Rowan University

Department of Chemical Engineering

Laboratory Operations and Safety Manual

(Rev 6/16/2025)

The Department of Chemical Engineering is committed to a strong safety culture that protects the health and welfare of everyone. This culture depends on adherence to safety protocols and policies and good laboratory practice. Good and safe laboratory operations are a professional requirement and allow for the avoidance of most accidents. This includes proper handling of chemicals, glassware and apparatus, and the knowledge and habitual use of safety protocols.

It is not possible to list every eventuality or the particulars of every piece of equipment in a manual. Not all laboratory equipment is mentioned in this safety manual. Common sense in the laboratory is essential. In addition, if there is any question regarding equipment or laboratory operation, students should ask their supervisor or Laboratory Management **before** proceeding.

Laboratory Safety Policy Violations

The Departmental safety protocols are designed to keep all laboratory personnel safe. Violations of these protocols endanger the safety of everyone in the laboratory. The following are the departmental policies regarding safety violations.

- If an individual has three (3) minor violations in one semester or one major safety violation, the individual(s) will be required to complete all five Level 1 Curriculum SAChE safety courses (~11 hours), and meet with their supervisor to discuss the importance of safety and the possible impact on their Clinic/research grade. The individual(s) will not be allowed in any laboratory until their supervisor has all completed Level 1 SAChE certificates from the violator(s). 4 or more violations in the same semester will result in the individual(s) being required to complete all Level 2 Curriculum safety courses (35 hours). With a subsequent violation after that, even in future semesters, the individual(s) will be prohibited from entering any laboratory until a decision has been made by the department head.

- Minor violations are events in which no one has been hurt and there has been no or minimal property damage. Individuals who accrue more than four (4) minor violations per semester may be subject to the University's process for endangering the welfare of others and/or damaging property.

- Major safety violations resulting in injured individuals requiring medical assistance and/ or severe damage to property will be reviewed by the faculty PI, the Department Head, and the Safety Committee for mitigating circumstances and addressed on an individual basis. Major safety violations resulting from negligence or irresponsible behavior will be submitted to the University process as described above.

GENERAL SAFETY RULES

- Supervisor's approval is required for anyone to be in the laboratory after hours, on weekends, or on non-scheduled laboratory days. Undergraduate students are not allowed to work alone in the laboratory at any time.

- No equipment is to be operated without your supervisor's approval. All individuals must be familiar with the safety aspects of their equipment and laboratory.

- Safety glasses or safety goggles (when handling hazardous chemicals) are required. Prescription glasses are NOT a substitute for safety glasses.

- Contact lenses may not be worn in the laboratory. This protocol is more stringent than the University protocol due to the nature of the work in many Chemical Engineering laboratories.

- Neckties, dangling clothing or jewelry, food, and drinks are not permitted in the laboratory. Long pants and closed toe shoes are required.

- Sleeping and horseplay of any sort are prohibited in the laboratory.

- Cell phone use is limited to laboratory associated functions. Personal use of cell phones is not allowed in the laboratory.

- Smoking, vaping, and open flames are prohibited in the laboratory.

- The safety precautions associated with the equipment must be followed.

- No operating equipment may be left unattended unless there are clear protocols for its unattended operation which are approved by the faculty/supervsior in charge.

- The laboratory floor must be kept dry, clean, and uncluttered at all times. Follow Rowan's Chemical Spill Cleanup Guidelines for any hazardous spills. All Non-hazardous spills must be cleaned up immediately. Immediately notify the laboratory manager of any spills in the laboratory.

- All chemicals must be transported in a safety carrier or cart with a secondary containment tray. More than one item of glassware must be transported on a laboratory cart or other suitable container.

- Chemicals and glassware are not to be transported on the spiral staircase.

- Students are expected to be familiar with the safety aspects of all the chemicals used in the laboratory and with the coding system used to label containers and pipelines.

- Any near miss, accident or hazardous situation must be reported to the laboratory supervisor immediately.

PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment shall be provided, used, and maintained in a sanitary and reliable condition and used in accordance with the Department's safety protocols.

- RESPIRATORY PROTECTION
  - An appropriate respirator should be worn when handling any small particulates (<10μm).

- EAR PROTECTION
  - Earplugs protect the ears against high-decibel noise (85 dBA or above). They must be worn when in a noisy environment or as instructed by your supervsior or laboratory management.
  - Earplugs are always available, while working in the laboratory, for those with noise sensitivity.

- EYE PROTECTION
  - Safety glasses or safety goggles are to be always worn in the laboratory. Prescription glasses are NOT a substitute for safety glasses.
  - Safety goggles must be worn when handling liquid or airborne hazardous chemicals or when there is a splash hazard.
  - Contact lenses are not allowed in the laboratory. This protocol is more stringent than the University CITI training policy due to the nature of the work in many Chemical Engineering laboratories. Contacts can trap hazardous chemicals between the lens and the eye.

- FOOTWEAR
  - Ventilated footwear or sandals are not allowed in the laboratory.
  - Closed-toe shoes are required. Porous leather, cloth or tennis shoes are NOT recommended. Proper footwear is required to protect the feet against burns from chemicals, steam, and hot water. Good judgment in the selection of footwear used in the laboratory will avoid injuries.

- LABORATORY COATS AND GLOVES
  - Laboratory coats must be worn in the laboratory when handling hazardous materials or when instructed by your supervisor or laboratory manager. Laboratory coats may be worn outside the laboratory as appropriate, e.g. walking between laboratories.
  - Use proper laboratory gloves when handling hazardous materials (chemical, heat/ cold resistant). Insulated gloves are required to avoid burns when operating steam valves and when handling hot objects. Appropriate chemical resistant gloves are required to avoid contact with chemicals that can burn or penetrate the skin.
  - Laboratory gloves for chemical handling may not be worn outside of the laboratory. Any type of glove must be removed before touching door handles. Laboratory gloves should be worn as needed upon arrival to a new location. Cut resistant work gloves (not laboratory gloves) may be worn outside the laboratory while working with sharp or heavy objects.

- REQUIRED LABORATORY APPAREL
  - Long pants and closed-toe shoes are required. Sleeveless shirts are prohibited.
  - No neckties, dangling clothes or jewelry. Hoods and strings must be tucked in at all times.
  - Long hair must be pulled back without dangling.
  - Laboratory coats must be worn when handling chemicals or when instructed by your supervisor or laboratory management personnel.

- PERSONAL HYGIENE PRACTICES
  - Wash hands before and after running an experiment.
  - Wear gloves appropriate for the experiment. Clean or dispose of gloves after use.
  - Cover any cuts or open wounds with clean, suitable material.
  - Do not apply skin products or comb hair while in the laboratory.
  - Keep extra clothing available to change after working in the laboratory or in case your clothes become contaminated.
  - Use a pipette bulb; do not use your mouth to pipette.

- LOCATION OF LABORATORY SAFETY EQUIPMENT
  - Students must be familiar with the location of all laboratory safety equipment. This includes but is not limited to: fire extinguishers, first aid kits, eye-wash stations, and safety showers.

GENERAL EQUIPMENT SAFETY

- CHEMICAL SAFETY
  - All chemicals must be transported using a safety carrier/cart and be in a closed container.
  - No chemicals are to be carried on the spiral staircase. Use the elevators with a cart and secondary containment.
  - Flammable, volatile chemicals are to be stored in the Flammable Liquids Storage Cabinet.
  - Chemicals are NOT to be stored in the hoods. Chemicals must be removed from the hoods at the end of the day.
  - All primary and secondary containers must be labeled as to their contents and must have “Right to Know Act” Label Requirements attached as appropriate. Visit Rowan's Environmental Health and Safety website for more information.
  - Any unlabeled container must be reported to the laboratory supervisor and be treated as a hazardous substance.
  - The laboratory supervisor must be notified of any new chemical introduced into the laboratory so that the safety data sheet (SDS) can be obtained, and all students can be trained on the handling of the chemical.
  - All chemicals must be properly labeled and inventoried in the chemical inventory system.

- CHEMICAL STORAGE CABINET
  - Store acids in a labeled "Acids" cabinet, and store bases in a labeled "Bases" cabinet.
  - Store oxidizable materials away from acids and bases.

- FLAMMABLE LIQUIDS STORAGE CABINETS
  - Flammable chemicals must be stored in a Flammable Liquids Storage Cabinet.
  - Separate incompatible chemicals.

- ELECTRICAL SAFETY
  - Power must be off before making electrical connections.
  - Avoid splashing or spraying water on electrical connections, wall sockets, and junction or power boxes.
  - Keep extension cords away from traffic and water.
  - Do not daisy chain or overload extension cords/surge protectors (keep combined current load <10A or consult technician)
  - Use 3-pronged plugs with a ground connection.
  - When operating power disconnects, do not stand directly in front of the box. Stand to the right side and use you left hand to operate the lever. Turn head away from disconnect and inhale, hold your breath before switching the lever. This will help protect you in event of arc flash.
  - Installation of equipment exceeding 110VAC or 24VDC consult with a technician.

- GAS CYLINDERS
  - Cylinders must be kept upright and secured to a sturdy base with a chain or strap.
  - The gas or liquid contained in the cylinder should be clearly identified on the container.
  - If a cylinder has been emptied, clearly label this information on the container.
  - Keep the valve cover screwed securely on top of the cylinder during transportation and storing process.
  - Store cylinders away from elevated temperatures.
  - Do not store flammable materials near oxygen cylinders.
  - Always move a cylinder tank with a cart; cylinder must be chained to the cart and valve cover screwed on.
  - Once the cylinder is installed:
    - Make sure proper CGA fitting is used with the pressure regulator, and that all connections downstream of the pressure regulator are secured.
    - Check for leaks with Snoop® or soapy water.
  - Only trained personnel may transport gas cylinders.

- GLASSWARE
  - Glassware is not to be transported up or down the spiral staircase. Use the elevators or alternate stairways. Preferably use elevator with safety cart.

- Glassware must be transported in a bucket or suitable container.
- Use hand protection when inserting glass tubing into rubber stoppers, corks, or rubber tubing.
- Glass tubing should be fire polished and lubricated before insertion into rubber stoppers or rubber tubing.
- Always wear eye protection when using glassware.
- Discard or replace damaged glassware.
- Use only vacuum designed glassware for vacuum applications.
- Dispose of broken glass in the broken glass disposal container.

- MIXING AND STIRRING DEVICES
  - Keep hands, hair, and loose clothing away from agitator.
  - Lock out the power supply to the agitator before adding material to the tank or before manually stirring the material in the tank.
  - For hand-held agitators, make sure agitator is off before adding material to the tank.
  - Make sure the agitator is immersed in the solution to be mixed before starting motor.
  - Turn off motor before removing the agitator from the mixed solution.

- PUMPS, FANS, BLOWERS, AND COMPRESSORS
  - Make sure that guards on moving parts and on electrical connections are in place.
  - Keep clothing, hands, and hair away from moving parts.

- ELECTRONIC DEVICES
  - Use of electronic devices for entertainment purposes is strictly prohibited in the laboratory.
  - Calculators, phones, and laptops may be used for calculations and data management associated with the experiment at appropriate locations in the laboratory.

- SAFE LIFTING PRACTICES
  - Clear a pathway before moving things.
  - Check the object's weight to see if help is needed.
  - Keep back straight and vertical to the ground. Keeping your head up and looking straight ahead will help.
  - Bend knees when lifting; use the legs to lift and not the back.
  - Bring the object as close to the body as possible.
  - Be careful when putting the object down; follow the same guidelines as for lifting.

- STEAM LINES AND CONDENSATE LINES
  - Use insulated gloves to operate steam valves.
  - Open valves slowly and only to the desired amount.
  - Keep hands and clothing away from steam lines.
  - Lines from steam traps should extend into the drain.
  - During start-up, by-pass steam traps until live steam exits from discharge line.
  - Stay clear of condensate/steam discharge lines, especially during start-up.

- GENERAL LABORATORY SAFETY
  - Food and drinks are strictly prohibited in all laboratories
  - Backpacks and personal items are NOT to be stored in the laboratory or block any hallways or doorways.
  - Laboratory doors may not be propped open at any time
  - All laboratory waste should be properly labeled. Visit Rowan's Environmental Health and Safety website for more information.