University of Illinois
School of Chemical Sciences

Chemical Hygiene Plan

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I. Introduction - Policy and Purpose

The Occupational Safety and Health Administration (OSHA) Laboratory Standard (29 CFR 1910.1450) was established to protect laboratory workers from harmful exposures to hazardous chemicals. All laboratories in which chemicals are used are covered by this Standard. In Illinois, the Standard is enforced by the Illinois Department of Labor (IDOL). The University of Illinois at Urbana-Champaign (UIUC) Division of Research Safety has coordinated the development of the UIUC OSHA Laboratory Standard Compliance Program to ensure campus compliance with this Standard. One element of the compliance program is the development of the *UIUC Model Chemical Hygiene Plan*. The School of Chemical Sciences has customized the model version to document departmental requirements.

The purpose of this Chemical Hygiene Plan is to define work practices and procedures to help ensure that laboratory workers at the UIUC School of Chemical Sciences are protected from health hazards associated with the hazardous chemicals with which they work.

OSHA has defined a hazardous chemical as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees." In addition, OSHA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis." Finally, laboratory workers are defined in the OSHA Lab Standard under the definition of "employee" as "an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments." **An example of a laboratory worker would be a University teaching assistant or faculty member instructing an academic lab; the students in the academic laboratory would not be considered laboratory workers. This Chemical Hygiene Plan shall be perused by all laboratory workers prior to the commencement of lab duties at the UIUC School of Chemical Sciences.** In addition to the Plan, the laboratory workers shall be cognizant of and adhere to the Campus Administrative Manual (CAM) Section V/B "Environmental Health and Safety" (refer to links/contacts page for web link to Section V/B) and any other sections of the CAM relevant to their research.

In addition to the formal health and safety policies found in the CAM, the Division of Research Safety (DRS) has prepared guidelines which represent prudent health and safety practices in a number of areas. For the DRS website, refer to the links/contacts page.

A written record stating that each laboratory worker has reviewed the UIUC Chemical Hygiene Plan and related health and safety policies and guides shall be kept by the person in charge of the lab or his/her supervisor. This Chemical Hygiene Plan will be reviewed annually by SCS Safety Personnel.

A current version of this document and various other resources made available to facilitate your safety, security and efficiency at UIUC is provided on the SCS Safety website (see links/contacts page for web link).

II. Responsibilities

Principal Investigators and Laboratory Supervisors:

- Retain an up-to-date copy of the *Chemical Hygiene Plan* and ensure that laboratory workers comply with the Plan
- Train or arrange for training of laboratory workers and maintain records documenting such training
- Approve of the acquisition and use of toxic chemical agents
- Implement and enforce the use of safety procedures including any necessary personal protective equipment
- Ensure the availability of Material Safety Data Sheets and relevant reference materials
- Appoint and oversee research group safety representative

Research Group Safety Representatives:

- Serve as a liaison between PI, group members, and SCS Safety Personnel
- Assist in safety inspection of group research labs, distribute inspection results, and coordinate the abatement of safety violations
- Assist PI and SCS Safety Personnel in contingency planning for safety aspects of emergency and non-emergency situations

- Oversee and coordinate general safety and housekeeping practices for group laboratories

For a complete list of Research Group Safety Representative responsibilities consult the SCS Safety Website (see links/contacts page at the end of the document).

Laboratory Workers:

- Follow all health and safety procedures
- Report all hazardous conditions to the supervisor
- Wear or use prescribed personal protective equipment
- Report any job-related injuries or illnesses to supervisor immediately
- Request information or training when unsure about how to handle a hazardous chemical

The Division of Research Safety (DRS):

- Maintain a library (hard and online versions) of Material Safety Data Sheets and other safety resources
- Maintain the *UIUC Chemical Safety Guide*
- Maintain the *UIUC Model Chemical Hygiene Plan*
- Provide training and consultative services upon request

Campus safety policies, including responsibilities, can be found in the Campus Administrative Manual (CAM). See links/contacts page for the CAM website.

III. Standard Operating Procedures

The Chemical Hygiene Plan represents a minimum set of guidelines for the handling of chemicals in the department. This plan has been modified from the UIUC's Model Plan as required. Additional acceptable lab safety references may be useful in developing additional procedures in the future. In all situations, individual faculty or staff will be responsible for enforcing adequate safety and hygiene measures in laboratories they supervise. If necessary, additional assistance from the Division of Research Safety (DRS) is available.

The School of Chemical Sciences is spread among four adjacent and interconnected buildings:

1. Noyes Lab (NL)
2. Chemistry Annex (CA) and portions of Davenport Hall (DH)
3. Rogers Adams Lab (RAL)
4. Chemical & Life Sciences Lab (CLSL) Building A

This Chemical Hygiene Plan is tailored specifically for the School of Chemical Sciences and not necessarily for all the people working in these buildings. This document is to suffice as a general document only. Specific hazards should be addressed in additional Plans.

A. General Guidelines for Working in a Laboratory

Research laboratories present a multitude of hazards. Personal safety and the safety of those around you are of paramount concern. All work should be performed with safety as the primary factor. Skin and eye contact, ingestion, and inhalation are the three major entry routes for a chemical to enter the body. Types of controls for prevention of these various routes of entry include: good work practices, engineering controls, personal protective equipment, and administrative controls. Personal protective equipment must be used in conjunction with, not as substitute, for the controls mentioned above and/or good work practices.

1. Protection Against Skin/Eye Contact Hazards

Protect yourself against potential injury while in the laboratory. Respect and understand the safety and health hazards associated with the chemicals and equipment in your laboratory. Follow the safety guidelines provided.

a. Eye protection

General

Eye protection is required equipment and MUST be worn at ALL times while you are in the laboratory or any area where eye hazards are a possibility, regardless of whether or not you are actually doing an experiment. Prescription eyeglasses (even with safety lenses) do not provide adequate eye protection, especially from the sides.

If wearing contact lenses in a research laboratory, appropriate eye protection must also be worn. It has been determined that wearing contact lenses in the lab does not present any greater risk than the naked eye. Contact lenses do not provide any protection from chemical splashing. Therefore, eye protection must be worn. When use of the eyewash is necessary, contact lenses must be removed since they prevent adequate and thorough flushing of chemicals from the eyes. It is advisable to inform coworkers that you wear contact lenses. This will help insure that proper safety measures can be taken in the event of an emergency.

1) Full Face Shield or Blast Shield

Full face shields should be worn in conjunction with chemical splash goggles or safety glasses, when the potential for implosion/explosion, and/or splashing is great. They are also designed to provide protection to the full face and neck.

2) Chemical Splash Goggles

Chemical Splash Goggles provide comprehensive eye protection against splashing and flying debris. Goggles should be worn when a significant eye exposure hazard is anticipated and are preferred over safety glasses in **ALL** instances. When choosing Chemical Splash Goggles, indirectly vented goggles should be worn.

3) Safety Glasses

Safety Glasses with side shields provide minimal acceptable protection for regular use. Safety Glasses must meet the ANSI standard Z87.1-1989.

4) Safety Glasses for Optical Light Hazards

Specific types of eye protection are available for optical light hazards. Laser light can be blocked with specially designed goggles which absorb at specific wavelengths. Specific goggles are designed for each type of laser. Plastic safety glasses protect at longer wavelengths and are preferred. Appropriate optical safety glasses should be used for other high intensity light sources.

b. Skin Protection

1) Appropriate Clothing and Attire

Proper attire for the laboratory provides some protection to the body. Wear clothing that will adequately cover the torso and legs. Absolutely no shorts are allowed in the lab. Loose clothing should not be worn as it could easily become caught in machinery, come in contact with chemicals, and/or catch on fire. Long hair must be tied back for the same reasons. Do not wear skimpy clothing as it provides very little protection against chemical spills or splashes. Do not wear hosiery as it will “melt” upon contact with acid and some chemicals. Always wear shoes that completely cover your entire foot. Open or perforated shoes/sandals are not permitted. A lab coat or apron should be worn for additional protection. Lab coats or aprons should be removed prior to exiting the laboratory. Lab coats should also be routinely laundered (minimum of twice per year).

2) Gloves

a) Chemical Hazards

Always wear protective gloves when working with chemical hazards. The proper gloves will prevent skin absorption, infection or burns due to chemical exposure. NITRILE ® gloves

provide the best all around chemical protection while latex surgical gloves provide little to no protection from most chemicals. If latex gloves come in contact with chemicals, they should be replaced immediately. Remove gloves prior to handling water/utility/door handles, or other surfaces likely to be touched with bare hands, to avoid contamination. Disposable gloves may not be re-used, even if holes or tears are not present.

For appropriate glove selection, consult chemical resistance charts, the glove manufacturer, SCS Safety Personnel, or contact DRS.

b) Broken Glassware/Glassware Under Strain

Always wear leather gloves when working with either broken glassware and/or glassware that is under strain (e.g., pressure vessels, tubing being inserted into stoppers, etc.). Note: Leather gloves do not provide protection from chemicals.

c) Temperature Extremes

Always wear insulated gloves made of Zetex® and Kevlar® when working with temperature extremes (hot OR cold). Note: Insulated gloves do not provide protection from chemicals.

2. Protection Against Ingestion/Inhalation Hazards

Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. To avoid significant inhalation exposures, engineering controls such as substituting a less volatile or less toxic chemical or substituting a liquid or solid chemical for a gaseous one are the best means of control. If substitution is not practical, ventilation should be used to lessen the chance of overexposure (see section III, B, part 10, Laboratory Chemical Hoods). If both substitution and ventilation are unavailable, the use of personal protective equipment, such as dust masks or respirators, may be required to reduce inhalation exposures. Prior to wearing a respirator, laboratory employees must be trained on the proper use of respirators, have medical surveillance to ensure the user is capable of wearing a respirator, and a fit test to ensure the respirator fits properly. Contact SCS Safety Personnel if respiratory protection is required. While inhalation is the most common route of entry, ingestion of chemicals is the least common route of entry into the body. Prevention of accidental ingestion of chemicals includes; washing hands thoroughly, the use of gloves, and eating in a non-chemical area.

a. Smoking, Food, and Drink Regulations

Never smoke, eat, or drink in the laboratory. Airborne powders/sprays/vapors, as well as residues on surfaces, can contaminate food and drink. Accidental ingestion of hazardous chemicals can result due to this contamination.

Smoking in campus buildings is prohibited. Cigarettes are not only a fire hazard but can result in harmful vapors being inhaled. Some freons will generate phosgene gas when they pass through the lit tip of a cigarette.

Application of cosmetics is forbidden in areas where hazardous chemicals are used and shall be done only in non-laboratory areas.

Taking medications in the laboratory is also forbidden and shall be done only in non-laboratory areas.

NOTE: Be sure to maintain food and laboratory chemicals segregated, providing separate refrigerators for storing food away from chemicals, biohazards and radioactive materials. Clearly label all chemical refrigerators (FOR CHEMICAL USE ONLY), label all eating places (NON-CHEMICAL AREAS), and food storage refrigerators (FOR FOOD USE ONLY).

b. Pipetting Regulations

Never pipette by mouth. This is extremely hazardous both from the possibility of exposure by drawing liquids into the body and from drawing vapors into the mouth and lungs.

c. Personal Hygiene

Personal hygiene MUST be stressed. Hands should be washed frequently throughout the day, before leaving the lab, after contact with any hazardous material, before eating, etc.

3. Good Perception of Surroundings

A good perception of your surroundings is very important in a research laboratory. Be aware of your actions as well as those of your coworkers. Immediately warn your coworker if you see him/her doing something dangerous. Do not hesitate to ask your coworker, advisor, TA, and/or storeroom manager for guidance with using laboratory equipment or for advice on safety matters. Please respect the fact that others must use common laboratory equipment (i.e., balances, melting point apparatuses, hoods, etc.). Take appropriate care of this equipment and clean up common areas immediately.

4. Good Housekeeping Rules

a. Label all containers.

Containers must be labeled with:

1) Full, common name of the chemical
2) Date first labeled
3) Owner's Name

- If unable to fit this onto the label, a secondary container (i.e. tray) may provide some of this information.

b. Wipe up all spills.

c. Maintain your bench tops and hoods free of clutter.

d. Maintain chemical hazards at least 2" from the edge of bench tops.

e. Maintain exits, aisles and safety equipment free of all obstructions.

Aisles within the laboratory should be 36 inches in clear width. Doors which are not in use but which are accessible from a corridor or adjacent room should be appropriately labeled if they are blocked on the interior of the room. Hallways are not to be used as storage areas. Refer to Campus Administrative Manual (CAM) V/B - 6.2, Departmental Use of Corridors for more information. No unauthorized items shall be stored in the corridors. For authorization to store items in a corridor please contact SCS Safety Personnel. Work areas and floors are not to be used for excessive storage as well.

5. Safety Facilities and Procedures

Familiarize yourself with the safety facilities and procedures in the lab. Everyone is expected to know where the fire alarm pulls, safety showers, eyewashes, spill clean-up kits and emergency exits are located.

6. Proper Conduct

Do not condone or participate in horseplay. Practical jokes or other behavior that might confuse, startle, or distract another worker are forbidden.

7. Sinks

Do not subject sinks to extreme changes in temperature. While most laboratory sinks are constructed of a pressed fibrous material that is quite inert chemically, they are subject to mechanical damage due to their glass-like properties. Due to a fairly high thermal coefficient of expansion, sinks can crack when they come in contact with extremely hot or cold substances.

8. Unattended Experiments

Leaving hazardous systems unattended, without proper fail safes installed (regulators, automatic shut-offs, etc.), is not good practice. Use caution and adequate labeling if leaving experiments unattended.

9. Transfer of Chemicals

Never pour chemicals directly from storage containers into your reaction vessel. The use of an intermediate instrument such as a graduated cylinder, beaker, or pipette prevents unwanted chemical reactions or overfilling of vessels from occurring.

10. Flammable Liquids and Open Flames

Never use an open flame in the vicinity of flammable liquids.

11. Children and Unauthorized Persons

Children and unauthorized persons (unless under direct supervision) are not to be in laboratories where hazardous substances or operations are present.

12. Reproductive Health and Pregnancy Safety

Please be aware that risks and hazards are commonplace within the SCS facilities and that you are a critical component in safeguarding your reproductive health, which applies to both men and women. In addition, laboratory workers who are pregnant or attempting to become pregnant need to take extra precautions to promote the best possible outcome of the pregnancy. The following guidelines are highly recommended to protect you and the developing embryo or fetus:

- Consult with your personal physician about your work conditions and activities in order to plan a safe course of action pre-conception, during pregnancy and post-partum. Any restrictions placed by the physician should be brought to the attention of the principal investigator or laboratory supervisor and SCS Safety Personnel immediately.
- Clear communication and cooperation among the laboratory worker, the principal investigator or laboratory supervisor, and SCS Safety Personnel are necessary to conduct a thorough hazard assessment of laboratory operations and conditions, which may put the developing embryo or fetus at risk. In cases where a pregnancy is planned, the laboratory worker should initiate the hazard assessment prior to conception because certain chemical exposures may affect fertility success or critical fetal development in the earliest stages.
- In addition, this same group (worker, supervisor and safety personnel) needs to work together in developing a plan and finding creative solutions to ensure a safe work environment during the pregnancy. In some cases, work activities and conditions may need to be modified - such as working in a separate laboratory, substituting extremely hazardous reagents with less harmful ones, or focusing on a different aspect of research (e.g. theoretical instead of synthetic).
- For the health of the developing embryo or fetus, the pregnant individual and laboratory co-workers must strictly adhere to the safety guidelines in this Chemical Hygiene Plan. Give special attention to section F, “Carcinogens, Reproductive Toxins and Acutely Toxic Chemicals.”

Any other safety concerns should be discussed with the laboratory supervisor and SCS Safety Personnel. If you feel that your concerns are not adequately addressed, please contact your Department Head.

13. Signage

Laboratories where hazardous materials or operations are present must follow UIUC signage guidelines. An emergency contact card must be posted on or near each entrance of the laboratory. This card must be updated annually or when contact information changes. A recommended form with the information needed by emergency responders is available from SCS Safety Personnel. For other information on laboratory and general campus signage, refer to Interior Signage Guidelines, UIUC, which is available from Facilities and Services (formerly PC&M/O&M).

14. Personal and Building Security

a. Personal Security

Personnel working late at night are discouraged to work alone and are strongly advised to keep their work area locked. Utilize caution on admitting anyone into your work area if alone or when in transit between destinations. Escort services are available. Contact SCS Safety Personnel for further information or consult the links/contacts page at the end of this document.

b. Building Security

All SCS building entrances should be open by seven o'clock in the morning. The entrances are locked at six o'clock in the evening for RAL, DH, and CLSL. For NL, the entrances are locked when the chemistry library closes. For CA, the entrances are locked when the learning center closes. On weekends and holidays the entrances to RAL, DH, and CLSL remain locked. NL and CA entrances remain open on the weekends during the operating hours of the chemistry library and the learning center.

15. Biological Materials

Work with biological materials such as cells, pathogens, and proteins, etc. may require permitting through the Institutional Biosafety Committee. If a research group encounters these or other materials listed below, requirements listed in the following sections may be required.

a. Biological Safety Levels

Four Biosafety Levels (BSL), also known as containment categories, have been established by the Centers for Disease Control (CDC). BSL describe a set of safety practices and physical containment guidelines. BSL1 is the minimum level for **all** labs using biological material, including teaching labs. BL1 is suitable for work involving well-characterized agents not known to cause disease in healthy adult humans or animals, and are of minimal potential hazard to laboratory personnel and the environment. BL2 is very similar to BL1. Work with BL2 materials requires more specialized training and more specific safety equipment requirements. Also, more focus is placed upon restricting access to BL2 labs. BL2 labs **must** have signs posted on the lab entrance doors identifying the Biosafety Level, the hazard, access restrictions, and emergency contact information. Contact DRS (see links/contacts page) for assistance in obtaining this sign. This sign will also include the International Biohazard Symbol which alerts individuals to the presence of biohazards. Currently no labs at UIUC work above the BL2 level. BL3 involves agents with the potential for aerosol transmission that may have serious health ramifications. BL4 involves dangerous/exotic agents which pose a high risk of life-threatening disease.

b. Biological Projection Registration

Work with certain biological materials, requires the project to be registered with the Institutional Biosafety Committee (IBC). The Institutional Biosafety Committee oversees the biological work and permitting for the University of Illinois at Urbana-Champaign, as required by the NIH guidelines. The committee is advisory on matters relating to the safe handling, transport, use and disposal of biological materials, including recombinant DNA molecules. Work done with any of the following biological materials must be registered with the IBC:

- Human materials (e.g., human cell lines; blood or blood products; semen or vaginal secretions; fluids surrounding internal organs, the joints or a fetus; any body fluids contaminated with visible blood; any tissues)
- Any plant, animal or human pathogen
- Transgenic animals (use or creation)
- Transgenic plants

- Nonhuman primate materials
- Biotoxins
- Wild mammal materials
- Recombinant DNA (even work that is exempt from the NIH Guidelines must be registered)

For more information on biological projects or to gain access to biological project registration forms, see the links/contacts page.

c. Minimum Biological Lab Working Requirements

Labs working with biological materials should, at the minimum, include: bench tops that are impervious to water, sinks for hand washing, door access, and work surfaces that can easily be decontaminated. In addition labs that perform microbial decontamination of work surfaces should prepare fresh bleach solutions on a daily basis. These solutions should contain 1 part bleach to 9 parts water and should have 30 minutes of contact time with the items being decontaminated.

d. Biological Safety Cabinets and Clean Air Benches

Biological Safety Cabinets (BSC) use HEPA filtration and directed airflow to provide primary containment for work with infectious materials. BSCs also protect personnel and the surrounding environment from infectious aerosols, create a contaminant-free work zone for the experiment, and are generally required for work at BL2 and higher. BSCs should never contain volatile chemicals or be used interchangeably with a Laboratory Chemical Hood, due to the fact that BSC's are generally vented directly back into the laboratory and do NOT filter out chemical vapors. Gas lines and open flames should not be used in re-circulating BSCs. BSCs must be inspected and certified by a professional cabinet certifier at the time of installation, annually after initial installation, and any time the unit is moved. Horizontal laminar flow "clean air benches" are not BSCs. They discharge HEPA filtered air across the work surface and out the front of the cabinet, directly toward the user. They provide product protection only. Clean Air Benches should never be used when handling potentially infectious materials or as a substitute for a Biological Safety Cabinet.

e. Biohazard Waste

1) SHARPS

SHARPS, including but not limited to, syringes with or without needles, razor blades, and pasteur pipettes, require disposal in a sharps container. These containers are available for free from campus stores. To request pick up of full SHARPS containers, go to the DRS website (see links/contacts page) and complete the online SHARPS Collection Request Form.

For further SHARPS information see Glassware, Section III, B,12. For detailed information regarding SHARPS consult the links/contacts page.

2) Other Biologically Contaminated Waste

Cultures, stocks, and disposable labware (not including sharps) that are generated from experiments with biological materials, MUST be treated prior to disposal by an approved decontamination method such as autoclaving. Disposal guidelines include:

- collect the waste in a designated, closable container, separate from the regular trash
- the waste container must prominently display the international biohazard symbol

- after autoclaving or other approved decontamination method, material must be overbagged with an opaque trash bag, sealed, and disposed of in the regular trash

NOTE: Bags with the biohazard symbol, regardless of use, must not be placed, without overbagging, in the regular garbage.

For more information on autoclave locations and obtaining use of autoclaves, contact SCS Safety Personnel.

Other decontamination methods exist (e.g. decontamination by bleach, ethanol, etc.). Autoclaving may not always be a suitable decontamination method. Consult with the Biological Safety Section (see links/contacts page) concerning the appropriate use of alternate decontamination procedures.

For more detailed biohazard waste procedures or for pathological waste (including human tissue and organs) disposal procedures, contact SCS Safety Personnel for assistance.

16. Radioactive Materials

Prior to working with radioactivity, laboratories must be permitted and registered as outlined below. Working with radioactivity can be hazardous and safety precautions should be followed.

a. Permitting

Laboratories must obtain a Radiation Permit before using radioactive materials. The permit outlines lab specific requirements. For more information on obtaining a permit, contact the Division of Research Safety, Radiation Safety Section (see links/contacts page) or SCS Safety Personnel.

b. Personal Protection

In order to avoid accidental ingestion, inhalation, or skin absorption of radioactive materials the same precautions used with hazardous chemicals should be applied when working with radioactive materials. External exposure to energy emitted by radiation can be controlled by minimizing exposure time, maximizing distance from radiation sources, and the use of appropriate shielding. Gloves should be checked frequently when working with radioactive materials to avoid cross contamination of other areas of the laboratory. The workspace should also be lined with absorbent paper to avoid spreading the radioactive material to countertops, etc.

c. Radiation Hazard Symbol

The radiation hazard symbol alerts others to the presence of radiation fields or radioactive materials. This symbol should appear on all waste containers and items that may come in contact with radioactive material (benches, fume hoods, shields, etc.).

d. Radioactive Waste

Radioactive waste must be collected in designated containers, separate from normal trash. Short and long-lived isotopes should be collected separately. If radioactive waste is also contaminated with biological or chemical waste, contact SCS Safety Personnel for case specific disposal instructions. In addition, contact SCS Safety Personnel for disposal instructions when dealing with radioactive SHARPS or non-SHARPS glassware.

e. Radiation Record and Survey Requirements

Laboratories using radioactive materials are required to keep an inventory of all the radioisotopes received by the laboratory. In addition, the laboratory must keep records of the quantities of radioactive materials used.

When radioactive material is actively used, a survey of the area must be performed during the week in which the material is used. The survey should be performed appropriate to the isotope used (i.e. swipe samples or the use of an instrument such as a Geiger counter). Prior to the survey, instruments used to perform the survey should be checked/calibrated to ensure proper function. Results of the survey should be recorded in the laboratory's survey record.

The monthly survey (which is required by the State of Illinois) of the entire laboratory space in which radioactive materials are used is performed by the Division of Research Safety.

For further information regarding radiation safety, consult the Radiation Safety Section website (see links/contacts page).

17. X-Ray Safety

X-ray machines are used on campus in many different locations for research and diagnosis. It is very important that users of X-ray machines become familiar with their operating procedures and potential hazards before using the machines. **It is especially important to avoid any exposure to the main beam of the X-ray machine.**

a. X-Ray Machines Description

An X-ray machine produces a beam of ionizing radiation when operating. These machines present no hazard when the power is off. All X-ray machines have a light that indicates when the X-ray is ON.

b. Signage

X-ray machines and signs should be posted with a sign or label indicating the presence of X-ray beams. These signs should also include lab contact information and contact information for emergency response personnel, should an emergency arise.

c. Safety Devices

Analytical X-ray machines used for research are surrounded by an enclosure to prevent personnel exposure and unauthorized entry. Areas around **enclosed** X-ray devices may be accessed safely. Most X-ray machines have an interlocking device that prevents entry of limbs, fingers, hands, etc. into the primary beam path or causes the beam to be shut off upon entry into its path. Operators must perform and document monthly checks of these interlocks. If you must enter an X-ray room and an operator is not present, stay outside of the X-ray enclosure. Do not disturb any settings on the X-ray machine.

18. High Magnetic Fields

High magnetic fields, such as those from NMR and MRI machines, can cause possible injury to individuals working in the vicinity of these instruments. Users should be aware of the potential risks prior to using these types of instruments.

a. Magnetic (Ferrous) Objects

Magnetic (ferrous) objects should not be taken close (5-10 feet, depending on the magnet) to a high magnetic field. Of particular danger is the potential for tools and small objects to move uncontrollably toward the magnet. This can pose a risk to anyone or anything in the object's flight path. Thus, tools, certain ladders, keys, and any other small ferrous objects should not be taken near a high magnetic field. High magnetic fields can also cause permanent damage to watches, calculators, credit cards, cell phones, magnetic media (should not be taken inside the 20 gauss line), and other electrical equipment. These items should be removed from pockets, etc. before entering an area with a NMR or MRI instrument. Assume any piece of metal is magnetic unless proven otherwise. For more specific information concerning what types of objects should not be taken near a NMR instrument, contact the SCS VOICE NMR Staff.

b. Pacemakers and Medical Implants

Individuals with cardiac pacemakers should not cross the 5 gauss line of a high magnetic field. (The 5 gauss line describes the distance from the center of the magnet to where a field strength of 5 gauss is experienced. If you are not sure where the 5 gauss line is located, consult with the SCS VOICE NMR Staff.) High magnetic fields could cause the pacemaker to function improperly or to stop working altogether. Individuals with other types of medical implants including clips and prostheses that contain ferromagnetic materials should not enter areas containing high magnetic fields. If uncertain about whether it is safe to use a NMR instrument due to medical devices/implants contact the SCS VOICE NMR Staff.

c. Magnet Quenching

In the unlikely event of the magnet quenching (sudden release of gas from the dewar), personnel should evacuate the area due to the possible risk of asphyxiation. A quench warranting evacuation would most likely be obvious by the noise of the escaping gas and clouds of vapor.

19. High Pressure/Hydrogenation Lab

The purpose of the High Pressure/Hydrogenation Lab is to provide an environment outside of a standard research laboratory with additional safety features where chemical reactions can be performed at high pressures and temperatures in equipment designed for these purposes. For example, in a standard laboratory pressures should not exceed 300 psi. However, the High Pressure/Hydrogenation Lab can be used for pressures up to 5000 psi.

a. Description and Safety Features

The High Pressure/Hydrogenation lab is located behind door P-8 in the penthouse (5^{th} floor) of South RAL. Contact SCS Safety Personnel for questions concerning access to this area of the building. The lab consists of a control room and two four foot by six foot cells that are independently ventilated. Both cells have walls reinforced with 3/8" plate steel and 12" reinforced concrete. In addition, the cells also have sliding reinforced doors with bullet-resistant viewing windows. For training information on the High Pressure/Hydrogenation lab, contact SCS Safety Personnel.

NOTE: It is highly recommended that you inform your coworkers of your plans to work in the HP lab and the length of time you will be working in the HP lab. If you do not return in a set amount of time, it is advised that a coworker check on your well being by making a visit to the HP lab and entering the lab if it is safe to do so. Similar arrangements can be made with campus public safety if a coworker is not available.

20. Cold Room Safety

Personnel working in cold rooms must remain especially cautious when working with chemicals. Due to turbulence caused by the air circulating fans, hoods must be used with both sashes closed and arms inserted through the arm ports provided. Be sure the sliding hood duct plate at the top of the hood is opened. Due to the fact that cold rooms are unventilated, enclosed areas no chemical reactions should be performed unless specifically approved by the cold room supervisor. In addition, no volatile chemicals (even those in closed containers) should be brought into the cold room. If these chemical containers were to break, toxic vapors would be released into the unventilated atmosphere. Cold room users should also note the condition of the floor prior to entering the cold room. Floors in these rooms can be slippery as they are often wet. It is also important to dress appropriate to temperature and duration of exposure.

Important Safety Information: The door to the inner cold room can freeze and the latch may become inoperable. Insure proper function before closing the door. In the event you become trapped within, use the panic button. However, someone must be nearby to hear and lend assistance. It is suggested that you inform coworkers of your plans to work in the cold room prior to the commencement of work in the cold room. Similar arrangements can be made with campus public safety if a coworker is not available.

a. Storage Requirements

All containers must be sealed by an appropriate method (parafilm, Teflon tape, polyethylene tape, electrical tape, etc.) that will stop vapors and odors from escaping. (This is especially important to O&M maintenance personnel). All containers, trays, etc. must be labeled with the chemical name (and any hazard information if greater than 100mL or 100g), contact person, advisor, and date stored. NOTE: containers may get wet, so the use of cardboard containers and/or water soluble markers is **not** recommended.

B. Guidelines for Handling Equipment and Apparatuses

1. Equipment Condition

All equipment should be in proper working condition. In particular, never use chipped or cracked glassware.

2. Equipment Access

All apparatuses should be securely mounted, where required, and free of strain. Heating mantles, oil baths, etc., must be readily accessible and quickly removable. Power cords and rubber hoses should be kept at a safe distance from hot surfaces.

3. Blast Shields and Explosion/Implosion Hazards

Blast shields should be used when working with pressurized equipment or reactions that are known or suspected to be potential explosion/implosion hazards. Blast shields are a necessary supplement to the blast protection offered by the hood design. Hood sashes are made of laminated safety glass to be blast resistant. Some hoods are equipped with a blast vent on the top front of the hood which will be blown open during an explosion, thus providing an outlet for the blast force while directing it up and away.

4. Catch Pans

Catch pans should be placed under reaction systems. In the event that a reaction should get out of control, or the container should accidentally break, the reactants and solvents will be contained and reaction materials may be easily recovered. If a fire is present, the catch pan may prevent spreading of the fire.

5. Compressed Gas Cylinders

Compressed gas cylinders pose a significant hazard in the laboratory. Precautions to prevent injury when working with compressed gas cylinders include:

1. Firmly securing cylinders at all times with a strap or chain to a stable object such as a wall, bench, or table.
2. Use an appropriate hand cart with a strap for moving cylinders (4 wheel cart preferred).
3. Cylinders must be CAPPED during movement.
4. Cylinders should be kept away from sources of heat or ignition.
5. Store cylinders in well-ventilated areas with their protective caps screwed on and the cylinder secured.
6. Do not store cylinders containing flammables and oxidizers in the same area.
7. Segregate empty and full cylinders while in storage.
8. Storage of large quantities of cylinders must be done in an approved gas cylinder storage area. Contact SCS Safety Personnel for further information.

Lecture bottles must be labeled properly and if empty, marked either “empty” or “MT”. For disposal use ChemTrak form 1 and Appendix C of the UIUC Chemical Waste Management Guide (see links/contacts page).

6. Dewar Flasks

Due to Dewar Flasks being continually under vacuum, they pose an implosion hazard. Dewar Flasks present an implosion hazard with the potential of abruptly releasing glass shrapnel and the contents of the container and should be handled carefully.

7. Electrical Equipment

Access to electrical equipment shut-offs (e.g., plugs, switches and electrical panels) must be maintained free from obstructions to allow immediate access in an emergency. All receptacle outlets in laboratory spaces shall be the polarized grounding type (three prong). Ground Fault Circuit Interrupters (GFCI's) should be used in all outlets within six feet of locations involving wet processes or outdoor work. In many areas GFCI circuit breakers have been installed in electrical panels to provide protection to entire circuits. All electrical hand tools used inside laboratories shall be grounded or double insulated.

a. Repairs

Use the following procedures to safely repair electrical equipment:

1) Turn off the equipment but leave it plugged in for a few seconds so that the internal capacitor has time to discharge to ground potential.

2) Unplug the equipment from the outlet.

3) If you are not well versed in electronics or if no instruction manual is available, have the device repaired in the electronics shop or by an electronics shop technician.

4) Do not replace blown fuses with fuses of higher ratings. Determine why the fuse blew and correct the problem before replacing with the proper fuse.

5) If you are working on any apparatus that is or was capable of producing high currents or high voltages, assume that the voltage is still resident within the device when probing for problems. Never have more than one hand in the apparatus, keeping the other hand in your pocket.

6) Do not use a standard voltmeter with standard leads to measure high voltages because the voltmeter could explode.

b. Extension Cords

1) Location

All electrical extension cords used shall be visible and inspected on a periodic basis for damage and/or defects. Cords may not be run through doors, walls or partitions, under rugs or above dropped ceilings. They may not be wrapped around fixtures, tied in knots, or draped over pipes, lights, or ventilation ductwork. Cords may not be run in aisles or corridors where they could be damaged or create a tripping hazard.

2) Usage

Electrical extension cords should only be used for temporary power or to supply equipment that is frequently moved. Extension cords should not be used as substitution for permanently installed outlets. Cords used for 110-120 volt service shall be UL listed standard heavy-duty three wire equipped with a polarized three-prong plug. One of the wires shall be an equipment-grounding conductor. In no case shall a two-wire type extension cord be used.

Frayed cords must be replaced. Simply putting electrical tape over the damaged area is not an acceptable long-term solution.

Extension Cords must be of appropriate length. Excessive lengths of coiled cord or inadequate conductor sizing can result in resistive heating. This may create a fire hazard and/or be detrimental to your equipment.

Power strips may not be daisy-chained together (i.e. plugged into another power strip). Additionally, if using an extension cord to supply power to a power strip, the extension cord must be of equivalent or larger current carrying capacity (power strips typically have 14/3 conductors; thus acceptable extension cords include cords having 14/3 or 12/3 conductors). This information is stamped into the outer insulating jacket of the cord.

8. Vacuum Systems

Evacuated glassware poses a significant implosion hazard, which includes the potential of abruptly releasing glass shrapnel and the contents of the container.

a. Desiccators

Utmost caution is to be employed when evacuating desiccators. Inspect for defects/cracks and discard if any are found. Implosion protection must be provided without impairing visual inspection. This is often accomplished by wrapping with tape in a grid pattern that leaves the contents visible while guarding against flying glass should the vessel implode. Handle cautiously.

b. Flasks

Never evacuate ordinary non-vacuum flasks, especially those with flat surfaces. Erlenmeyer flasks under vacuum pose a significant implosion hazard and should never be used on a rotovap or for evaporating chromatographic fractions.

c. Rotovaps

1) Implosion Protected

The body of a rotary evaporator needs to be implosion protected, WITHOUT loss of visibility. This can be accomplished by using a plastic encased flask or by wrapping with tape in a grid pattern.

2) Evaporation Containers

A one-liter flask is the largest that can be used effectively with most rotary evaporators. Flasks larger than one-liter pose safety risks due to possible breakage of the neck of the flask, increased

bumping of liquids, and the risk of spilling large quantities of chemicals due to the possibility of a poor vacuum.

d. Water Aspirators

Glassware evacuated using water aspirators poses a significant implosion hazard. Aspirators are a good vacuum source (achieving 30-40 mm Hg of vacuum) relative to atmospheric pressure (~760 mm Hg). Therefore, care should be taken when evacuating glassware using water aspirators.

9. Flooding

Flooding from laboratory sinks and service connections has caused major damage to research equipment, furniture, and project records in the flooded areas and floors below. In addition to physical damage, the standing water creates significant electrical shock and slip hazards. The following measures can be taken to minimize the chance of flooding.

a. Sink and Hood Gutter Drains

Ensure that there are no objects or debris in the sinks or hood gutters that could restrict flow down the drains. If plugging the drain is required, ensure that the water has an outlet and that the sink does not overflow.

b. Water Regulator

Use a water line with a regulator for all unattended water use. Water pressure regulators in the laboratories greatly reduce the chance of flooding because they maintain a steady flow of water regardless of the changes in water pressure in the building. To insure that the regulators will work properly when unattended:

1) Ensure that the water valves in line with the regulators are fully open (this insures that the regulators and NOT the valves are controlling the flow).

2) Tighten down the wing nut on the "T" handles or screw to prevent loosening from vibration.

3) Occasionally flush debris from the regulators by momentarily increasing flow through them. This can be accomplished by backing out the "T" handle or screw at the top of the regulator.

c. Tubing

1) Replace tubing before it becomes decomposed or brittle. Check tubing occasionally by bending sharply and looking for cracks.

2) Do NOT use pure gum rubber tubing for water lines. Pure gum tubing is not designed to handle the pressures often found in building water systems. Other more appropriate types of tubing such as Tygon are available in the SCS storeroom or through various suppliers.

d. Connections

1) Secure all tubing connections with wire or clamps.
2) Use locking quick disconnects where needed and secure non-locking quick disconnects with clips.

e. Bench Top Vessels

When filling bench top vessels, place the receiving container into a sink-drained secondary container or tray. Filling containers are sometimes forgotten, resulting in a significant flood.

10. Laboratory Chemical Hoods

a. Usage

Laboratory chemical hoods should be used when chemicals being handled have sufficient volatility to be hazardous or offensive if vented to the laboratory atmosphere. Highly toxic chemicals should only be used in a laboratory chemical hood. Highly toxic chemicals are those with a PEL (permissible

exposure limit) of 50ppm or less. Chemical characteristics which should be considered are toxicity, flash point, flammability, and odor. Contact SCS Safety Personnel for resources that contain PEL's for most common laboratory chemicals.

b. Sash

If possible, position the laboratory chemical hood sash so that work is performed by extending the arms under or around the sash, placing the head in front of the sash, and keeping the glass between the worker and the chemical source. The worker views the procedure through the glass, which will act as a primary barrier if a spill, splash, or explosion should occur. The hood sash should be maintained at the indicated mark for proper flow.

c. Laboratory Chemical Hood Working Space Guidelines

1) Maintain all items in the hood at least six inches behind the sash opening to minimize turbulence that would degrade the operation of the hood.

2) Place equipment as far to the back of the hood as practical without blocking the bottom baffle.

3) Large equipment should not be used in laboratory chemical hoods. Doing so may cause dead spaces in the airflow and reduce the efficiency of the hood. However, if it is necessary to place large equipment in a hood, the equipment can be placed on legs or blocks (min. of 2 inches high) to allow the proper flow of air under and around the equipment. If placing large equipment in the hood contact SCS Safety Personnel to have the hood recertified.

4) Avoid the use of hoods for storage. If storage is necessary, locate material so as to minimize air flow disturbances. Use of blocks to elevate equipment above the lower baffle air intake can significantly improve the hood's air flow. If placing storage items within the hood contact SCS Safety Personnel to have the hood recertified.

5) Laboratory chemical hoods should not be modified in any way that adversely affects the hood performance. If hood modifications are needed, please consult with SCS Safety Personnel. Proper hood air flow must be verified with SCS Safety Personnel following any modification.

6) Do not utilize a laboratory chemical hood for waste disposal.

7) If a laboratory chemical hood does not meet flow requirements, DRS will label accordingly. If hood airflow stops, clearly label "out of commission" and report to SCS Safety Personnel.

d. Hood Performance

Laboratory chemical hoods and their related air-handling systems should be designed to attain a face velocity of 100 ft/min. They should be capable of maintaining a minimum average face velocity of 80 linear feet per minute (lfpm) with a sash open to the latch position (~18 inches). Typically a range of 80-120 lfpm is acceptable for most uses. Note: Hoods installed after Fall 2006 should be designed to maintain a range of 95-110 lfpm and a minimum of 95 lfpm. Every hood should be labeled as to its operating air flow. DRS inspects hoods annually to ensure proper air flow. Tags will be affixed indicating proper sash height and flow rate. A green tag indicates proper operation. A red tag indicates "maintenance required-do not use".

1) Verify airflow PRIOR to starting experiments or commencing work. Check air flow visually to assure that the hood is functioning adequately. Air flow may be checked visually by the following methods.

   a) Simple tell-tale device such as a Kimwipe, tinsel, or a ribbon attached to the sash (qualitative)

   b) Installed hood monitors (semi-qualitative)

   c) Hood labels (DRS survey: quantitative but historic data). NOTE: labels denote proper airflow at the time of testing only.

d) Anemometer (may be borrowed from SCS Safety Personnel: quantitative).

2) Avoid opening and closing the laboratory chemical hood sash rapidly as well as swift arm and body movements in front of or inside the hood. Such actions may increase turbulence and reduce the effectiveness of laboratory chemical hood containment.

3) Check room conditions in front of the laboratory chemical hood prior to use. Any cross drafts present may seriously degrade the performance of the hood. Minimize cross drafts from open windows or from people walking by.

4) Do not disable alarms. Know what they mean, act on what they indicate, and report the discrepancy for corrective maintenance to SCS Safety Personnel.

e. Cutoffs

Generally, the hoods should be constantly on, however, in the case of certain types of fires, the hood may actually serve to fan the fire making it difficult to extinguish. Also, hood doors should always be kept closed when not actively working in the hood area.

Note for New RAL: In new RAL, cutoff switches are located typically outside one of the hallway doors to the lab. The cutoff switch has three modes of operation: 'Auto,' 'Manual,' and 'Off.' 'Auto' is used when working with chemicals that are not overly hazardous. The blower will shut down if the lab's supply blower shuts down, minimizing the building vacuum. 'Manual' is used when working with chemicals that are highly toxic. Highly toxic chemicals are those with a PEL (permissible exposure limit) of 50ppm or less. The blower will NOT shut down if the lab's supply blower shuts down. The hoods should not be used when in the 'Off' position. Only change the mode of operation after consulting ALL the laboratory occupants since the switch affects all the hoods in a module.

f. Biological Safety Cabinets

For Biological Safety Cabinet use and information refer to Biological Safety, section III, A, 15.

11. Glassware

a. Glass containers can be easily broken, resulting in a significant threat to life and property depending upon the contents, quantity, and location. To minimize the chance of breaking glass bottles, store them properly and well protected if on the floor. Secondary containment should be used to contain contents in the event of breakage. Transport containers safely using a bottle carrier, or cart for multiple items, in the halls, stairwells, and elevators. If transporting on a cart, ensure that the cart has side rails to prevent containers from sliding off and breaking. In addition, minimize the size of your working containers and use proper protective gloves which do not hamper dexterity to prevent accidental breakage of glassware.

b. Glass tubing and thermometers present unique hazards. When cutting, inserting, or removing glass tubes or thermometers into/from corks, rubber stoppers or hoses, always use protective gloves (see section III, A, 1). Lubricate glass with glycerin or soap. Moisten TYGON ® tubing with acetone. All glass tubing must be fire polished at the ends.

c. Damaged, cracked, or chipped glassware should not be used. Examine your glassware for "star" cracks. Broken glassware should be replaced immediately. Chipped or broken glassware can possibly be repaired by the Glass Shop located in Noyes Lab. When dealing with broken glassware, be sure to use leather gloves and protective eyewear. DO NOT handle broken glassware directly, but sweep into a dust pan or similar equipment. See table for specific disposal methods.

Type of glassware	Type of Packaging	Disposal Method
Non contaminated lab glass	Puncture proof packaging (box), sealed (taped), and labeled as "trash, broken glass"	General trash
Chemically contaminated lab glass	Bagged, placed in puncture proof packaging (box), sealed (taped), and labeled as "chemically contaminated glass"	Contact SCS Safety Personnel for disposal instructions
Biologically contaminated lab glass*	SHARPS container	Contact DRS Biological Safety Section for disposal

*Large biologically contaminated items can be packaged in a puncture proof box, sealed and labeled, and disposed of as a SHARPS container.

Non-broken glass containers can be triple rinsed, triple washed, marked "empty", allowed to dry, and discarded in the general trash.

For additional information regarding SHARPS, consult the links/contacts page.

NOTE: For information regarding radioactive SHARPS and glassware contaminated with radioactive material, contact SCS Safety Personnel for assistance.

12. Heating Cautions

a. Closed systems should not be heated. Always ensure an adequate vent and use a boiling chip when heating any liquid, even water.

b. Flammable solvents should not be heated in an open container with a bunsen burner. If a bunsen burner is to be used, make sure that your coworkers are not using flammable solvents. When lighting a bunsen burner, light the match first, then turn on the gas while holding the match close to the top of the burner. When work is completed, the bunsen burner should be turned off immediately. Long hair and loose clothing pose significant hazards when using bunsen burners.

c. Evacuated glassware should not be exposed to local overheating as it can weaken the glass and cause an implosion.

13. Heating Mantles

Heating mantles are not recommended for heating flasks which contain highly flammable solvents, heterogeneous mixtures, or a reaction where the temperature needs to be carefully controlled. Heating mantles tend to form hot spots which can result in intense localized heating and/or fire. Use of a stirred fluid bath with temperature control better regulates the temperature and eliminates the possibility of hot spots. The size of the heating bath must correspond to the size of reaction vessel.

14. High Voltage and/or High Current Equipment

a. Warning Signs

Equipment using high currents or high voltages must be labeled with a general warning of the dangers present.

Entrance doorways to rooms containing high voltage and/or high current equipment should have warning signs indicating when the equipment is in use.

b. Precautions

1) For proper grounding, use a three prong plug, unless other grounding provisions are made and checked.

2) Avoid becoming grounded by staying at least 6 feet away from all metal materials, walls, and water.

3) While working with high voltage and/or high current equipment, only one hand should be used. Keep the other hand at your side or in your pocket and away from all conducting materials. Using this precaution prevents accidents which result in current passing through the chest cavity.

15. House Nitrogen

The house nitrogen is under 5 psig (5 psi above atmospheric pressure). This pressure decreases loss through leaks and discourages misuse for drying, running stirrers, and using fast nitrogen sweeps. A check valve is required to prevent contamination of the system by allowing the flow of gas in only one direction.

16. Lasers

All class 3b and 4 lasers are required to be registered with DRS. For more information contact SCS Safety Personnel or consult the links/contacts page at the end of this document for the laser registration form.

a. Know the hazards associated with the laser(s) with which you are working.

b. Warning signs should be posted at all entrance doorways to areas containing optical light hazards. NOTE: not all laser light or other potentially dangerous light can be seen by the human eye.

c. Intense laser light paths should be marked. Before adding or removing optical components, anticipate and examine projected light paths.

d. Always wear specially designed protective glasses or goggles when working with optical light hazards. Eyes and skin must be protected when operating open UV light sources (including UV absorbance, LC detector, and hollow cathode lamps).

e. Reflective jewelry should be removed before working with lasers. NOTE: laser light reflected off a ring can permanently blind you.

f. Laser beams should be kept at or below chest height.

C. Guidelines for Hazardous Material Handling and Storage

Be aware of the specific hazards of the chemicals and equipment with which you are working. You should become acquainted with the properties of every chemical you use and understand all terminology. The Merck Index and other reference books, Material Safety Data Sheets (MSDSs), and compatibility charts are useful sources for finding hazard information. Coworkers, research advisors, DRS, and SCS Safety Personnel are also respected sources. Many hazards are outlined on the chemical container label. **All chemicals (including non-toxic chemicals) should be treated as though they were toxic.**

1. Working Alone with Hazardous Materials

Do not work alone when using hazardous materials. A second person should be present, or at a minimum, maintain telephone contact. **Never** work alone when working with high energy materials, high pressures, quick-acting/highly toxic materials (e.g., HCN), or transfer of flammable materials (except in small quantities), and when previous experience indicates the need for assistance.

2. Container Labels

Label all containers (including uncontaminated water) with the chemical name and appropriate hazards. In addition, it is recommended to have a researcher name and date on the label. Make sure all labels are legible and use common terms (no molecular diagrams). Peroxidizable and other chemicals which may become unstable over time should be dated upon purchase and opening.

3. Drying Ethers

An acceptable means of drying ethers is the use of sodium/benzophenone. In the past, a common laboratory method for drying ethers has been distillation from lithium aluminum hydride (LAH). LAH is a serious fire hazard and should not be used to dry ethers. It decomposes at ~125 °C which can be easily reached at a flask's surface in a heating mantle. The decomposition products of LAH can be quite explosive, especially when combined with CO_2. Therefore, use a Class D (Metal-X) fire extinguisher for fires involving LAH. Do not use CO_2 or bicarbonate (powder) extinguishers for these types of fires. For further information regarding lithium fires, see the fire extinguisher section of this document.

4. Mercury

Mercury (Hg) and mercury containing devices should be replaced with alternatives whenever possible. Mercury vapor is highly toxic. Due to mercury's low vapor pressure, the evolution of mercury vapors is especially of concern when the mercury is heated. Furthermore, mercury spills are very difficult to clean up because Hg splashes into microscopic spheres, which roll into cracks and crevices where they cannot be easily seen or removed. To reduce the chance of Hg spills, use a catch pan of appropriate size and depth under all mercury-containing equipment. Use non-mercury thermometers whenever possible. Never use a Hg thermometer in a heated oven. Consult SCS Safety Personnel for assistance in finding mercury substitutes.

5. Perchloric Acid

Perchloric acid heated above ambient temperature will give off vapors that can condense and form explosive perchlorates. When heating perchloric acid above ambient temperature, a perchloric acid laboratory chemical hood with a wash down system or a local scrubbing or trapping system **must** be used. Consult SCS Safety Personnel before performing these operations.

6. Peroxidizable Compounds

Peroxidizable compounds present considerable hazards within the laboratory. Commonly used solvents such as ether, dioxane, and THF can form explosive peroxides after exposure to air. Hazards associated with peroxidizable compounds can be minimized in several ways. Some peroxide formers sold through the SCS storeroom are provided with a bright yellow label on which the initial date opened should be written. Store peroxide formers in an obvious location where they will not be forgotten and where they are readily accessible to SCS Safety Personnel. Peroxide formers should be checked for peroxides every six months after opening. Peroxide test strips can be purchased from the SCS Storeroom. Peroxide formers should also be checked prior to performing distillations or evaporations. Concentrations of <100 ppm are generally acceptable, except for planned solvent evaporation experiments. Concentrations >100ppm should be disposed of through DRS chemical waste management.

7. Mal-odorous Compounds

Precautions should be taken when working with mal-odorous compounds. ALWAYS notify SCS Safety Personnel BEFORE using mal-odorous compounds. Minimize the quantity of material and time the container is open. Maintain the chemical and contaminated material in a sealed container. Always use mal-odorous compounds in a properly functioning laboratory chemical hood. Keep lab windows and doors closed to maintain proper laboratory chemical hood air flow.

8. Noxious Gases

Noxious gases and irritating odors can be swept back into the laboratory through open sink drains. This is due to a lower internal pressure maintained in laboratories as compared to outside pressure. Two things can be done to avoid this problem:

a. **Keep all sink traps (including cup sink traps) filled with water by running water (approx. one gallon) down the drain monthly.**

b. **Do NOT utilize the sink for waste disposal.**

9. Personal Protective Equipment (PPE)

Compounds can enter the body by being absorbed through the skin, inhaled, or ingested. Identify and utilize the proper PPE for the task to avoid chemical exposure. Contact SCS Safety Personnel for PPE selection advice.

10. Minimization of Hazardous Waste

Minimizing wastes also minimizes safety hazards. Utilize the following guidelines to reduce hazardous waste:

- Scale reactions to minimize the amount of required materials
- Substitute less hazardous materials whenever possible
- Periodically inspect the inventory of chemicals and dispose of unwanted or unusable items
- Purchase only the quantity needed. Before ordering from an outside vendor, check your supplies and refer to the SCS ChemTracking database
- Eliminate or reduce the use of: chromic acid cleaning solutions, heavy metals, and halogenated solvents if possible

11. Chemical Storage

a. Segregation of Chemicals

Chemicals should be kept separated by hazard class whenever possible to avoid unwanted reactions. Recommended hazard classes for chemical separation include: acids, bases, flammables, oxidizers, and reactives.

Physical separation (separate cabinets, storage containers, etc.) is the preferred method of storage.

Laboratories with large numbers of hazard classifications may choose to further segregate mineral/organic acids, unstable compounds, heat sensitive compounds, gases, etc.

b. Flammable Liquid/Solvent Storage

Solvent storage in a laboratory is limited. Large quantities of solvents, whether new, recycled, or waste must be stored in non-breakable containers (jerricans or fireproof). Flammable solvents stored outside of a flammable storage cabinet must **not** exceed a total volume 10 gallons, regardless of size of container(s) utilized, and **only one** 1-gallon glass container (non-plastic coated) may be used per laboratory.

Flammable materials must be stored in appropriate, labeled containers, in safety cans or Department of Transportation (DOT) approved containers. If in a substantial amount, waste solvents should be stored in polyethylene jerricans. Waste halogenated solvents may not be stored in metal safety cans due to corrosion.

c. Chemical Containers

Check the integrity of containers. Review the compatibility between the container and its contents. For example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

University of Illinois Hazardous Waste Management recommends using separate polyethylene jerricans for collecting halogenated and non-halogenated waste solvents in the labs. Polyethylene jerricans and containers should be dated upon purchase as they become brittle with age. Usage of polyethylene jerricans and containers becomes questionable after three years. Be aware that steel

safety cans frequently get plugged from solid materials and eventually rust through. Glass bottles are easily broken and are not a preferred storage container. If glass bottles are used and stored on the floor, they must be kept in secondary containment.

d. Volatile Toxic Substances

Volatile toxic substances shall be stored in volatile storage cabinets adequate to the purpose, or in/below hoods when cabinets are unavailable. When volatile compounds must be stored in a cooled atmosphere, explosion-proof refrigerators or cold rooms designed for this purpose must be used.

12. Chemical Waste Disposal

Campus chemical waste disposal is managed by DRS, Chemical Safety Section (CSS) utilizing the UIUC Chemical Waste Management Guide. Refer to links/contacts page for more information. NOTE: all chemicals, including those that are non-hazardous, can NOT be disposed of in the trash.

a. Regulations

The Environmental Protection Agency (United States and Illinois) and the Resource Conservation Recovery Act (RCRA) regulations mandate that hazardous waste be properly and clearly labeled, containers maintained closed when not actively adding waste, and properly disposed of in a timely manner. When hazardous waste containers are stored near sinks, secondary containment must be utilized.

b. Chemical Waste

Discard waste chemicals into labeled, closable (screw cap for liquids), waste containers. Solid and liquid wastes should be kept in separate containers and wastes should be further separated by their compatibility (i.e. oxidizers, acids, bases, solvents, halogenated solvents, etc.). Solvent wastes and aqueous acidic wastes can be collected separately in Jerricans, but other wastes should be collected in disposable containers. Labels should clearly identify the contents of the waste container and include the word “waste”. Examples:

- Waste acetone
- Waste hydrochloric acid, water, sodium sulfate, and lead acetate

If a generic label is used i.e. “Waste halogenated solvents”, a ledger **must** be maintained that records the contents of the container (required by EPA). See information under “Solvent Waste” for details regarding disposal of solvent mixtures.

Refer to the UIUC Chemical Waste Management Guide for an overview of what is considered hazardous waste. Some chemicals are not classified as hazardous, but are still toxic (i.e. ethidium bromide). These chemicals should also be disposed using the UIUC Chemical Waste Management Guide.

DRS picks up chemical waste submissions The process consists of the following steps:

1) Waste generator (user) submits pickup request forms to DRS. (Use campus mail address on forms)
2) DRS mails self-adhesive labels for waste containers.
3) Generator attaches labels and places waste containers in a pre-arranged location.
4) DRS picks up the containers and properly processes/disposes of them.

Waste submittal forms are online. For online forms see the links/contacts page.

c. Solvent Waste

Due to the large volume of solvent waste found in SCS facilities, special handling and disposal methods are required.

Solvent Wastes Must:

- Have a pH between 2 and 12.5 with minimal content of solids and water.

- Be inventoried properly and transferred safely to avert spills and compatibility concerns.
- Be discarded promptly. Excessive volumes should not be accumulated.
- Contain no radioactive, highly carcinogenic, or highly toxic substances.
- Be segregated into halogenated and non-halogenated waste streams.
- Maintain recyclable waste oil free of solvents or PCB (polychlorinated biphenyl) contaminants.

1) Solvent Waste Containers

Solvent waste containers (jerricans, polyethylene bottles) must be labeled clearly identifying the contents of the container and include the word "waste", ex. "waste halogenated solvent". In addition, solvent waste containers must be maintained closed when not actively adding waste. Color coded label tags are available in the SCS storeroom.

2) Disposal

Solvent waste generated in quantities greater than one jerrican per two weeks can be disposed through the weekly jerrican pickup program. Solvents should be separated into halogenated and non-halogenated waste streams. The program consists of the following steps:

1) Waste generator completes a CWM-TRK-05 or equivalent form to record all the waste chemicals in the jerrican. Individual forms should be used for each jerrican and should include jerrican identifying numbers and/or letters.
2) Forms must be placed in the drop box (in the RAL nitrogen room) by Monday 10am.
3) DRS picks up jerricans located in RAL on Tuesday afternoons (1:30 – 2:30), and jerricans located in CLSL on Monday mornings.
4) Jerricans are returned to RAL on Wednesday afternoons and to CLSL on Friday mornings.

Please note: Aqueous wastes or wastes containing heavy metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium or silver) should not be mixed with solvent wastes. Collect them in a separate container and use the standard pickup program for disposal.

Please see the links/contacts page for downloadable CWM-TRK-05 forms and more information.

Refer to Section III, B, 12 of this document for Sharps and Glassware disposal procedures.

D. Guidelines for Emergency Procedures

OVERVIEW

Prevention of serious injury and property damage is of utmost priority. This can be accomplished by minimizing laboratory hazards and by utilizing proper handling procedures. However, emergency situations will still arise. Prior to an emergency all lab personnel should know the location of safety equipment in or near their laboratory and should review the emergency plan established for the lab. Although few staff members, students and visitors are capable of dealing with emergency situations to completion, all must understand the basics of:

- Assessing and evaluating an emergency situation, and
- Securing the appropriate level of assistance (EMTs, Fire Department, Police, etc).

Professional help (Emergency Medical Technicians, Fire Department, Police, etc.) is the best means of handling serious emergencies. Until the arrival of professional help, isolate the hazard as much as possible. First aid may be provided by anyone willing to assist provided they are knowledgeable with concern to the associated hazards (i.e. exposure to the situation, the injured individual(s) blood/body fluids, etc.).

NOTE: not all staff members are trained in first aid practices. Training is made available on request. Providing first aid where needed is NOT a condition of employment due to the associated risks.

Emergency Situations:

1. **Alert Other People Immediately!**

2. **Injuries:**

   a. Get medical attention immediately. If necessary, call 9-911 from campus phones or 911 from all other phones.

   b. Answer all operator questions thoroughly and completely. Inform the operator if biological or radioactive materials are involved in the incident.

   c. Send someone to meet emergency response personnel at the nearest street-side entrance.

   If Providing First Aid:

   - Obtain consent from victim, if possible
   - Ensure caregiver safety is not in jeopardy
   - Caregiver should be knowledgeable in treatment methods and associated hazards

3. **Serious Wounds**

   Serious wounds should only be treated by a doctor.

4. **Small Burns**

   Small burns should be treated with cool water. Do not use oils, powders, etc.

5. **Inhalation of Noxious Gases**

   If inhalation of noxious gases is suspected, quickly remove the victim from the area into fresh air and call 9-911 (from campus phones). Provide oxygen if available.

6. **Ingestion of Poisonous Chemicals**

   If poisonous chemicals have been ingested, call 9-911 (from campus phones) and seek medical help immediately. Do not induce vomiting unless directed by medical personnel.

7. **Skin Contact with Aggressive Chemicals**

   Upon skin contact with aggressive chemicals, use a drench hose or safety shower to wash the affected area for 15 minutes. See Section E for safety shower locations.

   Contaminated clothing should be removed immediately. If modesty is a concern, cover with clean apparel, towels, blankets, etc., and minimize personnel in affected area.

8. **Eye Contact with Laboratory Chemicals**

   Upon eye contamination with laboratory chemicals use the eyewash to rinse copiously with water for 15 minutes. See Section E for eyewash locations.

9. **Blood Borne Pathogens**

   Care should be taken when dealing with blood and bodily fluids. Blood borne pathogens (e.g., HIV and Hepatitis) can live in a pool of blood for weeks. The best person to clean up the blood is the person who bled. Otherwise, an individual trained in the handling of blood borne pathogens should be responsible for cleaning up the blood. Should you decide to perform the cleanup; secure the area, wear gloves and eye protection, contain cleanup materials in plastic bags, disinfect the area with bleach, and dispose all materials according to proper procedures. Contact SCS Safety Personnel for cleanup contact assistance.

10. Accident Reporting

All injuries and/or accidents must be reported. Contact SCS Safety Personnel to obtain appropriate forms.

11. Mercury Spills and Cleanup

Mercury spill clean up methods are determined by the quantity of mercury spilled. Small spills can be managed by using a mercury sponge or by aspirating mercury droplets into a suction flask. If aspirating the mercury, the mercury can be transferred to another container for disposal. For large quantity spills or where the spill has contaminated a large area, quarantine the area to prevent further contamination (shoes, equipment, etc.). Contact SCS Safety Personnel to coordinate the mercury clean up with Facilities and Services mercury cleanup crews. DO NOT use sulfur to coat the mercury or use nitric acid to dissolve the mercury, since either method will greatly complicate disposal. Contaminated materials used to clean up the mercury spill should be collected and sealed in a bag. To dispose of the clean up materials or a container of mercury, follow the instructions for chemical waste disposal described in the UIUC Chemical Waste Management Guide.

12. Chemical Spill Cleanup

a. Personal safety

Wear appropriate personal protection (gloves, boots, goggles, respirator, etc.) as needed.

Spill kits are placed throughout all SCS buildings. Familiarize yourself with the storage locations and contents.

b. Containment of the spill

For solvents, be sure to eliminate potential sources of ignition. Close lab doors and windows to enable laboratory chemical hood exhaust to ventilate the area. Gently place absorbent pads on the spill. Allow spill pads to absorb the spill.

c. Cleanup

For large spills or extremely toxic releases call 9-911 and evacuate the area by activating the fire alarm pull box. Place the spill absorbent into a plastic bag or other appropriate container. Seal and label the container. Consult the UIUC Chemical Waste Management Guide for disposal information.

13. Fire

In the event of a large fire, the building should be evacuated by activating the fire alarm at the pull station. Pull stations are located throughout SCS buildings, primarily near exits. The fire alarm pull will set off continuous buzzers throughout the building, signal occupants to leave the building, and notify emergency response personnel.

Laboratory personnel may attempt to extinguish small fires if:

- Personal safety is not in jeopardy
- Personnel are properly trained concerning fire fighting equipment and its appropriate use
- Appropriate fire fighting equipment is available

If the fire grows or becomes unmanageable, activate the nearest fire alarm pull. Meet the fire department to direct them to the affected area.

14. Tornado

The campus is equipped with an alarm system to warn of impending tornadoes. When the tornado alarm has sounded, or there are other indications of a tornado, move to the basement of the building or connecting tunnels. If it is not possible to move from currently occupied space before a tornado strikes; move away from the windows and crouch beneath a desk or sturdy table. The interior corridors of the building are also reasonably safe places to be.

E. Emergency Equipment

1. Safety Showers and Eyewashes

Locations of safety showers and eyewashes vary throughout SCS buildings. Familiarize yourself with these locations. In general locations are: CLSL-A showers: laboratory doorways, eyewashes: laboratory sinks, Chemistry Annex various locations within laboratories, Davenport Hall various locations within laboratories, Noyes Lab various locations within laboratories, North RAL various locations within laboratories, South RAL located in corridors at every other doorway and indicated by a large green cross on the floor. Eyewashes and safety showers should be flushed on a regular basis. Safety showers and eyewashes will be flushed annually by maintenance personnel. It is recommended that lab occupants flush eyewashes on a monthly basis. If safety showers are activated, call the number for water cleanup immediately.

2. Fire Alarms

Fire alarms are used to indicate mandatory building evacuation and as a notification to the fire department. Building evacuation may be needed in the event of: fires, chemical spills, gas leaks, and other hazards.

3. Fire Extinguishers

Fire extinguishers must be available, charged, and hung in a location that is immediately accessible. If discharged, contact SCS Safety Personnel to get the extinguisher replaced. A spare extinguisher may be checked out from SCS Safety Personnel until the extinguisher is returned. Choosing the correct type of extinguisher is critical to effectively extinguish a fire. Review the following classes to determine which type of fire extinguisher is appropriate.

- **Class A Fires**

  Class A fires involve combustible solids such as paper and wood items which leave an ash. Typical extinguishers for Class A fires include water, CO_2, halon, and dry chemical. Associated problems with these fires are destructive distillation that results in flaming vapors and toxic gases, hot ash, and residue capable of re-ignition.

- **Class B Fires**

  Class B fires involve flammable liquids. Typical extinguishers include CO_2, halon, and dry chemical. Caution: Compressed gas may spread and/or worsen fire if force from the extinguisher is excessive.

- **Class C Fires**

  Class C fires involve Class A (combustible solids) and Class B (flammable liquids) fires as well as electrical equipment. Typical extinguishers include CO_2, dry chemical (may result in equipment damage), and halon. Caution: Due to possible electrical shock, de-energize the circuit prior to fighting the fire.

- **Class D Fires**

  Class D fires are those involving reactive metals (Li, Na, K, Mg, etc.) and active hydrides (NaH, KH, $LiAlH_4$, etc.). Typical extinguishers and control methods include inert powder (Ansul Metal-X, sand, talc, alkali metal salts) and Metal-X extinguishers.

- **Lithium Fires**

  Lithium fires may not extinguish easily with standard issue Class D Fire Extinguishers or with Class D Metal-X powder. SCS Safety Personnel recommend the purchase of a Class D Fire Extinguisher Copper Base for lithium fires. Contact SCS Safety Personnel for purchase information.

Small fires containing lithium that are not located in areas with large amounts of combustible materials must be observed until the lithium is consumed. Once the lithium portion of the fire has been consumed, the remaining fire should be extinguished with an appropriate extinguisher. Attempting to extinguish the fire prior to the consumption of the lithium may spread the fire further due to the force of the extinguisher, thus dispersing the burning, low density material. If large quantities of lithium are present in the laboratory, a Class D Fire Extinguisher Copper Base must be purchased and be kept near the lithium use area of the laboratory.

4. Other Emergency Equipment

a. Panic Buttons

Some South RAL laboratories are equipped with Panic Buttons, located inside the laboratory near the light switch closest to the corridor. The panic button does not call Emergency Response Personnel, evacuate the building, or turn off any electrical or utility services in the lab. The panic button alerts others that an emergency has occurred and is activated by pressing hard on the red button and deactivated by pulling out the same button.

b. Emergency Doors/Panels

Some South RAL and CLSL-A laboratories feature emergency doors or break-a-way panels between interconnecting labs. These doors/panels are marked "EMERGENCY" and are usually kept closed to avoid the spread of fire, provide privacy, and maintain security. They are weakly secured so that a hard impact will cause the mechanism to break allowing passage. Emergency doors/panels should never be blocked since they may be the only available exit during an emergency.

F. Carcinogens, Reproductive Toxins and Acutely Toxic Chemicals

When handling genotoxins, reproductive toxins and chemicals with a high degree of acute toxicity, special precautions are needed in addition to the general safety guidelines mentioned throughout the Chemical Hygiene Plan. Precautions designed to minimize risk of exposure to these substances are listed below. Additional precautions may be warranted as well.

- Quantities of these chemicals used and stored in the laboratory should be minimized, as should their concentrations in solution or mixtures.
- Work with genotoxins, reproductive toxins and acutely toxic chemicals should be performed within a functioning laboratory chemical hood (see section III, B, 10), 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 before being released into the atmosphere). In all cases, work with these types of chemicals shall be done in such a manner that the Occupational Safety and Health Administration's (OSHA) permissible exposure limits or similar standards are not exceeded.
- Compressed gas cylinders which contain acutely toxic chemicals, such as arsine and nitrogen dioxide, should (and may be required to) be kept in ventilated gas cabinets.
- The ventilation efficiency of the designated laboratory chemical hood, glove box or gas cabinet, and the operational effectiveness of mechanical and electrical equipment used to contain or manipulate these special substances should be evaluated periodically by the laboratory personnel at intervals determined by the laboratory supervisor. The interval of evaluating systems may vary from weekly to biannually depending upon the frequency of usage, quantities employed and level of hazard.
- Each laboratory utilizing these substances must designate an area for this purpose and must sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory, an area of the laboratory or a device such as a laboratory chemical hood or glove box.

The designated area should be marked with a DANGER, specific agent, AUTHORIZED PERSONNEL ONLY or comparable warning sign (see section III, A, 13).

- 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. For further information see section III, A, 12, Reproductive Health and Safety.
- Laboratory workers working with these chemicals must have access to appropriate protective equipment and clothing (available at no expense to the workers) and must be trained on how to properly utilize the safety equipment. For example, when working with highly toxic gases, it is often recommended that the workers have self-contained breathing apparatus available, and be trained by the Urbana Fire Department on their use (see section III, A, 2).
- Detection equipment may be required in laboratories where chemicals (especially poisonous gases) with a high degree of acute toxicity are utilized.
- All wastes contaminated with these substances should be collected and disposed of in a timely manner and appropriately as outlined in the University of Illinois at Urbana-Champaign (UIUC) Chemical Waste Management Guide (see links/contacts page). For further assistance with these types of chemical waste, contact SCS Safety Personnel.
- The designated working area shall be thoroughly and appropriately decontaminated and cleaned at regular intervals determined by the laboratory supervisor. The interval may be as short as one day or as long as six months depending upon the frequency of usage and level of hazard.
- Special precautions to avoid release and exposure to highly toxic chemicals, genotoxins, and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained, gases should have properly functioning valves, check valves, regulators, containment which can withstand pressure buildup, and appropriate piping. Dispersive solids should be kept in closed containers, used in places with minimum air currents, and appropriate contact materials should be used to avoid static charging.
- Emergency response planning for releases or spills shall be prepared by the lab supervisor and included in the training of the laboratory workers and others who may be affected in the building. DRS and the Urbana Fire Department should be involved in this planning.

G. *Employee Information and Training*

All individuals working in laboratories that may be exposed to hazardous chemicals must be apprised of the hazards of chemicals present in their work area. THIS INFORMATION AND TRAINING ON THESE TOPICS MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT AND BEFORE NEW EXPOSURE SITUATIONS. Equipment necessary for the safe handling of hazardous substances must also be provided.

Upon request by Departments or other administrative units, the Division of Research Safety (DRS) personnel will, from time to time, give presentations concerning general lab safety practices. For more information on DRS on-line training, refer to the links/contacts page. However, training specific for the particular lab where an employee is assigned is the responsibility of that employee's supervisor. The frequency of refresher information and training shall also be determined by the supervisor.

In addition to training offered by DRS, the following courses are available:

MatSE 492 "Lab Safety Fundamentals"

Please see the links/contacts page for a link to the course description

Chem 536 Safety Lecture

Please see the links/contacts page for a link to the course description

A. Information

Laboratory workers shall be informed of the location and availability of the following:

- 29 CFR Part 1910.1450 "Occupational Exposures to Hazardous Chemicals in Laboratories" (the Occupational Safety and Health Administration (OSHA) Lab Standard).
- This Chemical Hygiene Plan.
- Reference materials on chemical safety, including Material Safety Data Sheets (MSDS) must be immediately available.
- Permissible exposure limits (PEL) for OSHA regulated substances, or if there is no applicable OSHA standard, the recommended exposure limits or threshold limit value (TLV) may be provided.
- Signs and symptoms associated with exposure to the hazardous chemicals found in the lab.

B. Training

Laboratory worker training in the School of Chemical Sciences includes:

- The information provided in this Chemical Hygiene Plan
- The SCS Safety Exam, which must be taken prior to the commencement of laboratory work
- Information found on the links/contacts page at the end of this document
- Consultation with the Division of Research Safety

Additional topic specific training can be provided by contacting SCS Safety Personnel for more information.

UIUC School of Chemical Sciences Chemical Hygiene Plan
Links and Contacts Page

General Safety:

SCS Safety Website: http://safety.scs.uiuc.edu/
OSHA Laboratory Standard: http://www.drs.uiuc.edu/css/guidesplans/safety/pdf/appendix1.pdf
UIUC Facilities and Services, Safety and Compliance: http://www.fs.uiuc.edu/sac.cfm
Campus Administrative Manual: http://www.fs.uiuc.edu:1503/fsindex.html?col=cam&qc=cam
CAM Section V/B, Environmental Health and Safety:
http://www.fs.uiuc.edu:1503/fsindex.html?col=cam&qc=cam#emergency
Division of Research Safety: www.drs.uiuc.edu
Chemical Safety Section: http://www.drs.uiuc.edu/css/index.aspx or css@uiuc.edu
Biological Safety Section: http://www.drs.uiuc.edu/bss/index.aspx or bss@uiuc.edu
Radiation Safety Section: http://www.drs.uiuc.edu/rss/index.aspx or rss@uiuc.ediu

Guides and Important Information:

UIUC Chemical Waste Management Guide:
http://www.drs.uiuc.edu/css/guidesplans/wasteguide/index.aspx?tbID=gp
Material Safety Data Sheets: http://www.drs.uiuc.edu/css/msds/index.aspx?tbID=ms
SHARPS Information: http://www.drs.uiuc.edu/bss/factsheets/sharps.aspx?tbID=fs
SCS UIUC Chemical Tracking: http://www.scs.uiuc.edu/chemtracking/

Fact Sheets:

DRS Safety Fact Sheets: http://www.drs.uiuc.edu/factsheets/index.aspx
DRS Waste Minimization Fact Sheet: http://www.drs.uiuc.edu/css/factsheets/index.aspx?tbID=fs

Forms:

ChemTrak forms (including form 5): http://www.drs.uiuc.edu/css/guidesplans/wasteguide/cwmtrk.aspx
Biological Project Registration: http://www.drs.uiuc.edu/bss/ibc/index.aspx?tbID=ibc
Radiation Safety Forms (Including Laser Registration Form):
http://www.drs.uiuc.edu/rss/forms/index.aspx?tbID=frm
Safety Inspection Form and Instructions: http://www.drs.uiuc.edu/gls/forms/index.aspx
UIUC Employee Injury Report Form:
http://www.legal.uillinois.edu/wc/AccidentReportNew92001uiucRevised%2003142006.pdf

Personal Safety:

CUMTD Safe Rides Information: http://www.cumtd.com/ridingmtd/services/SafeRide.aspx

Safety Training:

DRS Safety Training: http://www.drs.uiuc.edu/training/index.aspx
MatSE 492 “Lab Safety Fundamentals”: http://courses.uiuc.edu/cis/catalog/urbana/2009/Spring/MSE/492.html
Chem 536 “Experimental Organic Chemistry”:
http://www.scs.uiuc.edu/chem/courses/course_list/Graduate-2008chem536.html

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