West Kentucky Community and Technical College

Chemical Hygiene Plan

2011

West Kentucky Community and Technical College

Chemical Hygiene Plan

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West Kentucky Community and Technical College

CHEMICAL HYGIENE PLAN

for

_____
principal investigator/laboratory supervisor

_____
department

_____
room and building

_____ _____
campus phone *after-hours emergencies**

Location of laboratories (specify all rooms in which hazardous materials are stored).

_____

_____

Authorized Personnel

Laboratory personnel: list all employees and students that use hazardous materials under your jurisdiction. Also indicate laboratory supervisor, if applicable, and his/her after-hours emergency telephone number

Name	Status (e.g. research asst., student)
_____	_____
_____	_____
_____	_____
_____	_____

Name**	Status (e.g. research asst., student)
_____	_____
_____	_____
_____	_____
_____	_____

_____ _____

Signature of Principal Investigator *Date*

NOTE: Maintain the original copy of this form in Laboratory Chemical Hygiene Plan binder. Submit photo copy to:

West Kentucky Community and Technical College
Safety, Renovation, and Construction Office

John Carrico	Vice President of Administrative Services	**(270)534-3089**
Keith Yearry	Director of Maintenance and Operations	**(270)534-3418** **Cell phone (270)564-9390**

*As an alternative to listing after hours phone numbers, laboratory supervisors can make arrangements with West Kentucky Community and Technical College Security (554-6300) and Maintenance and Operations Department (534-3064) on this Form, and providing the Security and Maintenance and Operations with relevant emergency after hours telephone numbers.

**Attach additional pages, if necessary.

CHAPTER 1

INTRODUCTION

The purpose of this Chemical Hygiene Plan is to define work practices and procedures to help ensure that laboratory workers at West Kentucky Community and Technical College are protected from health and safety hazards associated with the hazardous chemicals with which they work. The Chemical Hygiene Plan is part of the College's compliance with the regulations promulgated on January 31, 1990 by the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) and adopted by Kentucky OSH. This standard entitled "Occupational Exposures to Hazardous Chemicals in Laboratories" is hereafter referred to as the Lab Standard. See Appendix I for a complete copy of the Lab Standard). The Chemical Hygiene Plan must include:

- Standard operating procedures;
- Criteria to determine and implement specific control measures, such as engineering controls and personal protective equipment;
- A requirement that an ongoing program be developed to ensure that fume hoods and other engineering controls are functioning properly;
- Information and training requirements;
- Circumstances under which a particular laboratory function will require "prior approval";
- Provisions for medical consultation and medical exams;
- Designation of Chemical Hygiene Officer; and
- Additional precautions for work with select carcinogens, reproductive toxins, and extremely toxic substances.

OSHA has defined a hazardous chemical as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees". In addition, OSHA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis". Finally, the laboratory workers referred to in the Lab Standard are employees. OSHA defines employee as "an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments." An example of a laboratory worker would be a University teaching assistant, research assistant, or faculty

member instructing an academic lab. Students in an academic laboratory would not be considered laboratory workers by OSHA. However, as a matter of college policy, the principles outlined in this Chemical Hygiene Plan will apply to students in our laboratories. Thus, laboratory supervisors must ensure that students in their laboratories are adequately instructed in relation to safe laboratory procedures. If there is any question about where the Lab Standard applies and who it covers, the Chemical Hygiene Committee, upon request, will make this determination.

This Chemical Hygiene Plan must be read by all laboratory workers prior to the commencement of lab duties. In addition to the Plan, the laboratory workers must be familiar with and adhere to prudent laboratory safety guidelines developed by their laboratory supervisor and other relevant regulatory requirements (e.g. Radiation Safety).

A written record stating that each laboratory worker has reviewed the Chemical Hygiene Plan and related health and safety policies and guides must be kept by the person in charge of the training, Human Resources Office, and Safety Office. (See Appendix III for an example of a training record form.)

The KCTCS office of Environmental Health and Safety has professionals that can be consulted related to laboratory safety.

This model Chemical Hygiene Plan (referred to as the Plan throughout this document) will be reviewed annually by the institutional Chemical Hygiene Committee. Each laboratory's Chemical Hygiene Plan must be reviewed annually by the laboratory's Chemical Hygiene Officer and the "revised date" must be listed on the Plan. [For discussion of Institutional Chemical Hygiene Officer and Chemical Hygiene Officer see Chapter 9].

CHAPTER 2

RESPONSIBILITIES

West Kentucky Community and Technical College is committed to providing a safe and healthful environment for all persons associated with the institution. The college intends to be a role model for the Commonwealth in its environmental stewardship, health protection and safety standards and its compliance with all laws and regulations relating to the environment, health and safety. Management, faculty, staff, and students are asked to support these goals in all college activities and the college administration will provide the necessary resources to achieve these goals.

A vast array of educational activities and research utilizing hazardous materials is conducted at the college which requires cooperation of all parties involved to ensure that such activities are conducted safely with regard to workers, students, the community, and the environment. The following outlines specific responsibilities associated with laboratory safety and this Chemical Hygiene Plan.

President/CEO responsibilities include the following:

- Appoint an Institutional Chemical Hygiene Committee and Officer who will routinely review the model Chemical Hygiene Plan and suggest modifications as needed;

Chemical Hygiene Committee and Officer responsibilities include the following:

- Provide technical assistance to laboratory supervisors and workers concerning appropriate storage, handling and disposal of hazardous chemicals;

- Provide general laboratory safety training upon request;

- Conduct exposure assessments and laboratory inspections upon request and on a routine basis;

- Provide technical assistance concerning personal protective equipment and laboratory safety equipment; and

- Remain current on rules and regulations concerning chemicals used on campus.

President/CEO and Heads of Academic and Administrative Units have the primary responsibility for the health and safety of their staff and students. Specific responsibilities regarding the implementation of the Chemical Hygiene Plan include:

- Collaborate with faculty and staff to adapt the Model Chemical Hygiene Plan to include lab-specific guidelines and to develop strategies to implement the Plan;

- Consider the idea of developing departmental-wide laboratory safety training programs and/or committees, and

- Make budget arrangements for health and safety improvements. It is the responsibility of the President/CEO or Heads of these Units to request improvement monies in the budget process.

Faculty and staff in charge of supervising laboratories (referred to as laboratory supervisors or Principal Investigators throughout document) have the following responsibilities for implementing the Chemical Hygiene Plan:

- Inform and train employees concerning chemical safety as required by this Plan. Retain training records and all documentation;

- Implement and enforce rules and standards of this plan concerning health and safety for laboratories under the supervisor's jurisdiction and restrict access to the laboratory (see *Authorized Access* in Chapter 3 "Standard Operating Procedures");

- Ensure compliance of laboratory workers with this Plan;

- Ensure the availability and enforce the proper use of appropriate personal protective equipment and relevant health and safety reference materials;

- Remain cognizant of chemicals stored and used in labs and their associated hazards;

- Develop an annual inventory of chemicals present in the laboratory (see Appendix IV for sample inventory form);

- Conduct internal inspections of labs for health and safety concerns and maintain an inspection log of inspection findings (see Appendix V for a sample self inspection form);

- Request assistance from KCTCS Office of Facilities Management and Safety, as needed; and,

- Request allocation of funds from superiors for health and safety improvements as needed, or budget into research grant proposals.

Laboratory Worker responsibilities regarding implementation of the Chemical Hygiene Plan:

- Follow all health and safety standards and rules;

- Report all hazardous conditions to the Laboratory Supervisor;

- Wear or use prescribed protective equipment;

- Report any suspected job-related injuries or illnesses to the Laboratory Supervisor and seek treatment immediately;

- Refrain from the operation of any equipment or instrumentation without proper instruction and authorization;

- Remain aware of the hazards of the chemicals in the lab and how to handle hazardous chemicals safely; and,

- Request information and training when unsure how to handle a hazardous chemical or how to perform a procedure.

CHAPTER 3

STANDARD OPERATING PROCEDURES

The Lab Standard requires operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals.

This Plan represents a minimum set of guidelines for the handling of hazardous chemicals in laboratories at West Kentucky Community and Technical College. Individual administrative units, laboratories or research groups are required to develop more detailed procedures as their situations warrant. These procedures must be written, added to the laboratory's Chemical Hygiene Plan, and made available to laboratory workers. Acceptable lab safety references such as those listed in Appendix I of this document may be adopted in whole or may be useful in developing additional procedures. In all situations, individual faculty or staff will be responsible for enforcing adequate safety and hygiene measures in laboratories they supervise. If necessary, additional assistance from Chemical Hygiene Committee, Chemical Hygiene Officer and KCTCS Safety Office is available.

The following standard operating procedures apply to all labs at the college:

#1 - GENERAL

Respect and understand the safety and health hazards associated with the chemicals and equipment in your laboratory, and practice the following general safety guidelines at ALL times:

Authorized Access. The laboratory supervisor must restrict access to laboratories. Children (under age 17) are not allowed in laboratories except as authorized by the laboratory supervisor for an officially sanctioned activity (e.g. class or open house). Pets are also prohibited from laboratories.

Containers. Check the integrity of containers and if damaged or leaking, transfer to an acceptable container or call lab supervisor for assistance. Observe compatibilities, for example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

Cylinder Handling. Use appropriate hand carts to move cylinders. Cylinders must be secured at all times. Extremely toxic gases (e.g. hydrogen sulfide, chlorine, arsine) should not be moved through regular exit corridors, particularly during business hours. Always consider cylinders as full and handle them with corresponding care.

Glass Tubing. When inserting tubing into stoppers, lubricate tubing to help protect hands from being cut in the event of the tubing slipping and breaking.

No Smoking. This policy exists throughout the college and applies in all laboratories.

Unattended Experiments. Frequently, laboratory operations are carried out continuously or overnight. For experiments involving hazardous operations, it is essential to plan for interruptions in utility services such as electricity, water and inert gas. Operations are to be safe and plans made to avoid hazards in case of failure. If necessary, arrangements for routine inspection of the operation are to be made and, in all cases, the laboratory lights should be left on and an appropriate sign posted on the door.

Working Alone. When working with acutely hazardous materials, it is advisable to have a second person present, or at a minimum, maintain surveillance via telephone contact.

Housekeeping. Exits, aisles and safety equipment must NOT be obstructed in any way with equipment, furniture, etc. No items must be stored in the corridors. For questions related to the use of corridors or any exiting or Fire Marshal issue, contact the Campus Safety Office or KCTCS Office of Facilities Management.

Food, Drink, Cosmetics. Eating, drinking and the application of cosmetics (including lip balm) are forbidden in areas where hazardous chemicals are used and must be done only in well-defined designated non-chemical areas. Do not store food in the same refrigerator with chemicals, biohazards or radioactive materials.

Horseplay. Horseplay, practical jokes or other inappropriate and unprofessional behavior in the laboratory setting is forbidden. Avoid distracting or startling any other workers.

Equipment. Use proper equipment that is in good condition. For example, never use chipped or cracked glassware. Shield pressurized or vacuum apparatus and safeguard against bumping or overheating.

Disposal of Waste. It is important to segregate wastes. Disposal of all laboratory waste must follow the procedures specified by KCTCS Office of Facilities Management.

Hazardous Materials. Hazardous materials should not be used on open laboratory benches.

Mouth Pipetting. Mouth pipetting is forbidden.

Mercaptans. To avoid false reporting of natural gas leaks, the Physical Plant department should be contacted when mercaptans are used in a laboratory in such a manner that persons outside of the laboratory could smell the mercaptan and suspect a natural gas leak in the building.

Perchloric Acid. If perchloric acid is heated above ambient temperature it will give off vapors that can condense and *form explosive perchlorates*. Hence, when heating perchloric acid above ambient temperature, a specifically designed and dedicated perchloric acid fume hood with a wash down system or a local scrubbing or trapping system *must be used*.

#2 - PERSONAL

Personal protection and personal hygiene are two very basic aspects of laboratory safety. Wearing appropriate personal protective equipment and practicing good personal hygiene as described below will minimize exposures to hazardous chemicals during routine use and in the event of an accident.

Attire. Wear a lab coat or apron, cover legs and feet (no sandals or open-toed shoes), and confine loose clothing and long hair.

Gloves. Gloves are essential when working with hazardous substances. The proper gloves will prevent skin absorption, infection or burns. All glove materials are not equally effective in protection from chemical hazards. Consult a chemical resistance chart such as the one found in Appendix VI, consult a glove manufacturer or contact KCTCS Office of Facilities Management [(859)246-3220].

Fume Hoods and Other Engineering Controls. See Page 15.

Eye Protection. It is West Kentucky Community and Technical College policy that personnel including students, staff and visitors in laboratories wear appropriate safety glasses, goggles, or face shields at all times where chemicals are stored or handled. Goggles are recommended when chemical splashes are possible.

The wearing of contact lenses in labs is a controversial issue. If contact lenses must be worn consult your optometrist or ophthalmologist. When wearing contact lenses in the laboratory it is necessary to wear chemical splash goggles at all times.

Safety Shower/Eye Washes. Safety showers and/or eye washes are required in labs where corrosive chemicals are used. Eye washes and Safety showers must be tested monthly by Maintenance and Operations staff.

Face Shields. Full face shields must be worn when conducting a procedure which may generate an aerosol or when splashing is a potential. Full face shields with bottom caps to protect under the chin are preferred due to the tendency to raise the chin when a splash occurs.

Personal Hygiene. Hands should be washed frequently throughout the day, before leaving the lab, after contact with any hazardous material, and before eating.

Respiratory Protection. The use of some substances may require the use of respiratory protection (respirators). See Chapter 4 for a discussion of "Controlling Chemical Exposures".

#3 - HAZARDOUS MATERIAL HANDLING AND STORAGE

Hazards associated with various chemicals and gases vary widely. Understanding the hazards associated with a compound and minimizing the quantity used and stored in the lab will decrease chance of injury.

Chemical Spills and Accident Response. As a matter of policy, College personnel should handle their own spills and releases, unless they are severe in magnitude. Lab Supervisors, Safety Officer, Chemical Hygiene Officer and Committee will be called to advise and assist in these operations. For more severe incidents, call 911. Severe incidents include:

1. Fire or fire potential
2. Explosion or danger of explosion
3. Injury requiring emergency medical treatment
4. Release to the sanitary or storm sewer system
5. Threat to occupants in a building or adjacent area
6. Release of an unknown chemical.

For large spills/leaks, call 911 and evacuate the area.

Chemical Storage. Chemicals ideally should be stored by compatibility, not simply by alphabetical arrangement. Oxidizers should be separated from organics, air/water reactives must be kept dry and cyanides should be stored away from acids. (See Appendix VII for examples of incompatible chemicals).

Volatile toxic substances must be stored in volatile storage cabinets adequate to the purpose. When volatiles must be stored in a cooled atmosphere, explosion-proof refrigerators or similar specially designed equipment must be used.

Chemical Handling. Encourage the use of poly coated bottles or use bottle carriers for transporting chemicals which are in regular glass containers. Close caps securely and avoid storing chemical containers in hard to reach areas. Pour chemicals carefully, and never add water to concentrated acid. Metal containers and non-conductive containers (e.g., glass or plastic) holding more than five gallons must be grounded when transferring flammable liquids.

Cylinder Storage. Cylinders must be stored in well ventilated areas with their protective caps screwed on and the cylinder secured (e.g., strapped or chained in an upright position) to reduce the chance of the cylinder being knocked over. Do not store cylinders near heat or high traffic areas. Do not store flammables and oxidizers together. Do not store empty and full cylinders together. Storage of large quantities of cylinders must be done in an approved gas cylinder storage area. For storage and use of flammable gas cylinders, consult KCTCS Office of Facilities Management (859)246-3220.

#4 - LABELS

All labels must be legible, in English and include chemical/product name (chemical formulas alone are not acceptable) and include information related to relevant hazards. (See Appendix XII for examples of Hazard Ratings). Labels on incoming containers must not be removed or defaced. Date all peroxidizable and other chemicals which may become unstable over time (e.g. picric acid, ethers); test and/or dispose of them when appropriate. Waste chemical containers must be clearly marked "Hazardous Waste" indicating specific name of waste chemical and date when use of waste bottle begins.

#5 - LABORATORY DOOR SIGNAGE

Each laboratory door must be legibly marked with the following information:

1. Room number
2. Department
3. Laboratory Supervisor's Name
4. Emergency contacts, including names, office location, and office and emergency telephone numbers. (In cases where an individual does not wish to "post" his/her home telephone numbers, they may register the information with the Security and Maintenance and Operations.)

See Appendix VIII for Standard Laboratory Signage.

CHAPTER 4

CONTROLLING CHEMICAL EXPOSURES

The Lab Standard requires the employer to determine and implement control measures to reduce employee exposure to hazardous chemicals; and particular attention must be given to the selection of control measures for chemicals that are known to be extremely hazardous. There are three major routes of entry for a chemical to enter the body: inhalation, skin and eye contact, and ingestion. Three types of controls for prevention of these various routes of entry include engineering controls, personal protective equipment, and administrative controls. Each route of entry a chemical can take to enter the body can be controlled in a number of ways, as explained below.

Inhalation Hazards

Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. To avoid inhalation exposures, hazard reduction methods such as substituting a less volatile or a less toxic chemical or substituting a liquid or solid chemical for a gaseous one are the best means of control. If substitution is not practical, engineering controls such as ventilation should be used to lessen the chance of exposure. The use of well-functioning local exhaust ventilation such as fume hoods, biological safety cabinets, vented glove boxes and other local exhaust systems is often required to minimize exposure to hazardous chemicals. Dilution ventilation may be used to reduce exposure to nonhazardous nuisance odors. For extremely toxic chemicals such as those classified as poison gases by State or Federal agencies (e.g., arsine, phosgene) the use of closed systems, vented gas cabinets, fail-safe scrubbing, detection or other stricter controls may be required.

If both substitution and engineering controls are unavailable, the use of personal protective equipment may be required to reduce inhalation exposures. Respiratory protection from dust masks to self-contained breathing apparatus may be utilized to this end. If respirators are worn by laboratory employees, requirements of the OSHA Respirator Standard (1910.134) must be met and a written respirator program must be implemented (See Appendix IX for a model respirator program). This Standard requires training on the proper use of respirators, medical surveillance to ensure the user is capable of wearing a respirator, and fit testing to ensure that the respirator fits properly. A lab worker or his/her supervisor should contact West Kentucky Community and Technical College Safety Office in the event that respiratory protection is to be utilized to control exposures to hazardous chemicals.

In addition the following principles should be utilized to reduce the risk of exposure to hazardous chemicals:

- minimization of exposure time for individual employees;
- restricted access to an area where a hazardous chemical is used; and
- proper signage on lab doors to indicate special hazards within.

Skin/Eye Contact Hazards

To reduce the risk of a chemical entering the body via skin and eye contact, engineering controls include substitution and appropriate ventilation as described above in Inhalation Hazards. The more obvious means of preventing skin and eye contact is the wearing of personal protective equipment such as eye protection, face shields, gloves, appropriate shoes, lab aprons, lab coats, and other protective equipment as appropriate to the hazard. Since the chemical resistivity of the different types of protective equipment varies significantly, the lab supervisor should consult Appendix VI or other references to ascertain that the protective equipment material is resistant to the chemical being protected against. Safety showers/eye wash equipment is required where corrosive chemicals are used. Such equipment should be prominently labeled and not obstructed.

Ingestion Hazards

Ingestion of chemicals is the least common route of entry into the body. However a laboratory worker can easily ingest chemicals into the body via contaminated hands if they are not washed prior to eating, smoking or sticking part of the hand or a writing tool that has been in contaminated hands into the mouth. Some controls for preventing this route of exposure include engineering controls, such as isolating the hazardous substance so minimal contact is required (e.g., use glove box), personal protective equipment such as the wearing of gloves, and administrative controls such as restricting mouth pipetting, encouraging good personal hygiene and designating a well-marked nonchemical area where eating, drinking and the application of cosmetics is permitted.

Exposure Assessment

At the request of faculty, staff or students, exposure evaluations may be conducted by appropriate personnel and contact KCTCS Office of Facilities Management for any suspected overexposure to substances regulated by OSHA. Records of exposure evaluations will be kept in the college Safety Office and provided to the department and affected employees and any other appropriate authorities at the college.

CHAPTER 5

FUME HOODS AND OTHER ENGINEERING CONTROLS

Fume Hood Face Velocities

All fume hoods at West Kentucky Community and Technical College facilities should have face velocities between 80-150 feet per minute with the sash at a "working height" (approximately 12 inches). As a general rule, fume hoods should not be operated with the sash fully open and should have the sashes closed when not being used. The KCTCS Office of Facilities Management will conduct a fume hood inspection and certification program for all fume hoods at the college. Fume hoods with face velocities within the 80-150 feet per minute range may be used without restriction and will be marked with a fume hood sticker showing face velocity at a height designated with an arrow.

Hoods Needing Repairs

Non radiological use fume hoods with face velocities below 80 feet per minute or above 150 linear feet per minute must be marked with a sign indicating that the hood may not be used for chemical manipulations. A work order to repair these hoods should be processed as soon as possible.

Safe Work Practices for Laboratory Fume Hoods

When using a fume hood, one must remember that the hood does not provide absolute containment or absolute protection from the materials in the hood. However, for most exposures, a properly designed hood in a properly designed room can provide adequate protection if certain work practices are followed. The work practices listed below are recommended by the American Conference of Governmental Industrial Hygienists in their text: "Industrial Ventilation: A Manual of Recommended Practices."

No large open face hood with a low face velocity and a worker standing at the face can provide complete safety against all events which may occur in the hood, especially for volatile or other airborne contaminants with an exposure limit in the low part per billion range. For more ordinary exposures, a properly designed hood in a properly ventilated room can provide adequate protection. However, certain work practices are necessary in order for the hood to perform capably. The following work practices are required; more stringent practices may be necessary in some circumstances.

1. Conduct all operations which may generate air contaminants at or above the appropriate exposure limit inside a hood.

2. Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder.

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

4. Do not use the hood as a waste disposal mechanism except for very small quantities of volatile materials.

5. Do not store chemicals or apparatus in the hood. Store hazardous chemicals in an approved safety cabinet.

6. Test hood often for air flow (for example using a chemwipe), and ensure that the switch is in the "on" position.

7. Using hazardous solids (powders) in hood may not be appropriate.

8. Keep the slots in the hood baffle free of obstruction by apparatus or containers.

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

10. Keep laboratory doors closed (exception: some laboratories are designed for the lab doors to be open).

11. Do not remove hood sash or panels except when necessary for apparatus set-up; replace sash or panels before operating.

12. Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.

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

14. If hood sash is supposed to be partially closed for operation, the hood should be so labeled and the appropriate closure point clearly indicated.

15. Where perchloric acid is heated above ambient temperature, vapors may condense within the exhaust system to form explosive perchlorates. In such instances, specially designed fume hood exhaust systems must be utilized. These systems will have dedicated exhausts and a water washdown system, and may be used for perchloric acid digestions only.

16. All fume hoods should have spill protection lips (at the front of hood and for cup sinks located in the hood).

Any questions or requests for assistance in evaluation of fume hoods may be directed to KCTCS Office of Facilities Management (859)246-3220.

CHAPTER 6

EMPLOYEE INFORMATION and TRAINING

All individuals who work in laboratories who may be exposed to hazardous chemicals must be apprised of the hazards of chemicals present in their work area. THIS INFORMATION AND TRAINING AS OUTLINED BELOW MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT AND BEORE NEW EXPOSURE SITUATIONS. Equipment necessary for the safe handling of hazardous substances must also be provided. IT IS THE RESPONSIBILITY OF THE PRINCIPAL INVESTIGATOR TO ENSURE THAT ALL LABORATORY WORKERS HAVE BEEN PROPERLY TRAINED. Occupational Health personnel will, from time to time, give presentations concerning general lab safety practices. However, training specific for the particular lab where an employee is assigned is the responsibility of that employee's supervisor. The frequency of refresher information and training must be determined by the supervisor. Special hazardous materials training is mandatory for anyone who will be generating hazardous waste.

Information

Laboratory workers must be informed of the location and availability of the following:

- "Occupational Exposures to Hazardous Chemicals in Laboratories" (the OSHA Lab Standard - See Appendix I);
- This Chemical Hygiene Plan;
- Reference materials on chemical safety (including material safety data sheets);
- Permissible exposure limits for OSHA regulated substances, or if there is no applicable OSHA standard, the recommended exposure limits or threshold limit value may be provided; consult Material Safety Data Sheet, Chemical Manufacturer or KCTCS Office of Facilities Management(859)246-3220.
- Signs and symptoms associated with exposure to the hazardous chemicals found in the lab.

Training

Laboratory worker training must include:

- Detection methods that may be used to detect the presence or release of a hazardous chemical. Examples of detection methods include visual appearance, odor, detector papers, and an understanding of chemical monitoring devices;

- Physical and health hazards of the chemicals;

- Hazardous waste training;

- The work practices, personal protective equipment, and emergency procedures to be used to ensure that the employee may protect himself/herself from overexposure to hazardous chemicals; and

- Medical consultations and examinations.

The manufacturer's Material Safety Data Sheets will generally contain much of the above information needed to comply with the information and training requirements of the OSHA Lab Standard. Laboratory Supervisors and employees should understand the relevant MSDSs and/or other comparable literature on the hazardous chemicals which are used or stored in their laboratory. Additional training for specific lab hazards must be provided by the employee's supervisor.

Copies of MSDSs may be obtained from the chemical supplier. Individual departments or laboratories are strongly encouraged to maintain their own files of reference materials.

CHAPTER 7

PRIOR APPROVAL

The responsibility for approval of the acquisition and use of toxic chemical agents rests with the laboratory supervisor. Certain materials including radioactive materials, recombinant DNA and certain biohazards require prior internal or external approval at various levels. If there are questions concerning the need for approvals the West Kentucky Community and Technical College Safety office, Chemical Hygiene committee, or KCTCS Office of Facilities Management (e.g. Radiation Safety) should be consulted.

CHAPTER 8

MEDICAL CONSULTATION

An opportunity for laboratory workers to receive medical consultation must be provided under the following circumstances: if an employee develops any symptoms thought to arise from chemical overexposure; after an event such as a major spill, leak or explosion which may have resulted in an overexposure; or, an overexposure is identified as the result of an evaluation by the departmental or institutional Chemical Hygiene Committee and Officer. These suspected or actual exposures requiring medical evaluation can and should be treated as a regular Workers Compensation claim. The injured employee must fill out an Accident - Occupational Injury/Illness Report Form - Form 6 (see Appendix X for a copy of the employee injury reporting form) and go to an appropriate medical facility (e.g. occupational medicine clinic, employee health, qualified outside physician, etc.) for treatment. Following notification of overexposure, arrangements for an appropriate medical examination must be completed before the exposed individual may return to work. Any medical examination required by this Plan must be provided without cost to the employee, without loss of pay and at a reasonable time and place. Records of any medical examination will be maintained at the medical facility providing service.

CHAPTER 9

CHEMICAL HYGIENE OFFICER

The President/CEO shall designate the "Chemical Hygiene Officer" for the college laboratories. As such, the Chemical Hygiene Officer has the primary responsibility for safety and health within laboratories and may request assistance from the Chemical Hygiene Committee as needed.

The Chemical Hygiene Committee is responsible for coordinating an annual review of the Model Chemical Hygiene Plan and serving as a resource to the individual laboratory Chemical Hygiene Officer.

CHAPTER 10

SPECIAL PROVISIONS FOR SELECT CARCINOGENS, REPRODUCTIVE TOXINS and ACUTELY TOXIC CHEMICALS

There are provisions for additional employee protection for work with particularly hazardous substances. These hazardous substances include "select carcinogens," (see Appendix XI for a list of select carcinogens) reproductive toxins and substances which have a high degree of acute toxicity. The following provisions must be included:

(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.

In addition to the general safety guidelines mentioned in the first section and throughout the Plan, special precautions are needed when handling genotoxins, reproductive toxins and chemicals with a high degree of acute toxicity. A minimum set of guidelines that should be followed are listed below. The lab supervisor should ensure that these and other precautions designed to minimize risk of exposure to these substances are taken.

- Quantities of these chemicals used and stored in the laboratory must be minimized, as should their concentrations in solution or mixtures.

- Work with genotoxins, reproductive toxins and acutely toxic chemicals must be performed within a certified functioning fume hood, biological safety cabinet, ventilated glove box, sealed system, or other system designed to minimize exposure to these substances. (The exhaust air from the ventilation systems may require scrubbing, or other treatment, before being released into the atmosphere.) In all cases, work with these types of chemicals must be done in such a manner that the OSHA permissible exposure limits or similar standards are not exceeded.

- Compressed gas cylinders which contain acutely toxic chemicals such as arsine, chlorine, and nitrogen dioxide should (and may be required to) be kept in ventilated gas cabinets.

- The ventilation efficiency of the designated fume hood, glove box or gas cabinet, and the operational effectiveness of mechanical and electrical equipment used to contain or manipulate these special substances should be evaluated periodically by the laboratory personnel at intervals determined by the laboratory supervisor. The interval of evaluating systems may vary from weekly to biannually depending upon the frequency of usage, quantities employed and level of hazard.

- Each laboratory utilizing these substances must designate an area for this purpose and must sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory (bio-safety level three or four require that the ENTIRE laboratory be designated), an area of the laboratory or a device such as a fume hood or glove box. The designated area should be marked with a **DANGER, specific agent, AUTHORIZED PERSONNEL ONLY** or comparable warning sign.

- All laboratory workers who work in a laboratory which has an area designated for use with genotoxins, reproductive toxins and acutely toxic chemicals must be trained about the deleterious effects of these substances as well as signs and symptoms regarding exposure to these substances, whether or not they actually work with the substance themselves. Training to ensure the safe handling and storage of these substances is required for those who use these materials. This training is the responsibility of the laboratory supervisor and must be done prior to the use of any of these materials.

- Laboratory workers working with these chemicals must have access to appropriate protective equipment and clothing (available at no expense to the workers) and must be trained on how to properly utilize the safety equipment.

- Detection equipment may be required in laboratories where chemicals (especially poisonous gases) with a high degree of acute toxicity are utilized.

- For special disposal information, call KCTCS Office of Facilities Management (859)246-3220.

- The designated working area must be thoroughly and appropriately decontaminated and cleaned at regular intervals determined by the laboratory supervisor. The interval may be as short as one day or as long as six months depending upon the frequency of usage and level of hazard.

- Special precautions to avoid release and exposure to highly toxic chemicals, genotoxins and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained; gases should have properly functioning valves, check valves, regulators, containment which can withstand pressure buildup, and appropriate piping; and dispersive solids should be kept in closed containers, used in places with minimum air currents, and appropriate contact materials should be used to avoid static charging.

APPENDICES

APPENDIX I

OSHA LABORATORY STANDARD
Rules and Regulations

PART 1910 – OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS

§191.1450 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 individual 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.

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

"**Compressed gas"** means:

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

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

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

"**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.

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

“**Flammable**” means a chemical that falls into one of the following categories:

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

(ii) “**Gas, flammable**” means:

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

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

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

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

“**Flashpoint”** means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds

(SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

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

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

* Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

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

Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

"**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 safety 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 movable 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.

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

"**Oxidizer"** means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

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

"**Protective laboratory practices and equipment"** 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"** means chemicals which affect the reproductive chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

"**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.

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

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

(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, Material 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 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 material 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 material 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 material safety data sheets and labeling.

(i) **Use of respirators.**

Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 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 1910.1020.

(k) **Dates.**

(1) **Effective date.** This section shall become effective May 1, 1990.
(2) Start-up dates.
    (i) Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.
    (ii) Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

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

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APPENDIX A TO §1910.1450
National Research Council Recommendations
Concerning Chemical Hygiene in Laboratories (Non-Mandatory)

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Foreword

As guidance for each employer's development of an appropriate laboratory Chemical Hygiene Plan, the following non-mandatory recommendations are provided. They were extracted from "Prudent Practices" for Handling Hazardous Chemicals in Laboratories" (referred to below as "Prudent Practices"), which was published in 1981 by the National Research Council and is available from the National Academy Press, 2101 Constitution Ave., NW,. Washington DC 20418.

"Prudent Practices" is cited because of its wide distribution and acceptance and because of its preparation by members of the laboratory community through the sponsorship of the National Research Council. However, none of the recommendations given here will modify any requirements of the laboratory standard. This Appendix merely presents pertinent recommendations from "Prudent Practices", organized into a form convenient for quick reference during operation of a laboratory facility and during development and application of a Chemical Hygiene Plan. Users of this appendix should consult "Prudent Practices" for a more extended presentation and justification for each recommendation.

"Prudent Practices" deal with both safety and chemical hazards while the laboratory standard is concerned primarily with chemical hazards. Therefore, only those recommendations directed primarily toward control of toxic exposures are cited in this appendix, with the term "chemical hygiene" being substituted for the word "safety". However, since conditions producing or threatening physical injury often pose toxic risks as well, page references concerning major categories of safety hazards in the laboratory are given in section F.

The recommendations from “Prudent Practices” have been paraphrased, combined, or otherwise reorganized, and headings have been added. However, their meaning has not been changed.

Corresponding Sections of the Standard and this Appendix

The following table is given for the convenience of those who are developing a Chemical Hygiene Plan which will satisfy the requirements of paragraph (e) of the standard. It indicates those sections of this appendix which are most pertinent to each of the sections of paragraph (e) and related paragraphs.

PARAGRAPH AND TOPIC IN LABORATORY STANDARD	RELEVANT APPENDIX SECTION
(e)(3)(i) Standard operating procedures for handling toxic chemicals.	C, D, E
(e)(3)(ii) Criteria to be used for implementation of measures to reduce exposures.	D
(e)(3)(iii) Fume hood performance.	C4b
(e)(3)(iv) Employee information and training (including emergency procedures).	D10, D9
(e)(3)(v) Requirements for prior approval of laboratory activities.	E2b, E4b
(e)(3)(vi) Medical consultation and medical examinations.	D5, E4f
(e)(3)(vii) Chemical hygiene responsibilities.	B
(e)(3)(viii) Special precautions for work with particularly hazardous substances.	E2, E3, E4

In this appendix, those recommendations directed primarily at administrators and supervisors are given in sections A-D. Those recommendations of primary concern to employees who are actually handling laboratory chemicals are given in section E. (Reference to page numbers in “Prudent Practices” are given in parentheses.)

A. General Principles for Work with Laboratory Chemicals

In addition to the more detailed recommendations listed below in sections B-E, “Prudent Practices” expresses certain general principles, including the following:

1. **It is prudent to minimize all chemical exposures**. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals (2,10). Skin contact with chemicals should be avoided as a cardinal rule (198).

2. **Avoid underestimation of risk.** Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken (10, 37, 38). One should assume that any mixture will be more toxic than its most toxic component (30, 103) and that all substances of unknown toxicity are toxic (3, 34).

3. **Provide adequate ventilation.** The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices (32, 198).

4. **Institute a chemical hygiene program.** A mandatory chemical hygiene program designed to minimize exposures is needed; it should be a regular, continuing effort, not merely a standby or short-term activity (6,11). Its recommendations should be followed in academic teaching laboratories as well as by full-time laboratory workers (13).

5. **Observe the PELs, TLVs.** The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded (13).

B. Chemical Hygiene Responsibilities

Responsibility for chemical hygiene rests at all levels (6, 11, 21) including the:

1. **Chief executive officer**, who has ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene (7, 11).

2. **Supervisor of the department or other administrative unit**, who is responsible for chemical hygiene in that unit (7).

3. **Chemical hygiene officer(s)**, whose appointment is essential (7) and who must:

   (a) Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices (7);
   (b) Monitor procurement, use, and disposal of chemicals used in the lab (8);

(c) See that appropriate audits are maintained (8);
(d) Help project directors develop precautions and adequate facilities (10);
(e) Know the current legal requirements concerning regulated substances (50); and
(f) Seek ways to improve the chemical hygiene program (8, 11).

4. **Laboratory supervisor**, who has overall responsibility for chemical hygiene in the laboratory (21) including responsibility to:

(a) Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided (21, 22);

(b) Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment (21, 171);

(c) Know the current legal requirements concerning regulated substances (50, 231);

(d) Determine the required levels of protective apparel and equipment (156, 160, 162); and

(e) Ensure that facilities and training for use of any material being ordered are adequate (215).

5. **Project director or director of other specific operation**, who has primary responsibility for chemical hygiene procedures for that operation (7).

6. **Laboratory worker**, who is responsible for:
(a) Planning and conducting each operation in accordance with the institutional chemical hygiene procedures (7, 21, 22, 230); and
(b) Developing good personal chemical hygiene habits (22).

C. **The Laboratory Facility**

1. **Design.** The laboratory facility should have:

(a) An appropriate general ventilation system (see C4 below) with air intakes and exhausts located so as to avoid intake of contaminated air (194);
(b) Adequate, well-ventilated stockrooms/storerooms (218, 219).
(c) Laboratory hoods and sinks (12, 162);
(d) Other safety equipment including eyewash fountains and drench showers (162, 169); and
(e) Arrangements for waste disposal (12, 240).

2. **Maintenance.** Chemical-hygiene-related equipment (hoods, incinerator, etc.) should undergo continual appraisal and be modified if inadequate (11, 12).

3. **Usage.** The work conducted (10) and its scale (12) must be appropriate to the physical facilities available and, especially, to the quality of ventilation (13).

4. **Ventilation**
   (a) **General laboratory ventilation.** This system should: Provide a source of air for breathing and for input to local ventilation devices (199); it should not be relied on for protection from toxic substances released into the laboratory (198); ensure that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the working day (194); direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building (194).
   (b) **Hoods.** A laboratory hood with 2.5 linear feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals (199); each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use (200, 209). If this is not possible, work with substances of unknown toxicity should be avoided (13) or other types of local ventilation devices should be provided (199). See pp. 201-206 for a discussion of hood design, construction, and evaluation.
   (c) **Other local ventilation devices.** Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed (199). Each canopy hood and snorkel should have a separate exhaust duct (207).
   (d) **Special ventilation areas.** Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment before release into the regular exhaust system (208). Cold rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure (209).
   (e) **Modifications.** Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate (12, 193, 204).
   (f) **Performance.** Rate: 4-12 room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control (194).
   (g) **Quality.** General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas (194, 195); airflow into and within the hood should not be excessively turbulent (200); hood face velocity should be adequate (typically 60-100 lfm) (200, 204).
   (h) **Evaluation.** Quality and quantity of ventilation should be evaluated on installation (202), regularly monitored (at least every 3 months) (6, 12,

14, 195), and reevaluated whenever a change in local ventilation devices is made (12, 195, 207). See pp 195-198 for methods of evaluation and for calculation of estimated airborne contaminant concentrations.

D. **Components of the Chemical Hygiene Plan**

1. **Basic Rules and Procedures** (Recommendations for these are given in section E, below)
2. **Chemical Procurement, Distribution, and Storage**
   (a) **Procurement.** Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved (215, 216). No container should be accepted without an adequate identifying label (216). Preferably, all substances should be received in a central location (216).
   (b) **Stockrooms/storerooms.** Toxic substances should be segregated in a well-identified area with local exhaust ventilation (221). Chemicals which are highly toxic (227) or other chemicals whose containers have been opened should be in unbreakable secondary containers (219). Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity (218-19). Stockrooms/storerooms should not be used as preparation or repackaging areas, should be open during normal working hours, and should be controlled by one person (219).
   (c) **Distribution.** When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used if possible (223).
   (d) **Laboratory storage.** Amounts permitted should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to the storeroom/stockroom (225-6, 229).
3. **Environmental Monitoring** Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices (12) or when a highly toxic substance is stored or used regularly (e.g., 3 times/week) (13).

4. **Housekeeping, Maintenance, and Inspections**

   (a) **Cleaning.** Floors should be cleaned regularly (24).
   (b) **Inspections.** Formal housekeeping and chemical hygiene inspections should be held at least quarterly (6, 21) for units which have frequent

personnel changes and semiannually for others; informal inspections should be continual (21).

(c) **Maintenance.** Eye wash fountains should be inspected at intervals of not less than 3 months (6). Respirators for routine use should be inspected periodically by the laboratory supervisor (169). Other safety equipment should be inspected regularly (e.g., every 3-6 months) (6, 24, 171). Procedures to prevent restarting of out-of-service equipment should be established (25).

(d) **Passageways.** Stairways and hallways should not be used as storage areas (24). Access to exits, emergency equipment, and utility controls should never be blocked (24).

5. **Medical Program**

(a) Compliance with regulations. Regular medical surveillance should be established to the extent required by regulations (12).

(b) Routine surveillance. Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical should consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable (11, 50).

(c) **First aid.** Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be nearby (173). See pp. 176-178 for description of some emergency first aid procedures.

6. **Protective Apparel and Equipment.** These should include for each laboratory:

(a) Protective apparel compatible with the required degree of protection for substances being handled (158-161);
(b) An easily accessible drench-type safety shower (162, 169);
(c) An eyewash fountain (162)
(d) A fire extinguisher (162-164);
(e) Respiratory protection (164-9), fire alarm and telephone for emergency use (162) should be available nearby; and
(f) Other items designated by the laboratory supervisor (156, 160).

7. **Records**

(a) Accident records should be written and retained (174).
(b) Chemical Hygiene Plan records should document that the facilities and precautions were compatible with current knowledge and regulations (7).
(c) Inventory and usage records for high-risk substances should be kept as specified in sections E3e below.

(d) Medical records should be retained by the institution in accordance with the requirements of state and federal regulations (12).

8. **Signs and Labels.** Prominent signs and labels of the following types should be posted:

(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers (28);
(b) Identity labels, showing contents of containers (including waste receptacles) and associated hazards (27, 48);
(c) Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits (27) and areas where food and beverage consumption and storage are permitted (24); and
(d) Warnings at areas or equipment where special or unusual hazards exist (27).

9. **Spills and Accidents**

(a) A written emergency plan should be established and communicated to all personnel; it should include procedures for ventilation failure (200), evacuation, medical care, reporting, and drills (172).
(b) There should be an alarm system to alert people in all parts of the facility including isolation areas such as cold rooms (172).
(c) A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting (175).
(d) All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit (8, 28).

10. **Information and Training Program**

(a) **Aim:** To assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs (5, 15).
(b) **Emergency and Personal Protection Training:** Every laboratory worker should know the location and proper use of available protective apparel and equipment (154, 169).
Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures (6).
Such training as well as first aid instruction should be available to (154) and encouraged for (176) everyone who might need it.
(c) **Receiving and stockroom/storeroom personnel** should know about hazards, handling equipment, protective apparel, and relevant regulations (217).

(d) **Frequency of Training:** The training and education program should be a regular, continuing activity - not simply an annual presentation (15).

(e) **Literature/Consultation:** Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources (14).

11. **Waste Disposal Program.**

(a) **Aim:** To assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals (5).

(b) **Content (14, 232, 233, 240):** The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations (244).

(c) **Discarding Chemical Stocks:** Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened (24, 27).
Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage (226).

(d) **Frequency of Disposal:** Waste should be removed from laboratories to a central waste storage area at least once per week and from the central waste storage area at regular intervals (14).

(e) **Method of Disposal:** Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste (14, 238, 241).
Indiscriminate disposal by pouring waste chemicals down the drain (14, 231, 242) or adding them to mixed refuse for landfill burial is unacceptable (14).
Hoods should not be used as a means of disposal for volatile chemicals (40, 200).
Disposal by recycling (233, 243) or chemical decontamination (40, 230) should be used when possible.

E. **<u>Basic Rules and Procedures for Working with Chemicals</u>**

The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.

1. **General Rules.** The following should be used for essentially all laboratory work with chemicals:

(a) **Accidents and spills –**
Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention (33, 172).

Ingestion: Encourage the victim to drink large amounts of water (178).
Skin Contact: Promptly flush the affected area with water (33, 172, 178) and remove any contaminated clothing (172, 178). If symptoms persist after washing, seek medical attention (33).
Clean-up. Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal (24, 33). See pp. 233-237 for specific clean-up recommendations.

(b) **Avoidance of "routine" exposure:** Develop and encourage safe habits (23); avoid unnecessary exposure to chemicals by any route (23);
Do not smell or taste chemicals (32). Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices (199).
Inspect gloves (157) and test glove boxes (208) before use.
Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained re-circulated atmospheres (209).

(c) **Choice of chemicals:** Use only those chemicals for which the quality of the available ventilation system is appropriate (13).

(d) **Eating, smoking, etc.:** Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present (22, 24, 32, 40); wash hands before conducting these activities (23, 24).
Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations (23, 24, 226).

(e) **Equipment and glassware:** Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware (25). Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur (25). Use equipment only for its designed purpose (23, 26).

(f) **Exiting:** Wash areas of exposed skin well before leaving the laboratory (23).

(g) **Horseplay:** Avoid practical jokes or other behavior which might confuse, startle or distract another worker (23).

(h) **Mouth suction:** Do not use mouth suction for pipetting or starting a siphon (23, 32).

(i) **Personal apparel:** Confine long hair and loose clothing (23, 158). Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers (158).

(j) **Personal housekeeping:** Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation or at the end of each day (24).

(k) **Personal protection:** Assure that appropriate eye protection (154-156) is worn by all persons, including visitors, where chemicals are stored or handled (22, 23, 33, 154).
Wear appropriate gloves when the potential for contact with toxic materials exists (157); inspect the gloves before each use, wash them before removal, and replace them periodically (157). (A table of resistance to chemicals of common glove materials is given p. 159).
Use appropriate (164-168) respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls (164-5), inspecting the respirator before use (169).
Use any other protective and emergency apparel and equipment as appropriate (22, 157-162).
Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken (155).
Remove laboratory coats immediately on significant contamination (161).

(l) **Planning:** Seek information and advice about hazards (7), plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation (22, 23).

(m) **Unattended operations:** Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation (27, 128).

(n) **Use of hood:** Use the hood for operations which might result in release of toxic chemical vapors or dust (198-9).
As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm (13).
Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made (200); keep materials stored in hoods to a minimum and do not allow them to block vents or air flow (200).
Leave the hood “on” when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is “off” (200).

(o) **Vigilance:** Be alert to unsafe conditions and see that they are corrected when detected (22).

(p) **Waste disposal:** Assure that the plan for each laboratory operation includes plans and training for waste disposal (230).
Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan (22, 24).
Do not discharge to the sewer concentrated acids or bases (231); highly toxic, malodorous, or lachrymatory substances (231); or any substances which might interfere with the biological activity of waste water treatment

plants, create fire or explosion hazards, cause structural damage or obstruct flow (242).

(q) **Working alone:** Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous (28).

2. **Working with Allergens and Embryotoxins**

(a) **Allergens** (examples: diazomethane, isocyanates, bichromates): Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity (35).

(b) **Embryotoxins** (34-5) (examples: organomercurials, lead compounds, formamide): If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.

Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.

Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.

Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

3. **Work with Chemicals of Moderate Chronic or High Acute Toxicity**

Examples: diisopropylfluorophosphate (41), hydrofluoric acid (43), hydrogen cyanide (45).

Supplemental rules to be followed in addition to those mentioned above (Procedure B of “Prudent Practices”, pp. 39-41):

(a) **Aim:** To minimize exposure to these toxic substances by any route using all reasonable precautions (39).

(b) **Applicability:** These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities (39).

(c) **Location:** Use and store these substances only in areas of restricted access with special warning signs (40, 229).

Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 60 linear feet per minute) (40) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance (39); trap released vapors to re-vent their discharge with the hood exhaust (40).

(d) **Personal protection:** Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate) (39). Always wash hands and arms immediately after working with these materials (40).

(e) **Records:** Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved (40, 229).

(f) **Prevention of spills and accidents:** Be prepared for accidents and spills (41).

Assure that at least 2 people are present at all times if a compound in use is highly toxic or of unknown toxicity (39).
Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper (40).
If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment (41).

(g) **Waste:** Thoroughly decontaminate or incinerate contaminated clothing or shoes (41). If possible, chemically decontaminate by chemical conversion (40).
Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles half-filled with vermiculite) (40).

4. **Work with Chemicals of High Chronic Toxicity**

(Examples: dimethylmercury and nickel carbonyl (48), benzo-a-pyrene (51), N-nitrosodiethylamine (54), other human carcinogens or substances with high carcinogenic potency in animals (38).)
Further supplemental rules are to be followed, in addition to all these mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance) (47). (Procedure A of "Prudent Practices" pp. 47-50).

(a) **Access:** Conduct all transfers and work with these substances in a "controlled area": a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions (48).

(b) **Approvals:** Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor (48).

(c) **Non-contamination/Decontamination:** Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood (49). Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area (49, 50).
Decontaminate the controlled area before normal work is resumed there (50).

(d) **Exiting:** On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck (49).

(e) **Housekeeping:** Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder (50).

(f) **Medical surveillance**: If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a

qualified physician concerning desirability of regular medical surveillance (50).

(g) **Records:** Keep accurate records of the amounts of these substances stored (229) and used, the dates of use, and names of users (48).

(h) **Signs and labels:** Assure that the controlled area is conspicuously marked with warning and restricted access signs (49) and that all containers of these substances are appropriately labeled with identity and warning labels (48).

(i) **Spills:** Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available (233-4).

(j) **Storage:** Store containers of these chemicals only in a ventilated, limited access (48, 227, 229) area in appropriately labeled, unbreakable, chemically resistant, secondary containers (48, 229).

(k) **Glove boxes:** For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water (48). For a positive pressure glove box, thoroughly check for leaks before each use (49). In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood (49).

(l) **Waste:** Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel (49, 50, 233).

5. **Animal Work with Chemicals of High Chronic Toxicity**

(a) **Access:** For large scale studies, special facilities with restricted access are preferable (56).

(b) **Administration of the toxic substance:** When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar air flow directed toward HEPA filters (56).

(c) **Aerosol suppression:** Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood) (55, 56).

(d) **Personal protection:** When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed because of incomplete suppression of aerosols, other apparel and equipment (shoe and head coverings, respirator) (56).

(e) **Waste disposal:** Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products (238); otherwise, package the waste appropriately for burial in an EPA-approved site (239).

F. **Safety Recommendations**

The above recommendations from “Prudent Practices” do not include those which are directed primarily toward prevention of physical injury rather than toxic exposure. However, failure of precautions against injury will often have the secondary effect of causing toxic exposures. Therefore, we list below page references for recommendations concerning some of the major categories of safety hazards which also have implications for chemical hygiene:

1. Corrosive agents: (35-6)
2. Electrically powered laboratory apparatus: (179-92)
3. Fires, explosions: (26, 57-74, 162-64, 174-5, 219-20, 226-7)
4. Low temperature procedures: (26, 88)
5. Pressurized and vacuum operations (including use of compressed gas cylinders): (27, 75-101)

G. **Material Safety Data Sheets**

Material safety data sheets are presented in “Prudent Practices” for the chemicals listed below. (Asterisks denote that comprehensive material safety data sheets are provided).

* Acetyl peroxide (105)
* Acrolein (106)
* Acrylonitrile
* Ammonia (anhydrous)(91)
* Aniline (109)
* Benzene (110)
* Benzo[a]pyrene (112)
* Bis(chloromethyl) ether (113)
* Boron trichloride (91)
* Boron trifluoride (92)
* Bromine (114)
* Tert-butyl hydroperoxide (148)
* Carbon disulfide (116)
* Carbon monoxide (92)
* Carbon tetrachloride (118)
* Chlorine (119)
* Chlorine trifluoride (94)
* Chloroform (121)
* Chloromethane (93)
* Diethyl ether (122)
* Diisopropyl fluorophosphate (41)
* Dimethylformamide (123)
* Dimethyl sulfate (125)
* Dioxane (126)
* Ethylene dibromide (128)
* Fluorine (95)
* Formaldehyde (130)

* Hydrazine and salts (132)
* Hydrofluoric acid (43)
* Hydrogen bromide (98)
* Hydrogen chloride (98)
* Hydrogen cyanide (133)
* Hydrogen sulfide (135)
* Mercury and compounds (52)
* Methanol (137)
* Morpholine (138)
* Nickel carbonyl (99)
* Nitrobenzene (139)
* Nitrogen dioxide (100)
* N-nitrosodiethylamine (54)
* Peracetic acid (141)
* Phenol (142)
* Phosgene (143)
* Pyridine (144)
* Sodium azide (145)
* Sodium cyanide (147)
* Sulfur dioxide (101)
* Trichloroethylene (149)
* Vinyl chloride (150)

Regulations (Standards - 29 CFR)
References (Non-Mandatory) - 1910.1450 App B

The following references are provided to assist the employer in the development of a Chemical Hygiene Plan. The materials listed below are offered as non-mandatory guidance. References listed here do not imply specific endorsement of a book, opinion, technique, policy or a specific solution for a safe laboratory. (a) Materials for the development of the Chemical Hygiene Plan:

1. Amey or health problem. Other references not listed here may better meet the needs of a specific lrican Chemical Society, Safety in Academic Chemistry Laboratories, 4th edition, 1985.

2. Fawcett, H.H. and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd edition, Wiley-Interscience, New York, 1982.

3. Flury, Patricia A., Environmental Health and Safety in the Hospital Laboratory, Charles C. Thomas Publisher, Springfield IL, 1978.

4. Green, Michael E. and Turk, Amos, Safety in Working with Chemicals, Macmillan Publishing Co., NY, 1978.

5. Kaufman, James A., Laboratory Safety Guidelines, Dow Chemical Co., Box 1713, Midland, MI 48640, 1977.

6. National Institutes of Health, NIH Guidelines for the Laboratory use of Chemical Carcinogens, NIH Pub. No. 81-2385, GPO, Washington, DC 20402, 1981.

7. National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, DC, 1983.

8. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, DC, 1981.

9. Renfrew, Malcolm, Ed., Safety in the Chemical Laboratory, Vol. IV, J. Chem. Ed., American Chemical Society, Easlon, PA, 1981.

10. Steere, Norman V., Ed., Safety in the Chemical Laboratory, J. Chem. Ed. American Chemical Society, Easlon, PA, 18042, Vol. I, 1967, Vol. II, 1971, Vol. III, 1974.

11. Steere, Norman V., Handbook of Laboratory Safety, the Chemical Rubber Company Cleveland, OH, 1971.

12. Young, Jay A., Ed., Improving Safety in the Chemical Laboratory, John Wiley & Sons, Inc. New York, 1987.

(b) Hazardous Substances Information:

1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, 6500 Glenway Avenue, Bldg. D-7, Cincinnati, OH 45211-4438.

2. Annual Report on Carcinogens, National Toxicology Program U.S. Department of Health and Human Services, Public Health Service, U.S. Government Printing Office, Washington, DC, (latest edition).

3. Best Company, Best Safety Directory, Vols. I and II, Oldwick, N.J., 1981.

4. Bretherick, L., Handbook of Reactive Chemical Hazards, 2nd edition, Butterworths, London, 1979.

5. Bretherick, L., Hazards in the Chemical Laboratory, 3rd edition, Royal Society of Chemistry, London, 1986.

6. Code of Federal Regulations, 29 CFR part 1910 subpart Z. U.S. Govt. Printing Office, Washington, DC 20402 (latest edition).

7. IARC Monographs on the Evaluation of the Carcinogenic Risk of chemicals to Man, World Health Organization Publications Center, 49 Sheridan Avenue, Albany, New York 12210 (latest editions).

8. NIOSH/OSHA Pocket Guide to Chemical Hazards. NIOSH Pub. No. 85-114, U.S. Government Printing Office, Washington, DC, 1985 (or latest edition).

9. Occupational Health Guidelines, NIOSH/OSHA. NIOSH Pub. No. 81-123 U.S. Government Printing Office, Washington, DC, 1981.

10. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY (Five Volumes).

11. Registry of Toxic Effects of Chemical Substances, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Revised Annually, for sale from Superintendent of documents US. Govt. Printing Office, Washington, DC 20402.

12. The Merck Index: An Encyclopedia of Chemicals and Drugs. Merck and Company Inc. Rahway, N.J., 1976 (or latest edition).

13. Sax, N.I. Dangerous Properties of Industrial Materials, 5th edition, Van Nostrand Reinhold, NY., 1979.

14. Sittig, Marshall, Handbook of Toxic and Hazardous Chemicals, Noyes Publications. Park Ridge, NJ, 1981.

(c) Information on Ventilation:

1. American Conference of Governmental Industrial Hygienists Industrial Ventilation (latest edition), 6500 Glenway Avenue, Bldg. D-7, Cincinnati, Ohio 45211-4438.

2. American National Standards Institute, Inc. American National Standards Fundamentals Governing the Design and Operation of Local Exhaust Systems ANSI Z 9.2-1979 American National Standards Institute, N.Y. 1979.

3. mad, A.P. and Watson, C.L. Ventilation Index: An Easy Way to Decide about Hazardous Liquids, Professional Safety pp 15-18, April 1980.

4. National Fire Protection Association, Fire Protection for Laboratories Using Chemicals NFPA-45, 1982.

Safety Standard for Laboratories in Health Related Institutions, NFPA, 56c, 1980.

Fire Protection Guide on Hazardous Materials, 7th edition, 1978.

National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

5. Scientific Apparatus Makers Association (SAMA), Standard for Laboratory Fume Hoods, SAMA LF7-1980, 1101 16th Street, NW., Washington, DC 20036.

(d) Information on Availability of Referenced Material:

1. American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.

2. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

Appendix II

President of KCTCS

President/CEO of **West Kentucky Community and Technical College** **Dr. Barbara Veazey**

KCTCS Office of Facilities Management **Safety Coordinator** **Gregory Bonner** **(859)246-3220** **300 North Main** **Versailles, KY 40383**

West Kentucky Community and Technical College **Safety, Renovation and Construction Office** John Carrico Vice President of Administrative Services (270)534-3089	**West Kentucky Community and Technical College Safety Officer** Keith Yearry Director of Maintenance & Operations (270)534-3418 cell phone(270)564-9390

West Kentucky Community and Technical College

Chemical Hygiene Committee

Members: Larry Bigham - Chair, Keith Yearry, Shari Gholson, Christine Stalions, Teresa Mayo

APPENDIX III

West Kentucky Community and Technical College
Chemical Hygiene Plan

AWARENESS CERTIFICATION

The **West Kentucky Community and Technical College** Chemical Hygiene Plan requires that laboratory supervisors train their employees on the following topics:

- The location and availability of the OSHA Lab Standard, the laboratory's Chemical Hygiene Plan, chemical reference materials (such as material safety data sheets), and permissible exposure limits for chemicals if available;
- Location and availability of the signs and symptoms associated with exposure to the hazardous chemicals with which employees work;
- Detection methods and observations that may be used to detect the presence or release of a hazardous chemical in the lab (e.g. odor, monitoring equipment, or visual appearance);
- The physical and health hazards of the chemicals with which employees work; and
- Work practices, personal protective equipment and emergency procedures to be used to ensure protection from overexposure to the hazardous chemicals with which employees work.

In addition to the training provided by the laboratory supervisor, it is the employee's responsibility to request information and training when unsure how to handle a hazardous chemical or laboratory procedure and to follow all health and safety rules while working in the lab.

After training has been received from the laboratory supervisor related to the above information, please complete this form and return it to your laboratory supervisor.

_____ _____

employee's signature *lab supervisor's signature*

_____ _____

employee's name - please print *lab supervisor's name - please print*

_____

date

APPENDIX IV

Sample Chemical Inventory Form

Laboratory: _____ Laboratory Supervisor: _____

Completed by: _____ Date: _____

Chemical/Trade Name	**CAS #**	**Quantity** (e.g. 7 gallons)	**Type Container** g=glass c=compressed gas p=powder	**Where Stored** c=cabinet h=hood s=shelve l=lab bench

NOTE: Maintain the original copy of this form in laboratory Chemical Hygiene Binder. Submit Photo copy to: **West Kentucky Community and Technical College Safety Office, West Kentucky Community and Technical College Business Office and KCTCS Office of Facilities Management, Safety Coordinator.**

APPENDIX V

Sample Laboratory Self Inspection Form

Department: _____ Building: _____ Room Number: _____

Department Safety Officer: _____ Inspector: _____

Lab Supervisor: _____ Inspection Date: _____

Chairman: _____ Re-inspection Due: _____

Item	S	U	Comment	Corrective Action Taken
1. Entrances, exits, hallways, stairways				
2. Showers/eye wash operative				
3. Personal protective equipment				
4. Fire extinguishers/inspection & location				
5. Pressurized cylinders: storage/usage label				
6. Room use identification/labeling				
7. UL Electrical equipment & cords				
8. Fume hood operation				
9. Biological safety cabinets				
Certification				
Use				
10. Hazardous Chemicals				
Labeling				
Storage/amount/location				
Handling				

APPENDIX V (cont'd)

Sample Laboratory Self Inspection Form

Item	S	U	Comments	Corrective Action Taken
11. Hazardous Waste Disposal				
Training certificate				
Labeling				
Storage				
Disposal				
12. Equipment and utility labeling				
13. Location of cut-off valves/circuit breakers				
14. General safety (dress, eating, smoking, etc.)				
15. Use of flame and heat				
16. Ventilation				
17. Housekeeping/drains flushed				
18. Sharps (glass, scalpel, blades, syringe, etc.)				
19. Emergency lighting				
20. Emergency plan/posted numbers				
21. Safety manuals				
22. Accidents reported/investigated				
23. Safety training: Date: _____				
Subject: _____				

Laboratory safety questions? Call your laboratory supervisor, West Kentucky Community and Technical College Safety Office, or KCTCS Office of Facilities Management, Safety Coordinator.

APPENDIX VI

GLOVE SELECTION GUIDANCE

Resistant Properties of Selected Materials by Chemical Class

Chemicals	Butyl	CPE	Viton/ neoprene	Natural rubber	Neoprene	Nitrile +PVC	Nitrile	PE	PVA	PVC	Viton	Butyl/ noeprene
Acids, carboxylic and aliphatic												
Unsubstituted	R	r	r	**	rr	**	rr	N	**	**	**	r
Polybasic					rr	rr	rr	N	n	rr		
								rr				
Aldehydes												
Aliphatic and	RR	NN	r	**	NN	nn	NN	**	NN	NN	**	r
alicyclic	rr		n	nn	nn	n	nn	N	rr	N		r
Aromatic and heterocyclic								N				
Amides	rr			**	nn		nn	nn			nn	
Amines, aliphatic and alicyclic												
Primary	**	**	n	NN	**		rr		nn	**	**	
Secondary	**		n	NN	nn		**			NN	nn	n
Tertiary	**	**		**	**	**	**			**	rr	
Polyamine	**			NN	**	nn				NN	rr	
Cyanides					r							
Esters, carboxylic												
Formats			n							n		n
Acetates	**	**	n	NN	nn	nn	NN	N	**	NN	n	**
								N				

Chemicals	Butyl	CPE	Viton/ neoprene	Natural rubber	Neoprene	Nitrile +PVC	Nitrile	PE	PVA	PVC	Viton	Butyl/ noeprene
Higher monobasic	nn	nn	**	NN	nn		nn	N N	rr	N N		**
Polybasic			r	r	r		**			r r		r
Aromatic phthlate	rr		r	**	**		**			nn	rr	r
Ethers Alilthatic	**	rr	**	NN	**	**	**		**	**		**
Halogen Compounds Aliphatic, Unsubstituted Aliphatic, substituted Aromatic, unsubstituted Polynuclear Vinyl halides	nn ** nn	nn nn	r r	NN NN N NN	NN rr nn	NN n	NN nn nn	N N N N	** **	NN NN N n n	** rr rr rr rr	n n
Heterocyclic compounds Epoxy compounds Furan derivatives	** nn		nn	**	nn		nn	N N	**	nn NN	NN nn	n
Hydrazines	**	nn	n	**	**		**		nn	**	**	n
Hydrocarbons Aliphatic and alicyclic	N	r rr	r r	NN NN	** NN	** NN	**	** N	**	N N NN	R R RR	n r

Chemicals	Butyl	CPE	Viton/ neoprene	Natural rubber	Neoprene	Nitrile +PVC	Nitrile	PE	PVA	PVC	Viton	Butyl/ noeprene
Aromatic								N				
Hydroxyl compounds												
Aliphatic and	RR	rr	rr	nn	**	nn	**	**	**	**	rr	**
alicyclic	rr	rr	r	**	**	**	rr		rr	**	rr	r
Primary	r			**	rr	rr	rr			**		
Secondary	r		**	rr	rr	rr	rr			**		**
Tertiary	**		r	**	**	**	**	**	nn	**	rr	r
Polyols												
Aromatic												
Inorganic acids	**	**	rr	**	**	**	**	**	n	**	rr	**
Inorganic bases	r	r		RR	RR	**	RR	**	n	**	rr	r
Inorganic gases	**	r	n	n	r			**		**	**	**
Inorganic salts**	r		n	**	r	r	r			R		
Isocyanates				NN	n				rr			
Ketones, aliphatic		NN	n	NN	NN	N	**	N N	**	NN	NN	**
Nitrites, aliphatic	rr			NN	**			N N	rr	NN	rr	
Nitro compounds												
Unsubstituted	rr	r		NN	**		nn		**	**	**	
Organo-phosphorous compounds			r									r
Peroxides				r								
Sulfur compounds			**									n
Thiols												

Legend:

RR, R, rr and r represent positive degrees of resistance. NN, N, nn and n represent degrees of poor resistance. Double characters indicate that the rating is based on test data. Single characters indicate that the rating is based on qualitative data. Upper-case letters indicate a large body of consistent data.
Lower-case letters indicate either a small quantity of data or inconsistent information.

Asterisks (*"") mean that the material varied considerably in its resistance to chemicals within a given class and data for specific chemicals should be used if available.

Butyl - Butyl rubber
PVC - Polyvinyl chloride
PE - Polyethylene
Nitrile + PVC - Nitrile rubber + polyvinyl chloride
Natural rubber - same
CPE - Chlorinated polyethylene
Viton - same
PVA - Polyvinyl alcohol
Nitrile - Nitrile rubber
Neoprene - same
Viton/Neoprene - layered material, 1st material on surface
Butyl/Neoprene - layered material, 1st material on surface

Taken from CRC Handbook of Laboratory Safety, 3rd edition.

APPENDIX VII

EXAMPLES OF INCOMPATIBLE CHEMICALS

From: "Safety in Academic Chemistry Laboratories", American Chemical Society

Chemical	Is Incompatible With
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely

Chemical	Is Incompatible With
	divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	All other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen: flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold

Chemical	Is Incompatible With
Phosphorus (white)	Air, oxygen, alkalies, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

IN CASE OF EMERGENCY
CALL 911

ROOM NUMBER:
WAL 131
GENERAL CHEMISTRY LAB

DEPARTMENT:
CHEMISTRY

LABORATORY INSTRUCTORS:
LARRY BIGHAM
DR. REBECCA BROWN

Special Hazards:


Flammables


Corrosives


Poison/Toxic


Explosives


Oxidizers


Carcinogens

EMERGENCY CONTACTS FOR LABORATORY

****A TWO-WAY RADIO IS LOCATED IN THE MAIN OFFICE OF WALLER HALL TO BE USED FOR EMERGENCY PURPOSES****

NAME	PHONE #	CELLULAR #	PAGER#
CAMPUS EMERGENCY	9-534-3405		
JOHN CARRICO - V.P. of Administrative Services	9-534-3089		
MAINTENANCE DEPT.	9-534-3147		
SECURITY (On campus from 6pm through 1pm: Monday - Friday and 24 hours per day: Saturday, Sunday, and holidays)	9-554-6300	9-564-8403	
STEVE ORAZINE - Director of Security	9-534-3859	9-556-6300	
KEITH YEARRY - Director of Maintenance & Operations	9-534-3418	9-564-9390	
MIKE PEARISO - Assistant Supervisor of M&O - Days	9-534-3067	9-559-9196	9-441-8902
CHRIS RUSSELL - Assistant Supervisor of M&O - Evenings		9-559-9188	
CHRISTINE STALIONS - Laboratory Specialist	9-534-3234		

Prepared by: Christine Stalions
Date Posted:

Note: The information on this sign must be updated every six months and immediately in the event of any change of emergency contacts.

Appendix IX

_____

(date)

RESPIRATOR PROGRAM
FOR

_____

(*department)*

West Kentucky Community and Technical College

I. PURPOSE

The purpose of this program is to set forth standard operating procedures governing the selection and use of respirators. Appropriate respirators shall be used in accordance with this program to control adverse health effects caused by breathing harmful air contaminants. Though the primary objective shall be to prevent atmospheric contamination, respirators shall be used when effective engineering controls are not feasible, or while they are being implemented.

II. SCOPE

1. The following program establishes guidelines for safe practice in the use of respiratory protective devices to ensure the safety and health of WKCTC staff using these devices under routine and emergency conditions.

2. The provisions of this document were established per the requirements listed in the Federal Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.134, as enforced at WKCTC by the Commonwealth of Kentucky Labor Cabinet

3. Additional guidelines for this document were provided by the National Institute for Occupational Safety and Health (NIOSH) Guide to Industrial Respiratory Protection, the NIOSH Respirator Decision Logic, and American National Standards Institute (ANSI) Z88.6-1984.

III. GENERAL REQUIREMENTS

General requirements for the respirator program according to 29 CFR 1910.134 and pertinent guidelines are as follows:

1. _____ will serve as the departmental "Respirator Coordinator".

2. Respirators shall be selected by the Coordinator with assistance from the Occupational Health Department if needed. Selection shall be made based on:

(a) The type of hazards to which the worker will be exposed;
(b) The estimated concentration of the contaminant.

(c) Pertinent OSHA standards (substance-specific health standards).

3. The user shall be instructed and trained in the proper use of respirators and their limitations. The Coordinator shall be responsible for assuring that training is given to the user initially and annually thereafter. This training may be presented by an appropriate manufacturer's representative, the Occupational Health Department, or other qualified individuals (such as departmental Respirator Coordinators).

Training shall include:

(a) Proper cleaning and disinfecting of respirators,
(b) Proper inspection procedures,
(c) Proper storing of respirator,
(d) Instruction in actual use,
(e) Instruction of positive and negative pressure fit checks, and
(f) Actual "fit testing" which will be performed by the Occupational Health Department. A record of all fit testing will be provided to the Coordinator.

4. Respirators should be assigned to individual workers for their exclusive use. When this is not feasible, the Coordinator shall be responsible for ensuring that the respirator is maintained according to this program.

5. Respirators shall be cleaned and disinfected (by the user) after each use, daily, or as often as necessary to ensure sanitary use of the respirator. In the event that respirators are shared, they must be cleaned and disinfected after each use.

6. The Coordinator shall ensure that workers are provided a storage area for respirators that is in a convenient, clean and sanitary location. The respirators should be stored so as to not damage the integrity of the mask.

7. Respirators shall be inspected by the user during cleaning following the procedures learned in training. Inspection shall include:

(a) Face piece
(b) Straps

(c) Inhalation and exhalation valves
(d) Filters or cartridges

Any sign of damage or excessive wear shall be reported to the Coordinator or employee's supervisor immediately.

Respirators for emergency use shall be inspected by the individuals responsible for responding to such emergencies at least once a month and after each use.

8. Appropriate surveillance of work area conditions and degree of employee exposure shall be maintained. The Occupational Health Department will assist units by conducting air monitoring when deemed necessary, and will maintain records of such air monitoring. Air monitoring results must also be communicated to affected workers.

9. The Coordinator will institute at least annual inspections and evaluations to determine the continued effectiveness of the _____ Respirator Program.
(department)

10. Physical examination requirement: individuals shall not be assigned to tasks requiring use of respirators unless it has been determined by a physician that they are physically able to perform the work and use the equipment. It is recommended that employees take the respirator that they will be wearing to their physical examination so that the physician knows exactly what type respirator is to be worn.

11. Only approved respirators shall be used.

12. Names of persons this plan applies to, tasks requiring respirators, and effective dates must be attached to this plan. (See **Attachment A**)

13. Training records must be maintained by the Coordinator. (See **Attachment B** "Respirator Training Record")

IV. FURTHER INFORMATION

KCTCS Office of Facilities Management
Safety Coordinator
Gregory Bonner
2750 Research Park Drive
P.O. Box 14092
Lexington, KY 40512-4092
Phone (859)246-3220

Appendix A
WKCTC Respirator Training Program

Name _____ ID#_____

Division/Department_____ Job Classification _____

Physical examination completed? Yes ___ No ___ If no, when scheduled _____?
(Required prior to respirator use)

_____

The employee listed above has completed respiratory protection training presented by _____ on _____.
(trainer) *(date)*

The training included the following elements:

1. The reasons for the need of respiratory protection;
2. The nature, extent, and effects of respiratory hazardous to which one may be exposed;
3. An explanation of why engineering controls are not available, or are not adequate, and if feasible, what effort is being made to reduce or eliminate the need for respirators.
4. An explanation of why a particular type of respirator has been selected or a specific respirator hazard;
5. An explanation of the operation, capabilities, and limitations of the respirator;
6. Instruction in inspecting, donning,. checking the fit of, and wearing the respirator.
7. An opportunity to handle the respirator, learn how to don and wear it properly, check its seals* and wear it in a safe atmosphere;
8. An explanation of how maintenance and storage of the respirator is carried out;
9. Instructions in how to recognize and cope with emergency situations; and
10. Responsibilities of the employee and employer with regard to respiratory protection.

It is the responsibility of the respirator wearer to:

1. Use the respirator in accordance with instructions and training received;
2. Guard against damage to the respirator; and,
3. Immediately report any malfunction of the respirator to their supervisor or the Departmental Respirator Coordinator.

Employee signature _____

Trainer signature _____

**fit testing certification by the Occupational Health Department is required prior to respirator use.*

Appendix B

_____ Approved Respirator Users

(department)

	Name	Job Classification	Tasks Requiring Respirator Use	Type Respirator(s) Approved	Effective Date*
1.	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____
6.	_____	_____	_____	_____	_____
7.	_____	_____	_____	_____	_____
8.	_____	_____	_____	_____	_____

*Physical exams and re-training are required on an annual basis to maintain "approved use" status.

Maintained by: _____

Appendix X

West Kentucky Community and Technical College

Accident – Occupational Injury/Illness Report

ACCIDENT REPORT FORM

(Please Write Legibly)

Name_____Student ☐ Employee ☐ Visitor ☐ Date of Occurrence ___/___/___

Dept./Class_____SSN_____ _____ _____ Time of Occurrence ___:___ ___ ___
AM PM

Facility_____ Days Lost from School or Work_____

Address_____

DESCRIPTION OF INJURY

Apparent Nature of Injury

☐ Abrasion	☐ Concussion	☐ Puncture
☐ Amputation	☐ Cut	☐ Scald
☐ Asphyxiation	☐ Dislocation	☐ Scratch
☐ Bite	☐ Fracture	☐ Shock
☐ Bruise	☐ Laceration	☐ Sprain
☐ Burn	☐ Poisoning	☐ Other

Explain Other:_____
_____

Part of Body Injured

☐ Abdomen	☐ Elbow L__R__	☐ Head
☐ Ankle L__R__	☐ Eye L__R__	☐ Knee L__R__
☐ Arm L__R__	☐ Face	☐ Leg L__R__
☐ Back	☐ Finger	☐ Mouth
☐ Chest	☐ Foot L__R__	☐ Other
☐ Ear L__R__	☐ Hand L__R__	

Explain Other:_____
_____

Describe the nature of the injury (cut, third finger, left hand, etc.)_____
_____

Describe medical attention received, by whom, and address:_____
_____

DESCRIPTION OF ACCIDENT

Did accident occur while in an instructional or work activity? __Yes, __No, If no, explain_____
_____

Specify any machine, equipment, or tools involved_____

Were proper machine guards being used? __Yes, __No

Was student/employee using Safety Equipment? __Yes, __No

Was student/employee given safety orientation? __Yes, __No

Describe Safety Equipment_____

Was student/employee doing assigned work? __Yes, __No

If Safety Equipment was not in use, explain:_____
_____

Was this accident due to faulty equipment? __Yes, __No

Action taken to prevent recurrence_____
_____

Was supervisor present at accident? __Yes, __No If no, explain:_____
_____

Did student/employee have permission to use equipment? __Yes, __No If no, explain_____

FOR SAFETY SECTION USE ONLY
Degree of injury ___Minor ___Severe

DESCRIPTION OF ACCIDENT
(continued)

Student's/ Employee's description of accident (specify in detail)_____
_____
_____
_____

Student's/Employee's Signature_____ Date _____/_____/_____

Was family notified by facility?_____

Witness' description of accident (specify in detail)_____
_____
_____
_____

Witness' Signature_____ Date _____/_____/_____

Supervisor's description of accident (specify in detail)_____
_____
_____
_____

Supervisor's Signature_____ Date _____/_____/_____

Administrator's Comments _____
_____

Administrator's Signature_____ Date____/____/_____

List all non-student/non-supervisor witnesses and addresses:

1. _____ 2. _____ 3. _____
_____ _____ _____
_____ _____ _____

Date accident report received by Safety Coordinator ____/____/_____

Safety Coordinator: Sign and date original report and forward to Safety Section at:

KCTCS
Safety Section
2750 Research Park Drive
1st Floor, Barn
P.O. Box 14092
Lexington, KY 40512-4092

Appendix XI – Select Carcinogens List

Based on the National Toxicological Report of Known Carcinogens, 10th Edition; Report on Carcinogens Dec. 2002

Alcoholic Beverage Consumption
Analgesic Mixtures Containing Phenacetin (See Phenacetin and Analgesic Mixtures Containing Phenacetin)
Arsenic Compounds, Inorganic
Chromium Hexavalent Compounds
Coke Oven Emissions
Dyes Metabolized to Benzidine
Environmental Tobacco Smoke (See Tobacco Related Exposures**)**
Estrogens, Steroidal
Mineral Oils (Untreated and Mildly Treated)
Nickel Compounds (See Nickel Compounds and Metallic Nickel)
Smokeless Tobacco (See Tobacco Related Exposures)
Solar Radiation (See Ultraviolet Radiation Exposure)
Soots
Strong Inorganic Acid Mists Containing Sulfuric Acid
Sunlamps and Sunbeds, Exposure to (See Ultraviolet Radiation Related Exposure)
Tars (See Coal Tars and Coal Tar Pitches)
Tobacco Smoking (See Tobacco Related Exposures)
Broad Spectrum UV Radiation (See Ultraviolet Radiation Related Exposure)
Wood Dust
Cyclophosphamide CAS. No. 50-18-0
Thiotepa CAS. No. 52-24-4
1,4-Butanediol Dimethylsulfonate (Myleran®; Busulfan) CAS. No. 55-98-1
Diethylstilbestrol CAS. No. 56-53-1
Benzene CAS. No. 71-43-2
Vinyl Chloride CAS. No. 75-01-4
Ethylene Oxide CAS. No. 75-21-8
2-Naphthylamine (□-Naphthylamine) CAS. No. 91-59-8
4-Aminobiphenyl (4-Aminodiphenyl) CAS. No. 92-67-1
Benzidine (See Benzidine and Dyes Metabolized to Benzidine) CAS. No. 92-87-5
1,3-Butadiene CAS. No. 106-99-0
Chloromethyl Methyl Ether CAS. No. 107-30-2
Melphalan CAS. No. 148-82-3
Methoxsalen (See Methoxsalen with Ultraviolet A Therapy (PUVA)) [methoxsalen not carcinogenic alone] CAS. No. 298-81-7
Chlorambucil CAS. No. 305-03-3
Azathioprine CAS. No. 446-86-6
Mustard Gas CAS. No. 505-60-2
Bis(chloromethyl) Ether CAS. No. 542-88-1
Thorium Dioxide CAS. No. 1314-20-1
Asbestos CAS. No. 1332-21-4
Aflatoxins CAS. No. 1402-68-2
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD); “Dioxin” CAS. No. 1746-01-6

Beryllium (See Beryllium and Beryllium Compounds)CAS. No. **7440-41-7**
Cadmium (See Cadmium and Cadmium Compounds) CAS. No. 7440-43-9
Coal Tar (See Coal Tars and Coal Tar Pitches) CAS. No. 8007-45-2
Radon CAS. No. 10043-92-2
Tamoxifen CAS. No. 10540-29-1
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU) CAS. No. 13909-09-6
Cristobalite (See Silica, Crystalline [Respirable Size]) CAS. No. 14464-46-1
Quartz (See Silica, Crystalline [Respirable Size]) CAS. No. 14808-60-7
Tridymite (See Silica, Crystalline [Respirable Size]) CAS. No. 15468-32-3
Cyclosporin CAS. No. 59865-13-3
Erionite CAS. No. 66733-21-9

Based on the National Toxicological Report of Reasonably Anticipated to be Human Carcinogens, 10th Edition; Report on Carcinogens, Dec. 2002

Ceramic Fibers (Respirable Size)
Diesel Exhaust Particulates
Dyes Metabolized to 3,3'-Dimethoxybenzidine
Dyes Metabolized to 3,3□□-Dimethylbenzidine
Glasswool (Respirable Size)
Polybrominated Biphenyls (PBBs)
Polycyclic Aromatic Hydrocarbons (PAHs)
UVA Radiation (See Ultraviolet Radiation Related Exposure)
UVB Radiation (See Ultraviolet Radiation Related Exposure)
UVC Radiation (See Ultraviolet Radiation Related Exposure)
Formaldehyde (gas) CAS. No. 50-00-0
Dichlorodiphenyltrichloroethane (DDT) CAS. No. 50-29-3
Benzo[*a*]pyrene (See Polycyclic Aromatic Hydrocarbons, 15 Listings) CAS. No. 50-32-8
Reserpine CAS. No. 50-55-5
Propylthiouracil CAS. No. 51-52-5
Urethane CAS. No. 51-79-6
Dibenz[*a,h*]anthracene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 53-70-3
2-Acetylaminofluorene CAS. No. 53-96-3
N-Nitrosodiethylamine CAS. No. 55-18-5
Nitrogen Mustard Hydrochloride CAS. No. 55-86-7
Carbon Tetrachloride CAS. No. 56-23-5
Benz[*a*]anthracene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 56-55-3
Chloramphenicol CAS. No. **56-75-7**
1,1-Dimethylhydrazine (UDMH) CAS. No. 57-14-7
Phenytoin CAS. No. 57-41-0
β-Propiolactone CAS. No. 57-57-8
Progesterone CAS. No. 57-83-0
Lindane (See Lindane and Other Hexachlorocyclohexane Isomers)
CAS. No. 58-89-9

N-Nitrosomorpholine CAS. No. 59-89-2
4-Dimethylaminoazobenzene CAS. No. 60-11-7
Amitrole CAS. No. 61-82-5
Phenacetin (See Phenacetin and Analgesic Mixtures Containing Phenacetin) CAS. No. 62-44-2
Ethyl Methanesulfonate CAS. No. 62-50-0
Thioacetamide CAS. No. 62-55-5
Thiourea CAS. No. 62-56-6
N-Nitrosodimethylamine CAS. No. 62-75-9
Phenoxybenzamine Hydrochloride CAS. No. 63-92-3
Diethyl Sulfate CAS. No. 64-67-5
Methyl Methanesulfonate CAS. No. 66-27-3
Chloroform CAS. No. 67-66-3
Hexachloroethane CAS. No. 67-72-1
Norethisterone CAS. No. 68-22-4
N-Methyl-*N'*-nitro-*N*-nitrosoguanidine CAS. No. 70-25-7
Vinyl Fluoride CAS. No. **75-02-5**
Acetaldehyde CAS. No. 75-07-0
Dichloromethane (Methylene Chloride) CAS. No. 75-09-2
Bromodichloromethane CAS. No. 75-27-4
2-Methylaziridine (Propylenimine) CAS. No. 75-55-8
Propylene Oxide CAS. No. 75-56-9
Phenolphthalein CAS. No. 77-09-8
Dimethyl Sulfate CAS. No. 77-78-1
Isoprene CAS. No. 78-79-5
Trichloroethylene CAS. No. 79-01-6
Acrylamide CAS. No. 79-06-1
Dimethylcarbamoyl Chloride CAS. No. 79-44-7
2-Nitropropane CAS. No. 79-46-9
1-Amino-2-methylanthraquinone CAS. No. 82-28-0
2,4,6-Trichlorophenol CAS. No. 88-06-2
Michler's Ketone [4,4'□-(Dimethylamino)benzophenone] CAS. No. 90-94-8
o-Nitroanisole CAS. No. 91-23-6
3,3'□-Dichlorobenzidine CAS. No. 91-94-1
Methyleugenol CAS. No. **93-15-2**
Safrole CAS. No. 94-59-7
Sulfallate CAS. No. 95-06-7
o-Toluidine CAS. No. 95-53-4
p-Chloro-*o*-toluidine CAS. No. 95-69-2
2,4-Diaminotoluene CAS. No. 95-80-7
4-Chloro-*o*-phenylenediamine CAS. No. 95-83-0
Styrene-7,8-oxide CAS. No. **96-09-3**
1,2-Dibromo-3-chloropropane CAS. No. 96-12-8
2,3-Dibromo-1-propanol (DBP) CAS. No. **96-13-9**
1,2,3-Trichloropropane CAS. No. 96-18-4
Ethylene Thiourea CAS. No. 96-45-7
o-Aminoazotoluene CAS. No. 97-56-3
Benzotrichloride CAS. No. 98-07-7

N-Nitrosopiperidine CAS. No. 100-75-4
4,4'□-Methylenebis(2-chloraniline) (MBOCA) CAS. No. 101-14-4
4,4'□-Methylenebis(*N,N*-dimethylbenzenamine) CAS. No. 101-61-1
4,4'□-Methylenedianiline CAS. No. 101-77-9
4,4' -Oxydianiline CAS. No. 101-80-4
Diglycidyl Resorcinol Ether CAS. No. 101-90-6
1,4-Dichlorobenzene (*p*-Dichlorobenzene) CAS. No. 106-46-7
4-Vinyl-1-cyclohexene Diepoxide CAS. No. 106-87-6
Epichlorohydrin CAS. No. 106-89-8
1,2-Dibromoethane (Ethylene dibromide) CAS. No. 106-93-4
1,2-Dichloroethane (Ethylene Dichloride) CAS. No. 107-06-2
Acrylonitrile CAS. No. 107-13-1
Furan CAS. No. 110-00-9
Chlorendic Acid CAS. No. 115-28-6
Tetrafluoroethylene CAS. No. 116-14-3
Danthron (1,8-Dihydroxyanthraquinone) CAS. No. 117-10-2
2-Aminoanthraquinone CAS. No. 117-79-3
di(2-Ethylhexyl) Phthalate (DEHP) CAS. No. 117-81-7
Hexachlorobenzene CAS. No. 118-74-1
3,3'□-Dimethoxybenzidine (See 3,3□□-Dimethoxybenzidine and Dyes Metabolized to Dimethoxybenzidine) CAS. No. 119-90-4
3,3'□-Dimethylbenzidine (See 3,3□□-Dimethylbenzidine and Dyes Metabolized to Dimethylbenzidine) CAS. No. 119-93-7
p-Cresidine CAS. No. 120-71-8
Hydrazobenzene CAS. No. 122-66-7
1,4-Dioxane CAS. No. 123-91-1
Tris(2,3-dibromopropyl) Phosphate CAS. No. 126-72-7
Chloroprene CAS. No. 126-99-8
Tetrachloroethylene (Perchloroethylene) CAS. No. 127-18-4
o-Anisidine Hydrochloride CAS. No. 134-29-2
Cupferron CAS. No. 135-20-6
Phenazopyridine Hydrochloride CAS. No. 136-40-3
Nitrilotriacetic Acid CAS. No. 139-13-9
Kepone® (Chlordecone) CAS. No. 143-50-0
Bis(chloroethyl) Nitrosourea (BCNU) CAS. No. 154-93-8
Dibenzo[*a,l*]pyrene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 189-55-9

Dibenzo[*a,h*]pyrene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 189-64-0
Dibenzo[*a,l*]pyrene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No.191-30-0
Dibenzo[*a,e*]pyrene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 192-65-4
Indeno[1,2,3-*cd*]pyrene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 193-39-5
7*H*-Dibenzo[*c,g*]carbazole (See Polycyclic Aromatic Hydrocarbons, 15 Listings)

CAS. No. 194-59-2
Benzo[*j*]fluoranthene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 205-82-3
Benzo[*b*]fluoranthene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 205-99-2
Benzo[*k*]fluoranthene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 207-08-9
Dibenz[*a,j*]acridine (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 224-42-0
Dibenz[*a,h*]acridine (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 226-36-8
Lead Acetate CAS. No. 301-04-2
Hydrazine CAS. No. 302-01-2
Ochratoxin A CAS. No. 303-47-9
α-Hexachlorocyclohexane (See Lindane and Other Hexachlorocyclohexane Isomers)
CAS. No. 319-84-6
β-Hexachlorocyclohexane (See Lindane and Other Hexachlorocyclohexane Isomers) CAS. No. 319-85-7
Azacitidine (5-Azacytidine) CAS. No. 320-67-2
Procarbazine Hydrochloride CAS. No. 366-70-1
Oxymetholone CAS. No. 434-07-1
Metronidazole CAS. No. 443-48-1
Tetranitromethane CAS. No. 509-14-8
Dimethylvinyl Chloride CAS. No. 513-37-1
1,3-Dichloropropene (Technical Grade) CAS. No. 542-75-6
Glycidol CAS. No. 556-52-5
3-Chloro-2-methylpropene CAS. No. 563-47-3
C.I. Basic Red 9 Monohydrochloride CAS. No. 569-61-9
Vinyl Bromide CAS. No. **593-60-2**
Hexachlorocyclohexane (See Lindane and Other Hexachlorocyclohexane Isomers)
CAS. No. 608-73-1
3,3'□-Dichlorobenzidine Dihydrochloride CAS. No. 612-83-9
N-Nitrosodi-*n*-propylamine CAS. No. 621-64-7
o-Toluidine Hydrochloride CAS. No. 636-21-5
Hexamethylphosphoramide CAS. No. 680-31-9
N-Nitroso-*N*-methylurea (*N*-Methyl-*N*-nitrosourea) CAS. No. 684-93-5
N-Nitroso-*N*-ethylurea (*N*-Ethyl-*N*-nitrosourea; ENU) CAS. No. 759-73-9
N-Nitrosodi-*n*-butylamine CAS. No. 924-16-3
N-Nitrosopyrrolidine CAS. No. 930-55-2
N-Nitrosodiethanolamine CAS. No. 1116-54-7
1,3-Propane Sultone CAS. No. 1120-71-4
Polychlorinated Biphenyls (PCBs) CAS. No. 1336-36-3
Diepoxybutane CAS. No. 1464-53-5
Nitrofen CAS. No. 1836-75-5
Mirex CAS. No. 2385-85-5
Disperse Blue 1 CAS. No. 2475-45-8
p-Chloro-*o*-toluidine Hydrochloride CAS. No. 3165-93-3
2,2-bis-(Bromomethyl)-1,3-propanediol (Technical Grade) [BBMP]

CAS. No. **3296-90-0**
5-Methylchrysene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 3697-24-3
Dacarbazine CAS. No. 4342-03-4
N-Nitrosomethylvinylamine CAS. No. 4549-40-0
1-Nitropyrene CAS. No. 5522-43-0
Nickel (Metallic)(See Nickel Compounds and Metallic Nickel)
CAS. No. **7440-02-0**
5-Methylchrysene (See Polycyclic Aromatic Hydrocarbons, 15 Listings)
CAS. No. 3697-24-3
Dacarbazine CAS. No. 4342-03-4
N-Nitrosomethylvinylamine CAS. No. 4549-40-0
1-Nitropyrene CAS. No. 5522-43-0
Nickel (Metallic)(See Nickel Compounds and Metallic Nickel)
CAS. No. **7440-02-0**
Lead Phosphate CAS. No. 7446-27-7
Selenium Sulfide CAS. No. 7446-34-6
6-Nitrochrysene CAS. No. 7496-02-8
Toxaphene CAS. No. 8001-35-2
Iron Dextran Complex CAS. No. 9004-66-4
Hydrazine Sulfate CAS. No. 10034-93-2
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea CAS. No. 13010-47-4
N-Nitrososarcosine CAS. No. 13256-22-9
4,4'□-Methylenedianiline Dihydrochloride CAS. No. 13552-44-8
Decabromobiphenyl (See Polybrominated Biphenyls) CAS. No. 13654-09-6
Cisplatin CAS. No. 15663-27-1
N-Nitrosonornicotine CAS. No. 16543-55-8
Streptozotocin CAS. No. 18883-66-4
Adriamycin® (Doxorubicin hydrochloride) CAS. No. 23214-92-8
Butylated Hydroxyanisole (BHA) CAS. No. 25013-16-5
Toluene Diisocyanate CAS. No. 26471-62-5
Hexabromobiphenyl (Under Polybrominated Biphenyls) CAS. No. 36355-01-8
2,4-Diaminoanisole Sulfate CAS. No. 39156-41-7
1,6-Dinitropyrene CAS. No. 42397-64-8
1,8-Dinitropyrene CAS. No. 42397-65-9
Chlorozotocin CAS. No. 54749-90-5
4-Nitropyrene CAS. No. 57835-92-4
Octabromobiphenyl (Under Polybrominated Biphenyls) CAS. No. 61288-13-9
4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK) CAS. No. 64091-91-4
2-Amino-3-methylimidazo[4,5-f]quinoline (IQ) CAS. No. **76180-96-6**
Chlorinated Paraffins (C12, 60% Chlorine) CAS. No. 108171-26-2

Bold entries indicate new listing in *The Report on Carcinogens, Tenth Edition*

Hazard Rating Information for NFPA Fire Diamonds

Compound	Health	Fire	Reactivity	S/N
Acetal	2	3	0	
Acetaldehyde	2	4	2	
Acetic Acid (glacial)	2	2	2	
Acetic Anhydride	3	2	2	~~W~~
Acetone	1	3	0	
Acetonitrile	2	3	0	
Acetophenone	1	2	0	
Acetyl Chloride	3	3	2	~~W~~
Acetylene	1	4	3	
Acetyl Peroxide	1	2	4	
Acrolein	3	3	2	
Acrolein Dimer	1	2	1	
Acrylic Acid (glacial)	3	2	2	
Acrylonitrile	4	3	2	
Adipic Acid	-	1	0	
Adiponitrile	4	2	0	
Aldol	3	2	1	
Allyl Acetate	1	3	0	
Allyl Alcohol	3	3	0	
Allyl Bromide	3	3	1	
Allyl Chloride	3	3	1	
Aluminum (dust or powder)	0	1	1	
3-Aminopropanol	3	2	0	
Ammonia, Anhydrous	3	1	0	
Ammonium Bromide	2	0	0	

Compound	Health	Fire	Reactivity	S/N
Ammonium Chloride	2	0	0	
Ammonium Fluoride	3	0	0	
Ammonium Nitrate	2	0	3	OX
Ammonium Perchlorate	2	0	4	OX
Ammonium Permanganate	2	0	3	OX
Ammonium Sulfate	3	0	0	
Amyl Acetate	1	3	0	
Amyl Alcohol	1	3	0	
Amylamine	3	3	0	
Amylbenzene	1	2	0	
Amyl Chloride	1	3	0	
Amyl Ether	1	2	0	
Amyl Maleate	0	1	0	
Amyl Nitrate	2	2	0	OX
o-Amyl Phenol	2	1	0	
Amyl Propionate	0	2	0	
Amyl Stearate	0	1	0	
Amyl Toluene	2	2	0	
Aniline	3	2	0	
o-Anisidine	2	1	0	
Anisole	1	2	0	
Antimony Pentafluoride	3	0	1	
Antimony Pentasulfide	3	1	1	
Arsenic Chloride	3	0	0	
Arsenic Trisulfide	3	1	0	
Barium Chlorate	1	0	2	OX

Compound	Health	Fire	Reactivity	S/N
Barium Nitrate	1	0	0	OX
Barium Peroxide	1	0	0	OX
Benzaldehyde	2	2	0	
Benzoic Acid	2	1	-	
Benzol (benzene)	2	3	0	
Benzotrifluoride	4	3	0	
Benzoyl Chloride	3	2	1	W
Benzyl Acetate	1	1	0	
Benzyl Alcohol	2	1	0	
Benzyl Cyanide	2	1	0	
Benzyl Salicilate	1	1	0	
Beryllium (dust or powder)	4	1	0	
Biphenyl	2	1	0	
Boron Trifluoride	3	0	1	
Bromine	4	0	0	OX
Bromine Trifluoride	4	0	3	OX, W
Bromobenzene	2	2	0	
o-Bromotoluene	2	2	0	
Butadiene Monoxide	2	3	2	
Butane	1	4	0	
1-Butane	1	4	0	
Butenediol	1	1	0	
Butyl Acetate	1	3	0	
Butyl Acetoacetate	1	2	0	
Butyl Acrylate	2	2	2	
Butyl Alcohol	1	3	0	

Compound	Health	Fire	Reactivity	S/N
Butylamine	2	3	0	
Butylamine Oleate	3	2	0	
Butylbenzene	2	2	0	
Butyl Benzoate	1	1	0	
Butyl Bromide	2	3	0	
Butyl Chloride	2	3	0	
Butylcyclohexane	0	-	0	
Butyldecalin	1	1	0	
Butyl Formate	2	3	0	
N-Butyl Isocyanate	3	2	2	
Butyl Isovalerate	0	-	-	
Butyl Lactate	1	2	0	
Butyl Methacrylate	2	2	0	
Butyl Naphthalene	1	1	0	
Butyl Nitrate	1	3	3	
Butyl Oxalate	0	1	0	
Butyl Propionate	2	3	0	
Butyl Stearate	1	1	0	
Butyl Trichlorosilane	2	2	0	
Butyraldehyde	2	3	0	
Butyraldol	2	2	0	
Butyraldoxime	2	2	0	
Butyric Acid	2	2	0	
Calcium Carbide	1	4	2	~~W~~
Calcium Chlorate	2	0	2	OX
Calcium Cyanide	3	0	0	

Compound	Health	Fire	Reactivity	S/N
Calcium Hypochlorite	2	0	2	OX
Calcium Oxide	1	0	1	
Camphor	0	2	0	
Caproic Acid	2	1	0	
Capryladehyde	2	2	0	
Caprylyl Chloride	3	2	1	
Carbon Disulfide	2	3	0	
Carbon Monoxide	2	4	0	
Carbon Tetrachloride	3	0	0	
Castor Oil	0	1	0	
Chlorine	3	0	0	OX
Chlorine Monoxide	3	4	3	
Chloroacetic Acid	3	1	0	
Chloroaceto Phenone	2	1	0	
Chlorobenzene	2	3	0	
Chloroform	2	0	0	
Chloropicrin	4	0	3	
Chlorotoluene	2	2	0	
Chromic Acid	3	0	1	OX
Citral	0	2	0	
Cobalt Naphtha	1	2	0	
Coconut Oil	0	1	0	
Cod Liver Oil	0	1	0	
Corn Oil	0	1	0	
Creosote Oil	2	2	0	
o-Cresol	3	2	0	

Compound	Health	Fire	Reactivity	S/N
Crotonaldehyde	3	3	2	
Crotonic Acid	3	2	0	
Crotononitrile	-	1	0	
Cumene	2	3	0	
Cupric Nitrate	1	0	0	OX
Cyanogen	4	4	2	
Cyanogen Bromide	3	0	2	
Cyclobutane	1	4	0	
Cyclohexane	1	3	0	
Cyclohexanol	1	2	0	
Cyclohexanone	1	2	0	
Cyclohexene	1	3	0	
Cyclohexenone	1	3	0	
Cyclohexl Chloride	2	3	0	
Cyclopentane	1	3	0	
Cyclopentene	1	3	1	
Cyclopentanone	2	3	0	
Cyclopropane	1	4	0	
Decaborane	3	2	1	
Decane	0	2	0	
Decanol	0	2	0	
1-Decene	0	2	0	
Decylamine	2	1	0	
Dehydroacetic Acid	1	1	0	
Denatured Alcohol	0	3	0	
Deuterium	0	4	0	

Compound	Health	Fire	Reactivity	S/N
Diacetone Alcohol	1	2	0	
Diamyl Sulfide	2	2	0	
Dibenzoyl Peroxide	1	4	4	OX
Diborane	3	4	3	~~W~~
Dibutylamine	3	2	0	
Dibutyl Ether	2	3	0	
Dibutyl Oxalate	0	1	0	
Dibutyl Phosphite	3	2	0	
Dibutyl Phthalate	0	1	0	
o-Dichlorobenzene	2	2	0	
1, 2-Dichlorobutane	2	2	0	
1,1-Dichloroethene	2	4	2	
1,2-Dichloroethylene	2	3	2	
Dichlorosilane	3	4	2	
Didecyl Ether	0	1	0	
Diesel Fuel Oil No. 1	0	2	0	
Diethylamine	2	3	0	
Diethylene Glycol Dimethyl Ether	1	2	1	
Diethylene Triamine	3	1	0	
Diethyl Fumarate	1	1	0	
Diethyl Ketone	1	3	0	
Diethyl Succinate	1	1	0	
Diethyl Sulfate	3	1	1	
Diethylzinc	0	3	3	~~W~~
Dihexylamne	2	1	0	
Diisobuylamine	3	3	0	

Compound	Health	Fire	Reactivity	S/N
Diisobutyl Carbinol	1	2	0	
Diisobutyl Ketone	1	2	0	
Diisooctyl Phthalate	0	1	0	
Diisopropylamine	3	3	0	
Diisopropyl Benzene	0	2	0	
Diketene	2	2	2	
Dimethylamine	3	4	0	
N, N-Dimethylaniline	3	2	0	
2,2-Dimethylbutane	1	3	0	
Dimethyldioxane	2	3	0	
N, N-Dimethylformamide	1	2	0	
Dimethyl Maleate	1	1	0	
2,3-Dimethyloctane	0	2	0	
2,3-Dimethylpentane	0	3	0	
Dimethyl Phthalate	0	1	0	
Dimethyl Sulfate	4	2	0	
Dimethyl Sulfide	2	4	0	
Dimethyl Sulfoxide	1	1	0	
Dinitrobenzene (ortho)	3	1	4	
2,4-Dinitrotoluene	3	1	3	
Dioctyl Ether	0	1	0	
p-Dioxane	2	3	1	
Dioxolane	2	3	2	
Dipentene	0	2	0	
Diphenylamine	3	1	0	
Diphenyl Phthalate	0	1	0	

Compound	Health	Fire	Reactivity	S/N
Dipropylamine	3	3	0	
Divinylbenzene	2	2	2	
Divinyl Ether	2	3	2	
Dodecane	0	2	0	
1-Dodecanethiol	2	1	0	
1-Dodecanol	0	1	0	
Endrin (dry)	2	0	0	
Epichlorohydrin	3	2	1	
Ethane	1	4	0	
Ethanolamine	2	2	0	
Ethoxybenzene	0	2	0	
3-Ethoxypropanal	2	2	0	
Ethyl Acetate	1	3	0	
Ethyl Acrylate	2	3	2	
Ethyl Alcohol	0	3	0	
Ethylamine	3	4	0	
Ethybenzene	2	3	0	
Ethyl Benzoate	1	1	0	
Ethyl Borate	2	3	0	
Ethyl Bromide	2	1	0	
Ethylbutylamine	3	3	0	
Ethyl Butyl Carbonate	2	2	1	
Ethyl Butyl Ketone	1	2	0	
Ethyl Butyrate	0	3	0	
Ethyl Caprylate	2	2	0	
Ethyl Chloride	2	4	0	

Compound	Health	Fire	Reactivity	S/N
Ethyl Crotonate	2	3	0	
Ethylcyclohexane	1	3	0	
Ethylene	1	4	2	
Ethylenediamine	3	2	0	
Ethylene Dichloride	2	3	0	
Ethylene Glycol	1	1	0	
Ethylene Glycol Dibutyl Ether	1	2	0	
Ethylene Glycol Ethylbutyl Ether	1	2	0	
Ethylene Glycol Monobutyl Ether Acetate	1	2	0	
Ethylene Oxide	2	4	3	
Ethyl Ether	2	4	1	
Ethyl Formate	2	3	0	
Ethyl Isobutyrate	0	3	0	
Ethyl Mercaptan	2	4	0	
4-Ethylmorpholine	2	3	0	
Ethyl Nitrate	2	3	4	
Ethyl Oxalate	0	2	0	
Ethyl Propionate	-	3	0	
Ethyl Silicate	2	2	0	
Fluorine	4	0	3	~~W~~, OX
Formaldehyde (water solution)	2	2	0	
Formamide	2	1	-	
Formic Acid	3	2	0	
Furan	1	4	1	
Furfuryl Alcohol	1	2	1	
Gas, Natural	1	4	0	

Compound	Health	Fire	Reactivity	S/N
Gasoline 56-100 Octane	1	3	0	
Glycerine	1	1	0	
Glycidyl Acrylate	0	2	0	
Heptane	1	3	0	
2-Heptanol	0	2	0	
Heptylene	0	3	0	
Hexadecane	0	1	0	
Hexanal	2	3	1	
Hexane	1	3	0	
3-Hexanone	1	3	0	
1-Hexene	1	3	0	
Hexyl Alcohol	1	2	0	
Hexyl Methacrylate	0	2	0	
Hydrazine (Anhydrous)	3	3	2	
Hydrocyanic Acid-96%	4	4	2	
Hydrogen	0	4	0	
Hydrochloric Acid	3	0	0	
Hydrobromic Acid	3	0	0	
Hydrofluoric Acid	4	0	0	
Hydrogen Peroxide (35% to 52% by weight)	2	0	1	OX
Hydrogen Sulfide	3	4	0	
Hydroquinone	2	1	0	
Isoamyl Acetate	1	3	0	
Isoamyl Alcohol	1	2	0	
Isobutane	1	4	0	
Isobutyl Acetate	1	3	0	

Compound	Health	Fire	Reactivity	S/N
Isobutyl Acrylate	1	3	1	
Isobutyl Alcohol	1	3	0	
Isobutylbenzene	2	2	0	
Isobutyl Chloride	2	3	0	
Isobutyl Methyl Ketone	2	3	0	
Isobutyraldehyde	2	3	1	
Isobutyric Acid	1	2	0	
Isobutyric Anhydride	1	2	1	~~W~~
Isodecaldehyde	0	2	0	
Isodecanoic Acid	0	1	0	
Isohexane	1	3	0	
Isooctane	0	3	0	
Isooctanoic Acid	0	1	0	
Isooctyl Alcohol	0	2	0	
Isopentane	1	4	0	
Isophorone	2	2	0	
Isoprene	2	4	2	
Isopropyl Acetate	1	3	0	
Isopropyl Alcohol	1	3	0	
Isopropyl Chloride	2	4	0	
Isopropyl Ether	2	3	1	
Jet Fuels (JP-4)	1	3	0	
Jet Fuels (JP-5)	0	2	0	
Lanolin	0	1	0	
Lead Arsenates	2	0	0	
Lead Nitrate	1	0	0	OX

Compound	Health	Fire	Reactivity	S/N
Lead Thiocyanate	1	1	1	
Lithium	1	1	2	~~W~~
Lithium Hydride	3	4	2	~~W~~
Lubricating Oil, Mineral	0	1	0	
Magnesium (including all alloys)	0	1	2	~~W~~
Magnesium Nitrate	1	0	0	OX
Magnesium Perchlorate	1	0	0	OX
Maleic Anhydride	3	1	1	
Mercuric Cyanide	3	0	0	
Mesityl Oxide	3	3	0	
Methacrylic Acid	3	2	2	
Methane	1	4	0	
Methyl Acetate	1	3	0	
Methyl Acrylate	2	3	2	
Methylal	2	3	2	
Methyl Alcohol	1	3	0	
Methylamine	3	4	0	
Methyl Amyl Ketone	1	2	0	
Methyl Benzoate	0	2	0	
Methyl Borate	2	3	1	
Methyl Bromide	3	1	0	
Methyl Butyl Ketone	2	3	0	
Methyl Carbonate	2	3	1	
Methyl Cellosolve Acetate	0	2	0	
Methyl Chloride	2	4	0	
Methyl Chloroacetate	2	2	1	

Compound	Health	Fire	Reactivity	S/N
Methylcyclohexane	2	3	0	
Methylcyclohexanone	-	2	0	
Methylcyclopentane	2	3	0	
Methylene Chloride	2	1	0	
Methylene Diisocyanate	1	2	1	~~W~~
Methyl Ether	2	4	1	
Methyl Ethyl Ether	2	4	1	
Methyl Ethyl Ketone	1	3	0	
Methyl Formate	2	4	0	
Methyl Glycol Acetate	1	2	0	
Methyl Hexyl Ketone	0	2	0	
Methylhydrazine	3	3	2	
Methyl Isoamyl Ketone	1	2	0	
Methyl Isobutyl Carbinol	2	2	0	
Methyl Isobutyl Ketone	2	3	0	
Methyl Isocyanate	2	3	3	~~W~~
Methyl Lactate	1	2	0	
Methyl Mercaptan	2	4	0	
Methyl Methacrylate	2	3	2	
Methyl Parathion (solid)	4	1	2	
2-Methyl-1-Pentene	1	3	0	
Methyl Phenylacetate	0	2	0	
1-Methyl Piperazine	2	2	0	
Methyl Propionate	1	3	0	
Methyl Propyl Ketone	2	3	0	
2-Methylpyrazine	2	2	0	

Compound	Health	Fire	Reactivity	S/N
Methylpyrrole	2	3	1	
Methylprrolidine	2	3	1	
Methyl Salicylate	1	1	0	
Methyl Stearate	0	1	0	
Methyl Toluene Sulfonate	2	1	0	
Methyl Vinyl Ketone	3	3	2	
Mineral Oil	0	1	0	
Mineral Spirits	0	2	0	
Morpholine	2	3	0	
Mustard Oil	3	2	0	
Naptha	1	3	0	
Napthalene	2	2	0	
Nickel Carbonyl	4	3	3	
Nicotine	4	1	0	
Nitric Acid	3	0	0	OX
p-Nitroaniline	3	1	3	
Nitrobenzene	3	2	0	
Nitrobiphenyl	2	1	0	
Nitrochlorobenzene	3	1	1	
Nitroethane	1	3	3	
Nitrogen (liquefied)	3	0	0	
Nitrogen Peroxide	3	0	0	OX
Nitrogen Trioxide	3	0	0	OX
Nitroglycerine	2	2	4	
Nitromethane	1	3	3	
1-Nitropropane	1	3	1	

Compound	Health	Fire	Reactivity	S/N
o-Nitrotoluene	2	1	4	
Nonadecane	0	1	0	
Nonane	0	3	0	
Nonene	0	3	0	
Nonylbenzene	0	1	0	
Octadecane	0	1	0	
Octane	0	3	0	
2-Octanol	1	2	0	
1-Octene	1	3	0	
Oleic Acid	0	1	0	
Olive Oil	0	1	0	
Oxalic Acid	2	1	0	
Oxygen (liquid)	3	0	0	OX
Paraffin Oil	0	1	0	
Paraformaldehyde	2	1	0	
Paraldehyde	2	3	1	
Parathion	4	1	2	
Pentaborane	3	3	2	
Pentachlorophenol (dry)	3	0	0	
Pentane	1	4	0	
Pentanoic acid	2	1	0	
Pentaphen	2	1	0	
1-Pentene	1	4	0	
Perchloric Acid	3	0	3	OX
Perchloroethylene	2	0	0	
Petroleum, Crude	1	3	0	

Compound	Health	Fire	Reactivity	S/N
Petroleum Ether	1	4	0	
Phenol	3	2	0	
Phenylacetaldehyde	1	2	0	
Phenyl Acetate	1	2	0	
Phenylacetic Acid	1	1	0	
o-Phenylenediamine	-	1	0	
Phenylhydrazine	3	2	0	
Phenylpropyl Alcohol	0	1	0	
Phosgene	4	0	0	
Phosphine	3	4	1	
Phosphoric Acid	2	0	0	
Phosphorus Pentasulfide	3	1	2	~~W~~
Phosphorus, Red	0	1	1	
Phosphorus Trichloride	3	0	2	~~W~~
Phosphorus, White or Yellow	3	3	1	
Phosphoryl Chloride	3	0	2	~~W~~
Phthalic Acid	0	1	1	
Phthalic Anhydride	2	1	0	
Picric Acid	2	4	4	
Pine Oil	0	2	0	
Pine Tar	0	2	0	
Piperazine	2	2	0	
Piperidine	2	3	3	
Potassium	3	1	2	~~W~~
Potassium Bromate	1	0	0	OX
Potassium Chlorate	2	0	0	OX

Compound	Health	Fire	Reactivity	S/N
Potassium Cyanide	3	0	0	
Potassium Hydroxide (lye)	3	0	1	
Potassium Nitrate	1	0	0	OX
Potassium Permanganate	1	0	0	OX
Potassium Peroxide	3	0	2	~~W~~, OX
Potassium Persulfate	1	0	0	OX
Potassium Sulfide	2	1	0	
Propane	1	4	0	
Propionic Acid	2	2	0	
Propionyl Chloride	3	3	1	
Propyl Acetate	1	3	0	
Propyl Alcohol	1	3	0	
Propylamine	3	3	0	
Propyl Chloride	2	3	0	
Propylene	1	4	1	
Propylene Dichloride	2	3	0	
Propylene glycol	0	1	0	
Propylene Oxide	2	4	2	
n-Propyl Ether	-	3	0	
Propyl Nitrate	2	4	3	OX
Pyridine	2	3	0	
Pyrrole	2	2	0	
Pyrrolidine	2	3	1	
Quinoline	2	1	0	
Resorcinol	-	1	0	
Rhodinol	0	1	0	

Compound	Health	Fire	Reactivity	S/N
Salicylic Acid	0	1	0	
Silane	1	4	2	
Silver Nitrate	1	0	0	OX
Sodium	3	1	2	~~W~~
Sodium Chlorate	1	0	2	OX
Sodium Chlorite	1	1	2	OX
Sodium Cyanide	3	0	0	
Sodium Fluoride	2	0	0	
Sodium Hydride	3	3	2	~~W~~
Sodium Hydroxide (lye)	3	0	1	
Sodium Nitrate	1	0	0	OX
Sodium Perchlorate	2	0	2	OX
Sodium Peroxide	3	0	2	OX, ~~W~~
Sodium-Potassium Alloys	3	3	2	~~W~~
Sodium Sulfide	2	1	0	
Stannic Chloride	3	0	1	
Stearic Acid	1	1	0	
Stearyl Alcohol	0	-	0	
Stoddard Solvent	0	2	0	
Styrene	2	3	2	
Sulfur	2	1	0	
Sulfur Chloride	2	1	2	~~W~~
Sulfur Dioxide	2	0	0	
Sulfuric Acid	3	0	2	~~W~~
Tannic Acid	0	1	0	
Terephthaloyl Chloride	3	1	0	

Compound	Health	Fire	Reactivity	S/N
Tetrachlorobenzene	0	10	0	
Tetrachloroethylene	2	0	0	
Tetradecanol	0	1	0	
Tetraethylene Glycol	1	1	0	
Tetraethyl Lead, Compounds	3	2	3	
Tetrafluoroethylene	3	4	3	
Tetrahydrofuran	2	3	1	
Tetramethyl Lead, Compounds	3	3	3	
Thionyl Chloride	3	0	2	~~W~~
Thiophene	2	3	0	
Titanium Tetrachloride	3	0	1	
Toluene	2	3	0	
Toluene-2, 4-Diisocyanate	3	1	1	
o-Toluidine	3	2	0	
Triamylamine	2	1	0	
Triamylbenzene	0	1	0	
Tributylamine	2	2	0	
Tributyl Phosphate	2	1	0	
Tributylphosphine	0	1	0	
Tributyl Phosphite	2	1	1	
1,1,1-Trichloroethane	2	1	0	
Trichloroethylene	2	1	0	
Trichloroethylsilane	3	3	0	
Trichlorosilane	3	4	2	~~W~~
Triethanolamine	2	1	1	
Triethylamine	2	3	0	

Compound	Health	Fire	Reactivity	S/N
Triethyl Phosphate	0	1	1	
Triisobutyl Borate	3	2	1	
Trimethylamine	2	4	0	
Trimethylchlorosilane	3	3	2	~~W~~
Trinitrobenzene	2	4	4	
Trinitrotoluene (tnt)	2	4	4	
Trioxane	2	2	0	
Triphenylmethane	0	1	0	
Tripropylene	0	3	0	
Tripropylene Glycol	0	1	0	
Turpentine	1	3	0	
2-Undecanol	1	1	0	
Valeraldehyde	1	3	0	
Vanadium Tetrachloride	3	0	2	~~W~~
Vinyl Acetate	2	3	2	
Vinyl Bromide	2	0	1	
Vinyl Butyl Ether	2	3	2	
Vinyl Chloride	2	4	1	
Vinyl Crotonate	2	3	2	
Vinyl Ethyl Alcohol	0	2	0	
Vinyl Ethyl Ether	2	4	2	
Vinyl Fluoride	1	4	2	
Vinylidene Chloride	2	4	2	
Vinylidene fluoride	1	4	2	
Vinyl Methyl Ether	2	4	2	
Vinyl Propionate	2	3	2	

Compound	Health	Fire	Reactivity	S/N
Vinyl Toluene	2	2	1	
o-Xylene	2	3	0	
o-Xylidine	3	1	0	
Zinc (powder or dust)	0	1	1	
Zinc Chlorate	2	0	2	OX
Zirconium Tetrachloride	3	0	1	

Resistance to Chemicals of Common Glove Materials (E=Excellent, G=Good, F=Fair, P=Poor)

Chemical	Natural Rubber	Neoprene	Nitrile	Vinyl
Acetaldehyde	G	G	E	G
Acetic acid	E	E	E	E
Acetone	G	G	G	F
Acrylonitrile	P	G	-	F
Ammonium hydroxide	G	E	E	E
Aniline	F	G	E	G
Benzaldehyde	F	F	E	G
Benzene	P	F	G	F
Benzyl chloride	F	P	G	P
Bromine	G	G	-	G
Butane	P	E	-	P
Calcium hypochlorite	P	G	G	G
Carbon disulfide	P	P	G	F
Carbon tetrachloride	P	F	G	F
Chlorine	G	G	-	G
Chloroacetone	F	E	-	P
Chloroform	P	F	G	P
Chromic Acid	P	F	F	E
Cyclohexane	F	E	-	P
Dibenzylether	F	G	-	P
Dibutylphthalate	F	G	-	P
Diethanolamine	F	E	-	E
Diethyl ether	F	G	E	P
Dimethyl sulfoxide	-	-	-	-
Ethyl acetate	F	G	G	F
Ethylene dichloride	P	F	G	P
Ethylene glycol	G	G	E	E
Ethylene trichloride	P	P	-	P
Fluorine	G	G	-	G
Formaldehyde	G	E	E	E
Formic acid	G	E	E	E
Glycerol	G	G	E	E
Hexamine	P	E	-	P
Hydrobromic acid (40%)	G	E	-	E
Hydrochloric acid (conc)	G	G	G	E
Hydrofluoric acid (30%)	G	G	G	E
Hydrogen peroxide	G	G	G	E
Iodine	G	G	-	G

Chemical	Natural Rubber	Neoprene	Nitrile	Vinyl
Methylamine	G	G	E	E
Methyl cellosolve	F	E	-	P
Methyl chloride	P	E	-	P
Methyl ethyl ketone	F	G	G	P
Methylene chloride	F	F	G	F
Monoethanolamine	F	E	-	E
Morpholine	F	E	-	E
Naphthalene	G	G	E	G
Nitic acid (conc)	P	P	P	G
Perchloric acid	F	G	F	E
Phenol	G	E	-	E
Phosphoric acid	G	E	-	E
Potassium hydroxide (sat)	G	G	G	E
Propylene dichloride	P	F	-	P
Sodium hydroxide	G	G	G	E
Sodium hypochlorite	G	P	F	G
Sulfuric acid (conc)	G	G	F	G
Toluene	P	F	G	F
Trichloroethylene	P	F	G	F
Tricresyl phosphale	P	F	-	F
Triethanolamine	F	E	E	E
Trinitrotoluene	P	E	-	P

Aromatic and halogenated hydrocarbons will attack all types of natural and synthetic glove materials. Should swelling occur, the user should change to fresh gloves and allow the swollen gloves to dry and return to normal.

No data on the resistance to dimethyl sulfoxide of natural rubber, neoprene, nitrile rubber, or vinyl materials are available; the manufacturer of the substance recommends the use of butyl rubber gloves.

Taken from Prudent Practices for Handling Hazardous Chemicals in Laboratories, 1981.