

(k) [Reserved]

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

Appendix A to §1910.1450—National Research Council Recommendations Concerning Chemical Hygiene In Laboratories (Non-Mandatory)

To assist employers in developing an appropriate laboratory Chemical Hygiene Plan (CHP), the following non-mandatory recommendations were based on the National Research Council's (NRC) 2011 edition of "Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards." This reference, henceforth referred to as "Prudent Practices," is available from the National Academies Press, 500 Fifth Street NW., Washington DC 20001 (*www.nap.edu*). "Prudent Practices" is cited because of its wide distribution and acceptance and because of its preparation by recognized authorities in the laboratory community through the sponsorship of the NRC. However, these recommendations do not modify any requirements of the OSHA Laboratory standard. This appendix presents pertinent recommendations from "Prudent Practices," organized into a form convenient for quick reference during operation of a laboratory and during development and application of a CHP. For a detailed explanation and justification for each recommendation, consult "Prudent Practices."

"Prudent Practices" deals with both general laboratory safety and many types of chemical hazards, while the Laboratory standard is concerned primarily with chemical health hazards as a result of chemical exposures. The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized in order to adapt them for this purpose. However, their sense has not been changed.

Section F contains information from the U.S. Chemical Safety Board's (CSB) Fiscal Year 2011 Annual Performance and Accountability report and Section F contains recommendations extracted from the CSB's 2011 case study, "Texas Tech University Laboratory Explosion," available from: *http://www.csb.gov/.*

Culture of Safety

With the promulgation of the Occupational Safety and Health Administration (OSHA) Laboratory standard (29 CFR 1910.1450), a culture of safety consciousness, accountability, organization, and education has developed in industrial, governmental, and academic laboratories. Safety and training programs have been implemented to promote the safe handling of chemicals from ordering to disposal, and to train laboratory personnel in safe practices. Laboratory personnel must realize that the welfare and safety of each individual depends on clearly defined attitudes of teamwork and personal responsibility. Learning to participate in this culture of habitual risk assessment, experiment planning, and consideration of worst-case possibilities—for oneself and one's fellow workers—is as much part of a scientific education as learning the theoretical background of experiments or the step-by-step protocols for doing them in a professional manner. A crucial component of chemical education for all personnel is to nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities throughout their career.

Over the years, special techniques have been developed for handling chemicals safely. Local, state, and federal regulations hold institutions that sponsor chemical laboratories accountable for providing safe working environments. Beyond regulation, employers and scientists also hold themselves personally responsible for their own safety, the safety of their colleagues and the safety of the general public. A sound safety organization that is respected by all requires the participation and support of laboratory administrators, workers, and students. A successful health and safety program requires a daily

commitment from everyone in the organization. To be most effective, safety and health must be balanced with, and incorporated into, laboratory processes. A strong safety and health culture is the result of positive workplace attitudes—from the chief executive officer to the newest hire; involvement and buy-in of all members of the workforce; mutual, meaningful, and measurable safety and health improvement goals; and policies and procedures that serve as reference tools, rather than obscure rules.

In order to perform their work in a prudent manner, laboratory personnel must consider the health, physical, and environmental hazards of the chemicals they plan to use in an experiment. However, the ability to accurately identify and assess laboratory hazards must be taught and encouraged through training and ongoing organizational support. This training must be at the core of every good health and safety program. For management to lead, personnel to assess worksite hazards, and hazards to be eliminated or controlled, everyone involved must be trained.

A. General Principles

1. Minimize All Chemical Exposures and Risks

Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted. In addition to these general guidelines, specific guidelines for chemicals that are used frequently or are particularly hazardous should be adopted.

Laboratory personnel should conduct their work under conditions that minimize the risks from both known and unknown hazardous substances. Before beginning any laboratory work, the hazards and risks associated with an experiment or activity should be determined and the necessary safety precautions implemented. Every laboratory should develop facility-specific policies and procedures for the highest-risk materials and procedures used in their laboratory. To identify these, consideration should be given to past accidents, process conditions, chemicals used in large volumes, and particularly hazardous chemicals.

Perform Risk Assessments for Hazardous Chemicals and Procedures Prior to Laboratory Work:

(a) Identify chemicals to be used, amounts required, and circumstances of use in the experiment. Consider any special employee or laboratory conditions that could create or increase a hazard. Consult sources of safety and health information and experienced scientists to ensure that those conducting the risk assessment have sufficient expertise.

(b) Evaluate the hazards posed by the chemicals and the experimental conditions. The evaluation should cover toxic, physical, reactive, flammable, explosive, radiation, and biological hazards, as well as any other potential hazards posed by the chemicals.

(c) For a variety of physical and chemical reasons, reaction scale-ups pose special risks, which merit additional prior review and precautions.

(d) Select appropriate controls to minimize risk, including use of engineering controls, administrative controls, and personal protective equipment (PPE) to protect workers from hazards. The controls must ensure that OSHA's Permissible Exposure Limits (PELs) are not exceeded. Prepare for contingencies and be aware of the institutional procedures in the event of emergencies and accidents.

One sample approach to risk assessment is to answer these five questions:

(a) What are the hazards?

(b) What is the worst thing that could happen?

(c) What can be done to prevent this from happening?

(d) What can be done to protect from these hazards?

(e) What should be done if something goes wrong?

2. Avoid Underestimation of Risk

Even for substances of no known significant hazard, exposure should be minimized; when working with substances that present special hazards, special precautions should be taken. Reference should be made to the safety data sheet (SDS) that is provided for each chemical. Unless otherwise known, one should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

Determine the physical and health hazards associated with chemicals before working with them. This determination may involve consulting literature references, laboratory chemical safety summaries (LCSSs), SDSs, or other reference materials. Consider how the chemicals will be processed and determine whether the changing states or forms will change the nature of the hazard. Review your plan, operating limits, chemical evaluations and detailed risk assessment with other chemists, especially those with experience with similar materials and protocols.

Before working with chemicals, know your facility's policies and procedures for how to handle an accidental spill or fire. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone.

3. Adhere to the Hierarchy of Controls

The hierarchy of controls prioritizes intervention strategies based on the premise that the best way to control a hazard is to systematically remove it from the workplace, rather than relying on employees to reduce their exposure. The types of measures that may be used to protect employees (listed from most effective to least effective) are: engineering controls, administrative controls, work practices, and PPE. Engineering controls, such as chemical hoods, physically separate the employee from the hazard. Administrative controls, such as employee scheduling, are established by management to help minimize the employees' exposure time to hazardous chemicals. Work practice controls are tasks that are performed in a designated way to minimize or eliminate hazards. Personal protective equipment and apparel are additional protection provided under special circumstances and when exposure is unavoidable.

Face and eye protection is necessary to prevent ingestion and skin absorption of hazardous chemicals. At a minimum, safety glasses, with side shields, should be used for all laboratory work. Chemical splash goggles are more appropriate than regular safety glasses to protect against hazards such as projectiles, as well as when working with glassware under reduced or elevated pressures (e.g., sealed tube reactions), when handling potentially explosive compounds (particularly during distillations), and when using glassware in high-temperature operations. Do not allow laboratory chemicals to come in contact

with skin. Select gloves carefully to ensure that they are impervious to the chemicals being used and are of correct thickness to allow reasonable dexterity while also ensuring adequate barrier protection.

Lab coats and gloves should be worn when working with hazardous materials in a laboratory. Wear closed-toe shoes and long pants or other clothing that covers the legs when in a laboratory where hazardous chemicals are used. Additional protective clothing should be used when there is significant potential for skin-contact exposure to chemicals. The protective characteristics of this clothing must be matched to the hazard. Never wear gloves or laboratory coats outside the laboratory or into areas where food is stored and consumed.

4. Provide Laboratory Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by the use of hoods and other ventilation devices. To determine the best choice for laboratory ventilation using engineering controls for personal protection, employers are referred to Table 9.3 of the 2011 edition of "Prudent Practices." Laboratory chemical hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals.

(a) Toxic or corrosive chemicals that require vented storage should be stored in vented cabinets instead of in a chemical hood.

(b) Chemical waste should not be disposed of by evaporation in a chemical hood.

(c) Keep chemical hood areas clean and free of debris at all times.

(d) Solid objects and materials, such as paper, should be prevented from entering the exhaust ducts as they can reduce the air flow.

(e) Chemical hoods should be maintained, monitored and routinely tested for proper performance.

A laboratory ventilation system should include the following characteristics and practices:

(a) Heating and cooling should be adequate for the comfort of workers and operation of equipment. Before modification of any building HVAC, the impact on laboratory or hood ventilation should be considered, as well as how laboratory ventilation changes may affect the building HVAC.

(b) A negative pressure differential should exist between the amount of air exhausted from the laboratory and the amount supplied to the laboratory to prevent uncontrolled chemical vapors from leaving the laboratory.

(c) Local exhaust ventilation devices should be appropriate to the materials and operations in the laboratory.

(d) The air in chemical laboratories should be continuously replaced so that concentrations of odoriferous or toxic substances do not increase during the workday.

(e) Laboratory air should not be recirculated but exhausted directly outdoors.

(f) Air pressure should be negative with respect to the rest of the building. Local capture equipment and systems should be designed only by an experienced engineer or industrial hygienist.

(g) Ventilation systems should be inspected and maintained on a regular basis. There should be no areas where air remains static or areas that have unusually high airflow velocities.

Before work begins, laboratory workers should be provided with proper training that includes how to use the ventilation equipment, how to ensure that it is functioning properly, the consequences of improper use, what to do in the event of a system failure or power outage, special considerations, and the importance of signage and postings.

5. Institute a Chemical Hygiene Program

A comprehensive chemical hygiene program is required. It should be designed to minimize exposures, injuries, illnesses and incidents. There should be a regular, continuing effort that includes program oversight, safe facilities, chemical hygiene planning, training, emergency preparedness and chemical security. The chemical hygiene program must be reviewed annually and updated as necessary whenever new processes, chemicals, or equipment is implemented. Its recommendations should be followed in all laboratories.

6. Observe the PELs and TLVs

OSHA's Permissible Exposure Limits (PELs) must not be exceeded. The American Conference of Governmental Industrial Hygienists' Threshold Limit Values (TLVs) should also not be exceeded.

B. Responsibilities

Persons responsible for chemical hygiene include, but are not limited to, the following:

1. Chemical Hygiene Officer

(a) Establishes, maintains, and revises the chemical hygiene plan (CHP).

(b) Creates and revises safety rules and regulations.

(c) Monitors procurement, use, storage, and disposal of chemicals.

(d) Conducts regular inspections of the laboratories, preparations rooms, and chemical storage rooms, and submits detailed laboratory inspection reports to administration.

(e) Maintains inspection, personnel training, and inventory records.

(f) Assists laboratory supervisors in developing and maintaining adequate facilities.

(g) Seeks ways to improve the chemical hygiene program.

2. Department Chairperson or Director

(a) Assumes responsibility for personnel engaged in the laboratory use of hazardous chemicals.

(b) Provides the chemical hygiene officer (CHO) with the support necessary to implement and maintain the CHP.

(c) After receipt of laboratory inspection report from the CHO, meets with laboratory supervisors to discuss cited violations and to ensure timely actions to protect trained laboratory personnel and

facilities and to ensure that the department remains in compliance with all applicable federal, state, university, local and departmental codes and regulations.

(d) Provides budgetary arrangements to ensure the health and safety of the departmental personnel, visitors, and students.

3. Departmental Safety Committee reviews accident reports and makes appropriate recommendations to the department chairperson regarding proposed changes in the laboratory procedures.

4. Laboratory Supervisor or Principal Investigator has overall responsibility for chemical hygiene in the laboratory, including responsibility to:

(a) Ensure that laboratory personnel comply with the departmental CHP and do not operate equipment or handle hazardous chemicals without proper training and authorization.

(b) Always wear personal protective equipment (PPE) that is compatible to the degree of hazard of the chemical.

(c) Follow all pertinent safety rules when working in the laboratory to set an example.

(d) Review laboratory procedures for potential safety problems before assigning to other laboratory personnel.

(e) Ensure that visitors follow the laboratory rules and assumes responsibility for laboratory visitors.

(f) Ensure that PPE is available and properly used by each laboratory employee and visitor.

(g) Maintain and implement safe laboratory practices.

(h) Provide regular, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment;

(i) Monitor the facilities and the chemical fume hoods to ensure that they are maintained and function properly. Contact the appropriate person, as designated by the department chairperson, to report problems with the facilities or the chemical fume hoods.

5. Laboratory Personnel

(a) Read, understand, and follow all safety rules and regulations that apply to the work area;

(b) Plan and conduct each operation in accordance with the institutional chemical hygiene procedures;

(c) Promote good housekeeping practices in the laboratory or work area.

(d) Notify the supervisor of any hazardous conditions or unsafe work practices in the work area.

(e) Use PPE as appropriate for each procedure that involves hazardous chemicals.

C. The Laboratory Facility

General Laboratory Design Considerations

Wet chemical spaces and those with a higher degree of hazard should be separated from other spaces by a wall or protective barrier wherever possible. If the areas cannot be separated, then workers in lower hazard spaces may require additional protection from the hazards in connected spaces.

1. Laboratory Layout and Furnishing

(a) Work surfaces should be chemically resistant, smooth, and easy to clean.

(b) Hand washing sinks for hazardous materials may require elbow, foot, or electronic controls for safe operation.

(c) Wet laboratory areas should have chemically resistant, impermeable, slip-resistant flooring.

(d) Walls should be finished with a material that is easy to clean and maintain.

(e) Doors should have view panels to prevent accidents and should open in the direction of egress.

(f) Operable windows should not be present in laboratories, particularly if there are chemical hoods or other local ventilation systems present.

2. Safety Equipment and Utilities

(a) An adequate number and placement of safety showers, eyewash units, and fire extinguishers should be provided for the laboratory.

(b) Use of water sprinkler systems is resisted by some laboratories because of the presence of electrical equipment or water-reactive materials, but it is still generally safer to have sprinkler systems installed. A fire large enough to trigger the sprinkler system would have the potential to cause far more destruction than the local water damage.

D. Chemical Hygiene Plan (CHP)

The OSHA Laboratory standard defines a CHP as "a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace." (29 CFR 1910.1450(b)). The Laboratory Standard requires a CHP: "Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan." (29 CFR 1910.1450(e)(1)). The CHP is the foundation of the laboratory safety program and must be reviewed and updated, as needed, and at least on an annual basis to reflect changes in policies and personnel. A CHP should be facility specific and can assist in promoting a culture of safety to protect workers from exposure to hazardous materials.

1. The Laboratory's CHP must be readily available to workers and capable of protecting workers from health hazards and minimizing exposure. Include the following topics in the CHP:

(a) Individual chemical hygiene responsibilities;

(b) Standard operating procedures;

(c) Personal protective equipment, engineering controls and apparel;

(d) Laboratory equipment;

(e) Safety equipment;

(f) Chemical management;

(g) Housekeeping;

(h) Emergency procedures for accidents and spills;

(i) Chemical waste;

(j) Training;

(k) Safety rules and regulations;

(l) Laboratory design and ventilation;

(m) Exposure monitoring;

(n) Compressed gas safety;

(o) Medical consultation and examination.

It should be noted that the nature of laboratory work may necessitate addressing biological safety, radiation safety and security issues.

2. Chemical Procurement, Distribution, and Storage

Prudent chemical management includes the following processes:

Chemical Procurement:

(a) Information on proper handling, storage, and disposal should be known to those who will be involved before a substance is received.

(b) Only containers with adequate identifying labels should be accepted.

(c) Ideally, a central location should be used for receiving all chemical shipments.

(d) Shipments with breakage or leakage should be refused or opened in a chemical hood.

(e) Only the minimum amount of the chemical needed to perform the planned work should be ordered.

(f) Purchases of high risk chemicals should be reviewed and approved by the CHO.

(g) Proper protective equipment and handling and storage procedures should be in place before receiving a shipment.

Chemical Storage:

(a) Chemicals should be separated and stored according to hazard category and compatibility.

(b) SDS and label information should be followed for storage requirements.

(c) Maintain existing labels on incoming containers of chemicals and other materials.

(d) Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings.

(e) The contents of all other chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, should be properly identified.

(f) Chemical shipments should be dated upon receipt and stock rotated.

(g) Peroxide formers should be dated upon receipt, again dated upon opening, and stored away from heat and light with tight-fitting, nonmetal lids.

(h) Open shelves used for chemical storage should be secured to the wall and contain ¾ -inch lips. Secondary containment devices should be used as necessary.

(i) Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal.

(j) Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident.

(k) Chemicals should not be stored in the chemical hood, on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight.

(l) Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage. Do not store food or beverages in the laboratory refrigerator.

(m) Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose.

(n) Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents.

(o) Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.

Chemical Handling:

(a) As described above, a risk assessment should be conducted prior to beginning work with any hazardous chemical for the first time.

(b) All SDS and label information should be read before using a chemical for the first time.

(c) Trained laboratory workers should ensure that proper engineering controls (ventilation) and PPE are in place.

Chemical Inventory:

(a) Prudent management of chemicals in any laboratory is greatly facilitated by keeping an accurate inventory of the chemicals stored.

(b) Unneeded items should be discarded or returned to the storeroom.

Transporting Chemicals:

(a) Secondary containment devices should be used when transporting chemicals.

(b) When transporting chemicals outside of the laboratory or between stockrooms and laboratories, the transport container should be break-resistant.

(c) High-traffic areas should be avoided.

Transferring Chemicals:

(a) Use adequate ventilation (such as a fume hood) when transferring even a small amount of a particularly hazardous substance (PHS).

(b) While drum storage is not appropriate for laboratories, chemical stockrooms may purchase drum quantities of solvents used in high volumes. Ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup.

(c) If chemicals from commercial sources are repackaged into transfer vessels, the new containers should be labeled with all essential information on the original container.

Shipping Chemicals: Outgoing chemical shipments must meet all applicable Department of Transportation (DOT) regulations and should be authorized and handled by the institutional shipper.

3. Waste Management

A waste management plan should be in place before work begins on any laboratory activity. The plan should utilize the following hierarchy of practices:

(a) Reduce waste sources. The best approach to minimize waste generation is by reducing the scale of operations, reducing its formation during operations, and, if possible, substituting less hazardous chemicals for a particular operation.

(b) Reuse surplus materials. Only the amount of material necessary for an experiment should be purchased, and, if possible, materials should be reused.

(c) Recycle waste. If waste cannot be prevented or minimized, the organization should consider recycling chemicals that can be safely recovered or used as fuel.

(d) Dispose of waste properly. Sink disposal may not be appropriate. Proper waste disposal methods include incineration, treatment, and land disposal. The organization's environmental health and safety (EHS) office should be consulted in determining which methods are appropriate for different types of waste.

Collection and Storage of Waste:

(a) Chemical waste should be accumulated at or near the point of generation, under the control of laboratory workers.

(b) Each waste type should be stored in a compatible container pending transfer or disposal. Waste containers should be clearly labeled and kept sealed when not in use.

(c) Incompatible waste types should be kept separate to ensure that heat generation, gas evolution, or another reaction does not occur.

(d) Waste containers should be segregated by how they will be managed. Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types.

(e) Waste containers should be clearly labeled and kept sealed when not in use. Labels should include the accumulation start date and hazard warnings as appropriate.

(f) Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers should be used in the central waste accumulation area to minimize fire and explosion hazards. Fire suppression systems, specialized ventilation systems, and dikes should be installed in the central waste accumulation area. Waste management workers should be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained laboratory workers most familiar with the waste should be actively involved in waste management decisions to ensure that the waste is managed safely and efficiently. Engineering controls should be implemented as necessary, and personal protective equipment should be worn by workers involved in waste management.

4. Inspection Program

Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in the design of a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed.

Types of inspections: The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EHS inspections, and inspections by external entities.

Elements of an inspection:

(a) Inspectors should bring a checklist to ensure that all issues are covered and a camera to document issues that require correction.

(b) Conversations with workers should occur during the inspection, as they can provide valuable information and allow inspectors an opportunity to show workers how to fix problems.

(c) Issues resolved during the inspection should be noted.

(d) An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers.

(e) Management should follow-up on the inspection to ensure that all corrections are implemented.

5. Medical Consultation and Examination

The employer must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory. If an employee encounters a spill, leak,

explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee must be provided an opportunity for a medical consultation by a licensed physician. All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place. The identity of the hazardous chemical, a description of the incident, and any signs and symptoms that the employee may experience must be relayed to the physician.

6. Records

All accident, fatality, illness, injury, and medical records and exposure monitoring records must be retained by the institution in accordance with the requirements of state and federal regulations (see 29 CFR part 1904 and §1910.1450(j)). Any exposure monitoring results must be provided to affected laboratory staff within 15 working days after receipt of the results (29 CFR 1910.1450(d)(4)).

7. Signs

Prominent signs of the following types should be posted:

(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers;

(b) Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits; and

(c) Warnings at areas or equipment where special or unusual hazards exist.

8. Spills and Accidents

Before beginning an experiment, know your facility's policies and procedures for how to handle an accidental release of a hazardous substance, a spill or a fire. Emergency response planning and training are especially important when working with highly toxic compounds. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone. Know who to notify in the event of an emergency. Be prepared to provide basic emergency treatment. Keep your co-workers informed of your activities so they can respond appropriately. Safety equipment, including spill control kits, safety shields, fire safety equipment, PPE, safety showers and eyewash units, and emergency equipment should be available in well-marked highly visible locations in all chemical laboratories. The laboratory supervisor or CHO is responsible for ensuring that all personnel are aware of the locations of fire extinguishers and are trained in their use. After an extinguisher has been used, designated personnel must promptly recharge or replace it (29 CFR 1910.157(c)(4)). The laboratory supervisor or CHO is also responsible for ensuring proper training and providing supplementary equipment as needed.

Special care must be used when handling solutions of chemicals in syringes with needles. Do not recap needles, especially when they have been in contact with chemicals. Remove the needle and discard it immediately after use in the appropriate sharps containers. Blunt-tip needles are available from a number of commercial sources and should be used unless a sharp needle is required to puncture rubber septa or for subcutaneous injection.

For unattended operations, laboratory lights should be left on, and signs should be posted to identify the nature of the experiment and the hazardous substances in use. Arrangements should be made, if possible, for other workers to periodically inspect the operation. Information should be clearly posted indicating who to contact in the event of an emergency. Depending on the nature of the hazard, special rules, precautions, and alert systems may be necessary.

9. Training and Information

Personnel training at all levels within the organization, is essential. Responsibility and accountability throughout the organization are key elements in a strong safety and health program. The employer is required to provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area (29 CFR 1910.1450(f)). This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training should be determined by the employer. At a minimum, laboratory personnel should be trained on their facility's specific CHP, methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released), the physical and health hazards of chemicals in the work area and means to protect themselves from these hazards. Trained laboratory personnel must know shut-off procedures in case of an emergency. All SDSs must be made available to the employees.

E. General Procedures for Working With Chemicals

The risk of laboratory injuries can be reduced through adequate training, improved engineering, good housekeeping, safe work practice and personal behavior.

1. General Rules for Laboratory Work With Chemicals

(a) Assigned work schedules should be followed unless a deviation is authorized by the laboratory supervisor.

(b) Unauthorized experiments should not be performed.

(c) Plan safety procedures before beginning any operation.

(d) Follow standard operating procedures at all times.

(e) Always read the SDS and label before using a chemical.

(f) Wear appropriate PPE at all times.

(g) To protect your skin from splashes, spills and drips, always wear long pants and closed-toe shoes.

(h) Use appropriate ventilation when working with hazardous chemicals.

(i) Pipetting should never be done by mouth.

(j) Hands should be washed with soap and water immediately after working with any laboratory chemicals, even if gloves have been worn.

(k) Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used or stored should be strictly prohibited.

(l) Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are handled or stored.

(m) Laboratory refrigerators, ice chests, cold rooms, and ovens should not be used for food storage or preparation.

(n) Contact the laboratory supervisor, Principal Investigator, CHO or EHS office with all safety questions or concerns.

(o) Know the location and proper use of safety equipment.

(p) Maintain situational awareness.

(q) Make others aware of special hazards associated with your work.

(r) Notify supervisors of chemical sensitivities or allergies.

(s) Report all injuries, accidents, incidents, and near misses.

(t) Unauthorized persons should not be allowed in the laboratory.

(u) Report unsafe conditions to the laboratory supervisor or CHO.

(v) Properly dispose of chemical wastes.

Working Alone in the Laboratory

Working alone in a laboratory is dangerous and should be strictly avoided. There have been many tragic accidents that illustrate this danger. Accidents are unexpected by definition, which is why coworkers should always be present. Workers should coordinate schedules to avoid working alone.

Housekeeping

Housekeeping can help reduce or eliminate a number of laboratory hazards. Proper housekeeping includes appropriate labeling and storage of chemicals, safe and regular cleaning of the facility, and proper arrangement of laboratory equipment.

2. Nanoparticles and Nanomaterials

Nanoparticles and nanomaterials have different reactivities and interactions with biological systems than bulk materials, and understanding and exploiting these differences is an active area of research. However, these differences also mean that the risks and hazards associated with exposure to engineered nanomaterials are not well known. Because this is an area of ongoing research, consult trusted sources for the most up to date information available. Note that the higher reactivity of many nanoscale materials suggests that they should be treated as potential sources of ignition, accelerants, and fuel that could result in fire or explosion. Easily dispersed dry nanomaterials may pose the greatest health hazard because of the risk of inhalation. Operations involving these nanomaterials deserve more attention and more stringent controls than those where the nanomaterials are embedded in solid or suspended in liquid matrixes.

Consideration should be given to all possible routes of exposure to nanomaterials including inhalation, ingestion, injection, and dermal contact (including eye and mucous membranes). Avoid handling nanomaterials in the open air in a free-particle state. Whenever possible, handle and store dispersible nanomaterials, whether suspended in liquids or in a dry particle form, in closed (tightly-sealed) containers. Unless cutting or grinding occurs, nanomaterials that are not in a free form (encapsulated in a solid or a nanocomposite) typically will not require engineering controls. If a synthesis is being performed to create nanomaterials, it is not enough to only consider the final material in the risk assessment, but consider the hazardous properties of the precursor materials as well.

To minimize laboratory personnel exposure, conduct any work that could generate engineered nanoparticles in an enclosure that operates at a negative pressure differential compared to the laboratory personnel breathing zone. Limited data exist regarding the efficacy of PPE and ventilation systems against exposure to nanoparticles. However, until further information is available, it is prudent to follow standard chemical hygiene practices. Conduct a hazard evaluation to determine PPE appropriate for the level of hazard according to the requirements set forth in OSHA's Personal Protective Equipment standard (29 CFR 1910.132).

3. Highly Toxic and Explosive/Reactive Chemicals/Materials

The use of highly toxic and explosive/reactive chemicals and materials has been an area of growing concern. The frequency of academic laboratory incidents in the U.S. is an area of significant concern for the Chemical Safety Board (CSB). The CSB issued a case study on an explosion at Texas Tech University in Lubbock, Texas, which severely injured a graduate student handling a high-energy metal compound. Since 2001, the CSB has gathered preliminary information on 120 different university laboratory incidents that resulted in 87 evacuations, 96 injuries, and three deaths.

It is recommended that each facility keep a detailed inventory of highly toxic chemicals and explosive/reactive materials. There should be a record of the date of receipt, amount, location, and responsible individual for all acquisitions, syntheses, and disposal of these chemicals. A physical inventory should be performed annually to verify active inventory records. There should be a procedure in place to report security breaches, inventory discrepancies, losses, diversions, or suspected thefts.

Procedures for disposal of highly toxic materials should be established before any experiments begin, possibly even before the chemicals are ordered. The procedures should address methods for decontamination of any laboratory equipment that comes into contact with highly toxic chemicals. All waste should be accumulated in clearly labeled impervious containers that are stored in unbreakable secondary containment.

Highly reactive and explosive materials that may be used in the laboratory require appropriate procedures and training. An explosion can occur when a material undergoes a rapid reaction that results in a violent release of energy. Such reactions can happen spontaneously and can produce pressures, gases, and fumes that are hazardous. Some reagents pose a risk on contact with the atmosphere. It is prudent laboratory practice to use a safer alternative whenever possible.

If at all possible, substitutes for highly acute, chronic, explosive, or reactive chemicals should be considered prior to beginning work and used whenever possible.

4. Compressed Gas

Compressed gases expose laboratory personnel to both chemical and physical hazards. It is essential that these are monitored for leaks and have the proper labeling. By monitoring compressed gas inventories and disposing of or returning gases for which there is no immediate need, the laboratory can substantially reduce these risks. Leaking gas cylinders can cause serious hazards that may require an immediate evacuation of the area and activation of the emergency response system. Only appropriately trained hazmat responders may respond to stop a leaking gas cylinder under this situation.

F. Safety Recommendations—Physical Hazards

Physical hazards in the laboratory include combustible liquids, compressed gases, reactives, explosives and flammable chemicals, as well as high pressure/energy procedures, sharp objects and moving equipment. Injuries can result from bodily contact with rotating or moving objects, including mechanical equipment, parts, and devices. Personnel should not wear loose-fitting clothing, jewelry, or unrestrained long hair around machinery with moving parts.

The Chemical Safety Board has identified the following key lessons for laboratories that address both physical and other hazards:

(1) Ensure that research-specific hazards are evaluated and then controlled by developing specific written protocols and training.

(2) Expand existing laboratory safety plans to ensure that all safety hazards, including physical hazards of chemicals, are addressed.

(3) Ensure that the organization's EHS office reports directly to an identified individual/office with organizational authority to implement safety improvements.

(4) Develop a verification program that ensures that the safety provisions of the CHP are communicated, followed, and enforced at all levels within the organization.

(5) Document and communicate all laboratory near-misses and previous incidents to track safety, provide opportunities for education and improvement to drive safety changes at the university.

(6) Manage the hazards unique to laboratory chemical research in the academic environment. Utilize available practice guidance that identifies and describes methodologies to assess and control hazards.

(7) Written safety protocols and training are necessary to manage laboratory risk.

G. Emergency Planning

In addition to laboratory safety issues, laboratory personnel should be familiar with established facility policies and procedures regarding emergency situations. Topics may include, but are not limited to:

(1) Evacuation procedures—when it is appropriate and alternate routes;

(2) Emergency shutdown procedures—equipment shutdown and materials that should be stored safely;

(3) Communications during an emergency—what to expect, how to report, where to call or look for information;

(4) How and when to use a fire extinguisher;

(5) Security issues—preventing tailgating and unauthorized access;

(6) Protocol for absences due to travel restrictions or illness;

(7) Safe practices for power outage;

(8) Shelter in place—when it is appropriate;

(9) Handling suspicious mail or phone calls;

(10) Laboratory-specific protocols relating to emergency planning and response;

(11) Handling violent behavior in the workplace; and

(12) First-aid and CPR training, including automated external defibrillator training if available.

It is prudent that laboratory personnel are also trained in how to respond to short-term, long-term and large-scale emergencies. Laboratory security can play a role in reducing the likelihood of some emergencies and assisting in preparation and response for others. Every institution, department, and individual laboratory should consider having an emergency preparedness plan. The level of detail of the plan will vary depending on the function of the group and institutional planning efforts already in place.

Emergency planning is a dynamic process. As personnel, operations, and events change, plans will need to be updated and modified. To determine the type and level of emergency planning needed, laboratory personnel need to perform a vulnerability assessment. Periodic drills to assist in training and evaluation of the emergency plan are recommended as part of the training program.

H. Emergency Procedures

(1) Fire alarm policy. Most organizations use fire alarms whenever a building needs to be evacuated—for any reason. When a fire alarm sounds in the facility, evacuate immediately after extinguishing all equipment flames. Check on and assist others who may require help evacuating.

(2) Emergency safety equipment. The following safety elements should be met:

a. A written emergency action plan has been provided to workers;

b. Fire extinguishers, eyewash units, and safety showers are available and tested on a regular basis; and

c. Fire blankets, first-aid equipment, fire alarms, and telephones are available and accessible.

(3) Chemical spills. Workers should contact the CHO or EHS office for instructions before cleaning up a chemical spill. All SDS and label instructions should be followed, and appropriate PPE should be worn during spill cleanup.

(4) Accident procedures. In the event of an accident, immediately notify appropriate personnel and local emergency responders. Provide an SDS of any chemical involved to the attending physician. Complete an accident report and submit it to the appropriate office or individual within 24 hours.

(5) Employee safety training program. New workers should attend safety training before they begin any activities. Additional training should be provided when they advance in their duties or are required to

perform a task for the first time. Training documents should be recorded and maintained. Training should include hands-on instruction of how to use safety equipment appropriately.

(6) Conduct drills. Practice building evacuations, including the use of alternate routes. Practice shelter-in-place, including plans for extended stays. Walk the fastest route from your work area to the nearest fire alarm, emergency eye wash and emergency shower. Learn how each is activated. In the excitement of an actual emergency, people rely on what they learned from drills, practice and training.

(7) Contingency plans. All laboratories should have long-term contingency plans in place (e.g., for pandemics). Scheduling, workload, utilities and alternate work sites may need to be considered.

I. Laboratory Security

Laboratory security has evolved in the past decade, reducing the likelihood of some emergencies and assisting in preparation and response for others. Most security measures are based on the laboratory's vulnerability. Risks to laboratory security include, but are not limited to:

(1) Theft or diversion of chemicals, biologicals, and radioactive or proprietary materials, mission-critical or high-value equipment;

(2) Threats from activist groups;

(3) Intentional release of, or exposure to, hazardous materials;

(4) Sabotage or vandalism of chemicals or high-value equipment;

(5) Loss or release of sensitive information; and

(6) Rogue work or unauthorized laboratory experimentation. Security systems in the laboratory are used to detect and respond to a security breach, or a potential security breach, as well as to delay criminal activity by imposing multiple layered barriers of increasing stringency. A good laboratory security system will increase overall safety for laboratory personnel and the public, improve emergency preparedness by assisting with preplanning, and lower the organization's liability by incorporating more rigorous planning, staffing, training, and command systems and implementing emergency communications protocols, drills, background checks, card access systems, video surveillance, and other measures. The security plan should clearly delineate response to security issues, including the coordination of institution and laboratory personnel with both internal and external responders.

Appendix B – Laboratory Inspection Sheet

SUNY BUFFALO STATE
LABORATORY INSPECTION CHECKLIST

Laboratory: _____ Date_____

Inspector: _____

Laboratory Inspection Checklist	Yes	No	N/A
Fume Hoods/Ventilation			
1. Fume hoods in operation			
2. All velometers operational			
3. Are fume hood flows checked annually			
4. Lab maintaining negative pressure			
5. Local exhaust is provided for slot hoods, canopy hoods, biological hoods, autoclaves, atomic absorption units, safety cabinets, etc.			
6. Hoods valves (water, gas, compressed air) are working properly			
Electrical			
7. Electrical circuit boxes clear for 36" marked and labeled			
8. Ground fault circuit interrupters on outlets near sources of water			
9. Equipment grounded			
10. Heat generating devices (water baths, refrigerators, etc.) plugged directly into outlets			
11. Electrical cords free of visible defects (no bare wires, frayed wires)			
12. Prongs tight in outlet			
13. Receptacles in good condition (no cracks or chips present, faceplates in place)			
14. Local emergency utility shutoffs labeled and operating			
15. Are extension cords being used			
PPE			
16. Proper PPE readily available, clean and functional (gloves, goggles, safety glasses, etc)			
17. Applicable PPE worn by all personnel in lab			
Chemicals In Use/Storage			
18. All chemicals labeled properly with name			

	Yes	No	N/A
19. Chemical storage neat and orderly			
20. The inventory of chemicals has been updated in the last year			
21. The inventory list can be found in another location in the event of emergency Where?			
22. MSDS's available for all chemicals in the lab, Where?			
23. Chemicals are stored in proper containers			
24. Chemicals are stored according to compatibility (not alphabetically)			
25. Acids are stored separately from bases			
26. Acids are stored away from flammable material			
27. Oxidizing materials are stored in a Safety Cabinet			
28. Flammable liquids are properly stored			
29. Explosion-proof refrigerators/flammable storage cabinets are used for flammable storage			
30. Unused lecture bottles are returned to the manufacturer within one year			
31. All cancer suspect agents are so labeled			
32. Peroxide compounds are dated when received and opened			
33. Peroxide compounds are checked for peroxides or discarded every six months			
34. Large containers of dangerous reagents are not stored in the laboratory, e.g. standard 2.5 liter bottles of concentrated acids			
35. Ridges are along the front edges of shelves to prevent glass reagent bottles from rolling or jarring off			
36. Safety shields are used in front of glassware assemblies that are fragile, subject to heat shock, or contain flammable or explosive chemicals			
37. Dewar flasks & large vacuum vessels are screened, taped, or contained in a metal jacket			
Radioactive Materials			
38. RAM designation room posted on BSC Emergency Notification Sign			
39. RAM postings (Notice to Employees, Emergency Procedures etc.) are in place			
40. RAM and instruments are properly labeled, i.e. "Caution-Radioactive Material"			
41. RAM secured in refrigerator/freezer or fume hood			
Emergency Items			
42. Name of principle investigator and alternate posted on BSC Emergency Notification Sign			
43. Emergency phone numbers listed on BSC Notification Sign			
44. Students are aware of safety/emergency procedures			
45. First Aid kit available			
46. Emergency telephone numbers available by phone (UPD, EH&S, Hazardous Waste, Radiation Safety)			
47. All accidents, even minor ones, are recorded			
48. Chemical Spill Kit available			
49. Radioactive materials spill kit available (if applicable)			

	Yes	No	N/A
Cylinders/Tanks			
50. Cylinders are properly secured to bench or wall			
51. All cylinders are standing upright			
52. Contents of cylinders are clearly labeled			
53. Only those cylinders needed are located in the lab			
54. Empty cylinders are separated from full cylinders and properly labeled			
55. Unused cylinders are capped			
56. Cylinders are not stored by sole entrance to lab			
Hazardous Waste			
57. "Hazardous Wastes" containers are properly labeled with BSC hazardous waste label			
58. Container labels are filled out as waste is collected/waste and accurately described			
59. Waste containers are tightly capped when not in use and bottles are filled to a safe level			
60. Waste is compatible with the container			
61. Secondary containment is provided for waste			
62. Only compatible wastes are being stored next to each other			
63. Incompatible wastes are separated from each other by separate secondary containment			
64. Containers are non-leaking/are clean on the outside			
65. Waste material is not allowed to accumulate on floors, in corners, under shelves & tables			
66. Proper use of sharps and broken glass containers			
67. Unusable or excess stock is turned in as waste or for reissue			
Fire Safety			
68. Fire penetrations (i.e. holes for wiring) properly sealed			
69. Laboratory fire doors in compliance (working properly, unobstructed, normally closed unless magnetically held open)			
70. Fire extinguisher(s) available: Class "A" for wood, paper, cloth and plastic, Class "B" & "C" for electrical and flammable liquid. Class "A", "B", & "C" (dry chemical) for "total" protection in the lab			
71. Sprinklers - 18"minimum clearance maintained and proper heads used			
72. Aisle space in compliance with State Fire Codes			
73. Fire blanket – Location: Sign?			
Housekeeping/General Safety Items			
74. Personnel know the location of the Chemical Hygiene Plan and Hazardous Waste Policies and Procedures			
75. General housekeeping in good order			
76. The sink used to wash laboratory glassware, etc. is not used for washing eating utensils			

	Yes	No	N/A
77. Evidence of improper hazardous waste chemical sink disposal			
78. Smoking, eating or drinking is not done in any lab area			
79. Eye wash station and emergency shower present and operational			
80. All exits marked and free of clutter ; non-exits marked			
81. No slip or trip hazards			
82. Safe work procedures followed			
83. Employees subject to the Bloodborne Pathogen Regulation have attended training			
84. BSC Emergency Notification sign is appropriate to the current laboratory uses (biohazard, corrosive, flammable)			
85. Flexible tubing is in good condition (no cracks, cuts, holes) and tightly secured to equipment			
86. Flexible neoprene tubing used for gas burners in good condition			
87. Biosafety cabinet is certified and labeled within one year			
88. Biosafety cabinets is clear of excessive storage			
89. Emergency gas and electric shutoffs labeled			
90. Lab personnel have attended Laboratory Training Safety			

Comments:

Appendix C – Reproductive Toxins

STATE OF CALIFORNIA ENVIRONMENTAL
PROTECTION AGENCY
OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT
SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986

CHEMICALS KNOWN TO THE STATE TO CAUSE CANCER OR REPRODUCTIVE TOXICITY
January 23, 2015

The Safe Drinking Water and Toxic Enforcement Act of 1986 requires that the Governor revise and republish at least once per year the list of chemicals known to the State to cause cancer or reproductive toxicity. The identification number indicated in the following list is the Chemical Abstracts Service (CAS) Registry Number. No CAS number is given when several substances are presented as a single listing. The date refers to the initial appearance of the chemical on the list. For easy reference, chemicals which are shown underlined are newly added. Chemicals or endpoints shown in strikeout were placed on the Proposition 65 list on the date noted, and have subsequently been removed.

Chemical	Type of Toxicity	CAS No.	Date Listed
A-alpha-C (2-Amino-9H-pyrido [2,3-b]indole)	cancer	26148-68-5	January 1, 1990
Acetaldehyde	cancer	75-07-0	April 1, 1988
Acetamide	cancer	60-35-5	January 1, 1990
Acetazolamide	developmental	59-66-5	August 20, 1999
Acetochlor	cancer	34256-82-1	January 1, 1989
Acetohydroxamic acid	developmental	546-88-3	April 1, 1990
2-Acetylaminofluorene	cancer	53-96-3	July 1, 1987
Acifluorfen sodium	cancer	62476-59-9	January 1, 1990
Acrylamide	cancer	79-06-1	January 1, 1990
Acrylamide	developmental, male	79-06-1	February 25, 2011
Acrylonitrile	cancer	107-13-1	July 1, 1987
Actinomycin D	cancer developmental	50-76-0	October 1, 1989 October 1, 1992
AF-2;[2-(2-furyl)-3-(5-nitro-2-furyl)] acrylamide	cancer	3688-53-7	July 1, 1987
Aflatoxins	cancer	---	January 1, 1988
Alachlor	cancer	15972-60-8	January 1, 1989
Alcoholic beverages, when associated with alcohol abuse	cancer	---	July 1, 1988
Aldrin	cancer	309-00-2	July 1, 1988
All-trans retinoic acid	developmental	302-79-4	January 1, 1989
~~Allyl chloride~~ Delisted October 29, 1999	~~cancer~~	~~107-05-1~~	~~January 1, 1990~~
Alprazolam	developmental	28981-97-7	July 1, 1990
Altretamine	developmental, male	645-05-6	August 20, 1999
Amantadine hydrochloride	developmental	665-66-7	February 27, 2001
Amikacin sulfate	developmental	39831-55-5	July 1, 1990
2-Aminoanthraquinone	cancer	117-79-3	October 1, 1989
p-Aminoazobenzene	cancer	60-09-3	January 1, 1990
o-Aminoazotoluene	cancer	97-56-3	July 1, 1987

4-Aminobiphenyl (4-amino-diphenyl)	cancer	92-67-1	February 27, 1987
1-Amino-2,4-dibromo-anthraquinone	cancer	81-49-2	August 26, 1997
3-Amino-9-ethylcarbazole hydrochloride	cancer	6109-97-3	July 1, 1989
2-Aminofluorene	cancer	153-78-6	January 29, 1999
Aminoglutethimide	developmental	125-84-8	July 1, 1990
Aminoglycosides	developmental	---	October 1, 1992
1-Amino-2-methylanthraquinone	cancer	82-28-0	October 1, 1989
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	cancer	712-68-5	July 1, 1987
4-Amino-2-nitrophenol	cancer	119-34-6	January 29, 1999
Aminopterin	developmental, female	54-62-6	July 1, 1987
Amiodarone hydrochloride	developmental, female, male	19774-82-4	August 26, 1997
Amitraz	developmental	33089-61-1	March 30, 1999
Amitrole	cancer	61-82-5	July 1, 1987
Amoxapine	developmental	14028-44-5	May 15, 1998
Amsacrine	cancer	51264-14-3	August 7, 2009
~~tert-Amyl methyl ether~~ Delisted December 13, 2013	~~developmental~~	~~994-05-8~~	~~December 18, 2009~~
Anabolic steroids	female, male	---	April 1, 1990
Analgesic mixtures containing phenacetin	cancer	---	February 27, 1987
Androstenedione	cancer	27208-37-3	May 3, 2011
Angiotensin converting enzyme (ACE) inhibitors	developmental	---	October 1, 1992
Aniline	cancer	62-53-3	January 1, 1990
Aniline hydrochloride	cancer	142-04-1	May 15, 1998
o-Anisidine	cancer	90-04-0	July 1, 1987
o-Anisidine hydrochloride	cancer	134-29-2	July 1, 1987
Anisindione	developmental	117-37-3	October 1, 1992
Anthraquinone	cancer	84-65-1	September 28, 2007
Antimony oxide (Antimony trioxide)	cancer	1309-64-4	October 1, 1990
Aramite	cancer	140-57-8	July 1, 1987
Areca nut	cancer	---	February 3, 2006
Aristolochic acids	cancer	---	July 9, 2004
Arsenic (inorganic arsenic compounds)	cancer	--	February 27, 1987
Arsenic (inorganic oxides)	developmental	---	May 1, 1997
Asbestos	cancer	1332-21-4	February 27, 1987
Aspirin (NOTE: It is especially important not to use aspirin during the last three months of pregnancy, unless specifically directed to do so by a physician because it may cause problems in the unborn child or complications during delivery.)	developmental, female	50-78-2	July 1, 1990
Atenolol	developmental	29122-68-7	August 26, 1997
Auramine	cancer	492-80-8	July 1, 1987

Auranofin	developmental	34031-32-8	January 29, 1999
Avermectin B1 (Abamectin)	developmental	71751-41-2	December 3, 2010
Azacitidine	cancer	320-67-2	January 1, 1992
Azaserine	cancer	115-02-6	July 1, 1987
Azathioprine	cancer	446-86-6	February 27, 1987
Azathioprine	developmental	446-86-6	September 1, 1996
Azobenzene	cancer	103-33-3	January 1, 1990
Barbiturates	developmental	---	October 1, 1992
Beclomethasone dipropionate	developmental	5534-09-8	May 15, 1998
Benomyl	developmental, male	17804-35-2	July 1, 1991
Benthiavalicarb-isopropyl	cancer	177406-68-7	July 1, 2008
Benz[a]anthracene	cancer	56-55-3	July 1, 1987
Benzene	cancer	71-43-2	February 27, 1987
Benzene	developmental, male	71-43-2	December 26, 1997
Benzidine [and its salts]	cancer	92-87-5	February 27, 1987
Benzidine-based dyes	cancer	---	October 1, 1992
Benzodiazepines	developmental	---	October 1, 1992
Benzo[b]fluoranthene	cancer	205-99-2	July 1, 1987
Benzo[j]fluoranthene	cancer	205-82-3	July 1, 1987
Benzo[k]fluoranthene	cancer	207-08-9	July 1, 1987
Benzofuran	cancer	271-89-6	October 1, 1990
Benzophenone	cancer	119-61-9	June 22, 2012
Benzo[a]pyrene	cancer	50-32-8	July 1, 1987
Benzotrichloride	cancer	98-07-7	July 1, 1987
Benzphetamine hydrochloride	developmental	5411-22-3	April 1, 1990
Benzyl chloride	cancer	100-44-7	January 1, 1990
Benzyl violet 4B	cancer	1694-09-3	July 1, 1987
Beryllium and beryllium compounds	cancer	---	October 1, 1987
Betel quid with tobacco	cancer	---	January 1, 1990
Betel quid without tobacco	cancer	---	February 3, 2006
2,2-Bis(bromomethyl)-1,3-propanediol	cancer	3296-90-0	May 1, 1996
Bis(2-chloroethyl)ether	cancer	111-44-4	April 1, 1988
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornapazine)	cancer	494-03-1	February 27, 1987
Bischloroethyl nitrosourea (BCNU) (Carmustine)	cancer	154-93-8	July 1, 1987
Bischloroethyl nitrosourea (BCNU) (Carmustine)	developmental	154-93-8	July 1, 1990
Bis(chloromethyl)ether	cancer	542-88-1	February 27, 1987
Bis(2-chloro-1-methylethyl)ether, technical grade	cancer	---	October 29, 1999
~~Bisphenol A (BPA)~~ Delisted April 19, 2013	~~developmental~~	~~80-05-7~~	~~April 11, 2013~~
Bitumens, extracts of steam-refined and air refined	cancer	---	January 1, 1990
Bracken fern	cancer	---	January 1, 1990
Bromacil lithium salt	developmental	53404-19-6	May 18, 1999
Bromacil lithium salt	male	53404-19-6	January 17, 2003
Bromate	cancer	15541-45-4	May 31, 2002
Bromochloroacetic acid	cancer	5589-96-8	April 6, 2010

Bromodichloromethane	cancer	75-27-4	January 1, 1990
Bromoethane	cancer	74-96-4	December 22, 2000
Bromoform	cancer	75-25-2	April 1, 1991
1-Bromopropane (1-BP)	developmental, female, male	106-94-5	December 7, 2004
2-Bromopropane (2-BP)	female, male	75-26-3	May 31, 2005
Bromoxynil	developmental	1689-84-5	October 1, 1990
Bromoxynil octanoate	developmental	1689-99-2	May 18, 1999
Butabarbital sodium	developmental	143-81-7	October 1, 1992
1,3-Butadiene	cancer	106-99-0	April 1, 1988
1,3-Butadiene	developmental, female, male	106-99-0	April 16, 2004
1,4-Butanediol dimethanesulfonate (Busulfan)	cancer	55-98-1	February 27, 1987
1,4-Butanediol dimethanesulfonate (Busulfan)	developmental	55-98-1	January 1, 1989
Butylated hydroxyanisole	cancer	25013-16-5	January 1, 1990
Butyl benzyl phthalate (BBP)	developmental	85-68-7	December 2, 2005
~~n-Butyl glycidyl ether~~ Delisted April 4, 2014	~~male~~	~~2426-08-6~~	~~August 7, 2009~~
beta-Butyrolactone	cancer	3068-88-0	July 1, 1987
Cacodylic acid	cancer	75-60-5	May 1, 1996
Cadmium	developmental, male	---	May 1, 1997
Cadmium and cadmium compounds	cancer	---	October 1, 1987
Caffeic acid	cancer	331-39-5	October 1, 1994
Captafol	cancer	2425-06-1	October 1, 1988
Captan	cancer	133-06-2	January 1, 1990
Carbamazepine	developmental	298-46-4	January 29, 1999
Carbaryl	cancer	63-25-2	February 5, 2010
Carbaryl	developmental, female, male	63-25-2	August 7, 2009
Carbazole	cancer	86-74-8	May 1, 1996
Carbon black (airborne, unbound particles of respirable size)	cancer	1333-86-4	February 21, 2003
Carbon disulfide	developmental, female, male	75-15-0	July 1, 1989
Carbon monoxide	developmental	630-08-0	July 1, 1989
Carbon tetrachloride	cancer	56-23-5	October 1, 1987
Carbon-black extracts	cancer	---	January 1, 1990
Carboplatin	developmental	41575-94-4	July 1, 1990
N-Carboxymethyl-N-nitrosourea	cancer	60391-92-6	January 25, 2002
Catechol	cancer	120-80-9	July 15, 2003
Ceramic fibers (airborne particles of respirable size)	cancer	---	July 1, 1990
Certain combined chemotherapy for lymphomas	cancer	---	February 27, 1987
Chenodiol	developmental	474-25-9	April 1, 1990
Chloral	cancer	75-87-6	September 13, 2013
Chloral hydrate	cancer	302-17-0	September 13, 2013
Chlorambucil	cancer	305-03-3	February 27, 1987

Chlorambucil	developmental	305-03-3	January 1, 1989
~~Chloramphenicol~~	~~cancer~~	~~56-75-7~~	~~October 1, 1989~~
Delisted January 4, 2013			
Chloramphenicol sodium succinate	cancer	982-57-0	September 27, 2013
Chlorcyclizine hydrochloride	developmental	1620-21-9	July 1, 1987
Chlordane	cancer	57-74-9	July 1, 1988
Chlordecone (Kepone)	cancer	143-50-0	January 1, 1988
Chlordecone (Kepone)	developmental	143-50-0	January 1, 1989
Chlordiazepoxide	developmental	58-25-3	January 1, 1992
Chlordiazepoxide hydrochloride	developmental	438-41-5	January 1, 1992
Chlordimeform	cancer	6164-98-3	January 1, 1989
Chlorendic acid	cancer	115-28-6	July 1, 1989
Chlorinated paraffins (Average chain length, C12; approximately 60 percent chlorine by weight)	cancer	108171-26-2	July 1, 1989
p-Chloroaniline	cancer	106-47-8	October 1, 1994
p-Chloroaniline hydrochloride	cancer	20265-96-7	May 15, 1998
~~Chlorodibromomethane~~	~~cancer~~	~~124-48-1~~	~~January 1, 1990~~
Delisted October 29, 1999			
Chloroethane (Ethyl chloride)	cancer	75-00-3	July 1, 1990
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) (Lomustine)	cancer	13010-47-4	January 1, 1988
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) Lomustine)	developmental	13010-47-4	July 1, 1990
1-(2-Chloroethyl)-3-(4-methyl-cyclohexyl) -1-nitrosourea (Methyl-CCNU)	cancer	13909-09-6	October 1, 1988
Chloroform	cancer	67-66-3	October 1, 1987
Chloroform	developmental	67-66-3	August 7, 2009
Chloromethyl methyl ether (technical grade)	cancer	107-30-2	February 27, 1987
3-Chloro-2-methylpropene	cancer	563-47-3	July 1, 1989
1-Chloro-4-nitrobenzene	cancer	100-00-5	October 29, 1999
4-Chloro-*o*-phenylenediamine	cancer	95-83-0	January 1, 1988
Chloroprene	cancer	126-99-8	June 2, 2000
2-Chloropropionic acid	male	598-78-7	August 7, 2009
Chlorothalonil	cancer	1897-45-6	January 1, 1989
p-Chloro-*o*-toluidine	cancer	95-69-2	January 1, 1990
p-Chloro-*o*-toluidine, strong acid salts of	cancer	---	May 15, 1998
5-Chloro-*o*-toluidine and its strong acid salts	cancer	---	October 24, 1997
Chlorotrianisene	cancer	569-57-3	September 1, 1996
Chlorozotocin	cancer	54749-90-5	January 1, 1992
~~Chlorsulfuron~~	~~developmental, female, male~~	~~64902-72-3~~	~~May 14, 1999~~
Delisted June 6, 2014			
Chromium (hexavalent compounds)	cancer	---	February 27, 1987
Chromium (hexavalent compounds)	developmental, female, male	---	December 19, 2008
Chrysene	cancer	218-01-9	January 1, 1990
C.I. Acid Red 114	cancer	6459-94-5	July 1, 1992
C.I. Basic Red 9 monohydrochloride	cancer	569-61-9	July 1, 1989

C.I. Direct Blue 15	cancer	2429-74-5	August 26, 1997
C.I. Direct Blue 218	cancer	28407-37-6	August 26, 1997
C.I. Disperse Yellow 3	cancer	2832-40-8	February 8, 2013
C.I. Solvent Yellow 14	cancer	842-07-9	May 15, 1998
Ciclosporin (Cyclosporin A; Cyclosporine)	cancer	59865-13-3 79217-60-0	January 1, 1992
Cidofovir	cancer, developmental, female, male	113852-37-2	January 29, 1999
Cinnamyl anthranilate	cancer	87-29-6	July 1, 1989
Cisplatin	cancer	15663-27-1	October 1, 1988
Citrus Red No. 2	cancer	6358-53-8	October 1, 1989
Cladribine	developmental	4291-63-8	September 1, 1996
Clarithromycin	developmental	81103-11-9	May 1, 1997
Clobetasol propionate	developmental, female	25122-46-7	May 15, 1998
Clofibrate	cancer	637-07-0	September 1, 1996
Clomiphene citrate	cancer	50-41-9	May 24, 2013
Clomiphene citrate	developmental	50-41-9	April 1, 1990
Clorazepate dipotassium	developmental	57109-90-7	October 1, 1992
Cobalt metal powder	cancer	7440-48-4	July 1, 1992
Cobalt [II] oxide	cancer	1307-96-6	July 1, 1992
Cobalt sulfate	cancer	10124-43-3	May 20, 2005
Cobalt sulfate heptahydrate	cancer	10026-24-1	June 2, 2000
Cocaine	developmental, female	50-36-2	July 1, 1989
Coconut oil diethanolamine condensate (cocamide diethanolamine)	cancer	---	June 22, 2012
Codeine phosphate	developmental	52-28-8	May 15, 1998
Coke oven emissions	cancer	---	February 27, 1987
Colchicine	developmental, male	64-86-8	October 1, 1992
Conjugated estrogens	cancer	---	February 27, 1987
Conjugated estrogens	developmental	---	April 1, 1990
Creosotes	cancer	---	October 1, 1988
p-Cresidine	cancer	120-71-8	January 1, 1988
Cumene	cancer	98-82-8	April 6, 2010
Cupferron	cancer	135-20-6	January 1, 1988
Cyanazine	developmental	21725-46-2	April 1, 1990
Cycasin	cancer	14901-08-7	January 1, 1988
Cycloate	developmental	1134-23-2	March 19, 1999
~~Cyclohexanol~~ Delisted January 25, 2002	~~male~~	~~108-93-0~~	~~November 6, 1998~~
Cycloheximide	developmental	66-81-9	January 1, 1989
Cyclopenta[cd]pyrene	cancer	27208-37-3	April 29, 2011
Cyclophosphamide (anhydrous)	cancer	50-18-0	February 27, 1987
Cyclophosphamide (anhydrous)	developmental, female, male	50-18-0	January 1, 1989
Cyclophosphamide (hydrated)	cancer	6055-19-2	February 27, 1987
Cyclophosphamide (hydrated)	developmental, female, male	6055-19-2	January 1, 1989
Cyhexatin	developmental	13121-70-5	January 1, 1989
Cytarabine	developmental	147-94-4	January 1, 1989
Cytembena	cancer	21739-91-3	May 15, 1998

D&C Orange No. 17	cancer	3468-63-1	July 1, 1990
D&C Red No. 8	cancer	2092-56-0	October 1, 1990
D&C Red No. 9	cancer	5160-02-1	July 1, 1990
D&C Red No. 19	cancer	81-88-9	July 1, 1990
Dacarbazine	cancer	4342-03-4	January 1, 1988
Dacarbazine	developmental	4342-03-4	January 29, 1999
Daminozide	cancer	1596-84-5	January 1, 1990
Danazol	developmental	17230-88-5	April 1, 1990
Dantron (Chrysazin; 1,8-Dihydroxyanthraquinone)	cancer	117-10-2	January 1, 1992
Daunomycin	cancer	20830-81-3	January 1, 1988
Daunorubicin hydrochloride	developmental	23541-50-6	July 1, 1990
2,4-D butyric acid	developmental, male	94-82-6	June 18, 1999
DDD (Dichlorodiphenyl-dichloroethane)	cancer	72-54-8	January 1, 1989
DDE (Dichlorodi-phenyldichloroethylene)	cancer	72-55-9	January 1, 1989
DDT (Dichlorodi-phenyltrichloroethane)	cancer	50-29-3	October 1 , 1987
o,p'-DDT	developmental, female, male	789-02-6	May 15, 1998
p,p'-DDT	developmental, female, male	50-29-3	May 15, 1998
DDVP (Dichlorvos)	cancer	62-73-7	January 1, 1989
Demeclocycline hydrochloride (internal use)	developmental	64-73-3	January 1, 1992
~~2,4-DP (dichloroprop)~~ Delisted January 25, 2002	~~developmental~~	~~120-36-5~~	~~April 27, 1999~~
N,N'-Diacetylbenzidine	cancer	613-35-4	October 1, 1989
2,4-Diaminoanisole	cancer	615-05-4	October 1, 1990
2,4-Diaminoanisole sulfate	cancer	39156-41-7	January 1, 1988
4,4'-Diaminodiphenyl ether (4,4'-Oxydianiline)	cancer	101-80-4	January 1, 1988
2,4-Diaminotoluene	cancer	95-80-7	January 1, 1988
Diaminotoluene (mixed)	cancer	---	January 1, 1990
Diazepam	developmental	439-14-5	January 1, 1992
Diazoaminobenzene	cancer	136-35-6	May 20, 2005
Diazoxide	developmental	364-98-7	February 27, 2001
Dibenz[a,h]acridine	cancer	226-36-8	January 1, 1988
Dibenz[a,j]acridine	cancer	224-42-0	January 1, 1988
Dibenzanthracenes	cancer	---	December 26, 2014
Dibenz[a,c]anthracene	cancer	215-58-7	December 26, 2014
Dibenz[a,h]anthracene	cancer	53-70-3	January 1, 1988
Dibenz[a,j]anthracene	cancer	224-41-9	December 26, 2014
7H-Dibenzo[c,g]carbazole	cancer	194-59-2	January 1, 1988
Dibenzo[a,e]pyrene	cancer	192-65-4	January 1, 1988
Dibenzo[a,h]pyrene	cancer	189-64-0	January 1, 1988
Dibenzo[a,i]pyrene	cancer	189-55-9	January 1, 1988
Dibenzo[a,l]pyrene	cancer	191-30-0	January 1, 1988
Dibromoacetic acid	cancer	631-64-1	June 17, 2008
Dibromoacetonitrile	cancer	3252-43-5	May 3, 2011
1,2-Dibromo-3-chloropropane (DBCP)	cancer	96-12-8	July 1, 1987

1,2-Dibromo-3-chloropropane (DBCP)	male	96-12-8	February 27, 1987
2,3-Dibromo-1-propanol	cancer	96-13-9	October 1, 1994
Dichloroacetic acid	cancer	79-43-6	May 1, 1996
Dichloroacetic acid	developmental, male	79-43-6	August 7, 2009
p-Dichlorobenzene	cancer	106-46-7	January 1, 1989
3,3'-Dichlorobenzidine	cancer	91-94-1	October 1, 1987
3,3'-Dichlorobenzidine dihydrochloride	cancer	612-83-9	May 15, 1998
1,1-Dichloro-2,2-bis(*p*-chlorophenyl)ethylene (DDE)	developmental, male	72-55-9	March 30, 2010
1,4-Dichloro-2-butene	cancer	764-41-0	January 1, 1990
3,3'-Dichloro-4,4'-diaminodiphenyl ether	cancer	28434-86-8	January 1, 1988
1,1-Dichloroethane	cancer	75-34-3	January 1, 1990
Dichloromethane (Methylene chloride)	cancer	75-09-2	April 1, 1988
Dichlorophene	developmental	97-23-4	April 27, 1999
1,2-Dichloropropane	cancer	78-87-5	January 1, 1990
1,3-Dichloro-2-propanol (1,3-DCP)	cancer	96-23-1	October 8, 2010
1,3-Dichloropropene	cancer	542-75-6	January 1, 1989
Dichlorphenamide	developmental	120-97-8	February 27, 2001
Diclofop-methyl	cancer	51338-27-3	April 6, 2010
Diclofop methyl	developmental	51338-27-3	March 5, 1999
Dicumarol	developmental	66-76-2	October 1, 1992
Dieldrin	cancer	60-57-1	July 1, 1988
~~Dienestrol~~ Delisted January 4, 2013	~~cancer~~	~~84-17-3~~	~~January 1, 1990~~
Diepoxybutane	cancer	1464-53-5	January 1, 1988
Diesel engine exhaust	cancer	---	October 1, 1990
Diethanolamine	cancer	111-42-2	June 22, 2012
Di(2-ethylhexyl)phthalate (DEHP)	cancer	117-81-7	January 1, 1988
Di(2-ethylhexyl)phthalate (DEHP)	developmental, male	117-81-7	October 24, 2003
1,2-Diethylhydrazine	cancer	1615-80-1	January 1, 1988
Diethylstilbestrol (DES)	cancer	56-53-1	February 27, 1987
Diethylstilbestrol (DES)	developmental	56-53-1	July 1, 1987
Diethyl sulfate	cancer	64-67-5	January 1, 1988
Diflunisal	developmental, female	22494-42-4	January 29, 1999
~~Diglycidyl ether~~ Delisted April 4, 2014	~~male~~	~~2238-07-5~~	~~August 7, 2009~~
Diglycidyl resorcinol ether (DGRE)	cancer	101-90-6	July 1, 1989
Dihydroergotamine mesylate	developmental	6190-39-2	May 1, 1997
Dihydrosafrole	cancer	94-58-6	January 1, 1988
Di-isodecyl phthalate (DIDP)	developmental	68515-49-1/ 26761-40-0	April 20, 2007
Diisononyl phthalate (DINP)	cancer	---	December 20, 2013
Diisopropyl sulfate	cancer	2973-10-6	April 1, 1993
Diltiazem hydrochloride	developmental	33286-22-5	February 27, 2001
3,3'-Dimethoxybenzidine (*o*-Dianisidine)	cancer	119-90-4	January 1, 1988
3,3'-Dimethoxybenzidine dihydrochloride (*o*-Dianisidine dihydrochloride)	cancer	20325-40-0	October 1, 1990

3,3'-Dimethoxybenzidine-based dyes metabolized to 3,3'-dimethoxybenzidine	cancer	---	June 11, 2004
N, N-Dimethylacetamide	developmental, male	127-19-5	May 21, 2010
4-Dimethylaminoazobenzene	cancer	60-11-7	January 1, 1988
trans-2-[(Dimethylamino)methyl-imino]-5-[2-(5-nitro-2-furyl)vinyl]-1,3,4-oxadiazole	cancer	55738-54-0	January 1, 1988
7,12-Dimethylbenz(a)anthracene	cancer	57-97-6	January 1, 1990
3,3'-Dimethylbenzidine (ortho-Tolidine)	cancer	119-93-7	January 1, 1988
3,3'-Dimethylbenzidine-based dyes metabolized to 3,3'-dimethylbenzidine	cancer	---	June 11, 2004
3,3'-Dimethylbenzidine dihydrochloride	cancer	612-82-8	April 1, 1992
Dimethylcarbamoyl chloride	cancer	79-44-7	January 1, 1988
1,1-Dimethylhydrazine (UDMH)	cancer	57-14-7	October 1, 1989
1,2-Dimethylhydrazine	cancer	540-73-8	January 1, 1988
2,6-Dimethyl-N-nitrosomorpholine	cancer	1456-28-6	February 8, 2013
Dimethyl sulfate	cancer	77-78-1	January 1, 1988
Dimethylvinylchloride	cancer	513-37-1	July 1, 1989
N,N-Dimethyl-*p*-toluidine	cancer	99-97-8	May 2, 2014
Di-*n*-butyl phthalate (DBP)	developmental, female, male	84-74-2	December 2, 2005
Di-*n*-hexyl phthalate (DnHP)	female, male	84-75-3	December 2, 2005
m-Dinitrobenzene	male	99-65-0	July 1, 1990
o-Dinitrobenzene	male	528-29-0	July 1, 1990
p-Dinitrobenzene	male	100-25-4	July 1, 1990
3,7-Dinitrofluoranthene	cancer	105735-71-5	August 26, 1997
3,9-Dinitrofluoranthene	cancer	22506-53-2	August 26, 1997
1,3-Dinitropyrene	cancer	75321-20-9	November 2, 2012
1,6-Dinitropyrene	cancer	42397-64-8	October 1, 1990
1,8-Dinitropyrene	cancer	42397-65-9	October 1, 1990
Dinitrotoluene (technical grade)	female, male	---	August 20, 1999
Dinitrotoluene mixture, 2,4-/2,6-	cancer	---	May 1, 1996
2,4-Dinitrotoluene	cancer	121-14-2	July 1, 1988
2,4-Dinitrotoluene	male	121-14-2	August 20, 1999
2,6-Dinitrotoluene	cancer	606-20-2	July 1, 1995
2,6-Dinitrotoluene	male	606-20-2	August 20, 1999
Dinocap	developmental	39300-45-3	April 1, 1990
Dinoseb	developmental, male	88-85-7	January 1, 1989
Di-*n*-propyl isocinchomeronate (MGK Repellent 326)	cancer	136-45-8	May 1, 1996
1,4-Dioxane	cancer	123-91-1	January 1, 1988
Diphenylhydantoin (Phenytoin)	cancer	57-41-0	January 1, 1988
Diphenylhydantoin (Phenytoin)	developmental	57-41-0	July 1, 1987
Diphenylhydantoin (Phenytoin), sodium salt	cancer	630-93-3	January 1, 1988
Direct Black 38 (technical grade)	cancer	1937-37-7	January 1, 1988
Direct Blue 6 (technical grade)	cancer	2602-46-2	January 1, 1988
Direct Brown 95 (technical grade)	cancer	16071-86-6	October 1, 1988

Disodium cyanodithioimido-carbonate	developmental	138-93-2	March 30, 1999
Disperse Blue 1	cancer	2475-45-8	October 1, 1990
Diuron	cancer	330-54-1	May 31, 2002
Doxorubicin hydrochloride (Adriamycin)	cancer	25316-40-9	July 1, 1987
Doxorubicin hydrochloride (Adriamycin)	developmental, male	25316-40-9	January 29, 1999
Doxycycline (internal use)	developmental	564-25-0	July 1, 1990
Doxycycline calcium (internal use)	developmental	94088-85-4	January 1, 1992
Doxycycline hyclate (internal use)	developmental	24390-14-5	October 1, 1991
Doxycycline monohydrate (internal use)	developmental	17086-28-1	October 1, 1991
Emissions from combustion of coal	cancer	---	August 7, 2013
Emissions from high-temperature unrefined rapeseed oil	cancer	---	January 3, 2014
Endrin	developmental	72-20-8	May 15, 1998
Environmental tobacco smoke (ETS)	developmental	---	June 9, 2006
Epichlorohydrin	cancer	106-89-8	October 1, 1987
Epichlorohydrin	male	106-89-8	September 1, 1996
Epoxiconazole	cancer	135319-73-2	April 15, 2011
Ergotamine tartrate	developmental	379-79-3	April 1, 1990
Erionite	cancer	12510-42-8/ 66733-21-9	October 1, 1988
Estradiol 17B	cancer	50-28-2	January 1, 1988
Estragole	cancer	140-67-0	October 29, 1999
Estrogens, steroidal	cancer	---	August 19, 2005
Estrogen-progestogen (combined) as menopausal therapy	cancer	---	November 4, 2011
Estrone	cancer	53-16-7	January 1, 1988
Estropipate	cancer, developmental	7280-37-7	August 26, 1997
Ethanol in alcoholic beverages	cancer	---	April 29, 2011
Ethinylestradiol	cancer	57-63-6	January 1, 1988
Ethionamide	developmental	536-33-4	August 26, 1997
Ethoprop	cancer	13194-48-4	February 27, 2001
Ethyl acrylate	cancer	140-88-5	July 1, 1989
Ethyl alcohol in alcoholic beverages	developmental	---	October 1, 1987
Ethylbenzene	cancer	100-41-4	June 11, 2004
~~Ethyl tert-butyl ether~~ Delisted December 13, 2013	~~male~~	~~637-92-3~~	~~December 18, 2009~~
Ethyl dipropylthiocarbamate	developmental	759-94-4	April 27, 1999
Ethyl-4,4'-dichlorobenzilate	cancer	510-15-6	January 1, 1990
Ethylene dibromide	cancer	106-93-4	July 1, 1987
Ethylene dibromide	developmental, male	106-93-4	May 15, 1998
Ethylene dichloride (1,2-Dichloroethane)	cancer	107-06-2	October 1, 1987
Ethylene glycol monoethyl ether	developmental, male	110-80-5	January 1, 1989
Ethylene glycol monoethyl ether acetate	developmental, male	111-15-9	January 1, 1993
Ethylene glycol monomethyl ether	developmental, male	109-86-4	January 1, 1989

Ethylene glycol monomethyl ether acetate	developmental, male	110-49-6	January 1, 1993
Ethyleneimine (Aziridine)	cancer	151-56-4	January 1, 1988
Ethylene oxide	cancer	75-21-8	July 1, 1987
Ethylene oxide	female	75-21-8	February 27, 1987
Ethylene oxide	developmental, male	75-21-8	August 7, 2009
Ethylene thiourea	cancer	96-45-7	January 1, 1988
Ethylene thiourea	developmental	96-45-7	January 1, 1993
~~2-Ethylhexanoic acid~~ Delisted December 13, 2013	~~developmental~~	~~149-57-5~~	~~August 7, 2009~~
Ethyl methanesulfonate	cancer	62-50-0	January 1, 1988
Etodolac	developmental, female	41340-25-4	August 20, 1999
Etoposide	cancer	33419-42-0	November 4, 2011
Etoposide	developmental	33419-42-0	July 1, 1990
Etoposide in combination with cisplatin and bleomycin	cancer	---	November 4, 2011
Etretinate	developmental	54350-48-0	July 1, 1987
Fenoxaprop ethyl	developmental	66441-23-4	March 26, 1999
Fenoxycarb	cancer	72490-01-8	June 2, 2000
Filgrastim	developmental	121181-53-1	February 27, 2001
Fluazifop butyl	developmental	69806-50-4	November 6, 1998
Flunisolide	developmental, female	3385-03-3	May 15, 1998
Fluorouracil	developmental	51-21-8	January 1, 1989
Fluoxymesterone	developmental	76-43-7	April 1, 1990
Flurazepam hydrochloride	developmental	1172-18-5	October 1, 1992
Flurbiprofen	developmental, female	5104-49-4	August 20, 1999
Flutamide	developmental	13311-84-7	July 1, 1990
Fluticasone propionate	developmental	80474-14-2	May 15, 1998
Fluvalinate	developmental	69409-94-5	November 6, 1998
Folpet	cancer	133-07-3	January 1, 1989
Formaldehyde (gas)	cancer	50-00-0	January 1, 1988
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	cancer	3570-75-0	January 1, 1988
Fumonisin B_1	cancer	116355-83-0	November 14, 2003
Furan	cancer	110-00-9	October 1, 1993
Furazolidone	cancer	67-45-8	January 1, 1990
Furmecyclox	cancer	60568-05-0	January 1, 1990
Fusarin C	cancer	79748-81-5	July 1, 1995
Gallium arsenide	cancer	1303-00-0	August 1, 2008
Ganciclovir	cancer, developmental, male	82410-32-0	August 26, 1997
Ganciclovir sodium	developmental, male	107910-75-8	August 26, 1997
Gasoline engine exhaust (condensates/extracts)	cancer	---	October 1, 1990
Gemfibrozil	cancer	25812-30-0	December 22, 2000
Gemfibrozil	female, male	25812-30-0	August 20, 1999
Glass wool fibers (inhalable and biopersistent)	cancer	---	July 1, 1990

Glu-P-1 (2-Amino-6-methyldipyrido [1,2- a:3',2'-d]imidazole)	cancer	67730-11-4	January 1, 1990
Glu-P-2 (2-Aminodipyrido [1,2-a:3',2'-d]imidazole)	cancer	67730-10-3	January 1, 1990
Glycidaldehyde	cancer	765-34-4	January 1, 1988
Glycidol	cancer	556-52-5	July 1, 1990
Goserelin acetate	developmental, female, male	65807-02-5	August 26, 1997
Griseofulvin	cancer	126-07-8	January 1, 1990
Gyromitrin (Acetaldehyde methylformylhydrazone)	cancer	16568-02-8	January 1, 1988
Halazepam	developmental	23092-17-3	July 1, 1990
Halobetasol propionate	developmental	66852-54-8	August 20, 1999
Haloperidol	developmental, female	52-86-8	January 29, 1999
Halothane	developmental	151-67-7	September 1, 1996
HC Blue 1	cancer	2784-94-3	July 1, 1989
Heptachlor	cancer	76-44-8	July 1, 1988
Heptachlor	developmental	76-44-8	August 20, 1999
Heptachlor epoxide	cancer	1024-57-3	July 1, 1988
Herbal remedies containing plant species of the genus *Aristolochia*	cancer	---	July 9, 2004
Hexachlorobenzene	cancer	118-74-1	October 1, 1987
Hexachlorobenzene	developmental	118-74-1	January 1, 1989
Hexachlorobutadiene	cancer	87-68-3	May 3, 2011
Hexachlorocyclohexane (technical grade)	cancer	---	October 1, 1987
Hexachlorodibenzodioxin	cancer	34465-46-8	April 1, 1988
Hexachloroethane	cancer	67-72-1	July 1, 1990
2,4-Hexadienal (89% trans, trans isomer; 11% cis, trans isomer)	cancer	---	March 4, 2005
Hexafluoroacetone	developmental, male	684-16-2	August 1, 2008
Hexamethylphosphoramide	cancer	680-31-9	January 1, 1988
Hexamethylphosphoramide	male	680-31-9	October 1, 1994
Histrelin acetate	developmental	---	May 15, 1998
Hydramethylnon	developmental, male	67485-29-4	March 5, 1999
Hydrazine	cancer	302-01-2	January 1, 1988
Hydrazine sulfate	cancer	10034-93-2	January 1, 1988
Hydrazobenzene (1,2-Diphenylhydrazine)	cancer	122-66-7	January 1, 1988
Hydrogen cyanide (HCN) and cyanide salts (CN salts)	male	---	July 5, 2013
1-Hydroxyanthraquinone	cancer	129-43-1	May 27, 2005
Hydroxyurea	developmental	127-07-1	May 1, 1997
Idarubicin hydrochloride	developmental, male	57852-57-0	August 20, 1999
Ifosfamide	developmental	3778-73-2	July 1, 1990
Iodine-131	developmental	10043-66-0	January 1, 1989
Imazalil	cancer	35554-44-0	May 20, 2011
Indeno[1,2,3-cd]pyrene	cancer	193-39-5	January 1, 1988

Indium phosphide	cancer	22398-80-7	February 27, 2001
IQ (2-Amino-3-methylimidazo [4,5-f] quinoline)	cancer	76180-96-6	April 1, 1990
Iprodione	cancer	36734-19-7	May 1, 1996
Iprovalicarb	cancer	140923-17-7 140923-25-7	June 1, 2007
Iron dextran complex	cancer	9004-66-4	January 1, 1988
Isobutyl nitrite	cancer	542-56-3	May 1, 1996
Isoprene	cancer	78-79-5	May 1, 1996
Isopyrazam	cancer	881685-58-1	July 24, 2012
~~Isosafrole~~ Delisted December 8, 2006	~~cancer~~	~~120-58-1~~	~~October 1, 1989~~
Isotretinoin	developmental	4759-48-2	July 1, 1987
Isoxaflutole	cancer	141112-29-0	December 22, 2000
Kresoxim-methyl	cancer	143390-89-0	February 3, 2012
Lactofen	cancer	77501-63-4	January 1, 1989
Lasiocarpine	cancer	303-34-4	April 1, 1988
Lead	developmental, female, male	---	February 27, 1987
Lead and lead compounds	cancer	---	October 1, 1992
Lead acetate Lead	cancer	301-04-2	January 1, 1988
phosphate Lead	cancer	7446-27-7	April 1, 1988
subacetate	cancer	1335-32-6	October 1, 1989
Leather dust	cancer	---	April 29, 2011
Leuprolide acetate	developmental, female, male	74381-53-6	August 26, 1997
Levodopa Levonorgestrel	developmental	59-92-7	January 29, 1999
implants Lindane and other	female	797-63-7	May 15, 1998
hexachloro-cyclohexane isomers	cancer	---	October 1, 1989
Linuron	developmental	330-55-2	March 19, 1999
Lithium carbonate	developmental	554-13-2	January 1, 1991
Lithium citrate	developmental	919-16-4	January 1, 1991
Lorazepam	developmental	846-49-1	July 1, 1990
Lovastatin	developmental	75330-75-5	October 1, 1992
Lynestrenol	cancer	52-76-6	February 27, 2001
Malonaldehyde, sodium salt	cancer	24382-04-5	May 3, 2011
Mancozeb	cancer	8018-01-7	January 1, 1990
Maneb	cancer	12427-38-2	January 1, 1990
Marijuana smoke	cancer	---	June 19, 2009
Me-A-alpha-C (2-Amino-3-methyl-9H-pyrido[2,3-b]indole)	cancer	68006-83-7	January 1, 1990
Mebendazole	developmental	31431-39-7	August 20, 1999
Medroxyprogesterone acetate	cancer	71-58-9	January 1, 1990
Medroxyprogesterone acetate	developmental	71-58-9	April 1, 1990
Megestrol acetate	cancer	595-33-5	March 28, 2014
Megestrol acetate	developmental	595-33-5	January 1, 1991

MeIQ (2-Amino-3,4-dimethyl-imidazo[4,5-f]quinoline)	cancer	77094-11-2	October 1, 1994
MeIQx (2-Amino-3,8-dimethyl-imidazo[4,5-f]quinoxaline)	cancer	77500-04-0	October 1, 1994
Melphalan	cancer	148-82-3	February 27, 1987
Melphalan	developmental	148-82-3	July 1, 1990
Menotropins	developmental	9002-68-0	April 1, 1990
Mepanipyrim	cancer	110235-47-7	July 1, 2008
Meprobamate	developmental	57-53-4	January 1, 1992
Mercaptopurine	developmental	6112-76-1	July 1, 1990
Mercury and mercury compounds	developmental	---	July 1, 1990
Merphalan	cancer	531-76-0	April 1, 1988
Mestranol	cancer	72-33-3	April 1, 1988
Metam potassium	cancer	137-41-7	December 31, 2010
Methacycline hydrochloride	developmental	3963-95-9	January 1, 1991
Metham sodium	cancer	137-42-8	November 6, 1998
Metham sodium	developmental	137-42-8	May 15, 1998
Methanol	developmental	67-56-1	March 16, 2012
Methazole	developmental	20354-26-1	December 1, 1999
Methimazole	developmental	60-56-0	July 1, 1990
Methotrexate	developmental	59-05-2	January 1, 1989
Methotrexate sodium	developmental	15475-56-6	April 1, 1990
5-Methoxypsoralen with ultraviolet A therapy	cancer	484-20-8	October 1, 1988
8-Methoxypsoralen with ultraviolet A therapy	cancer	298-81-7	February 27, 1987
2-Methylaziridine (Propyleneimine)	cancer	75-55-8	January 1, 1988
Methylazoxymethanol	cancer	590-96-5	April 1, 1988
Methylazoxymethanol acetate	cancer	592-62-1	April 1, 1988
Methyl bromide, as a structural fumigant	developmental	74-83-9	January 1, 1993
Methyl carbamate	cancer	598-55-0	May 15, 1998
Methyl chloride	developmental	74-87-3	March 10, 2000
Methyl chloride	male	74-87-3	August 7, 2009
3-Methylcholanthrene	cancer	56-49-5	January 1, 1990
5-Methylchrysene	cancer	3697-24-3	April 1, 1988
4,4'-Methylene bis(2-chloroaniline)	cancer	101-14-4	July 1, 1987
4,4'-Methylene bis(N,N-dimethyl) benzenamine	cancer	101-61-1	October 1, 1989
4,4'-Methylene bis(2-methylaniline)	cancer	838-88-0	April 1, 1988
4,4'-Methylenedianiline	cancer	101-77-9	January 1, 1988
4,4'-Methylenedianiline dihydrochloride	cancer	13552-44-8	January 1, 1988
Methyleugenol	cancer	93-15-2	November 16, 2001
Methylhydrazine and its salts	cancer	---	July 1, 1992
2-Methylimidazole	cancer	693-98-1	June 22, 2012
4-Methylimidazole	cancer	822-36-6	January 7, 2011
Methyl iodide	cancer	74-88-4	April 1, 1988
Methyl isobutyl ketone	cancer	108-10-1	November 4, 2011
Methyl isobutyl ketone (MIBK)	developmental	108-10-1	March 28, 2014
Methyl isocyanate (MIC)	developmental, female	624-83-9	November 12, 2010
~~Methyl isopropyl ketone~~ Delisted April 4, 2014	~~developmental~~	~~563-80-4~~	~~February 17, 2012~~

Methyl mercury	developmental	---	July 1, 1987
Methylmercury compounds	cancer	---	May 1, 1996
Methyl methanesulfonate	cancer	66-27-3	April 1, 1988
Methyl n-butyl ketone	male	591-78-6	August 7, 2009
2-Methyl-1-nitroanthraquinone (of uncertain purity)	cancer	129-15-7	April 1, 1988
N-Methyl-N'-nitro-N-nitrosoguanidine	cancer	70-25-7	April 1, 1988
N-Methylolacrylamide	cancer	924-42-5	July 1, 1990
N-Methylpyrrolidone	developmental	872-50-4	June 15, 2001
α-Methyl styrene (alpha-Methylstyrene)	cancer	98-83-9	November 2, 2012
~~α-Methyl styrene~~ Delisted April 4, 2014	~~female~~	~~98-83-9~~	~~July 29, 2011~~
Methyltestosterone	developmental	58-18-4	April 1, 1990
Methylthiouracil	cancer	56-04-2	October 1, 1989
Metiram	cancer	9006-42-2	January 1, 1990
Metiram	developmental	9006-42-2	March 30, 1999
Metronidazole	cancer	443-48-1	January 1, 1988
Michler's ketone	cancer	90-94-8	January 1, 1988
Midazolam hydrochloride	developmental	59467-96-8	July 1, 1990
Minocycline hydrochloride (internal use)	developmental	13614-98-7	January 1, 1992
Mirex	cancer	2385-85-5	January 1, 1988
Misoprostol	developmental	59122-46-2	April 1, 1990
Mitomycin C	cancer	50-07-7	April 1, 1988
Mitoxantrone hydrochloride	cancer	70476-82-3	January 23, 2015
Mitoxantrone hydrochloride	developmental	70476-82-3	July 1, 1990
Molinate	developmental, female, male	2212-67-1	December 11, 2009
MON 4660 (dichloroacetyl-1-oxa-4-azaspiro(4,5)-decane)	cancer	71526-07-3	March 22, 2011
MON 13900 (furilazole)	cancer	121776-33-8	March 22, 2011
3-Monochloropropane-1,2-diol (3-MCPD)	cancer	96-24-2	October 8, 2010
Monocrotaline	cancer	315-22-0	April 1, 1988
5-(Morpholinomethyl)-3-[(5-nitrofurfuryl-idene)-amino]-2-oxazolidinone	cancer	139-91-3	April 1, 1988
MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixture)	cancer	113803-47-7	November 4, 2011
Mustard Gas	cancer	505-60-2	February 27, 1987
MX (3-chloro-4-(dichloromethyl) 5-hydroxy-2(5H)-furanone)	cancer	77439-76-0	December 22, 2000
Myclobutanil	developmental, male	88671-89-0	April 16, 1999
Nabam	developmental	142-59-6	March 30, 1999
Nafarelin acetate	developmental	86220-42-0	April 1, 1990
Nafenopin	cancer	3771-19-5	April 1, 1988
Nalidixic acid	cancer	389-08-2	May 15, 1998
Naphthalene	cancer	91-20-3	April 19, 2002

1-Naphthylamine	cancer	134-32-7	October 1, 1989
2-Naphthylamine	cancer	91-59-8	February 27, 1987
Neomycin sulfate (internal use)	developmental	1405-10-3	October 1, 1992
Netilmicin sulfate	developmental	56391-57-2	July 1, 1990
Nickel (Metallic)	cancer	7440-02-0	October 1, 1989
Nickel acetate	cancer	373-02-4	October 1, 1989
Nickel carbonate	cancer	3333-67-3	October 1, 1989
Nickel carbonyl	cancer	13463-39-3	October 1, 1987
Nickel carbonyl	developmental	13463-39-3	September 1, 1996
Nickel compounds	cancer	---	May 7, 2004
Nickel hydroxide	cancer	12054-48-7; 12125-56-3	October 1, 1989
Nickelocene	cancer	1271-28-9	October 1, 1989
Nickel oxide	cancer	1313-99-1	October 1, 1989
Nickel refinery dust from the pyrometallurgical process	cancer	---	October 1, 1987
Nickel subsulfide	cancer	12035-72-2	October 1, 1987
Nicotine	developmental	54-11-5	April 1, 1990
Nifedipine	developmental, female, male	21829-25-4	January 29, 1999
Nimodipine	developmental	66085-59-4	April 24, 2001
Niridazole	cancer	61-57-4	April 1, 1988
Nitrapyrin	cancer	1929-82-4	October 5, 2005
Nitrapyrin	developmental	1929-82-4	March 30, 1999
Nitrilotriacetic acid	cancer	139-13-9	January 1, 1988
Nitrilotriacetic acid, trisodium salt monohydrate	cancer	18662-53-8	April 1, 1989
5-Nitroacenaphthene	cancer	602-87-9	April 1, 1988
~~5-Nitro-*o*-anisidine~~ Delisted December 8, 2006	~~cancer~~	~~99-59-2~~	~~October 1, 1989~~
o-Nitroanisole	cancer	91-23-6	October 1, 1992
Nitrobenzene	cancer	98-95-3	August 26, 1997
Nitrobenzene	male	98-95-3	March 30, 2010
4-Nitrobiphenyl	cancer	92-93-3	April 1, 1988
6-Nitrochrysene	cancer	7496-02-8	October 1, 1990
Nitrofen (technical grade)	cancer	1836-75-5	January 1, 1988
2-Nitrofluorene	cancer	607-57-8	October 1, 1990
Nitrofurantoin	male	67-20-9	April 1, 1991
Nitrofurazone	cancer	59-87-0	January 1, 1990
1-[(5-Nitrofurfurylidene)-amino]-2-imidazolidinone	cancer	555-84-0	April 1, 1988
N-[4-(5-Nitro-2-furyl)-2-thiazolyl] acetamide	cancer	531-82-8	April 1, 1988
Nitrogen mustard (Mechlorethamine)	cancer	51-75-2	January 1, 1988
Nitrogen mustard (Mechlorethamine)	developmental	51-75-2	January 1, 1989
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)	cancer	55-86-7	April 1, 1988
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)	developmental	55-86-7	July 1, 1990
Nitrogen mustard N-oxide	cancer	126-85-2	April 1, 1988
Nitrogen mustard N-oxide	cancer	302-70-5	April 1, 1988

hydrochloride			
Nitromethane	cancer	75-52-5	May 1, 1997
2-Nitropropane	cancer	79-46-9	January 1, 1988
1-Nitropyrene	cancer	5522-43-0	October 1, 1990
4-Nitropyrene	cancer	57835-92-4	October 1, 1990
N-Nitrosodi-*n*-butylamine	cancer	924-16-3	October 1, 1987
N-Nitrosodiethanolamine	cancer	1116-54-7	January 1, 1988
N-Nitrosodiethylamine	cancer	55-18-5	October 1, 1987
N-Nitrosodimethylamine	cancer	62-75-9	October 1, 1987
p-Nitrosodiphenylamine	cancer	156-10-5	January 1, 1988
N-Nitrosodiphenylamine	cancer	86-30-6	April 1, 1988
N-Nitrosodi-*n*-propylamine	cancer	621-64-7	January 1, 1988
N-Nitroso-N-ethylurea	cancer	759-73-9	October 1, 1987
3-(N-Nitrosomethylamino)-propionitrile	cancer	60153-49-3	April 1, 1990
4-(N-Nitrosomethylamino)-1-(3-pyridyl)1-butanone	cancer	64091-91-4	April 1, 1990
N-Nitrosomethyl-*n*-butylamine	cancer	7068-83-9	December 26, 2014
N-Nitrosomethyl-*n*-decylamine	cancer	75881-22-0	December 26, 2014
N-Nitrosomethyl-*n*-dodecylamine	cancer	55090-44-3	December 26, 2014
N-Nitrosomethylethylamine	cancer	10595-95-6	October 1, 1989
N-Nitrosomethyl-*n*-heptylamine	cancer	16338-99-1	December 26, 2014
N-Nitrosomethyl-*n*-hexylamine	cancer	28538-70-7	December 26, 2014
N-Nitrosomethyl-*n*-nonylamine	cancer	75881-19-5	December 26, 2014
N-Nitrosomethyl-*n*-octylamine	cancer	34423-54-6	December 26, 2014
N-Nitrosomethyl-*n*-pentylamine	cancer	13256-07-0	December 26, 2014
N-Nitrosomethyl-*n*-propylamine	cancer	924-46-9	December 26, 2014
N-Nitrosomethyl-*n*-tetradecylamine	cancer	75881-20-8	December 26, 2014
N-Nitrosomethyl-*n*-undecylamine	cancer	68107-26-6	December 26, 2014
N-Nitroso-N-methylurea	cancer	684-93-5	October 1, 1987
N-Nitroso-N-methylurethane	cancer	615-53-2	April 1, 1988
N-Nitrosomethylvinylamine	cancer	4549-40-0	January 1, 1988
N-Nitrosomorpholine	cancer	59-89-2	January 1, 1988
N-Nitrosonornicotine	cancer	16543-55-8	January 1, 1988
N-Nitrosopiperidine	cancer	100-75-4	January 1, 1988
N-Nitrosopyrrolidine	cancer	930-55-2	October 1, 1987
N-Nitrososarcosine	cancer	13256-22-9	January 1, 1988
o-Nitrotoluene	cancer	88-72-2	May 15, 1998
Nitrous oxide	developmental, female	10024-97-2	August 1, 2008
Norethisterone (Norethindrone)	cancer	68-22-4	October 1, 1989
Norethisterone (Norethindrone)	developmental	68-22-4	April 1, 1990
Norethisterone acetate (Norethindrone acetate)	developmental	51-98-9	October 1, 1991
Norethisterone (Norethindrone) /Ethinyl estradiol	developmental	68-22-4/ 57-63-6	April 1, 1990
Norethisterone (Norethindrone)/Mestranol	developmental	68-22-4/ 72-33-3	April 1, 1990
Norethynodrel	cancer	68-23-5	February 27, 2001
Norgestrel	developmental	6533-00-2	April 1, 1990
Ochratoxin A	cancer	303-47-9	July 1, 1990
Oil Orange SS	cancer	2646-17-5	April 1, 1988

Oral contraceptives, combined	cancer	---	October 1, 1989
Oral contraceptives, sequential	cancer	---	October 1, 1989
Oryzalin	cancer	19044-88-3	September 12, 2008
Oxadiazon	cancer	19666-30-9	July 1, 1991
Oxadiazon	developmental	19666-30-9	May 15, 1998
Oxazepam	cancer	604-75-1	October 1, 1994
Oxazepam	developmental	604-75-1	October 1, 1992
~~p,p'-Oxybis(benzenesulfonyl hydrazide)~~	~~developmental~~	~~80-51-3~~	~~August 7, 2009~~
Delisted December 13, 2013			
Oxydemeton methyl	female, male	301-12-2	November 6, 1998
Oxymetholone	cancer	434-07-1	January 1, 1988
Oxymetholone	developmental	434-07-1	May 1, 1997
Oxytetracycline (internal use)	developmental	79-57-2	January 1, 1991
Oxytetracycline hydrochloride (internal use)	developmental	2058-46-0	October 1, 1991
Oxythioquinox (Chinomethionat)	cancer	2439-01-2	August 20, 1999
Oxythioquinox (Chinomethionat)	developmental	2439-01-2	November 6, 1998
Paclitaxel	developmental, female, male	33069-62-4	August 26, 1997
Palygorskite fibers (> 5µm in length)	cancer	12174-11-7	December 28, 1999
Panfuran S	cancer	794-93-4	January 1, 1988
Paramethadione	developmental	115-67-3	July 1, 1990
Penicillamine	developmental	52-67-5	January 1, 1991
Pentachlorophenol	cancer	87-86-5	January 1, 1990
Pentobarbital sodium	developmental	57-33-0	July 1, 1990
Pentosan polysulfate sodium	cancer	---	April 18, 2014
Pentostatin	developmental	53910-25-1	September 1, 1996
Phenacemide	developmental	63-98-9	July 1, 1990
Phenacetin	cancer	62-44-2	October 1, 1989
Phenazopyridine	cancer	94-78-0	January 1, 1988
Phenazopyridine hydrochloride	cancer	136-40-3	January 1, 1988
Phenesterin	cancer	3546-10-9	July 1, 1989
Phenobarbital	cancer	50-06-6	January 1, 1990
Phenolphthalein	cancer	77-09-8	May 15, 1998
Phenoxybenzamine	cancer	59-96-1	April 1, 1988
Phenoxybenzamine hydrochloride	cancer	63-92-3	April 1, 1988
Phenprocoumon	developmental	435-97-2	October 1, 1992
o-Phenylenediamine and its salts	cancer	95-54-5	May 15, 1998
Phenyl glycidyl ether	cancer	122-60-1	October 1, 1990
~~Phenyl glycidyl ether~~	~~male~~	~~122-60-1~~	~~August 7, 2009~~
Delisted April 4, 2014			
Phenylhydrazine and its salts	cancer	---	July 1, 1992
o-Phenylphenate, sodium	cancer	132-27-4	January 1, 1990
o-Phenylphenol	cancer	90-43-7	August 4, 2000
Phenylphosphine	~~developmental~~ male	638-21-1	August 7, 2009
PhiP(2-Amino-1-methyl-6-phenylimidazol[4,5-b]pyridine)	cancer	105650-23-5	October 1, 1994
Pimozide	developmental, female	2062-78-4	August 20, 1999
Pioglitazone	cancer	111025-46-8	April 18, 2014
Pipobroman	developmental	54-91-1	July 1, 1990

Pirimicarb	cancer	23103-98-2	July 1, 2008
Plicamycin	developmental	18378-89-7	April 1, 1990
Polybrominated biphenyls	cancer	---	January 1, 1988
Polybrominated biphenyls	developmental	---	October 1, 1994
Polychlorinated biphenyls	cancer	---	October 1, 1989
Polychlorinated biphenyls	developmental	---	January 1, 1991
Polychlorinated biphenyls (containing 60 or more percent chlorine by molecular weight)	cancer	---	January 1, 1988
Polychlorinated dibenzo-*p*-dioxins	cancer	---	October 1, 1992
Polychlorinated dibenzofurans	cancer	---	October 1, 1992
Polygeenan	cancer	53973-98-1	January 1, 1988
Ponceau MX	cancer	3761-53-3	April 1, 1988
Ponceau 3R	cancer	3564-09-8	April 1, 1988
Potassium bromate	cancer	7758-01-2	January 1, 1990
Potassium dimethyldithiocarbamate	developmental	128-03-0	March 30 1999
Pravastatin sodium	developmental	81131-70-6	March 3, 2000
Prednisolone sodium phosphate	developmental	125-02-0	August 20, 1999
Primidone	cancer	125-33-7	August 20, 1999
Procarbazine	cancer	671-16-9	January 1, 1988
Procarbazine hydrochloride	cancer	366-70-1	January 1, 1988
	developmental		July 1, 1990
Procymidone	cancer	32809-16-8	October 1, 1994
Progesterone	cancer	57-83-0	January 1, 1988
Pronamide	cancer	23950-58-5	May 1, 1996
Propachlor	cancer	1918-16-7	February 27, 2001
1,3-Propane sultone	cancer	1120-71-4	January 1, 1988
Propargite	cancer	2312-35-8	October 1, 1994
Propargite	developmental	2312-35-8	June 15, 1999
beta-Propiolactone	cancer	57-57-8	January 1, 1988
Propoxur	cancer	114-26-1	August 11, 2006
Propylene glycol mono-*t*-butyl ether	cancer	57018-52-7	June 11, 2004
Propylene oxide	cancer	75-56-9	October 1, 1988
Propylthiouracil	cancer	51-52-5	January 1, 1988
Propylthiouracil	developmental	51-52-5	July 1, 1990
Pulegone	cancer	89-82-7	April 18, 2014
Pymetrozine	cancer	1233112-89-0	March 22, 2011
Pyridine	cancer	110-86-1	May 17, 2002
Pyrimethamine	developmental	58-14-0	January 29, 1999
Quazepam	developmental	36735-22-5	August 26, 1997
Quinoline and its strong acid salts	cancer	---	October 24, 1997
Quizalofop-ethyl	male	76578-14-8	December 24, 1999
Radionuclides	cancer	---	July 1, 1989
Reserpine	cancer	50-55-5	October 1, 1989
Residual (heavy) fuel oils	cancer	---	October 1, 1990
Resmethrin	cancer	10453-86-8	July 1, 2008
Resmethrin	developmental	10453-86-8	November 6, 1998

Retinol/retinyl esters, when in daily dosages in excess of 10,000 IU, or 3,000 retinol equivalents. (NOTE: Retinol/retinyl esters are required and essential for maintenance of normal reproductive function. The recommended daily level during pregnancy is 8,000 IU.)	developmental	---	July 1, 1989
Ribavirin	developmental	36791-04-5	April 1, 1990
Ribavirin	male	36791-04-5	February 27, 2001
Riddelliine	cancer	23246-96-0	December 3, 2004
Rifampin	developmental, female	13292-46-1	February 27, 2001
~~Saccharin~~ Delisted April 6, 2001	~~cancer~~	~~81-07-2~~	~~October 1, 1989~~
~~Saccharin, sodium~~ Delisted January 17, 2003	~~cancer~~	~~128-44-9~~	~~January 1, 1988~~
Safrole	cancer	94-59-7	January 1, 1988
Salted fish, Chinese-style	cancer	---	April 29, 2011
Secobarbital sodium	developmental	309-43-3	October 1, 1992
Selenium sulfide	cancer	7446-34-6	October 1, 1989
Sermorelin acetate	developmental	---	August 20, 1999
Shale-oils	cancer	68308-34-9	April 1, 1990
Silica, crystalline (airborne particles of respirable size)	cancer	---	October 1, 1988
Sodium dimethyldithiocarbamate	developmental	128-04-1	March 30 1999
Sodium fluoroacetate	male	62-74-8	November 6, 1998
Soots, tars, and mineral oils (untreated and mildly treated oils and used engine oils)	cancer	---	February 27, 1987
Spirodiclofen	cancer	148477-71-8	October 8, 2010
Spironolactone	cancer	52-01-7	May 1, 1997
Stanozolol	cancer	10418-03-8	May 1, 1997
Sterigmatocystin	cancer	10048-13-2	April 1, 1988
Streptomycin sulfate	developmental	3810-74-0	January 1, 1991
Streptozocin (streptozotocin)	developmental, female, male	18883-66-4	August 20, 1999
Streptozotocin (streptozocin)	cancer	18883-66-4	January 1, 1988
Strong inorganic acid mists containing sulfuric acid	cancer	---	March 14, 2003
Styrene oxide	cancer	96-09-3	October 1, 1988
Sulfallate	cancer	95-06-7	January 1, 1988
Sulfasalazine (salicylazosulfapyridine)	cancer	599-79-1	May 15, 1998
Sulfasalazine (salicylazosulfapyridine)	male	599-79-1	January 29, 1999
Sulfur dioxide	developmental	7446-09-5	July 29, 2011
Sulindac	developmental, female	38194-50-2	January 29, 1999
Talc containing asbestiform fibers	cancer	---	April 1, 1990

Tamoxifen and its salts	cancer	10540-29-1	September 1, 1996
Tamoxifen citrate	developmental	54965-24-1	July 1, 1990
Temazepam	developmental	846-50-4	April 1, 1990
Teniposide	developmental	29767-20-2	September 1, 1996
Terbacil	developmental	5902-51-2	May 18, 1999
Terrazole	cancer	2593-15-9	October 1, 1994
Testosterone and its esters	cancer	58-22-0	April 1, 1988
Testosterone cypionate	developmental	58-20-8	October 1, 1991
Testosterone enanthate	developmental	315-37-7	April 1, 1990
3,3',4,4'-Tetrachloroazobenzene	cancer	14047-09-7	July 24, 2012
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	cancer	1746-01-6	January 1, 1988
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	developmental	1746-01-6	April 1, 1991
1,1,1,2-Tetrachloroethane	cancer	630-20-6	September 13, 2013
1,1,2,2-Tetrachloroethane	cancer	79-34-5	July 1, 1990
Tetrachloroethylene (Perchloroethylene)	cancer	127-18-4	April 1, 1988
p-a,a,a-Tetrachlorotoluene	cancer	5216-25-1	January 1, 1990
Tetracycline (internal use)	developmental	60-54-8	October 1, 1991
Tetracyclines (internal use)	developmental	---	October 1, 1992
Tetracycline hydrochloride (internal use)	developmental	64-75-5	January 1, 1991
Tetrafluoroethylene	cancer	116-14-3	May 1, 1997
Tetranitromethane	cancer	509-14-8	July 1, 1990
Thalidomide	developmental	50-35-1	July 1, 1987
Thioacetamide	cancer	62-55-5	January 1, 1988
4,4'-Thiodianiline	cancer	139-65-1	April 1, 1988
Thiodicarb	cancer	59669-26-0	August 20, 1999
Thioguanine	developmental	154-42-7	July 1, 1990
Thiophanate methyl	female, male	23564-05-8	May 18, 1999
Thiouracil	cancer	141-90-2	June 11, 2004
Thiourea	cancer	62-56-6	January 1, 1988
Thorium dioxide	cancer	1314-20-1	February 27, 1987
Titanium dioxide (airborne, unbound particles of respirable size)	cancer	---	September 2, 2011
Tobacco, oral use of smokeless products	cancer	---	April 1, 1988
Tobacco smoke	cancer	---	April 1, 1988
Tobacco smoke (primary)	developmental, female, male	---	April 1, 1988
Tobramycin sulfate	developmental	49842-07-1	July 1, 1990
Toluene	developmental	108-88-3	January 1, 1991
	~~female~~	~~108-88-3~~	~~August 7, 2009~~
Toluene diisocyanate	cancer	26471-62-5	October 1, 1989
o-Toluidine	cancer	95-53-4	January 1, 1988
o-Toluidine hydrochloride	cancer	636-21-5	January 1, 1988
~~para-Toluidine~~ Delisted October 29, 1999	~~cancer~~	~~106-49-0~~	~~January 1, 1990~~
Toxaphene (Polychlorinated camphenes)	cancer	8001-35-2	January 1, 1988

Toxins derived from *Fusarium* Moniliforme (Fusarium verticillioides)	cancer	---	August 7, 2009
Treosulfan	cancer	299-75-2	February 27, 1987
Triadimefon	developmental, female, male	43121-43-3	March 30, 1999
Triamterene	cancer	396-01-0	April 18, 2014
Triazolam	developmental	28911-01-5	April 1, 1990
S,S,S-Tributyl phosphorotrithioate (Tribufos, DEF)	cancer	78-48-8	February 25, 2011
Tributyltin methacrylate	developmental	2155-70-6	December 1, 1999
Trichlormethine (Trimustine hydrochloride)	cancer	817-09-4	January 1, 1992
Trichloroacetic acid	cancer	76-03-9	September 13, 2013
Trichloroethylene	cancer	79-01-6	April 1, 1988
Trichloroethylene	developmental, male	79-01-6	January 31, 2014
2,4,6-Trichlorophenol	cancer	88-06-2	January 1, 1988
1,2,3-Trichloropropane	cancer	96-18-4	October 1,1992
Trientine hydrochloride	developmental	38260-01-4	February 27, 2001
Triforine	developmental	26644-46-2	June 18, 1999
~~1,3,5-Triglycidyl-s-triazinetrione~~ Delisted December 13, 2013	~~male~~	~~2451-62-9~~	~~August 7, 2009~~
Trilostane	developmental	13647-35-3	April 1, 1990
Trimethadione	developmental	127-48-0	January 1, 1991
2,4,5-Trimethylaniline and its strong acid salts	cancer	---	October 24, 1997
Trimethyl phosphate	cancer	512-56-1	May 1, 1996
Trimetrexate glucuronate	developmental	82952-64-5	August 26, 1997
2,4,6-Trinitrotoluene	cancer	118-96-7	December 19, 2008
Triphenyltin hydroxide	cancer	76-87-9	July 1, 1992
Triphenyltin hydroxide	developmental	76-87-9	March 18, 2002
~~Tris(aziridinyl)-*p*-benzoquinone (Triaziquone)~~ Delisted December 8, 2006	~~cancer~~	~~68-76-8~~	~~October 1, 1989~~
Tris(1-aziridinyl)phosphine sulfide (Thiotepa)	cancer	52-24-4	January 1, 1988
Tris(2-chloroethyl) phosphate	cancer	115-96-8	April 1, 1992
Tris(2,3-dibromopropyl)phosphate	cancer	126-72-7	January 1, 1988
Tris(1,3-dichloro-2-propyl) phosphate (TDCPP)	cancer	13674-87-8	October 28, 2011
Trp-P-1 (Tryptophan-P-1)	cancer	62450-06-0	April 1, 1988
Trp-P-2 (Tryptophan-P-2)	cancer	62450-07-1	April 1, 1988
Trypan blue (commercial grade)	cancer	72-57-1	October 1, 1989
Unleaded gasoline (wholly vaporized)	cancer	---	April 1, 1988
Uracil mustard	cancer	66-75-1	April 1, 1988
	developmental, female, male		January 1, 1992
Urethane (Ethyl carbamate)	cancer	51-79-6	January 1, 1988
	developmental		October 1, 1994

Urofollitropin	developmental	97048-13-0	April 1, 1990
Valproate (Valproic acid)	developmental	99-66-1	July 1, 1987
Vanadium pentoxide (orthorhombic crystalline form)	cancer	1314-62-1	February 11, 2005
Vinblastine sulfate	developmental	143-67-9	July 1, 1990
Vinclozolin	cancer developmental	50471-44-8	August 20, 1999 May 15, 1998
Vincristine sulfate	developmental	2068-78-2	July 1, 1990
Vinyl bromide	cancer	593-60-2	October 1, 1988
Vinyl chloride	cancer	75-01-4	February 27, 1987
4-Vinylcyclohexene	cancer	100-40-3	May 1, 1996
4-Vinyl-cyclohexene	female, ~~male~~	100-40-3	August 7, 2009
4-Vinyl-1-cyclohexene diepoxide (Vinyl cyclohexene dioxide)	cancer	106-87-6	July 1, 1990
Vinyl cyclohexene dioxide (4-Vinyl-1-cyclohexene diepoxide)	female, ~~male~~	106-87-6	August 1, 2008
Vinyl fluoride	cancer	75-02-5	May 1, 1997
Vinyl trichloride (1,1,2-Trichloroethane)	cancer	79-00-5	October 1, 1990
Warfarin	developmental	81-81-2	July 1, 1987
Wood dust	cancer	---	December 18, 2009
2,6-Xylidine (2,6-Dimethylaniline)	cancer	87-62-7	January 1, 1991
Zalcitabine	cancer	7481-89-2	August 7, 2009
Zidovudine (AZT)	cancer	30516-87-1	December 18, 2009
Zileuton	cancer, developmental, female	111406-87-2	December 22, 2000
~~Zineb~~ Delisted October 29, 1999	~~cancer~~	~~12122-67-7~~	~~January 1, 1990~~

Date: January 23, 2015

Appendix D – Select Carcinogens

*This list is based on the OSHA Select Carcinogen definition at the bottom of this document as of October 2009.

OSHA - Occupational Safety and Health Administration, U.S. Department of Labor
- **Group ORC**: OSHA Regulated Carcinogen
- **Group S**: OSHA Select Carcinogen

IARC - International Agency for Research on Cancer
- **Group 1**: Carcinogenic to humans
- **Group 2A**: Probably carcinogenic to humans
- **Group 2B**: Possibly carcinogenic to humans

NTP - National Toxicology Program, Public Health Service, U.S. Department of Health and Human Services
- **Group 1**: Known to be Human Carcinogens (K)
- **Group 2**: Reasonably Anticipated to be Human Carcinogens (R)

CHEMICAL NAME	CAS NUMBER	OSHA	IARC	NTP
AF-2[2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide]	3688-53-7	S	2B	
Acetaldehyde	75-07-0	S	2B	2
Acetamide	60-35-5	S	2B	
Acetic acid, cobalt(2+) salt	71-48-7	S	2B	
2-Acetylaminofluorene	53-96-3	ORC		2
Acrylamide	79-06-1	S	2A	2
Acrylonitrile	107-13-1	ORC	2B	2
Adriamycin	023214-92-8	S	2A	2
Adriamycin hydrochloride	025316-40-9	S		2
Aflatoxin B1	1162-65-8	S	1	
Aflatoxin M1	6795-23-9	S	2B	
Aflatoxins	1402-68-2	S	1	1
1-Amino-2-methylanthraquinone	82-28-0	S		2
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	712-68-5	S	2B	
Amino-alpha-C (2-Amino-9h-pyrido[2,3-b]indole)	026148-68-5	S	2B	
2-Aminoanthraquinone	117-79-3	S		2
para-Aminoazobenzene	60-09-3	S	2B	
ortho-Aminoazotoluene	97-56-3	S	2B	2
4-Aminodiphenyl	92-67-1	ORC	1	1
Amitrole	61-82-5	S	2B	2
Ammonium dichromate (VI)	07789-09-5	S	1	
Anaesthetics, volatile	--	S	2A	
Analgesic mixtures containing phenacetin	--	S	1	1
Androgenic (anabolic) steroids	--	S	2A	
Aniline	62-53-3			
ortho-Anisidine	90-04-0	S	2B	2
o-Anisidine hydrochloride	134-29-2	S	2B	2
Antimony trioxide production	1309-64-4	S	2B	
Aramite	140-57-8	S	2B	
Arsenenous acid, calcium salt (2:1)	015194-98-6	S		1

Arsenenous acid, potassium salt	013464-35-2	S		1
Arsenic acid, calcium salt	010103-62-5	S	1	1
Arsenic acid, calcium salt (2:3)	7778-44-1	S	1	1
Arsenic acid, disodium salt, heptahydrate	010048-95-0	S		1
Arsenic acid, lead(2+) salt(1:1)	7784-40-9	S		1
Arsenic acid, monopotassium salt	7784-41-0	S		1
Arsenic acid, sodium salt	7631-89-2	S		1
Arsenic pentoxide	1303-28-2	S		1
Arsenic trioxide	1327-53-3	S	1	1
Arsenic, elemental, and inorganic compounds, as As	7440-38-2	R	1	1
Arsenious acid, monosodium salt	7784-46-5	S	1	1
Arsenious acid, calcium salt	027152-57-4	S		1
Arsonic acid, calcium salt (1:1)	052740-16-6	S		1
Asbestos	1332-21-4	R	1	1
Asbestos, Actinolite	077536-66-4	R	1	
Asbestos, Amosite	012172-73-5	R	1	1
Asbestos, Anthophyllite	077536-67-5	R	1	1
Asbestos, Chrysotile	012001-29-5	R	1	1
Asbestos, Crocidolite	012001-28-4	R	1	1
Asbestos, Tremolite	077536-68-6	R	1	
Atrazine	1912-24-9	S	2B	
Auramine	492-80-8	S	2B	
Azacitidine	320-67-2	S	2A	2
Azaserine	115-02-6	S	2B	
Azathioprine	446-86-6	S	1	1
Azbllen asbestos	017068-78-9	S		1
Barium chromate(VI)	010294-40-3	S	1	1
Benz[a]anthracene	56-55-3	S	2A	2
Benzal chloride	98-87-3	S	2A	
Benzene	71-43-2	ORC	1	1
Benzidine	92-87-5	ORC	1	1
Benzidine-based dyes	--	S	2A	
Benzo[a]pyrene	50-32-8	S	2A	2
Benzo[b]fluoranthene	205-99-2	S	2B	2
Benzo[j]fluoranthene	205-82-3	S	2B	2
Benzo[k]fluoranthene	207-08-9	S	2B	2
Benzofuran	271-89-6	S	2B	
Benzotrichloride	98-07-7	S	2A	2
Benzoyl chloride	98-88-4	S	2A	
Benzyl chloride	100-44-7	S	2A	
Benzyl violet 4B	1694-09-3	S	2B	
Beryllium aluminum alloy	012770-50-2	S	1	2
Beryllium aluminum silicate	1302-52-9	S	1	2
Beryllium and beryllium compounds	7440-41-7	S	1	2
Beryllium chloride	7787-47-5	S	1	2
Beryllium fluoride	7787-49-7	S	1	2
Beryllium phosphate	013598-15-7	S	1	2
Beryllium hydroxide	013327-32-7	S	1	2
Beryllium oxide	1304-56-9	S	1	2
Beryllium oxide carbonate	066104-24-3	S	1	2
Beryllium sulfate	013510-49-1	S	1	2

Beryllium sulfate tetrahydrate	7787-56-6	S	1	2
Beryllium zinc silicate	039413-47-3	S	1	2
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)	494-03-1	S	1	
Bis(chloromethyl)ether	542-88-1	ORC	1	1
Bischloroethyl nitrosourea (BCNU)	154-93-8	S	2A	2
Bitumens, extracts of steam-refined and air-refined	8052-42-4	S	2B,3	
Bleomycin, chlorohydrate	067763-87-5	S	2B	
Bleomycin, sulfate	9041-93-4	S	2B	
Bleomycins	011056-06-7	S	2B	
Bracken fern	--	S	2B	
Bromacil	314-40-9	S		
Bromodichloromethane	75-27-4	S	2B	2
Bromoform	75-25-2	S		
1,3-Butadiene	106-99-0	ORC	2A	2
1,4-Butanediol dimethanesulfonate (Busulphan;Myleran)	55-98-1	S	1	1
Butylated hydroxyanisole (BHA)	025013-16-5	S	2B	2
beta-Butyrolactone	3068-88-0	S	2B	
CI Acid Red 114	6459-94-5	S	2B	
CI Basic Red 9	569-61-9	S	2B	2
CI Direct blue 15	2429-74-5	S	2B	
Cadmium carbonate	513-78-0	S		2
Cadmium chloride	010108-64-2	S	1	2
Cadmium fluoborate	014486-19-2	S		2
Cadmium fume (as Cd)	1306-19-0	S	1	2
Cadmium nitrate	010325-94-7	S		2
Cadmium oxide	1306-19-0	S		2
Cadmium sulfate	010124-36-4	S	1	2
Cadmium sulfide	1306-23-6	S	1	2
Cadmium, elemental, and compounds, as Cd	7440-43-9	ORC	1	2
Caffeic acid	331-39-5	S	2B	
Calcium chromate (VI)	013765-19-0	S	1	1
Captafol	0612-42-5	S	2A	
Carbon black	1333-86-4	S	2B	
Carbon tetrachloride	56-23-5	S	2B	2
Carrageenan, degraded	972-00-1	S	2B	
Catechol	120-80-9	S	2B	
Ceramic fibers	--	S		2
Ceramic fibres	--	S	2B	
Chlorambucil	305-03-3	S	1	1
Chloramphenicol	56-75-7	S	2A	
alpha-Chlordane	5103-71-9	S	2B	
beta-Chlordane	5103-74-2	S	2B	
Chlordane	57-74-9	S	2B	
gamma-Chlordane	5566-34-7	S	2B	
Chlordecone (Kepone)	143-50-0	S	2B	2
Chlorendic acid	115-28-6	S	2B	2
Chlorinated paraffins (C12, 60% Chlorine)	108171-26-2	S	2B	2
Chlorinated paraffins (C23, 43% chlorine)	108171-27-3	S		2
alpha-Chlorinated toluenes (Benzal chloride, Benzyl	--	S	2A	

chloride, Benzotrichloride)and bonzoyl chloride (combined exposures)				
2-(4-Chloro-2-methyl phenoxy) propionic acid (Mecoprop)	93-65-2	S	2B	
1-Chloro-2-methyl propene	513-37-1	S	2B	2
3-Chloro-2-methylpropene	563-47-3	S		2
4-Chloro-o-toluidine hydrochloride	3165-93-3	S	2A	2
4-Chloro-ortho-phenylenediamine	95-83-0	S	2B	2
para-Chloro-ortho-toluidine	95-69-2	S	2A	
para-Chloro-ortho-toluidine and its strong acid salts	--	S	2A	2
para-Chloroaniline	106-47-8	S	2B	
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (Methyl-CCNU; Semustine)	013909-09-6	S	1	1
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)	013010-47-4	S	2A	2
Chloroform	67-66-3	S	2B	2
Chloromethyl methyl ether	107-30-2	ORC	1	1
Chlorophenols	95-57-8	S	2B	
Polychlorophenols and their sodium salts (mixed exposures)	--	S	2B	
Chlorophenoxy herbicides	--	S	2B	
2-(o-Chlorophenyl)-2-(p-chlorophenyl)-1,1,1-trichloroethane	789-02-6	S	2B	
2-(o-Chlorophenyl)-2-(p-chlorophenyl)-1,1-dichloroethane	53-19-0	S	2B	
Chloroprene	126-99-8	S	2B	
Chlorothalonil	1897-45-6	S	2B	
Chlorozotocin	054749-90-5	S	2A	2
Chromate(1-), Hydroxyoctaoxodizincatedi-, Potassium	011103-86-9	S	1	
Chromic acid, Lead(2+) Salt (1:1)	7758-97-6	S	1	1
Chromic acid, disodium salt	01137-77-5	S	1	1
Chromite (mineral)	1308-31-2	S		1
Chromium (VI) chloride	014986-48-2	S	1	
Chromium (VI) compounds	--	S	1	1
Chromium (VI) dioxychloride	014977-61-8	S	1	
Chromium and certain chromium compounds	--	S		1
Chromium carbamate (6Cl)	029689-14-3	S		1
Chromium phosphate	7789-04-0	S		1
Chromium triacetate	1066-30-4	S		1
Chromium(VI) oxide (1:3)	1333-82-0	S	1	1
Ciclosporin	079217-60-0	S	1	
Cisplatin	015663-27-1	S	2A	2
Citrus red no.2	6358-53-8	S	2B	
Coal gasification	--	S	1	
Coal tar	065996-89-6	S		1
Coal tar distillate	065996-92-1	S		1
Coal tar pitch volatiles, as benzene solubles	065996-93-2	S	1	
Coal tars	87-45-2	S	1	1
Cobalt (II) carbonate hydroxide (2:3) monohydroxide	051839-24-8	S	2B	
Cobalt alloy, Co,Cr	011114-92-4	S	2B	1
Cobalt and cobalt compounds	7440-48-4	S	2B	

Cobalt carbonate (1:1)	513-79-1	S	2B	
Cobalt carbonate, Cobalt dihydroxide (2:3)	012602-23-2	S	2B	
Cobalt carbonyl (co4(CO)12)	017786-31-1	S	2B	
Cobalt dinitrate hexahydrate	010026-22-9	S	2B	
Cobalt hydroxide	1307-86-4	S	2B	
Cobalt hydroxide oxide	012016-80-7	S	2B	
Cobalt molydate (VI)	013762-14-6	S	2B	
Cobalt naphthanate	061789-51-3	S	2B	
Cobalt oxide	1308-06-1	S	2B	
Cobalt triacetate	917-69-1	S	2B	
Cobalt(2+) oxide	1307-96-6	S	2B	
Cobalt(2+) sulfide	1317-42-6	S	2B	
Cobalt(II) acetate tetrahydrate	6147-53-1	S	2B	
Cobalt(II) chloride	7646-79-9	S	2B	
Cobalt(II) chloride, hexahydrate	7791-13-1	S	2B	
Cobalt(II) hydroxide	021041-93-0	S	2B	
Cobalt(II) nitrate (1:2)	010141-05-6	S	2B	
Cobalt(II) sulfate (1:1)	010124-43-3	S	2B	
Cobalt(III) oxide	1308-04-9	S	2B	
Cobalt, (mu-(Carbonato(2-)-O:O'))Dihydroxydi	012069-68-0	S	2B	
Cobalt, di-mu-carbonylhexacarbonyldi-, (Co-Co)	010210-68-1	S	2B	
Cobalt-aluminium-chromium spinel	--	S	2B	
Cobalt-chromium-molybdenum-alloy	012629-02-6	S	2B	
Cobalt-chromium-nickel-tungsten alloy	012638-07-2	S	2B	
Coke oven emissions	--	ORC		1
Coke production	--	ORC	1	1
Conjugated estrogens	012126-59-9	S		1
Conjugated estrogens	--	S		1
Creosote	81-58-9	S	2A	1
para-Cresidine	120-71-8	S	2B	2
Creosote, wood	8021-39-4	S		1
Crotonaldehyde	4170-30-3			
Cupferron	135-20-6	S		2
Cycasin	014901-08-7	S	2B	
Cyclophosphamide	50-18-0	S	1	1
Cyclophosphamide hydrate	6055-19-2	S	1	
Cyclosporin A	059865-13-3	S	1	1
DDD (dichlorodiphenyldichloroethane)	72-54-8	S	2B	
DDE (dichlorodiphenyldichloroethylene)	72-55-9	S	2B	
DDT	50-29-3	S	2B	2
Dacarbazine	0344-34-2	S	2B	2
Dantron (Chrysazin; 1,8-Dihydroxyanthraquinone, Danthron)	117-10-2	S	2B	2
Daunomycin	020830-81-3	S	2B	
Decabromobiphenyl (under polybrominated biphenyls)	013654-09-6	S		2
Di(2-ethylhexyl) phthalate	117-81-7	S	2B	2
N,N'-Diacetylbenzidine	613-35-4	S	2B	
2,4-Diaminoanisole (and its salts)	615-05-4	S	2B	
2,4-Diaminoanisole sulfate	039156-41-7	S		2
4,4'-Diaminodiphenyl ether	101-80-4	S	2B	2

2,4-Diaminotoluene	95-80-7	S	2B	2
Dibenz[a,h]acridine	226-36-8	S	2B	2
Dibenz[a,h]anthracene	53-70-3	S	2A	2
Dibenz[a,j]acridine	224-42-0	S	2B	2
Dibenzo[a,e]pyrene	192-65-4	S	2B	2
Dibenzo[a,h]pyrene	189-64-0	S	2B	2
Dibenzo[a,i]pyrene	189-55-9	S	2B	2
Dibenzo[a,l]pyrene	191-30-0	S	2B	2
7H-Dibenzo[c,g]carbazole	194-59-2	S	2B	2
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	ORC	2B	2
3,3'-Dichloro-4,4'-diaminodiphenyl ether	028434-86-8	S	2B	
para-Dichlorobenzene	106-46-7	S	2B	2
3,3'-Dichlorobenzidine	91-94-1	ORC	2B	2
3,3'-Dichlorobenzidine and 3,3'-Dichlorobenzidine hydrochloride	--	S		2
3,3'-Dichlorobenzidine dihydrochloride	612-83-9	S		2
1,2-Dichloroethane	107-06-2	S	2B	2
Dichloromethane (Methylene Chloride)	75-09-2	ORC	2B	2
2-(2,4-Dichlorophenoxy)propionic acid	120-36-5	S	2B	
1,3-Dichloropropene (technical-grade)	542-75-6	S	2B	2
Dichlorvos	62-73-7	S	2B	
Diepoxybutane	1464-53-5	S		2
1-1,2:3,4-Diepoxybutane	030031-64-2	S	2B	
Diepoxybutane, (+-)-1,2:3,4-	--	S	2B	
Diesel engine exhaust	--	S	2A	
Diesel fuels	--	S	2B	
Diethyl sulfate	64-67-5	S	2A	2
1,2-Diethylhydrazine	1615-80-1	S	2B	
Diethylstilbesterol (DES)	56-53-1	S	1	1
Diglycidyl resorcinol ether	101-90-6	S	2B	2
Dihydrosafrole	94-58-6	S	2B	
Dihydroxymethylfuratrizine	794-93-4	S	2B	
Diisopropyl sulfate	01062-97-3	S	2B	
3,3'-Dimethoxybenzidine (ortho-Dianisidine)	119-90-4	S	2B	2
3,3'-dimethoxybenzidine dihydrochloride	020325-40-0	S		2
Dimethyl sulfate	77-78-1	S	2A	2
trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)vinyl]-1,3,4-oxadiazole	025962-77-0	S	2B	
para-Dimethylaminoazobenzene	60-11-7	ORC	2B	2
2,6-Dimethylaniline (2,6-Xylidine)	87-62-7	S	2B	
3,3'-Dimethylbenzidine (o-Tolidine)	119-93-7	S	2B	2
Dimethylcarbamoyl chloride	79-44-7	S	2A	2
1,1-Dimethylhydrazine	57-14-7	S	2B	2
1,2-Dimethylhydrazine	540-73-8	S	2A	
3,7-Dinitrofluorantene	105735-71-5	S	2B	
3,9-Dinitrofluoranthene	022506-53-2	S	2B	
1,6-Dinitropyrene	042397-64-8	S	2B	2
1,8-Dinitropyrene	042397-65-9	S	2B	2
2,4-Dinitrotoluene	121-14-2	S	2B	
2,6-Dinitrotoluene	606-20-2	S	2B	
1,4-Dioxane	123-91-1	S	2B	2

Direct black 38	1937-37-7	S		2
Direct blue 6	2602-46-2	S		2
Disperse blue 1	2475-45-8	S	2B	2
Engine exhaust, gasoline	--	S	2B	
Epichlorohydrin	106-89-8	S	2A	2
1,2-Epoxybutane	106-88-7	S	2B	
Erionite	066733-21-9	S	1	1
Estrogens (not conjugated) Estradiol-17 beta	50-28-2	S		2
Estrogens (not conjugated) Estrone	53-16-7	S		2
Estrogens (not conjugated) Ethinylestradiol	57-63-6	S		2
Estrogens (not conjugated) Mestranol	72-33-3	S		2
Ethyl acrylate	140-88-5	S	2B	2
Ethyl bromide	74-96-4			
Ethyl methanesulfonate	62-50-0	S	2B	2
n-Ethyl-N-nitrosourea	759-73-9	S	2A	2
Ethylene dibromide	106-93-4	S	2A	2
Ethylene oxide	75-21-8	ORC	1	2
Ethylene thiourea	96-45-7	S	2B	2
Ethyleneimine (Aziridine)	151-56-4	ORC	2B	
FireMaster BP-6 (under polybrominated biphenyls)	--	S	2B	2
Formaldehyde	50-00-0	ORC	2A	2
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	3570-75-0	S	2B	
Fowler's solution	1332-10-1	S	1	
Fuel oil, residual	068476-33-5	S	2B	
Furan	110-00-9	S	2B	2
Gasoline	86-61-9	S	2B	
Gasoline, unleaded	--	S	2B	
Glass wool fibers	--	S	2B	2
Glu-P-1 (2-Amino-6-methyldipyrido[1,2-a:3',2'-d]imidazole)	067730-11-4	S	2B	
Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'-d]imidazole)	067730-10-3	S	2B	
Glycidaldehyde	765-34-4	S	2B	
Glycidol	556-52-5	S		2
Griseofulvin	126-07-8	S	2B	HC Blue
No. 1	2784-94-3	S	2B	
Heptachlor	76-44-8	S	2B	
Heptachlor epoxide	1024-57-3	S	2B	
Hexachlorobenzene	118-74-1	S	2B	2
Hexachlorocyclohexanes (all isomers)	608-73-1	S	2B	2
gamma-Hexachlorocyclohexane	58-89-9	S		2
beta-Hexachlorocyclohexane	319-85-7	S		2
alpha-Hexachlorocyclohexane	319-84-6	S		2
Hexachloroethane	67-72-1	S	2B	2
Hexamethyl phosphoramide	680-31-9	S	2B	2
Hot mate	--	S	2A	
Hydrazine	302-01-2	S	2B	2
Hydrazine sulfate	010034-93-2	S		2
Hydrazobenzene	122-66-7	S		2
IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)	076180-96-6	S	2A	
Indeno[1,2,3-cd]pyrene	193-39-5	S	2B	2
Iron-dextran complex	94-66-4	S	2B	2

Isoprene	78-79-5	S	2B	
Kanechlor (under polychlorinated biphenyls)	037317-41-2	S		2
Lasiocarpine	303-34-4	S	2B	
Lead acetate	301-04-2	S		2
Lead acetate (II), trihydrate	6080-56-4	S		2
Lead and lead compounds, inorganic	7439-92-1	S	2B	
Lead chromate	7758-97-6	S		1
Lead chromate(VI) oxide	018454-12-1	S	1	1
Lead phosphate	7446-27-7	S	2B	2
Lindane	58-89-9			
Magenta (containing CI basic red 9)	632-99-5	S	2B	
Mea-alpha-c (2-Amino-3-methyl-9H-pyrido[2,3-b]indole)	068006-83-7	S	2B	
Medroxyprogesterone acetate	71-58-9	S	2B	
MeIQ (2-Amino-3,4-dimethylimidazo[4,5f]quinoline	077094-11-2	S	2B	
MeIQx (2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline	077500-04-0	S	2B	
Melphalan	148-82-3	S	1	1
Merphalan	531-76-0	S	2B	
Meso-1,2:3,4-Diepoxybutane	564-00-1	S	2B	
5-Methoxypsoralen	484-20-8	S	2A	
Methyl mercury compounds	--	S	2B	
Methyl methanesulfonate	66-27-3	S	2A	2
2-Methyl-1-nitroanthraquinone (uncertain purity)	129-15-7	S	2B	
n-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)	70-25-7	S	2A	2
n-Methyl-N-nitrosourea	684-93-5	S	2A	2
n-Methyl-N-nitrosourethane	615-53-2	S	2B	
2-Methylaziridine (Propyleneimine)	75-55-8	S	2B	2
Methylazoxymethanol acetate	592-62-1	S	2B	
Methylazoxymethanol and its acetate	590-96-5	S	2B	
5-Methylchrysene	3697-24-3	S	2B	2
4,4'-Methylene bis(2-chloroaniline)	101-14-4	S	2A	2
4,4'-Methylene bis(2-methylaniline)	838-88-0	S	2B	
4,4'-Methylene bis(n,n-dimethyl)benzenamine	101-61-1	S		2
4,4'-Methylenedianiline	101-77-9	ORC	2B	2
4,4'-Methylenedianiline dihydrochloride	013552-44-8	S		2
Methylthiouracil	56-04-2	S	2B	
Metronidazole	443-48-1	S	2B	2
Michler's ketone	90-94-8	S		2
Mineral Oil, petroleum distillates with certain solvent and hydrotreatments. Consult MSDS for product status	064742-03-6	S	1	
Mirex	2385-85-5	S	2B	2
Mitomycin C	50-07-7	S	2B	
Molybdate orange	012656-85-8	S	1	
Monocrotaline	315-22-0	S	2B	
5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone	3795-88-8	S	2B	
Mustard gas	505-60-2	S	1	1
Nafenopin	3771-19-5	S	2B	
2-Naphthylamine	91-59-8	ORC	1	1

alpha-Naphthylamine	134-32-7	ORC		
Nickel alloy, Ni 47-59,Co 17-20,Cr 13-17,Mo 4.5-5.7,Al 3.7-4.7,Ti 3-4,Fe 0-1,C 0- 0.1 (AISI 687)	011068-91-0	S	2B	
Nickel biscyclopentadiene	1271-28-9	S		2
Nickel carbonyl (as Ni)	013463-39-3	S		2
Nickel compounds	--	S	1	
Nickel hydroxide	11113-74-9	S		2
Nickel sulfide (3:2)	012035-72-2	S		2
Nickel(II) acetate (1:2)	373-02-4	S		2
Nickel(II) carbonate (1:1)	3333-67-3	S		2
Nickel(II) hydroxide	012054-48-7	S		2
Nickel(II) oxide (1:1)	1313-99-1	S		2
Nickel(III) hydroxide	012125-56-3	S		2
Nickel, compd with pi-Cyclopentadienyl (1:2)	--	S		2
Nickel, metallic and alloys	7440-02-0	S	2B	2
Niridazole	61-57-4	S	2B	
Nitrilotriacetic acid and its salts	139-13-9	S	2B	2
Nitrilotriacetic acid disodium salt monohydrate	023255-03-0	S	2B	
Nitrilotriacetic acid monosodium salt	018994-66-6	S	2B	
Nitrilotriacetic acid sodium salt	010042-84-9	S	2B	
Nitrilotriacetic acid trisodium salt monohydrate	018662-53-8	S	2B	
Nitrilotriacetic acid, disodium salt	015467-20-6	S	2B	
Nitrilotriacetic acid, trisodium salt	5064-31-3	S	2B	
N-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide	531-82-8	S	2B	
5-Nitroacenaphthene	602-87-9	S	2B	
2-Nitroanisole	91-23-6	S	2B	2
Nitrobenzene	98-95-3	S	2B	
4-Nitrobiphenyl	92-93-3	ORC		
6-Nitrochrysene	0287-49-6	S	2B	2
Nitrofen, (technical-grade)	1836-75-5	S	2B	2
2-Nitrofluorene	607-57-8	S	2B	
1-[(5-Nitrofurfurylidene)amino]-2-imidazolidinone	555-84-0	S	2B	
Nitrogen mustard	51-75-2	S	2A	2
Nitrogen mustard N-oxide	126-85-2	S	2B	
Nitrogen mustard N-oxide hydrochloride	302-70-5	S	2B	
Nitrogen mustard hydrochloride	55-86-7	S	2A	2
2-Nitropropane	79-46-9	S	2B	2
1-Nitropyrene	5522-43-0	S	2B	2
4-Nitropyrene	057835-92-4	S	2B	2
n-Nitrosobutylbutanolamine	01163-81-7	S		2
n-Nitrosobutylcarboxypropylamine	038252-74-3	S		2
N-Nitrosodi-n-butylamine	924-16-3	S	2B	2
N-Nitrosodi-n-propylamine	621-64-7	S	2B	2
N-Nitrosodiethanolamine	1116-54-7	S	2B	2
n-Nitrosodiethylamine	55-18-5	S	2A	2
n-Nitrosodimethylamine	62-75-9	ORC	2A	2
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	064091-91-4	S	2B	2
3-(N-Nitrosomethylamino)propionitrile	060153-49-3	S	2B	
N-Nitrosomethylethylamine	010595-95-6	S	2B	
N-Nitrosomethylvinylamine	4549-40-0	S	2B	2

N-Nitrosomorpholine	59-89-2	S	2B	2
N'-Nitrosonornicotine	016543-55-8	S	2B	2
N'-Nitrosonornicotine, (+-)	084237-38-7	S	2B	
N-Nitrosopiperidine	100-75-4	S	2B	2
N-Nitrosopyrrolidine	930-55-2	S	2B	2
N-Nitrososarcosine	013256-22-9	S	2B	2
Norethisterone	68-22-4	S		2
Ochratoxin A	303-47-9	S	2B	2
Octabromobiphenyl (under polybrominated biphenyls)	061288-13-9	S		2
Oestrogens, nonsteroidal	--	S	1	
Oestrogens, steroidal	--	S	1	
Oil orange SS	2646-17-5	S	2B	
Oxazepam	604-75-1	S	2B	
Oxymetholone	434-07-1	S		2
Palygorskite (attapulgite) (long fibres, > 5 micrometers)	012174-11-7	S	2B	
Panfuran S (containing dihydroxymethylfuratrizine)	794-93-4	S	2B	
Pentachlorobiphenyl	025429-29-2	S		2
Petroleum Residues , Thermal Cracked	064741-80-6	S	2A	
Phenacetin	62-44-2	S	2A	2
Phenazopyridine hydrochloride	136-40-3	S	2B	2
Phenobarbital	50-06-6	S	2B	
Phenoxybenzamine hydrochloride	63-92-3	S	2B	2
Phenyl glycidyl ether	122-60-1	S	2B	
o-Phenylenediamine	95-54-5			
Phenylhydrazine	100-63-0			
Phenytoin	57-41-0	S	2B	2
PhIP (2-Amino-1-methyl-6-phenyl-imidazo[4,5-b]pyridine)	105650-23-5	S	2B	
Piperazine Estrone Sulfate (under conjugated estrogens)	7280-37-7	S		1
Polybrominated biphenyl (FF-1)	067774-32-7	S	2B	2
Polybrominated biphenyls (PBBs)	059536-65-1	S	2B	2
Polychlorinated biphenyl (Aroclor 1254)	011097-69-1	S	2A	2
Polychlorinated biphenyl (Aroclor 1260)	011096-82-5	S		2
Polychlorinated biphenyls [PCBs]	1336-36-3	S	2A	2
Polychlorophenols and their sodium salts (mixed exposures)	--	S	2B	
Polycyclic aromatic hydrocarbons (PAHs)	--	S		2
Ponceau 3R	0983-56-4	S	2B	
Ponceau MX	3761-53-3	S	2B	
Potassium bromate	127-75-8	S	2B	
Potassium chromate (VI)	7789-00-6	S	1	1
Potassium dichromate (VI)	7778-50-9	S	1	1
Procarbazine hydrochloride	366-70-1	S	2A	2
Progesterone	57-83-0	S		2
Progestins	--	S	2B	
1,3-Propane sultone	1120-71-4	S	2B	2
beta-Propiolactone	57-57-8	ORC	2B	2
Propoxur (Baygon)	114-26-1	S		

Propylene oxide	75-56-9	S	2B	2
Propylthiouracil	51-52-5	S	2B	2
Radon and its decay products	010043-92-2	S	1	1
Reserpine	50-55-5	S		2
Rock wool fibers	--	S	2B	
Saccharin	81-07-2	S	2B	2
Saccharin calcium	6485-34-3	S		2
Saccharin, sodium salt	128-44-9	S	2B	2
Safrole	94-59-7	S	2B	2
Selenium sulfide	7446-34-6	S		2
Senarmontite	012412-52-1	S	2B	
Shale-oils	068308-34-9	S	1	
Silica, crystalline	014808-60-7	S	1	2
Silica, crystalline cristobalite	014464-46-1	S	2A	2
Silica, crystalline tridymite	015468-32-3	S	2A	2
Silica, crystalline tripoli	1317-95-9	S	2A	
Silicic acid, Beryllium salt	015191-85-2	S	1	
Slag wool fibers	--	S	2B	
Sodium dichromate (VI)	010588-01-9	S	1	1
Sodium estrone sulfate (under conjugated estrogens)	438-67-5	S		1
Sodium equilin sulfate (under conjugated estrogens)	016680-47-0	S		1
Sodium ortho-phenylphenate	132-27-4	S	2B	
Soots	--	S	1	1
Sterigmatocystin	010048-13-2	S	2B	
Streptozotocin	018883-66-4	S	2B	2
Strontium chromate (VI)	627-78-9	S	1	1
Styrene	100-42-5	S	2B	
Styrene-7,8-oxide	96-09-3	S	2A	
Sulfallate	95-06-7	S	2B	2
Sulfur trioxide	01197-44-6	S	1	
Talc (containing asbestos fibers)	--	S	1	
Talc containing asbestiform fibres	--	S	1	
Tamoxifen	010540-29-1	S	1	
Tars	--	S		1
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)	1746-01-6		1	2
Tetrachloroethylene	127-18-4	S	2A	2
Tetrafluoroethylene	116-14-3	S	2B	
Tetranitromethane	509-14-8	S	2B	2
Thioacetamide	62-55-5	S	2B	2
4,4'-Thiodianiline	139-65-1	S	2B	
Thiotepa	52-24-4	S	2A	1
Thiourea	62-56-6	S	2B	2
Thorium dioxide	1314-20-1	S		1
2,6-Toluene diisocyanate	91-08-7	S	2B	
2,4-Toluene diisocyanate	584-84-9	S	2B	
Toluene diisocyanate (mixed isomers)	026471-62-5	S	2B	2
o-Toluenesulfonamide	88-19-7	S	2B	
o-Toluidine hydrochloride	636-21-5	S		2
ortho-Toluidine	95-53-4	S	2B	2
Toxaphene (Polychlorinated camphenes)	81-35-2	S	2B	2

Toxins derived from Fusarium moniliforme	--	S	2B	
Treosulphan	299-75-2	S	1	
Trichlormethine (trimustine hydrochloride)	817-09-4	S	2B	
Trichloroethylene	79-01-6	S	2A	
2,4,6-Trichlorophenol	88-06-2	S		2
1,2,3-Trichloropropane	96-18-4	S	2A	2
Tris(2,3-dibromopropyl)phosphate	126-72-7	S	2A	2
Trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)	062450-06-0	S	2B	
Trp-P-2(3-Amino-1-methyl-5H-pyrido[4,3-b]indole)	062450-07-1	S	2B	
Trypan blue	72-57-1	S	2B	
Uracil mustard	66-75-1	S	2B	
Urethane	51-79-6	S	2B	2
VM & P Naphtha	8032-32-4	S		
Valentinite	1317-98-2	S	2B	
Vinyl acetate	108-05-4	S	2B	
Vinyl bromide	593-60-2	S	2A	
Vinyl chloride	75-01-4	ORC	1	1
4-Vinyl cyclohexene	100-40-3	S	2B	
Vinyl fluoride	75-02-5	S	2A	
4-Vinyl-1-cyclohexene diepoxide	106-87-6	S		2
4-Vinylcyclohexene diepoxide	106-87-6	S	2B	
Zinc chromate (VI)	013530-65-9	S	1	1
Zinc chromate (VI) hydroxide	015930-94-6	S	1	

Select Carcinogens Definition

A carcinogen is any substance or agent that is capable of causing cancer – the abnormal or uncontrolled growth of new cells in any part of the body in humans or animals. Carcinogens are chronic toxins with long latency periods that can cause damage after repeated or long duration exposures and often do not have immediate apparent harmful effects.

The OSHA Lab Standard defines a "Select Carcinogen" as any substance, which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of

the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m(3);

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

With regard to mixtures, OSHA requires that a mixture, "shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1% or greater, which is considered to be carcinogenic."

Note that the potential for carcinogens to result in cancer can also be dependent on other "lifestyle" factors such as:

- Cigarette smoking
- Alcohol consumption
- Consumption of high fat diet
- Geographic location – industrial areas and UV light exposure
- Therapeutic drugs
- Inherited conditions

More information on carcinogens, including numerous useful web links such as a listing of OSHA regulated carcinogens, can be found on the OSHA Safety and Health Topics for Carcinogens webpage.

The State of California has developed an extensive list of "Carcinogens Known to the State of California through Prop 65."

APPENDIX E - Substances with High Acute Toxicity

The following list Provides examples of substances with a high degree of acute toxicity. It is not meant to be all inclusive. This list is only provided to give a general indication of materials which have this degree of potential hazard.

Certain chemicals have been identified as causing acute health effects or long-term chronic health effects. Substances of high acute toxicity cause immediate health effects at very low concentrations. (Prudent Practices in the Laboratory - Chapter 3 refers to the following definition of toxicity for ingested chemicals: Moderately toxic LD50 of 500-5,000 mg/kg; very toxic LD50 of 50-500 mg/kg, extremely toxic LD50 of 5-50mg/kg and supertoxic LD50 <5mg/kg). Examples of chemicals with high acute toxicity include hydrogen cyanide, phosgene or arsine. Research with supertoxic hazardous chemicals should receive prior approval from EH&S.

Substances that have high chronic toxicity cause damage after repeated exposure over a period of time. These may include carcinogens (or search the NIH report on carcinogens) reproductive toxins, mutagens, teratogens and sensitizers (see Reproductive Hazards, Teratogenic Agents and Pregnancy for other resources). Laboratory personnel (male and female), especially those of childbearing age, should be notified of any reproductive toxins being used in the laboratory. Any employee who is pregnant or planning to become pregnant should contact EH&S and a personal physician to assess potential exposures.

Procedures for Handling Highly Toxic & Carcinogenic Chemicals

Because chemicals with high acute toxicity and those with high chronic toxicity are hazardous at very low concentrations, the following practices must be observed:

- Notify all employees of the particular hazards associated with this work.
- Minimize contact with these chemicals by any route of exposure (inhalation, skin contact, mucous membrane contact or injection).
- Work only in a properly operating chemical fume hood or glove box.
- Decontaminate work surfaces after completing procedures.
- Remove all protective clothing before leaving the area and decontaminate it or if disposable, place it in a plastic bag, label and secure it. Call EH&S for disposal.
- Wash hands and any exposed skin before exiting the work area.
- Establish an emergency plan for procedures involving highly toxic chemicals. Do not conduct normal laboratory work in the designated area until decontaminated.

CHEMICAL NAME	CAS #
ACROLEIN	000107-02-8
ACRYLONITRILE	000107-13-1
ADIPONITRILE	000111-69-3
AMMONIA (GAS)	007664-41-7
ANILINE AND COMPOUNDS	000062-53-3
ARSENIC ACID	007778-39-4
ARSENIC PENTAFLUORIDE	007784-36-3
ARSENIC TRIOXIDE	001327-53-3
ARSINE	07784-42-1
BORON TRIBROMIDE	010294-33-4
BORON TRIFLUORIDE	007637-07-2
BROMINE	007726-95-6
BROMINE PENTAFLUORIDE	007789-30-2
BROMOACETONE	000598-31-2
BROMODICHLOROMETHANE	000075-27-4
CHLORINE TRIFLUORIDE	007790-91-2
CHLOROPICRIN	000076-06-2
CYANAMIDE	000420-04-2
CYANIDES	000057-12-5
CYANOGEN	000460-19-5
DECABORANE	017702-41-9
DIBORANE	019287-45-7
DICHLOROACETYLENE	007572-29-4
DIMETHYL SULFATE	000077-78-1
ENDOSULFAN	000115-29-7
ENDRIN	000072-20-8
ETHYLENE CHLOROHYDRIN	000107-07-3
FLUORINE	007782-41-4
GERMANE	007782-65-2
HYDROGEN CYANIDE	000074-90-8
HYDROGEN FLUORIDE	007664-39-3
HYDROGEN SELENIDE	007783-07-5
HYDROGEN SULFIDE	007783-06-4
METHYL BROMIDE	000074-83-9
METHYL CYCLOPENTADIENYL MANGANESE TRICARBONYL	012108-13-3
METHYL HYDRAZINE	000060-34-4
METHYL ISOCYANATE	000624-83-9
METHYLDICHLOROARSINE	000593-89-5
NICKEL CARBONYL	013463-39-3
NICOTINE	000054-11-5
NITRIC ACID (FUMING)	007697-37-2
NITRIC OXIDE	010102-43-9
NITROGEN DIOXIDE	010102-44-0
NITROGEN TETROXIDE	010544-72-6
PARATHION	000056-38-2
PENTABORANE	019624-22-7
PENTACHLOROPHENOL	000087-86-5
PHOSGENE	000075-44-5
PHOSPHINE	007803-51-2
PHOSPHORUS (YELLOW)	007723-14-0
PROPARGYL BROMIDE	000106-96-7

PROPIONIC NITRILE	000107-12-0
PROPYLENE OXIDE	000075-56-9
SELENIUM HEXAFLUORIDE	007783-79-1
SODIUM FLUOROACETATE	000062-74-8
STIBINE	007803-52-3
STRYCHNINE	000057-24-9
TETRAETHYL LEAD	000078-00-2
TETRAETHYL PYROPHOSPHATE	000107-49-3
TETRAMETHYL SUCCINONITRILE	003333-52-6
THIOPHENOL	000108-98-5
TOLUIDINE, ORTHO-	000095-53-4
TOLUIDINE, ORTHO-	000108-49-0
VANADIUM PENTOXIDE	001314-62-1
VENOM, SNAKE- CROTALUS ADAMANTEUS	000000-00-0
VENOM, SNAKE- CROTALUS ATROX	000000-00-0
XYLIDINE	001330-73-8

APPENDIX F

SELECTION, USE AND CARE OF PERSONAL PROTECTIVE EQUIPMENT

OSHA Standard 29CFR1910.132

General requirements:

A variety of specialized clothing and equipment is commercially available for use in the laboratory. The proper use of these items will minimize or eliminate exposure to the hazards associated with many laboratory operations.

Every laboratory worker should be familiar with the location and proper use of the available protective apparel and safety equipment that has been designated for use by the respective department.

Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

Employee/student-owned equipment:

Where employees or students provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

Design:

All personal protective equipment shall be of safe design and construction for the work to be performed as per ANSI Standards.

Hazard assessment and equipment selection:

The departmental designee shall assess each laboratory to determine what hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If

such hazards are present, or likely to be present, the departmental designee, with assistance from the Environmental Health and Safety shall:

1. Select, and have each affected person use, the types of PPE that will protect the affected person from the hazards identified in the hazard assessment;

2. Communicate selection decisions to each affected person; and,

3. Select PPE that properly fits each affected employee.

Environmental health and safety shall verify that the required laboratory hazard assessment has been performed through a written certification that identifies the laboratory evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.

Defective and damaged equipment:

Defective or damaged personal protective equipment shall not be used.

Training:

The departmental designee shall insure that training is provided to each person who is required by this section to use PPE. Each such person shall be trained to know at least the following:

1. When PPE is necessary;
2. What PPE is necessary;
3. How to properly don, doff, adjust, and wear PPE;
4. The limitations of the PPE; and, (v) the proper care, maintenance, useful life and disposal of the PPE.

Each affected person shall demonstrate an understanding of the training specified above, and the ability to use PPE properly, before being allowed to perform work requiring the use

When the department has reason to believe that any affected person who has already been trained does not have the understanding and skill required the department shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

1. Changes in the workplace render previous training obsolete; or
2. Changes in the types of PPE to be used render previous training obsolete; or
3. Inadequacies in an affected person's knowledge or use of assigned PPE indicate that the person has not retained the requisite understanding or skill.

The department shall verify that each affected employee has received and understood the required training through a written documentation that contains the name of each employee trained, the date(s) of training, and that identifies the subject of the training.

A. SELECTION

1. The purpose of chemical protective clothing and equipment is to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered during hazardous materials operations. During chemical operations, it is not always apparent when exposure occurs. Many chemicals pose invisible hazards and offer no warning properties.

2. These guidelines describe the various types of clothing that are appropriate for use in various chemical operations, and provides recommendations in their selection and use.

3. It is important to realize that no single of protecting you against all hazards. Thus protective clothing should be used in conjunction with other protective methods. For example, engineering or administrative controls to limit chemical contact with personnel should always be considered as an alternative measure for preventing chemical exposure.

4. The use of protective clothing can itself create significant wearer hazards, such as heat stress, physical and psychological stress, in addition to impaired vision, mobility, and communication. In general, the greater the level of chemical protective clothing, the greater the associated risks. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. Over-protection as well as under-protection can be hazardous and should be avoided.

B. PROTECTIVE CLOTHING APPLICATIONS

1. Protective clothing must be worn whenever the wearer faces potential hazards arising from chemical exposure. Some examples include:
   - Emergency response
   - Chemical experiments and research operations

2. Within each application, there are several operations which require chemical protective clothing. For example, in emergency response, the following activities dictate chemical protective clothing use:
   - Site Survey
   - Rescue
   - Spill Mitigation
   - Emergency Monitoring

C. THE CLOTHING ENSEMBLE

1. The approach in selecting personal protective clothing must encompass an "ensemble" of clothing and equipment items that are easily integrated to provide both an appropriate level of protection and still allow one to carry out activities involving chemicals. In many cases, simple protective clothing by itself may be sufficient to prevent chemical exposure such as in the wearing of gloves in combination with a splash apron and face shield (or safety goggles).

2. The following is a checklist of components that may form the chemical protective ensemble:

   - Protective clothing (lab coats, coveralls, hoods, gloves, boots);

   - Respiratory equipment (air purifying respirators, dust masks);

   - Head protection;

   - Eye protection;

   - Ear protection;

   - Inner garments; and

   - Outer protection (overgloves, overboots, flashcover.)

3. Factors which affect the selection of ensemble components include:

   a. How each item accommodates the integration of other ensemble components.

   b. The ease of interfacing ensemble components without sacrificing required performance (e.g., a poorly fitting overglove that greatly reduces wearer dexterity).

   c. Limiting the number of equipment items to reduce donning time and complexity.

4. Level of Protection:

   a. Generally, all lab experiments with the potential for release of hazardous materials should be performed under the ventilation hood, and the basic safety equipment, i.e.

safety glasses or goggles and a lab coat would be sufficient. However, certain situations may require modifications in order to provide the most appropriate level of protection. For example, if an emergency response activity involves a highly contaminated area or if the potential for contamination is high, it may be advisable to wear a disposable covering such as Tyvek coveralls or PVC splash suits, gloves and respiratory protection in addition to the basic equipment.

b. The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the chemical situation or process increases, and when workers are required to perform different tasks. Personnel should upgrade or downgrade their level of protection only with the concurrence with the departmental designee and environmental health and safety.

c. The recommendations that follow serve only as guidelines. It is important for you to realize that selecting items by how they are designed or configured alone, is not sufficient to ensure adequate protection. In other words, just having the right components to form an ensemble is not enough. The EPA levels of protection do not define what performance the selected clothing or equipment must offer. Many of these considerations include the type of chemical, the chemical state and the concentration.

Body Protection:

a. Lab Coat: General use for most experiments. Protects against contamination from solids and provides a limited degree of splash protection.

b. Apron: More protective in situations involving liquid chemicals with potential for splashing or spilling. Provides protection to chest and legs. Sleeves should be added if arm protection is required.

c. Tyvek Suit (uncoated): Provides full body protection against dusts and other materials but not gases and vapors. Does not protect head or neck.

d. Tyvek Suit (coated): Provides limited protection against liquids and some vapors.

* Refer to Manufacturers recommendations of for chemical resistive properties of all Personal Protective Equipment.

Head:

a. Hood: Protects against chemical splashes and particulates.

b. Protective Hair Covering: Protects against chemical contamination of hair. Also prevents the entanglement of hair in machinery or equipment.

Eyes and Face:

a. Safety Glasses: Protect eyes against large particulates and projectiles (Mandatory in All Labs).

b. Goggles: Depending on their construction (vented, Non-vented) goggles can provide protection against vaporized chemicals, splashes, large particles, and projectiles (if constructed with impact resistant lenses).

c. Face Shield: Protects against chemical splashes. Does not adequately protect against projectiles.

Hands and Arms:

a. Gloves and sleeves: Protect hands and arms from chemical contact. (Must refer to manufacturer's recommendations regarding chemical resistance prior to use.)

Foot:

a. Shoes/boots: Constructed of chemical resistive materials to protect feet from contact with chemicals.

b. Shoe Covers: Normally disposable. Provide wide range of protection to feet dependant on material and construction.

Respiratory:

a. Dust Mask: Offers protection against some nuisance dusts and particulates.

b. 1/2 Face Respirator: Used by qualified persons only. Offers air purifying of stipulated dusts, mists, fumes and other chemicals at lower concentrations. Not effective in low oxygen atmospheres or areas with high chemical concentrations. Cartridge should be specified based on the chemicals present.

* For the purposes of this Plan, no other respiratory protection will be specified or allowed for use, unless authorized by Environmental Health and Safety.

** **Never** use emergency oxygen supply bottles as a source of respiratory protection.

D. USE OF PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment can only provide protection if it is worn on a consistent basis. Several factors may lead to inconsistent use of personal protective equipment. It is important that these factors be considered and addressed at the same time that the protective equipment is selected.

Possible causative factors for inconsistent use of PPE:

1. Improper fit or size
2. Unavailability of Item
3. Damaged or worn Equipment
4. Dirty or unsanitary equipment
5. Unsatisfactory, or lack of, training
6. PPE not suited for hazard
7. Personal image - PPE is unattractive
8. Lack of enforcement by department personnel

All factors above must be considered. Deficiencies in any of these areas should be addressed to maintain the effectiveness of the Personal Protective Equipment program. This in turn will minimize or eliminate exposure to hazardous materials, as well as the liability normally associated with those exposures.

All departmental personnel are encouraged to report continued deficiencies to the Chemical/Biological Hygiene Committee for assistance in their correction.

Personal protective equipment which is found to be inadequate to protect against the hazard, shall be replaced with equipment which provides an increased level of protection.

E. CARE OF PERSONAL PROTECTIVE EQUIPMENT

All equipment must be inspected for wear and deterioration of their components before and after each use. Special attention should be given to rubber or plastic parts that can deteriorate.

Any defective equipment shall be discarded and replaced prior to the next use. Soiled or otherwise contaminated clothing and/or equipment must be cleaned or otherwise decontaminated prior to re-use. This cleaning and decontamination shall proceed immediately following its use. Under no circumstances should contaminated clothing or other equipment be left in the laboratory. Each department should designate an area for the storage of contaminated clothing and an area for the storage of other contaminated equipment. Soiled clothing that cannot be laundered due to heavy contamination should be discarded. Care should be taken during disposal to insure that the clothing is assigned the correct waste designation.

Equipment that can be easily decontaminated can be washed in a detergent solution and then sanitized by immersion in a sanitizing solution. Cleaner - sanitizer that effectively clean the respirator and contain a bactericidal agent are commercially available Contact Environmental Health and Safety or assistance in finding a vendor if required.

The bactericidal agent frequently used is a quaternary ammonium compound. A mixture of bleach and water (1:10) can be used for solid surfaces.

The use of strong cleaning agent or solvents to clean equipment should be avoided. Many of these products may affect the protective qualities of the equipment.

Once clothing and equipment is decontaminated, it should be thoroughly dried and stored in a cool dry place. "Clean" equipment should be kept in a distinctly different area than "dirty" equipment to prevent cross contamination.

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Comparison of NFPA 704 and HazCom 2012 Labels

	 NFPA 704	 HazCom 2012
Purpose	Provides basic information for emergency personnel responding to a fire or spill and those planning for emergency response.	Informs workers about the hazards of chemicals in workplace under normal conditions of use and foreseeable emergencies.
Number System: NFPA Rating and OSHA's Classification System	0-4 0-least hazardous 4-most hazardous	1-4 1-most severe hazard 4-least severe hazard • The Hazard category numbers are NOT required to be on labels but are required on SDSs in Section 2. • Numbers are used to CLASSIFY hazards to determine what label information is required.
Information Provided on Label	• Health-Blue • Flammability-Red • Instability-Yellow • Special Hazards*-White *OX Oxidizers W Water Reactives SA Simple Asphyxiants	• Product Identifier • Signal Word • Hazard Statement(s) • Pictogram(s) • Precautionary statement(s); and • Name address and phone number of responsible party.
Health Hazards on Label	Acute (short term) health hazards ONLY. Acute hazards are more typical for emergency response applications. Chronic health effects are not covered by NFPA 704.	Acute (short term) and chronic (long term) health hazards. Both acute and chronic health effects are relevant for employees working with chemicals day after day. Health hazards include acute hazards such as eye irritants, simple asphyxiants and skin corrosives as well as chronic hazards such as carcinogens.
Flammability/ Physical Hazards on Label	NFPA divides flammability and instability hazards into two separate numbers on the label. Flammability in red section Instability in yellow section	A broad range of physical hazard classes are listed on the label including explosives, flammables, oxidizers, reactives, pyrophorics,combustible dusts and corrosives.
Where to get information to place on label	Rating system found in NFPA Fire Protection Guide to Hazardous Materials OR NFPA 704 Standard System for Identification of the Hazards of Materials for Emergency Response 2012 Edition. Tables 5.2, 6.2, 7.2 and Chapter 8 of NFPA 704	OSHA Hazard Communication Standard 29 CFR 1910.1200 (2012). 1) Classify using Appendix A (Health Hazards) and Appendix B (Physical Hazards) 2) Label using Appendix C
Other	The hazard category numbers found in section 2 of the HC2012 compliant SDSs are NOT to be used to fill in the NFPA 704 diamond.	Supplemental information may also appear on the label such as any hazards not otherwise classified, and directions for use.
website	www.nfpa.org/704	www.osha.gov OR www.osha.gov/dsg/hazcom/index.html

For more information:

NFPA®
National Fire Protection Association
www.nfpa.org
(800) 344-3555

OSHA® Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

NFPA® OSHA® QUICK CARD™

The substance: "NOMIXUP 7042012"

To create an OSHA label per HazCom 2012:

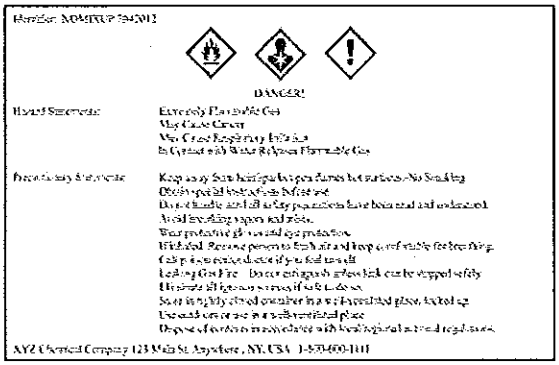
Step 1: Perform the classification in accordance with Appendix A: Health Hazards & Appendix B Physical Hazards of 29 CFR 1910.1200 — this is where you find the criteria for each hazard class and hazard category.

Class: Flammable Gas, Category 1

Class: Carcinogen, Category 1B

Class: Specific Target Organ Toxicity (Single Exposure), Category 3

Class: Substances and Mixtures Which, in Contact with Water, Emit Flammable Gases, Category 3



Step 2: Gather labeling information (Pictograms, Signal Word, Hazard Statements) from Appendix C of 29 CFR 1910.1200 based on the chemical's hazard class and category.

Step 3: Create the Label

To Create NFPA 704 label:

Step 1: Collect information on hazards from applicable sections of SDS. Some SDSs may provide the NFPA diamond symbol with hazard rating numbers filled in already. **Note: Do NOT use the hazard category numbers given in section 2 of HazCom 2012 compliant SDS on 704 label!**

If the diamond is not provided on the SDS you can obtain the information under the following sections of the SDS. Note that additional information may be provided in other sections of the SDS.

- Health hazard information under Section 11
- Flammability information under Section 9
- Instability information under Section 10
- Special information under Section 9, 10, 11

Step 2: Obtain current edition copy of NFPA 704 or view on line at www.nfpa.org/704. Compare the criteria on the SDS sections as shown above with the criteria shown in Tables 5.2 (Health), 6.2 (Flammability), 7.2 (Instability) and 8.2 (Special Hazards).

Step 3: Place numbers for the degree of hazard associated with the criteria obtained in Step 2 in the correct quadrant of NFPA 704 placard.

For more information:

National Fire Protection Association
www.nfpa.org
(800) 344-3555

OSHA® Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

Appendix H – OSHA Subpart Z Toxic and Hazardous Substances

OSHA Regulations (Standards – 29CFR1910.1000)

- Part Number: 1910
- Part Title: Occupational Safety and Health Standards
- Subpart: Z
- Subpart Title: Toxic and Hazardous Substances
- Standard Number: 1910.1000 TABLE Z-1
- Title: TABLE Z-1 Limits for Air Contaminants.

TABLE Z-1 LIMITS FOR AIR CONTAMINANTS

NOTE: Because of the length of the table, please refer to this link for TABLE Z-1: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9992 and explanatory Footnotes applicable to all substances are given below as well as at the end of the table. Footnotes specific only to a limited number of substances are also shown within the table.

Footnote(1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote(d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote(f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote(2) See Table Z-2.

Link: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9993

Footnote(3) See Table Z-3

Link: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9994

Footnote(4) Varies with compound.

Footnote(5) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1026 are stayed or are otherwise not in effect.

Appendix I

SUNY Buffalo State Student Injury Report Form

Student Name: _____ **ID#:** _____

SEX: MALE_____ **FEMALE**_____ **AGE:** _____

Incident Information:

Time of Incident: _____ AM / PM Date (dd/mm/yy): _____

Location of Incident (BLDG, ROOM #): _____

Individual in Charge: _____

Describe Injury, how it happened and immediate first aid (BE AS SPECIFIC AS POSSIBLE):

_____

_____

_____

_____

_____

Witness Information (include name, title and telephone number):

_____

_____

Was the injury a result of an unsafe condition? YES: _____ NO: _____

DID THE STUDENT REFUSE TO BE ESCORTED TO THE WEIGEL HEALTH CENTER?

YES: _____ NO: _____ DATE (dd/mm/yy): _____

Injured person (initials): _____

Person Responding: _____
(Name, Campus Address and Phone Extension)

Reporting Person: _____
(Name, Campus Address and Phone Extension)

Safety Committee Chairperson (initials): _____

Department Chairperson (initials): _____

Appendix J

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Hazard Communication Standard Pictogram

As of June 1, 2015, the Hazard Communication Standard (HCS) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

HCS Pictograms and Hazards

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment** (Non-Mandatory)  • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

For more infomation:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA (6742)

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Hazard Communication Safety Data Sheets

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products. As of June 1, 2015, the HCS will require new SDSs to be in a uniform format, and include the section numbers, the headings, and associated information under the headings below:

Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.

(Continued on other side)

For more information:

OSHA® Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

OSHA 3493-02 2012

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Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties lists the chemical's characteristics.

Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information*
Section 13, Disposal considerations*
Section 14, Transport information*
Section 15, Regulatory information*

Section 16, Other information, includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)).

Employers must ensure that SDSs are readily accessible to employees.
See Appendix D of 29 CFR 1910.1200 for a detailed description of SDS contents.

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