Laboratory Safety and Chemical Hygiene Plan for Chemistry

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I. INTRODUCTION

A. LABORATORY HEALTH and SAFETY POLICY STATEMENT

It is the policy of the University of Evansville (UE) to ensure that the hazards of all chemicals, equipment, procedures and experiments are identified and information concerning these hazards is transmitted to employees and students to provide for their safety and health protection.

B. AUTHORITY

This Laboratory Safety and Chemical Hygiene Plan is authorized by the University of Evansville. It will be implemented pursuant to Title 29 of the U.S. Code of Federal Regulations, Part 1910, subpart 1450.

C. FEDERAL LABORATORY STANDARD

OSHA has developed a special regulatory regime for laboratories: The Laboratory Standard, 29 CFR 1910.1450. Chemical waste generated in laboratories is regulated under the Resources Conservation and Recovery Act (RCRA): 40 CFR 261-265, 270.

While students are not covered under the provisions of the OSHA Laboratory Standard, students should be made aware of chemical health and safety hazards in classroom situations and should be provided with information and equipment to protect themselves from those hazards. Individual laboratories should provide student training at the beginning of each course in which hazardous chemicals are used. Specific safety instructions should be provided at the beginning of each class period. Additionally, students should be informed that the entire Plan is accessible on the UE website.

D. RESPONSIBILITIES

Responsibility for chemical hygiene rest at all levels, including faculty, staff, Chemical Hygiene Officer (this is a shared function with the Manager, Risk and Environmental Management) and students. A description of responsibilities is located in Appendix A.

II. STANDARD OPERATING PROCEDURES

It is prudent to minimize all chemical exposure. This can be accomplished by first carefully planning experiments to minimize the risk of exposure and to limit use of especially hazardous chemicals. Chemical exposure can occur through several different routes: (1) inhalation (vapors, dust), (2) contact with skin or eyes, (3) ingestion, and (4) injection. The following section describes the Standard Operating Procedures for using chemicals in the laboratories at UE. Following these rules will minimize the risk of chemical exposure.

A. Basic Laboratory Safety Rules

All employees and students should follow these basic rules at all times in the laboratory:

- Only work with chemicals alone in the laboratory or chemical storage area, if a faculty member has been notified and is on the floor.
- Wear eye protection at all times.
- When working with flammable chemicals, be certain that there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or spill.
- Know the hazards of the chemical you are working with as determined by MSDS (Material Safety Data Sheet). See Appendix B – How to interpret MSDS.
- Know what appropriate safeguards, including personal protective equipment, the chemical requires.
- Know the location and proper use of emergency equipment (i.e., eyewash station, safety shower, face drench, and/or fire extinguisher)
- Know how and where to properly store the chemical and chemical waste.
- Know the proper method of transporting chemicals within the laboratory.
- Know the appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures and proper waste disposal.

Behavior in the laboratory can affect everyone's safety. The following Safety Rules apply to all laboratories at UE:

i. Personal Behavior:

- No horseplay in the lab. Avoid distracting or startling other employees or students.
- Confine long hair and loose clothing.
- No eating, drinking, smoking, or applying cosmetics in the laboratory.
- Do not store food in chemical storage refrigerators.
- Wash promptly with soap and / or copious amounts of water whenever a chemical has contacted the skin.
- Avoid inhalation of chemicals.
- Do not use mouth suction to pipet anything.
- Keep your work area clean and uncluttered.
- Wash well with soap and water before leaving the laboratory. Do not wash with solvents.

ii. Personal Protective Equipment:

- Wear appropriate eye protection whenever in the laboratory and chemical storage areas. Be sure that all persons including visitors also wear protection in these areas. Goggles are the type of eye protection required in the laboratory. More hazardous operations including conducting reactions that have potential for explosion and using

or mixing strong caustics or acids require a combination of a face shield and safety goggles or glasses. Contact lenses are acceptable for use in the chemistry laboratory **BUT** they are never a substitute for eye protection. If contact lenses are worn when volatile liquids are in use, fitted goggles are required. The contact wearer must mark their goggles with: "Contacts".

- If spillage or exposure is likely, wear appropriate gloves when handling chemicals. See Appendix C – Glove Chart
- Wearing appropriate clothing such as laboratory coats or aprons is recommended. Shoes with fully covering 'uppers' (no sandals or open-toed shoes). Long pants or long skirts are required. Midriff tops and low-waisted pants are not appropriate for the laboratory.
- Whenever exposure by inhalation has the potential to exceed the threshold limits as described in MSDS, use the chemical in a chemical hood**.**

iii. Housekeeping

- All containers must be clearly labeled with chemical name, your initials, date and special hazards associated with that chemical.
- Do not use any cracked or chipped glassware. Dispose of this in one of the broken glass boxes, which are picked up by housekeeping and handled as trash.
    - When full, the broken glass boxes should be closed, taped shut and marked "Full". Take the full, closed, taped boxes to KC 337A for pickup.
    - The following items are NOT to be put in the broken glass boxes, and are considered hazardous waste:
        - Unbroken vials with chemicals in them
        - Mercury thermometers
- Keep all work areas, especially lab benches, clear of clutter.
- Keep all aisles, hallways and stairs clear of all chemicals.
- Access to emergency equipment, showers, eyewashes and exits should never be blocked or obstructed.
- All chemicals should be placed in their assigned storage area at the end of each work period.
- Wastes should be properly labeled and kept in their proper containers and stored appropriately, with secondary containment in case of spills.
- Promptly clean up all spills. Pay special attention to common areas such as balances.

B. Special Handling Procedures

Some procedures will require prior approval from faculty. Examples include: conducting a new procedure, scaling up a procedure, working with acute toxins, working alone or working with hazardous equipment.

General Categories of Chemicals

Acids

All concentrated strong acids can damage the skin and eyes. Nitric, chromic, and hydrofluoric acids are especially damaging because of the types of burns they inflict. Wear gloves, chemical resistant goggles and a lab coat or apron when handling strong acids. Exposed areas should be flushed promptly with water.

Bases

The common strong bases are potassium hydroxide, sodium hydroxide and ammonia. Ammonia is a severe bronchial irritant and concentrated solutions of ammonia should always be used in a hood. The metal hydroxides are extremely damaging to the eyes. Should eyes be exposed, they should be washed immediately for at least 15 minutes and an ophthalmologist should evaluate the need for further treatment.

Blood Products and Body Fluids

Gloves and eye protection must be worn when working with body fluids. Needles and lancets should be disposed of in a 'Sharps' container. Never recap needles. All materials used should be disposed of as Biohazard Waste. Lab benches where blood or body fluids have been used should be wiped after use with a 1:10 bleach solution. Blood spills should be cleaned up with a 1:10 bleach solution as described in the Spill Clean up and Accidents Section VI. If a stick with a used needle occurs, immediately wash with soap and water. Follow up with a physician.

Carcinogens, Reproductive Toxins, Acute Toxins

Investigate the properties of the chemical in use. Consult SDS and other references for appropriate handling precautions. Prior faculty approval is necessary for using these chemicals. Use in a designated area and post signs identifying the chemicals in use. Use the smallest amount of chemical that is feasible. Decontaminate the area when work is completed by washing with soap and water. Wear eye protection, lab coat and gloves (double gloving is prudent). Waste from using these chemicals should be handled by faculty or Lab Supervisor. See Waste Disposal Section VIII.

Corrosive Chemicals

Definition: Corrosive chemicals cause visible destruction or permanent changes in human skin tissue at the site of contact. Strong acids (e.g., sulfuric acid), strong bases (e.g., sodium hydroxide) are examples.

Corrosive substances cause destruction of living tissue by chemical action and can be solids, liquids or gases. Corrosive materials are probably the most common toxic substances in the laboratory. They are especially dangerous because their effect on tissues takes place very rapidly and they affect skin, eyes, respiratory tract and gastrointestinal tract (in case of ingestion). Examples are: bromine, sulfuric acid, aqueous sodium hydroxide, chlorine gas, ammonia gas and phenol. These materials should be used in a hood to avoid inhalation. Gloves should always be worn when handling these materials and the smallest possible amounts should be used.

Dehydrating Agents

The strong dehydrating agents include concentrated sulfuric acid, sodium hydroxide, phosphorus pentoxide and calcium oxide. Because so much heat is evolved on mixing these substances with water, mixing should always be done by adding the agent to water to avoid violent reaction and splattering. Because of their affinity for water, these substances cause severe burns on contact with the skin. Always wear gloves and safety goggles, and a face shield is recommended. If substance contacts skin, affected areas should be washed promptly with large volumes of water.

Flammable Chemicals

Many solvents used in the laboratory are flammable, for example: ethanol, methanol, acetone and diethyl ether. The vapors from a flammable liquid may travel along bench tops and floors. Remember: the vapor from the liquid will ignite and burn. Keep only minimum quantities of flammable liquids (including solvents) in the laboratory. Keep flammable liquids away from heat and direct sunlight. DO NOT heat flammable liquids directly over a burner or an electrical device which may generate sparks. A fume hood should be used when appreciable quantities of flammable materials are transferred from one container to another, allowed to stand in open containers or heated in open containers.

Oxidizing Agents

In addition to their corrosive properties, powerful oxidizing agents such as perchloric acid and chromic acid present fire and explosion hazards on contact with organic compounds and other oxidizable substances. The hazards associated with perchloric acid are especially severe. Working with >70% perchloric acid requires special faculty permission. Strong oxidizers should be stored and used in glass or other inert containers, and cork or rubber stoppers should not be used. Always use gloves and eye protection.

Peroxide Forming Chemicals:

Peroxides and many other laboratory chemicals that can form peroxides can become very dangerous with age. They can become a severe explosion hazard when shocked, exposed to heat, or if they undergo a spontaneous chemical reaction. Containers used for storage of peroxides or chemicals that can form peroxides should be disposed of through Risk Management in a timely manner.

See Procedure xxx for details on managing peroxide forming chemicals.

Radiation Safety

- Avoid skin contamination (absorption), ingestion, inhalation, and injection (all routes of intake)
- Many ^{14}C compounds readily penetrate gloves and skin; handle such compounds remotely and wear double gloves, changing the outer pair at least every 20 minutes.

- Maintain your occupational exposure to radiation As Low As Reasonably Achievable [ALARA].
- Ensure all persons handling radioactive material are trained, registered, and listed on an approved (by Mark Davis, the Radiation Officer) protocol.
- Review the nuclide characteristics prior to working with that nuclide. (see MSDS)
- Plan experiments to minimize external exposure by reducing exposure time, using shielding and increasing your distance from the radiation source. Use the smallest amount of radioisotope possible so as to minimize radiation dose and radioactive waste.
- Provide for safe disposal of radioactive waste by following the Waste Handling and Disposal Procedures. Avoid generating mixed waste (combinations of radioactive, biological, and/or chemical waste). Lab staff may not pour measurable quantities of radioactive material down the drain.
- If there is a question regarding any aspect of the radiation safety program or radioactive material use, contact the Radiation Safety Officer, Mark Davis, at 488-6423.
- Disposable gloves, lab coats, and safety glasses are the minimum Personal Protective Equipment (PPE) required when handling radioactive material. Remove and discard potentially contaminated PPE prior to leaving the area where radioactive material is used.
- Clearly outline radioactive material use areas with tape bearing the legend "radioactive". Cover lab bench tops where radioactive material will be handled with plastic-backed absorbent paper; change this covering periodically and whenever it's contaminated. Alternatively cover benches with thick plastic sheeting (i.e., painter's drop cloth), periodically wipe it clean and replace it if torn.
- Label each unattended radioactive material container with the radioactive symbol, isotope, activity, and, except for waste, the inventory control number (ICN). Place containers too small for such labels in larger labeled containers.
- Handle radioactive solutions in trays large enough to contain the material in the event of a spill.
- Never eat, drink, smoke, handle contact lenses, apply cosmetics, or take/apply medicine in the lab; keep food, drinks, cosmetics, etc. out of the lab entirely. Do not pipette by mouth.
- Never store food and beverage in refrigerators/freezers used for storing radioisotopes.
- Prevent skin contact with skin-absorbable solvents containing radioactive material.
- Fume hoods and biological safety cabinets for use with non-airborne radioactive material must be approved (through the protocol) and must be labeled "Caution Radioactive Material".
- All volatile, gaseous, or aerosolized radioactive material must be used only in a properly operating charcoal and/or HEPA filtered fume hood or Biological Safety

Cabinet bearing a Caution Airborne Radioactivity hood label, unless otherwise specified in writing by the Radiation Safety Officer. The Radiation Safety Officer (through a protocol) must approve all such use.

- Use sealed containers and appropriate secondary containment to carry radioactive material between rooms. Notify Radiation Safety Officer before taking any radioactive material off site.
- Work with volatile forms or procedures that may produce volatile compounds, (i.e., $^{14}CO2$), must be done in a fume hood.
- Use caution when handling ^{14}C labeled halogenated acids. These penetrate the skin and give high radiation doses. Most ^{14}C compounds are rapidly metabolized and exhaled as $^{14}CO2$.

For additional information contact the Radiation Safety Officer at 488-?

Liquid Nitrogen

There are two main risks associated with using and handling Liquid Nitrogen (LN_2): frost-burns and asphyxiation. LN_2 is extremely cold (<<-196 C) and will rapidly cause frost-burns and frostbite on any flesh that it remains in contact with. During vaporization at normal atmospheric pressure and temperature, LN_2 expands to produce a large volume of gaseous Nitrogen. [1 liter of LN_2 produces 683 liters of N_2 gas] Asphyxiation may result from this large volume of Nitrogen gas displacing the oxygen present in the room.

Handling Procedure for Liquid Nitrogen:
Always wear the following protective equipment:

- Goggles or safety glasses**.**
- Heavily insulated gauntlet-type gloves as needed, or when handling cold valves.
- Closed toe footwear
  Note: Use extreme caution to prevent clothing from being in contact with liquid nitrogen, as the clothing will freeze to the skin.

Never work alone when handling LN_2. Because of the danger of rapid oxygen depletion, there should always be more than one person in the immediate area.
Beware of 'Blow-Back' when filling containers. The introduction of LN_2 into a container previously at room temperature will cause the rapid vaporization and expansion of the LN_2. If the container has a narrow neck, the pressure may rapidly build up in the container and result in the ejection or 'blow back' of LN_2. Care must always be taken during the filling of containers to allow the receiving container to cool down by the slow introduction of LN_2.

- Dispense only into Dewars that are rated for LN_2.
- Prevent splashing by placing the filling hose below the mouth of the receiving Dewar.
- Do not transport LN_2 in an elevator.

Spill Procedure for Liquid Nitrogen:

- Minor spills: Allow the LN_2 to evaporate. Open doors to ensure good ventilation. Warn all people in the area to leave until the spill has evaporated and had time to disperse.
- Major spills: If there is an uncontrolled release of LN_2 (a leak in the tank or if the Dewar flask has broken), alert others in the area and evacuate immediately. Pull fire alarm to evacuate building. **Call Security at 6911** from a safe location.
- Any major spill of LN_2 must be reported and an accident report must be filed with the Faculty and the Manager, Risk and Environmental Management.

In case of exposure for Liquid Nitrogen:

- Eye or skin: Flush with cold water for 15 minutes. Seek immediate medical help.
- Inhalation: Remove victim from area to fresh air if it is safe to do so. Seek immediate medical help.

Specific Chemicals

See pertinent MSDSs stored in the three ring binders specifically for Material Safety Data Sheets located in the Stock Room, room KC 333.

Equipment

Gas Cylinders

Gas cylinders should be transported on a cart with a strap or chain, and the valve cover should remain in place during transport. Securely strap or chain gas cylinders to a wall or bench top. When the cylinder is not in use, shut the valves and relieve the pressure on the regulator. Incompatible classes of gases should be stored separately.

Small empty gas cylinders should have a hazardous waste label attached, and taken to the hazardous waste storage area in KC 184.

Electrical Equipment

All electrical equipment should be grounded properly through a 3-prong plug.

Ultraviolet sources

UV sources represent a major eye hazard. Always wear safety glasses, preferably together with a plastic face shield. Never look directly at the source or at strong reflections. Minimize “on-time”.

Strong Magnetic Field sources

These Safety Rules in the Nuclear Magnetic Resonance (NMR) lab must be adhered to. This note must be read and understood by all NMR users.

Magnetic Field Hazards:

Large attractive forces may be exerted on equipment/magnetic subjects in proximity to the magnet. The force may become large enough to move the equipment uncontrollably towards the NMR magnet.

Small pieces of metallic subjects may become projectiles (keys, wrench, screwdrivers).

Large equipment (i.e., gas cylinders, dolly) could cause bodies or limbs to become trapped between the equipment and the magnet.

The closer to the magnet, the larger the force.
The larger the subject mass, the larger the force.

Rules:

- You should not bring any metallic object close to the magnet. The yellow tape on the floor indicates the sensitive area around the magnet, approximately the 5 gauss line. **PLEASE DO NOT BRING ANY METALLIC SUBJECT WITHIN THE YELLOW TAPE AREA!**
- When using low temperature, a metallic dolly is provided to carry the non-magnetic Dewar. **This dolly is magnetic and MUST NOT be brought inside the 5 gauss line (delineated by the yellow line on the floor).**
- Should you require to move a gas Dewar, ask the following technical instructor to do it for you: Todsapon Thananatthanachon **or Bryan Lynch.**
- Only individuals who have had special training should transfer liquid helium and nitrogen to the instruments. Handling cryogens is dangerous and can cause serious burns. Safety glasses and gloves must be worn during the transfer of all cryogens.
- Please do not bring any chemicals other than your own NMR samples to the NMR room.
- It is your responsibility to report ANY accident to the following NMR technical instructor immediately: Todsapon Thananatthanachon **or Bryan Lynch.**
- **In the event of a quench.** On rare occasions cryomagnets may lose superconductivity and start to conduct resistively. When this happens all the energy stored in the main coil will rapidly dissipate as heat, and boil off the magnet's reservoirs of liquid He and N_2. This is called a quench. You will hear a loud sound of rushing gas and see white plumes rushing out of the top of the magnet. When this happens there is nothing you can do to stop it. Leave the lab immediately, **notify** Todsapon Thananatthanachon **or Bryan Lynch** and watch the quench through the hall window.
- No food and drink are allowed in the NMR lab.

Medical Electronic implants

The operation of medical implants (cardiac pacemaker for instance) may be affected by static or changing fields (above 5 gauss).

Other medical implants such as aneurysm clips, surgical clips or prostheses may contain ferromagnetic materials and therefore would be subjected to strong attractive forces near the magnet. This could result in injury or death. Additionally, in the vicinity of rapidly changing fields (pulsed gradient fields), eddy currents may be induced in the implant

resulting in heat generation. If you carry any of these implants, you should not be within the 5 gauss line (yellow line on the floor) of the NMR spectrometer.

Other Hazards

Equipment such as watches, tape recorders and cameras may be magnetized and irreparably damaged if exposed to fields above 10 gauss. Information encoded magnetically on credit cards, diskettes, or tapes may be corrupted. These subjects should be kept outside of the yellow line, and can be temporarily stored in the office desk.

Users who do not follow the safety rules described above will lose the privilege to use the NMR facility.

III. CHEMICAL PROCUREMENT, STORAGE and DISTRIBUTION

A. ORDERING

- Order the smallest quantity of the chemical needed to avoid future waste.
- Consider if any safer, less hazardous chemicals could be used.
- Copy the Manager, Risk and Environmental Management on chemical orders placed to ensure awareness of any materials needing to be reported for Federal or State requirements.

B. INVENTORY

All chemicals received are to be unpacked in the stock room. Each chemical is entered into the barcode data base. The name, amount, date received and location in the stockroom are recorded. Each chemical should arrive with a Material Safety Data Sheet. The sheets are alphabetically filed in the MSDS binders located in the Stock Room, room KC 333.

B. LABELING

No label will be removed from a chemical container. All labels should be clean and legible. If some of a chemical is transferred to a smaller container, the new container should be labeled with the chemical name, date and any special hazards of this chemical.

C. STORAGE

- Stored chemicals are to be examined periodically by the stock room Manager for replacement, deterioration, and container integrity.
- Flammable liquids are stored in Flammable Liquid Cabinets.
- Acids are stored in the acid cabinets.

- 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 placed in the chemical waste disposal room or returned to the chemical stockroom.

D. DISTRIBUTION

- Chemicals distributed from the stockroom should be moved on carts. Large amounts of chemicals should be moved in a basin or tray to contain any spill.
- Acids and solvents of 16 ounces or more should be moved in a rubber pail.
- The elevator should not be used to transport chemicals between floors. If chemicals are being transported in the elevator, only the laboratory personnel should accompany them - no other people should ride in the elevator at the same time.

IV. SAFETY EQUIPMENT

A. Hoods

Chemical Fume Hoods

- Use hoods for operations which might result in the release of toxic chemical vapor or dust, or which have fire or explosion potential.
- Handle chemicals with a TLV (threshold limit value) of less than 50 ppm in a hood. When in doubt, use the chemical in a hood.
- Confirm adequate hood performance before starting the experiment. Open the sash to activate the low-air flow alarm to confirm proper face air flow velocity. A light weight piece of paper near the front of the hood can also be used to check airflow.
- Keep the hood closed except when adjustments are being made.
- Work at least 6 inches back from the front edge of the hood.
- Keep the hood uncluttered. Remove extraneous materials from the hood to reduce disruption of airflow.
- Place bulky equipment on platforms to allow flow of air underneath.
- Avoid creating strong cross drafts caused by opening doors or personnel movement. Drafts can pull contaminants from the hood into the laboratory.

B. Safety Showers

- Safety showers are located in or near the laboratories. The location of the closest safety shower should be determined before work is begun in any laboratory. The laboratories are designed so that the nearest safety shower is no more than 10 seconds away. An unobstructed path to the safety shower should always be maintained.
- Safety showers should be used for immediate first aid treatment of chemical splashes. The showers should be used for chemical splashes over a large area of the body. In

case of a chemical splash, remove any contaminated clothing and shoes (spilled chemicals can collect in the shoes) and thoroughly drench any body parts that have been exposed to the chemical. Further instructions are located in the Accident Section VI, B.

C. Eyewash Fountains and Face Drenches

- Eyewash fountains and face drenches are located throughout the laboratories. The location of the closest eyewash fountain or face drench should be determined before work is begun in any laboratory. The laboratories are designed so that the nearest eyewash fountain or face drench is no more than 10 seconds away. An unobstructed path to the eyewash fountain or face drench should always be maintained.
- Eyewash fountains or face drenches should be used for immediate first aid in the case of chemical splashes to the eye or face. The eyes should be flushed for 15 minutes if chemicals have contacted the eye. Further instructions are located in the Accident Section of Section VI Chemical Spill Response and Accidents.

D. Fire Extinguishers

- Fire extinguishers are located in all laboratories.
- Faculty and lab supervisors whom have volunteered will be trained in the use of fire extinguishers.
- In case of a fire, follow the procedures in Section VI Chemical Spill Response and Accidents under section B Accidents of this Chemical Hygiene Plan.

V. EXPOSURE ASSESSMENTS, MEDICAL CONSULTATIONS and EXAMINATIONS

There may be times when employees or supervisors suspect that an employee or student has been exposed to a hazardous chemical to a degree and in a manner that might have caused harm. If the circumstances suggest a reasonable suspicion of exposure, it may be necessary for employees or students to seek medical consultation to determine the need for treatment or further medical examination. Medical consultation should be sought under the following conditions:

- A hazardous chemical leaked or was spilled or was otherwise rapidly released in an uncontrolled manner.
- A laboratory employee or student had direct skin or eye contact with a hazardous chemical.
- A laboratory employee or student manifests symptoms, such as headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment, etc., and

    - Some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air, and
    - The symptoms reappear soon after the employee returns to work with the same chemicals.
- Two or more persons in the same laboratory work area have similar complaints.

The faculty will provide the following information to the physician:

- The chemical or chemicals under suspicion.
- All chemicals being used by others in the immediate area.
- The exposure conditions.
- Symptoms exhibited or claimed by the victim.

The physician shall respond in writing to the faculty and in writing or orally to the patient. The response will include:

- Medical examination and test results
- Recommendations for further follow-up
- Medical conditions which place the employee or student at increased risk due to chemical exposure.

In addition, the employee or student must be informed about all medical conditions discovered in the examination, whether they are related to laboratory exposure or not.

The physician shall not inform the employer of medical conditions unrelated to occupational exposure.

All complaints of exposure are to be documented using the University of Evansville Accident Report and the Chemical Hygiene Plan Accident Report Form. The completed forms are to be forwarded the Manager, Risk and Environmental Management.

VI. CHEMICAL SPILL RESPONSE AND ACCIDENTS

A. SPILLS

All small, non-emergency spills should be cleaned up promptly and properly. If chemicals are spilled on the skin or in the eyes, immediately remove contaminated clothing and shoes and flush the affected area with water (using the emergency shower, eyewash or face drench) for 15 minutes. If no person has been contaminated by a spill, first notify the Faculty member, of the spill. The Faculty member will decide if the situation calls for emergency methods and whether Security needs to be contacted.

It is important to plan a response to accidents and spills before starting an experiment. Be aware of the toxicity and physical hazards of chemicals used.

In the case of a large or especially hazardous chemical spill:

- Warn people in the lab of the spill. Notify the Faculty member. The Faculty member will notify Security. They will be in charge of the determining what to do. Evacuate if there are hazardous fumes. Assist people exiting the area. Turn off all electrical equipment if this can be done safely. If the spill occurs in the prep area of the stockroom, activate emergency setting on fume hoods.
- Give first aid if needed, including flushing eyes or areas exposed to chemicals with water.
- From a safe location **call Security at 6911** for emergency help
    - Report that this is an emergency and give your name, phone and location. Location of the spill. The name and amount of material spilled (if known). The extent of any injuries. The safest route to the spill.
    - Stay by that phone until help arrives.

Emergency Spill Situations

The following situations are examples of an emergency situation:

- The situation is unclear to the person causing or discovering the spill.
- The release involves or poses a threat of:
    - Fire, suspected fire, explosion or other imminent danger.
    - Conditions that are immediately dangerous to life and health.
    - High levels of exposure to toxic substances.
- Spills that involve injury requiring medical treatment.
- A large amount of mercury (over 1/3 ounce) is spilled.
- A large amount of formaldehyde (over 1.5 ounces) is spilled.
- Over 1/2 gallon of solvent is spilled.
- Multiple chemicals are involved.
- The person(s) in the work area is uncertain they can handle the severity of the hazard with the personal protective equipment and response equipment that has been provided and/or the exposure limit could easily be exceeded.

Non-Emergency Spill Procedure

Chemical Spill Response materials are located in the stockroom and Laboratories. If a chemical is spilled on the workbench or floor, and the Faculty member decides that it can be cleaned up safely without emergency help, follow this procedure:

For a Chemical Spill

- Warn people in the lab of the spill. Evacuate if there are hazardous fumes. Assist people exiting the area. Turn off all electrical equipment and extinguish any flames. Close doors to prevent the spread of fumes or vapors.
- Keep others in the lab from walking through the spill and spreading it.
- If warranted by the hazard posed by the spilled material (or if the identify of the spilled material is unclear), put on personal protective equipment that involves at least gloves and goggles.
- Contain the spill using the Chemical Spill Response materials available in each Lab and the stockroom. Work from the outside edges of the spill in towards the middle.
- If the spill is an acid or base, neutralize using sodium bicarbonate (for acid spills) or sodium bisulfate (for base spill) and scoop the material into a plastic container. Test the pH of the material. If it is pH 6-8, it can usually be diluted and flushed down the drain. Ask the supervising professor for help in determining disposal. Use care during neutralization because the process is often vigorous and can cause splashes and give off a large amount of heat. Decontaminate the area by washing with detergent and water.
- If the spill is a liquid, apply absorbent from the spill kit. Scoop up absorbed material into a plastic container. Label for disposal and store in room KC 184 for disposal. Decontaminate the area by washing with detergent and water.
- If the spill is a powder, carefully sweep up the powder to minimize generation of dust. Put all residues in a sealed container and store in room KC 184 for disposal. If needed, protect your respiratory system from dusts by wearing a dust mask. Decontaminate the area by washing with detergent and water.
- If a powdered metal is spilled, such as magnesium, do not expose to water. Cover the spill with sand or soda-ash (anhydrous sodium carbonate). Carefully sweep up powder, package and label the container, and store it in room KC 184 for disposal. Wear a dust mask while cleaning up the spill. Ventilate area and wash spill site after pick-up is complete.
- If a small amount of mercury is spilled (for example from a broken thermometer), collect the droplets of mercury by consolidating them using a scraper or a piece of cardboard. The pool of mercury can then be removed with the vacuum flask that has been prepared for use in mercury spills. Broken thermometers should be put into a sealed jar. A large spill (more than 1/3 ounce) should be handled by the Lab Supervisor or Faculty member. Waste mercury should be collected in a high-density polyethylene bottle, labeled and stored with the hazardous waste in room KC 184. The exposed work surfaces and floors should be decontaminated using the mercury spill kit in the stockroom.

For a Biohazard Spill
Blood or Body Fluids

- All large spills of blood or other body fluid (10 ml or more) should be cleaned up using a 1:10 bleach solution. Only people who have been trained should clean up blood or body fluid spills.

- Wear gloves and eye protection.
- Don't touch your face or any other part of your body once you have started clean-up procedures.
- Place all contaminated materials in a biohazard bag. Any contaminated clothing, equipment, etc must be discarded in a biohazard bag or disinfected by either autoclaving or washing with recommended disinfectant.
- Large areas such as floors may be disinfected with a 1:10 mix of bleach to water.
- Remove gloves by turning inside out, being careful not to contaminate your hands. Place gloves in biohazard bag.
- Wash hands for at least 15 seconds under hot water using a disinfectant soap.

B. ACCIDENTS

In the case of an emergency:

- Give first aid if needed, including flushing eyes or areas exposed to chemicals with water.
- From a safe location **call Security at 6911** for emergency help
    - Report that this is an emergency and give your name, phone, location (building, floor, room number) and extent of any injuries.
    - Stay by that phone until help arrives.

Dealing with Fire

- A fire contained in a small vessel can usually be suffocated by covering the vessel. Do not pick up the vessel. Do not cover with dry towels or cloths. Remove nearby flammable materials to avoid spread of fire.
- If the fire is burning over an area too large for the fire to be suffocated quickly and simply, all persons should evacuate the area except those trained to fight fires.
- Faculty and the lab supervisors who have volunteered have been trained to use fire extinguishers. They may fight the fire from a position from which they can escape, if they are reasonably confident that they can succeed.
- Activate the fire alarm. Notify faculty or lab supervisor.
- Call Security at **6911**
- **Call the Fire Department at 9911.** Inform fire fighters what chemical is involved in the fire, and what chemicals are present in the room.
- Toxic gases and smoke may be present. If so, evacuate.

Personal Injuries Involving Fires

- If a person's clothing is on fire, that person should use the safety shower.

- If the shower is not readily available, douse the individual with water or wrap the person in a fire blanket, coat or whatever is available to extinguish the fire and roll the person on the floor.
- **Call Security at 6911** and seek medical attention.

Common laboratory first aid practice:

- **Eye contact.** Immediately flush eyes using an eyewash fountain or face drench for 15 minutes. The victim may need assistance to hold open the eyelids. Remove contact lenses. Seek medical attention if a caustic substance was splashed into the eye or if eye irritation continues after flushing.
- **Ingestion.** If pure chemical is ingested, follow label and MSDS instructions, if any. **Call poison control center at 800-222-1222**. Encourage victim (if conscious) to drink water. **Call Campus Health Center at 488-2033 AND Security at 6911**. Seek medical attention.
- **Skin contact.** Immediately flush area with water for 15 minutes. If hands and arms are exposed, use sink to flush with water. Remove any jewelry to facilitate removal of chemical. If a larger area is exposed, flush under safety shower, removing contaminated clothing and shoes (spilled chemicals can pool in shoes). Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes. If irritation persists or other symptoms occur, **call Campus Health Center at 488-2033 AND Security at 6911**. Seek medical attention.
- **In the case of a cut** caused by glassware or other laboratory equipment. Wash thoroughly with soap and water to flush off any chemicals. Stop excessive bleeding by applying pressure. If needed, seek medical attention by calling the **Campus Health Center at 488-2033** to assure that no glass remains in the cut. If irritation or other symptoms occur, seek medical attention.

Accident Reports

All accidents must be reported to the Chemical Hygiene Officer. The University of Evansville Accident Report form should be filled out and submitted. Hard copies are available by contacting Risk Management at extension 2276 or on the UE website. If any chemical exposure is suspected, the report in Appendix E should also be completed and forwarded to the Chemical Hygiene Officer. Any incident that could have resulted in exposure to chemicals exceeding safe levels will be investigated. The purpose of an exposure assessment is to determine whether that exposure might have caused harm to one or more employees or students. The results of these assessments may be used to modify operating procedures and thus prevent future overexposures.

VII. TRAINING REQUIREMENTS (yet to be reviewed)

All student lab assistants will be trained by the Faculty member or Lab Supervisor at the beginning of each school semester. New assistants added during the year will be trained as they begin work. Training will include:

- Using the Chemical Hygiene Plan.
- Emergency response and evacuation.
- Fire training: prevention and response.
- Interpretation of a Material Safety Data Sheet (MSDS).
- Using appropriate Personal Protection Equipment.
- Use of safety equipment: hoods, shower, eyewash fountain, face drenches.
- Causes and prevention of laboratory accidents.

A record of each training session will be kept by the trainer.

Each student taking a Chemistry course will be instructed by a Faculty member in safe laboratory practice and asked to sign a Laboratory Safety Agreement. These forms may vary as the laboratory procedures vary for each course. The signed agreements will be kept by the Faculty trainer with a copy sent to the Manager, Risk and Environmental Management.

Fire extinguisher training will be provided as needed for faculty and lab supervisors. The training will be provided by the Security Department as needed.

VIII. WASTE DISPOSAL

Some waste generated in the laboratories at UE is classified as hazardous waste. A waste is hazardous if it is specifically listed by name or by category in 40 CFR 261, or if it meets one of four characteristics: corrosivity, ignitability, reactivity and the toxic constituent leachate extraction procedure.

The University of Evansville qualifies as a Conditionally Exempt Small Quantity Generator. This means that less than 100 kg of hazardous waste is produced per month. All chemical waste that is produced is evaluated and handled accordingly. The waste generated by each laboratory is collected, labeled and evaluated by the Laboratory Supervisor, Faculty member, or Chemical Hygiene Officer. A label on a chemical waste container must include at least the following information:

1. Written name (no formulas) of the chemical(s),
2. Chemical concentrations (as best as can be determined),
3. Any chemical hazards (i.e., flammable, corrosive, toxic, explosive),
4. The name of the individual generating the waste, and
5. The date the waste is placed in room KC 184.

Please contact the Manager, Risk and Environmental Services, if labels are needed.

Waste that is not categorized as hazardous is disposed of in an appropriate manner. Some procedures for waste disposal of specific chemicals are described in Appendix F. Waste that is determined to be hazardous is stored in Koch Center Room 184 and collected at the end of the Summer and Fall semester by a licensed chemical disposal agency. Biohazardous waste is collected in the Biochemistry Lab for incineration at a treatment facility.

Records are kept for all waste disposal as described in Section IX, Records and Record Keeping of this Chemical Hygiene Plan. These records are kept in the office of the Manager, Risk and Environmental Management.

IX. RECORDS and RECORD KEEPING

The Faculty and or Manager, Risk and Environmental Management will maintain records of the following:

- Inspection and maintenance records of hoods, safety showers, eyewash fountains and face drenches

Training records will be maintained as described in Section VII – Training Requirements.

APPENDIX A

RESPONSIBILITIES for LABORATORY SAFETY

Manager, Risk and Environmental Management

- Works with faculty to develop, implement, and update the Chemical Hygiene Plan.
- Determines, with faculty, the required levels of protective apparel and equipment necessary for laboratory procedures.
- Performs chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment.
- Coordinates and arranges disposal of hazardous waste.

Faculty (Chemical Hygiene Officer):

- Determines, with faculty, the required levels of protective apparel and equipment necessary for laboratory procedures.
- Monitors procurement, use and disposal of chemicals in the lab.

- Ensures that copies of all MSDSs (Material Data Safety Sheets) received are properly stored and maintained and that other relevant reference material is available.
- Ensures that a Chemical Inventory List is maintained.
- Performs chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment.

Department Chairperson:

- Is responsible for safety in the Department.
- Works with the faculty and Chemical Hygiene Officer to maintain the Chemical Hygiene Plan.
- Makes available or provides appropriate training for all workers and students and documents this training.
- Ensures that employees and students know and follow the chemical hygiene rules.
- Ensures that protective equipment is available, in working order and is being used.
- Determines, with faculty and the Manager, Risk and Environmental Management, the required levels of protective apparel and equipment needed for each procedure.

Faculty / Laboratory Supervisor:

- Knows and follows appropriate written safety rules, including the Chemical Hygiene Plan.
- Develop appropriate safety procedures for course laboratory sessions and update as necessary.
- Develop and maintain Standard Operating Procedures for their laboratories.
- Places orders to obtain chemicals for the laboratories.
- Monitors procurement, use, and disposal of chemicals in the lab.
- Maintain safe behavior in the laboratory.
- Monitors procurement, use, and disposal of chemicals in the lab.
- Ensures that all chemical containers in the work area are properly labeled.

Stockroom Manager:

- Maintains the Chemical Inventory List.
- Maintains the collection of MSDSs for all chemicals and sees that they are readily accessible to laboratory employees and students.
- Monitors procurement, use, and disposal of chemicals in the lab.
- Ensures that all chemical containers in the work area are properly labeled.

Laboratory Assistants:

- Ensure that students know and follow the chemical hygiene rules.
- Develop and maintain good personal chemical hygiene habits.

- Should know and observe the safety rules as outlined in the Laboratory Syllabus and Chemical Hygiene Plan.

Students:

- Should know and observe the safety rules as outlined in the Laboratory Syllabus and Chemical Hygiene Plan.

APPENDIX B

INTERPRETING SAFETY DATA SHEETS

Federal law requires that manufacturers and distributors of chemicals provide users with Safety Data Sheets (SDSs), which are designed to provide the information needed to protect users from any hazards that may be associated with the chemical.

It should be understood that SDSs address the hazards associated with chemicals in all possible situation, including industrial manufacturing operation and large-scale transportation accidents. For this reason, some of the information in an SDS may not be relevant to the handling and use of that chemical in a laboratory. Also, many SDSs comprehensively list all conceivable health hazards associated with a substance without indicating which are most serious or most likely.

SDSs typically contain the following information:

- Name, address, and phone number of supplier and the date the SDS was prepared or revised.
- Name of chemical or its synonyms.
- Physical and chemical properties. Data such as melting point, boiling point and molecular weight.
- Physical hazards: flash point, auto ignition temperature, explosivity are addressed here.
- Exposure limits: PEL (Personal Exposure Limit) designated by OSHA and TLV (Threshold Level Value) are often listed here.
- Health Effects. Identifies target organs or systems that are adversely affected by overexposure.
- Health Hazard Data. Includes LD50, the lethal single dose in mg/kg of a chemical that is expected to kill 50% of a test animal population. Other descriptions such as carcinogen, irritant, mutagen and the precautions that should be taken are also found here.
- First Aid. Appropriate procedures for emergency first aid.
- Precautions for spills and cleanup. Appropriate steps for safe cleanup are given. Appropriate waste disposal procedures are given.

- Control Measures. Types of protective equipment needed are described.

APPENDIX C

CHEMICAL RESISTANCE of PROTECTIVE GLOVE MATERIAL

Chemical	Resistance of Material					
	Neoprene	Vinyl Plastic	Rubber Latex	Nitrile	Syn. Latex	Nat. Latex
Alcohols	E	E	G	E	E	G
Caustics	E	E	E	E	E	E
Chlorinated solvents	G	NR	G	G	G	G
Ketones	G	NR	G	G	G	G
Petroleum Solvents	E	F	F	S	E	F
Organic acids	E	E	E	E	E	E
Inorganic acids	E	E	E	E	E	E
Non-chlorinated Solvents	G	F	NR	G	G	NR
Insecticides	E	E	S	F	E	F
Inks	E	E	F	S	E	F
Formaldehyde	E	E	E	S	S	E
Acrylonitrile	E	G	E	S	E	E
Hydraulic fluid	E	E	S	S	E	F
Carbon Disulfide	NR	F	G	F	NR	G
Paint Remover	F	F	NR	E	F	NR

S-Superior E-Excellent G-Good F-Fair NR-Not Recommended

APPENDIX D

PRIOR CONSENT FORM

Name: _____
Date: _____
Supervising Faculty: _____
Laboratory Room Number: _____

Description of Experimental Procedure:

Describe any potential hazards of Procedure (chemical and special equipment):

PPE required:

MSDS and other relevant information reviewed:

Safety Procedures reviewed and approved by

Supervision Faculty _____ Date:_____

APPENDIX E

SUSPECT CHEMICAL EXPOSURE ACCIDENT REPORT

Interview with the complainant and victim, if not the same person:

Name: _____

Date of Interview: _____

Date of Accident: _____

Laboratory: _____

Description of Accident

What chemical do you suspect was involved?

How were you exposed to this chemical? (skin contact, inhalation, eye contact)

What other chemicals were being used at the time by victim or others in the lab?

What symptoms did you experience?

What symptoms are described in MSDS for that chemical?

What control measures, such as personal protective equipment or hoods, were being used?

What treatment did you receive?

Recommended follow-up:

Campus Health Center
Physician
Other

Signature victim: _____

Supervisor: _____

APPENDIX F

WASTE HANDLING PROCEDURES

The waste generated by each laboratory is collected, labeled and evaluated by the Laboratory Supervisor, Faculty member, or Chemical Hygiene Officer. A label on a chemical waste container must include at least the following information:

1. Written name (no formulas) of the chemical(s),
2. Chemical concentrations (as best as can be determined),
3. Any chemical hazards (i.e., flammable, corrosive, toxic, explosive),
4. The name of the individual generating the waste, and
5. The date the waste is placed in room KC 184.

Some waste can be treated safely and rendered non-hazardous. Some references for determining whether a chemical waste is hazardous and for procedures to convert chemical waste to a non-hazardous material are located in MSDS. Some specific procedures and waste types are described below.

Specific procedures

Acids:

- Most strong acids can be diluted, neutralized and disposed of down the drain. Do not neutralize acid anhydrides and acid chlorides. Carry out the neutralization in a fume hood. Use the sash or a safety shield for protection against vigorous reactions.
- Wear an apron, goggles and face shield, and nitrile or latex gloves when neutralizing a strong acid.
- Procedure:
    - Dilute acid solution to 3M or less by slowly adding acid to water.
    - Slowly stir in 6M sodium hydroxide or 6M potassium hydroxide. Use waste base if possible.

- Monitor pH with pH paper. When a pH greater than 2 is reached, the solution can be poured down the drain with a large amount of water.

Bases:

- Most strong base solutions can be diluted, neutralized and disposed of down the drain. Carry out the neutralization in a fume hood. Use the sash or a safety shield for protection against vigorous reactions.
- Wear an apron, goggles and face shield, and nitrile or latex gloves when neutralizing a strong base.
- Procedure: Dilute base solution by adding to water. For sodium hydroxide, potassium hydroxide, and alcoholic cleaning solutions of these: slowly add 2L of hydroxide solution to 10L water. For ammonium hydroxide or amine base solutions: add up to 1.5L amine to 1 L water. Slowly stir in 6M hydrochloric acid or other suitable acid, but not sulfuric acid. Monitor pH with pH paper. When a pH of less than 10 is reached for sodium hydroxide and potassium hydroxide, and less than 7 is reached for amines, the solution can be poured down the drain with a large amount of water.

Chemical Carcinogens and Mutagens:

- Handled by faculty or lab supervisor.

Metals

- Some metals are toxic, including arsenic, barium, cadmium, chromium, lead, mercury and others. Solid waste containing these metals should be packed for hazardous disposal. Solutions should be labeled and collected for hazardous disposal. The Chemical Hygiene Officer should be notified of the generated waste and the location where it is stored.

Organic Solvents

- Collect in waste containers, separating halogenated solvents from non-halogenated. Label and dispose of as hazardous waste. Notify the Chemical Hygiene Officer of the waste and its storage location.