Agriculture Research Service
Lincoln, Nebraska Location
Chemical Hygiene Plan (CHP)
January 1998

1. Introduction

A. Purpose

Guidance: Each Principle Investigator (PI) must review the CHP and decide how to apply pertinent sections to the chemical procedures used in their laboratories. If changes, deletions and/or modifications are necessary, contact the Chemical Hygiene Officer to modify the text to address local hazards, policies and procedures.

This Chemical Hygiene Plan describes:

- Policies
- Procedures
- Equipment
- Personal Protective Equipment
- Work Practices

This Plan is intended to meet the requirements of the federal Occupational Safety and Health Administration (OSHA) standard 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories (Appendix A).

This Chemical Hygiene Plan is intended to protect employees from the health hazards presented by many hazardous chemicals used in laboratories and limit their exposures to OSHA regulated substances. Laboratory workers must not be exposed to substances in excess of the permissible exposure limits (PEL) specified in OSHA rule 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances. PELs for regulated substances are provided in Appendix B. PELs refer to airborne concentrations of substances and are averaged over an eight-hour day. A few compounds/substances have individual standards that must be referred to for specific details. These generally have "action levels" (usually set at half the Threshold Limit Value (TLV)), and special air and medical monitoring requirements. Action levels are air concentrations below the PEL which nevertheless require that certain actions such as medical surveillance and workplace monitoring take place.

Guidance: Pay particular attention to the following paragraph. If you, as a PI, suspect exposure concentrations exceed allowable levels, please contact the Location Safety Officer for air monitoring assistance.

An employee's workplace exposure to any regulated substance must be monitored if there is reason to believe that the exposure will exceed an action level or a PEL. If exposure to any regulated substance routinely exceed an action level or PEL, there must also be employee medical surveillance.

B. Scope and Application

Guidance: This section specifies which researchers and laboratories are covered. The text below provides guidance.

This standard applies where "laboratory use" of hazardous chemicals occurs. Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met: 1) the handling or use of chemicals occurs on a "laboratory scale", that is, the work involves containers which can easily and safely be manipulated by one person, 2) multiple chemical procedures or chemical substances are used, 3) protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposures to hazardous chemicals.

At a minimum, this definition covers employees (including student employees, technicians, supervisors and lead researchers) who use chemicals in research at the Location. Certain non-traditional laboratory settings may be included under this standard at the option of Unit Research Leaders.

C. Responsibilities

Guidance: Implementation of the Chemical Hygiene Plan at the Location is a shared responsibility. Chemical Hygiene Officer, Location Coordinator, Research Leaders, Laboratory Supervisors, Location Safety Committee and Location Safety Officer all have roles to play. These roles are outlined generally below.

The Location Coordinator is responsible for developing and supporting a broad-based chemical hygiene program that will protect laboratory employees from health effects associated with hazardous chemicals. As Management, the Location Coordinator is responsible for integrating safety into all location activities and for promoting the same attitude among all levels of employment.

Research Leaders have the responsibility to ensure that each of their employees adhere to the Chemical Hygiene Plan.

Principal and Co-Principal Investigators(PI) shall ensure applicable parts of the Chemical Hygiene Plan and other safety precautions are incorporated in all research protocols.

Laboratory Supervisors are responsible for scheduling time for employees to attend designated training sessions and for assuring that potential hazards of specific projects have been addressed before work is started. The supervisor is also responsible for enforcing safe work practices and for reporting hazardous conditions to the Chemical Hygiene Officer or Location Safety Officer.

Employee. Each laboratory employee is responsible for attending scheduled training sessions, following safety guidelines applicable to the procedures being carried out, assuring that required safety precautions are in place before work is started, and reporting hazardous conditions encountered.

Location Safety Committee shall assist the Location's management by making recommendations regarding methods of addressing safety and health concerns. The committee will also assist management in assessing the effectiveness of training and abatement efforts at the Location.

Location Safety Officer shall provide advice to management on issues involving the safety, health and environmental conditions at the Location. Additional responsibilities include: 1) identifying safety, health and environmental education/training needs, 2) arrange for and schedule appropriate safety, health and environmental education/training needs, 3) distribute information related to safety, health and environmental education/training, 4) arrange for the abatement of any identified health hazards. Assist the Chemical Hygiene Officer in maintaining and managing required chemical inventories. Assist in obtaining employee medical surveillance services and maintenance of required records and documentation.

Chemical Hygiene Officer. The Location's Chemical Hygiene Officer is Dr.Dennis Berkebile. The Chemical Hygiene Officer shall develop and update the Chemical Hygiene Plan and appropriate policies and practices. Provides technical assistance in complying with the Chemical Hygiene and answers specific inquires from employees. Assist Research Leaders in developing appropriate safety pre-cautions for new projects and procedures. Monitors procurement of new chemicals and the collection and disposal of chemical wastes. Develops and implements and chemical labeling program. Reviews chemical inventories to determine which chemicals are carcinogen, particularly hazardous substances or chemical of special interest.

2. Standard Operating Procedures

Guidance: Subsections A, B and C present the topics of the Standard Operating Procedures(SOPs). Each PI should review these subsections and adopt and train their employees on all the SOPs which pertain to the chemicals and procedures used in the laboratory. Work with particularly hazardous or unique chemicals and/or procedures may not be covered by the SOPs listed below. In this case, the PI must write SOPs that describe the work to be conducted, and the safety measures to be taken by

employees. Procedures and written safety precautions included in the "Laboratory Procedure Notebook" may serve as laboratory-specific SOPs. Keep these individual SOPs in the laboratory and train employees on their contents.

A. Laboratory operating procedures found in Prudent Practices in the Laboratory: Handling and Disposal of Chemicals (National Research Council, 1995) are adopted for general use at the Location. This publication should be obtained and referred to by all laboratories. A copy is available in the Location Safety Office. Chapters 5 and 6 are of special importance. The topics included in these chapters are:

Chapter 5: Working With Chemicals

a. Introduction
b. Prudent Planning
c. General Procedures for Working with Hazardous Chemicals
d. Working with Substances of High Toxicity
e. Working with Biohazardous and Radioactive Materials
f. Working with Flammable Chemicals
g. Working with Highly Reactive or Explosive Chemicals
h. Working with Compressed Gases

Chapter 6: Working with Laboratory Equipment

a. Introduction
b. Working with Water-Cooled Equipment
c. Working with Electrically Powered Laboratory Equipment
d. Working with Compressed Gases
e. Working with High/Low Pressures and Temperatures
f. Using Personal Protective, Safety, and Emergency Equipment
g. Emergency Procedures

3. Criteria for Implementation of Control Measures

Guidance: Engineering controls, personal protective equipment, hygiene practices, and administrative controls each play a role in a comprehensive laboratory safety program. Implementation of specific measures must be carried out on a case-by-case basis, using the following criteria for guidance in decision making. Assistance is available from the Chemical Hygiene and Location Safety Officers.

A. When to Use Fume Hoods

The laboratory fume hood is the major protective device available to laboratory workers. It is

designed to capture chemicals that escape from their containers or apparatus and to remove them from the laboratory environment before inhalation occurs. Characteristics to be considered in requiring fume hood use are physical state, volatility, toxicity, flammability, eye and skin irritation, odor, and the potential for producing aerosols. A fume hood should be used if a proposed chemical procedure exhibits any one of these characteristics to a degree that (1) airborne concentrations might approach the action level (or permissible exposure limit), (2) flammable vapors might approach one-tenth of the lower explosion limit, (3) materials of unknown toxicity are used or generated, or (4) the odor produced is annoying to laboratory occupants or adjacent units.

Procedures that can generally be carried out safely outside the fume hood include those involving (1) water-based solutions of salts, dilute acids, bases, or other reagents, (2) very low volatility liquids or solids, (3) closed systems that do not allow significant escape into the laboratory environment, and (4) extremely small quantities of otherwise problematic chemicals. The procedure itself must be evaluated for its potential to increase volatility or procedure aerosols.

In specialized cases, fume hoods will contain exhaust treatment devices, such as water wash-down for perchloric acid use, or charcoal or HEPA filters for removal of particularly toxic or radioactive materials.

B. When to Use Safety Shields or Other Containment Devices

Safety shields, such as the sliding sash of a fume hood, are appropriate when working with highly concentrated acids, bases, oxidizers or reducing agents, all of which have the potential for causing sudden spattering or even explosive release of material. Reactions carried out at non-ambient pressure (vacuum or high pressure) also require safety shields, as do reactions that are carried out for the first time or are significantly scaled up from normal operating conditions.

Other containment devices, such as glove boxes or vented gas cabinets, may be required when it is necessary to provide an inert atmosphere for the chemical procedure taking place, when capture of any chemical emission is desirable, or when the standard laboratory fume hood does not provide adequate assurance that over exposure to a hazardous chemical will not occur. The presence of biological or radioactive materials may also mandate certain special containment devices.

High strength barriers coupled with remote handling devices may be necessary for safe use of extremely shock sensitive or reactive chemicals.

Highly localized exhaust ventilation, such as is usually installed over atomic absorption units, may be required for instrumentation that exhaust toxic or irritating materials to the laboratory environment.

Ventilated chemical storage cabinets or rooms should be used when the chemicals in storage may generate toxic, flammable or irritating levels of airborne contamination.

C. When to Use Personal Protective Equipment

Eye protection is required for all personnel and any visitors whose eyes may be exposed to chemical or physical hazards. Side shields on safety spectacles provide some protection against splashed chemicals or flying particles, but goggles or face shields are necessary when there is a greater than average danger of eye contact. A higher than average risk exists when working with highly reactive chemicals, concentrated corrosives, or with vacuum or pressurized glassware systems. Contact lenses should not be worn in the laboratory. Chemicals can be concentrated under contact lenses and contact lenses will interfere with eye flushing in case of emergency.

Lab coats or other similar clothing protectors are strongly encouraged for all laboratory personnel. Lab coats are required when working with select carcinogens, reproductive toxins, substances which have a high degree of acute toxicity, strong acids and bases, and any substance on the OSHA PEL list carrying a "skin" notation.

Gloves made of appropriate material are required to protect the hands and arms from thermal burns, cuts, or chemical exposure that may result in absorption through the skin or reaction on the surface of the skin. Gloves are also required when working with particularly hazardous substances where possible transfer from hand to mouth must be avoided. Thus gloves are required for work involving pure or concentrated solutions of select carcinogens, reproductive toxins, substances which have a high degree of acute toxicity, strong acids and bases, and any substance on the OSHA PEL list carrying a "skin" notation.

Gloves should be carefully selected using guides from the manufacturers. General selection guides are available (see Prudent Practices, p.159); however, glove-resistance to various chemical materials will vary with the manufacturer, model and thickness. Therefore, review a glove-resistance chart from the manufacturer you intend to buy from before purchase.

Bare feet are not permitted in any laboratory. Sandals, open-toed and cloth shoes are prohibited in all laboratories.

Respiratory protection is generally not necessary in the laboratory setting and must not be used as a substitute for adequate engineering controls. Availability of respiratory protection for emergency situations may be required when working with chemicals that are highly toxic and highly volatile or gaseous. Any procedure where the potential for respiratory protection exist, will not be performed prior to contacting the Chemical Hygiene and Location Safety Officers.

Supervisors shall designate areas, activities, and tasks which require specific types of personal protective equipment as described above.

4. Management of Fume Hoods and Other Protective Equipment

Guidance: Each PI should identify the safety equipment to be used in the laboratory, and ensure

that all employees are properly trained in its use. Since no two fumes hoods operate exactly alike, be sure employees understand the operating principals and use safe operating procedures. Contact the Location Safety Officer for assistance. Appendix C details procedures to be followed for the use and maintenance of Fume Hoods.

A. Monitoring Safety Equipment

Fume hoods must be monitored daily by the user to ensure that air is moving into the hood. Any malfunctions must be reported immediately to the Location Safety Officer. The hood should have a continuous reading device, such as a pressure gauge, to indicate that air is moving correctly. Users of older hoods without these devices should attach a strip of tissue or yarn to the bottom of the vertical sliding sash. The user must ensure the hood and baffles are not blocked by equipment and bottles, as air velocity through the face may be decreased. The Location Safety Office will ensure the average face velocity of each fume hood is measured annually. A record of monitoring results will be made.

The acceptable operating range for fume hoods is 80 to 100 linear feet per minute, at the designated sash opening (usually 18 inches). Sash height should only be lowered or raised, as necessary, to protect a worker's breathing zone. Never operate at full-up sash position. The glass provides good protection, even in the event of an explosion.

Eye washes must be flushed weekly by the user. This will ensure that the eye wash is working, and that the water is clean, should emergency use become necessary. Fire extinguishers will be checked annually by a University contractor. The user is responsible for regularly checking other protective equipment to ensure proper functioning. The Location Safety Office can assist with these evaluations, should assistance be necessary.

B. Maintenance

During maintenance of fume hoods, laboratories must clean out, and if necessary, decontaminate the fume hood and restrict use of chemicals to ensure the safety of maintenance personnel.

C. Training

Training in the appropriate use and care of fume hood systems, showers, eyewashes and other safety equipment must be included in the initial training of employees.

5. Employee Information and Training

Guidance: All employees must be trained on the topics listed in subsections A and B below. Training must occur at initial hire and at annual refresher intervals. Reading and/or oral presentation of the contents of the CHP may be supplemented by video and slide presentations. Ensure employees are trained on the details of all applicable general and laboratory-specific Standard Operating Procedures and document the training.

A. Information

It is essential that laboratory employees have access to information on the hazards of chemicals and procedures for working safely. Supervisors must ensure that laboratory employees are informed about and have access to the following information sources:

i. The contents of the OSHA standard,
Occupational Exposure to Hazardous Chemicals in Laboratories, and its appendices (29 CFR 1910.1450) (Appendix A)

ii. The Location Chemical Hygiene Plan

iii. The University of Nebraska, Lincoln Chemical Hygiene Plan (Appendix D)

iv. The Permissible Exposure Limits (PEL)(Appendix B)

v. Material Safety Data Sheets (MSDS)
Copies shall be available in each laboratory for each chemical present and a master list is available through the Location Safety Office.

B. Training

Each laboratory supervisor is responsible for ensuring that laboratory employees are provided with training about the hazards of chemicals present in their laboratory work area, and methods to control exposure to such chemicals. Such training must be provided at the time of an employee's initial assignment and prior to assignments involving new potential exposure situations. Refresher training must be provided annually.

Employee training will include, at a minimum, the following subjects:

i. Methods of detecting the presence of hazardous chemicals
(Observation, odor, real-time monitoring, air sampling, etc.)

ii. Basic toxicological principles,

including toxicity, hazard, exposure, routes of entry, acute and chronic effects, dose-response relationship, LD50, threshold limit values and permissible exposure limits, and health hazards related to classes of chemicals

iii. Good laboratory practice,

including general techniques designed to reduce personal exposure and to control physical hazards, as well as specific protective mechanisms and warning systems used in individual laboratories. Appropriate use of fume hoods is to be specifically addressed.

iv. Description of information available,

including Material Safety Data Sheets.

v. Emergency response actions

appropriate to Location and individual laboratories.

vi. Applicable details of the laboratory's Chemical Hygiene Plan,

including general and laboratory-specific Standard Operating Procedures.

6. Required Approvals

Guidance: Certain laboratory operations, procedures or activities may warrant prior approval from a designated supervisor. Procedures involving chemicals listed in Tables 1-5 require prior approval. The PI must consider the toxicity of the chemicals used, the hazards of each procedure, and the knowledge and experience of the laboratory workers, and decide which will require pre-approval.

A. After Hours Work

All after-hours work requires prior approval by, or notification of, the project leader. The project leader is the individual responsible for ensuring adherence to the after-hours policy. Each employee will be required to certify their understanding of the policy in writing. Original signed copy will be maintained by the project leader.

7. Medical Consultation and Examination

Guidance: PIs must be aware of when any employee is entitled to receive medical attention, and must ensure employees are also aware of the process that will be followed.

A. All employees who work with hazardous chemicals

All employees who work with hazardous chemicals will have 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 laboratory.

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.

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 will be provided an opportunity for a medical consultation. Such consultation will be for the purpose of determining the need for a medical examination.

The Chemical Hygiene Officer will be contacted whenever the need for a medical consultation or examination occurs, or when there is uncertainty as to whether any of the above criteria have been met.

B. All Medical Examinations and Consultations

will be performed by or under the direct supervision of a licensed physician and will be provided without cost to the employee, without loss of pay and at a reasonable time and place.

8. Additional Employee Protection for Work with Particularly Hazardous Substances

Guidance: PIs must consider the toxicity of the chemicals used and the hazards of each procedure performed, and decide whether the procedure requires the use of additional protective measures. The additional protective measures should be incorporated into the Standard Operating Procedure.

Additional employee protection will be considered for work with particularly hazardous substances. These include select carcinogens, reproductive toxins and substances which have a high degree of acute toxicity. Prudent Practices, pp. 90-93 provides detailed recommendations

for work with particularly hazardous substances. Laboratory supervisors and PIs are responsible for assuring that laboratory procedures involving particularly hazardous chemicals have been evaluated for the level of employee protection required. Specific consideration will be given to the need for inclusion of the following provisions:

A. Planning;
B. Establishment of designated area;
C. Access control;
D. Special precautions such as:

- use of containment devices such as fume hoods or glove boxes
- use of personal protective equipment
- isolation of contaminated equipment
- practicing good laboratory hygiene
- prudent transportation of very toxic chemicals

E. Planning for accidents and spills
F. Special storage and waste disposal practices

9. Recordkeeping, Review and Update of Chemical Hygiene Plan

A. Record Keeping

i. Exposure evaluation

All records of exposure evaluations and results will be retained in the Location Safety Office files for the term of employment plus 30 years as required by OSHA.

ii. Medical consultation and examination

Results of medical consultations and examinations will be kept by the appropriate agency contract health care provider for a length of time specified by appropriate medical records standards. This retention period will be at least the term of employment plus 30 years.

iii. Training

All records of general safety training required by the Location will be recorded in a centralized database in the Location Safety Office. Records of Laboratory specific training will be retained within the employees work area. These records will be retained for the length of employment plus 2 years.

iv. Fume hood monitoring
Data on annual fume hood monitoring will be maintained in the Location Safety Office. Fume hood monitoring data are considered maintenance records and as such will be kept for 5 years.

B. Review and Update of Chemical Hygiene Plan

On an annual basis, the Chemical Hygiene Plan will be reviewed and evaluated for its effectiveness by the Chemical Hygiene Officer, Location Safety Officer and Location Safety Committee and updated as necessary. Any changes in the CHP will be transmitted to all Laboratories. As an ongoing evaluation, all users shall continuously review the CHP and submit recommendations for change to the Chemical Hygiene Officer.

TABLES

Table 1 - Chemical Hazards of Select Gases

Workers are advised to consult the Material Safety Data Sheet (MSDS) for all gases used. Certain hazardous substances that may be supplied as compressed gases are:

- Baron Halides
- Chlorine Trifluoride
- Hydrogen Selenide
- Methyl Chloride
- Phosphine
- Silane
- Silyl Halides

The above list is not all inclusive.

Guidance: Laboratories may choose to add other chemicals to the above list: for example, sulfur-containing compounds such as mercaptans can cause significant odor problems when used in the laboratory. Pre-approval of the conditions under which they can be used may prevent odor complaints.

Table 2 - Shock Sensitive Chemicals

The classes of chemicals listed below may explode when subjected to shock or friction. Therefore, users must have appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

- Acetylenic compounds, especially polyacetylenes, haloacetylene, and heavy metal salts of acetylenes (copper, silver, and mercury salts are particularly sensitive)
- Acyl nitrates
- Alkyl nitrates, particularly polyol nitrates such as nitrocellulose and nitroglycerine
- Alkyl perchlorates
- Amminemetal oxosalts: metal compounds with coordinated ammonia, hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate, or other oxidizing group
- Azides, including metal, nonmetal, and organic azides
- Chlorite salts of metals, such as $AgClO_2$ and $Hg(ClO_2)_2$
- Diazo compounds such as CH_2N_2
- Diazonium salts, when dry
- Fulminates such as mercury fulminate (Hg(CNO)2)

- Hydrogen peroxide (which becomes increasingly treacherous as the concentration rises above 0%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals
- N-Halogen compounds such as difluoroamino compounds and halogen azides
- N-Nitro compounds such as N-nitromethylamine, nitrourea, nitroguanidine, and nitric amide
- Oxo salts of nitrogenous bases: perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.
- Perchlorate salts (which can form when perchloric acid mists dry in fume hoods or associated duct work. Most metal, nonmetal, and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials)
- Peroxides and hydroperoxides, organic
- Peroxides (solid) that crystallize from or are left from evaporation of peroxidizable solvents
- Peroxides, transition-metal salts
- Picrates, especially salts of transition and heavy metals, such as Ni, Pb, Hg, Cu and Zn
- Polynitroalkyl compounds such as tetranitromethane and dinitroacetonitrile
- Polynitroaromatic compounds especially polynitrohydrocarbons, phenols, and amines (e.g., dinitrotoluene, trinitrotoluene, and picric acid)

Note: Perchloric acid must be used only in specially-designed perchloric acid fume hoods that have built-in wash down systems to remove shock-sensitive deposits. Before purchasing this acid, laboratories must arrange for use of an approved perchloric acid hood.

Table 3 - Pyrophoric Chemicals

The class of chemicals listed below will readily oxidize and ignite spontaneously in air. Therefore, users must demonstrate that they have the appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

- Grignard reagents, RmgX
- Metal alkyls and aryls, such as Rli, Rna, R_3Al, R_2Zn
- Metal carbonyls such as $Ni(CO)_4$, $Fe(CO)_5$, $Co_2(CO)_8$
- Alkali metals, such as Na, K
- Metal powders, such as Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn, Zn, Zr
- Metal hydrides, such as NaH, $LiAlH_4$
- Nonmetal hydrides, such as B_2H_6 and other boranes, PH_3, AsH_3
- Nonmetal alkyls, such as R_3B, R_3P, R_3Ax

Table 4 - Peroxide Forming Chemicals

The chemicals listed below can form explosive peroxide crystals on exposure to air, and therefore require special handling procedures after the container is opened. Some of the chemicals form peroxides that are violently explosive in concentrated solution or as solids, and should be evaporated to dryness. Others are polymerizable unsaturated compounds and can initiate a runaway, explosive polymerization reaction. All peroxidizable compounds should be stored away from heat and light. They should be protected from physical damage and ignition sources. A warning label should be affixed to all peroxidizable materials to indicate the date of receipt and the date the container was first opened. Due to these special handling requirements, users must have the appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

-- Severe Peroxide Hazard with Exposure to Air **(Discard within 3 months from opening)**

- Diisopropyl ether (isopropyl ether)
- Divinylacetylene (DVA)
- Vinylidene chloride (1,1-dichloroethylene)
- Potassium metal
- Sodium amide (sodamide)
- Potassium amide

-- Peroxide Hazard on Concentration **(do not distill or evaporate without first testing for the presence of peroxides. Discard or test for peroxide after 6 months)**

- Acetalhehyde diethyl acetal (acetal)
- Cumene (isopropylbenzene)
- Cyclohexene
- Cyclopentene
- Decalin (decahydronaphthalene)
- Diacetylene (butadiene)
- Dicyclopentadiene
- Diethyl ether (ether)
- Diethylene glycol dimethyl ether (diglyme)
- Dioxane
- Ethylene glycol dimethyl ether (glyme)
- Ethylene glycol ether acetates
- Ethylene glycol monoethers (cellosolves)
- Furan
- Methylacetylene
- Methylcyclopentane
- Methyl isobutyl ketone
- Tetrahydrofuran (THF)
- Tetralin (tetrahydronaphthalene)
- Vinyl ethers

-- Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides

(1) Liquids (Discard or test for peroxides after 6 months)

- Chloroprene (2-chloro-1,3-butadiene)
- Vinyl acetate
- Styrene
- Vinylpyridine

(2) Gases (Discard after 12 months)

- Butadiene
- Vinylacetylene (MVA)
- Tetrafluoroethylene (TFE)
- Vinyl chloride

Table 5 - Carcinogens, Reproductive Toxins or Highly Toxic Chemicals

The chemicals listed below are extremely hazardous. Workers must have knowledge of the dangers of these chemicals prior to use, and documentation of training in safe working procedures.

Biologically active compounds

- Protease inhibitors (e.g. PMSF, Aprotin, Pepstatin A, Leopeptin)
- Protein synthesis inhibitors (e.g cycloheximide, Puromycin)

- Transcriptional inhibitors (e.g. a-amanitin, actinomycin D)
- DNA synthesis inhibitors (e.g. Hydroxyurea, Nucleotide analogs, Acidicolin)
- Phosphatase inhibitors (e.g. Okadaic Acid)
- Respiratory chain inhibitors (e.g. Sodium Azide)
- Kinase inhibitors (e.g. NaF)
- Mitogenic inhibitors (e.g. Colcemid)
- Mitogenic compounds (e.g. Concanavalin A)

The following additional references have been provided for your use as needed:

Incompatibility listing of common laboratory chemicals (Appendix E)

National Fire Protection Association (NFPA) chemical hazard ratings(Appendix F)