LABORATORY CHEMICAL HYGIENE PLAN

OFFICE OF SAFETY AND EMERGENCY MANAGEMENT

NORTHERN KENTUCKY UNIVERSITY

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NORTHERN KENTUCKY UNIVERSITY

POLICY LINK: **CHEMICAL SAFETY POLICY**
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TITLE: **LABORATORY CHEMICAL HYGIENE PLAN**

I. PURPOSE

The purpose of the Laboratory Chemical Hygiene Plan (LCHP) is to develop and implement a program which defines the minimum standards necessary to avoid exposures to hazardous chemicals through eye, skin, inhalation, and/or ingestion in the workplace according to Kentucky Occupational Safety and Health Standards, 803 Kentucky Administrative Regulations Chapter 2 (803KAR2).

II. SCOPE AND APPLICATION

The LCHP applies to all employees of Northern Kentucky University who handle or use hazardous chemicals in a laboratory.

III. RESPONSIBILITIES

A. Each Department Chair, in collaboration with department laboratory supervisors, is responsible for the overall chemical hygiene program in his/her department. The chair shall be responsible for:

- Ensuring experiments/analysis conducted under his/her direction is such that the task does not pose an undue risk to the person performing the work.
- Ensuring new employees in his/her area are informed of the location of all emergency equipment, and the specific safety rules and requirements of the LCHP for that lab.
- Implementing the LCHP in their laboratories.
- Ensuring training is performed within the required time frame and is responsible for all record keeping associated with the LCHP.
- Assigning a Chemical Hygiene Officer or Officers (CHO).

B. Laboratory employees shall comply with the provisions of the LCHP and with any safety instructions received from their immediate supervisor.

C. Safety and Emergency Management will coordinate with laboratory supervisors to ensure that a viable hygiene plan is in effect in all chemical laboratories and assist with the coordination of training programs.

IV. STANDARD OPERATING PROCEDURES

A. The following procedures will be followed when working in the laboratory:

- Awareness is the most fundamental rule of chemical safety. All faculty and staff working in or around laboratories should remain constantly aware of:
  - The chemical hazards as defined in the Safety Data Sheets (SDSs) or other appropriate references.
  - Appropriate safeguards for using that chemical including personal protective equipment (PPE).
  - Location and proper use of emergency equipment (i.e. deluge shower, eye wash fountain, fire extinguisher, natural gas shut off valve, etc.).
  - How and where to store chemicals when not in use.
  - Proper personal hygiene practices.

    - Appropriate procedures for emergencies including evacuation routes, spill cleanup procedures, natural gas leak, and proper waste disposal.
- Working alone in the laboratory is strongly discouraged, and permission to work alone is considered based on the based on the following guidelines:
    - Students are never allowed to work unsupervised in teaching laboratories but may work if a laboratory supervisor is present in a physically connected laboratory space.
    - Personnel are allowed to work in research laboratories alone providing their laboratory supervisor has approved the activity following consultation and other individuals are present in a physically connected laboratory space.
- Personal hygiene rules shall be followed:
    - Wash skin promptly if contact is made with any chemical.
    - Wear appropriate personal protective equipment at all times.
    - Avoid inhalation of chemicals. Do not "sniff" test chemicals.
    - DO NOT mouth pipette. Use a suction bulb.
    - Always wash hands before leaving the lab.
    - Do not eat or drink in the laboratory unless in a designated food area.
    - Do not wear contact lenses (if possible).
- Protective Clothing and Equipment (PPE) must be utilized.
    - Appropriate PPE shall be utilized based on the chemical or physical hazards of the work being performed and the nature of the work area. Recommendations listed below.
    - Long pants and long-sleeved lab coats are recommended.
    - Rubber aprons or coats should be worn when working with highly corrosive liquids.
    - Personal clothes worn in labs should be washed separate from all other clothes.
    - Gloves must be made of a material compatible with the chemicals used.
    - Information on the type of glove to use is found in the SDSs.
    - Safety glasses must be worn when working with solid materials such as glass.
    - Safety goggles that meet ANSI Z87.l-l989 standard must be worn when working with hazardous materials.
    - Goggles and a face shield should be used during acutely hazardous procedures.
    - No open toed shoes should be worn in the lab.
- Good housekeeping practices shall be followed at all times:
    - Keep all aisles clear of obstructions.
    - Keep all work areas and work benches clear of clutter and obstructions.
    - Clean working surfaces regularly.
    - Do not block access to emergency equipment such as eye wash station and emergency showers.
    - Transport chemicals on carts, in tubs, or by caddies.
    - Always use the freight elevator to transport chemicals between floors.
    - Ensure all chemicals are labeled in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200).
    - Dispose of chemical waste regularly.
    - Small chemical spills should be cleaned up by laboratory personnel immediately if safe to do so.
    - For all other spills or uncontrolled reactions, immediately evacuate the area and notify University Police (911 or x7777), the department chair, and laboratory supervisor.
    - Electrical heating devices and stirrers must be checked for frayed electrical cords and malfunctioning switches before using them.
    - Use caution when working with volatile chemicals; keep them away from open heat

sources that could cause a fire or explosion to occur.
    - Experiments that must run continuously and are unattended for several hours each day must be approved by the appropriate department chair.
- All experiments using highly toxic materials, carcinogens, reproductive toxins, poisons, and flammable chemicals shall be performed in a fume hood, using other containment devices or engineering controls as required.
- In the event of a chemical spill or uncontrolled reaction, immediately evacuate the area and contact University Police (911), the department chair, and laboratory supervisor.

V. CHEMICAL PROCUREMENT AND STORAGE

A. Copies of SDS's which are received must be available to the User at all times.
B. Computer access to SDS's is permissible as long as it is accessible to employees.
C. No container shall be accepted without a legible identifying label.
D. Storage areas shall allow for segregated storage of non-compatible chemicals (i.e. acids, flammables, corrosives, cyanides, peroxides, etc.).
E. Chemicals shall be stored with appropriate safety measures (i.e. secondary containment) according to the class of the chemical.
F. Each person who orders chemicals shall ensure an SDS is available before using the chemical, and labels on incoming containers are legible and shall not be removed or defaced.
G. Stored containers should be inspected at least annually for replacement, deterioration, label integrity, and container integrity.
H. Chemicals should be brought to the work area as needed so as to minimize the quantities of chemicals stored in individual labs.
I. Chemicals may be stored in laboratories only if being used for a current project. Once the project is complete, chemicals must be returned to the control room.
J. Chemical quantities stored in laboratories may not exceed acceptable regulatory limits. (i.e. flammable liquids stored outside of the control room are limited to 5 gallons per 100 square feet of laboratory space [NFPA 45]).
K. Storage of chemicals in lab hoods is to be discouraged. If it is deemed necessary, provisions should be made to ensure the storage will not adversely impact the overall performance of the hood.
L. All chemicals that have been removed from DOT shipping containers must be transported to the laboratories in a safe manner appropriate to the class of chemical, which may require bottle carriers or laboratory carts.
M. All gas cylinders shall be transported on cylinder hand trucks and be properly clamped when in use. The kick-spin method will not be used to move gas cylinders.
N. Always use a freight elevator when available to transport chemicals between floors.

VI. HAZARD IDENTIFICATION

A. MATERIALS PURCHASED FOR USE IN LABORATORIES
- It is the supplier's responsibility to determine the hazards of materials and to communicate these hazards, as well as recommended safe handling practices, in the form of labels and SDS's for the material.
- Safety Data Sheets (SDSs) must be available for all materials purchased for use in the laboratory. These must be accessible to employees at all times.
- Labels on incoming containers of materials shall not be damaged, removed or defaced.
- Designated areas for hazardous materials storage will be established by the laboratory supervisor and shall be posted so as to be readily identifiable using such means as signs,

barricade tape or any other visible means of posting.

B. MATERIALS PRODUCED IN LABORATORIES

- The laboratory supervisor shall determine the hazards of all compounds created in a lab.
- Proper training of all employees within the lab shall be conducted and documented by the laboratory supervisor.
- If the hazards of the compound cannot be determined then the hazards of the chemicals used in the preparation of the compound shall be used (i.e. similar structures and functional groups have similar hazards).
- Compounds which are generated in the lab for exclusive use in the lab must be labeled with the identity of the compound to allow reference to any available safety information.

VII. EMPLOYEE INFORMATION AND TRAINING

A. Employees working in laboratories will be informed of the OSHA "Occupational Exposures to Hazardous Chemicals in Laboratories" standard (29 CFR l9l0.l450 promulgated on May l, l990) and 803KAR2.

- Copies of the Chemical Hygiene Plan shall be available to all employees.
- Each department is responsible for providing access to Safety Data Sheets (SDSs) for all chemicals to all personnel.
- Employees must be aware of the Permissible Exposure Level (PEL) and the Threshold Limit Value (TLV) of each chemical they are working with so as to prevent over-exposure to the chemical(s). This information is contained in the SDS.
- Employees shall be informed of 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.).
- Employees must know the physical and health hazards of the chemicals they are working with in the laboratory. This information is contained in the SDS and may be found on some labels. No one should use any chemical until they know what hazards they may encounter.
- Other reference materials on the hazards, safe handling, storage, and disposal of hazardous chemicals are available through Safety and Emergency Management (Administrative Center 724).
- Employees shall know the location and proper operations of eyewash stations and emergency showers.
- Employees shall know the location of the nearest exit and fire alarm pull station.
- In the event of a fire employees shall evacuate the area and activate the fire alarm.
- Hazardous waste generated in laboratories shall be disposed of according to the Hazardous Waste Manual.

B. Employees working in laboratories will be told about specific safety procedures by the laboratory supervisor.

- Detailed information about safety practices shall be listed in laboratory and departmental safety manuals.
- Department safety manuals shall be made available to all employees.
- Laboratory Employees shall receive lab specific training that is conducted and documented by their laboratory supervisor in addition to general safety training.

C. Employees shall receive initial training on the hazards associated with their work in the laboratory to include the LCHP and other safety rules and regulations.

- Every laboratory employee must read the LCHP prior to beginning laboratory work. A written record stating each worker has reviewed and understands the LCHP and safety related policies and procedures must be kept by the laboratory supervisor or related department.
- Each laboratory worker shall complete both general and laboratory specific training and written records must be kept by the laboratory supervisor or related department.
- Employees shall receive annual retraining.

VIII. LABORATORY HOOD OPERATION

A. Laboratory hoods shall be tested annually by Safety and Emergency Management for face velocity using accepted testing techniques (i.e.: hotwire and/or smoke tubes) to ensure adequate operation.

B. Testing should also be performed when mechanical changes are made to the hood or changes are made to the system such as the addition of more hoods.

C. Except when in use, hoods should be kept closed.

D. Storage shall be minimized in fume hoods.

E. Where storage in a fume hood is considered the best practice for a laboratory, the stored container must be positioned in the hood so as to not adversely affect the overall ventilation of the hood.

F. Hoods shall not be operated with sashes in the fully raised position as this will negatively affect performance of the hood.

G. Bottles, equipment, etc., should be kept at least 10cm (4 in.) back from the hood sash.

H. Employees using a hood should check the air flow before conducting an experiment.

IX. NATURAL GAS SAFETY

If you smell natural gas in the area DO NOT turn on lights, cell phones, or any other electronic devices. Turn the natural gas lever to the shut off position if safe to do so and immediately evacuate the area. Call University Police (859-572-7777) or 911 after you have safely evacuated the area. Contact the department chair and laboratory supervisor as soon as possible.

X. EXTREMELY HAZARDOUS MATERIALS

A. Provisions shall be made for additional employee protection when work with particularly hazardous substances takes place. These include "select carcinogens," (see *Report on Carcinogens, Fourteeneth Edition*) reproductive toxins and substances which have a high degree of acute toxicity. The following provisions must be included:

- Establishment of a designated area.
- Use of containment devices such as laboratory chemical hoods or glove boxes.
- Procedures for safe removal of contaminated waste; and
- Decontamination procedures (Standard Operating Procedures (SOPs)) are required before work is to begin.

B. In addition to the general safety guidelines mentioned 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.

- The quantities of these chemicals used and stored in the laboratory must be minimized, as should their concentrations in solution or mixtures.
- Work with genotoxins, reproductive toxins, and acutely toxic chemicals must be performed within a certified functioning 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 the ventilation systems may require scrubbing, or other treatment, before being released into the atmosphere.) In all cases, work with these types of chemicals must be done in such a manner that the OSHA permissible exposure limits or similar standards are not exceeded.

- 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. These sources include but are not limited to the respective Department Chair, Laboratory Supervisor, Safety Data Sheets, and the Safety and Emergency Management Office. Notify supervisors of all incidents of exposure or spills; consult a qualified 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 the laboratory personnel at intervals determined by the Laboratory Supervisor. The interval of evaluating systems may vary from weekly to annually depending upon the frequency of usage, quantities employed and level of hazard.
- Each laboratory utilizing these substances must designate an area for this purpose and must sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory, an area of the laboratory or a device such as a laboratory chemical hood or glove box. The designated area should be marked with a DANGER, specific agent, AUTHORIZED PERSONNEL ONLY or comparable warning sign.
- All laboratory workers who work in a laboratory which has an area designated for use with genotoxins, reproductive toxins, and acutely toxic chemicals must be trained about the deleterious effects of these substances as well as signs and symptoms regarding exposure to these substances, whether or not they actually work with the substance themselves. Training to ensure the safe handling and storage of these substances is required for those who use these materials. This training is the responsibility of the Laboratory Supervisor and must be done prior to the use of any of these materials.
- All training shall be documented and repeated at least annually.
- Laboratory Workers working with these chemicals must have access to appropriate personal protective equipment and clothing (available at no expense to the workers) and must be trained on how to properly utilize the safety equipment.
- Detection equipment may be required in laboratories where chemicals (especially poisonous gases) with a high degree of acute toxicity are utilized.
- For special disposal information, contact Safety and Emergency Management (x6528).

- The designated working area must be thoroughly and appropriately decontaminated and cleaned at regular intervals determined by the Laboratory Supervisor. The interval may be as short as one day or as long as six months depending upon the frequency of usage and level of hazard.
- Special precautions to avoid release and exposure to highly toxic chemicals, genotoxins, and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained. Gases should have properly functioning valves, check valves, regulators, containment 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.

XI. PRIOR APPROVAL REQUIREMENTS

The responsibility for approval of the acquisition and use of toxic biological agents and any recombinant DNA rests with the Institutional Biosafety Committee. Some materials including toxic compressed gases, radioactive materials, and certain recombinant DNA, and biohazards require prior internal (Northern Kentucky University) and/or external approval at various levels. Please contact Safety and Emergency Management for additional information regarding prior approval.

XII. MEDICAL CONSULTATION/EXAMINATION

A. Northern Kentucky University will make available physical exams/medical consultation for employees working with hazardous chemicals when:
- Employee develops signs/symptoms of chemical exposure.
- Upon request.
- If monitoring reveals exposure above the action level (or in the absence of the action level, the PEL).
- The occurrence of a spill/leak/explosion would cause likelihood of a hazardous chemical exposure.

B. All medical exams/consultation will be performed under the direct supervision of a licensed physician.

C. The following information shall be provided to the physician:
- The identity of the chemical.
- Description of incident that caused exposure and quantity if available.
- Description of sign/symptoms employee is experiencing.

D. The physician shall provide a written opinion which includes:

- Any recommendation for further medical follow-up;

E. The results of the medical examination and any associated tests;
- 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.
- 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.

XIII. RECORD KEEPING

A. The Office of Human Resources 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.

B. Monitoring and Medical records must be kept, transferred, and made available in accordance with Kentucky Department of Labor requirements.

XIV. LABORATORY DESIGN CRITERIA

In the planning for additional laboratory facilities, criteria for location must be included for placement of showers and eyewash stations.

XV. LABORATORY SAFETY EQUIPMENT

A. Eyewash stations shall be tested and flushed on a regular basis.

B. Shower stations shall be tested and flushed on a regular basis.

C. All laboratory equipment shall be inspected before use for possible safety hazards (i.e. frayed cords on hot plates).

APPENDIX A

GENERAL LABORATORY SAFETY RULES and BEST PRACTICES

A. Know all emergency procedures and how to use emergency equipment.

B. Use personal protective equipment as required.

C. Eating and drinking in laboratories is strictly forbidden unless a food safe area is designated and clearly marked.

D. Smoking in laboratories is prohibited.

E. All containers must be labeled and missing or illegible labels should be replaced.

F. Containers holding non-hazardous substances such as water must also be labeled to avoid confusion with other clear and colorless chemicals.

G. Horseplay is strictly forbidden.

H. Appropriate eye protection is mandatory in all laboratory areas.

I. Do not use mouth suction to pipette chemicals or start a siphon. A pipette bulb or aspirator should be used to provide vacuum.

J. Use good personal hygiene and wash hands before leaving a laboratory.

K. Use of non-aqueous solvents for washing the skin is forbidden.

L. If skin contact with any chemical occurs, wash immediately.

M. If eye contact with any chemical occurs, flush eyes for a full 15 minutes

N. Chemicals are forbidden in food safe areas.

O. Never use laboratory glassware to prepare food.

P. It is prohibited to store and/or prepare food in the same equipment used for laboratory operations (i.e.: refrigerators, microwaves, etc.)

Q. Small spills must be cleaned up immediately and disposed of properly.

R. For all other spills or uncontrolled reactions, immediately evacuate the area and notify University Police (911 or x7777), the department chair, and laboratory supervisor.

S. Contact lenses should not be worn in laboratories.

T. Never smell or taste a chemical to identify it.

U. Housekeeping must be maintained at all times.

V. Chemicals shall not be permitted to be used or stored outside of laboratories or approved storage areas. Hazardous chemicals shall not be stored in offices.

W. The use of pressurized air is not permitted for cleaning of clothing.

X. Broken glassware must be discarded in proper receptacles.

APPENDIX B: DEFINITIONS

Action Level

The exposure level at which certain regulatory requirements become necessary under OSHA regulation.

This value is typically one half of the Permissible Exposure Limit (PEL). The requirements typically initiated include such things as medical monitoring, the use of personal protective equipment, and other measures dependent on the applicable regulation.

Designated Area

An area which may be used for work with "select carcinogens," reproductive toxins, or substances which have a high degree of acute toxicity.

A designated area may be the entire laboratory, an area of a lab, or a device such as a laboratory hood.

Emergency

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 non-acutely hazardous chemical (over 4L) into the workplace.

Food Safe Area

A clearly marked area in a laboratory that is designated for non-chemical activities and is free from risk of chemical contamination of food.

Hazardous Chemical

A chemical for which any of the following criteria apply; 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 (a health hazard as defined below). A material for which handling practices are not available or for which there is no safety/toxicity information available.

Health Hazard

Chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatoxins (toxic to the liver), nephrotoxins (toxic to the kidneys), neurotoxins, agents which act on the hematopoietic (blood and blood forming organs) system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Laboratory

A facility that is designed and equipped for scientific experiments, research, or teaching and where relatively small quantities of chemicals are used.

Laboratory Chemical Hygiene Plan

A written program developed and implemented at Northern Kentucky University which sets forth procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from health hazards presented by hazardous chemicals used in our laboratories.

Laboratory Scale

Work with substances in which the quantities used for reactions, transfers, and other handling of substances are such that they can easily and safely be manipulated by one person.

"Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory Supervisor

The individual(s) responsible for a laboratory. The laboratory supervisor is typically the principal investigator(s) or a laboratory manager(s).

Laboratory-Type Hood

A device located in a laboratory, with a movable sash, which acts as an enclosure, or a fixed partial enclosure constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminant into the laboratory. It allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employees' 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.

Large Spills

Spills that present an immediate hazard (fire, explosion, chemical exposure, etc.), any spill of high toxicity, spills that cause a release to the environment, spills greater than 4L, or spills that cannot be managed by laboratory personnel without putting themselves or others in danger.

Local Exhaust

A moveable, adjustable, or flexible tube used over a mechanical or chemical process to draw air from the lab and to prevent or minimize the escape of air contaminants. Examples of local exhaust are: elephant trunks, canopy hoods slot vents, etc.

Permissible Exposure Limit (PEL)

That concentration of a material to which an individual may be exposed to for 8-hours per day, five days per week over the duration of his/her working lifetime. This is a value determined by OSHA and is a legal requirement. These values may be adjusted to consider alternate work schedules such as 10- or 12-hour shifts.

Regulated Chemical

A material which has a specific OSHA regulation. For a list of regulated chemicals contact the Office of Safety and Emergency Management.

Small Chemical Spills

A spill of 4L or less that can be cleaned up by lab personnel without putting themselves or others in danger.

Short Term Exposure Limit (STEL)

That concentration of a chemical that an individual may be exposed to for a 15-minute duration without adverse effects.

Threshold Limit Value (TLV)

That concentration of a chemical to which a person may safely be exposed during an 8-hour day, five days a week over the duration of his/her working lifetime. This is a recommended value that is updated annually by the American Council of Governmental Industrial Hygienists.

Time Weighted Average (TWA)

This is the average concentration of a chemical over a given period of time (typically the duration of the work shift) and is the method by which exposure limits are typically communicated.