School of Chemical Sciences Chemical Hygiene Plan

The SCS Chemical Hygiene Plan provides supplemental information to the DRS Laboratory Safety Guide regarding safe working practices in SCS laboratories. The CHP is reviewed annually by SCS Safety personnel. Any changes that are found during this review are brought to the SCS Director for approval.

Facilities

The School of Chemical Sciences is spread among five adjacent and interconnected buildings:
1. Noyes Lab (NL)
2. Chemistry Annex (CA)
3. Davenport Hall (DH)
4. Rogers Adams Lab (RAL)
5. Chemical & Life Sciences Lab (CLSL) Building A

If you experience any non-emergency facility-related issues in your lab (fume hood not working properly, weak flow from eyewash, outlet experiences power trip, etc.), please submit a work order in Reaction. Reaction is a web-based software package used by SCS to manage procurement needs, submit work orders for building maintenance as well as for project requests with our SCS shops, and manage compressed gas cylinder inventory. Email the SCS Facilities and Safety team at scs-facilities@illinois.edu if you have any questions regarding work orders.

If you experience any emergency facility-related issues (major water leaks, unexpected power outage, elevator issues, etc.), call the F&S Service Office at 333-0340. Once F&S has been contacted, email the SCS Facilities and Safety team so they can follow up on the issue.

Responsibilities

The overall safety of the SCS staff, students, and researchers is overseen by the Director of Facilities and Safety as well as the department Safety Officer. They are responsible for ensuring that everyone has a safe environment to work in and that all university and departmental safety policies are being complied with. The Principal Investigator (PI) of each research group is responsible for the safety of their researchers as well as anyone who enters their lab space. Each research group will also have their own Laboratory Safety Officer (LSO) to provide safety training and guidance for their group as well as work with departmental safety staff to maintain or improve the safety within their area.

Training

The following training is a prerequisite before beginning work in a laboratory within the School of Chemical Sciences:

- Read the DRS Laboratory Safety Guide and the SCS Chemical Hygiene Plan
- Pass the SCS Safety Exam
- Complete the following DRS training modules:
    - Laboratory Safety Training
    - Chemical Safety: An Introduction
    - Any other modules required by DRS based upon the hazards present in your research area

- Complete the Laboratory Safety Training checklist for your research group
- Review the Building Emergency Action Plan for your building(s)
- Review chemical hazard classification and labeling according to the Globally Harmonized System

Policies

Everybody working in a laboratory within the School of Chemical Sciences has to adhere to the following policies in addition to those outlined in the DRS Laboratory Safety Guide:

Clothing and PPE

Eye protection must be worn at all times in a lab unless you are at your desk and your desk is isolated from the active research areas of the lab. The minimum eye protection constitutes ANSI Z87.1 certified safety glasses. Regular prescription glasses are NOT safety glasses and do NOT serve as eye protection.
Clothing must cover the torso and legs. Shorts are not allowed in the lab. Clothing made of synthetic fabrics, such as nylon and rayon, is not recommended as it can melt in contact with chemicals. Shoes must cover the entire foot. Open or perforated shoes or sandals are not permitted. Long hair must be tied back.
Lab coats must be worn while in a lab. A flame-resistant lab coat is highly recommended for anyone working near an open flame or with flammable or explosive chemicals. Lab coats should NOT be stored at your desk or hung on your desk chair. Lab coats should be routinely laundered. The School of Chemical Sciences has implemented a lab coat laundering program to pay for the laundering of chemically contaminated lab coats worn by all SCS graduate students, employees, and staff. Biologically contaminated coats must be decontaminated via autoclave prior to utilizing this laundering program. If the lab coat is unable to be autoclaved, a 10% bleach solution can also be used for decontamination. Coats will be collected two times per calendar year. An e-mail notice will be sent out informing users of the collection dates.
Gloves should be worn while performing any procedure that requires the handling of hazardous materials, contaminated surfaces, or equipment. Disposable gloves should not be washed, reused, or sprayed with chemical solvents such as ethanol. Gloves should not be worn when touching clean surfaces like keyboards, cell phones, and door knobs. Gloves must not be worn in public areas such as elevators. Glove materials vary widely in effectiveness in protecting against specific hazards. Disposable gloves provide very little protection against chemicals and should be removed immediately when in contact with a chemical. Consult a chemical resistance chart, a glove manufacturer, or contact DRS for assistance in appropriate selection.

For more information, refer to the DRS guidance document Personal Protective Equipment.

Children and Unauthorized Persons

Unauthorized persons are not permitted in laboratories where hazardous substances or operations are present unless under direct supervision of lab personnel. Personnel are strongly encouraged to keep their work area locked to prevent unauthorized access. Children are only allowed in the labs when participating in approved educational tours or activities.

Working Alone

Personnel working late at night are advised against working alone. Should you need to work alone, consult with your PI to determine if your planned activities are allowed by your group's policies. Utilize caution on admitting anyone into your work area if alone or when in transit between destinations. Campus Safety escort services are available.

Prudent Practices for Laboratory Work

Equipment

Only use equipment in proper working condition and never use chipped or cracked glassware. All equipment and apparatuses should be securely mounted and free of strain.

Secondary Containment

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

Transfer of Chemicals

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

Proper Chemical Transportation

When transporting liquid chemicals in excess of 500mL through public corridors, always use a rubber bottle carrier or a cart with side rails of at least 2". If the chemical needs to be transported to a different building, try to utilize any interior building connections or the underground tunnels connecting RAL, Chem Annex, and Noyes to minimize potential environmental chemical release.

Heating Cautions

Always ensure an adequate vent when heating chemicals. Closed systems should not be heated unless performing controlled pressurized reactions in approved equipment.
Heating equipment such as mantles or fluid baths must be readily accessible and quickly removable in case of a runaway reaction.
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. 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 accommodate the size of the heated vessel.
Bunsen burners must never be used to heat flammable solvents. Before using a Bunsen burner, make sure that your coworkers are not using flammable solvents in the area. Always use a sparker to light a Bunsen burner. When work is completed, the Bunsen burner must be turned off immediately.

Vacuum Systems

Evacuated glassware poses a significant implosion hazard, which includes the potential of abruptly releasing glass shrapnel and the contents of the container. Implosion protection must be provided for all evacuated glassware 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. Other commonly used protection methods include using plastic-coated glassware or using a plastic mesh to cover the glassware. All glassware must be inspected for defects and cracks before evacuating and discarded if any are found. Evacuated glassware should not be exposed to local overheating as it can weaken the glass and cause an implosion. Commonly evacuated vessels include:

- **Desiccators**

- **Flasks:** Never evacuate ordinary non-vacuum flasks, especially those with flat surfaces.
- **Rotovaps**
  The body of a rotary evaporator and the receiving flask must both be implosion protected.
- **Dewar Flasks**

Any equipment connected to a vacuum pump or the house vacuum system must be protected with a trap.

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.

Freezers/Equipment in Shared Labs

Freezers and other equipment that are used within a shared lab should be labeled with the PI's name so that in the event the equipment begins to malfunction or sound an alarm, the correct owner can be quickly notified. If the PI's contact information isn't provided on the door sign, it should also be present on the equipment.

Chemical Inventory

All chemicals stored in SCS research labs, teaching labs, and service facilities are tracked in the Chemical Safety EMS chemical inventory module. This inventory allows SCS to maintain compliance with all state and federal regulations, allows researchers and staff to easily track their own chemical storage, and facilitates sharing of chemicals between researchers. For more information about the SCS Chemical Inventory Program or how to use the Chemical Safety EMS inventory, please refer to the Chemical Inventory webpage on the SCS website.

Chemical Borrowing Policies

When borrowing chemicals from another research group, the following policies must be adhered to:

- ALWAYS ask for permission from a member of the research group that owns the chemical. If they aren't able to grant permission for the specific chemical, they will be able to direct you to the person who can. NEVER go into a lab and just take a chemical.
- It is always at the discretion of the research group that owns the chemical whether to allow the chemical to be borrowed. There are several factors that may lead a researcher to deny access to a chemical such as only having enough for their own research or the chemical being too expensive.
- ALWAYS read the SDS prior to borrowing any chemical that you have not used before.
- Chemical bottles should not be removed from the lab of the group that owns them so make sure to bring a vial with you to measure out the quantity of chemical you need. Make sure to also be aware of any special handling procedures needed to safely transfer the chemical from the bottle to your vial. There may be special cases where the research group allows you to take the bottle back to your own lab but that is at their discretion.
- If your group requires training prior to using the particular chemical or the class of chemicals it belongs to, make sure you receive and document the training from your LSO or member of your group that has experience using it.

Chemical Waste

DRS offers a jerrican pick-up program for high-volume generators of solvent waste at RAL and CLSL. 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. Waste jerricans are available for purchase in the RAL Storeroom.

For more information, refer to the DRS guidance document Roger Adams Lab Jerrican Pickup Program
For all other waste collection information, refer to the DRS Laboratory Safety Guide.

Preventing 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. Should a flood occur that is the result of negligence on the part of a researcher or staff member, the PI will be responsible for the costs of any repairs or item replacement. The following measures can be taken to minimize the chance of flooding.

Sink and Hood Gutter Drains

Ensure 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 the water has an outlet and that the sink does not overflow.

Water Regulator

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. Some of the faucets in the fume hoods in RAL South have water regulators installed. This is an example of what these regulators may look like:

To ensure the regulators will work properly when unattended:

1. Ensure the water valves in line with the regulators are fully open (this ensures 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.

Tubing and Connections

1. 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.
2. Replace tubing before it becomes decomposed or brittle. Check tubing occasionally by bending sharply and looking for cracks.
3. Secure all tubing connections with clamps.
4. Use locking quick disconnects where needed and secure non-locking quick disconnects with clips.

Cold Rooms

Cold rooms are enclosed areas that are poorly ventilated. For that reason, volatile chemicals and cryogens should not be brought into cold rooms. Due to possible water condensation, floors in cold rooms can be slippery. The door to the cold room can freeze and the latch may become inoperable on the inside. Ensure proper function before closing the door and ensure the phone has a dial tone. In the event you become trapped within, use the phone in the cold room to call Campus Public Safety, 333-1216, or 911. It is suggested that you inform coworkers of your plans to work in the cold room prior to entering the cold room. Similar arrangements can be made with Campus Public Safety if a coworker is not available.

High Magnetic Fields

Researchers should be aware of the potential risks of working in areas with high magnetic fields, such as NMR facilities.

Magnetic (Ferrous) Objects

Magnetic (ferrous) objects should not be taken close (5-10 feet, depending on the magnet) to 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. 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 NMR Staff.

Pacemakers and Medical Implants

Individuals with cardiac pacemakers should not cross the 5 gauss line of a high magnetic field. If you are not sure where the 5 gauss line is located, consult with the SCS 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 NMR Staff.

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 risk of asphyxiation. A quench warranting evacuation would most likely be obvious by the noise of the escaping gas and clouds of vapor.

High Pressure/Hydrogenation Lab

The High Pressure/Hydrogenation Lab is located behind door P-8 in the penthouse on the 5th floor of South RAL. It is equipped with apparatuses designed for pressures up to 5000 psi that allow to perform chemical reactions safely at high pressures and temperatures. See SCS Safety Personnel for access and training to use the High Pressure/Hydrogenation Lab.

Emergency Situations and Equipment

In the event of a fire, accident, injury, or other emergency situation, email SCS Facilities and Safety to notify them about the event in addition to contacting DRS. An "Incident or Near Miss" form should also be filled out for the Chemistry Joint Safety Team.

Building Emergency Action Plan (BEAP)

The BEAP contains information about how to respond to emergencies such as fire, severe weather, and active threats to the campus. There is a BEAP for each building in SCS so be sure to review the information for each building you typically work in.

Safety Showers and Eyewashes

Safety showers and eyewashes are to be used to rinse off affected areas on your body in the event of an exposure to a hazardous chemical or biological material. Locations of safety showers and eyewashes vary throughout SCS buildings so make sure to identify where the locations are in your lab and your surrounding areas. Safety showers and eyewashes will be tested annually by DRS personnel. In addition, eyewashes must be flushed weekly by lab occupants to ensure proper function and clean water. If the safety showers are activated in the event of emergency, contact Facilities and Services at 333-0340 for water cleanup.

Fire Alarms and Extinguishers

Fire alarms will set off continuous buzzers throughout the building, signal occupants to leave the building, and notify emergency response personnel. Pull stations are located throughout SCS buildings, primarily near exits. They should be activated when building evacuation is necessary in the event of a fire, chemical spill, gas leaks, or other hazard.
Laboratory personnel may attempt to extinguish small fires if:

- 911 has already been called
- 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. Meet the fire department to direct them to the affected area.

Fire extinguishers are provided in every laboratory and must be readily accessible at all times. There are two types of fire extinguishers available in the labs: carbon dioxide and ABC dry powder. The carbon dioxide extinguishers are effective with Class B (flammable liquid) and Class C (electrical) fires. The ABC dry powder extinguisher is effective with Class A (combustible solid) as well as Class B and C fires. The tag attached to each extinguisher will let you know what type of extinguisher it is. If the fire contains reactive metals (Na, K, Mg, etc.) or active hydrides (NaH, KH, etc.), also known as a Class D fire, DO NOT use the ABC or carbon dioxide fire extinguishers. An inert powder such as Metal-X or sand or a Class D fire extinguisher will need to be used to put out this type of fire.

For lithium fires, a Class D Copper Base fire extinguisher, Lith-X powder, or sand is needed. SCS has Class D Copper Base fire extinguishers and Lith-X available for check-out in the following closets in South RAL: 155A, 255A, 355A, 455A. There are also Class D extinguishers available in designated areas in the hallways of the 1st through 4th floors of CLSL-A. Any time you plan to use lithium, check out one of these extinguishers by filling out your information on the sheet inside the closet door. Keep the extinguisher by your work area and promptly return it to the closet when you are done using lithium for the day.

Spill Kits

It is required that each research group maintain their own spill kit. Each kit should contain necessary materials to address spills for any hazard type present in your labs. There are spill kits available in the hallways that contain gloves, goggles, and spill pads for simple spills. If you use any of the materials from the hallway spill kits, contact SCS Safety personnel so we can replace any necessary items. For more information about preparing a spill kit, please visit the Emergency Preparedness webpage on the DRS website.

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.

Bodily Fluid Cleanup

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. If that person is unavailable to do so, secure the area and contact SCS Safety personnel for cleanup assistance.

First Aid

First aid training can be made available upon request but providing first aid is NOT a condition of employment due to the associated risks. If you would like to receive first aid training, contact SCS Safety personnel for information about upcoming classes.

Helpful Links

SCS Safety Website

Division of Research Safety

Chemistry Joint Safety Team