Eastern Kentucky University

College of Science

Chemical Hygiene Plan

2016 - 2017

TABLE OF CONTENTS

I. Purpose

It is the responsibility of Eastern Kentucky University, as an employer, to take every reasonable precaution to provide a workplace that is free from recognizable hazards. The purpose of this Chemical Hygiene Plan (CHP) is to describe occupation practices and procedures pertaining to handling or managing hazardous chemicals in the Eastern Kentucky University College of Science laboratories. This CHP should assist and ensure employees are protected from physical and health hazards associated with hazardous chemicals. The U.S. Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.1450, entitled "Occupational Exposures to Hazardous Chemicals in Laboratories," often referred, as the Laboratory Standard requires this CHP. The full text of the Laboratory Standard can be viewed at the OSHA web site (1). General information about OSHA Hazard Communication programs can also be found at the OSHA web site (2).

II. Definitions

The following definitions are taken/adapted from the Laboratory Standard (1). Other definitions are available from that document.

Chemical Hygiene Plan: A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meet the requirements of paragraph (e) of the Laboratory Standard.

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

Hazardous Chemical: The Occupational Safety and Health Administration (OSHA) defines a hazardous chemical as any chemical that is either a:

i) *Physical Hazard*: For a physical hazard, a chemical has scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

Or

ii) *Health Hazard:* For a health hazard, a chemical which is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard.

See Appendix 1 for detailed definitions of individual physical and health hazards.

Laboratory: A facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory Scale: Working with substances in which the containers used for reactions, transfers, and other handlings of substances are designed to be easily and safety manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory Supervisor: Any faculty, staff, teaching assistants, and/or research assistants that have been placed in charge of supervising specified laboratories as well as the training and safety of laboratory workers. A laboratory supervisor must be identified and assigned to each individual laboratory.

Laboratory Workers: Any person, employee or student, working in a laboratory. Although students are not technically employees of the university, this CHP specifies that all students

involved in laboratory activities must adhere to the requirements of the CHP for their safety.

III. Applicability and Assistance

The Laboratory Standard applies to all employers engaged in the laboratory use of hazardous chemicals. This Chemical Hygiene Plan applies to all employees from the Departments of Biological Sciences, Chemistry, Geography and Geology, and Physics in the College of Science at Eastern Kentucky University.

If there are questions about this document, contact the Chemical Safety Officer (see Appendix 2 for a personnel listing).

IV. Responsibilities and Authority

The Eastern Kentucky University College of Science is committed to providing a safe and healthful environment for all persons associated with the college. All administrators, faculty, staff, and students are expected to support these goals.

A. **The College of Science Dean** has the ultimate responsibility for implementation of the College Chemical Hygiene Plan. The Dean (or his/her designate) shall

1. Identify those departments within the College to which the Laboratory Standard applies;
2. Appoint a College Chemical Safety Officer;
3. Approve and support the Chemical Hygiene Plan;
4. Make budget arrangements for health and safety improvements;
5. Have authority to halt operations of any laboratory that is not compliant with the Chemical Hygiene Plan (typical after consultation with the Chemical Safety Officer and appropriate departmental chair(s) and/or laboratory supervisor(s)).

B. **The College of Science Chemical Safety Officer (CSO)** shall

1. Ensure this CHP is reviewed annually and modified as needed;
2. Assign areas of responsibility to departments, laboratory supervisors, and other individuals as necessary, to implement and carry out the provisions of the CHP;
3. Chair the College Safety Committee;
4. Maintain documentation relating to the College CHP, training records, internal inspection records, copies of meeting minutes and memos, and the website (www.chemicalsafety.eku.edu);
5. Inform and train laboratory faculty, staff, and student workers about chemical safety as required by the College CHP;
6. Conduct annual internal inspections of labs for health and safety and submit written reports of the inspection to the Department Chair.

C. **The College of Science Chemical Safety Work Group (CSWG)** shall consist of the Chemical Safety Officer, the Chemical Storage Facility manager, and at least one representative from each department covered by this CHP. The Department Chair appoints the representatives. The committee shall

1. Assist the CSO with annual review of this CHP;
2. Provide technical advice to laboratory supervisors and their respective workers concerning requirements of this CHP;
3. Make recommendations to the department chairs and dean for safety improvements;
4. Serve as a liaison between public safety personnel and the departments to improve communication.
5. Assist the CSO with annual safety inspection evaluations of the appropriate department laboratories.

D. The College of Science Chemical Storage Facility (CSF) Manager shall

1. Provide access to SDS sheets upon request;
2. Maintain the chemical inventory for the Chemical Storage Facility and records of distribution of chemicals to the laboratories;
3. Ensure proper guidelines and information about waste management are reviewed and modified as needed;
4. Ensure proper guidelines and information about waste management are available for faculty and staff;
5. Maintain the Waste / Used / Excess Chemical area until periodic waste pickup by the University Safety and Health Office;
6. Assist faculty with issues relating to chemical storage, handling, disposal, labeling, and safety;
7. Assist the CSO with training and informing laboratory faculty, staff, and student workers about safety issues;
8. Assist the CSO in conducting annual internal inspections of labs for health and safety.

E. Environmental Health and Safety Department shall

1. Appoint a member to the CSWG and assist in review of this CHP;
2. Provide technical assistance as needed to the CSO and/or CSWG;
3. Provide technical assistance or training concerning personal protective equipment and laboratory safety equipment upon request;
4. Conduct exposure assessments and laboratory inspections upon request and on a routine basis
5. Remain current on rules and regulations concerning chemicals used on campus.
6. Provide technical assistance as needed for other matters in environmental health and safety (aside from laboratory and chemical safety).

F. Department Chairs or Directors of Biological Sciences, Chemistry, Geography and Geology, and Physicshave the primary responsibility for implementation of the CHP within their departments/facilities and shall

1. Appoint a departmental representative to the CSWG;
2. Support the safety program, CSO, and CSWG with the implementation of the CHP within their respective department/facility;
3. Work with faculty and staff to adapt the CHP to include department- or lab-specific guidelines;
4. Ensure that faculty and staff adhere to the CHP and to accepted safety practices;
5. Ensure that each laboratory in the department has a specific person designated as the “laboratory supervisor”. This is especially important for labs that have many users, such as teaching labs.
6. Make budget requests for health and safety improvements;
7. Maintain a current copy of the CHP in the departmental or facility offices.

G. Laboratory Supervisors shall

1. Comply with all the requirements of this CHP and follow accepted safety practices;
2. Ensure that all of their laboratory workers receive appropriate training with respect to the CHP and any other special hazards encountered within a specific laboratory (all training must be documented);
3. Ensure all assigned laboratory workers comply with this CHP and accepted safety practices;
4. Identify hazards unique to their individual laboratories, develop and maintain written procedures and training to address safety issues pertinent to these special hazards, and add these to this CHP (consult the CSO if necessary);
5. Control access to the laboratory;

6. Know what chemicals are stored and used in their laboratories and the hazards associated with them;
7. Maintain a current inventory of chemicals present in the laboratory;
8. Provide access to SDS sheets;
9. Ensure that safety equipment and supplies are present and functional as well as training laboratory workers on the use of equipment as needed;
10. Request funds needed for specific health and safety improvements;
11. Report significant accidents or incidents to the department chair;
12. Ensure that the contact and chemical information on laboratory signage is current;
13. Conduct periodic laboratory inspections to ensure that safety precautions are being followed and compliant to the CHP.
14. Correct any safety deficiencies identified during inspections.

H. Laboratory workers shall

1. Comply with all the requirements of this CHP and follow provided procedures and/or training by the laboratory supervisor;
2. Report any and all hazardous conditions to the laboratory supervisor;
3. Wear or use prescribed protective equipment;
4. Report any suspected job-related injuries or illnesses to the laboratory supervisor and seek treatment immediately;
5. Refrain from the operation of any equipment or instrumentation without proper instruction and authorization;
6. Remain aware of the hazards of the chemicals in the lab and handle hazardous chemicals safely;
7. Request additional information and/or training when unsure how to handle a hazardous chemical or procedure.

Appendix 2 provides a list of current administrative personnel.

V. Standard Operating Procedures

The OSHA Laboratory Standard requires that operating procedures relevant to safety and health considerations be developed by the employer and followed by the employee for laboratory work involving the use of hazardous materials.

This CHP includes a minimum set of procedures for laboratory operations and for handling hazardous chemicals in laboratories at Eastern Kentucky University. Individual laboratories or research groups are required to develop more detailed procedures as their situations warrant. These procedures must be written, added to this CHP, and made available to laboratory workers. Acceptable lab safety references such as those listed in the OSHA Laboratory Standard may be adopted in whole or may be useful in developing additional procedures. ***In all situations, individual laboratory supervisors will be responsible for enforcing adequate safety and hygiene measures in their specified laboratories***. If necessary, additional assistance from the College Chemical Safety Committee is available. The following standard operating procedures apply to all labs in the College.

A. General Safety Practices

1. Examine the laboratory signage for any special considerations or instructions.
2. All laboratory employees, students, and visitors in laboratories must wear appropriate safety glasses, goggles, or face shields at all times where hazardous chemicals are stored or handled. Safety glasses with side shields or goggles are required when chemical splashes are possible. A set of guidelines for the use of personal protective equipment (PPE) is provided in Appendix 3.

   According to OSHA and the American Chemical Society, contact lenses may be worn in the laboratory, but they should not be considered eye protection devices. Safety glasses or splash goggles shall be worn over the lenses (3, 4).

3. While working in a laboratory, examine the known hazards associated with used materials. Make sure to read the label carefully and review the Safety Data Sheet (SDS) for storage specifications (*including temperature requirements*) as well as special handling information. Determine the potential hazards and use appropriate safety precautions with new material or process.
4. Know the location of emergency laboratory equipment including fire alarms, fire extinguishers, emergency eyewash, and shower stations. Also, be aware of emergency response procedures.
5. Know the location of chemical spill kits or procedures in case on an incident. Spills are to be cleaned up immediately according to the guidelines in Section Xa of this CHP. Custodial staff is not responsible for cleaning unknown powders or chemical spills.
6. Avoid distracting or startling other workers when handling hazardous chemicals or operating equipment. Horseplay, practical jokes or other inappropriate and unprofessional behavior in the laboratory setting is forbidden.
7. Always use equipment and hazardous chemicals for their intended purposes.
8. Do NOT remove chemicals from the lab or storage area for personal use.
9. Always be alert and call attention to potential harmful conditions and resolve the situation(s) as quickly as possible.
10. Inspect equipment (including fume hoods, gloves, goggles, etc.) for damage or review inspection labels before handling a hazardous chemical.
11. Avoid tasting or smelling hazardous chemicals.

B. Laboratory Safety Plans

1. In accordance with the Eastern Kentucky University Laboratory Safety Policy (http://policies.eku.edu/policies/l) each laboratory space containing, or with the potential to contain, hazardous chemicals, physical hazards, radiation, biohazardous materials or any other potential hazards, must contain a Laboratory Safety Plan.

2. Laboratory workers must familiarize themselves with the individual Laboratory Safety Plan and standard operating procedures therein pertaining to the laboratory in which the work will be performed before work in the lab is commenced.

C. Individual Health and Hygiene Practices

1. Avoid direct contact with hazardous materials. All laboratory employees, students, and visitors must wear or use additional personal protective equipment (PPE) as appropriate and needed. Appendices 3 and 3a provides guidelines for the appropriate PPE for various operations and information is available with respect to PPE (3, 4).
2. Eating, drinking, smoking and the application of cosmetics are strictly prohibited in areas where hazardous chemicals are used.
3. Do NOT store food intended for human consumption in the same refrigerator with chemical, biohazard, or radioactive materials.
4. Room or areas which are adjacent, but separated by floor to ceiling walls, and do not have any chemical, biohazard, or radioactive materials present, may be used for food consumption, preparation, or applying cosmetics.
5. Hands should be washed frequently throughout the day, before leaving the lab, after contact with any hazardous material, and before eating/drinking.
6. Loose hair and clothing must be confined. Shoes are to be worn at all times in the laboratory. Closed toe shoes must be worn in laboratories where hazardous materials will be handled.
7. Do NOT mouth pipette
8. Pregnant workers or students should inform the laboratory supervisor of their pregnancy. The laboratory supervisor can provide the pregnant woman with information about the hazardous

materials that will be encountered during the course of the laboratory work. The decision about whether or not to continue to work in the lab or remain in a laboratory based teaching course is made by the student and her physician.

9. No one shall work in the laboratory while under the influence of alcohol or drugs.

D. Laboratory Maintenance

1. Laboratory areas shall be kept clean and uncluttered. This will help prevent spills, breakage, injuries, unnecessary contact with chemicals, and accidents.
2. Access to all exits, aisles, safety showers, eyewash fountains, and fire extinguishers shall not be obstructed in any way with equipment, furniture, supplies, etc. that would prevent use.
3. Maintain an unobstructed clearance of 30" for circuit breaker panels.
4. All laboratory supervisors (or his/her designates) are responsible for cleaning the laboratory benches and/or table surfaces. The custodial staff will be responsible for routine cleaning of the floors (does not include chemical spills) and chalkboards as well as emptying regular waste containers. The custodial staff will be not responsible for cleaning unknown chemicals that might be present on the benches and/or table surfaces.
5. Keep the floor clean and free of slip hazards by reasonable cleaning.
6. Do NOT place hazardous materials or broken glass into the regular waste containers. The custodial staff is not responsible for the disposal of hazardous materials or broken glass from these regular waste containers.
7. Designate a separate waste container for non-contaminated glass. Do NOT place hazardous materials into the broken glass container.
8. Wear cut resistant gloves if one needs to handle a broken glass container.
9. Any other sharps or needles must be placed into a specific and labeled container.
10. Do NOT place paper, plastic, or miscellaneous waste into the broken glass or sharps waste containers.
11. Make certain that all appropriate utility services (e.g. water, electricity, gas) or appropriate equipment (circulating pumps, vacuum systems, portable air conditions, etc.) are shut down at the end of daily operations. If continuous or overnight use is needed, see below.

E. Unattended Operations / Working Unaccompanied

1. For laboratory operations carried out continuously or overnight, it is essential to plan for interruptions in utility services such as electricity, water and gas. Plans must be made to avoid hazards in case of failure. If necessary, arrangements for routine inspection of the operation are to be made.
2. In all cases of unattended experiments, leave the laboratory lights on and post an appropriate sign on the door. The identity of the materials being used, hazard labels, correct action to take in case of emergency, and the phone number of a contact person should be included.
3. Avoid working alone whenever possible. When working with materials or equipment that present a significant hazard, a second person must be present who can assist in case of an emergency.
4. Make the laboratory supervisor aware when unattended operations or working unaccompanied will occur.

F. Hazardous Material Handling / Labeling / Transportation

Handling

1. Information on proper handling of hazardous chemicals presented from SDSs should be made available to all laboratory employees prior to the use of the chemical.

2. Chemicals used in the laboratory must be appropriate for the laboratory's ventilation system. Do NOT use extremely hazardous materials on open laboratory benches. A few examples would include irritants such as ammonia, carcinogenic materials, asphyxiants, etc.

3. Chemicals should be transferred from one container to another with care. Place labels on the new container with the chemical name and hazard warnings. Containers that hold more than five gallons of a flammable material must be grounded when transferring the liquid.

4. Always add concentrated acid/base to water. Never add water to concentrated acid/base. A list of all common laboratory corrosives can be found at www.chemicalsafety.eku.edu.

5. Consider any chemical solution or mixture toxic according to the most toxic component.

6. Consider materials of unspecified toxicity to be toxic.

7. Do NOT use perchloric acid in the College of Science at Eastern Kentucky University laboratories since no fume hoods are currently designed for perchloric acid use.

   When perchloric acid is heated above ambient temperature, vapors may condense in the exhaust system to form explosive perchlorates. Specially designed fume hoods with dedicated exhausts and a water wash-down system are used for such perchloric acid applications.

   A list of common shock sensitive and explosive chemicals that might be found in the laboratory is found at www.chemicalsafety.eku.edu. Special care should be used for these types of materials.

8. The following apply to novel materials developed in synthetic laboratories:

   a. If the composition of a chemical is known, which is generated exclusively for use by the laboratory supervisor, the laboratory supervisor must determine if the chemical is hazardous. An assessment can be done through a literature search for similar substances. If the chemical is established to be hazardous, the laboratory supervisor must provide training to protect employees.

   b. If a chemical generated is a product or a by-product whose composition is unknown, the laboratory supervisor must assume the substance is hazardous and must comply with the practices of the CHP.

   c. The laboratory supervisor must prepare an appropriate SDS in accordance with the OSHA Hazard Communication Standard if a generated chemical is to be sold or used outside of the laboratory

9. The Laboratory Standard requires that laboratory supervisors identify operations that pose a sufficient hazard and will warrant prior approval before implementation by an employee. (See the following section, Section VI, of this CHP for additional information).

Labeling

1. All containers must be labeled. All labels must be legible and in English. The label should include the chemical/product name (product identifier), signal word, pictogram, date prepared, received, or opened, name of the user, and hazard statement. Contact the CSO or Chemical Storage Facility Manager for additional information.

a. Signal words are either “Danger” for severe hazards or “Warning” for less severe hazards.

b. Pictograms and descriptions are found in Appendix 4.

2. Labels on incoming containers must not be removed or defaced.

3. Replace damaged or semi-attached labels.

4. Materials available to the general public acquired over-the-counter is exempt from labeling requirements as long as appropriate labels are present from the manufacturer.

5. For transferred products or prepared solutions, the user must label each chemical container with the chemical name and hazard warning (refer to the SDS(s) for hazard warnings when necessary).

6. If multiple small containers of solutions, mixtures, etc. are prepared, the following alternative

labeling methods may be used:

a. Legend Method
   - Containers will be labeled with abbreviated chemical name(s) and hazard warning(s).
   - A key to the abbreviations with the complete chemical names will be provided in a clearly visible location

     Document that employees have been properly trained with the labeling system.

b. Box or Tray Method
   - Place the multiple containers in a box or tray
   - Label the individual containers with appropriate abbreviation(s) and the box/tray with the complete chemical name(s), hazard warning(s), and related abbreviation(s).
   - If containers are removed from the box/tray, the individual containers must be labeled with the complete chemical name(s) and hazard warning(s) or returned to the box/tray immediately after use.
   - Document that employees have been properly trained with the labeling system.

7. All substances that can form explosive peroxides and other chemicals that may become unstable over time (e.g. picric acid, ethers) must be dated when received and opened. These materials should be used promptly and disposed of appropriately. Contact the Chemical Storage Facility Manager for assistance. A list of peroxides can be found at www.chemicalsafety.eku.edu.

8. Stationary process containers such as tanks may be identified with signs, placards, process sheets, batch tickets or other written materials instead of actually affixing labels to process containers. The sign or placard must convey the same information that a label would and be visible to employees at any time.

Transportation

1. Always use plastic-coated bottles or bottle carriers for transporting chemicals housed in regular glass containers. Caps should be closed securely.
2. When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.
3. When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.

G. Hazardous Material Storage

1. Information on proper storage of hazardous chemicals presented from SDSs should be made available to all laboratory employees prior to the storage of the chemical.
2. When ordering materials, purchase only the minimum amount to sustain operations.
3. Check the integrity of containers. If they are found to be damaged or leaking, transfer material to an acceptable container with appropriate labels or call the CSF Manger for assistance.
4. Store chemicals based on compatibility, not simply by alphabetical arrangement. Oxidizers must be separated from organics, air/water reactive chemicals must be kept dry and cyanides should be stored away from acids. See Appendix 1 for detailed definitions and www.chemicalsafety.eku.edu for examples of common incompatible chemicals. More information on chemical compatibility is available. (5, 6)
5. Do NOT store chemical containers on high shelves. Large containers should be stored no more than two feet (sixty centimeters) above the floor level.
6. Keep the storage of chemicals at the lab bench or other work areas to a minimum.
7. Do NOT use hoods for long-term storage of chemicals.

8. Store volatile toxic substances in cabinets designed for this purpose. When volatiles must be stored in a cooled atmosphere, flammable refrigerators or similar specially designed equipment must be used.
9. Ensure that chemicals are stored at appropriate temperature; reference the SDS or container labels.
10. Laboratory refrigerators needed to store or cool flammable liquids will be in compliance with NFPA 45 - Fire Protection for Laboratories Using Chemicals, section 9.2.2.2 and A.9.2.2.2. Self-defrosting refrigerators, either modified or unmodified, will not be used for storing or cooling flammable liquids. General-purpose refrigerators are not to be used for the storage of flammable or reactive liquids or solids. They shall be labeled "Not for Storage of Flammable or Reactive Liquids or Solids." Refrigerators used for storage of chemicals must not be used to store food, beverages or cosmetics. They shall be labeled "Not for Storage of Food, Beverages or Cosmetics." Example signs are available at www.chemicalsafety.eku.edu.
11. Substances with an NFPA flammability rating of 3 or 4 must be stored in approved flammables cabinets. No more than 500 mL (total) of flammable material should be on a bench or table surface at any given time.

H. Pressurized Gas Cylinders

Special consideration should be taken for materials stored under pressure. Cylinders pose significant physical and/or health hazards, depending on the nature of the material in the cylinder.

1. Secure cylinders with suitable straps, chains, racks, or stands to support the cylinders against an immovable object (e.g. bench, wall, etc.) in an upright position at all times.
2. Do NOT allow cylinders to fall or lean against each other.
3. Stored cylinders must be in well-ventilated approved gas cylinder storage areas with their protective caps fastened. If protective caps are fastened, then multiple cylinders can be safely gang-secured (secured in groups).
4. Store cylinders with other compatible cylinders. Do not store flammables and oxidizers together.
5. Do NOT store cylinders in or near heat or high traffic areas.
6. Do NOT store empty and full cylinders together.
7. In-use cylinders with regulators must be individually secured.
8. Appropriate regulators, gauges, and fittings that are material compatible with the particular gas must be used.
9. When moving a cylinder, using appropriate handcarts.
10. When moving a cylinder, make sure the protective cap is fastened to protect to stem.
11. Extremely toxic gases (e.g. hydrogen sulfide, chlorine, arsine) should not be moved through regular exit corridors, particularly during business hours.
12. Toxic, corrosive, and reactive gases must be used and stored according to the specific handling and/or storage requirements of the particular gas (e.g. lab hood or gas cabinet specific to gas).
13. Always consider cylinders as full and handle them with corresponding care.
14. Never allow a cylinder to completely empty. A slight pressure in the cylinder will keep contaminants out.

I. Cryogens

Cryogens are cold substances (gases, solids and liquids at or below -100° F). Cryogenic liquids, include nitrogen (N_2), helium (He), argon (Ar), hydrogen (H), methane and carbon dioxide (CO_2), have boiling points below -130° F (-90° C). Hazards associated with cryogens include exposure (e.g. cold burns, frostbite). Contact (even brief) with liquefied gases at extremely low temperatures can

cause severe burns. Additionally, hazards could also associated with an increase in pressure leading to explosions or implosions, toxicity, and asphyxiation. These low temperatures can also make many materials brittle. Visit www.chemicalsafety.eku.edu for more details on cryogenic materials and associated hazards. Departments that use cryogens should take special precautions.

Personnel who are responsible for any cryogenic equipment must conduct a safety review prior to the dispensing of cryogenic materials and/or the use of the equipment that utilize these materials.

Cryogenic Safety Key Elements:

1. Always wear safety glasses with side shields or goggles when handling. If there is a chance of a splash or spray, a full-face protection shield, an impervious apron or coat, cuffless trousers, and high side shoes should be worn. Watches, rings, and other jewelry should not be worn.
2. Appropriate gloves should be worn when handling. Gloves should be impervious and sufficiently large to be readily thrown off should a cryogen spill occur. Potholders may be used for specific and appropriate applications.
3. These liquefied gases have the potential to condense oxygen from the air, create an oxygen rich atmosphere and increase potential for fire if flammable or combustible materials and a source of ignition are present. Mixtures of gases or fluids should be strictly controlled to prevent formation of flammable or explosive mixtures.
4. Containers and systems containing cryogens should have pressure relief mechanisms.
5. Containers and systems should be capable of withstanding extreme cold without becoming brittle.
6. Since glass ampoules can explode when removed from cryogenic storage if not sealed properly, storage of toxic or infectious agents should be placed in plastic cryogenic storage ampoules. Reheat cold sample containers slowly.
7. Equipment should be kept clean, especially when working with liquid or gaseous oxygen.

Cryogens Manager:

If a Department houses large storage tanks of cryogenic materials used for dispensing smaller volumes for various purposes, the Department Chair should appoint a person as Cryogen Manager. This assigned person will have the following duties:

1. Training faculty and students on the safe use, handling, and dispensing of cryogenic materials. All users should receive proper training regarding safe practices of cryogenic materials before they are allowed to individually use a large storage tank.
2. Maintaining appropriate Personal Protective Equipment (PPE) as outlined in Appendix 3 (listed under “Temperature extremes”). One must ensure these items are available at all times and being used. Ensure students and faculty are using the appropriate containers (dewars) and keeping inventory of available containers for a department, as well as ordering new equipment as needed.
3. Monitor and track cryogenic material usage. This could be as simple as a log sheet in close proximity to the large storage tank.
4. Inform the Chemical Storage Facility Manager when the large storage tank is empty and needs to be replaced.
5. Create a yearly summary report and distribute to departments, chemical storage, and/or other necessary personnel.
6. Ensure that other departmental equipment / instrumentation requiring cryogenic materials, mandated by the Department Chair, is appropriately handled.

7. Consult with the Department Chair to identify auxillary personnel to appropriately handle specific duties requiring cryogens on a permament or temporary basis (e.g. Cryogen Manager is away from campus).

J. Mercury

The presence of mercury in a laboratory, while not desirable, may be necessary with specific applications. Mercury thermometers are the single most common response incident pertaining to mercury spills. Each laboratory supervisor should evaluate whether the use of mercury is absolutely necessary or consider if alternative *safe solutions* are possible.

Safe Solutions:

1. Stand-alone Hg-thermometer: *Replace* with chemical-based thermometers or electronic temperature sensors for most uses, and expansion or aneroid devices in high temperature ovens. Mercury thermometers can be the single most common HazMat emergency response incident.
2. Hg-filled manometers: *Replace* mercury with phthalate or another suitable liquid
3. Hg-filled McLeod gauges: *Replace* with electronic version
4. Hg-filled bubblers: *Replace* with a safer device such as check valves or mineral oil bubblers

Requests for mercury or mercury containing compounds will occur with a Request for Mercury / Mercury Compounds form (www.chemicalsafety.eku.edu). If the decision to use mercury in the laboratory is made, training to ensure the safe handling and storage of mercury (including the procedures for cleaning up mercury spills provided below) is required for those that will use the metal. This training needs to be documented with the Mercury / Mercury Compound Training form (www.chemicalsafety.eku.edu) and is the responsibility of the laboratory supervisor. This documented training must be completed prior to any use of mercury.

***Mercury Spill Procedures (7)*:**
While a set of general chemical procedures exist in Section X of the CHP, a specific set of steps for the clean-up of mercury is provided below given the unique nature of the material (Procedure adapted from the Environmental Protection Agency (EPA): 'Mercury Releases and Spills': http://www.epa.gov/hg/spills/). This procedure is also available in handout form in Appendix 8.

SMALL MERCURY SPILL (i.e. thermometers)

- Have everyone else leave the lab; don't let anyone walk through the mercury on the way out. Open all windows and doors to the outside; shut all doors to other parts of the lab.
- DO NOT allow personnel unfamiliar with the mercury spill procedure to help you clean up the spill.
- Mercury can be cleaned up easily from the following surfaces: wood, linoleum, tile and any similarly smooth surfaces.
- A lab should be clear of on any textiles on the floor or furniture. If a spill does occur on any absorbent surfaces, specifically clothing, these contaminated items should be thrown away in accordance with the disposal means outlined below. Only cut and remove the affected portion of the contaminated carpet for disposal (if applicable).

Clean-up Instructions (small mercury spill)

1. Put on rubber, nitrile or latex gloves.
2. If there are any broken pieces of glass or sharp objects, pick them up with care. Place all broken objects on a paper towel. Fold the paper towel and place in a zip lock bag. Secure the bag and label it accordingly. Contact the EKU Environmental & Health Safety (E&HS) Office to assist in the proper disposal.
3. Locate visible mercury beads. Use cardboard or 'squeegee' to gather mercury beads. Use slow sweeping motions to keep mercury from becoming uncontrollable. Take a flashlight, hold it at a low angle close to the floor in a darkened room and

ITEMS NEEDED FOR CLEAN-UP
1. Ziplock-type bags (4 to 5)
2. Trash bags (2 to 6 mils thick)
3. Rubber, nitrile or latex gloves
4. Paper towels
5. Cardboard or 'squeegee'
6. Eyedropper
7. Duct tape, or shaving cream and small paint brush
8. Flashlight
9. Powdered sulfur (optional)

look for additional glistening beads of mercury sticking to the surface or small cracked areas of the surface. Note: Mercury can move surprising distances on hard-flat surfaces, so be sure to inspect the entire room when "searching."

4. Use the eyedropper to collect or draw up the mercury beads. Slowly and carefully squeeze mercury onto a damp paper towel. Place the paper towel in a zip lock bag and secure. Make sure to label the bag as directed by your local health or fire department.
5. After you remove larger beads, put shaving cream on top of small paintbrush and gently "dot" the affected area to pick up smaller hard-to-see beads. Alternatively, use duct tape to collect smaller hard-to-see beads. Place the paintbrush or duct tape in a zip lock bag and secure. Make sure to label the bag as directed by your local health or fire department.
6. *OPTIONAL STEP*: It is OPTIONAL to use commercially available powdered sulfur to absorb the beads that are too small to see. The sulfur does two things: i) it makes the mercury easier to see since there may be a color change from yellow to brown and ii) it binds the mercury so that it can be easily removed and suppresses the vapor of any missing mercury. The mercury vapor absorbent can be found in commercially available mercury spill kits.
   Note: When using powdered sulfur, do not breathe in the powder as it can be moderately toxic. Additionally, users should read and understand product information before use.
7. Request the services the EH&S Office who has monitoring equipment to screen for mercury vapors. Place all materials used with the cleanup, including gloves, in a trash bag. Place all mercury beads and objects into the trash bag. Secure the bag and label it accordingly. The EH&S Office can assist with proper disposal.
8. Contact your local health department, municipal waste authority or your local fire department for proper disposal in accordance with local, state and federal laws.
9. Remember to keep the area well ventilated to the outside (i.e., windows open and fans in exterior windows running) for at least 24 hours after your successful cleanup. Keep personnel out of cleanup area. If sickness occurs, seek medical attention immediately. For additional information on health effects from elemental mercury and associated vapors, consult the Agency for Toxic Substances and Disease Registry (ATSDR) Mercury Fact Sheet (http://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=113&tid=24).

LARGE MERCURY SPILL
(Greater than Thermometer but Less than Two Tablespoons or One Pound)

Cleanup Instructions (large mercury spill)

CALL EKU Director of Environmental Health and Safety through EKU Police Dispatch: 622-1111

1. Have everyone else leave the area; don't let anyone walk through the mercury on the way out.
2. Open all windows and doors to the outside.
3. Turn down the temperature.
4. Shut all doors to other parts of the room, and leave the area.
5. *DO NOT attempt vacuum.*

EXCESSIVE MERCURY SPILL
(More than Two Tablespoons or One Pound)

Cleanup Instructions (excessive mercury spill)

CALL EKU Director of Environmental Health and Safety through EKU Police Dispatch: 622-1111

Any time one pound or more of mercury is released to the environment, it is mandatory to call the National Response Center (NRC). The NRC hotline operates 24 hours a day, 7 days a week. Call (800) 424-8802. Note that because mercury is heavy, only two tablespoons of mercury weigh about one pound.

K. Laser Radiation Safety

Laser (acronym: Light Amplified by the Stimulated Emission of Radiation) is any device producing an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels. The following guidelines were developed from the American National Standard Institute's Standard For The Safe Use of Lasers (ANSI z136.1-2000), which is the laser industry's

standard for all persons who operate Class II, Class III, or Class IV laser products. The following are Laser Product Classifications:

Class I Laser Product:	Poses no threat of biological damage.
Class II Laser Product:	Output can cause biological damage if the beam is stared into for long periods of time.
Class IIIa Laser Product:	Output can cause biological damage to the eyes if the beam is collected by an optical instrument and directed into the eye.
Class IIIb Laser Product:	Can cause biological damage to the eyes if viewed briefly.
Class IV Laser Product:	Direct viewing and specular as well as diffuse reflections can cause biological damage to the eyes or skin.

Principle Laser Manager

An individual faculty or staff should be identified as the Principle Laser Manager for a particular laser found in a teaching or research laboratory and would be responsible for:

1. The immediate supervision of lasers in the laboratory.
2. Providing, implementing, and enforcing the safety recommendations and requirements prescribed in this program.
3. Place appropriate warning signs for each laboratory and while lasers are in operation. Each entrance must be posted with a danger sign in accordance with ANSI Z136.1-1993.
4. Classifying and labeling all of their lasers.
5. Ensure laser laboratories and other controlled areas must be designed so that personnel can enter and leave under emergency conditions.
6. Completing a Laser Registry Form (www.chemicalsafety.eku.edu) and sending it to the Department Chair.
7. Training all students / employees who work with and around Class 2a, 2, 3a, 3b, and 4 lasers in the safe use of lasers. This training has to be documented and accessible.
8. Registering for the Medical Surveillance program for users of Class 3b and Class 4 lasers.
9. Notifying the RSO immediately in the event of an exposure to a Class 3b or Class 4 laser.

Laser Operators

Faculty, staff, or students that plan on using a laser in a specific teaching or research laboratory, but has not been identified, as the Principle Laser Manager, must do the following:

1. Request laser safety and operating training from the Principle Laser Manager. This training has to be documented and accessible.
2. Read all the safety and instructions found in the operator manual for a specifc type of laser equipment.
3. Following appropriate alignment and standard operating procedures while operating a laser.
4. Keeping the Principal Laser Manager fully informed of any departure from established safety procedures. This includes notification of an exposure incident.

General Laser Safety Recommendations and Requirements

1. Eye Protection: Principal Investigators or staff who operate or supervise the operation of a laser is responsible for determining the need for laser eye protection for a particular laser. If required, the supervisor for staff and visitors to the area will provide eye protection. The booklet "Guide for Selection of Laser Eye Protection: produced by the Laser Institute of America may provide assistance in eyewear selection. Check with your Principal Investigator or OH&S for a copy.
2. The minimum laser radiant energy or laser power level required for the application should always be used.
3. Beam Control: To minimize direct eye exposure, observe these precautions:
    a. Do not intentionally look directly into the laser beam or at a specular reflection, regardless of its power.
    b. Terminate the beam path at the end of its useful path.
    c. Locate the beam path at a point other than eye level when standing or when sitting at a desk.
    d. Orient the laser so that the beam is not directed toward entry doors or aisles.
    e. Minimize specular reflections.

f. Securely mount the laser system on a stable platform to maintain the beam in a fixed position during operation and limit beam traverse during adjustments.
g. Confine primary beams and dangerous reflections to the optical table.
h. Clearly identify beam paths and ensure that they do not cross-populated areas or traffic paths.
i. When the beam path is not totally enclosed, locate the laser system so that the beam will be outside the normal eye-level range, which is between 1.2 to 2 meters from the floor. A beam path that exits from a controlled area must be enclosed where the beam irradiance exceeds the Maximum Permissible Exposure (MPE).

Controlling Associated Hazards

Many chemical and physical hazards other than laser radiation can be found in the laser area that must also be adequately controlled.

1. Electrical Equipment And Systems
   a. Always be aware of the high risk of injury and fire in laser operations because of the presence of electrical power sources.
   b. The installation, operation, and maintenance of electrical equipment and systems must conform to the standards stated in the National Electric Code (NFPA 70). Contact Facilities Division for assistance.
2. Lighting
   a. Adequate lighting is necessary in controlled areas.
   b. If lights are extinguished during laser operation, provide control switches in convenient locations or install a radio-controlled switch.
   c. Luminescent strips should be used to identify table and equipment corners, switch locations, aisles, etc.
   d. When ambient light is not sufficient for safe egress from a laser area during an electrical power failure, install emergency lighting.
3. Ionizing and Non-ionizing Radiation
   a. A laser operation may involve ionizing radiation that originates from the presence of radioactive materials or the use of electrical power in excess of 15kV.
   b. If radioactive material is present in the laser system, "CAUTION RADIOACTIVE MATERIAL" sign must be prominently displayed. If X-rays are generated a "CAUTION-X-RAYS" sign must be prominently displayed.
   c. Microwave and radio frequency (RF) fields may be generated by laser systems or support equipment.
4. Hazardous Materials
   a. Bring into the laser area only those hazardous materials that are needed for the operation.
   b. All hazardous materials must be properly used, stored and controlled. Consult Material Safety Data Sheets.
   c. Do not allow laser beams and strong reflections to impinge on combustible materials, explosives, highly flammable liquids or gases or substances that decompose into highly toxic products under elevated temperatures, without providing adequate controls.
   d. Conduct or sponsor tests that establish the effects of beam interactions with hazardous materials. Test results can be used to determine safe parameters for laser operation.
5. Dyes and Solutions
   a. Dye lasers normally use a lasing medium composed of a complex fluorescent organic dye dissolved in an organic solvent. These dyes vary greatly in toxicity, mutagenicity, and potential carcinogenicity.
   b. All dyes must be treated as hazardous chemicals. Most solvents suitable for dye solutions are flammable and toxic by inhalation and/or skin absorption.
   c. Obtain Safety Data Sheets for all dyes and solvents. Use and store all dyes and solvents in accordance with the Safety Data Sheets.
   d. Prepare and handle dye-solutions inside a chemical fume hood.
   e. Wear appropriate PPE (e.g lab coat, eye protection and gloves).
   f. Pressure-test all dye laser components before using dye solutions. Pay particular attention to tubing connections.
   g. Install spill pans under pumps and reservoirs.
   h. Be alert to contaminated parts.
   i. Keep dye-mixing areas clean.

L. Radioactive Materials

All matters pertaining to radioactive material must be discussed with the University Radiation Safety Officer (see Appendix 2).

M. Hazardous Material Disposal – General Guidelines

1. Information on proper disposal of hazardous chemicals presented from SDSs should be made available to all laboratory employees prior to discarding the chemical.
2. A guide to materials that may be disposed of in laboratory drains is found in the College of Science *Chemical Waste Handling Guide* (www.cas.eku.edu/CSF/docs/Chem_waste_handling.pdf). No water-insoluble materials should be disposed of in laboratory drains.
3. All hazardous waste must be placed into appropriate containers and labeled clearly with the identity of the waste(s), the approximate amount of each material; the dates when wastes were added to the container, and the name of the person who added the waste. Each container must be clearly marked with the words "Hazardous Waste" at the top of each label. An example label that can be used is found in Appendix 7.
4. Segregate waste by type. Mixing of waste material must be avoided because this complicates disposal and creates a potentially dangerous condition. Contact the Chemical Storage Facility Manager for information **before** creating waste.
5. Chlorinated solvents must be separated from non-chlorinated solvents in waste containers.
6. Special care should be taken when disposing of compounds that are shock sensitive or explosive. See list of compounds in Appendices 5 and 7.
7. All sharp objects, needles and glass must be disposed of in an approved labeled container (see Section Vc). Glass objects and other potentially sharp objects shall not be disposed of in regular waste containers. These types of materials in regular waste will significantly increase the risk of injury to the custodial staff. Containers must not be overfilled and must be labeled and sealed for proper handling and disposal.
8. Bio-hazardous waste must be placed into a container that is appropriately marked for such waste.
9. All waste containers that are rejected by the University Safety and Health office for pickup will be returned to the responsible faculty member. ***Departments will be responsible for the cost of characterization and disposal of unmarked hazardous waste.***

N. Laboratory Decommissioning

Laboratories vacated by University personnel should not contain abandoned equipment, chemicals, biological specimens, sharps, and a variety of waste materials. Those leaving the space are instrumental in assisting the departments in decommissioning space by identifying potential hazards in the area. Those entering these spaces (cleaning staff, contractors, new occupants, etc.) can be placed at great risk. The implement of this Laboratory Decommissioning Policy is to maintain safety for these individuals.

Laboratory Decommision General Principles

1. The policy is applicable for all laboratories and auxiliary spaces serving laboratories. This policy provides requirements for the removal of hazards from laboratory spaces when space is vacated. These moves can include:

   - Leaving Eastern Kentucky University (all campuses);

   - Moving to another building on campus; or

   - Relocating to another laboratory within the same building

2. When laboratories are vacated, all chemical, radioactive and biological materials, sharps and other wastes must be removed and disposed of properly.

3. When laboratories are vacated, all non-fixed pieces of laboratory equipment must be decontaminated, then removed from the location and appropriately placed back into service, stored in another location, or arranged for surplus (see www.chemicalsafety.eku.edu: Equipment Release Form).

   Surplus Note: Items that have been marked for surplus must be decontaminated (see www.chemicalsafety.eku.edu: Equipment Release Form) to avoid injury. Once released, please DO NOT place these items in the hallway or stairwell while waiting for a Facility Services pick-up. The Fire Marshall has the ability to shutdown entire facilities / buildings if items are found in these locations until the items are removed. Please keep these items in the existing location or to a separate storage space and direct Facility Services to those locations for pick-up.

4. The laboratory must be cleared of all possible hazards to reduce / eliminate risks of injury or potential for exposure (see www.chemicalsafety.eku.edu: Laboratory Clearance Checklist).

5. The person vacated the space MUST perform this decommissioning process so all materials found within the lab DO NOT become the responsibility of the new PI/supervisor.

VI. Provisions for Particularly Hazardous Substances

A. Permissible Exposure Limits (PELs)

1. The Laboratory Standard requires the employer to assure that employees' exposures to regulated substances do not exceed the Permissible Exposure Limits (PELs), specified in 29 CFR part 1910, subpart Z. The PELs represent Time Weighted Averages (TWAs) in parts per million (ppm) or milligrams of substance per cubic meter of air (mg/m^3). The TWA represents the ratio between exposure and work shift. Exposure limits can be found on a particular chemical SDS.

2. The American Conference of Governmental Industrial Hygienists (ACGIH) has established Threshold Limit Values (TLVs), which are TWA values similar to PELs but in some cases lower than the PELs. To keep employee exposures as low as reasonably achievable, employers are expected to uphold the lowest exposure limit, whether PEL or TLV.

B. Employee Exposure Determination

1. Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

2. Periodic monitoring. If the initial monitoring prescribed by the previous paragraph of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

3. Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

4. Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location accessible to the employees.

C. Special Provisions for Select Carcinogens, Reproductive Toxins, and Acutely Toxic Chemicals

In addition to the general safety guidelines mentioned throughout this CHP, special precautions are needed when handling genotoxins, reproductive toxins and chemicals with a high degree of acute toxicity. The laboratory supervisor must make provisions for additional employee protection for work with particularly hazardous substances and information about these substances can be found at

www.chemicalsafety.eku.edu. The following provisions and practices must be included with these materials:

1. Consult the SDS(s) for toxic properties of highly hazardous materials and follow the specific precautions and practices that are listed.
2. Quantities of these chemicals used and stored in the laboratory must be minimized, as should their concentrations in solution or mixtures.
3. Establish a designated area to use and store highly hazardous materials. The designated area may be a specific portion of laboratory, the entire laboratory (bio-safety level three or four require the *entire* laboratory be the designated area), or a device such as a fume hood or glove box.
4. The laboratory signage should have the appropriate symbols and special hazards in the appropriate sections (see Section VIIIa) and the designated area should be marked with a **DANGER, specific agent, AUTHORIZED PERSONNEL ONLY** sign or a comparable warning sign will assure that all personnel with access are aware of necessary safety precautions.
5. Label all containers, storage, and use areas appropriately.
6. Recommended that materials in breakable containers should be stored in chemical-resistant trays.
7. Work with genotoxins, reproductive toxins and acutely toxic chemicals must be performed within a certified functioning fume hood, biological safety cabinet, ventilated glove box, sealed system, or other system designed to minimize exposure to these substances. (The exhaust air from the ventilation systems may require scrubbing, or other treatment, before being released into the atmosphere.) In all cases, work with these types of chemicals must be done in such a manner that the OSHA permissible exposure limits or similar standards are not exceeded.
8. The ventilation efficiency of the designated fume hood, glove box or gas cabinet, and the operational effectiveness of mechanical and electrical equipment used to contain or manipulate these special substances should be evaluated periodically by the University Environmental Health and Safety Office at regular intervals.
9. Compressed gas cylinders that contain acutely toxic chemicals such as arsine, chlorine, and nitrogen dioxide must be kept in well-ventilated areas.
10. Establish procedures for safe removal of contaminated waste. Detection equipment may be required in laboratories where chemicals (especially poisonous gases) with a high degree of acute toxicity are utilized.
11. Establish decontamination procedures. 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.
12. 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.
13. Laboratory workers working with these chemicals must have access to appropriate protective equipment and clothing and must be trained on how to properly utilize the safety equipment.
14. Special precautions to avoid release and exposure to highly toxic chemicals, genotoxins and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained; gases should have properly functioning valves, check valves, regulators, containment which can withstand pressure buildup, and appropriate piping; and dispersive solids should be kept in closed containers, used in places with minimum air currents, and appropriate contact materials should be used to avoid static charging.

VII. Prior Approval

The responsibility for approval of the acquisition and use of toxic chemical agents rests with the laboratory supervisor. Some materials including toxic compressed gases, radioactive materials, and certain recombinant DNA and biohazards require prior internal or external approval at various levels. The laboratory supervisor should contact the Chemical Safety Officer and Chemical Storage Facility Manager regarding the approval process for use of highly hazardous materials or operations. This is also necessary since the Department of Homeland Security has issued a regulation entitled "Chemical Facilities Anti- Terrorism Standards" (CFATS). This rule applies to all entities that possess certain hazardous chemicals and is intended to prevent the intentional misuse of these chemicals. The regulation requires subject facilities to estimate the types and quantities of the chemicals, *Chemicals of Interest* (COI), on hand, and, in some cases, to develop site security plans and measures, perform training and drills, and maintain records. The list of COI can be found at www.chemicalsafety.eku.edu.

An approval form for certain materials may need to be processed before the purchase of these materials occurs (www.chemicalsafety.eku.edu). If a laboratory already has a significant amount of a COI, then the Chemical Storage Facility Manager needs to be notified.

VIII. Standard Laboratory Equipment

A. Laboratory Information and Signage

1. A Safety Data Sheet (SDS) is a document containing chemical hazard identification and safe handling information and is prepared in accordance with the OSHA Hazard Communication Standard.

   Chemical manufacturers and distributors must provide the purchasers of hazardous chemicals an appropriate SDS for each hazardous chemical/product purchased.

   The Departments and/or laboratory supervisors are required to keep SDSs and are readily accessible to laboratory employees. The system a laboratory uses to store SDSs can vary from keeping them in a notebook or file cabinet to using an on-line database. The system adopted must provide easy access to SDSs for hazardous chemicals used by all employees in the lab.

2. A standardized laboratory sign that should be used for Eastern Kentucky University College of Science laboratories is found at www.chemicalsafety.eku.edu. These forms should be filled out according to the instructions provided below, printed on yellow paper, and then affixed to each laboratory door/entrance.

   a. The top portion of the form should be filled in with appropriate symbols that pertain to the conditions of the laboratory. Every form already includes the “No Food/Drink” and “Eye Protection” symbol. Simply place the appropriate symbols in the provided boxes. If more symbols are needed than boxes are present, then multiple forms should be used.

   b. Under the symbols, a section exists called *“Necessary Information”* to include any special hazards/instructions. A statement is required in this section if more than 10 gallons or more of flammable liquid is present in a laboratory. Any information in this section would be important to aid in emergency response personnel.

   c. The next section will illustrate what types of hazardous material exist in the laboratory according to classification. Simply place the “Check-mark” symbol by the appropriate classifications. Detailed definitions of the hazardous chemical classifications can be found in Appendix 1.

   d. The final information is the names and contact information (including office location with phone numbers along with emergency phone numbers) for the laboratory supervisor and two additional personnel associated with the lab. Additional information in this section must be the room number, department contacts, and emergency 9-1-1.

e. An example of a laboratory sign filled out for a mock laboratory is provided at www.chemicalsafety.eku.edu.

B. Safety Showers / Eye Wash Stations

1. Safety showers and eye wash stations shall be available in or near all laboratories where hazardous materials are in use.
2. Safety Showers. Safety showers provide an immediate water drench of an affected person. The CSWG recommends the following American National Standards Institute (ANSI) standards for location, design and maintenance of safety showers:
   a. Showers shall be located within 25 feet of areas where chemicals with a pH of 2.0 or 12.5 are used.
   b. Showers shall be located within 100 feet of areas where chemicals with a pH of > 2 and < 4 or 9 and < 12.5 are used.
   c. The location of the shower should be clearly marked, well lighted and free from obstacles, closed doorways or turns.
   d. Safety showers are checked and flushed bi-annually by the laboratory supervisor. The laboratory supervisor also maintains documentation of these inspections.
3. Eye Wash Facilities. Eye wash facilities should be within 25 feet or 10 seconds travel of laboratories where injurious or corrosive chemicals are used or stored.
   b. Optimally, those affected must have both hands free to hold open the eye to ensure an effective wash behind the lids. This means providing eye wash facilities that are operated by a quick release system and simultaneously drench both eyes.
   c. Eye wash facilities must provide the minimum of a 15 minutes water supply at no less than 0.4 gallons per minute.
   d. Eye wash facilities must not exceed 25 pounds per square inch (PSI).
   e. Eye wash facilities need to be flushed out for five minutes at a time, once per week, by the laboratory supervisor. The laboratory supervisor also maintains documentation of these inspections. This will prevent buildup of materials or organisms that could damage the eye if the eyewash were used for an emergency.

C. Ventilation Controls

Ventilation controls are those controls intended to minimize employee exposure to hazardous chemicals by removing air contaminants from the work site. There are two main types of ventilation controls:

1. General (Dilution) Exhaust: a room or building-wide system that brings in air from outside and ventilates within. Laboratory air must be continually replaced, preventing the increase of air concentration of toxic substances during the workday. General exhaust systems are not recommended for the use of most hazardous chemicals.
2. Local Exhaust: a ventilated, enclosed work area intended to capture, contain and exhaust harmful or dangerous fumes, vapors and particulate matter generated by procedures conducted with hazardous chemicals, e.g. fume hood.

To determine ventilation requirements, assess the SDS. Some SDS terminology, as listed below, may indicate a need for special ventilation considerations beyond general exhaust ventilation:

   a. Use with adequate ventilation
   b. Avoid vapor inhalation
   c. Use in a fume hood
   d. Provide local exhaust ventilation

Proper Use of Local Ventilation Systems: Once a local ventilation system is installed, they must be used properly to be effective. For use of hazardous chemicals warranting local ventilation controls, the following practices should be observed:

1. Conduct all operations that may generate air contaminants at or above the appropriate PEL or TLV inside a fume hood.

   All fume hoods at Eastern Kentucky University facilities should have face velocities between 80 and 150 fpm with the sash at a "working height" (approximately 14 inches). As a general rule, fume hoods should not be operated with the sash fully open and should have the sash closed when not being used.

   The University Environmental Health and Safety office conducts a fume hood inspection and certification program for all fume hoods at the university. The CSO should be provided with a copy of the hood inspection results.

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

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

2. Keep the slots in the hood baffle free of obstruction by apparatus or containers.
3. Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder. Large equipment should be elevated at least two inches off the base of the fume hood, to allow for the passage of air underneath the apparatus.
4. Do not put your head in the hood when contaminants are being generated.
5. Do not use the hood as a waste disposal mechanism.
6. Excessive storage of chemicals or any apparatus in the hood will impair the performance of the chemical fume hood. Store flammable chemicals in an approved flammable storage safety cabinet. Store corrosive chemicals in a corrosive storage cabinet.
7. Be sure the switch is in the "on" position whenever the hood is in use and test hood often for airflow. Periodically check the airflow in the hood using a continuous monitoring device or another source of visible air flow indicator (e.g. attaching a lightweight ribbon to the bottom of the sash).
8. Minimize foot traffic past the face of the hood.
9. Do not remove hood sash or panels except when necessary for apparatus set-up; replace sash or panels before operating.
10. Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.
11. Use an appropriate safety shield/barricade if there is a chance of explosion or eruption.
12. If the hood sash is supposed to be partially closed for operation, the hood should be so labeled and the appropriate closure point clearly indicated.

Proper use of Ductless Ventilation Systems: If any ductless, or portable fume hoods, which employ filtration media, will be acquired and used instead of conventional local exhaust hoods, contact the CSO and or Environmental Health and Safety office for consultation before acquisition.

IX. Controlling Chemical Exposures

The Laboratory Standard requires the employer to determine and implement control measures to reduce employee exposure to hazardous chemicals. Particular attention must be given to the control measures for chemicals that are known to be extremely hazardous. There are three major routes of entry for a chemical to enter the body: inhalation, absorption, and ingestion. The controls for prevention of these various routes of entry include engineering controls, personal protective equipment and administrative controls.

A. Inhalation

Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. The best method for reducing inhalation risk is using a less hazardous material in place of a more hazardous one. If substitution is not practical, engineering controls such as ventilation should be used to lessen the chance of exposure. The use of properly functioning local exhaust ventilation such as fume hoods, biological safety cabinets, and vented glove boxes is often required to minimize exposure to hazardous chemicals. Dilution ventilation may be used to reduce exposure to nonhazardous nuisance odors. For extremely toxic chemicals such as those classified as poison gases by State or Federal agencies (e.g., arsine, phosgene) the use of closed systems, vented gas cabinets, fail-safe scrubbing, detection or other stricter controls may be required.

If neither substitution nor engineering controls are practical, the use of personal protective equipment, such as dust masks or respirators may be required to reduce inhalation exposures. If laboratory employees wear respirators, requirements of the OSHA Respirator Standard (1910.134) must be met and a written respirator program must be implemented.

In addition to the controls discussed above, the following general guidelines should be followed to reduce the risk of exposure to hazardous chemicals:

- Minimize exposure time to hazardous materials
- Restrict access to an area where a hazardous chemical is used
- Maintain proper signs on lab doors to indicate special hazards within

B. Absorption

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

C. Ingestion

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

X. Emergency / Medical Practices

Planning for emergencies is an essential component of laboratory safety. Workers in labs should have the knowledge necessary to assess their risks from a small spill or release of a chemical or a fire, if they have received proper training. Generally, laboratory personnel should respond to emergencies situations *only if they are formally trained or certified to do so*. Employees are expected to respond to non-emergency situations. The most important aspect of this section is being able to differentiate between an incidental situation and an emergency.

A. Emergency and Spill Response – Basic Steps

1. Releases of hazardous substances that pose a significant threat to health and safety or that, by their very nature, require an emergency response regardless of the circumstances surrounding the release or the mitigating factors are emergency situations. The following definitions designate an ***Emergency Situation***:

    a. Situation is unclear to the person causing or discovering a spill;

b. Release requires evacuation of persons;

c. Release involves or poses a threat of fire, suspected fire, explosion or other imminent danger; conditions that are Immediately Dangerous to Life and Health (IDLH); high levels of exposure to toxic substances.

d. Person(s) in the work area is uncertain they can handle the severity of the hazard with the personal protective equipment (PPE) and response equipment that has been provided and/or the exposure limit could easily be exceeded.

2. Releases that do not pose significant safety or health hazards to person(s) in the immediate vicinity or to the person(s) cleaning up the material and do not have the potential to become emergencies within a short time frame are not emergency situations. The following situations ***ARE NOT Emergency Situations:***

   a. Person causing or discovering the release understands the properties and can make an informed decision as to the exposure level.

   b. Lab supervisor and/or workers can appropriately clean release.

   c. Materials are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to persons in the immediate work area or those assigned to clean up the activity.

   d. Incidental releases of hazardous substances that are routinely cleaned up by the laboratory supervisor (or his/her designate) need not be considered an emergency.

3. Laboratory Fires

   a. *Small Localized Fires*: Smother the fire with a fire-resistant material can put out fires isolated in a chemical container. A person trained in the use of fire extinguishers can extinguish slightly larger fires.

   b. *Emergency Situation Fires*: If an employee judges that the fire or fire-related emergency is too large to be handled without danger to the employee, then:

      i. Alert personnel in the area and alert neighbors;

      ii. Pull the fire alarm, or instruct another to do so;

      iii. Confine the fire if it is possible to do so without endangering yourself.

      iv. If the fire is in a fume hood, shut hood sash if possible.

      v. Close doors to prevent spread of fire.

      vi. Evacuate the building or hazardous area.

      vii. Call 9-1-1 or other emergency response personnel from a safe location. Remain on the line until all necessary information has been given to the responding organization.

   Actual fire emergency conditions may require that the previous actions be followed in a different order, depending on the layout of the laboratory, time of day, the number of people present and the location of the emergency relative to doors and alarm stations or telephones.

4. Laboratory Spills

   a. *Minor Spills*: If the spill is less than one liter and the chemical involved is of low toxicity and a low flammable hazard, lab personnel should clean up the spill of chemicals immediately. The person cleaning up the spill should avoid contact with the hazardous material.

      i. Non-reactive Spills: Cover liquid spills with absorbent and scoop into a plastic disposal bag. Sweep solid materials into a dustpan and place in a sealed container. Contact the Chemical Storage Facility Manager for information on disposal.

      ii. Reactive or Potentially Reactive Spills: Absorbent materials will be available in all laboratories to absorb acidic, basic, or organic spills. Absorbent towels will also be available. Wet mop dry substances to avoid spreading hazardous dust, provided it is non-water reactive. If spilled chemical is a volatile solvent, transfer disposal bag to a hood for containment. Contact the Chemical Storage Facility Manager for information on disposal.

   b. *Emergency Situation Spills*: If the spill is of high toxicity or flammability or you are unsure of how to proceed or is more than one liter, execute the following:

i. Evacuate personnel from the spill area and alert neighbors to the spill;
ii. Isolate the spill area and close doors to the room where the spill occurred;
iii. Shut down equipment if possible;
iv. Call 9-1-1 or other emergency response personnel from a safe location;
v. Provide information on the nature and location of spill to emergency response personnel.

c. *Attend to Victims for a Body Splash*:

i. Remove person(s) from spill area to fresh air only if an attempt to rescue victim(s) does not present a danger to the rescuers.
ii. Remove contaminated clothing while under an emergency shower.
iii. Flood affected area with water for at least 15 minutes or longer if pain persists.
iv. Wash skin with mild soap and water – do not use neutralizing chemicals, unguents, creams, lotions or salves.
v. Contact emergency response personnel and assure they know the chemical(s) involved. Have SDS(s) available if possible.

d. *Attend to Victims for an Eye Splash*:

i. Remove victim(s) from spill area to fresh air only if an attempt to rescue victim(s) does not present a danger to the rescuers.
ii. Lead the victim(s) immediately to an emergency eye wash facility.
iii. Hold eyelids open.
iv. Flush eyes for at least 15 minutes or longer if pain persists.
v. Contact emergency response personnel and assure they know the chemical(s) involved. Have SDS(s) available if possible.

5. Hazardous Material (HazMat) Emergency

The following are examples that would require a HazMat response:

a. Spill or release of significant quantities of toxic or highly toxic substances (e.g. mercury, carcinogens, chemicals with very low exposure limits;
b. Release or spill of significant quantities of chemicals with other dangerous properties (such as highly corrosive, water reactive);
c. Condition that poses a fire or explosion hazard.

6. Power Outages. If emergency lighting and fire alarms ARE NOT operable, evacuate the building after the following steps have been taken:

a. Place lids on all open containers of volatile chemicals;
b. Lower the sash on chemical fume hoods;
c. Shut down all equipment (leave cooling water and purge gases on as necessary);
d. Turn off ignition sources;
e. Secure or isolate reactions that are underway (boiling liquid on a hot plate, distillations);
f. Take your books, coats, purse/wallet, keys, etc.;
g. Close fire doors.

In anticipation of possible power outages, do the following:

a. Have a flashlight conveniently located or other emergency lighting;
b. Make sure that all emergency contact numbers on the door are accurate and updated;
c. Shut down experiments.

B. Injury and Illness

Any incident resulting in injury (example list of common injuries are found below) in the laboratory must be documented with a Laboratory Incident / Injury Report (www.chemicalsafety.eku.edu),

which consists of two different forms. Form A of the Report needs to be completed by the injured party and returned to the immediate Principal Investigator or Instructor or Supervisor within 24 Hours of the event. Form B of the Report needs to be completed by the Principal Investigator or Instructor or Supervisor and returned to the appropriate Departmental Office (copy to Chemical Safety Officer) within 24 Hours of the incident. The time for the entire Report completion may be dependent on the conditions of an incident.

1. Minor burns or injuries: Minor burns or injuries are those that can be easily treated by the injured person. Treatment could include running cold water over a burn, or applying a band-aid to a small cut.
2. Serious but not life-threatening burns or injuries: If the burn or injury is serious enough that self-medication is not sufficient, the person should seek medical attention. The student health center is located in Rowlett Building. For extended campuses, the student is directed to a local health care facility or emergency room that can treat the injury. Another person should accompany the person who needs medical attention.
3. Life-threatening burns, injuries or illness: In situations where burns or injuries are life threatening, medical personnel should be summoned to the lab by calling 911. Other laboratory personnel should take only those actions that will prevent additional harm to the person. No medical treatment should be administered to the injured person unless the person administering the treatment is trained and certified to perform the treatment.
4. If a person is on fire, the following actions can be taken:
    b. Stop the person on fire from running! Do not allow anyone to run, not even to a fire blanket.
    c. Drop the person to the floor. Standing will allow flames to spread upward to eyes and nose.
    d. Roll the person to snuff out the flames.
    e. Cool the person. Remove smoldering clothing. Use cold water or ice packs to cool burns and minimize injury.
    f. Get medical assistance immediately.
5. Chemical exposure: If a person has suffered a widespread chemical exposure to the body and/or eyes, other persons should help the injured person get to the safety shower and eyewash. The most important emergency measure if chemicals are splashed to the eyes or skin is immediate flushing with water. Most splashes need at least 15 minutes of washing. Get medical assistance immediately.

C. Medical Consultations

An opportunity for laboratory workers to receive medical consultation must be provided if an employee develops any symptoms thought to arise from chemical overexposure or after an event such as a major spill, leak or explosion which may have resulted in an overexposure.

These suspected or actual exposures requiring medical evaluation can and should be treated as a regular Workers Compensation claim. The injured employee must fill out an Accident - Occupational Injury/Illness Report Form and go to an appropriate medical facility (e.g. occupational medicine clinic, employee health, qualified outside physician, etc.) for treatment. Following notification of overexposure, arrangements for an appropriate medical examination must be completed before the exposed individual may return to work.

Any medical examination required by this CHP must be provided without cost to the employee, without loss of pay and at a reasonable time and place. Records of any medical examination will be maintained at the medical facility providing service or with appropriate medical personnel at the University.

D. University Guide for General Emergency Response

The EKU Emergency Action Plan contains information about responding to general emergencies, such as weather, utilities, etc. This document can be accessed at the EKU Public Safety page (https://emergency.eku.edu:4745/sites/emergency.eku.edu/files/EAP.pdf).

XI. Employee Information And Training

A. Information

All individuals who work in laboratories where they may be exposed to hazardous chemicals must be informed about the hazards of chemicals and equipment present in their work area. This information and training must be provided before initial assignment and before new exposure situations. The employer must provide equipment necessary for the safe handling of hazardous substances. **It is the responsibility of the Laboratory Supervisor to ensure that all laboratory workers have been properly trained.** The College Chemical Safety Officer will provide general training materials concerning lab safety and the EKU CHP. However, training specific for the particular lab where an employee is assigned is the responsibility of that employee's supervisor. The laboratory supervisor must maintain a written record, showing the content of the training, the date, and the names of the trainer and employee. The supervisor must determine the frequency of refresher information and training.

B. Training

General training will be provided to all Laboratory Supervisors and Workers and may take the form of individual instruction, group seminars, webinars / web-tutorials, handout materials, or any combination of the above.

Laboratory workers must be familiar with and adhere to the requirements of the CHP, other specific laboratory safety guidelines developed by their laboratory supervisor, EKU requirements and other relevant regulatory requirements (e.g. Radiation Safety).

1. General Training: Laboratory worker training must include information on:

    a. Location and availability of the OSHA Laboratory Standard;
    b. Location and availability of this Chemical Hygiene Plan (CHP);
    c. Methods that can be used to obtain reference materials on chemical safety (including SDSs);
    d. Handling hazardous waste;
    e. Labelling;
    f. The work practices, personal protective equipment, and emergency procedures to be used to ensure that the employee may protect himself/herself from overexposure to hazardous chemicals.

    The manufacturer's safety data sheets (SDS) will generally contain much of the information needed to comply with the information and training requirements of the OSHA Laboratory Standard. Laboratory supervisors and employees should understand the relevant SDS and/or other comparable literature on the hazardous chemicals, which are used or stored in their laboratory. The employee’s supervisor must provide additional training for specific lab hazards.

    Copies of SDS may be obtained from the chemical supplier or from trusted sources found on the Internet. Individual departments or laboratories are strongly encouraged to maintain their own files of reference materials.

2. Special Hazards: Special hazards that apply only to a specific laboratory are to be identified by the laboratory supervisor. The supervisor is responsible for training the workers in that laboratory on these special hazards, and for maintaining documentation of this training. The training should include information on:

    a. The permissible exposure limits for OSHA regulated substances;
    b. Signs and symptoms associated with exposure to the hazardous chemicals found in the lab;
    c. Detection methods that may be used to detect the presence or release of a hazardous chemical.

3. Documentation: General awareness training about the OSHA laboratory standard and waste handling by Resource Conservation and Recovery Act (RCRA) will be performed by the CSO and recorded when complete. It is necessary the laboratory supervisor or the department retain records of specific laboratory training needed for individual laboratories (departments will need to identify those labs that need specific training (example: Handling of Mercury or Mercury Compounds). The amount of time a unit chooses to retain training records is not specified in the Laboratory Standard.

4. Accident Reports: Laboratory workers and Principal Investigators or Instructors or Supervisors must be aware that any incident resulting in injury in the laboratory must be followed by filling out and filing a Laboratory Incident / Injury Report (www.chemicalsafety.eku.edu), which consists of two different forms. Form A of the Report needs to be completed by the injured party and returned to the immediate Principal Investigator or Instructor or Supervisor within 24 Hours of the event. Form B of the Report needs to be completed by the Principal Investigator or Instructor or Supervisor and returned to the appropriate Departmental Office (copy to Chemical Safety Officer) within 24 Hours of the incident. The time for the entire Report completion may be dependent on the conditions of an incident.

XII. Inspections

A. Inspection and Maintenance

1. Temperature control and over-temperature shutoff devices on heating equipment should be tested in accordance with manufacturer recommendations to ensure proper operation.
2. All automatic shutoff devices should be tested in accordance with manufacturer recommendations to ensure proper operation.
3. The user should visually inspect explosion shields and isolation devices for cracks or other damage before each use.
4. Laboratory (or related areas) Inspections:
   - Laboratories need to be inspected on a periodic basis. Laboratory principle investigators, instructors, or supervisors shall conduct internal periodic laboratory inspections based on the Laboratory Safety Inspection Checklist (www.chemicalsafety.eku.edu). The purpose of this checklist is to provide the Principal Investigator or Laboratory Supervisor a tool to help perform a self-audit of each laboratory. The frequency of these internal inspections is at the disgretion of the individual departments. A section at the end of the checklist is available where department specific items that require inspection can be added. The internal inspection can be delegated to Laboratory workers as needed.
   - Laboratories shall be inspected externally at least annually by CSO.

XIII. Records

The following records shall be maintained:

1. Safety training records are maintained by the CSO or, for special hazards training, by the Laboratory Supervisor.
2. Annual inspection reports of the laboratories are maintained by the CSO.
3. Each department should maintain a list of all personnel who have access to the building after hours. For extended campuses, the director of the extended campus should maintain this list of personnel. This list should include emergency contact information for each person.
4. The department chairs or campus director shall maintain copies of all incident reports submitted to them.

REFERENCES

References Cited in Text

1. The 2012 OSHA Hazard Communication:
http://www.osha.gov/dsg/hazcom/ghs-final-rule.html

2. General information about the OSHA Hazard Communications Program:
http://www.osha.gov/dsg/hazcom/index.html

3. *Safety in Academic Chemistry Laboratories*, Volume 1 and 2. American Chemical Society, 7th Edition, 2003.

4. Personal Protective Equipment:
   a. United States Department of Labor: Occupational Safety and Health Administration: Safety and Health Topics: http://www.osha.gov/SLTC/personalprotectiveequipment/
   b. Gloves: search for the best glove for a variety of hazardous materials: http://www.chemrest.com/

5. The Chemical Reactivity Worksheet is a free program you can use to find out about the reactivity of substances or mixtures of substances. http://response.restoration.noaa.gov/chemaids/react.html

6. Furr, A. Keith. *CRD Handbook of Laboratory Safety*. Boca Raton: CRC Press, 2000, pp. 243-244.

7. Environmental Protection Agency (EPA): 'Mercury Releases and Spills': http://www.epa.gov/hg/spills/

General References

Prudent Practices in the Laboratory: Handling and Disposal of Chemicals, National Academy of Sciences, National Academies Press, 1995. Online version: http://books.nap.edu/books/0309052297/html/index.html

American Industrial Hygienists Association (AIHA) Laboratory Safety Information and Links
http://www.aiha.org/Pages/default.aspx

NIOSH links to many topics on chemical safety:
http://www.cdc.gov/niosh/topics/chemical-safety/

Appendix 1. Detailed Definitions (Physical and Health Hazards)

A. Physical Hazards (definitions):

Hazard	Definition
Cryogens	Cryogenic liquids such as oxygen, nitrogen, argon, helium and hydrogen are substances that are normally in the gaseous state but are cooled to extremely low temperatures so that they are liquids. Some of the hazards associated with cryogens are fire, pressure, weakening of materials, and skin or eye burns upon contact with the liquid.
Hazard Category	The division of criteria within each hazard class, e.g., oral acute toxicity and flammable liquids include four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.
Hazard Class	The nature of the physical or health hazards, e.g., flammable solid, carcinogen, oral acute toxicity.
Hazard Statement	A statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.
Heavy Metals	Any metal with a specific gravity of 5.0 or greater and that can be toxic to organisms at certain concentrations. Heavy metals include antimony, arsenic, bismuth, cadmium, cerium, chromium, cobalt, copper, gallium, gold, iron, lead, manganese, mercury, nickel, platinum, silver, tellurium, thallium, tin, uranium, vanadium, and zinc.
Light Sensitive Materials	Materials that degrade in the presence of light forming new compounds that can be hazardous, or resulting in conditions such as pressure build-up inside a container, which may be hazardous. Examples of light sensitive materials include chloroform, tetrahydrofuran, ketones and anhydrides.
Pictogram	A composition that may include a symbol plus other graphic elements, such as a border, background pattern, or color, that is intended to convey specific information about the hazards of a chemical. Eight pictograms are designated under this standard for application to a hazard category.
Product Identifier	The name or number used for a hazardous chemical on a label or in the SDS. It provides a unique means by which the user can identify the chemical. The product identifier used shall permit cross-references to be made among the list of hazardous chemicals required in the written hazard communication program, the label and the SDS.
Pyrophoric gas	A chemical in a gaseous state that will ignite spontaneously in air at a temperature of 130 degrees F (54.4 degrees C) or below.
Signal Word	A word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used in this section are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for the less severe.

B. Health Hazards (definitions):

Hazard	Definition
Carcinogens	Chemicals that cause cancer.
Select carcinogens	Compounds including those which are regulated by OSHA as carcinogens (20 CFR 1910); are listed under the category, "known to be carcinogens," (www.chemicalsafety.eku.edu/) in the Annual Report on Carcinogens published

	by the National Toxicology Program, or are listed under group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs.
Corrosives	Chemicals that cause visible destruction or, or irreversible alterations in, living tissue by chemical action at the site of initial contact.
Irritants	Chemicals which are not corrosive, but which cause a reversible inflammatory effect on living tissue by chemical action at the site of contact.
Sensitizers	Chemicals that cause a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.
Target organ effects	The following is a target organ categorization of effects that may occur, including examples of signs and symptoms and chemicals that have been found to cause such effects. These examples are presented to illustrate the range and diversity of effects and hazards found in the workplace, and the broad scope employees must consider in this area. The examples are not intended to be all-inclusive:
Hepatotoxins	Chemicals, which produce liver, damage. Example of signs and symptoms include jaundice and liver enlargement. Examples of chemicals, which are hepatotoxins, include carbon tetrachloride, nitrosamines.
Nephrotoxins	Chemicals, which produce kidney damage. Examples of signs and symptoms include edema (retention of water) and proteinuria (protein in the urine). Examples of chemicals, which are nephrotoxins, include halogenated hydrocarbons and uranium.
Neurotoxins	Chemicals that produce their primary toxic effects on the nervous system. Examples of signs and symptoms include behavioral changes, decrease in motor functions. Examples of chemicals, which are neurotoxins, include mercury and carbon disulfide.
Agents, which act on the hematopoietic system	Chemicals that act on the blood system. Examples of signs and symptoms include cyanosis and loss of consciousness. Examples of chemicals, which act on the hematopoietic system, include carbon monoxide and cyanides.
Agents, which damage the lungs	Chemicals that irritate or damage the pulmonary tissue. Examples of signs and symptoms include tightness in the chest and shortness of breath. Examples of chemicals, which damage the lungs, include silica and asbestos.
Reproductive toxins	Chemicals, which affect the reproductive capabilities including chromosomal damage (mutagens) and effects on the fetuses (teratogens). Examples of signs and symptoms include birth defects and sterility. Examples of chemicals that are reproductive toxins include lead and DBCP (dibromochloropropane).
Cutaneous hazards	Chemicals, which affect the dermal layer (skin) of the body. Examples of signs and symptoms include defatting (drying) of the skin, rashes, and irritation. Examples of chemicals that are cutaneous hazards include ketones and chlorinated compounds.
Eye hazards	Chemicals that affect the eye or visual capacity. Examples of signs and symptoms include conjunctivitis and corneal damage. Examples of chemicals that are eye hazards include acids, bases and organic solvents.
Toxic	All chemicals are considered toxic, or capable of producing injury to some degree, should they gain access into the body in sufficient concentration.
	The Occupational Safety and Health Administration defines "toxic" as chemicals which have an average lethal dose (LD_{50}) or lethal concentration (LC_{50}, indicates average lethal inhalation exposure) of:
Ingestion:	LD_{50} between 50 and 500 mg/kg body weight when administered orally to albino rats;

Skin Contact: LD_{50} between 200 and 1000 mg/kg body weight when administered by continuous dermal contact over a 24 hour period to albino rabbits;

Inhalation: LC_{50} between 200 and 2000 parts per million of gas or vapor or between 2 and 20 mg/l of mist, fume, or dust, when administered continuously by inhalation for one hour to albino rats.

Highly toxic: Chemicals, which have an average lethal dose of:

Ingestion: LD_{50} of less than 50 mg/kg body weight when administered orally to albino rats;

Skin Contact: LD_{50} of less than 200 mg/kg body weight when administered by continuous dermal contact over a 24 hour period to albino rabbits, or

Inhalation: LC_{50} of less than 200 parts per million of gas or vapor or 2 mg/l of mist, fume, or dust, when administered continuously by inhalation for one hour to albino rats.

Appendix 2. Chemical Safety Personnel Listing

Academic Year 2016 – 2017

Dean of the College of Science:	Tom Otieno	622-1405
Associate Dean of the College of Science	Karen Sehmann	622-8140
Biological Sciences Department Chair	Malcolm Frisbie	622-1531
Chemistry Department Chair	Darrin Smith	622-1456
Geosciences Department Chair	Melissa Dieckmann	622-1274
Physics Department Chair	Anthony Blose	622-1521
Extended Campuses		
Corbin Director	Sandra Stevens	622-6715
Manchester Director	Terry Gray	622-6644
Danville Director	Cindy Peck	622-6636
Science Laboratory Manager	Mary Lamar	622-6709
Chemical Safety Officer	Andrew Garrett	622-2049
Chemical Storage Facility Manager	Larry Miller	622-6355

Chemical Safety Workgroup

Biological Sciences Department Representative:	Marcia Pierce	622-1535
Geosciences Department Representative:	Stewart Farrar	622-1279
Physics Department Representative:	Jon Gaffney	622-1528
Biological Sciences Laboratory Manager:	Tim Weckman	622-1533
Chemical Storage Facility Manager:	Larry Miller	622-6355
Chemistry Department Representative:	Andrew Garrett	622-2049
Chemistry Laboratory Manager:	Joseph Bequette	622-1461
Environmental Health and Safety, Director:	Bryan Makinen	622-2421
Extended Campuses Science Laboratory Manager	Mary Lamar	622-6709
University Counsel:		622-6694

Appendix 3. Label Elements

Labels on chemical containers will comply with the Globally Harmonized System (GHS) for labeling of chemicals. As stated in Section V part F of this Chemical Hygiene Plan, all labels will contain the following parts:

a. Product Identifier: Chemical name, code number, or batch number determined by the supplier.

b. Signal Word: Either “Danger” for severe hazards or “Warning” for less severe hazards.

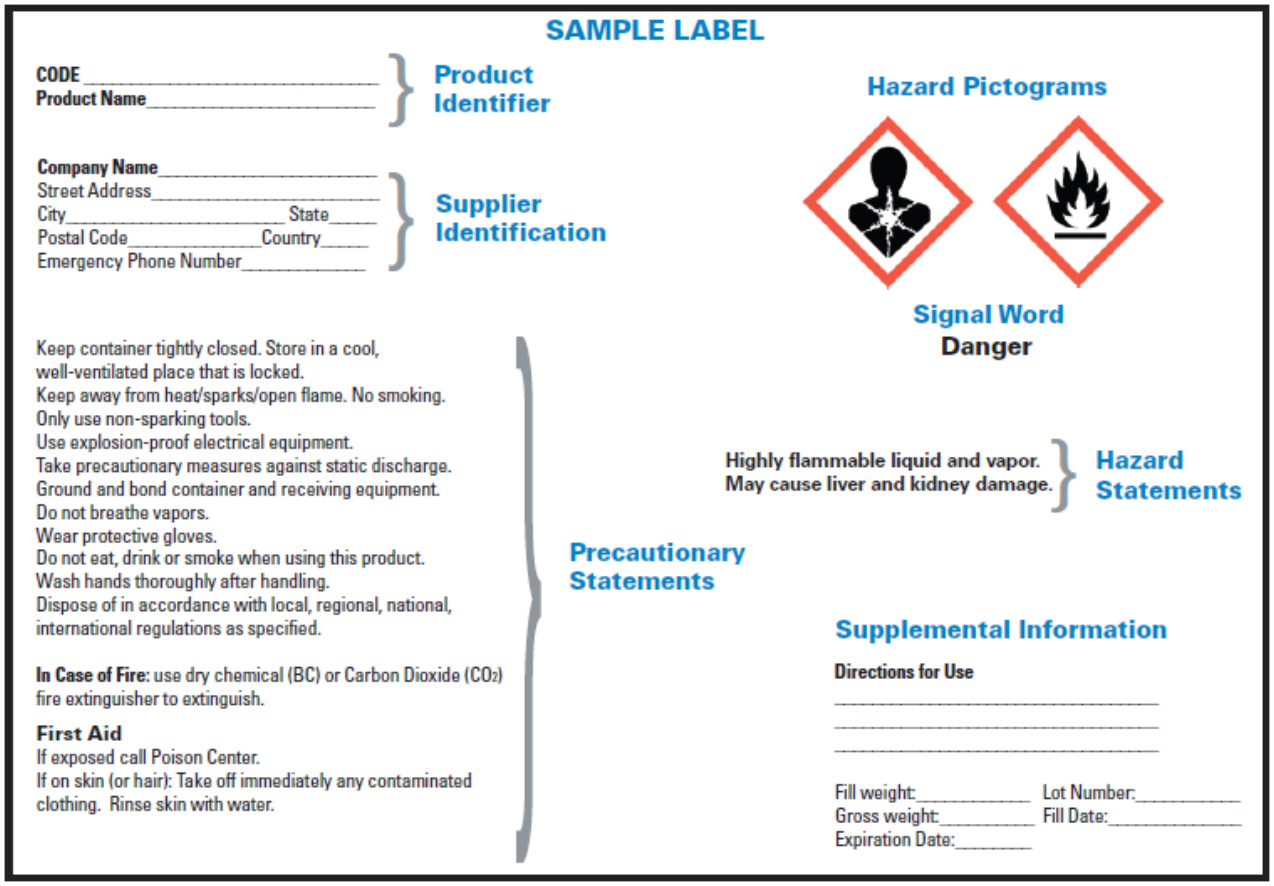
c. Pictogram: Symbols used to depict the hazard categories associated with the chemical. The eight possible pictograms include: Health Hazard, Flame, Exclaimation Mark, Gas Cylinder, Corrosion, Exploding Bomb, Flame over Cirlce, Environment, and Skull and Crossbones. See HCS Pictograms and Symbols below for all symbols and definitions.

d. Hazard Statement(s): A description of the hazard(s) of the chemical. For example: “Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin.” Hazard Statements are specific to the hazard classification categories, and chemical users should always see the same statement for the same hazards.

e. Precautionary Statement(s): A phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling.

f. Name, address and phone number of the chemical manufacturer, distributor, or importer.

An example of a chemical label and pictograms are found below.



HCS Pictograms and Definitions

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment** (Non-Mandatory)  • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

Appendix 4. Safety Data Sheet (SDS) Format and Information

Previously, Material Safety Data Sheets (MSDSs) could vary in format and information from one manufacturer to another. Under the new GHS protocol, Safety Data Sheets (SDSs) all must include a standardized 16-section format:

1. **Identification**: Product identifier, manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

2. **Hazard(s) identification**: includes all hazards regarding the chemical; required label elements.

3. **Composition/information on ingredients**: includes information on chemical ingredients; trade secret claims.

4. **First-aid measures**: includes important symptoms/effects, acute, delayed; required treatment.

5. **Fire-fighting measures**: lists suitable extinguishing techniques, equipment; chemical hazards from fire.

6. **Accidental release measures**: lists emergency procedures; protective equipment; proper methods of containment and cleanup.

7. **Handling and storage**: lists precautions for safe handling and storage, including incompatibilities.

8. **Exposure controls/personal protection**: lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

9. **Physical and chemical properties**: lists the chemical's characteristics.

10. **Stability and reactivity**: lists chemical stability and possibility of hazardous reactions.

11. **Toxicological information**: includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

*12. Ecological information

*13. Disposal information

*14. Transport information

*15. Regulatory information

16. **Other information**:,includes the date of preparation or last revision.

*Note: Sections 12-15 are not regulated by OSHA (29 CFR 1910.1200(g)(2)).

Appendix 5. Personal Protective Equipment (PPE) Guidelines for Hazardous Material Handling

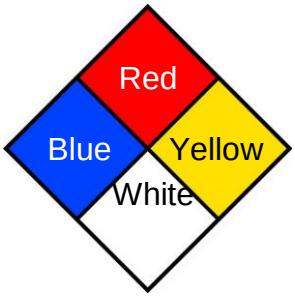
Hazard Assessment And Personal Protective Equipment Guidelines For General Laboratory Operations

Hazard	Personal Protective Equipment (PPE) Recommended		
	Eye	**Face**	**Hand/Skin/Body**
Any laboratory use of hazardous chemicals or potential for impact hazard	Safety glasses with side shields **required** at all times		Lab coat*
Any use of corrosive chemicals, strong oxidizing agents, carcinogens, mutagens, etc. where a reasonable probability of splash exist.	Chemical splash goggles	Full face shield with chemical splash goggles when working with larger quantities including i) acid baths, ii) over 4 liters of corrosive liquids, iii) any volume of concentrated corrosives, or iv) highly reactive chemicals.	Resistant gloves (See www.chemicalsafety.eku.edu for chemical resistance of common glove materials) *Impervious lab coat, coveralls, apron, protective suit (for work with over 5 gallons corrosive liquids)
Temperature extremes	Face shield required for transfer of cryogenic materials	Face shield required for transfer of cryogenic materials	*Insulated gloves for handling ovens, furnaces, cryogenic bath and other devices over 100° C or below -1° C
Sharp objects (broken glass, insertion of tubes or rods into stoppers)	Safety glasses with side shields		*Heavy cloth barrier or leather gloves

* These garments should not leave the work site.

Appendix 6. National Fire Protection Association (NFPA) Hazard Diamond

This labeling system uses 4 diamonds of different colors to denote various types of hazards. Within each colored diamond is a number that indicates the level of hazard for the material.



Health (Blue Diamond)

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

Flammability (Red Diamond)

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

Reactivity (Yellow Diamond)

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

Special Notice (White Diamond)

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

Appendix 7. Sample Hazardous Waste Label

CAMPUS PICK-UP DATE:_____
OUTSIDE CONTRACTOR PICK-UP DATE:_____

HAZARDOUS WASTE DISPOSAL
EKU Risk Management and Insurance
Million House, Ext. 2-5523
(please print legibly)

Name of Contact Person:_____Accumulation Start Date:_____
Department:_____Building:_____Room#_____ Phone:_____
Contents (Chemical Name):_____ Amount:_____
_____ Amount:_____
_____ Amount:_____
Physical State (Solid, Semi-Solid, Liquid, Gas):_____ Weight (in lbs):_____

CIRCLE the applicable one:

Flammable Corrosive Acid Base

Toxic Poison Explosive Metal Oxidizer Shock Sensitive

SPECIAL PRECAUTIONS:_____
PLEASE NOTE:
1. Tape 2 copies of this completed form to each waste item to be picked up
2. Damaged, leaking, or pressurized containers will be refused
3. "Unknown" contents will not be accepted

CAMPUS PICK-UP DATE:_____
OUTSIDE CONTRACTOR PICK-UP DATE:_____

HAZARDOUS WASTE DISPOSAL
EKU Risk Management and Insurance
Million House, Ext. 2-5523
(please print legibly)

Name of Contact Person:_____Accumulation Start Date:_____
Department:_____Building:_____Room#_____ Phone:_____
Contents (Chemical Name):_____ Amount:_____
_____ Amount:_____
_____ Amount:_____
Physical State (Solid, Semi-Solid, Liquid, Gas):_____ Weight (in lbs):_____

CIRCLE the applicable one:

Flammable Corrosive Acid Base

Toxic Poison Explosive Metal Oxidizer Shock Sensitive

SPECIAL PRECAUTIONS:_____
PLEASE NOTE:
1. Tape 2 copies of this completed form to each waste item to be picked up
2. Damaged, leaking, or pressurized containers will be refused
3. "Unknown" contents will not be accepted

Appendix 8: Mercury Spill Procedures[x]

SMALL MERCURY SPILL (i.e. thermometers)

- Have everyone else leave the lab; don't let anyone walk through the mercury on the way out. Open all windows and doors to the outside; shut all doors to other parts of the lab.
- DO NOT allow personnel unfamiliar with the mercury spill procedure to help you clean up the spill.
- Mercury can be cleaned up easily from the following surfaces: wood, linoleum, tile and any similarly smooth surfaces.
- A lab should be clear of on any textiles. If a spill occurs on any absorbent surfaces, these contaminated items should be thrown away in accordance with the disposal means outlined below. Only cut and remove the affected portion of the contaminated carpet for disposal (if applicable).

Clean-up Instructions

ITEMS NEEDED FOR CLEAN-UP
1. Ziplock-type bags (4 to 5)
2. Trash bags (2 to 6 mils thick)
3. Rubber, nitrile or latex gloves
4. Paper towels
5. Cardboard or 'squeegee'
6. Eyedropper
7. Duct tape, or shaving cream and small paint brush
8. Flashlight
9. Powdered sulfur (optional)

1. Put on rubber, nitrile or latex gloves.
2. If there are any broken pieces of glass or sharp objects, pick them up with care. Place all broken objects on a paper towel. Fold the paper towel and place in a zip lock bag. Secure the bag and label it accordingly. Contact the EKU Environmental & Health Safety (E&HS) Office to assist in the proper disposal.
3. Locate visible mercury beads. Use cardboard or 'squeegee' to gather mercury beads. Use slow sweeping motions to keep mercury from becoming uncontrollable. Take a flashlight, hold it at a low angle close to the floor in a darkened room and look for additional glistening beads of mercury sticking to the surface or small cracked areas of the surface. Note: Mercury can move surprising distances on hard-flat surfaces, so be sure to inspect the entire room when "searching."
4. Use the eyedropper to collect or draw up the mercury beads. Slowly and carefully squeeze mercury onto a damp paper towel. Place the paper towel in a zip lock bag and secure. Make sure to label the bag as directed by your local health or fire department.
5. After you remove larger beads, put shaving cream on top of small paintbrush and gently "dot" the affected area to pick up smaller hard-to-see beads. Alternatively, use duct tape to collect smaller hard-to-see beads. Place the paintbrush or duct tape in a zip lock bag and secure. Make sure to label the bag as directed by your local health or fire department.
6. *OPTIONAL STEP*: It is OPTIONAL to use commercially available powdered sulfur to absorb the beads that are too small to see. The sulfur does two things: (1) it makes the mercury easier to see since there may be a color change from yellow to brown and (2) it binds the mercury so that it can be easily removed and suppresses the vapor of any missing mercury. The mercury vapor absorbent can be found in commercially available mercury spill kits.
7. Note: When using powdered sulfur, do not breathe in the powder as it can be moderately toxic. Additionally, users should read and understand product information before use.
8. Request the services the EKU Environmental Health & Safety (EH&S) Office who has monitoring equipment to screen for mercury vapors. Place all materials used with the cleanup, including gloves, in a trash bag. Place all mercury beads and objects into the trash bag. Secure the bag and label it accordingly. The EKU E&HS Office can assist in the proper disposal.
9. Contact your local health department, municipal waste authority or your local fire department for proper disposal in accordance with local, state and federal laws.
10. Remember to keep the area well ventilated to the outside (i.e., windows open and fans in exterior windows running) for at least 24 hours after your successful cleanup. Keep personnel out of cleanup area. If sickness occurs, seek medical attention immediately. For additional information on health effects from elemental mercury and associated vapors, consult the Agency for Toxic Substances and Disease Registry (ATSDR) Mercury Fact Sheet.

LARGE MERCURY SPILL (Greater than Thermometer but Less than Two Tablespoons or One Pound)

Cleanup Instructions

CALL EKU Director of Environmental Health and Safety through EKU Police Dispatch: 622-1111

1. Have everyone else leave the area; don't let anyone walk through the mercury on the way out.
2. Open all windows and doors to the outside.
3. Turn down the temperature.
4. Shut all doors to other parts of the house, and leave the area.
5. *DO NOT attempt vacuum.*

EXCESSIVE MERCURY SPILL (More than Two Tablespoons or One Pound)

Cleanup Instructions Contact the Director of the EKU Environmental & Health Safety (E&HS) Office immediately!

Any time one pound or more of mercury is released to the environment, it is mandatory to call the National Response Center (NRC). The NRC hotline operates 24 hours a day, 7 days a week. Call (800) 424-8802. Note that because mercury is heavy, only two tablespoons of mercury weigh approximately one pound.

✖ Procedure adapted from the Environmental Protection Agency (EPA): 'Mercury Releases and Spills': http://www.epa.gov/hg/spills/

Appendix 9

College of Science
Emergency Numbers
2015-2016

Campus Emergency	**911**
EKU Police Dispatch	622 – 1111
EKU Public Safety	622 – 1111
EKU Student Health Services	622 – 1761
Energy Management System (for physical plant problems after regular hours, weekends)	622 – 1438
Facilities Services (for physical plant problems during regular working hours)	622 – 2966
Chemical Safety Officer: Dr. Andrew Garrett	622 – 2049 andrew.garrett@eku.edu
Chemical Storage Manager: Larry Miller	622 – 6355 lawrence.miller@eku.edu
Van Service for transportation to cars 6:00 p.m. to 2:00 a.m.	622 – 2821
Biological Sciences Department Chair: Dr. Malcolm Frisbie	622 – 1531
Chemistry Department Chair: Dr. Darrin Smith	622 – 1456
Geosciences Department Chair: Dr. Melissa Dieckmann	622 – 1273
Physics Department Chair: Dr. Anthony Blose	622 – 1521
Extended Campuses	
Corbin Director: Sandra Stevens	622 – 6715
Manchester Director: Terry Gray	622 – 6644
Danville Director: Cindy Peck	622 – 6636
Science Laboratory Manager: Mary Lamar	622 – 6709