

# Chemical Hygiene Plan for Cooper, Danville, Leestown, Lawrenceburg, and Winchester Campuses

Reviewed: May 2012

# Bluegrass Community and Technical College

# **CHEMICAL HYGIENE PLAN**

		For
(Chemic		gator/Laboratory Supervisor cal Hygiene Officer)
		Department
		m and Building
 Сатрі	us Phone	After-hours Emergencies Phone
Location of labora stored).	atories (specify all	rooms in which hazardous materials are
Authorized Perso	onnel	
materials under y	our jurisdiction. A	byees and students that use hazardous lso indicate Laboratory Supervisor, if emergency telephone number.
Name		Status (e.g. research asst., student)

Name**	* Status (e.g. research asst., studen		search asst., student)
Signature	of Principal Investigator/Labora (Chemical Hygiene Officer)	atory Supervisor	Date
			Annual Revision Date
			Annual Revision Date
			Annual Revision Date
			Annual Revision Date
NOTE:	Maintain the original copy Hygiene Plan binder.	of this form in La	boratory Chemical

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#### INTRODUCTION

## Purpose

The purpose of this model Chemical Hygiene Plan is to define work practices and procedures to help ensure that Laboratory Workers at the Bluegrass Community and Technical College are protected from health and safety hazards associated with the hazardous chemicals with which they work.

## **Background**

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 information on obtaining or viewing a copy of the Lab Standard.

#### Overview

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;
- an ongoing program to ensure that Laboratory chemical 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 the Principal Investigator/Laboratory Supervisor as the Chemical Hygiene Officer;
- additional precautions for work with select carcinogens, reproductive toxins, and extremely toxic substances.

This model Chemical Hygiene Plan (referred to as the Plan throughout this document) will be reviewed annually by the institutional Chemical Hygiene Officer and/or the Environmental Health and Safety 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].

All Laboratory Workers prior to the commencement of lab duties must read this Chemical Hygiene Plan. In addition to the Plan, the Laboratory Workers must be familiar with and adhere to prudent laboratory safety guidelines developed by their Laboratory Supervisor, UK/KCTCS requirements 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 lab. (See Form II for an example of a training record form.)

#### **Definitions**

<u>Hazardous Chemical</u>-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". For more information on hazardous chemicals go to

http://www.osha.gov/OshDoc/data\_General\_Facts/hazardouschemicalsinlabs-factsheet.pdf.<sup>2</sup>

<u>Laboratory</u>- OSHA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis".

Lab workers-the Laboratory Workers referred to in the Lab Standard are employees. OSHA defines an 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 any faculty member, full-time or adjunct, instructing an academic lab, staff (e.g. Instructional specialists), and student workers. OSHA would not consider students in an academic laboratory as employees. 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 these groups that are in their laboratories are adequately instructed in relation to safe laboratory procedures.

## Assistance

If there is any question about where the Lab Standard applies and whom it covers, the KCTCS Office of Environmental Health and Safety, upon request, will make this determination. The KCTCS Office of Environmental Health and Safety can be consulted related to laboratory safety. See Appendix II for an organizational chart.

#### **RESPONSIBILITIES**

## Background

As an institutional member of KCTCS, Bluegrass 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 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 that 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.

## Faculty and Staff -

Because Bluegrass Community & Technical College is primarily a teaching institution, the area coordinator and/or instructional specialist is considered to be the lab supervisor. Faculty and Staff in charge of supervising laboratories (referred to as Laboratory Supervisors 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");
- serve as the "Laboratory Supervisor" for his/her laboratories;
  - 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 III for a sample self inspection form. Also visit the website for the example table of laboratory violations <a href="http://ehs.uky.edu/ohs/violations.html">http://ehs.uky.edu/ohs/violations.html</a>;
- request assistance from KCTCS Office of Environmental Health and Safety, as needed;
- 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;
- request information and training when unsure how to handle a hazardous chemical or procedure.

#### Deans, Directors, 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 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, committees, and shared use facilities;
- make budget arrangements for health and safety improvements. It is the responsibility of these respective individuals to request the necessary monies in the budget process;
- appoint an Chemical Hygiene Officer who will routinely review the model Chemical Hygiene Plan and suggest modifications as needed.

## Chemical Hygiene Officer for the BCTC District

The Chemical Hygiene Officer of Bluegrass Community and Technical College District is appointed by the President of the College and reports directly to the Assistant to the President/Special Projects who is designated as the Safety Officer for Bluegrass Community and Technical College. In conjunction with area/program coordinators, the responsibilities of this position include:

- to work with administrators, faculty and staff to develop and implement appropriate chemical hygiene policies and practices (including lab specific guidelines);
- to provide and keep records of annual housekeeping inspections, including routine inspections of emergency equipment;
- to conduct annual reviews and revisions of BCTC Chemical Hygiene Plan;
- To ensure that chemical inventories are updated on an annual basis and distribute the current inventories to the system office and safety office at the college;
- to ensure that all employees receive appropriate training (general and lab specific);

- · to keep records of such training;
- to ensure that all employees have access to the Chemical Hygiene Plan and other reference materials;
- 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.

## Chemical Hygiene Committee for the BCTC District

Charge of the Chemical Hygiene Committee: The Chemical Hygiene Committee will review and update the Chemical Hygiene Plan (CHP) annually. Meetings will be called two to three times per year to review existing CHP and update as needed. Committee members will revise assigned portion(s) of CHP, update the material as needed including research on related subjects contained within the assigned portions of the CHP. After all sections are completed, the document will be posted online and replaced in each folder for each of our labs that require the CHP.

Members of this committee will be selected from areas that are required to maintain a chemical hygiene plan in their respective areas and will serve on a yearly basis.

#### STANDARD OPERATING PROCEDURES

## **Purpose**

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 BCTC laboratories handling hazardous chemicals.

## **Background**

The Lab Standard is intentionally vague about SOPs. 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. To assist in the development of SOPs, Form IV can be used. Acceptable lab safety references such as those listed in the OSHA Lab Standard 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 KCTCS Office of Environmental Health and Safety is available.

## **Hierarchy of Defense**

To protect workers from exposure to hazardous chemicals there is a hierarchy of defense. The first line of defense is engineering controls, consisting of general room ventilation and, most notable in laboratories, fume hoods. The second is work practice/administrative controls and finally, personal protective equipment(PPE). It is imperative that all lab personnel know what PPE is appropriate for all operations in the lab, what work practices are to be followed and understand the operation of engineering controls.

The following standard operating procedures apply to all labs at the College. Individual labs may require additional requirements as determined by a hazards evaluation.

## Personal Protective Equipment

### Attire

At a minimum, all lab personnel should be wearing a lab coat and safety glasses when there is active work being done with hazardous chemical in the lab. Also, legs and feet should be covered, i.e. no open toed shoes or shorts, and loose clothing and long hair should be confined. PPE should be left in the laboratories and not worn in public areas.

#### **Gloves**

Most laboratories will require more than one type of glove material. Latex examination gloves are not meant to provide protection from chemicals and should not be used in labs for this purpose. Nitrile is a good all purpose glove material and is generally considered hypoallergenic. Appendix IV offers some generic information for glove selection. Glove suppliers can also provide information. When working with highly hazardous chemicals that can be absorbed through the skin, specific glove testing information should be obtained from the manufacturer. Written information needs to be provided to all lab workers preferably in the form of an SOP, Form IV. KCTCS Office of Environmental Health and Safety can provide additional assistance in appropriate selection.

Gloves shall not be worn in halls or public areas. It is recommended that any samples transferred through general use areas be transferred in a secondary container. If samples must be carried by hand, glove one hand to hold a protected sample. The ungloved hand shall be used to open doors or push elevator buttons. Within the lab, be aware of using common equipment with gloved hands such as computers and phones.

## **Eye Protection**

It is Bluegrass 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. Use the assessment chart to help determine which is appropriate. The wearing of **contact lenses** in labs has been a controversial issue. Most research has shown there is no greater risk but you might want to consult your optometrist or ophthalmologist.

## **Face Shields**

Full-face shields must be worn when conducting a procedure where 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.

# **Respiratory Protection**

The use of some substances may require respirators. See Chapter 4 for a discussion of "Controlling Chemical Exposures".

# HAZARD ASSESSMENT AND PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS FOR GENERAL LABORATORY OPERATIONS

Hazard	Personal Protective Equipment Required		
	Eye	Face	Hand/Skin/ Body
Any laboratory use of chemicals	Safety glasses at all times		Lab coat
Use of corrosive chemicals, strong oxidizing agents, carcinogens, mutagens, etc.	Chemical splash goggles	Full face shield and goggles (for work with over 4 liters of corrosive liquids)	Resistant gloves (See Appendix VI for chemical resistance of common glove materials)  Impervious lab coat, coveralls, apron, protective suit (for work with over 5 gallons corrosive liquids)
Temperature extremes			Insulated gloves for handling ovens, furnaces, cryogenic bath and other devices over 100° C or below -1° C
Sharp objects (broken glass, insertion of tubes or rods into stoppers)			Heavy cloth barrier or leather gloves

### **Work Practice and Administrative Controls**

## **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

For BCTC campuses other than Cooper Campus: Check the integrity of containers and if damaged or leaking, transfer to an acceptable container. For disposal, collect all properly labeled hazardous waste in an approved area and in proper containers. The KCTCS Office of Environmental Health and Safety will contact the Safety Officer for an inventory list of all the hazardous waste for a given site. KCTCS Office of Environmental Health and Safety will then contact an outside company for pick-up and disposal of hazardous waste. After contacting the company for pick-up a time and date will be scheduled and the Safety Officer will be notified of pick-up time and date. A contact person will need to be available when the company is to pick-up the hazardous waste. Observe chemical compatibility; for example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers. For labs at the Cooper Campus: Check the integrity of containers and if damaged or leaking, transfer to an acceptable container or call Environmental Management for assistance (323-6280). For disposal, fill out a "hazardous waste ticket" on E-Trax and submit to UK Environmental Management. Observe chemical compatibility; for example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

# **Broken Glassware**

Broken glassware cannot be disposed of in the regular garbage. It should be placed in a box with a plastic liner so that no shards can present a hazard when disposing of the entire container. Do not overfill the container; try to keep it under 30 pounds. For more information on how to properly dispose of broken glassware, go the the provided link: <a href="http://ehs.uky.edu/hmm/disposal.html">http://ehs.uky.edu/hmm/disposal.html</a>

# **Glass Tubing**

When inserting tubing into stoppers, the practice oflubricating the tubing as well as wearing gloves or wrapping in a thick cloth will help to 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. In all cases, the laboratory lights should be left on and an appropriate sign posted on the door.

## **Door View Panel**

Lab view panel should not be covered.

# **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 KCTCS Office of Environmental Health and Safety(859)256-3220 or (859)256 - 3357.

# Food, Drink, Cosmetics

Eating, drinking and the application of cosmetics (including lip balm) are forbidden in areas where hazardous chemicals, biohazards and radioactive materials are used. These activities must be in designated, well defined non-chemical areas that are separated from the lab area by physical barriers such as

partitions or filing cabinets. A line on the floor will not be considered adequate separation. Consumables must not be placed in the same refrigerator as chemicals, biohazards or radioactive material.

# 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. Use flammables with only approved equipment such as blenders. Flammables that require cooler temperatures for storage should be put in specific refrigerators/freezers. For example, flammable safe refrigerator/freezers have no exposed ignition sources inside the cabinet, such as lights or switches that could ignite vapors. These are less expensive than the explosion-proof refrigerators/freezers and would be adequate in most lab applications. The other type of refrigerator/freezer, the explosion-proof type, may be required in rare circumstances for hazardous locations. Explosion-proof or spark-proof units have no interior or exterior ignition sources and are considerably more expensive. For details about flammable safe or explosion proof refrigerator/freezer refer to Chemical Storage in this section.

# **Electrical Policy**

Extension cords shall not be used as permanent wiring. Only Underwriters Laboratory (UL) listed surge protectors that are ground and have a built-in 15 amp circuit may be used. For further information regarding the Electrical Policy please contact KCTCS Office of Environmental Health and Safety.

# Vacuum pumps and vacuum lines

Vacuum lines leading from an experimental procedure shall always be equipped with traps to prevent contamination of vacuum equipment or house lines. Traps shall be evaluated for appropriateness and special safety precautions instituted if needed.

- Particulates: determine size range being generated and choose appropriate filtration
- Aqueous non-volatile: in most cases a filter flask at room temperature will prevent liquids from contaminating the vacuum source
- Solvent or other volatile liquids: use a cold trap that is large enough and cold enough to condense vapors plus a filter flask large enough to hold all possible liquids that could be aspirated. Avoid using liquid nitrogen if at all possible. Liquid nitrogen should only be used in sealed or evacuated equipment and with extreme caution. Liquid oxygen can form if

- proper procedures are not followed. For most applications a slurry of dry ice and isopropanol or ethanol can be used.
- Corrosive, highly reactive or toxic gases: a sorbent canister or scrubber shall be used that can trap the contaminant.

## **Disposal of Waste**

For BCTC Campuses other than Cooper Campus: It is important to segregate wastes. Disposal of all laboratory waste must follow the procedures specified by KCTCS Office of Environmental Health and Safety. If there are questions regarding the pick-up of Hazardous Materials contact the KCTCS Office of Environmental Health and Safety(859)256-3220 or (859)256-3357. For BCTC Cooper Campus: It is important to segregate wastes. To request pick-up of hazardous waste, biohazardous waste or chemicals, call Environmental Management at 323-6280. Disposal of all laboratory waste must follow the procedures specified by Environmental Management. To request pick-up of radioactive wastes, contact Radiation Safety at 323-6777. (http://ehs.uky.edu/radiation).

## **Hazardous Materials**

Hazardous materials should not be used on open laboratory benches.

# **Mouth Pipetting**

Mouth pipetting is forbidden.

# <u>Mercaptans</u>

For Cooper Campus: 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. Please review the fact sheet at <a href="http://ehs.uky.edu/ohs/mercaptans.pdf">http://ehs.uky.edu/ohs/mercaptans.pdf</a>. If a natural gas leak occurs, the building should be evacuated, and the proper authorities should be notified. For more information about the emergency response procedures for natural gas ,please view the following website: <a href="http://ehs.uky.edu/fire/natgas.html">http://ehs.uky.edu/fire/natgas.html</a> For all other campuses: To avoid false reporting of natural gas leaks, the Maintenance and Operations department, as well as the director of the campus, 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. If a natural gas leak occurs, the building should be evacuated, and the proper authorities should be notified.

## **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 Laboratory chemical hood with a wash down system or a local scrubbing or trapping system must be used.

Perchloric Acid will <u>not</u> be allowed for use at BCTC since proper hoods are not available to use. For questions please contact the BCTC Manager, Security &Safety, Todd Gray at (859)246-6422 and KCTCS Office of Environmental Health and Safety (859)256-3220 or (859)256-3357 before initiating this type of work with perchloric acid.

# Personal Hygiene

Hands should be washed frequently throughout the day, before leaving the lab, after contact with any hazardous material, and before eating, drinking, smoking and applying make-up or lip balm.

## Personal Use of Chemicals

Lab workers are not allowed to remove chemicals from the lab for personal use.

# **Pregnant Laboratory Workers**

If a worker is pregnant or is planning to become pregnant, UK Occupational Health and Safety can provide guidance for working with reproductive toxins. More information can be found at the following website, <a href="http://ehs.uky.edu/ohs/pregnant.html">http://ehs.uky.edu/ohs/pregnant.html</a>

# Chemical Spills and Accident Response

As a matter of policy, College personnel should handle their own small spills and releases. For emergency situations i.e., large spills and leaks, evacuate and call 911 from a safe location. See Chapter 11, Planning for Emergencies for more information.

# **Chemical Storage**

Chemicals 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).

## Flammable liquids:

shall be limited to 10 gallons per 100 ft2. Half that amount must be in a flammable storage cabinet. Please review fact sheet at <a href="http://ehs.uky.edu/fire/flstpol1.html">http://ehs.uky.edu/fire/flstpol1.html</a>.

Storage of flammables in a refrigerator is prohibited unless it is approved for such storage. Such refrigerators are designed not to spark inside the refrigerator. If refrigerated storage is needed, choose either a flammable safe or explosion proof refrigerator. More information about the different types of refrigerators can be found at the following web page: <a href="http://ehs.uky.edu/ohs/refrigerators.pdf">http://ehs.uky.edu/ohs/refrigerators.pdf</a>.

Self Inspection checklist on proper storage of flammable and combustable liquids is accessable through the CDC website: http://www.cdc.gov/niosh/docs/2004-101/chklists/r1n39f~1.htm

## Peroxide forming:

chemicals shall be labeled when opened and disposed of by manufacturer's recommendation or within specified time as discussed at <a href="http://ehs.uky.edu/ohs/peroxide.htm">http://ehs.uky.edu/ohs/peroxide.htm</a> or whichever time is shorter.

# Chemical Handling

Encourage the use of poly coated bottles or use bottle carriers for transporting chemicals that 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 Handling and Storage

Use appropriate hand carts to move cylinders. Cylinders must be secured at all times. Extremely toxic gases (e.g. hydrogen sulfide, chlorine, and arsine) should not be moved through regular exit corridors, particularly during business hours. Always consider cylinders as full and handle them with corresponding care. 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. Whenever possible, do not store empty and full cylinders together. Clearly mark empty cylinders. 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 Environmental Health and Safety(859)256-3220 or (859)256-3357.

# Labeling

All chemical containers must be labeled. 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 VIII for Hazard Ratings) Labels on incoming containers must not be removed or defaced. Date all **peroxidizable**, see <a href="http://ehs.uky.edu/ohs/peroxide.htm">http://ehs.uky.edu/ohs/peroxide.htm</a>, 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 full.

Intermediate reactions should be labeled. These chemicals shall be assumed as hazardous and subject to the Chemical Hygiene Plan. To insure compliance, label the container with as much information as possible such as any potential hazards and health effects. The NFPA rating system is a good system to use and categorize the hazards by fire, health and reactivity. For explanation of the NFPA Rating System see Appendix VIII.

# 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
- 5. Special hazards/instructions (e.g. location of large quantities of flammables or the presence of a "local alarm" system)

See Appendix VIII for standard laboratory signage.

# **Engineering Controls**

## **Laboratory Chemical Hood and Other Engineering Controls**

See Chapter 5, "Laboratory chemical hoods and Other Engineering Controls."

## Safety Shower/Eyewashes

Safety showers and/or eyewashes are required in labs where corrosive chemicals are used. Instructional specialists or Maintenance & Operations is charged with testing the eyewashes on a weekly basis and Maintenance & Operations is charges with checking the shower units on a monthly basis. A log of those checks can be obtained by contacting Michael Ball, M&O Superintendent.

Laboratory personnel should be familiar with using an eyewash or safety showers. Training for proper use must be done prior to laboratory personnel beginning work in the laboratory. Please see laboratory specific guidelines.

If operations in the lab require safety procedures greater than what is outlined above please insert or reference the location of lab specific SOPs here. For the SOP template consult Form IV.

### **CONTROLLING CHEMICAL EXPOSURES**

The Lab Standard requires the employer to determine and implement control measures to reduce employee exposure to hazardous chemicals. Particular attention must be given to the selection of control measures for chemicals known to be extremely hazardous. Control measures include engineering controls, personal protective equipment and administrative controls.

Below are the control measures for each of the three major routes of entry for a chemical to enter the body: inhalation, absorption, and ingestion.

### **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. The use of well-functioning local exhaust ventilation such as laboratory chemical hoods, biological safety cabinets, vented glove boxes and other local exhaust systems is often required to further minimize the risks. 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.

The use of personal protective equipment should also be used. Dust masks or self-contained breathing apparatus may be utilized to this end. If laboratory employees wear respirators, requirements of the OSHA Respirator Standard (1910.134) must be met and a written respirator program must be implemented. (See <u>Appendix IX</u> for a model respirator program). This Standard details the training required on the proper use of respirators, the type of medical surveillance required to ensure the user is capable of wearing a respirator, and fit testing to ensure that the respirator fits properly. Contact the KCTCS Office of Environmental Health and Safety (859) 256-3220 in the event that respiratory protection is to be utilized to control exposures to hazardous chemicals.

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

- Minimize the exposure time for individual employees
- Restrict access to an area where a hazardous chemical is used: and
- Post proper signage on lab doors to indicate special hazards within
- Proper chemical storage

## **Absorption (Skin/Eye Contact Hazards)**

To reduce the risk of a chemical entering the body via skin and eye contact, engineering controls should 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, etc. Since the chemical resistivity of the different types of protective equipment varies significantly, the lab supervisor should consult the MSDS or Appendix IV to ascertain the proper protective equipment to be used. Safety showers/eye wash equipment is required where corrosive chemicals are used. Such equipment should be prominently labeled, not obstructed, and properly maintained.

### **Ingestion Hazards**

Ingestion of chemicals is the least common route of entry into the body but can occur if proper controls are not enforced. Eating and drinking is prohibited in all laboratories but must be enforced by each laboratory instructor. Laboratory workers can accidently ingest chemicals into the body via contaminated hands if they are not washed prior to eating, smoking, etc. Some controls for preventing this route of exposure include isolating the hazardous substance so that minimal contact is required (e.g., use glove box). Also, administrative controls such as forbidding mouth pipetting, encouraging good personal hygiene and designating a well-marked nonchemical area where eating, drinking, etc. is permitted. Proper chemical labeling and posting of "no food or drink signs" may also help to prevent accident ingestion chemical hazards.

### **Exposure Assessment**

At the request of faculty, staff or students, exposure evaluations may be conducted by the KCTCS Office of Environmental Health and Safety for any suspected overexposure to substances regulated by OSHA. Records of exposure evaluations will be kept in the KCTCS Office of Environmental Health and Safety and provided to the department and affected employees and any other appropriate authorities at KCTCS. The following list of chemicals require initial monitoring to determine exposures:

1,2-Dibromo-3-chloropropane	Ethylene oxide
1,3-butadiene	Formaldehyde
Acrylonitrile	Inorganic arsenic
Asbestos	Lead
Benzene	Methylenedianiline
Cadmium	Methylene chloride
Cotton dust	Vinyl chloride

If these chemicals are used outside a fume hood please contact the KCTCS Office of Environmental Health and Safety at (859) 256-3220 or (859) 256-3357.

#### LABORATORY CHEMICAL HOODS AND OTHER ENGINEERING CONTROLS

#### **Laboratory Chemical Hood Face Velocities**

All Laboratory chemical hoods at Bluegrass Community and Technical College facilities should have face velocities between 80-120 feet per minute with the sash at a "working height" (approximately 12 inches). As a general rule, laboratory chemical hoods should not be operated with the sash fully open and should have the sash closed when not in use. The KCTCS Office of Environmental Health and Safety will conduct a laboratory chemical hood inspection and certification program for all laboratory chemical hoods at all extended campuses for BCTC. The University of Kentucky's Office of Occupational Health & Safety (OH&S) will conduct a laboratory chemical hood inspection and certification program for all laboratory chemical hoods located at the BCTC Cooper Campus. Laboratory chemical hoods with face velocities within the 80-150 feet per minute range may be used without restriction and will be marked with a laboratory chemical hood sticker showing face velocity at a height designated with an arrow.

## **Hoods Needing Repairs**

Laboratory chemical hoods with face velocities below 60 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. For all BCTC campuses, contact your building administrator and/or operator. Once the hood has been repaired, the KCTCS Office of Environmental Health and Safety will need to be contacted to reevaluate the hood's performance (the Cooper campus will contact the University of Kentucky's Office of Occupational Health & Safety instead).

### **Safe Work Practices for Laboratory Chemical Hoods**

A laboratory chemical hood cannot provide complete safety against all events that may occur in the hood, especially for toxic airborne contaminants with an exposure limit in the low part per billion range. For ordinary exposures a properly designed hood in a properly ventilated room can provide adequate protection. Nevertheless, certain work practices are necessary in order for the hood to perform efficiently. The work practices listed below are recommended by the American Conference of Governmental Industrial Hygienists:

1. All operations that may generate air contaminants at levels above the exposure limit must be conducted 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.
- Do not use the hood as a waste disposal mechanism except for very small quantities of volatile materials.
- Excessive storage of chemicals or any apparatus in the hood will impair the performance
  of the chemical Laboratory chemical hood. Flammable chemicals must be stored in an
  approved flammable storage safety cabinet. Corrosive chemicals must be stored in a
  corrosive storage cabinet.
- 6. Be sure that the switch is in the "on" position whenever the hood is in use and test hood often for airflow (for example using a Kim wipe).
- 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 and windows 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 Laboratory chemical hood exhaust systems must be utilized. These systems will have dedicated exhausts and a water wash-down system, and may be used for perchloric acid digestions only.
- 16. All Laboratory chemical 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 laboratory chemical hoods may be directed to the KCTCS Office of Environmental Health and Safety (859) 256-3220 or (859) 256-3357. Personnel at the BCTC Cooper campus should contact the UK Occupational Health and Safety office (859) 257-3827.

Most fume hoods on campus are equipped with flow monitors. These monitors are designed to give the user a guide for the proper function of the face velocity

of the fume hood. See the *Fume Hood Flow Monitors - Reference Guide for Occupants* for more information: <a href="http://ehs.uky.edu/ohs/flowmonitor.html">http://ehs.uky.edu/ohs/flowmonitor.html</a>.

#### **EMPLOYEE INFORMATION AND TRAINING**

#### Background

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 before 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.

## Responsibilities

The OSHA Lab Standard Training, which covers the Chemical Hygiene Plan and Laboratory Safety documents, informs laboratory workers and supervisors of the general laboratory safety policies and defines the roles and responsibilities of all people in the laboratory. However, training specific for the particular laboratory where an employee is assigned is the responsibility of that employee's supervisor. The supervisor must determine the frequency of refresher information and training. Also, 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 documents:

- "Occupational Exposures to Hazardous Chemicals in Laboratories" (the OSHA Lab Standard - See Appendix I).
- This Chemical Hygiene Plan document.
- Reference materials on chemical safety (including MSDS sheets).
- Permissible exposure limits for OSHA regulated substances. If there are no applicable OSHA standards, the recommended exposure limits or threshold limit value may be obtained by contacting the KCTCS Office of Environmental Health and Safety (859) 256-3220.
- Signs and symptoms associated with exposure to the hazardous chemicals found in the laboratory in which they work.

## **Material Safety Data Sheets**

Material Safety Data Sheets (MSDS) are generally the best source of information on the particular chemicals in your laboratory. They should contain information on the hazards associated with a chemical, signs and symptoms of exposure, emergency procedures and any required protective equipment. It is required by law that all employees have access to the MSDS sheets for the chemicals they use or may be exposed to. Although not required, it is most prudent for the MSDS sheets to be directly accessible in the laboratory where the chemicals are used. Therefore, it is recommended that hard copies of the MSDS sheets for all chemicals in a laboratory be kept in that laboratory. Material Safety Data Sheets can be obtained from:

- The supplier (if they are not included upon delivery they may be requested from the company).
- A collection of MSDS sheets is in Oswald Bldg. Room 208 or one of the other laboratories on campus.
- There are several sources on the internet that can be downloaded and printed; often directly from the company. A good site is MSDS Online: <a href="http://www.ilpi.com/msds/index.html">http://www.ilpi.com/msds/index.html</a>

In addition to the MSDS sheets being kept in the laboratories in which the chemicals are used, a second copy may be sent to a central location at each campus site. Below is a list of secondary locations for each BCTC location:

Cooper Campus: Oswald Building room 208

Danville Campus: Main Office
Leestown Campus: Main Office
Lawrenceburg Campus: Main Office
Winchester Campus: Main office

#### 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, and detector papers.
- 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.
- Medical consultations and examinations.

The MSDS will generally contain much of the above information needed to comply with the information and training requirements of the OSHA Laboratory Standard. Laboratory supervisors and employees should understand the relevant MSDS and/or other comparable literature on the hazardous chemicals that are used or stored in their laboratory. The employee's supervisor must provide additional training for any specific laboratory hazards.

## Required Training for All BCTC Employees who Work With Chemicals:

All employees who work in a laboratory with chemicals in an experimental manner must obtain the appropriate training **prior** to beginning work in that laboratory. The Laboratory Standard identifies three training classes which are required by for all BCTC employees working with chemicals in a laboratory:

- 1. OSHA Laboratory Standard (Chemical Hygiene Plan) Training (DVD) is available on reserve in the library. It may be viewed at any time.
- 2. Hazardous Waste Training is offered annually by the Chemical Hygiene Officer. If an employee cannot attend a live training session, they may view a PowerPoint presentation available on request from the Chemical Hygiene Officer.
- 3. Fire Extinguisher Use Training (click & train CD) is available upon request to the Chemical Hygiene Officer.

After completing each training session, a copy of the signed and dated evaluation quiz must be sent to the BCTC Chemical Hygiene Officer. A certificate will then be generated and sent to HR and to the employee's supervisor. Copies with be kept in the laboratory safety binder in each laboratory in which the employee will be working.

In addition, all employees must receive **laboratory specific training** from their laboratory supervisor. This training must be documented by having the employee and supervisor sign the form in Appendix III of the Chemical Hygiene Plan. Laboratory specific training must include:

- The location and availability of the OSHA Laboratory Standard, the laboratory's Chemical Hygiene Plan, MSDS sheets, and permissible exposure limits for applicable chemicals.
- The signs and symptoms associated with exposure to the hazardous chemicals with which employees work.
- Locations of fire extinguishers and exits

- Detection methods and observations that may be used to detect the presence or release of a hazardous chemical in the laboratory (e.g. odor, monitoring equipment, or visual appearance).
- The physical and health hazards of the chemicals in the laboratory.
- Work practices, personal protective equipment and emergency procedures to be used to ensure protection from overexposure to the hazardous chemicals with which employees work.
- How to use personal protective equipment and limitations of personal protective equipment.
- How to properly use safety showers, eye wash stations and other safety equipment present in the laboratory.

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 laboratory.

## **PRIOR APPROVAL**

The responsibility for approval of the acquisition and use of toxic chemical agents rests with the Laboratory Supervisor. Some materials (including toxic compressed gases, radioactive materials, and certain recombinant DNA and biohazards) require prior internal (KCTCS) or external approval at various levels.

All questions concerning the need for approvals should be directed to the KCTCS Office of Environmental Health and Safety (859) 256-3220.

#### **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;
- the laboratory specific or Institutional Chemical Hygiene Officer identifies an overexposure as the result of an evaluation.

Employees or student workers receiving pay that require medical evaluation should follow the same procedure as reporting an accident.

## FOR NON EMPLOYEES

#### 1. General Guidelines

- a. If the emergency occurs in the classroom, the instructor of the class is responsible for carrying out the emergency procedures.
- b. If the emergency occurs outside the classroom, the first college employee on the scene is responsible for carrying out the emergency procedures.
- The emergency number is 911 for all campuses from campus telephones, but if calling on a cell phone for a Cooper Campus emergency, call 257-1616 for Police, Fire and Ambulance assistance.
- d. A report of all accidents/emergencies, etc., should be filed on Form FM84 within 24 hours and submitted to the Manager, Safety & Security, 202-B Oswald Building. Report forms are available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a>. After selecting the link, log on to "The Point" by using kctcsacc\username and password.
- e. Procedures apply to accidents, emergencies, etc., which occur on the Cooper Campus, including leased facilities and other off-campus/extended campus sites.

## 2. Specific Procedures

- a. The faculty/staff member should call 911 (if calling on a cell phone for a Cooper Campus emergency, call 257-1616). Notify the Visitors Information Center by dialing ext. 56200 or 246-6200 and then "0" to advise VIC of location of emergency so that Police and Fire Departments can be directed accordingly.
  - Stay with the victim until emergency treatment personnel arrive.
     Employees are advised not to transport the victim under any circumstances.

- Determine the identity of victim and provide data to emergency personnel.
- b. If individual does not want to be taken by ambulance, call 246-6490, Records & Registrar, and they will contact family or relatives of the victim and arrange for transportation as needed.

A report of all accidents/emergencies, etc., should be filed on Form FM84 within 24 hours and submitted to the Manager, Security & Safety, 202-B Oswald Building. Report forms are available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a>. After selecting the link, log on to "The Point" by using kctcsacc\username and password.

## FOR BLUEGRASS DISTRICT EMPLOYEES

KCTCS procedures are followed for reporting occupational injuries that occur in the workplace. *In order to qualify for Workers' Compensation, a call must be made to (888) 860-0302, Monday-Friday, 8:00 a.m. – 4:30 p.m., within 24 hours of the incident.* 

To have medical care paid for in a work related injury; the employee **must** immediately notify his/her supervisor-- when possible notice should be in writing. Employee's failure to notify his/her supervisor could result in denial of benefits. The employee may select the physician or medical facility to render care.

For any questions relative to Workers Compensation, call toll free (502) 546-6846 or (502)546-6847 between 8 a.m. and 4:30 p.m. Monday – Friday or contact BCTC Human Resources.

## To report work related incidents:

- 1. Employee should contact his/her supervisor immediately on the day the incident occurs. The supervisor for a faculty member is his/her division Assistant Dean.
- Supervisor should call (888) 860-0302 to report injury within the first 24 hours of the incident. If injury occurs in the evening hours or on the weekend, the injury must be reported at the beginning of the next working day.
- 3. Supervisor should complete the injury report Form FM84, available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a> within 24 hours of incident. After selecting the link, log on to "The Point" by using kctcsacc\username and password.
- 4. Supervisor or employee should contact BCTC Human Resources to obtain Worker's Comp forms.

**Note:** 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 or with appropriate medical personnel at the College.

## **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 Safety Committee and KCTCS Office of Environmental Health and Safety as needed.

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

## **CHAPTER 10**

## SPECIAL PROVISIONS FOR SELECT CARCINOGENS, REPRODUCTIVE TOXINS AND ACUTELY TOXIC CHEMICALS

Provisions shall be made for additional employee protection when working with particularly hazardous substances takes place. These include "select carcinogens" (see Appendix VII for a list of select carcinogens), reproductive toxins, and substances which have a high degree of acute toxicity. The following provisions must be included:

- 1. Establishment of a designated area
- 2. Use of containment devices such as laboratory chemical hoods or glove boxes
- 3. Procedures for safe removal of contaminated waste; and
- 4. 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 is 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 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 laboratory chemical hood,
  biological safety cabinet, ventilated glove box, sealed system, or other
  system designed to minimize exposure to these substances. The exhaust
  air from 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.
- Certain chemicals are known or suspected to harm fetuses or reproductive health of adults. Some examples of reproductive toxins are: anesthetic gases, arsenic and certain arsenic compounds, benzene, cadmium and certain cadmium compounds, carbon disulfide, ethylene glycol monomethyl and ethyl ethers, ethylene oxide, lead compounds, mercury compounds, toluene, vinyl chloride, xylene, and formamide. The first trimester of pregnancy is a period of high susceptibility. Often a woman does not know that she is pregnant during this period. Individuals of childbearing potential are warned to be especially cautious when working with such reproductive toxins. These individuals must use

appropriate protective apparel (especially gloves) to prevent skin contact. Pregnant women and women intending to become pregnant should seek advice from knowledgeable sources before working with substances that are suspected to be reproductive toxins.

- Read the Material Safety Data Sheets for all chemicals in your lab, and take the appropriate precautions in handling, labeling, and disposing of the chemicals.
- Notify supervisors of all incidents of exposure or spills and consult a physician when appropriate.
- Compressed gas cylinders that contain acutely toxic chemicals such as arsine, chlorine, and nitrogen dioxide must be kept in well-ventilated areas.
- The ventilation efficiency of the designated laboratory chemical 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 laboratory personnel at intervals determined by the Laboratory Supervisor. The interval of evaluating systems varies depending upon the frequency of usage, quantities employed, and the level of hazard.
- Every laboratory utilizing genotoxins, reproductive toxins and acutely toxic
  chemicals must designate an area for working with these chemicals. The
  designated area must have a sign or appropriate hazard warning
  (DANGER, AUTHORIZED PERSONNEL ONLY, etc.). The designated
  area may be an entire laboratory (bio-safety level three or four requires
  that the ENTIRE laboratory be designated), an area of the laboratory, or a
  device such as a laboratory chemical hood or glove box.
- All laboratory workers in a laboratory with an area designated for use with genotoxins, reproductive toxins and acutely toxic chemicals must be trained about the deleterious effects of these substances. The workers must also be aware of the signs and symptoms regarding exposure to these substances, whether or not they actually work with the substances 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 genotoxins, reproductive toxins and acutely toxic 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 are utilized (especially poisonous gases with a high degree of acute toxicity).
- For special disposal information, call KCTCS Office of Environmental Health and Safety (859) 256-3220 or (859) 256-3357.
- The designated working area must be thoroughly and appropriately decontaminated and cleaned at regular intervals determined by the Laboratory Supervisor. The interval will vary depending on the frequency of usage and level of hazard.
- Special precautions to avoid release and exposure to genotoxins, reproductive toxins and acutely toxic chemicals must be utilized. For instance, volatile substances should be kept cool and contained. Gases should have properly functioning valves, check valves, regulators, containment that can withstand pressure buildup, and appropriate piping. 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.

## **CHAPTER 11**

## **EMERGENCIES**

Planning and practicing for emergencies is an essential component of laboratory safety. Workers in labs should have training necessary to assess their risks from spills, releasing of chemicals, or fire. The most important aspect of this training is being able to differentiate between an incidental situation and an emergency. Practice in emergency procedures and evacuation drills provide lab workers with the insight needed to make this differentiation.

An incidental release is one that does not cause an imminent health or safety hazard to lab workers and does not have to be cleaned up immediately in order to prevent death or serious injury to employees. Lab workers should prepare for and handle their own incidental spills or releases.

## **EMERGENCY REPORTING PROCEDURES**

In all cases of severe accidents call 911 and evacuate the area if necessary.

All accidents must be reported as follows:

- Contact Todd Gray, Operations Manager-Security & Safety (859) 246-6422.
- 2. Contact BCTC Human Resources in order that the appropriate accident form(s) are filed and to apply for worker's compensation, if appropriate.
- 3. Call 1-888-860-0302 to report injuries prior to obtaining medical care (unless it's an emergency).

#### **EMERGENCY PROCEDURES**

## I. Fires and Other Life Threatening Situations

All labs should be equipped with the proper type(s) of fire extinguishers - class C are most common, however if reactive metals (Na, K) are present, a class D extinguisher is required.

Fires contained in small vessels can often be suffocated by covering the vessel with an inverted (empty) container. Other fires may be fought with a fire extinguisher ONLY after the area has been evacuated and *only if you are trained to do so*.

For larger fires pull the fire alarm to evacuate the building, call 911 and meet emergency personnel to inform them of the chemicals, if any, involved and any other potential dangers.

The four actions below must be taken by whoever discovers a fire or other life threatening situations.

- 1. Call 911 from a safe location. Give location and type of emergency.
- 2. Alert personnel in the immediate vicinity. Tell the nature and extent of the emergency. Give instructions to sound the alarm, call for assistance.
- Turn off heat source. Confine the fire or emergency without endangering yourself. Shut hood sashes if possible. Close doors to prevent spread of vapors, gases or fire.
- 4. Evacuate the building or hazardous area. Use the evacuation alarm system. Follow posted evacuation procedures. Assemble at designated meeting points. Practice evacuation and assembly in drills.

## II. Clothing Fires and Severe Thermal Burns

Thermal burns from a clothing fire or large splash of hot material can be life threatening if they are deep, extensive or located on critical areas of the body. Severe burns of the hands, feet, face and genital areas are considered critical.

#### To extinguish a clothing fire:

- 1. Stop the person on fire from running!
- 2. Drop the person to the floor. Standing allows flames to spread upward to the eyes and nose
- 3. Roll the person to snuff out the flames
- 4. Cool the person. Remove smoldering clothing. Use cold water or ice packs to cool burns and minimize injury
- 5. Get medical assistance immediately

## III. Chemical Splash to the Eyes or Skin

The most important emergency measure if chemicals are splashed to the eyes or skin is immediate flushing with water in an emergency eyewash and/or shower.

Each laboratory equipped with an eyewash station must be checked weekly by lab personnel and yearly by BCTC M&O. Flushing these out periodically prevents the buildup of bacteria which may cause visual damage. Laboratories equipped with safety showers must be checked monthly by BCTC M&O or by laboratory personnel.

## Safety shower locations:

- Cooper Campus Oswald Building, Room 244, 245 and 322.
- Lawrenceburg campus Science Lab, Room 139.
- Leestown campus Building A, Room N109.
- Winchester campus Science Lab Room 216.

## Using an eyewash station:

- Wash with tepid or cool water from the inside edges of the eyes to the outside. This helps to avoid washing the chemicals back into the eyes or into an unaffected eye.
- 2. Flush eyes and eyelids for a **minimum** of 15 minutes. "Roll" eyes around to ensure full rinsing.
- 3. Immediately seek medical attention.

## Using a safety shower:

- 1. Stand directly under the shower head.
- 2. Pull handle to activate shower.
- 3. Wash with tepid water for a **minimum** of 15 minutes.
- 4. Push handle up to turn off shower.

#### IV. Chemical Exposure by Ingestion

If chemicals are ingested, immediately locate and read the emergency procedures on the MSDS. Procedures vary depending on the substance. Get the victim to the nearest medical facility in the quickest way possible. Inform medical personnel regarding the chemical(s) ingested.

In all cases seek medical attention if necessary. Bring the MSDS of the chemical to the emergency room with you.

## V. Medical Emergencies

Every laboratory should be equipped with minimum first aid supplies to deal with minor cuts or burns. Clean affected areas and apply bandages, compresses, and cold water as necessary. Do not administer any drugs. Consult medical personnel as required.

## In case of a major medical emergency:

- 1. Call 911 (if using a cell phone from the Cooper Campus, call 257-1616) and give all the pertinent information.
- Ensure that there is someone to meet and direct emergency personnel. Contact the Visitors Information Center at 56200 or 246-6200, then dial "0", if time permits. They can meet the emergency personnel as they arrive.
- 3. Do not move the injured person unless they are in further danger.
- 4. Use general first aid procedures if necessary. If you are not qualified to give first aid, and the person is not in desperate condition, it is advised that you wait for emergency personnel to arrive.

## VII. Chemical Spills

Every laboratory should be equipped to handle small chemical spills. Consult the MSDS for proper clean up procedures or call University of Kentucky Environmental Management, 323-6280 if at the Cooper Campus. Other campuses should contact the KCTCS Office of Environmental Health and Safety at (859) 256-3220 or (859) 256-3357 for advice. Wear proper protective equipment and dispose of clean up materials appropriately.

For large spills call 911 and evacuate the area.

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## **APPENDIX I**

#### **OSHA LABORATORY STANDARD**

#### (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 2, 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° F (37.8° C), but below 200° F (93.3° C), except any mixture having components with flashpoints of 200° F (93.3° C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

## "Compressed gas" means:

- (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70° F (21.1° C); or
- (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130° F (54.4° C) regardless of the pressure at 70° F (21.1° C); or
- (iii) A liquid having a vapor pressure exceeding 40 psi at 100° 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° F (37.8°
   C), except any mixture having components with flashpoints of 100° 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° F (37.8° 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° F (37.8° 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 tat 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) <u>Permissible exposure limits:</u> 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 Laboratory chemical 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 Laboratory chemical 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) <u>Information</u>. 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) <u>Information provided to the physician</u>. 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) <u>Use of respirators.</u> 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.

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

#### **APPENDIX A TO 1910.1450**

## National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)

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#### Foreword

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- B. Responsibilities
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- F. Safety Recommendations
- G. Material Safety Data Sheets

As guidance for each employer's development of an appropriate laboratory Chemical Hygiene Plan, the following non-mandatory recommendations are provided. They were extracted form

"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 sense 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) Laboratory chemical 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.	В
(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:

- 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).

#### 3. 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 I 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. <u>Components of the Chemical Hygiene Plan</u>

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 r 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.** Basic Rules and Procedures for Working with Chemicals

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 recirculated atmospheres (209).
  - (c) **Choice of chemicals:** Use only those chemicals for which the quality of the available ventilation system is appropriate (13).
  - (e) 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 pipeting 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).
- (I) **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 s tructural 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 revent 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 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
- (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).
- (I) 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)
- 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)

#### **APPENDIX B TO 1910.1450**

#### **REFERENCES (NON-MANDATORY)**

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 safety or health problem. Other references not listed here may better meet the needs of a specific laboratory.

#### (a) Materials for the development of the Chemical Hygiene Plan:

- American 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:

- 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) <u>Information on Ventilation:</u>

- 1. American Conference of Governmental Industrial Hygienists Industrial Ventilation (latest edition), 6500 Glenway Avenue, Bldg. D-7, Cincinnati, Ohio 45211-4438.
- 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. Imad, A.P. and Watson, C.L. Ventilation Index: An Easy Way to Decide about Hazardous Liquids, Professional Safety pp 15-18, April 1980.
- 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) <u>Information on Availability of Referenced Material:</u>

- 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

## **BCTC Organization Chart for Health and Safety**

## KCTCS Office of Environmental Health and Safety

System Director, Crisis Management Lewis Prewitt, interm (859) 246-3181 300 North Main Versailles, KY 40383

## **KCTCS Office of Environmental Health and Safety**

Safety Coordinators
Gregory Bonner and Melvin Smith
(859) 246-3220 or (859) 246-3357
300 North Main
Versailles, KY 40383

## **Bluegrass Community and Technical College**

Operations Manager-Security & Safety & Safety Committee Chair
Todd Gray
(859) 246-6422

Office Location: Cooper Campus (OB)

## Bluegrass Community and Technical College

Chemical Hygiene Officer
Please refer any questions to Todd Gray, Manager –
Security & Safety
(859)246-6422

Office Location: Cooper Campus (OB)

## **Appendix III**

## **LABORATORY INSPECTION GUIDELINES**

The following guide has been developed to assist you in your scheduled safety surveillance of laboratories and departments under your auspices as lab supervisor. This guide is by no means all encompassing, however information contained after each item should assist you in determining whether your area may be in full, partial or non-compliance.

Keep in mind that all Federal, State and college rules, recommendations and regulations determine the compliance of our area concerning OSHA, EPA, NIH, CDC, and DOT. If you have any specific questions on the information below, please contact the KCTCS Office of Facilities Management.

- 1. Entrances, Exits, Hallways and Stairways All entrances, exits, hallways and stairways must be clear and unobstructed.
- 2. Showers/Eye Wash Operative Any area which deals with corrosive, flammable or otherwise hazardous material is required to have immediate access to eyewash and drench shower facilities. Eye wash bottles are not adequate equipment. All showers and eye wash equipment must be in full operational order and unobstructed. Weekly inspections of eyewashes and monthly inspections of safety showers are required.
- 3. Personal Protective Equipment Personal Protective Equipment such as goggles, masks, gloves and cover gowns must be readily available and not worn outside the immediate work areas. Lab coats and appropriate shoes shall be worn to avoid any contact with harmful materials. Respirators shall be used when applicable. Evidence of respirator training and certification must be readily available.
- 4. Fire Extinguisher/Inspection and Location All fire extinguishers must be inspected annually. Extinguishers must be properly mounted, unobstructed and be properly labeled for the intended use. Training classes are offered via CD located on reserve in the Learning Resource Center and offered as a class by the KCTCS Office of Facilities Management. If fire extinguishers are in need of replacement, please contact the Maintenance and Operations department or if at Cooper Campus contact UK's University Fire Marshal at (257-6326).
- 5. Pressurized Cylinders All cylinders must be stored in proper locations. Cylinders must be secured in an upright position and properly restrained. Containers must be labeled for contents and usage. The maximum number of E-size flammable gas and oxygen cylinders that can be stored in an area is 3 per 500 square feet in an un-sprinklered space or 6 in an area with overhead

sprinklers. When using liquefied gas cylinders in laboratory work areas limit the number of cylinders to 3.

- 6. Room Use Identification All access doors must be marked when rooms or areas are being used for chemical, biological or radioactive purposes as outlined in the Chemical Hygiene Plan. All doors must remain closed and the vision panel must remain unobstructed. Unattended labs shall be locked at all times.
- 7. UL Electrical Equipment and Cords Only Underwriters Laboratories approved equipment and cords are authorized for use. Only UL listed multiple outlet strips equipped with 15 AMP circuit breakers are approved.
- 8. Laboratory chemical hood Operation Face Velocities should be between 80 and 150 FPM at the working sash height with an optimum level of 100 FPM. The sash should never be higher than 12 inches except when accessing equipment. Hoods should not be located in high traffic areas or under air supply vents. The hood must have user spill protection and cup sinks must have spill guards.
- Biological Safety Cabinets Certification is required annually or any time the hood is moved or has had maintenance performed. Cabinets must not be located near high traffic areas or air supply ducts.
- 10. Hazardous Chemicals All chemicals must be appropriately labeled and shall not be placed near or over floor drains. Flammable liquids must be stored in appropriate containers. There should be no more than 5 gallons of solvents or Class I or IA flammables in a laboratory work area. No more than 10 gallons should be in specific storage cabinets per 100 sq. ft. For larger storage capacities and long term storage of flammable and solvents and approved storage area should be used. Please consult the KCTCS Office of Environmental Health and Safety for questions concerning approved storage.
- 11. Hazardous Waste Disposal Hazardous waste training is required for all employees who handle hazardous material. The Fire Commission Office gives training. A certification of training must be posted in laboratories. For information about Hazardous Waste Training, contact Rae Ann Gill – BCTC Chemical Hygiene Officer at (859) 246-6458, Todd Gray, Manager – Security & Safety at (859)246-6422 or contact KCTCS Office of Environmental Health and Safety.
- 12. Equipment and Utility Labeling Refrigerators, ice machines and microwaves must be labeled for intended use. Food, personal medication and hazardous materials shall not be housed in the same refrigerator. All utility and plumbing

- lines need to be labeled and indicate the product contained; i.e., gas, water, etc.
- 13. Location of Cut-off Valves/Circuit Breakers All cut off valves and breakers must be properly labeled.
- Use of Flame and Heat No heat generating devices should be left unattended.
- 15. General Safety Eating, drinking, smoking and applying cosmetics is not permitted in any laboratory. Lab personnel shall not wear loose clothing or unrestrained long hair. Perforated shoes, sandals, or cloth sneakers should not be worn in labs. Individual labs may be more restrictive depending on the chemicals used and hazards in that laboratory.
- 16. Ventilation Airflow in most labs should be "negative" with respect to the corridor. Laboratory doors shall be kept closed when laboratory procedures are in progress. Volatile hazardous materials shall not be used on the open bench top.
- 17. Housekeeping/Drains Flushed All unnecessary material, boxes, and containers must be disposed of in the appropriate manner. All drains, including floor drains and cup sinks should be flushed with water on a weekly basis to eliminate sewer odors. Proper housekeeping must be maintained to provide adequate clearance of sprinkler systems and emergency equipment.
- 18. Sharps All sharps, needles and glass must be disposed of in an approved, labeled container. Glass containers and other potentially sharp objects shall not be disposed of in common office refuse. Containers must not be overfilled and must be labeled and sealed for proper handling and disposal.
- 19. Emergency lighting Where necessary, emergency lighting units shall be properly mounted and unobstructed. If emergency lighting exists, it should be checked periodically to ensure it is functional.
- 20. Emergency Plans/Posted Numbers All emergency and contingency plans and evacuation routes shall be clearly posted in conspicuous places. A list of emergency numbers and contacts must be kept updated and posted alongside the emergency plans.
- 21. Safety Manuals Manuals must be current and readily available for all employees.
- 22. Accidents Reported/Investigated All accidents must be reported to the immediate supervisor for the completion of the appropriate form. File copies

of reported incidents and accidents must be on hand, as well as the action taken to alleviate the safety hazard in the future.

# **Acronyms**

CDC Center for Disease Control

**DOT** Department of Transportation

FPM Feet Per Minute

MSDS Material Safety Data Sheets

OSHA Occupational Safety and Health Administration

**EPA** Environmental Protection Agency

NIH National Institutes of Health

**HMM Hazardous Materials Management** 

# **APPENDIX III**

# LABORATORY SELF INSPECTION FORM

Department:	Building:	Room Number:
Department Safety Officer:		Inspector:
Lab Supervisor:		Inspection Date:
Chairman:		Re-inspection Due:

S=Satisfactory; U=Unsatisfactory

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

# **APPENDIX III (cont'd)**

# **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:				

Call KCTCS Office of Environmental Health and Safety (859) 256-3220 or (859) 256-3357, for answers to lab safety concern

# **APPENDIX IV**

# **GLOVE SELECTION GUIDANCE**

Resistant Properties of Selected Materials by Chemical Class

Chemicals	Butyl	СРЕ	Viton™/ neoprene	Natural rubber	Neoprene	Nitrile + PVC	Nitrile	PE	PVA	PVC	Viton	Butyl/ neoprene
Acids, carboxylic and aliphatic												
Unsubstituted	R	r	r	**	rr	**	rr	NN	**	**	**	R
Polybasic					rr	rr	rr	rr	n	rr		
Aldehydes												
Aliphatic and	RR	NN	r	**	NN	nn	NN	**	NN	NN	**	r
alicyclic	rr		n	nn	nn	n	nn	NN	rr	N		r
Aromatic and												
heterocyclic												
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	NN	**	NN	n	**

Higher monobasic	nn	nn	**	NN	nn		nn	NN	rr	NN		**
Polybasic			r	r	r		**			rr		r
Aromatic phthlate	rr		r	**	**		**			nn	rr	r
Ethers Aliphatic	**	rr	**	NN	**	**	**		**	**		**
Halogen compounds Aliphatic, unsubstituted Aliphatic, substituted Aromatic, unsubstituted Polynuclear Vinyl halides	nn ** nn	nn	r	NN NN N	NN rr nn	NN n	NN nn nn	NN NN	**	NN NN N n	** rr rr rr	n n
Heterocyclic compounds Epoxy compounds Furan derivatives	** nn		nn	**	nn		nn **	NN	**	nn NN	NN nn	n
Hydrazines Hydrocarbons Aliphatic and alicyclic Aromatic	** N **	r rr	r r	NN NN	** ** NN	** NN	**	** NN	** **	NN NN	RR RR	n n r

Hydroxyl												
compounds	DD				**		**	**	**	**		**
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
Polyois												
Aromatic												
Inorganic acids	**	**	rr	**	**	**	**	**	n	**	rr	**
Inorganic base	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	**	NN	**	NN	NN	**
Nitriles, aliphatic	rr			NN	**			NN	rr	NN	rr	
Nitro compounds												
Unsubstituted	rr	r		NN	**		nn		**	**	**	
Organo-			r									r
phosphorous												
compounds												
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 Natural rubber - same CPE - Chrlorinated polyethylene

PE - Polyethylene

Viton - same

Nitrile + PVC - Nitrile rubber + polyvinyl chloride

PVA - Polyvinyl alcohol

Neoprene - same

Nitrile - Nitrile rubber

Viton™/Neoprene - layered material, 1st

material on surface

Butyl/Neoprene - layered material, 1st

material on surface

Taken from <u>CRC Handbook of Laboratory Safety</u>, 3rd edition.

# 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	Е	Е	E	E
Acetone	G	G	G	F
Acrylonitrile	Р	G	-	F
Ammonium hydroxide	G	Е	E	Е
Aniline	F	G	E	G
Benzaldehyde	F	F	E	G
Benzene	Р	F	G	F
Benzyl chloride	F	Р	G	Р
Bromine	G	G	-	G
Butane	Р	E	-	Р
Calcium hypochlorite	Р	G	G	G
Carbon disulfide	Р	Р	G	F
Carbon tetrachloride	P	F	G	F
Chlorine	G	G	-	G
Chloroscetone	F	E	-	P
Chloroform	Р	F	G	P
Chromic Acid	Р	F	F	E
Cyclohexane	F	E	-	Р
Dibenzylether	F	G	-	Р
Dibutylphthalate	F	G	-	P
Diethanolamine	F	E	-	E
Diethyl ether	F	G	E	P
Dimethyl sulfoxide	-	-	-	-
Ethyl acetate	F	G	G	F
Ethylene dichloride	Р	F	G	Р
Ethylene glycol	G	G	E	E
Ethylene trichloride	P	Р	-	P
Flourine	G	G	-	G
Formaldehyde	G	E	E	E
Formic acid	G	Е	E	Е
Glycerol	G	G	E	E
Hexammne	Р	E	-	Р
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
lodine	G	G	-	G
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)	Р	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	Р	F	-	Р
Sodium hydroxide	G	G	G	E
Sodium hypochlorite	G	Р	F	G
Sulfuric acid (conc)	G	G	F	G
Toluene	Р	F	G	F
Triichloroethylene	Р	F	G	F
Tricresyl phosphale	Р	F	-	F

Triethanolamine	F	E	E	E
Trinitrotoluene	Р	E	-	Р

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.

Other web resources:

http://www.chemrest.com

http://www.ansell-edmont.com/download/Ansell\_7thEditionChemicalResistanceGuide.pdf

# **APPENDIX V**

# **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	Water, carbon tetrachloride or other chlorinated
(such as powdered aluminum	hydrocarbons, carbon dioxide, halogens
or magnesium, calcium,	
lithium, sodium, potassium)	
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 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)	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
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see	Sulfuric and other acids
also chlorates)	
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

#### **APPENDIX VI**

## **Bluegrass Community and Technical College**

#### ACCIDENT AND EMERGENCY PROCEDURES

#### FOR NON EMPLOYEES

#### 1. General Guidelines

- a. If the emergency occurs in the classroom, the instructor of the class is responsible for carrying out the emergency procedures.
- b. If the emergency occurs outside the classroom, the first college employee on the scene is responsible for carrying out the emergency procedures.
- c. The emergency number for all campuses is 911 (if calling on a cell phone for a Cooper Campus emergency, call 257-1616) for Police, Fire and Ambulance assistance.
- d. A report of all accidents/emergencies, etc., should be filed on Form FM84 within 24 hours and submitted to the Assistant to the President/Special Projects, 202-B Oswald Building, (859) 246-6374 or to the Safety and Security Officer, 241 Moloney Building, (859) 246-6422. Report forms are available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a>. After selecting the link, log on to "The Point" by using kctcsacc\username and password.
- e. Procedures apply to accidents, emergencies, etc., on all campuses,including leased facilities and other off-campus/extended campus sites.

#### 2. Specific Procedures

- a. The faculty/staff member should call 911 (if calling on a cell phone for a Cooper Campus emergency, call 257-1616). Notify the Visitors Information Center by dialing extension 56200 or 246-6200, then "0" to advise VIC of location of emergency so that Police and Fire Departments can be directed accordingly.
  - Stay with the victim until emergency treatment personnel arrive.
     Employees are advised not to transport the victim under any circumstances.
  - Determine the identity of victim and provide data to emergency personnel.
- b. If individual does not want to be taken by ambulance, call 246-6490, Records & Registrar, and they will contact family or relatives of the victim and arrange for transportation as needed.
- c. A report of all accidents/emergencies, etc., should be filed on Form FM84 within 24 hours and submitted to the Assistant to the President/Special Projects, 202-B Oswald Building, (859) 246-6374 or to the Safety and Security Officer, 241 Moloney Building, (859) 246-6422. Report forms are available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a> After selecting the link, log on to "The Point" by using kctcsacc\username and password.

#### FOR BCTC EMPLOYEES

KCTCS procedures are followed for reporting occupational injuries that occur in the workplace. *In order to qualify for Workers' Compensation, a call must be made to (888) 860-0302, Monday-Friday, 8:00 a.m. – 4:30 p.m., within 24 hours of the incident.* 

To have medical care paid for in a work related injury; the employee **must** immediately notify his/her supervisor-- when possible notice should be in writing. Employee's failure to notify his/her supervisor could result in denial of benefits. The employee may select the physician or medical facility to render care.

For any questions relative to Workers Compensation, call toll free (502) 564-6846 between 8 a.m. and 4:30 p.m. Monday – Friday or contact BCTC Human Resources.

#### To report work related incidents:

- 5. Employee should contact his/her supervisor immediately on the day the incident occurs. The supervisor for a faculty member is his/her division Assistant Dean.
- 6. Supervisor should call (888) 860-0302 to report injury within the first 24 hours of the incident. If injury occurs in the evening hours or on the weekend, the injury must be reported at the beginning of the next working day.
- 7. Supervisor should complete the injury report Form FM84, available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a> within 24 hours of incident. After selecting the link, log on to "The Point" by using kctcsacc\username and password.
- 8. Supervisor or employee should contact BCTC Human Resources to obtain Worker's Comp forms.

# Accident Reporting Procedures to use in addition to the BCTC Accident Reporting Polices for the Cooper Campus

#### **KCTCS--- Accident Reporting Procedures**

All accidents must be reported as quickly as possible. Any fatal accident, any accident requiring hospitalization of any one person, or any serious injury involving a student, visitor, or an employee MUST BE REPORTED to KCTCS Office of Environmental Health and Safety IMMEDIATELY at (859)256-3220 or (859)256-3357.

#### STUDENT OR VISITOR ACCIDENTS

Any faculty or staff member witnessing or being informed of an accident involving a student or a visitor should report the accident using KCTCS's Accident Report Form Form FM84. This form can be found at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a>. After selecting the link, log on to "The Point" by using kctcsacc\username and password. Forward the original of the Form FM84 to the Manager, Security & Safety, 202-B Oswald Building at Cooper Campus. Report forms are available on the web. If accident occurs at Cooper Campus the Safety Officer will forward a copy to the UK Occupational Health and Safety Department either by e-mail or at 252 East Maxwell Street, Lexington, KY, 40506-0314.

#### **EMPLOYEE ACCIDENTS**

Employee accidents should be reported immediately by the employee's supervisor. Student workers receiving pay other than scholarships, fellowships, student loans, or grants are considered employees.

#### To report work related incidents:

- 1. Employee should contact his/her supervisor immediately on the day the incident occurs. The supervisor for a faculty member is his/her division Assistant Dean.
- 2. Supervisor should call (888) 860-0302 to report injury within the first 24 hours of the incident. If injury occurs in the evening hours or on the weekend, the injury must be reported at the beginning of the next working day.
- 3. Supervisor should complete the injury report Form FM84, available on the web at: <a href="http://thepoint.kctcs.edu">http://thepoint.kctcs.edu</a> within 24 hours of incident. After selecting the link, log on to "The Point" by using kctcsacc\username and password.
- 4. Supervisor or employee should contact BCTC Human Resources to obtain Worker's Comp forms.

If an **employee** is injured and **DOES NOT SEEK MEDICAL ATTENTION** at this time, please complete the Accident-Occupational Injury/Illness Report.

# PROPERTY DAMAGE ACCIDENTS

Property Damage accidents such as fire, water, wind, theft and other property damage claims are not reported on any one form. After a loss is discovered, the loss should be reported to the Manager, Security & Safety, (859)246-6422.

#### **APPENDIX VII**

#### CARCINOGENS LISTED IN THE ELEVENTH REPORT

#### REPORT ON CARCINOGENS, ELEVENTH EDITION

# Carcinogens Listed in the Eleventh Report Part A. Known to be Human Carcinogens.

Name or synonym

Aflatoxins

Alcoholic Beverage Consumption

4-Aminobiphenyl

Analgesic Mixtures Containing Phenacetin (See Phenacetin and Analgesic Mixtures Containing Phenacetin)

Arsenic Compounds, Inorganic

Asbestos

Azathioprine

Benzene

Benzidine (See Benzidine and Dyes Metabolized to Benzidine)

Beryllium and Beryllium Compounds

1,3-Butadiene

1,4-Butanediol Dimethanesulfonate (Myleran®)

Cadmium and Cadmium Compounds

Chlorambucil

1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU)

bis(Chloromethyl) Ether and Technical-Grade Chloromethyl Methyl Ether

Chromium Hexavalent Compounds

Coal Tar Pitches (See Coal Tars and Coal Tar Pitches)

Coal Tars (See Coal Tars and Coal Tar Pitches)

Coke Oven Emissions

Cyclophosphamide

Cyclosporin A

Diethylstilbestrol

Dyes Metabolized to Benzidine (See Benzidine and Dyes Metabolized to Benzidine)

Environmental Tobacco Smoke (See Tobacco Related Exposures)

Erionite

Estrogens, Steroidal

Ethylene Oxide

Hepatitis B Virus

Hepatitis C Virus

#### Human Papillomas Viruses: Some Genital-Mucosal Types

Melphalan

Methoxsalen with Ultraviolet A Therapy (PUVA)

Mineral Oils (Untreated and Mildly Treated)

Mustard Gas

2-Naphthylamine

#### **Neutrons (See Ionizing Radiation)**

Nickel Compounds (See Nickel Compounds and Metallic Nickel)

Radon (See Ionizing Radiation)

Silica, Crystalline (Respirable Size)

Smokeless Tobacco (See Tobacco Related Exposures)

Solar Radiation (See Ultraviolet Radiation Related Exposures)

Soots

Strong Inorganic Acid Mists Containing Sulfuric Acid

Sunlamps or Sunbeds, Exposure to (See Ultraviolet Radiation Related Exposures)

Tamoxifen

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD); "Dioxin"

Thiotepa

Thorium Dioxide (See Ionizing Radiation)

Tobacco Smoking (See Tobacco Related Exposures)

Vinvl Chloride

Ultraviolet Radiation, Broad Spectrum UV Radiation (See Ultraviolet Radiation Related Exposures)

Wood Dust

#### X-Radiation and Gamma Radiation (See Ionizing Radiation)

Bold entries indicate new or changed listing in The Report on Carcinogens, Eleventh Edition.

#### CARCINOGENS LISTED IN THE ELEVENTH REPORT

## Part B. Reasonably Anticipated to be a Human Carcinogen.

Name or synonym

Acetaldehyde

2-Acetylaminofluorene

Acrylamide

Acrylonitrile

Adriamycin® (Doxorubicin Hydrochloride)

2-Aminoanthraquinone

o-Aminoazotoluene

#### 1-Amino-2,4-dibromoanthraquinone

1-Amino-2-methylanthraquinone

2-Amino-3,4-dimethylimidazo[4,5-f]quinoline (MelQ)

2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline (MelQx)

2-Amino-3-methylimidazo[4,5-f]quinoline (IQ)

2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP)

Amitrole

o-Anisidine Hydrochloride

Azacitidine (5-Azacytidine®, 5-AzaC)

Benz[a]anthracene (See Polycyclic Aromatic Hydrocarbons)

Benzo[b]fluoranthene (See Polycyclic Aromatic Hydrocarbons)

Benzo[/]fluoranthene (See Polycyclic Aromatic Hydrocarbons)

Benzo[k]fluoranthene (See Polycyclic Aromatic Hydrocarbons)

Benzo[a]pyrene (See Polycyclic Aromatic Hydrocarbons)

Benzotrichloride

Bromodichloromethane

2,2-bis-(Bromoethyl)-1,3-propanediol (Technical Grade)

Butylated Hydroxyanisole (BHA)

Carbon Tetrachloride

Ceramic Fibers (Respirable Size)

Chloramphenicol

Chlorendic Acid

Chlorinated Paraffins (C<sub>12</sub>, 60% Chlorine)

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea

bis(Chloroethyl) nitrosourea

Chloroform

3-Chloro-2-methylpropene

4-Chloro-o-phenylenediamine

Chloroprene

p-Chloro-o-toluidine and p-Chloro-o-toluidine Hydrochloride

Chlorozotocin

C.I. Basic Red 9 Monohydrochloride

Cisplatin

#### **Cobalt Sulfate**

p-Cresidine

Cupferron

Dacarbazine

Danthron (1,8-Dihydroxyanthraquinone)

2,4-Diaminoanisole Sulfate

2,4-Diaminotoluene

#### Diazoaminobenzene

Dibenz[a,h]acridine (See Polycyclic Aromatic Hydrocarbons)

Dibenz[a,j]acridine (See Polycyclic Aromatic Hydrocarbons)

Dibenz[a,h]anthracene (See Polycyclic Aromatic Hydrocarbons)

7H-Dibenzo[c,g]carbazole (See Polycyclic Aromatic Hydrocarbons)

Dibenzo[a,e]pyrene (See Polycyclic Aromatic Hydrocarbons)

Dibenzo[a,h]pyrene (See Polycyclic Aromatic Hydrocarbons)

Dibenzo[a,i]pyrene (See Polycyclic Aromatic Hydrocarbons)

Dibenzo[a,l]pyrene (See Polycyclic Aromatic Hydrocarbons)

1,2-Dibromo-3-chloropropane

1,2-Dibromoethane (Ethylene Dibromide)

2,3-Dibromo-1-propanol

tris(2,3-Dibromopropyl) Phosphate

1,4-Dichlorobenzene

3,3'-Dichlorobenzidine and 3,3'-Dichlorobenzidine Dihydrochloride

Dichlorodiphenyltrichloroethane (DDT)

1,2-Dichloroethane (Ethylene Dichloride)

Dichloromethane (Methylene Chloride)

1,3-Dichloropropene (Technical Grade)

Diepoxybutane

**Diesel Exhaust Particulates** 

Diethyl Sulfate

Diglycidyl Resorcinol Ether

3,3'-Dimethoxybenzidine (See 3,3'-Dimethoxybenzidine and Dyes Metabolized to 3,3'-Dimethoxybenzidine)

4-Dimethylaminoazobenzene

3,3'-Dimethylbenzidine (See 3,3'-Dimethylbenzidine and Dyes Metabolized to 3,3'-Dimethylbenzidine)

Dimethylcarbamoyl Chloride

1,1-Dimethylhydrazine

Dimethyl Sulfate

Dimethylvinyl Chloride

1,6-Dinitropyrene (See Nitroarenes (selected))

1,8-Dinitropyrene (See Nitroarenes (selected))

1,4-Dioxane

Disperse Blue 1

Dyes Metabolized to 3,3´-Dimethoxybenzidine (See 3,3´-Dimethoxybenzidine and Dyes Metabolized to 3,3´-Dimethoxybenzidine)

Dyes Metabolized to 3,3´-Dimethylbenzidine (See 3,3´-Dimethylbenzidine and Dyes Metabolized to 3,3´-Dimethylbenzidine)

Epichlorohydrin

Ethylene Thiourea

di(2-Ethylhexyl) Phthalate

Ethyl Methanesulfonate

Formaldehyde (Gas)

Furan

Glass Wool (Respirable Size)

Glycidol

Hexachlorobenzene

Hexachlorocyclohexane Isomers (See Lindane and Other Hexachlorocyclohexane Isomers)

Hexachloroethane

Hexamethylphosphoramide

Hydrazine and Hydrazine Sulfate

Hydrazobenzene

Indeno[1,2,3-cd|pyrene (See Polycyclic Aromatic Hydrocarbons)

Iron Dextran Complex

Isoprene

Kepone® (Chlordecone)

#### Lead and Lead Compounds

Lindane and Other Hexachlorocyclohexane Isomers

2-Methylaziridine (Propylenimine)

5-Methylchrysene (See Polycyclic Aromatic Hydrocarbons)

4,4'-Methylenebis(2-chloroaniline)

4-4´-Methylenebis(N,N-dimethyl)benzenamine

4,4'-Methylenedianiline and Its Dihydrochloride Salt

Methyleugenol

Methyl Methanesulfonate

N-Methyl-N'-nitro-N-nitrosoguanidine

Metronidazole

Michler's Ketone [4,4'-(Dimethylamino)benzophenone]

Mirex

#### Naphthalene

Nickel (Metallic) (See Nickel Compounds and Metallic Nickel)

Nitrilotriacetic Acid

o-Nitroanisole

#### Nitrobenzene

6-Nitrochrysene (See Nitroarenes (selected))

Nitrofen (2,4-Dichlorophenyl-p-nitrophenyl ether)

Nitrogen Mustard Hydrochloride

#### Nitromethane

2-Nitropropane

1-Nitropyrene (See Nitroarenes (selected))

4-Nitropyrene (See Nitroarenes (selected))

N-Nitrosodi-n-butylamine

N-Nitrosodiethanolamine

N-Nitrosodiethylamine

*N*-Nitrosodimethylamine

N-Nitrosodi-n-propylamine

N-Nitroso-N-ethylurea

4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone

N-Nitroso-N-methylurea

N-Nitrosomethylvinylamine

N-Nitrosomorpholine

N-Nitrosonornicotine

N-Nitrosopiperidine

N-Nitrosopyrrolidine

*N*-Nitrososarcosine

Norethisterone

Ochratoxin A

4,4'-Oxydianiline

Oxymetholone

Phenacetin (See Phenacetin and Analgesic Mixtures Containing Phenacetin)

Phenazopyridine Hydrochloride

Phenolphthalein

Phenoxybenzamine Hydrochloride

Phenytoin

Polybrominated Biphenyls (PBBs)

Polychlorinated Biphenyls (PCBs)

Polycyclic Aromatic Hydrocarbons (PAHs)

Procarbazine Hydrochloride

Progesterone

1,3-Propane Sultone

®-Propiolactone

Propylene Oxide

Propylthiouracil

Reserpine

Safrole

Selenium Sulfide

Streptozotocin

Styrene-7,8-oxide

Sulfallate

Tetrachloroethylene (Perchloroethylene)

Tetrafluoroethylene

Tetranitromethane

Thioacetamide

#### 4,4'-Thiodianaline

Thiourea

Toluene Diisocyanate

o-Toluidine and o-Toluidine Hydrochloride

Toxaphene

Trichloroethylene

2,4,6-Trichlorophenol

1,2,3-Trichloropropane

Ultraviolet A Radiation (See Ultraviolet Radiation Related Exposure)
Ultraviolet B Radiation (See Ultraviolet Radiation Related Exposure)

Ultraviolet C Radiation (See Ultraviolet Radiation Related Exposure)

Urethane

Vinyl Bromide

4-Vinyl-1-cyclohexene Diepoxide

Vinvl Fluoride

Bold entries indicate new or changed listing in The Report on Carcinogens, Eleventh Edition.

#### **APPENDIX VIII**

#### HAZARD RATING INFORMATION FOR NFPA FIRE DIAMONDS

This appendix provides hazard rating information for many common chemicals. You may wish to use labels that include the NFPA fire diamond. Use this reference to complete the health, fire, reactivity, and special notice areas in the diamond. An explanation of the hazard rating system is given below.

### **Health (Blue Diamond)**

0	No chemical is without some degree of toxicity.
1	Slightly toxic material. May cause irritation, but only minor residual injury even without treatment. Recognized innocuous materials when used with responsible care.
2	Moderately toxic material. Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.
3	Seriously toxic material. Short term exposure could cause serious temporary or residual injury even though prompt medical treatment is given. Includes known or suspect small animal carcinogens, mutagens or teratogens.
4	Highly toxic material. Very limited exposure could cause death or major injury even though prompt medical treatment is given. Includes known or suspect human carcinogens, mutagens or teratogens.

# Flammability (Red Diamond)

0	Materials which will not burn.
1	Slightly combustible. Materials that require considerable preheating before ignition can occur. This rating includes most ordinary combustible materials.
2	Combustible. Materials that must be moderately heated before ignition can occur. Including liquids having a flash point above 100 degrees F, and solids that readily give off flammable vapors.
3	Flammable. Liquids and solids that can be ignited under almost all ambient temperature conditions. Including liquids with a flash point below 73 degrees F and a boiling point above 100 degrees F, solid materials which form coarse dusts that burn rapidly without becoming explosive, materials which burn rapidly by reason of self-contained oxygen (i.e. organic peroxides), and materials which ignite spontaneously when exposed to air.
4	Extremely flammable. Materials which will rapidly vaporize at normal pressure and temperature and will burn readily. Including: gases, cryogenic materials, any liquid or gaseous material having a flash point below 73 degrees F and a boiling point below 100 degrees F, and materials which can form explosive mixtures with air.

#### Reactivity (Yellow Diamond)

- Materials which are normally stable, even under fire conditions, and which are not reactive with water. Materials which are normally stable, but which can become unstable at elevated temperatures and pressures, or which may react with water with some release of
- 1 energy, but not violently.
- Materials which in themselves are normally unstable and readily undergo violent 2 chemical change, but do not detonate. It includes materials which may react violently with water or which may form potentially explosive mixtures with water.
- Materials which in themselves are capable of detonation but which require a strong initiating source, or which must be heated first. This rating includes materials which 3 are shock sensitive at elevated temperatures, and which react explosively with water without requiring heat.
- Materials which in themselves are readily capable of detonation or explosive decomposition at normal temperatures and pressures. Includes materials which are shock sensitive at normal temperatures and pressures.

# **Special Notice (White Diamond)**

- Denotes materials that are oxidizing agents. These compounds give up oxygen easily, remove hydrogen from other compounds or attract negative electrons.
- W Denotes materials that are water reactive. These compounds undergo rapid energy releases on contact with water.

# **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	₩
Acetone	1	3	0	
Acetonitrile	2	3	0	
Acetophenone	1	2	0	
Acetyl Chloride	3	3	2	₩
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	
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	ОХ
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	₩
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, ₩
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	
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	

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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	₩
Calcium Chlorate	2	0	2	OX
Calcium Cyanide	3	0	0	
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	
Crotonaldehyde	3	3	2	
Crotonic Acid	3	2	0	
Crotononitrile	-	1	0	
Cumene	2	3	0	
Cupric Nitrate	1	0	0	ОХ
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	
Cyclohexyl Chloride	2	3	0	
Cyclopentane	1	3	0	
	1	3	1	
Cyclopentene	2	3	0	
Cyclopentanone	1	4	0	
Cyclopropane		2		
Decaborane	3	2	1	
Decane	0		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	
Diacetone Alcohol	1	2	0	
Diamyl Sulfide	2	2	0	
Dibenzoyl Peroxide	1	4	4	OX
Diborane	3	4	3	₩
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	₩
Dihexylamne	2	1	0	
Diisobutylamine	3	3	0	
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	
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	
Ethylbenzene	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	
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	₩, OX
Formaldehyde (water solution)	2	2	0	
Formamide	2	1	-	

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Formic Acid	3	2	0	
Furan	1	4	1	
Furfuryl Alcohol	1	2	1	
Gas, Natural	1	4	0	
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	2	0	1	OX
weight)				
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	
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	₩
Isodecaldehyde	0	2	0	
Isodecanoic Acid	0	1	0	
Isohexane	1	3	0	
Isooctane	0	3	0	
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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
Lead Thiocyanate	1	1	1	
Lithium	1	1	2	₩
Lithium Hydride	3	4	2	₩
Lubricating Oil, Mineral	0	1	0	
Magnesium (including all alloys)	0	1	2	₩
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	
Methylcyclohexane	2	3	0	
Methylcyclohexanone	-	2	0	
Methylcyclopentane	2	3	0	

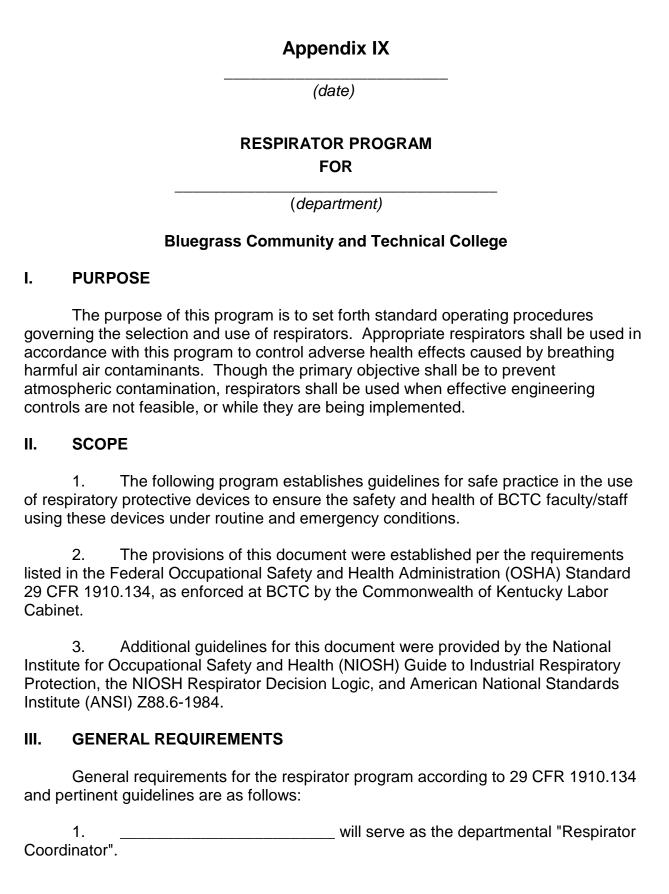
Methylene Chloride	3	1	1	
Methylene Diisocyanate	1	2	1	₩
Methyl Ether	2	4	1	
Methyl Ethyl Ether	2	4	1	
Methyl Ethyl Ketone	1	3	0	
Methyl Formate	2	4	0	
Methyl Glycol Acetate	1	2	0	
Methyl Hexyl Ketone	0	2	0	
Methylhydrazine	3	3	2	
Methyl Isoamyl Ketone	1	2	0	
Methyl Isobutyl Carbinol	2	2	0	
Methyl Isobutyl Ketone	2	3	0	
Methyl Isocyanate	2	3	3	₩
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	
Methylpyrrole	2	3	1	
Methylpyrrolidine	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 (liquified) 3 0 0 0 0X Nitrogen Peroxide 3 0 0 0 0X Nitrogen Trioxide 3 0 0 0 0X Nitroglycerine 2 2 2 4 4 1 1 1 1 1 0 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1	A 11/2 / / / / / / / / / / / / / / / / /				
Nitrogen Trioxide   3	Nitrogen (liquified)	3	0	0	2)/
Nitroglycerine         2         2         4           Nitromethane         1         3         3           1-Nitropropane         1         3         1           o-Nitrotoluene         2         1         4           Nonadecane         0         1         0           Nonane         0         3         0           Nonene         0         3         0           Nonylbenzene         0         1         0           Octadecane         1         0         0           Octadecane         1					
Nitromethane					OX
1-Nitropropane         1         3         1           0-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           1-Octane         1         3         0           2-Octanol         1         2         0           1-Octane         1         3         0           1-Octane         1         0         0 <td></td> <td></td> <td></td> <td></td> <td></td>					
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           1-Octadecide         0         1         0           Olice Cacid         0         1         0           Oxalic Acid         0         1         0           Oxaric Acid         2         <					
Nonane					
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         OX           Parafformaldehyde         2         1         0         OX           Paraformaldehyde         2         3         1         Paradormaldehyde         2         3         1           Paraformaldehyde         2         3         1         2         Peradormaldehyde         2         3         1         2           Paraformaldehyde         2         3         1         2         2         3         1         2 </td <td></td> <td>2</td> <td>1</td> <td>4</td> <td></td>		2	1	4	
Nonene	Nonadecane				
Nonylbenzene	Nonane	0		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         OX           Parafformaldehyde         2         1         0         OX           Parafformaldehyde         2         1         0         OX           Paraffin Oil         0         1         0         OX           Paraffin Oil         2         1         0         OX           Pentaborane	Nonene	0	3	0	
Octane         0         3         0           2-Octanol         1         2         0           1-Octene         1         3         0           Oleic Acid         0         1         0           Oxalic Acid         2         1         0           Oxygen (liquid)         3         0         0         OX           Paraffin Oil         0         1         0         OX         Parafformaldehyde         2         1         0         O         OX         Parafformaldehyde         1         3         0 <td>Nonylbenzene</td> <td>0</td> <td>1</td> <td>0</td> <td></td>	Nonylbenzene	0	1	0	
2-Octanol	Octadecane	0	1	0	
1-Octene	Octane	0	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         OX           Parafformaldehyde         2         1         0         OX           Paradhonde         2         3         1         OX	2-Octanol	1	2	0	
Olive Oil         0         1         0           Oxalic Acid         2         1         0           Oxygen (liquid)         3         0         0         OX           Paraffin Oil         0         1         0         O         OX           Paraffin Oil         0         1         0         O	1-Octene	1	3	0	
Oxalic Acid         2         1         0           Oxygen (liquid)         3         0         0         OX           Paraffin Oil         0         1         0         OX           Paraffin Oil         0         1         0         OX           Paraffin Oil         0         1         0         OX	Oleic Acid	0	1	0	
Oxygen (liquid)         3         0         0         OX           Paraffin Oil         0         1         0         0           Paraformaldehyde         2         1         0         0           Paraldehyde         2         3         1         1           Parathion         4         1         2         2           Pentaborane         3         3         2         2           Pentaborane         3         3         2         2           Pentaborane         3         0         0         0           Pentachlorophenol (dry)         3         0         0         0           Pertabene         1         4         0         0         0           Perchloric Acid         3         0         3         0         0         <	Olive Oil	0	1	0	
Paraffin Oil         0         1         0           Paraformaldehyde         2         1         0           Paraldehyde         2         3         1           Parathion         4         1         2           Pentaborane         3         3         2           Pentaborane         3         0         0           Pentachlorophenol (dry)         3         0         0           Pentane         1         4         0           Pentane         2         1         0           Pentaneic         2         1         0           Pentane         2         1         0           Pentaneic         2         1         0           Pentane         1         4         0           Pentane         2         1         0           Pentane         1         4         0           Pentane         1         4         0           Perchane         1         4         0           Perchloric Acid         3         0         3         OX           Petroleum, Crude         1         3         2         0 <td< td=""><td>Oxalic Acid</td><td>2</td><td>1</td><td>0</td><td></td></td<>	Oxalic Acid	2	1	0	
Paraffin Oil         0         1         0           Paraformaldehyde         2         1         0           Paraldehyde         2         3         1           Parathion         4         1         2           Pentaborane         3         3         2           Pentaborane         3         0         0           Pentachlorophenol (dry)         3         0         0           Pentane         1         4         0           Pentane         2         1         0           Pentaneic         2         1         0           Pentane         2         1         0           Pentaneic         2         1         0           Pentane         1         4         0           Pentane         2         1         0           Pentane         1         4         0           Pentane         1         4         0           Perchane         1         4         0           Perchloric Acid         3         0         3         OX           Petroleum, Crude         1         3         2         0 <td< td=""><td>Oxygen (liquid)</td><td>3</td><td>0</td><td>0</td><td>OX</td></td<>	Oxygen (liquid)	3	0	0	OX
Paraldehyde         2         3         1           Parathion         4         1         2           Pentaborane         3         3         2           Pentachlorophenol (dry)         3         0         0           Pentane         1         4         0           Pentane         2         1         0           Pentaphen         2         1         0           1-Pentene         1         4         0           Perchloric Acid         3         0         3         OX           Perchloroethylene         2         0         0         0           Petroleum, Crude         1         3         0         0         0           Petroleum, Crude         1         3         0 </td <td>Paraffin Oil</td> <td>0</td> <td>1</td> <td>0</td> <td></td>	Paraffin Oil	0	1	0	
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         0           Petroleum, Crude         1         3         0         0         0           Petroleum, Crude         1         3         0	Paraformaldehyde	2	1	0	
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         0           Petroleum, Crude         1         3         0	Paraldehyde	2	3	1	
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         0           Petroleum, Crude         1         3         0         0         0           Petroleum Ether         1         4         0	Parathion	4	1	2	
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         O           Petroleum, Crude         1         3         0         O <td>Pentaborane</td> <td>3</td> <td>3</td> <td>2</td> <td></td>	Pentaborane	3	3	2	
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         O           Petroleum, Crude         1         3         0         O <td>Pentachlorophenol (dry)</td> <td>3</td> <td>0</td> <td>0</td> <td></td>	Pentachlorophenol (dry)	3	0	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         Petroleum Ether       1       4       0         Phenol       3       2       0         Phenylacetaldehyde       1       2       0         Phenylacetate       1       2       0         Phenylacetic Acid       1       1       0         o-Phenylenediamine       -       1       0         Phenylhydrazine       3       2       0         Phenylpropyl Alcohol       0       1       0         Phosphine       3       4       1	Pentane	1	4	0	
1-Pentene       1       4       0         Perchloric Acid       3       0       3       OX         Perchloroethylene       2       0       0         Petroleum, Crude       1       3       0         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         Phospene       4       0       0         Phosphine       3       4       1	Pentanoic acid	2	1	0	
1-Pentene       1       4       0         Perchloric Acid       3       0       3       OX         Perchloroethylene       2       0       0         Petroleum, Crude       1       3       0         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         Phospene       4       0       0         Phosphine       3       4       1	Pentaphen	2	1	0	
Petroleum, Crude         1         3         0           Petroleum, Crude         1         3         0           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           Phospene         4         0         0           Phosphine         3         4         1		1	4	0	
Petroleum, Crude         1         3         0           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	Perchloric Acid	3	0	3	OX
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	Perchloroethylene	2	0	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	Petroleum, Crude	1	3	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	Petroleum Ether	1	4	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	Phenol	3	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	Phenylacetaldehyde	1	2	0	
o-Phenylenediamine       -       1       0         Phenylhydrazine       3       2       0         Phenylpropyl Alcohol       0       1       0         Phosgene       4       0       0         Phosphine       3       4       1	·	1	2	0	
o-Phenylenediamine       -       1       0         Phenylhydrazine       3       2       0         Phenylpropyl Alcohol       0       1       0         Phosgene       4       0       0         Phosphine       3       4       1	•	1		0	
Phenylhydrazine         3         2         0           Phenylpropyl Alcohol         0         1         0           Phosgene         4         0         0           Phosphine         3         4         1	•	-	1	0	
Phenylpropyl Alcohol         0         1         0           Phosgene         4         0         0           Phosphine         3         4         1		3	2	0	
Phosgene         4         0         0           Phosphine         3         4         1		0	1	0	
Phosphine 3 4 1		4	0	0	
· '		3	4	1	
		2	0	0	

Phosphorus Pentasulfide	3	1	2	₩
Phosphorus, Red	0	1	1	
Phosphorus Trichloride	3	0	2	₩
Phosphorus, White or Yellow	3	3	1	
Phosphoryl Chloride	3	0	2	₩
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	₩
Potassium Bromate	1	0	0	OX
Potassium Chlorate	2	0	0	ОХ
Potassium Cyanide	3	0	0	
Potassium Hydroxide (lye)	3	0	1	
Potassium Nitrate	1	0	0	ОХ
Potassium Permanganate	1	0	0	OX
Potassium Peroxide	3	0	2	₩, 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	
Salicylic Acid	0	1	0	
Silane	1	4	2	

Silver Nitrate	1	0	0	ОХ
Sodium	3	1	2	₩
Sodium Chlorate	1	0	2	OX
Sodium Chlorite	1	1	2	OX
Sodium Cyanide	3	0	0	O/A
Sodium Fluoride	2	0	0	
Sodium Hydride	3	3	2	₩
Sodium Hydroxide (lye)	3	0	1	
Sodium Nitrate	1	0	0	ОХ
Sodium Perchlorate	2	0	2	OX
Sodium Peroxide	3	0	2	OX, ₩
Sodium-Potassium Alloys	3	3	2	₩
Sodium Sulfide	2	1	0	
Stannic Chloride	3	0	1	
Stearic Acid	1	1	0	
Stearyl Alcohol	0	<u>'</u>	0	
Stoddard Solvent	0	2	0	
Styrene	2	3	2	
Sulfur	2	1	0	
Sulfur Chloride	2	1	2	₩
Sulfur Dioxide	2	0	0	"
Sulfuric Acid	3	0	2	₩
Tannic Acid	0	1	0	"
Terephthaloyl Chloride	3	1	0	
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	₩
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	1			+
	2	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	₩
Triethanolamine	2	1	1	
Triethylamine	2	3	0	
Triethyl Phosphate	0	1	1	
Triisobutyl Borate	3	2	1	
Trimethylamine	2	4	0	
Trimethylchlorosilane	3	3	2	₩
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	₩
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	
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	



- 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 <a href="Attachment B">Attachment B</a> "Respirator Training Record")

#### IV. FURTHER INFORMATION

KCTCS Environmental Health and Safety Safety Coordinators Gregory Bonner and Melvin Smith 300 North Main Street Versailles, KY 40383 Phone (859)246-3220 or (859)246-3357

# Appendix A

## **BCTC Respirator Training Program**

Name		ID#			
Division/Department		Job Classification			
-	Physical examination completed? Yes No If no, when scheduled? (Required prior to respirator use)				
The		mpleted respiratory protection training presented by on .			
	(trainer)	on (date)			
The	training included the following	elements:			
1. 2.	The reasons for the need of The nature, extent, and effer exposed;	f respiratory protection; ects of respiratory hazards to which one may be			
3.	<ol> <li>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.</li> </ol>				
4.	An explanation of why a pail specific respirator hazard;	rticular type of respirator has been selected for a			
5. 6. 7.	<ul> <li>An explanation of the operation, capabilities, and limitations of the respirator</li> <li>Instruction in inspecting, donning, checking the fit of, and wearing the respir</li> <li>An opportunity to handle the respirator, learn how to don and wear it properly</li> </ul>				
8.	check its seals* and wear it in a safe atmosphere;  An explanation of how maintenance and storage of the respirator is carried or				
9. 10.	Instructions in how to recognize and cope with emergency situations; and Responsibilities of the employee and employer with regard to respiratory protection.				
It is t	he responsibility of the respira	tor wearer to:			
1. 2. 3.	. Guard against damage to the respirator; and,				
Emp	loyee signature				
	ner signature esting certification by the Occu	pational 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 I	Effective Date*
			·	
*Physical exam	s and re-training are required on an	annual basis to maintain "approved use" sta	itus.	
Maintained by:				

#### **FORMS**

#### Form I

#### LAB SPECIFIC TRAINING CERTIFICATION

The 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 applicable chemicals;
- 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;
- Work practices, personal protective equipment and emergency procedures to be used to ensure protection from overexposure to the hazardous chemicals with which employees work;
- How to use personal protective equipment and limitations of personal protective equipment; and,
- How to properly use safety showers, eye wash stations and other safety equipment that is present in the laboratory space.

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.

Employee Name	Employee Signature	Lab Supervisor Signature	Date

# Form II

## CHEMICAL INVENTORY FORM

Laboratory:	
Laboratory Supervisor:	
Completed by:	Date:

Chemical/Trade Name	CAS#	Quantity
		Quantity (e.g. 7 gallons)

Chemical/Trade Name	CAS#	Quantity (e.g. 7 gallons)

**NOTE:** Maintain the original copy of this form in laboratory Chemical Hygiene Binder. Submit Photocopy to:

Bluegrass Community and Technical College - Manager, Security & Safety, 470 Cooper Drive, Oswald Building Room 202B, Lexington, KY 40506
\*\*\*\*\*\*Make duplicate copies as necessary depending on how large your inventory is.\*\*\*\*\*

## Form III

## LABORATORY SIGNAGE

# **IN CASE OF EMERGENCY CALL 911**

Department			
Laboratory Supervisor Investigator	or/Principal		
Emergency Contacts	for laboratory:		
<u>Name</u>	Office Location	Office Phone	Home Phone
Special			
Hazards/Instructions:	<u>:</u>		
Prepared by:			
Date Posted:			

**Note**: The information in this sign must be updated at least every six months and immediately in the event of any change of emergency contacts or special

hazards.

# Form IV

# Laboratory Specific - Standard Operating Procedures Form

Bluegrass Commu	inity and Techni	cal College
Please fill out and place in C	h. 3 of the Lab	oratory Safety Manual
Building: Department:	Room: PI:	
Section 1: (check one)		
□ Process □ Hazard	dous Chemical	☐ Hazard Class
Section 2: Describe process, chemi	ical hazard, or h	nazard class
Section 3: Potential Hazards		

Section 4:	Personal Protective Equipment
Section 5:	Engineering Controls
Section 6:	Special Handling and Storage Procedures
Section 7:	Spill and Accident Procedures
Section 8:	Decontamination Procedures

Sec	Section 9: Waste Disposal Procedures		
Sec	tion 10	: MSDS Location	
Sec	ction 11	: Protocol	

Borrowed from Michigan State University

## Laboratory Specific Standard Operating Procedures

## **Guidelines for Preparing SOPs**

- Section 1 Check the appropriate box indicating process, chemical hazard, or hazard Class
- Section 2 Describe process, hazardous chemical, or hazard class

Process- Describe the process and list all chemicals involved Hazardous Chemical- List the chemical name, common name and any other abbreviations

Hazard class- Describe the hazards associated with a particular group of similar chemicals, list the ones used in the lab

• Section 3 Potential Hazards

Describe both physical and health hazards associated with process, hazard, or class

Section 4 PPE

Indicate the level of PPE needed including (but not limited to) gloves, goggles, face shields, aprons, and lab coats

Section 5 Engineering Controls

List the engineering controls used to prevent and reduce exposure Example Fume hoods

Section 6 Special Handling and Storage Procedures

Indicate specific areas used for storage, including storage compatibility. List policies regarding access and dating procedures, such as dating peroxide formers

Section 7 Spill and Accident Procedures

List who and how spills will be handled. Indicate where emergency equipment is located and the location of emergency numbers

Section 8 Decontamination Procedures

List procedures including cleaning solutions and solvents that may be used

Section 9 Waste Disposal

Indicate which substances are required to be picked up by hazardous waste. ensure all hazardous waste is appropriately labeled "Hazardous Waste" and has a ticket on it.

Section 10 MSDS Location

Indicate the location of all MSDS and any other chemical or safety manuals In the lab

• Section 11 Protocol

List specific procedures for working with this particular process, chemical hazard, or hazard class

## Resources:

The BCTC Chemical Hygiene Plan was adapted from the University of Kentucky's Model Chemical Hygiene Plan.

OSHA Fact Sheet: Hazardous Chemicals in Laboratories, U.S. Department of Labor, OSHA, 2002

## CRC Handbook of Laboratory Safety, 3rd edition.

Prudent Practices for Handling Hazardous Chemicals in Laboratories, 1981