

## CHEMICAL HYGIENE PLAN

Chemistry Department  
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Harrisonburg, VA 22807

### PURPOSE

The purpose of the Chemical Hygiene Plan (CHP) is to establish procedures, equipment, personal protective equipment and work practices that will protect employees from health hazards presented by hazardous chemicals used in their particular workplace. This plan is intended to comply with OSHA Standard 29 CFR 1910.1450. A copy of the standard is attached to this plan (Attachment 1).

### SCOPE

This plan applies to all JMU Chemistry Department employees who are engaged in laboratory work that may expose them to hazardous chemicals.

### DEFINITIONS

**Action Level:** a concentration designated in 29 CFR 1910 for a specific substance, calculated as an eight-hour time-weighted average, which initiated certain required activities such as exposure monitoring and medical surveillance.

**Chemical Hygiene Officer:** 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.

**Designated Area:** area that may be used for work with "select carcinogens", reproductive toxins or substances that 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 hood.

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

**Glove Box:** a device for providing an inert atmosphere in which to work with air-sensitive chemicals. This application is contrary to the typical application of glove boxes, in which the device is used to handle dangerous samples or biohazards. When used in this application, the exhaust air from the glove box should be vented through scrubbers or other treatment before being released into the regular exhaust system.

**Hazardous Chemical:** chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute and chronic health effects may occur in exposed employees. This includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, and agents which damage the lungs, skin, eyes, or mucous membranes.

**High acute toxicity chemical:** chemical that may be fatal or cause damage to target organs as a result of a single exposure or exposures of short duration.

**Laboratory:** workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

**Laboratory Scale:** work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily manipulated by one person.

**Laboratory-type Hood:** five-sided enclosure with a moveable sash or fixed partial sash enclosed on the remaining side. It is constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory. It allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the body other than hands and arms. Walk-in hoods with adjustable sashes meet the definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and no work is done inside the enclosure during the release of airborne hazardous chemicals.

**Reproductive Toxin:** chemicals that affect human reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

**Select Carcinogen:** substance that meets one of the following criteria:

- (1) regulated by OSHA as a carcinogen.
- (2) listed under the category "known to be a carcinogen" in the Annual Report on Carcinogens published by the National Toxicology Program (NTP).
- (3) listed under Group 1 (carcinogenic to humans) by the International Agency for Research on Cancer Monographs (IARC).
- (4) listed in either Group 2A or 2B in IARC or under the category "reasonably anticipated to be carcinogens" by the NTP and causes statistically significant tumor incidence in experimental animals.

## **RESPONSIBILITIES**

### **Department Head:**

Ultimately responsible for chemical hygiene for the department and must, with other administrators, provide continuing support for departmental chemical hygiene.

Appoints the Chemical Hygiene Officer.

### **Chemical Hygiene Officer (CHO):**

Works with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.

Maintains volumes of current MSDS sheets for the entire Chemistry Department chemical inventory in a centrally accessible location.

Conducts monthly checks of safety equipment in all teaching and research labs (Attachment 5 & 6).

Seeks ways to improve the chemical hygiene plan.

**Departmental Safety Committee:**

Works with the chemical hygiene officer, administrators, and other employees to develop and implement appropriate chemical hygiene policies and practices.

**Laboratory Supervisors/Laboratory Instructors/Research Advisers:**

Responsible overall for chemical hygiene in their particular laboratory.

Ensures that laboratory workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided.

Knows the current legal requirements for regulated substances used in their laboratory.

Determines the required levels of protective apparel and equipment.

Ensures that the facilities and proper training for the use of hazardous materials being ordered/used in the laboratory are adequate.

**Laboratory Workers:**

Responsible for planning and conducting all operations in accordance with the departmental chemical hygiene plan.

Develops good personal chemical hygiene habits.

**PERMISSIBLE EXPOSURE LIMITS**

For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits (PEL) specified in 29 CFR part 1910, Z tables (Attachment 2).

**EMPLOYEE EXPOSURE DETERMINATION**

**Initial Monitoring:** Initial employee exposure monitoring should be conducted when there is reason to believe that exposure levels for OSHA-regulated substances routinely exceed the action level (or in the absence of an action level, the PEL).

**Periodic Monitoring:** If the initial monitoring discloses employee exposure over the action level (or PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

**Termination of Monitoring:** Monitoring may be terminated in accordance with the relevant standard.

**Employee Notification of Results:** The employer shall, within 15 working days after the receipt of

any monitoring results, notify the employee of these results in writing by posting results in the departmental office.

**Records:** Records of exposure monitoring results should be maintained by employer for 30 years and be accessible to employees or their representatives.

### **CONTROL MEASURES AND EQUIPMENT**

**Laboratory Design:** Each laboratory should have:

- (1) An appropriate general ventilation system with air intakes and exhausts so as to avoid the intake of contaminated air that exceeds PEL/TLV levels.
- (2) Adequate, well-ventilated storage areas.
- (3) Laboratory hoods and sinks.
- (4) Access to safety equipment including eyewash fountains, safety showers, and fire extinguishers. Respiratory protection, a fire alarm and telephone for emergency use should be available nearby.
- (5) Arrangements for waste storage and disposal.

#### **Ventilation:**

Laboratory ventilation should:

- (1) provide a source of air for breathing and for input to local ventilation devices,
- (2) not be relied on for protection from toxic substances released into the laboratory, and
- (3) provide four to 12 room changes per hour.

Laboratory-type hoods should:

- (1) be used for work with hazardous chemicals, especially toxic chemicals that have low air concentration limits, or that have high vapor pressures,
- (2) provide 2.5 linear feet of space per person for every 2 workers that spend most of their time working directly with hazardous chemicals,
- (3) provide a hood face velocity of 80-120 fpm,
- (4) not be used as storage areas for chemicals, apparatus or other materials,
- (5) not to be used to evaporate solvents (except small quantities of volatile materials)

Work inside the hood should be conducted at least six inches from the front edge of the hood.

Hood sashes should be lowered at all times except when necessary to raise them to adjust the apparatus inside the hood.

The hood fan should be kept "on" whenever a chemical is inside the hood, whether or not any work is being done in the hood.

Do not allow solid objects to enter the hood's exhaust duct. Hood ducts and fans should be inspected semi-annually by maintenance personnel at frequent intervals to be sure they are clean and clear of obstructions.

Fume hoods should be maintained in satisfactory operating condition at all times. Performance levels

should be monitored annually or whenever a change in local ventilation devices is made. Any hood with inadequate performance should be repaired immediately.

Canopy hoods and snorkels should be provided as needed. Each canopy and snorkel should have a separate duct.

Exhaust air from vacuum pumps and glove boxes should be vented directly into the building exhaust system.

Cold rooms should have provisions for rapid escape in the event of electrical failure.

**Safety Equipment:**

All laboratories should be equipped with eyewash fountains and safety showers. These should be located so that they can be reached from any point in the laboratory.

Access to eyewash fountains and safety showers should not be restricted or blocked in any way.

Fire extinguishers should be type tri-class ABC and should comply with the guidelines set forth in the University Comprehensive Safety Plan.

**STANDARD OPERATING PROCEDURES**

**General Safety Rules:**

Never work alone in a laboratory or chemical storage area.

Minimize all chemical exposures.

Appropriate eye protection should be worn at all times.

Skin contact with chemicals should be avoided.

Do not smell or taste chemicals.

Use protective safety equipment to reduce potential exposure to hazardous chemicals.

Do not run in the laboratory.

Avoid distracting or startling other workers. Horseplay should be avoided.

Prior approval should be obtained from the supervisor/instructor whenever a new laboratory procedure, test or experiment is carried out; or there is a change in an existing procedure, test or experiment.

All laboratory workers should know:

- (1) the hazards of a chemical as stated in the MSDS and other appropriate references.
- (2) the location and proper use of emergency equipment.

- (3) how and where to properly store chemicals when not in use.
- (4) the proper method for transporting chemicals within the department.
- (5) the appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures and proper waste disposal.

**Personal Hygiene Guidelines:**

Do not eat, drink, smoke, chew gum or apply cosmetics in the laboratory.

Avoid inhalation of chemicals. Never sniff chemicals directly; always waft the odors to your nose using your hand.

Do not pipet by mouth. Use a pipet bulb or other appropriate device.

Wash promptly after a chemical has contacted the skin.

Wash hands and other areas of exposed skin before leaving the laboratory.

Do not store or handle food or beverages in laboratory areas (including refrigerators used for chemical storage).

**Protective Clothing and Equipment:**

Eye protection must be worn at all times. Eye protection should meet the requirements of ANSI Z87.1.

When working with hazardous chemicals, wear gloves made of material known to be resistant to permeation by that chemical. A table of Chemical Resistance of Common Glove Materials is attached to the CHP (Attachment 3). Inspect gloves before each use, wash them before removal and replace them periodically.

A laboratory coat or apron should be worn when working with hazardous chemicals.

Full foot coverage is required at all times.

Where the use of respirators is necessary to maintain exposure below PEL's, the Chemistry Department shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of ANSI Z88.2 (Attachment 4).

Confine long hair and loose clothing.

**Personal Housekeeping:**

Keep work area clean and uncluttered.

Properly label and store all chemicals and equipment. All chemicals (including solutions and chemicals transferred from their original containers) should be labeled with their names, concentrations and hazards.

Clean up work area on completion of work or at the end of the day.

Do not block access to emergency equipment or exits.

All chemicals and wastes should be placed in their proper storage area at the end of the day.

All working surfaces and floors should be cleaned regularly.

**Glassware:**

Do not use broken, chipped, starred or cracked glassware.

Clean all glassware after use.

Do not pick up broken glassware with bare hands. Use gloves or sweep it up. Deposit broken glass in a special "Broken Glass" box for disposal.

Handle hot glassware with proper size and type of tongs or hot mitts.

**Syringes:**

Syringes are intended for dispensing reactive and/or hazardous chemicals that cannot be safely handled in any other manner. Syringes and needles will be stored in a central, secure location and will be issued to departmental faculty, staff, and students as needed by the Chemical Hygiene Officer. Following use, syringes are to be placed intact in a puncture-resistant, leak-proof container specified for sharps disposal.

**Vacuum/Pressure Equipment:**

Use a safety shield whenever an implosion might occur.

Shield or wrap Dewar flasks or other evacuated glass apparatus in case implosion occurs.

Relieve vacuum in all parts of system before opening apparatus. Relieve vacuum slowly. Avoid sudden pressure changes that could cause breakage or spattering of contents. Do not relieve vacuum on heated apparatus until apparatus has cooled.

Use steam or heating mantles to heat vacuum distillation flasks.

Do not apply pressure to glassware.

**Compressed Gases:**

Prior to delivery to the site of use, all compressed gas cylinders will be kept in a locked tank storage facility where cylinders will be secured upright.

Store and transport compressed gas cylinders with the safety caps on.

Transport large cylinders on a hand truck to which the cylinder is secured.

Cylinders should be securely clamped to a firm support with an appropriate cylinder clamp or chains.

Always use a reducing valve.

Never lubricate, modify or tamper with a cylinder valve.

Do not heat cylinders or store near a heat source.

### **CHEMICAL-SPECIFIC SAFETY PROCEDURES**

#### **Reproductive Toxins:**

Reproductive toxins should be handled only in a hood, using appropriate protective apparel (especially suitable gloves) to prevent skin contact.

Reproductive toxins should be properly labeled and stored in well-ventilated areas in unbreakable secondary containers, if possible.

Notify supervisor/instructor of all incidents of exposure or spills.

**High Acute Toxicity Chemicals** (Supplemental rules to be followed in addition to those mentioned above):

Use and store these chemicals in areas of restricted access that are posted with special warning signs. These areas should include a hood (with a face velocity of at least 60 linear feet/minute) or other containment device for procedures that may generate aerosols or vapors containing the substance.

Use gloves, long sleeves and other protective apparel as needed to avoid skin contact. Always wash hands after working with these chemicals.

Maintain records of the amounts of these materials on hand, amounts used and the names of the workers involved.

Assure that at least two people are present at all times if a compound in use is highly toxic or of unknown toxicity.

Be prepared for accidents and spills. Store breakable containers of these substances in chemically resistant trays. Cover work and storage surfaces with removable, absorbent, plastic backed paper.

If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment.

Thoroughly decontaminate or incinerate contaminated clothing or shoes. If possibly, chemically

decontaminate by chemical conversion.

Store contaminated waste in closed, suitably labeled, secondary containers (for liquids, plastic bottles half-filled with vermiculite).

**Select Carcinogens** (Further supplemental rules to be followed, in addition to all these mentioned above):

Conduct all transfers and work with these substances in a designated 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 substance being used and necessary precautions. The designated area should be conspicuously marked with warning and restricted access signs.

Prepare a plan for use and disposal of these materials and obtain approval of the appropriate lab supervisor or instructor.

All containers of these substances should be properly labeled with identity and warning labels.

Store containers of these chemicals in ventilated, limited access areas in appropriately labeled, unbreakable, chemically resistant, secondary containers.

If using toxicologically significant quantities of a select carcinogen on a regular basis (3 times per week or more), consult a physician concerning desirability of regular medical surveillance.

Use a wet mop instead of dry sweeping if the toxic substance was a dry powder.

When using a positive pressure glove box, thoroughly check for leaks before each use. Trap exit gases or filter them through a HEPA filter and then release into the hood.

Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in secondary container under the supervision of the laboratory supervisor/instructor.

Decontaminate any equipment, including glassware, in the hood before removing them from the controlled area. Decontaminate the controlled area before resuming normal work there.

On leaving the area, remove protective apparel and wash hands, forearms, face and neck.

**Flammables:**

Never heat flammable liquids with an open flame or hot plate. Use a heating mantle, steam bath or hot water bath.

Never use or store flammable chemicals near any source of ignition, spark or open flame.

Handle solvents in an exhaust hood or a well-ventilated area.

Ground containers when transferring from one container to another if the potential for sparking

exists.

Do not store large quantities of flammable reagents in the laboratory.

Store flammable liquids in appropriate safety cabinets and/or safety cans.

## **EMERGENCY PROCEDURES**

### **Accidents:**

Eye contact: promptly flush eyes with water for 15 minutes and seek medical attention.

Skin contact: promptly remove any contaminated clothing and flush area with water for 15 minutes. Seek medical attention if necessary.

If medical attention is needed, notify campus security (86911) to call the rescue squad.

Report all accidents/injuries to your supervisor or the CHO.

### **Fires:**

For small fires, try to suffocate the fire or use a fire extinguisher.

In cases of large fires, evacuate the area and activate the manual pull alarm. Call campus security (86911) to report the fire. Evacuate the building.

### **Spills:**

Promptly clean up all chemical spills and properly dispose of spilled chemical and cleanup material. Consult Hazards in the Chemical Laboratory or Prudent Practices in the Laboratory: Handling and Disposal of Chemicals for specific cleanup recommendations.

For large chemical spills of volatile or toxic material, immediately evacuate the area. Call campus security (86911) to report the spill.

### **Evacuation:**

When the building fire alarm sounds, turn off all sources of heat, electricity and gas, and stabilize any reaction processes. Evacuate the building immediately.

Evacuate by the stairwell, not the elevator.

Laboratory worker should become familiar with evacuation routes before an emergency occurs. Supervisors/instructors/research advisers should arrange a place to meet with students in case of emergency evacuation. After evacuation, supervisors/instructors/research advisers should meet at the designated place and make sure all students are accounted for.

## **CHEMICAL PROCUREMENT, DISTRIBUTION AND STORAGE**

### **Procurement:**

Before a chemical is ordered, the person who will use it should know the proper handling, storage and disposal procedures for the chemical.

No container should be accepted without an adequate identifying label.

All substances should be received in the Stockroom.

**Distribution:** Chemicals should be put in a tray and transported via the dumbwaiter or placed in trays on a cart and transported via the elevator.

**Storage:**

Hazardous chemicals should be stored in an area with proper ventilation.

Chemicals that are highly toxic should be in unbreakable secondary containers.

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

Do not store incompatible reagents together.

The chemical storeroom should:

- (1) not be used as preparation or repackaging areas.
- (2) be open during normal working hours.
- (3) be controlled by a designated individual.
- (4) have a designated and properly labeled area for the storage of waste awaiting disposal.

**Laboratory Storage:**

The amount of chemicals stored in laboratory areas should be small as possible.

Chemicals should not be stored on bench tops or hoods in order to avoid inadvertent spills or breakage.

Exposure of chemicals to heat or direct sunlight should be avoided.

Unneeded items should be discarded or returned to chemical storeroom.

**WASTE DISPOSAL**

See Hazards in the Chemical Laboratory or Prudent Practices for Handling Hazardous Chemicals in Laboratories for specific disposal procedures.

The chemistry department will periodically contract with a chemical disposal company to dispose of unwanted and waste chemicals.

Waste for "commercial" disposal should be put into a suitable container (preferably glass, if possible). A departmental waste label should be filled out and attached to the container. The waste container

and duplicate copy of the label should be left in the stockroom for the CHO.

Before a worker's employment ends, chemicals for which that person was responsible should be discarded or returned to the chemical storeroom.

### **RECORDS**

The University Safety Engineer shall maintain an accurate record of any measurements taken to monitor employee exposures and any medical consultations/examinations including tests or written opinions required by this plan. He will assure that such records are kept, transferred and made available in accordance with 29 CFR 1910.20.

### **EMPLOYEE INFORMATION AND TRAINING**

**Information:** Each laboratory supervisor, instructor or research adviser is responsible for ensuring that the following information is communicated and made available to their employees:

- (1) the contents of the OSHA Laboratory Standard (29 CFR 1910.1450) and its appendices. (Attachment 1).
- (2) the location and availability of the department's CHP.
- (3) the permissible exposure limits for OSHA-regulated substances (or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard) used in the work area.
- (4) signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
- (5) location and availability of known reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals. Reference materials may include, but not be limited to, material safety data sheets received from chemical suppliers.

**Training:** Each laboratory supervisor, instructor or research adviser is responsible for ensuring that laboratory employees receive adequate training. This training should include the following:

- (1) methods and observations that may be used to detect the presence or release of a hazardous chemical (such as employee exposure monitoring, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.).
- (2) physical and health hazards of chemicals in the work area.
- (3) measures employees can take to protect themselves from such hazards, including specific procedures that have been implemented to protect laboratory employees from exposure to hazard chemicals. These include appropriate work practices, emergency response procedures and personal protective equipment to be used.
- (4) applicable details of the CHP.

Information and training 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 individual laboratory supervisor, instructor or research adviser may determine the frequency of refresher information and training.

### **MEDICAL CONSULTATION AND MEDICAL EXAMINATIONS**

Laboratory employees who work with hazardous chemicals should be given an opportunity to receive medical attention, including any follow-up examination that the examining physician determines to be necessary, under the following circumstances:

- (1) 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.
- (2) Where exposure monitoring reveals an exposure level routinely above the action level (or PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirement, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
- (3) Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, 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.

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.

The employer should provide the following information to the physician:

- (1) identity of the hazardous chemical(s) to which the employee may have been exposed.
- (2) description of the conditions under which the exposure occurred including quantitative exposure data, if available.
- (3) description of the signs and symptoms of exposure that the employee is experiencing, if any.

For medical consultations required under OSHA Laboratory Standard 29 CFR 1910.1450, the employer shall obtain a written opinion from the examining physician which should include the following:

- (1) any recommendation for further medical follow-up.
- (2) results of the medical examination and any associated tests.
- (3) any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
- (4) 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.

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

### **HAZARD IDENTIFICATION**

Stockroom personnel who unpack and distribute incoming chemicals should ensure that labels on containers of hazardous chemicals are not removed or defaced.

The Chemistry Department will maintain material safety data sheets that accompany incoming

shipments of hazardous chemicals in the stockroom and make the MSDS readily accessible to employees.

Laboratory-Generated Chemical Substances:

- (1) If the composition of a chemical produced exclusively for the laboratory's use is known, available hazard information will be provided to employees exposed to the substance.
- (2) If the chemical produced is a byproduct whose composition is not known, the substance should be assumed to be hazardous and handled according to the CHP.
- (3) If the chemical substance is produced for another user outside of the laboratory, the laboratory shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material safety data sheets and labeling.

## **REFERENCES**

Muir, G.D. ed. Hazards in the Chemical Laboratory, London: The Chemical Society, 1977.

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

National Research Council, Prudent Practices in the Laboratory, Washington: National Academy Press, 1995.