LABORATORY SAFETY PLAN

Scott Bioengineering Building

Updated December 2023

A paper copy of this plan must be present in each laboratory.

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APPENDICES

1. EMERGENCY TELEPHONE NUMBERS

POLICE & FIRE (EMERGENCIES - THREATS TO LIFE & SAFETY)….**911 or 491-6425**
BUILDING PROCTOR (Jim Jensen)……..491-5356
BUILDING LAB MANAGER (Ellen Brennan-Pierce)……...491-5046
CBE DEPARTMENT LAB MANAGER (Tim Gonzales)…….....491-2390
ENVIRONMENTAL HEALTH SERVICES…….……..491-6745
BIOSAFETY…….....491-0270
FIRE SAFETY…….....491-4749
HAZARDOUS CHEMICALS…….....491-4830
RADIOACTIVE MATERIALS……...491-3736
FOOD SAFETY/WATER QUALITY/INDOOR AIR……491-6121
FACILITIES MANAGEMENT / AFTER-HOURS FACILITIES ISSUES……491-0077
RISK MANAGEMENT……...491-7726
STUDENT HEALTH ……..…….491-7121

On Job Injuries:

Injured Person on University Payroll:

Emergency Care
Poudre Valley Hospital Emergency Department
1024 South Lemay Ave
Fort Collins, CO
24 hours, 7 days per week

Occupational Health
University of Colorado Health Occupational Health
151 W. Lake St., Suite 1500
Fort Collins, CO 80524
970-495-8450

Walk-In Urgent Care
Associates in Family Medicine – CSU Office
CSU Heath and Medical Center (corner of College Ave. & Prospect Rd.)
151 W. Lake St, Suite 1500
Fort Collins, CO 80524
970-237-8200
Mon - Fri, 7 am - 7 pm
Sat & Sun, 9am – 5pm

Concentra
620 S. Lemay Avenue
Fort Collins, CO 80524
970-221-5811
Mon - Fri, 7 am - 7 pm
Sat, 9 am - 1 pm
Sun, CLOSED

Injured Person NOT on University Payroll
On Campus: CSU Health and Medical Center (corner of College Ave. and Prospect Rd.)

2. REQUIRED SAFETY TRAINING

- All building users must be familiar with the General Building Safety Plan document.
- All personnel who access the laboratory side of the building must also be familiar with sections 3 and 4.1 of the Scott Bioengineering Building Laboratory Safety Plan (General Laboratory Safety Rules General Work Practices).
- All laboratory users must also be familiar with all contents of this document, and complete the training below. In the Scott Bioengineering Building, the term "laboratory" applies to all rooms listed in Appendix A, regardless of the nature of the work.
- Card access to laboratories will be granted after completion of training.
- All visitors to the laboratories must be escorted by a trained laboratory user at all times and wear appropriate personal protective equipment (PPE).

Please give all training completion certificates to your faculty member.

1. General Laboratory Safety Training:
Complete the Scott Bioengineering Building General Laboratory Safety Training and quiz on the EHS training webpage (http://www.ehs.colostate.edu/WTrainReg/ClassSignUp.aspx). This training includes working with hazardous materials, proper use of PPE, and location and proper use of emergency equipment and spill kits.

2. Hazardous Waste Training:
Please go to the following website (http://www.ehs.colostate.edu/WTrainReg/ClassSignUp.aspx) to complete the online training module entitled "Chem Management & Hazardous Waste Training."

3. Biosafety Training:
Please go to the following website (https://colostate.scishield.com/) to complete the online training module entitled "Annual Biosafety Training."

4. Laser Safety Training:
If applicable, go to the following website (http://www.ehs.colostate.edu/WTrainReg/ClassSignUp.aspx) to complete the online training module entitled "Laser Safety Program."

5. Responsible Conduct in Research Training:
All graduate students, post-docs, and undergraduates engaged in research and scholarly inquiry at CSU are required to have training in nine core areas related to responsible conduct in research. In addition, for graduate students supported by NSF or NIH grants, this training is required to include "face-to-face" training (i.e. they have to attend a class and online classes or reading a book at the library doesn't count). All graduate students, post-docs, and undergraduate researchers should fulfill the training requirement by following these steps:

a. Go to http://rcr.colostate.edu (notice there is no www).
b. Click on the "RCR Training and Certification" link on the left hand side of the page.
c. View the 12 "training modules" (slide shows).
d. Complete the "Mastery Quiz" (and pass it!)
e. Print your training certificate and give a copy to your faculty member.

6. Occupational Health and Safety Program (OHSP)

a. Go to the following link (http://www.ehs.colostate.edu/WTrainReg/ClassSignUp.aspx) to complete the OHSP Risk Assessment.
b. Select applicable risk categories. All Scott Bioengineering laboratory users must select Biosafety Level 2 (BSL-2) research since several labs' research involves BSL-2 organisms. BSL-2 means that there are organisms present that pose a moderate potential hazard to personnel

and the environment. Unless you work directly with these organisms, there is minimum risk for exposure to these BSL-2 level organisms during your research.

i. For BSL-2 risk, indicate frequency of contact. If you do not work directly with BSL2 organisms, select Facility/Maintenance Only.

ii. Select the BSL-2 organisms. See Appendix B for the current list of BLS-2 organisms used in Scott Bioengineering, as of July 2021.

iii. Click on Add to list

c. Select any other risk categories that apply to your research. Ask your supervisor if you are not sure.

d. Click on Submit Assessment.

7. Lab Specific Training

Consult Appendix A for additional training required for labs with special hazards. Contact a member of the Scott Bioengineering Building Safety Committee if you have questions.

8. Equipment Training

Contact the Building Lab Manager for training on liquid nitrogen dispensing, autoclave use, and glass washer use. For all other equipment use, contact the faculty member responsible for the equipment. See Appendix C for the Scott Bioengineering Liquid Nitrogen Dispensing Training Agreement.

3. GENERAL LABORATORY SAFETY RULES

In the Scott Bioengineering Building, the term "laboratory" applies to all rooms listed in Appendix A, regardless of the nature of the work.

Laboratory Hallways

- Any laboratory materials or food/drink transported through the laboratory hallways must be covered during transport through the hallway. Food and drink must not be consumed in the laboratory hallways.
- Due to the large number of students attending classes in the teaching labs on the second floor, transport of laboratory materials through this hallway should be minimized.

Food, drink and related utensils shall not be brought into, stored in or consumed in a laboratory.

- The separation of food and drink from locations containing hazardous materials and potentially contaminated items minimizes the risk of accidental ingestion. The risk of exposure is also reduced by not using laboratory equipment for preparing or storing foods. Food, drinks and other related utensils may also contaminate samples and be detrimental to the related research performed in the laboratory.

Personal & hygiene items

- Avoid the insertion or removal of contact lenses and other manipulations that could transfer hazardous materials to your eyes or mouth. DO NOT apply cosmetics or lip balm in a laboratory environment.
- Smoking is strictly prohibited inside all university buildings / laboratories. The proximity to hazardous, toxic, radioactive, infectious, and flammable substances makes smoking in laboratories an extreme risk for ingestion and fire. It also violates local and university smoking policies.

Personal protective equipment (PPE)

- All persons in a laboratory, whether conducting experiments or not and including visitors, are required to wear laboratory-appropriate clothing (closed-toe shoes, shirts that cover upper arms and entire torso, long pants or long skirts that completely cover the legs). It is recommended that all researchers store a change of clothes and shoes in Scott Bioengineering in case of emergency.
- All persons in a research laboratory, whether conducting experiments or not and including visitors, are encouraged to wear lab coats at all times. Lab coats MUST be worn when working in a laboratory containing chemical or biological entities. Lab coats provide the initial barrier that helps to prevent contamination and injury. Lab coats are only required in teaching laboratories when indicated by the instructor.

  Scott Bioengineering is equipped with an on-site combination washing machine and dryer available for lab coat cleaning, located in Autoclave Room 182. This machine is only to be used for lab coats - under no circumstances can it be used to wash other clothing. Potentially biohazardous lab coats must be disinfected (by autoclaving using the 60 minute waste cycle, or soaking in 10% bleach solution for at least 30 minutes) before washing/drying. This includes lab coats of any personnel working with primary human cells. Chemically contaminated lab coats must be spot treated before washing/drying. If a lab coat has had a significant spill or accumulation on it, the coat must be disposed of as hazardous waste. Non-compliance with any of these procedures will result in removal of card access to room 182. High efficiency detergent will be supplied by the building.
- All persons in a laboratory, whether conducting experiments or not and including visitors, are encouraged to wear safety glasses or other appropriate eye protection (goggles or face shield) at all

times. Safety glasses MUST be worn when entering a laboratory containing chemical or biological entities and may be briefly removed for such tasks as looking in a microscope.

- Appropriate gloves for the hazardous material being used must be worn during handling. Consult Appendix D for an overview of commonly used glove types for laboratory use and their general advantages and disadvantages.
- No gloves are to be used on doors that exit laboratories or are common for the building (building doors, classrooms, bathrooms, offices, elevators, etc).

  Gloves are meant to protect the wearer from laboratory hazards; touching surfaces while wearing gloves transfers residue from the glove to the surface, leaving a hazard for the next person who touches the same surface while not wearing gloves. This glove policy is intended to ensure that no hazardous material is transferred to surfaces that are routinely touched without wearing gloves. One might also use gloves to protect a sample from being contaminated by touching it, rather than to protect the user from the chemical. However, there is no provision in this policy for “fresh gloves” or "clean gloves". If you are wearing gloves, they are assumed to have come in contact with hazardous material. If you see someone using gloves inappropriately, please remind them of the policy, and ask them (INSISTANTLY) to remove their gloves before proceeding. When leaving a laboratory, you should always dispose of your gloves and wash your hands. If you are leaving your laboratory to perform work in another laboratory and feel that your safety in carrying something with you depends on wearing gloves, you must carry the item in a safety carrier with one gloved hand and use the ungloved hand for opening doors, turning on lights, etc or ask another laboratory member who is not wearing gloves to accompany you. If you will need gloves for both hands once you arrive at your destination, carry a spare glove with you or ask the other laboratory for gloves to use.
- Personnel are encouraged to label items in labs or within their research space where gloves are not appropriate (e.g. telephones, computer keyboards, etc.). When working in another laboratory, follow their protocols and ask if something is unclear. When traveling to other laboratories or buildings on campus to do work, do not ever use gloves on a door handle there, unless specifically told that it is appropriate. Always assume a door is “no gloves” unless it is labeled otherwise.
- Laboratory coats shall be removed before leaving the laboratory side of the building.

  It is possible that laboratory coats may be contaminated with radioactive material, bio-hazardous agents or chemicals. For this reason lab coats shall not be worn in areas such as coffee areas, cafeterias, snack shops, offices, general use corridors, and meeting rooms. Personal Protective Equipment does not belong in public areas even if presumed uncontaminated and should not be removed from the lab (taken home) unless it is for professional cleaning.
- In laboratories equipped with sinks, hands shall be washed before leaving laboratories.

  Make sure to wash your hands before leaving the laboratory to minimize the risk of carrying radioactive, biological, or other hazards out of your work area into areas that should be clean and uncontaminated. The wearing of gloves is no guarantee that your hands are not contaminated. Make certain that soap and towels are provided in your work area.
- Occupants shall be familiar with the locations and operation of safety and emergency equipment such as fire extinguishers, first aid kits, spill kits, emergency eye wash stations, emergency showers, fire alarm pull stations, emergency telephones, and emergency exits. Emergency contact numbers should be posted close to the telephone and on the outside of the laboratory.

  Learn and know what to do in an emergency and where the necessary items and phone numbers are located. Become familiar with the whole chain of events before it is necessary to respond to an emergency.
- For specialized equipment and hazards, additional PPE may be required. For example, special safety glasses are required for laser and UV light use. Ask your faculty member about any special PPE required for your work.

General Housekeeping

Good housekeeping is a necessary requirement for maintaining a safe work environment. Clean and tidy work sites hold fewer hazards for all employees. Accidents and injuries are avoided and productivity improved where good housekeeping is a daily occurrence. General housekeeping of the area will reduce the likelihood of accidents and reduce the possibility of personnel contamination.

- Provide sufficient safe clearances and access to any and all work stations and work areas, fire aisles, fire extinguishers, fire blankets, electrical disconnects, safety showers, other emergency aids, doors, and access to stairways.
- Keep aisles and walkways free of physical obstructions that would prevent access or emergency egress, including path-blocking objects, liquid or solid spills, and other obstructions.
- Keep aisles at least 3 feet wide where necessary for reasons of access to doors, windows, or standpipe connections.
- Keep floors clean, dry; slip-resistant; and free of waste and any other unnecessary material.
- Provide an adequate number of non-hazardous waste receptacles at accessible locations throughout all work areas.
- Chemical residue on surfaces is not allowed.
- Stock containers should be returned to the storage location after each use and not left on the bench top work area. Storage of items on bench tops may expose substances to ignition sources and are more easily knocked over. Only chemicals in use should be in the work area.
- All work surfaces should be disinfected before and after working with biological agents. Disinfectant (diluted to the correct concentration) should be available at the work area.
- Biohazardous materials and sharps such as needles and scalpel blades must be disposed of in labeled biohazardous waste containers and sharps containers.
- All biohazardous materials should be autoclaved or decontaminated prior to disposal in the red bins on the loading dock. Autoclaves should be tested periodically to ensure that all infectious materials are sterilized prior to disposal. SteriGage strips should be included in all autoclave cycles.
- Correct sharps containers, including broken glass containers, need to be provided and accessible. CSU's sharps procedures can be found at this link: http://www.ehs.colostate.edu/WOHSP/sharps.aspx
- Label all chemical waste as "Hazardous Waste" and with start date, name of generator and contents. See the CSU EHS Hazardous Waste website (http://www.ehs.colostate.edu/WHazWaste/Home.aspx) for additional resources.
- All chemicals must be appropriately labeled. If possible store chemicals in their original containers. If they are transferred to secondary containers, the secondary container must have a label that contains a minimum of full chemical name, concentration of each chemical, hazard (danger, warning, caution, water reactive, flammable, etc), name or initials of user, and date of transfer. Everything must be labeled, even bottles of water and flasks for temporary use.
- Unauthorized experiments are forbidden. Before an experiment is performed in an instructional laboratory, approval must be given by the instructor in charge. Experimental work in research laboratories must be a part of the program approved by the faculty member.
- Experimental work with radioactive materials or equipment generating ionizing radiation is strictly forbidden without official approval from the University Radiation Officer. Approval for such work may be requested by the faculty member who will contact the Supervisor of University Radiation Control Office (ext. 3736).
- Warning signs such as "No Smoking", "Caution--Radiation Area", or other warning signs must be strictly obeyed.
- Horseplay and practical joking of any kind is strictly forbidden.

Biological Safety Cabinets (BSC)

- All persons using a BSC must be trained in the correct procedures for use and maintenance of the cabinet.

- A certified BSC is required when performing manipulations that could potentially result in aerosolization of infectious agents.
- The use of a flame inside a BSC is STRONGLY discouraged as this creates turbulence and inhibits correct function of the cabinet, as well as presenting a fire hazard if ethanol is used for disinfection. If a flame is absolutely required, a pilotless burner may be used at as low of a flame as possible.

Chemical Fume Hoods

Exhausted fume hoods should not be used for dual use (i.e. performing processes and storage). While the fume hood is used for processes, any items such as hazardous waste containers and other nonessential equipment or stock in the hood must be removed to prevent unsafe turbulence or the blocking of airflow in the hood exhaust components. Clutter in the hood disrupts the airflow, reducing its capture efficiency. If the fume hood will be used for storage of chemicals, the fume hood must be marked "CHEMICAL STORAGE ONLY" and no processes are allowed in the fume hood.

- Procedures involving the liberation of volatile or toxic or flammable materials shall be performed in a chemical fume hood. Do not expose yourself or your colleagues to hazardous materials - use the provided fume hoods to eliminate the risk at the source.
- Do not allow paper or other debris to enter the exhaust duct of the hood.
- Keep the sash closed when the exhausted fume hood is not in use. When using the exhausted fume hood, keep the sash as low as possible without interfering with the work process, but never exceed the maximum sash height as indicated by the arrows placed on the sides of sash closure. The only time the sash should be completely open is while setting up equipment.
- Keep your head outside the fume exhausted fume hood, and keep all work at least 10 cm away from the front edge of the hood to allow proper ventilation and reduce the chance of exposure to hazardous vapors.
- Keep objects away from the air baffles.
- Any large object that must be in a hood (e.g. centrifuge, water bath) should be raised a minimum of one inch to allow air flow on all sides.
- Do not rely on the fume hood to protect you from splashes or projectiles – WEAR SAFETY GLASSES, SAFETY GOGGLES, or a FACE SHIELD.
- Wear gloves appropriate for the chemicals being used.
- Electrical equipment is not allowed in the fume hood if the hood is used for chemical storage.
- DO NOT use the fume hood to handle infectious agents.
- DO NOT use porous materials inside the fume hood (wood, notepads, pencils etc.).
- If a fume hood stops working and fumes or vapors are released into the work area, immediately leave the area.
- Respirator protection should not be worn when working with fume hoods unless specifically approved by EHS. Respirator use should only be used when all other controls fail to meet the safety requirements. Every CSU employee or student who wears a respirator MUST participate in the Respiratory Use Surveillance Program. See the CSU Respiratory Protection Program website: http://www.ehs.colostate.edu/wresp/Home.aspx

Laboratory Access

Unauthorized person(s) shall not be allowed in a laboratory.

- Authorized means having business in the laboratory with the permission of a faculty member supervising activities in that laboratory. It also means that such authorized persons must be provided the same kind of protection from hazards as persons working in the laboratory, and made aware of the hazards in the laboratory.
- Card access can be requested using http://www.engr.colostate.edu/access/ Access will only be granted with approval of the appropriate faculty member and appropriate training.
- Do not allow tailgating into the laboratories by holding doors open for others.

Laboratory Security

- Laboratory shall remain locked when unoccupied.
- Laboratory doors and windows shall remain closed during normal operations. This is necessary to preserve proper air flow and air balance in the building.

Chemical Storage

Chemicals must be stored appropriately.

- All containers of chemicals must be clearly labeled showing the name of the chemical, date, owner's name, and hazards and safety precautions if hazardous. Cancer Hazard labels should be used where appropriate.
- Use of narcotic drugs in research work is strictly limited. For up-to-date information on rules and regulations governing narcotic drugs, contact a member of the University drug committee.
- Chemicals that are considered carcinogens should be used with great care to prevent contamination of either personnel or the work place. All chemicals of this type should be appropriately labeled. For the current list of carcinogenic chemicals, contact the Office of Environmental Health Services (ext. 6745).
- Compressed gas cylinders must be secured with a strap, base or chain at all times, even when empty.

Source: CSU EHS General Lab Safety

4. SAFE PRACTICES

4.1 General Work Practices

A. Laboratory Layout and Facilities

It is important that graduate students, postdoctoral fellows, and faculty working in the Scott Bioengineering Building laboratories make a thorough safety assessment of the facility before starting work. The scope of such a safety check of the laboratory layout should include:

1. Locating the exits from the laboratory and from the building. Are the aisles, stairwells, and corridors clear? Do not block exits.
   a. Building exits are: south main entrance, west entrance, east stairwell, auditorium, and loading dock.
2. Locating the fire doors. State codes require that fire doors be kept closed.
   a. All atrium-facing doors are fire doors.
3. Locating the nearest automated external defibrillator (AED).
   a. AEDs are located on each floor across from the west stairwell door.
4. Locating the nearest telephone and fire alarm box for use in case of an emergency.
   a. Emergency telephones are located at the main entrance, west entrance, and in the east and west stairwells at the second and third floor landings.
5. Locating and checking the condition, type, and accessibility of fire extinguishers.
   a. On the first floor, fire extinguishers are located next to the east restrooms, next to the AED, and in the laboratory hallway near the east entrance. On the second floor, fire extinguishers are located next to the AED and in the laboratory hallway near the east entrance. On the third floor, fire extinguishers are located next to the AED, next to the west faculty suite entrance, next to the east faculty suite entrance, in room 303, next to room 328, and in the laboratory hallway near the east entrance. A fire extinguisher is also supplied in each laboratory.
6. Locating and checking the operability of the safety showers /emergency sprays.

a. There are five emergency shower and eyewash stations located in the laboratory hallway of each floor. Additional eyewash/drench hose stations are located at each laboratory sink. A fire and first aid blanket is located in the laboratory hallway of each floor, next to the freight elevator.

7. Checking to make sure the exhaust hood system is operating properly and is appropriate for the work that is planned.
8. Locating and checking the operating condition of utility lines, such as hot and cold water, distilled water, steam, gas, nitrogen, oxygen, electrical power (red electrical outlets are powered by a generator in the event of a power outage), and sewer drains. Location of the main cut-off switches to the laboratory should be known. All drains, valves, and fittings should be checked and requests submitted for repairs when necessary. University and State codes require that only authorized mechanics are to repair or modify power and utility lines.
9. Make an inventory of chemicals and apparatus. Arrange for discarding waste chemicals and obsolete apparatus.
10. Inspect and clean all cabinets and benches.
11. Check to see that the proper trash, chemical, and solvent waste disposal containers are available and properly labeled.
12. Make sure gas cylinder supports (bases, chains or straps) are available and used. If needed, make a request to the building proctor.
13. Special chemicals or spill kits needed to deal with particular types of hazardous materials must be available in the labs in which the hazardous materials are being used.
14. Consider and mitigate ergonomic risks in the laboratory and office. CSU's Ergonomics program has more information at the following link: https://rmi.colostate.edu/ergonomics/

B. Working Alone

Working alone should be avoided whenever possible. A worker is considered as "working alone" if the individual is working by his/herself such that assistance is not readily available should injury, illness, or emergency arise. Alone is interpreted as being out of visual contact or earshot from another person for more than a few minutes. It is possible for a worker to be on the same floor of a building or even in the same general area as others, yet be working alone. It can occur during normal working hours as well as in the evening, at night, or during weekends. Requirements for personnel working alone are based on experience:

1. High School Students: Never permitted to work alone in a research lab, even with non-hazardous materials. They must always have a supervisor present.

2. Undergraduate Students: Permitted to work alone in a research laboratory if they are highly trained to perform the planned work safely, and only at the PI's discretion. They must follow the PI's safety protocol for working alone and let someone know when they are working alone in the laboratory.

3. Graduate Students, Postdoctoral Fellows, Research Scientists, Technicians, and PIs: Permitted to work alone in a research laboratory after approval by the PI and following the PI's safety protocol for working alone. It is recommended that these personnel let someone know that they are working alone in the laboratory.

C. Utility or Power Failures

To perform laboratory work safely, it is essential that the worker include in his or her experimental design provision for a possible utility failure which could cause an accident situation or an unsafe condition to develop. For example, in distillation operations loss of cooling water flowing through the condenser would develop an unsafe condition and result in a possible fire unless provision is made to cut off the source of heat to the still pot. Loss of power to vacuum pumps can cause serious damage to vacuum systems and expensive instruments unless the equipment design and operating procedures are carefully planned to meet such an eventuality. A broken fan belt could shut down a hood.

Scott Bioengineering's generator will provide backup power to all card readers, network closets, air handlers, emergency lights, data center, and equipment plugged into red electrical outlets. If power fails while you are actively using a fume hood or biosafety cabinet, immediately close the sash and vacate the lab. Scott Bioengineering's generator will provide air flow to fume hoods and biosafety cabinets during a power outage, but there could be two to five minutes of down time before proper air flow is re-established. To be safe, wait at least five minutes after power failure before resuming work in a fume hood or biosafety cabinet.

In the event of loss of power or a critical utility, the worker should quickly terminate his or her experiment, close down the laboratory, and evacuate. He or she should then inform his or her supervisor and report the situation to the Building Proctor. At night or on weekends the CSU police department should be called at 1-6425 or 911.

D. Unattended Operations

Operations or experiments are not to be left unattended except for certain routine operations where automatic safeties have been installed to effect shutdown in the event of loss in power and other utilities. Such unattended operations must be approved by the research supervisor. Inspect such operations frequently and leave your telephone number where you may be reached in case of an emergency.

E. Reporting Unsafe Practices and Conditions

Unsafe practices and conditions cause virtually all accidents. Immediate correction of a potential accident cause is a basic accident-prevention technique. A person observing an unsafe act, practice, or situation should call it to the attention of the researcher involved or his or her supervisor. Safety concerns, near misses, or learning opportunities should be reported using the following link: http://rmi.prep.colostate.edu/insurance/incident-reporting/

F. Reporting Accidents

All accidents resulting in an injury, in property damage, in a fire or release of toxic chemicals into the environment must be reported promptly to the instructor in charge or to the building proctor. In the event of an accident, the following steps should be taken:

1. In case of injury, render prompt first aid doing only the minimum necessary to prevent more serious injury to the victim. Wash off chemicals with water (shower/spray). Cool burns with water. Control bleeding. Administer CPR if necessary.
2.. If injury appears serious, have someone call an ambulance, giving room number and name of building. CSU Police Department-dial 911.
3. For minor injuries involving **students**, send or take the injured student to the CSU Health and Medical Center for treatment. The injured person should be accompanied to the Health Center. Accidents involving **staff** are treated at the Emergency Department, south side of Poudre Valley Hospital, 1024 South Lemay Avenue, 495-8000. For accidents involving staff, please see the cover of this book for the latest approved locations for treatment of workplace injuries.
4. Report the accident promptly to your supervisor and to the Safety Committee. Also use the following link to report the incident: http://rmi.prep.colostate.edu/insurance/incident-reporting/ Worker's Compensation rules require that notification be made within 48 hours.
5. Finally, prepare a written report for the Department for an accident resulting in injury, property, damage, or fire. See Appendix E.
6. Smells (and any other situation that may annoy those in other locations) must be reported even if they are not hazardous. If you create or detect such a smell, call the non-emergency police number: 491-6425.

G. Visitors

Visitors shall comply with all safety regulations in force in the place visited. Appropriate eye protection shall be worn by visitors to any laboratory. In each laboratory it is the responsibility of the occupant assigned to work there to remind visitors of this regulation. Lab coats, safety glasses, and booties are available for visitors to the lab side of the building.

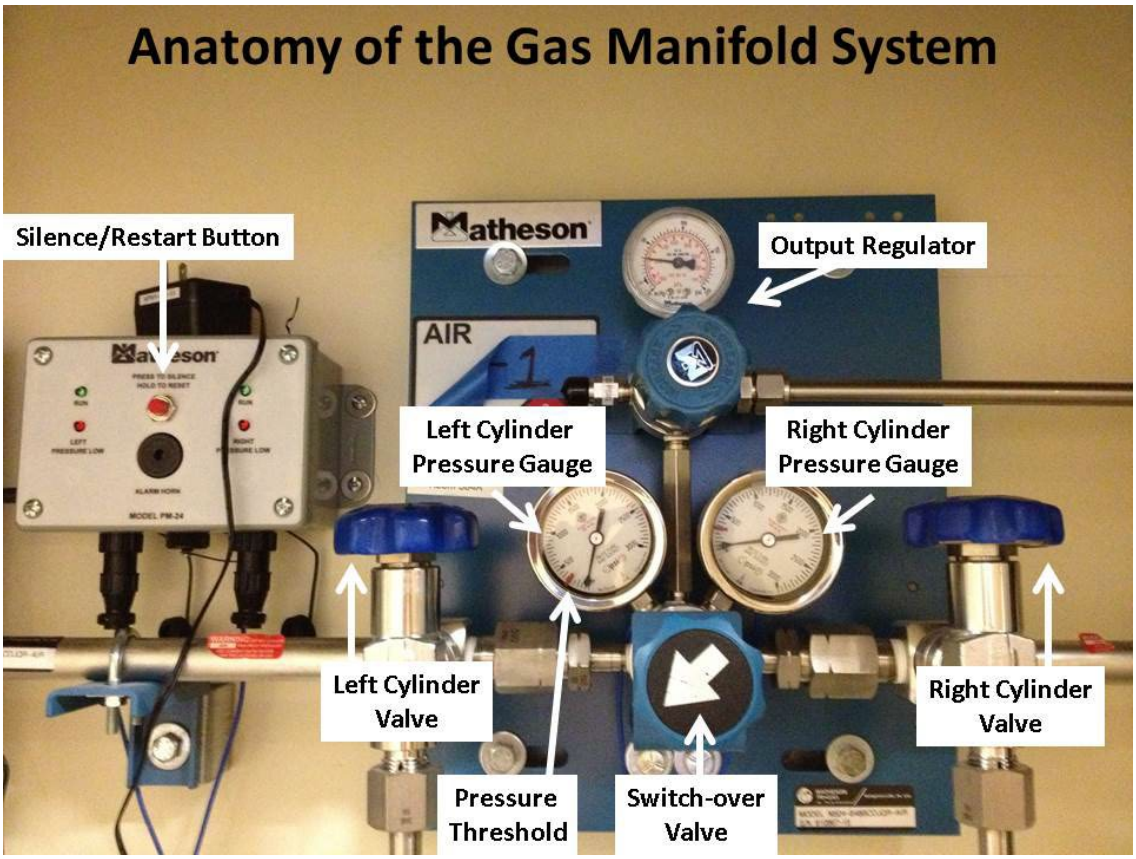
H. Gas Alarms

There are several oxygen depletion alarms (shown below) in the lab hallways. These alarms will go off if the oxygen concentration in the gas closet is less than 18.5% or greater than 23%. See Appendix F for a description of the effects of different oxygen levels on humans. If you see/hear this alarm, do not open the gas closet door! Immediately warn anyone nearby, get out of the hallway, call 911, and notify the Building Proctor and Lab Manager. An additional oxygen depletion alarm is located in the liquid nitrogen cage on the loading dock. If you see/hear this alarm, immediately leave the loading dock, call 911, and notify the Building Proctor and Lab Manager.

The other, more common, alarm that you may hear in the lab hallway is the low pressure alarm for gas cylinders stored in the hallway closets. If your group has gas cylinders, please remember to check on the gas cylinders weekly so you are not surprised by a low pressure alarm and need to urgently purchase a new cylinder. To check for leaks, use soapy water to bubble test each connection. Please post contact information for your group on the inside of the closet door where your cylinders are in use.

If you hear a low pressure alarm, enter the gas closet and press the silence/restart button to silence the alarm. If the closet is locked, gas closet master keys are located in room 166 (in the glass-doored cabinet), room 280 (in the wall-mounted cabinet near the door), and room 382 (in the wall-mounted cabinet to the right of the sink). Notify the group responsible for the gas cylinder. If members of the group responsible for the cylinder are not present, especially during off hours, they may authorize you to switch to a new cylinder for them so their research operations are not compromised. To switch to a new gas cylinder, follow the instructions below:

The active cylinder is denoted in the alarm system by the small green "Run" light. If alarming, the small red low pressure light for that side of the gas manifold system will be lit up as well. Confirm that the active cylinder's pressure is below the pressure threshold, marked by a red line on the cylinder's pressure gauge. If a full cylinder is attached to the other side of the gas manifold system, turn the switch-over valve to the new cylinder. Close the cylinder valve controlling the old cylinder and open the cylinder valve controlling the new cylinder. You should not need to adjust the output regulator. Press and hold the silence/restart button to restart the alarm system. Confirm that the alarm system now shows the green "Run" button lit up for the new cylinder side, and pressure for the new cylinder is above the low pressure threshold.



4.2 Handling Chemicals

A. General

Chemicals can be hazardous unless properly handled. Serious skin and eye irritations and damage to clothing can result from needless spills and sprays. Toxic materials can cause severe illness, even death. All chemicals, especially new compounds for which the toxicity has not yet been determined, should be assumed to be highly toxic. Flammable gases, liquid, and solids can cause fires or develop into explosive mixtures.

Before working with any chemical, it is essential to **know** its properties. The properties of known reaction products, intermediates, or even possible reaction products should be ascertained **before** work begins. In exploratory research work, only very small quantities of chemicals should be employed. Larger amounts may be used only after the initial work has been successfully completed and the reaction rates and the properties of the reaction products have been established. It is worthwhile in making predictions about reactions to calculate the free energy of reaction for the planned experiment.

Hazardous chemicals include, in addition to flammable materials, those substances which are pressurized, cryogenic, temperature sensitive, toxic, corrosive, and/or reactive. It must be recognized that a material, which by itself is comparatively harmless, can become very hazardous under conditions of use and under conditions to which it may be subjected accidentally--as in the event of fire. Good references for additional information on chemicals and their hazardous properties are listed in Appendix G; see also the EHS website Hazardous Laboratory Chemicals Disposal. Material Safety Data Sheets (MSDS) for all chemicals used in each laboratory are stored in each laboratory's safety binder. A copy

of the MSDS for any recently purchased chemicals should be emailed to the Building Lab Manager for the file.

B. Labeling

A most important safety practice in the handling of chemicals is to keep reagent containers and solutions of chemicals properly LABELED. Everything must be labeled, even bottles of water and flasks for temporary use. Containers of all substances in your laboratory shall be labeled showing:

1. The chemical name(s) and structure(s).
2. The date of purchase, preparation, or transfer to its present container.
3. The owner's name.
4. A brief notation of hazard if any, as for example a word like one of the following: toxic, corrosive, flammable, explosive, poison.

Containers used to collect and temporarily store chemical waste should be clearly labeled **'HAZARDOUS WASTE'** and in addition information as to:

1. Type of waste, i.e., halogenated solvents, acid waste, etc.
2. Date when waste collection in the container was initiated.
3. Owner's name and room.
4. A running record should be kept of the types of waste and quantities so as to be able to give percent composition (1%) of the contents of the filled container.

For additional resources and to print labels, see the CSU EHS Hazardous Waste website:
http://www.ehs.colostate.edu/WHazWaste/Home.aspx

C. Hazardous Vapors

Experiments involving toxic, flammable and/or corrosive vapors should be carried out in fume hoods. In general, when working with small quantities of such materials the hood exhaust volume is sufficient to prevent an atmospheric pollution problem above and outside the building. When large-scale operations are carried out in fume hoods which evolve large amounts of either flammable, corrosive, or toxic vapors, these vapors should be treated to destroy the harmful effects and thereby prevent atmospheric pollution outside the building. For example:

1. Condense flammable vapors and then dispose of the condensate.
2. Absorb halogens and like materials in an appropriate reducing agent and flush the resulting solution to the sewer (check pH). See Appendix H for a list of chemicals that may not be flushed to the sewer.
3. Absorb HCN in an alkaline oxidizing agent such as Clorox and flush the solution to the sewer.

D. Explosive Reactants

Perchloric acid is especially dangerous because explosions occur when in contact with organic materials. Do not use perchloric acid on wooden benches or tables. Keep perchloric acid bottles on glass or ceramic trays having enough volume to hold all the acid in case the bottle breaks. Discolored acid (contaminated) should be disposed of immediately. Gently pour the discolored acid into a beaker or porcelain jar which contains at least twenty volumes of cold water for each volume of acid. Mix gently, neutralize to a pH range of 6-9 and pour the diluted and neutralized material down a drain with large amounts of cold water. A special hood is required if an operation is carried out in which the acid is heated to fuming. Such fuming operations are forbidden in ordinary hoods.

E. Unused Chemicals

Unused chemicals should not be allowed to accumulate in a laboratory. All reagents should be inspected periodically and those not needed removed. Dates on labels of materials that may form hazardous substances on prolonged storage should be checked periodically and those that are excessively old should be disposed of in a prudent manner. See Appendix I for lists of chemicals that should not be stored beyond three or six months after opening, and peroxide detection procedures.

F. Flammable Reagents

The total amount of volatile, flammable solvents stored in a laboratory should not exceed 10 gallons (five gallons in teaching laboratories). Whenever corrosion or contamination is not a factor, store solvents in excess of one gallon quantities in metal containers and store low flash point liquid in standard safety cans. Two gallon or larger containers require grounding wires/bonding. Limit quantities of solvents in glass bottles to the smallest practical size but not over one gallon; store glass bottles of solvents in closed metal cabinets. Because of the danger of fire, low flash point liquids and gases under pressure should not be stored close to sources of heat such as radiators, hot plates, ovens, etc. Use an explosion-proof hot plate for heating of flammable materials. Also, keep cloth and paper towels away from heat sources. (Safety may be increased by storing glass bottles in topless metal cans.)

G. Spills

Non-hazardous materials may be cleaned up using normal procedures. The appropriate response for a hazardous spill depends on the location (lab, hallway, outside the building) and the chemical (solid, liquid, flammable, toxic). Absorbent pillows are available in every lab and should be in a location known to all lab personnel. The spill should be contained as quickly as possible using appropriate means to do so. Corrosive material should be neutralized with sodium carbonate or sodium bisulfate. Avoid breathing vapors and use a respirator if necessary. Material that is especially hazardous may necessitate evacuation of the area/building and require special cleanup apparel (bromine, hydrofluoric acid, etc.) DO NOT ENDANGER HEALTH OR LIVES by failing to evacuate promptly if such a hazard exits. After containing the spill consult a manual, MSDS or Environment Health Services for proper cleanup procedure. Consult Appendix J for additional instructions for cleanup of a hazardous chemical spill.

H. Routine Precautions

Listed below are a few simple but important reminders of precautions that should be considered in the routine handling of reagents. It should be remembered that under the right set of conditions any chemical can be hazardous. You are in charge of your own safety; it is your responsibility to use good safety practices at all times.

1. Keep reagent containers clean on the outside to protect your hands; use rubber or plastic gloves when appropriate.
2. Be sure reusable laboratory gloves are clean on the inside before using; cleanse or decontaminate gloves regularly.
3. Avoid prolonged contact of chemicals with skin; wash hands and face frequently; be sure laboratory clothing is cleaned regularly.
4. If water is not the appropriate washing agent or antidote, procure proper emergency supplies before starting work.
5. Avoid inadvertent contamination by not returning unused portion of reagents to stock bottles. Stoppers should be held while pouring.
6. Never taste a chemical.
7. Use a safety pipette filler (pipetting by mouth is prohibited).

8. Cool sealed vials of chemicals below the boiling point of the substance contained therein before breaking seal. Cool gradually, first in ice water, then CO_2, etc. to avoid temperature shock to the glass vial and a possible explosion.
9. Add concentrated chemicals to water (never vice versa).
10. Keep flammable solvents such as benzene, ether, etc. away from hot plates and flames. Use an explosion-proof hot plate for heating of flammable materials.
11. Use bonding and grounding wires when transferring flammable solvents.
12. Use adequate eye protection for the job you are doing. If you are working with liquids, use goggles that fit tight against the forehead and sides of the face, if you are working with solids where the danger is from propelled particles then regular safety glasses are probably sufficient. You must be the judge of the danger in what you are doing. If chemicals do get into the eyes they should be washed for at least 15 minutes with the spray and help should be summoned. In all cases involving the eyes a physician should be seen.
13. Use caution in working with mercury to avoid vapor contamination of the laboratory air. The equilibrium concentration of Hg vapor over liquid mercury at room temperature is approximately 20 times the threshold toxic limit (TLV).
14. Clean up spills of mercury and other chemicals promptly. Mercury spill kits (Cinnasorb Activator and Base) are available from Tim Gonzales (Glover//146). After the cleanup is complete have EHS check the area.
15. Be sure that incompatible chemicals are stored in separate locations. See Appendix K for a typical list of incompatible materials.
16. Use appropriate protective equipment as the situation may warrant, i.e., lab coats, gloves, respiratory equipment (every CSU employee or student who wears a respirator MUST participate in the Respiratory Use Surveillance Program: http://www.ehs.colostate.edu/wresp/Home.aspx), face shields, chemically resistant aprons. Bear in mind that plastic aprons can accumulate static electricity and should not be worn around flammable solvents. Lab coats should be removed immediately upon significant contamination.
17. Do not use chemicals with which you have not had previous experience prior to receiving clearance from the faculty member. Discuss each experimental procedure with your laboratory faculty member from a safety standpoint prior to carrying it out for the first time. Where possible calculate a free energy for the reaction prior to actually trying the reaction.
18. Read the MSDS for each new chemical prior to using it for the first time and follow the recommended safety procedures. Have available the spill response equipment needed to clean up in case of a spill.
19. Be aware of the types of compounds that are susceptible to peroxide formation. Discard any that are suspicious. Active peroxide formers should be dated when first opened and then not kept for more than three months.

I. Secondary Containment of Caustic/Flammable Chemicals

When transporting caustic or flammable chemicals from laboratory to laboratory or from the stockroom to the laboratory these chemicals should have secondary containment sufficiently large to hold the contents of the chemical container if it were to break. See Appendix A, Paragraph D. of CFR (Code of Federal Regulations) Part 1910.1450. A copy of this document is kept at Environmental Health Services.

4.3 Chemical Waste Disposal

Refer to the CSU Hazardous Waste Manual (http://www.ehs.colostate.edu/WHazWaste/PDF/HazWasteManual.pdf) for a detailed resource on chemical waste disposal. The information below is a summary of the main points regarding chemical waste disposal.

A. Responsibility

In the instructional laboratories, the disposal of unused chemicals is incorporated as an integral part of the course and specific instructions are given on methods of handling and disposing of waste products. In the research laboratory, where many unusual and specific chemicals are used, the responsibility for disposal of unused reagents and waste reaction products is vested directly with the researcher and his or her project supervisor because, in most cases, it is only the researcher who knows how to handle the materials safely. In either case, waste chemicals should never be deposited in wastebaskets or other trash containers, but rather should be disposed of by one of the following general procedures. See Appendix H for further details.

B. Water Soluble Wastes

In general, small quantities (100 ml or less) of water-soluble chemicals which do not hydrolyze to form volatile, toxic, or odoriferous materials may be flushed down the drain. Larger quantities of waste acids, bases, and chemicals which hydrolyze to form corrosive and hazardous products should be treated to render them harmless before flushing to the sewer. In general, hazardous chemical wastes should be subjected to a process in the laboratory which converts them into harmless products not requiring special handling. See Appendix H for the list of chemicals which may not be disposed of through the drain system.

C. Flammable Liquid Waste

Flammable liquids not miscible with water must not be poured into the sink or other sewer drains. Low flash point, flammable wastes and solvents should be placed in safety cans and turned over to Environmental Health Services for disposal. Waste solvents containing materials in solution apt to form toxic or corrosive substances of hydrolysis, oxidation, etc. should first be treated to render them harmless prior to disposal. When in doubt, contact Office of Environmental Health Services (ext. 6745).

D. Water Insoluble Solids and Nonflammable Liquids

Those hazardous materials which can be stored safely over a period of time without deterioration should be kept in their original containers and turned over to Environmental Health Services for disposal. Forms are available in the Main Office to initiate this procedure. Used column packing (Al_2O_3, SiO_2) should not be dumped loose into waste paper baskets. It should be packaged and then disposed of by placing it in the dumpster or if contaminated by highly toxic compounds, disposed of by normal hazardous waste procedures.

E. Emptied Chemical Containers

Before discarding, all empty chemical containers must be triple rinsed and dried. Rinse containers for organic reagents first with acetone and then with water. This practice prevents subsequent injury to those handling the discarded containers. Black out labels and puncture containers before disposal.

F. Special Attention

Mercaptans and organic sulfides have posed a number of problems when improperly disposed. The proper disposal of these chemicals includes a pre-treatment, in the hood, with hypochlorite to oxidize the sulfur followed by acid/base neutralization (neutral to litmus), if necessary. This solution may then be washed to sewer with excess water.

4.4 Handling Compressed Gas Cylinders

Compressed gases impose potential hazards on the laboratory worker if not properly handled. Such gases can be used in the laboratory with safety if the following precautions are complied with completely during cylinder receiving operations, storage, transportation, usage, and empty cylinder disposal.

A. Know Cylinder Contents and Its Properties

The physical properties, flammability, corrosiveness, and physiological (e.g., toxicity, anesthetic, and irritating) properties of a cylinder gas should be known before it is used. If the contents of a cylinder cannot be determined completely from looking on the cylinder or an accompanying tag attached to the cylinder (not its cap), mark the cylinder "Unidentified" and return to the supplier. Do not rely on cylinder colors, which vary from company to company; some people are color blind. Never remove or deface a label.

B. Handling of Cylinders

Cylinders are built as lightweight as possible consistent with safety and durability for use as shipping containers. They therefore should be transported carefully--large cylinders (over 24 inches high) should be transported only with a wheeled cart. Large cylinders should be fastened securely with a strap or chain before removing the cap. Abuse and hard knocks can seriously weaken a container, and a falling cylinder can break legs and crush feet. Do not transport cylinders in a car. Never be in a confined space (such as an elevator) with a cylinder. Finally, should the valve be broken, the cylinder becomes a powerful rocket. Keep these hazards in mind when working with gas cylinders.

C. Heating of Cylinders

Most cylinders are equipped with fusible metal safety plugs which release if it is heated above 70°C. Therefore, if it is necessary to warm a cylinder to facilitate discharge of the contents, immerse no more than the lower 20% in warm water; steam should never be used directly on a cylinder. The valve must be partly open whenever a cylinder is warmed.

D. Use of Valves and Regulators

A cylinder is always used with a regulator selected specifically for the given gas. The threads of the regulator will match the threads of the cylinder outlets. If the connection must be forced, you have either the wrong regulator or the wrong gas. To remove gas through a regulator, first ensure that all valves are closed, then, in succession, and slowly open all valves (starting with the cylinder valve). Be sure that the final valve opening directs the flow of gas away from you, others and any ignition source if applicable. Always wear safety glasses or goggles. Close all valves in the same order as used in opening them. Since cylinder valves, particularly those used with corrosive gases, are designed so that the valve stem and packing are protected from contact with the gas when the valve is either completely

open or closed, it should always be in either of these two positions. The cylinder valve should be closed when gas is not in use.

E. Control of Gas and Reaction System

To prevent contaminants from entering the system, always place a trap between the cylinder and the system. To prevent an explosion resulting from suck-back of contamination into the cylinder, never completely empty the cylinder. If pressure may build up in the system, equip the line with a pressure indicator and a safety vent.

F. Handling of Empty Cylinders

The valve should be closed and the cap replaced on empty cylinders. They should be marked with "MT" and dated. Do not attempt to refill a cylinder.

G. Repair and Adjustment of Equipment

Do not attempt to repair a regulator yourself. Also, never attempt to tighten nuts or bolts on fittings of high-pressure equipment while it is in use. Release the pressure first, then make adjustments.

4.5 Handling Equipment and Apparatus

Any material (be it a chemical, an apparatus, an item of furniture, a fixture...) can present a hazard, start a fire, or cause injury if not properly handled. You can remove or minimize the hazard with proper handling. Some of the precautions in handling common laboratory equipment are listed below.

A. Equipment Location

Locate equipment set-ups as far back from the bench edge as possible, and be sure that the center of gravity of the apparatus is within the base area. Use ring stands properly.

B. High-Pressure Apparatus

Inspect all pressure equipment carefully before using and establish the limitations of the equipment with respect to temperature, pressure, and capacity. Be certain that the system is equipped with a safety relief valve and that it is operative. Introduce compressed gas from cylinders slowly and cautiously into the system, making certain that there is adequate shielding between you and the system including the pressure gauge. Remember to reduce the internal pressure to atmospheric pressure via the relief valve before you open the pressure vessel. High-pressure apparatus should be used in the bomb room on the roof.

C. Reduced-Pressure Systems

Many of the precautions for use of high-pressure equipment apply equally here (e.g., limitations and inspection of equipment, provision for capillary relief valve, turning vacuum lines on (or off) slowly, examination of pressure gauges). In addition, round-bottom flasks should be used for low-pressure reactions, and vacuum pumps should be protected from corrosive gases (such as halogens, SO_2, HCl, etc.) by placing appropriate traps in the system. All glass vessels used in vacuum or pressure systems should be wrapped in tape to reduce the danger of flying glass in case of an implosion/explosion.

D. Mechanical Systems

Avoid personal injury by protecting or covering pump shafts, moving belts, etc. from towels or clothing, using explosion-proof motors on which liquid has been spilled, and use again only after they have thoroughly dried inside and out.

E. Electrical Assemblies

Avoid dangerous makeshift wiring assemblies by having permanent wiring (either conduit or BX cable) installed by an electrician. Replace immediately worn extension cords. Never handle any electrical connections with damp hands or when standing in or near water, and be wary of static accumulations, especially in high voltage situations. Never leave any conductor exposed if the electrical potential from it to ground exceeds 50 volts.

4.6 Handling Laboratory Glassware

If not properly handled, glass apparatus can be a serious hazard to the researcher. These hazards can be minimized by exercising certain precautions.

A. Handling Glassware and Tubing

Always carry glass tubing or rod in a vertical position. Protect your hands with a cloth towel or with gloves when cutting or breaking tubing, and fire polish immediately sharp edges of all glassware. Test glassware for strains, and when necessary remove strains by annealing.

B. Inserting and Removing Tubing and Stop-cocks

Lubricate, using water or glycerol, the surface of glass tubing before inserting into rubber tubing or stoppers. When working such connections, protect your hands with gloves or a towel, and keep your hands close together. Use the same technique to remove glass tubing from rubber tubing or stoppers, and never use great force. If necessary, a lubricant can be worked between the rubber and the glass with the neck of a file. Frozen stoppers or stop-cocks should be removed with a stop-cock lifter.

C. Using Vacuum Glassware

Protect yourself from flying glassware in the event of an explosion or implosion whenever glass apparatus under pressure or vacuum is used by employing a safety shield. *Face shields should be required when using glass vacuum lines containing corrosive or toxic materials.*

Additional protection can be gained by wrapping vacuum desiccators and Dewar flasks with electrical tape. Remove the cover of a desiccator with caution, after the pressure has been equalized, by sliding the cover to one side; do not lift. If the lubricant on the ground-glass surface has hardened, soften it by gentle warming with hot water. *Vacuum lines containing hazardous materials must be located in fume hoods.*

D. Disposing of Broken Glassware

Glassware should always be washed before it is stored or discarded. Remove broken glass fragments from desktops and floors with a brush (never a towel), placing it in the proper disposal can. Glass and other sharps (needles) should never be disposed of in the garbage. Always pack glass and sharps waste

in a cardboard box and tape the box closed for disposal. Label as “Sharps” or “Broken Glass”. For disposal, place box in the red bin on the loading dock.

4.7 Fire Prevention

A. Fire Requirements

To start a fire three components must be present: a fuel, an oxidizing agent, and a source of heat for ignition. Many fires can be avoided if the worker simply keeps the fuel and oxidant away from the hot ignition source. The major sources of heat in the laboratory are matches, Bunsen burner, electric hot plates, electric sparks, and steam baths. The major source of oxidant is, of course, air (oxygen); however, other oxidizing agents can supply the oxidant. Sources of fuel include wood, painted surfaces, towels, oily rags, paper, hair, clothing, gases (methane, hydrogen), flammable solvents, and many other chemicals or dusts thereof.

B. Precautions

The storage and handling of volatile flammable liquids requires that certain precautions be taken to minimize the fire hazard. The inherent fire and explosion hazard depends not only on the flash point of the fuel but also on its ignition temperature, explosive range, and vapor density.

- The flash point of a fuel is the lowest temperature at which it volatilizes fast enough to form an ignitable mixture with the air surrounding the flash apparatus.
- The ignition temperature of a material (whether solid, liquid, or gaseous) is the temperature required to cause sufficiently rapid oxidation to be self-sustained when the hot ignition source is removed.

  The explosive range of a fuel refers to the definite limitations of combustibility and rate of burning of the flammable vapor or dust mixture in air. The mixture is "too lean to burn" when the particles are so widely separated that those set afire by the hot ignition source will not set fire to others that are nearest. The mixture is "too rich to burn" when the particles are so close together that they exclude the oxygen necessary for combustion. The concentration between the "leanest" and the "richest" mixtures that will burn is called the "explosive range".
- A flash fire results from very rapid oxidation and occurs only when:
  - The fuel is mixed with sufficient oxygen for complete combustion. The particles of fuel vapor or dust are suspended in a diffused state in air, close enough to each other to propagate the flame through the vapor or dust and still sufficiently separated to make room for the required amount of oxygen for combustion.
  - A source of heat equal to the ignition temperature is present. Any electronic equipment, even equipment not used for heating, can generate heat. Furthermore, electronics and electrical equipment not rated as explosion proof (e. g. a stir plate) may produce a spark that could serve as an ignition source. Such equipment should not be used with volatile organics in confined spaces where explosive vapors may accumulate. For example, flammable liquids and gasses should never be stored in a non-explosion proof refrigerator or freezer.
- To avoid a flash fire, keep the fuel at a temperature below its flash point and keep it away from hot surfaces that are above the ignition temperature. Remember the vapors having a density greater than air will flow downward to the hot plate whereas those less dense than air will flow upward. Use an explosion-proof hot plate for heating of flammable materials.

C. Fire Extinguishing

A fire is extinguished by applying the same principles followed in trying to avoid it.

1. Reduce the air supply by smothering--cover the vessel or apply CO_2.
2. Shut off or reduce the fuel supply.
3. Cool the fuel below its ignition temperature.
4. Lower the concentration of the fuel by dilution with an inert material.

Types of fires:

1. Class A: burning wood, paper, cloth, etc.; extinguished with water, foam, soda-acid, or CO_2.
2. Class B: burning oils, greases, paints, etc.; extinguished with foam, CO_2, or dry chemical.
3. Class C: live electrical equipment; extinguished with CO_2 or dry chemical.
4. Class D: active metals such as sodium, potassium, aluminum, magnesium, lithium, also diborane, etc.; extinguished by smothering with dry soda ash, dry sodium chloride, sand (never use water, foam, CO_2, or CCl_4)..

D. Safe Practices

The following safe practices must be known and observed to prevent or handle a fire:

1. See that corridors and stairwells are kept clear; avoid placing chemicals, equipment or furniture therein.
2. See that fire doors are kept closed at all times.
3. Know the location of fire blankets, safety showers, buckets, and fire extinguishers.
4. Know how to operate fire extinguishers and the type of fires for which they are to be used. Keep in mind that fire extinguishers typically contain only about 30 seconds worth of extinguishing chemical.
5. If a fire occurs, first get a fire extinguisher, and after assessing the situation and your personal safety, extinguish the fire, render assistance, or get additional help.
6. Never return an empty or partially used extinguisher to its rack. Tag it empty and call the facilities dispatcher (1-0077) to have it replaced.
7. All fires for which an extinguisher is used or which causes damage or injury must be reported.
8. If your clothing should catch fire, try to stay calm, don't run, but quickly get under a shower and keep the water running. Or, wrap yourself in a fire blanket. Yell for help.
9. If a fire cannot be snuffed out immediately, have someone sound the building fire alarm and call **911**. Give name and room number. Go to the front door of the building to direct firemen.
10. After hours call the emergency number (911). Give name, building, and room number.

4.8 Guidelines for a Biosafety Level 1 Laboratory

Contact the CSU Biosafety Office if you will be working with a new Biosafety Level 1 organism. Refer to Appendix L for additional information regarding Biosafety Level 2 laboratories (rooms 280, 290, 367, 376, and 380A).

A. Biosafety Level 1 (BL1)

A BL1 lab is suitable for work involving agents of minimal potential hazard to laboratory personnel and the environment. It is appropriate for undergraduate and secondary education training and teaching laboratories as well as facilities in which work is done with defined and characterized strains of viable microorganisms not known to cause disease in health adult humans. Biosafety Level 1 represents a basic

level of containment which relies on standard microbiological practices. Laboratory personnel have specific training in the procedures conducted in the laboratory and are supervised by a scientist with general training in microbiology or a related science.

B. BL1 Standard Microbiological Practices

1. Access to the laboratory is limited or restricted at the discretion of the laboratory director when experiments or work with cultures and specimens are in progress.
2. Persons wash their hands after they handle viable materials and animals, after removing gloves, and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, and applying cosmetics are not permitted in the work areas where there is reasonable likelihood of exposure to potentially infectious materials. Persons who wear contact lenses in laboratories should also wear goggles or a face shield. Food is stored outside the work area in cabinets or refrigerators designated and used for this purpose only.
4. Mouth pipetting prohibited; mechanical pipetting devices are used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries.
   a. Precautions, including those listed below, must always be taken with sharp items.
      i Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
      ii. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
      iii. Non-disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
      iv Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
6. All procedures are performed carefully to minimize the creation of splashes or aerosols.
7. Work surfaces are decontaminated at least once a day and after any spill of viable material.
8. All cultures, stocks and other regulated wastes are decontaminated before disposal by an approved decontamination method, such as autoclaving. Materials to be decontaminated outside of the immediate laboratory are to be placed in a durable, leakproof container and closed for transport from the laboratory. Materials to be decontaminated at off-site from the laboratory are packaged in accordance with applicable local, state and federal regulations, before removal from the facility.
9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. The sign will include the name and phone number of the laboratory supervisor or other responsible personnel. Agent information should be posted in accordance with the institutional policy.
10. An insect and rodent control program is in effect.
11. The faculty member/ laboratory supervisor must ensure and document that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals with these conditions are encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

C. BL1 Special Practices

1. None required.

D. BL1 Safety Equipment (Primary Barriers)

1. Special containment devices or equipment such as a biological safety cabinet are generally not required for manipulations of agents assigned to Biosafety Level 1.
2. It is recommended that laboratory coats, gowns, or uniforms be worn to prevent contamination or soiling of street clothes.
3. Gloves should be worn if the skin on the hands is broken or if a rash exists.
4. Protective eyewear should be worn for anticipated splashes of microorganisms or other hazardous materials to the face.

E. Laboratory Facilities (Secondary Barriers)

1. Each laboratory contains a sink for hand washing.
2. The laboratory is designed so that it can be easily cleaned. Rugs in laboratories are not appropriate, and should not be used because proper decontamination following a spill is extremely difficult to achieve.
3. Bench tops are impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
4. Laboratory furniture is sturdy. Spaces between benches, cabinets, and equipment are accessible for cleaning.
5. If the laboratory has windows that open, they are fitted with fly screens.

F. Disposal of Metal and Biohazard Sharps and Glassware

Any sharps made of metal (including, but not limited to: scalpel blades, razor blades and needles), and/or biohazard-contaminated glassware will be placed in a puncture-resistant container. When said container is full, it will be autoclaved (if necessary), sealed and placed in a cardboard box, which will in turn be sealed. The container and box will both be labeled with the laboratory faculty member's name, a contact phone number, the date, and the words, "Decontaminated Laboratory Sharps" written conspicuously on the top of the box.

To avoid needle stick injuries and possible exposure to hazardous agents, needles should not be recapped, bent, sheared or broken. Retractable or self re-sheathing needles should be used when appropriate. In rare instances a one-handed technique (eg., use a one-handed scoop technique, or hold the cap with a hemostat or forceps) may be used to recap needles, but this is discouraged. Used needles, as is the case with other sharps, must be appropriately disposed of in a sharps container.
Glassware:

Any non-biohazard-contaminated glassware will be placed in a cardboard box. When full, the box will be sealed and placed in a second box, which will be sealed. The outer box will be labeled with the laboratory PI's name, a contact phone number, the date, and the words, "Sharps" (and/or) "Broken Glass" written conspicuously on the top of the box.

EHS does not pick up sharps or glassware. To dispose of the sharps or glassware, place the labeled, sealed cardboard box in the red bin on the loading dock outside of the northeast corner of Scott Bioengineering.

G. Disposal of Biohazardous Material

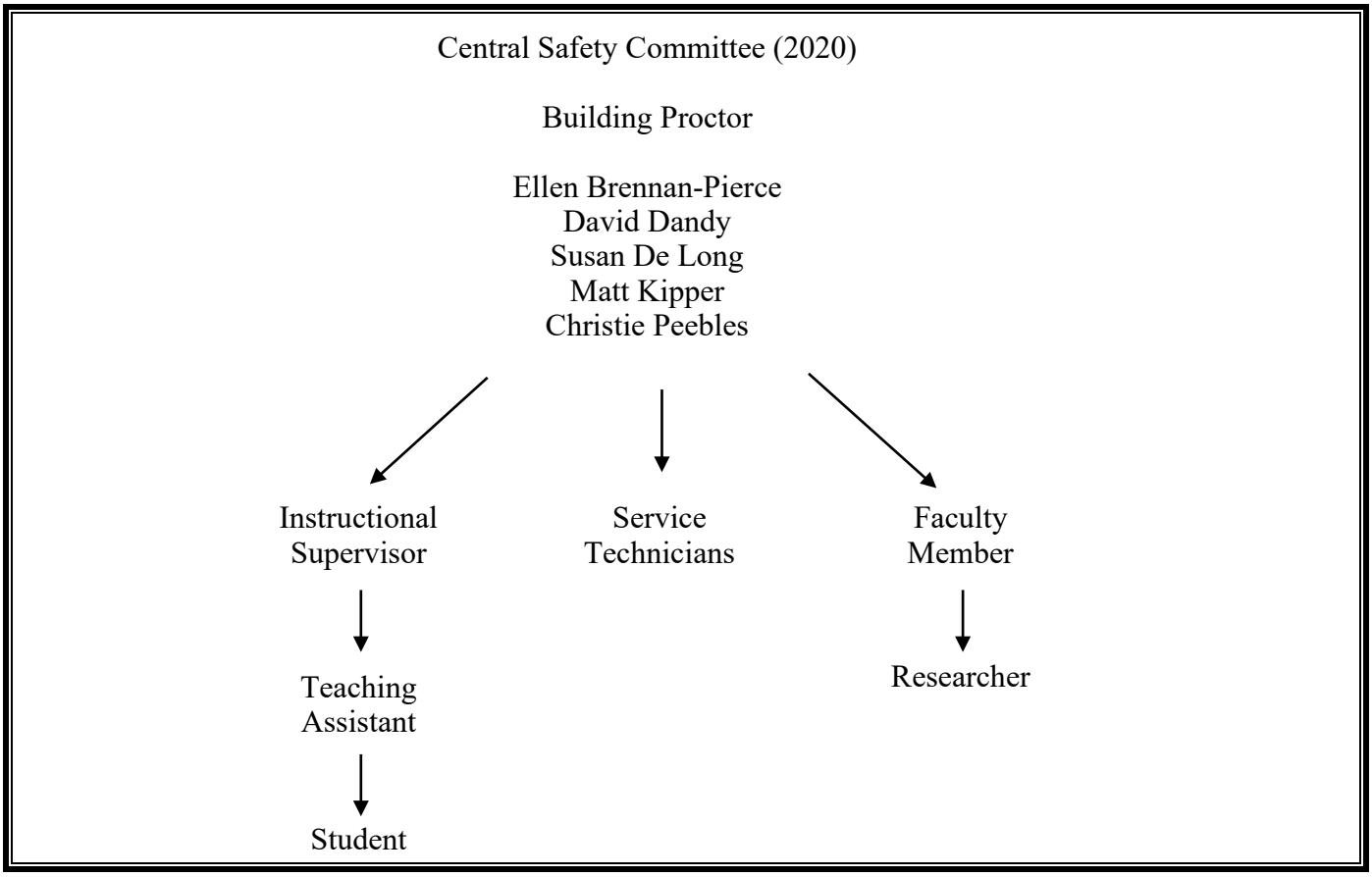
- Gloves, plates, pipette tips, loops, paper towels, bench towels, etc. should be thrown away in the red biohazard bag.
    - Once the bag is ¾ full, or after 7 days of waste accumulation, which ever comes first, autoclave bag on liquid cycle for 45 minutes. Do not leave the bags in the autoclave overnight. Once waste has cooled, dispose of in the red bin on the loading dock outside Scott Bioengineering.
- All liquid waste must be bleached or autoclaved. Bleach should be added to approximately 10% of the volume of the waste. After waiting 15 minutes, the liquid waste can be poured down the drain in

the sink. Alternatively, autoclave liquid waste on the 30-minute liquid autoclave cycle. Once cool, waste can be poured down the drain in the sink.

- Consult Appendix M for additional instructions for cleanup of a biological spill.

Source: CSU Biosafety Manual:
https://drive.google.com/file/d/0BzRT2XYL-3jhS0NpUE5yOV9EREk/view?resourcekey=0-AJ_PteWdzGmHpHXuuAKMKQ

5. SCOTT BIOENGINEERING BUILDING SAFETY ORGANIZATION



A. Responsibility for Safety

Each member of the Scott Bioengineering Building is a member of the safety team; this includes all employees as well as postdoctoral fellows, and graduate and undergraduate students. Primary responsibility is placed on the individual doing the work. For example, the student, the craftsman, or the researcher is responsible to his or her supervisor or faculty member for doing their work safely. In turn the teaching assistant, the instructor, or the service supervisor is responsible to his or her supervisor who in turn is responsible to the Chair and to the Dean of the College.

B. Central Safety Committee

Members of the committee representing each of the research pods are appointed by the Dean of the College. The committee is responsible for:

1. Establishing building-wide safety policy.
2. Promoting uniform safety practices.
3. Fostering good communication in safety.
4. Reviewing the building's safety program.
5. Reviewing the building's accident experience.
6. Conducting or organizing quarterly building-wide safety inspections.
7. Assessing the building's safety protection equipment.
8. Formulating the annual safety budget.

C. Faculty Member and Group Safety Representative

The faculty member and/or supervisor of each operational group in the building is responsible for the safety program within that group. To assist in discharging this responsibility, he or she may appoint a member of his or her group to serve as safety representative and an alternate. The primary duties of the safety representative include:

1. Development of a safety program for his or her group.
2. Consultation on matters pertaining to safety.
3. Establishing procedures to handle emergencies.
4. Reviewing new or modified practices.
5. Reviewing design and construction of new and modified experimental units.
6. Periodically participating in building safety inspections.

D. Teaching Assistant Duties and Responsibilities for Safety

The strength of the building's safety program depends on the performance of its Teaching Assistants in the undergraduate instructional laboratories. By his or her actions and example the Teaching Assistant develops students with safe working habits. By doing so he or she strengthens his or her own safe working habits and acquires an alertness to the hazards of the chemistry laboratory. These habits carry over to his or her own graduate research work. A few guidelines regarding the Teaching Assistant's duties with respect to safety are:

1. Teach and enforce safety as an integral part of the course.
2. Ensure the students make a careful analysis for safety before starting an experiment. Such an assessment includes:
   a. Collecting pertinent information
   b. Forecasting potential hazards
   c. Selection of safe techniques
   d. Use of protective equipment
   e. Plan of action in case an unanticipated accident occurs.
3. See that safety rules are obeyed; set a good example yourself.
4. Remain in the laboratory at all times when students are present; have someone else in charge if you must leave.
5. Know the location and use of the protective equipment provided.
6. In case of accident or illness:
   a. Render prompt first aid
   b. Have someone report to the course storeroom for help.
   c. If injury or illness appears serious, have someone call for an ambulance.
   d. Report all accidents that cause injury, no matter how minor, immediately to your supervisor and the Chair of the Central Safety Committee.
   e. Prepare a written report on all accidents that cause injury.

E. Non-compliance with Safety Policies

If a lab safety violation is observed, please report the violation using the tool at www.engr.colostate.edu/facilities/report or by communicating directly with the Building Lab Manager or Building Proctor. The procedure for non-compliance with safety policies is as follows:
The first time a person is reported for non-compliance with safety policies is considered a warning, and is an opportunity for us to educate the person about safety issues. If a non-compliance is reported a second time, the faculty member responsible for the person will be notified. If a non-compliance is reported a third time, the Department Head responsible for the person will be notified. If a non-compliance is noted a fourth time, card access to the labs will be revoked.

6. CHEMICAL INVENTORIES

A. Laboratory Chemical Storage

Chemical Inventories in research laboratories should be kept at the minimum level consistent with efficiency and safety. Unneeded chemicals should be turned over to the University's surplus program (administered by Environmental Health Services). Chemicals in the surplus program are available to all research groups and both should be checked for chemicals prior to ordering new reagents.

Flammable chemicals, those having flash points less than 38° C. should be stored in solvent cabinets. Chemicals should be stored according to functional group or reactive character and NOT alphabetically. Items stored in refrigerators should have secondary containment so as to protect the evaporator coils (aluminum) in the refrigerator. Oxidants should not be stored next to reducing agents and should have secondary containment.

Highly toxic chemicals and those known to be carcinogens should be stored in ventilated storage cabinets or, if not these are not available, then in fume hoods. These chemicals should be labeled "CAUTION: HIGH CHRONIC TOXICITY OR CANCER SUSPECT AGENT." These chemicals should be used only in a designated area with appropriate warning signs (see Chemical Biohazards in the CSU Biosafety Handbook)

Fume hoods should not be used for general chemical or equipment storage.

Cylinders of compressed gases should be chained to the bench top or wall except when being transported. Cylinders not in use should have the top cap screwed on tight. Small cylinders not equipped with caps should be stored in such a way as to prevent them being accidentally dropped to the floor when not in use. All cylinders that are in the laboratory for more than twelve months should have regular (bimonthly) inspections to check for leaks and corrosion. Cylinders should be returned to the manufacturer at the first sign of corrosion. Leaking cylinders should be immediately moved to the hood and the contents released and neutralized or rendered non-hazardous by the appropriate technique. The empty cylinder should then be returned to the manufacturer.

B. Inventories

An inventory of the chemicals stored in the laboratory should be taken annually and reported to the building proctor. This information is further communicated to Environmental Health Services and to the local fire departments. This is a requirement of the Emergency Planning and Community Right-to-Know Act as well as the CSU Building and Fire Code.

Each laboratory maintaining a stock of chemicals should have on hand, in a loose leaf or other readily available form, a Material Safety Data Sheet (MSDS) for every chemical in the laboratory. The annual inventory is a good time to compare the items on the inventory with the MSDS available and request those MSDS that are not on hand. A copy of each MSDS should be supplied to the main office for filing and future reference.

7. ENGINEERING CONTROLS

- All fume hoods are inspected annually by EHS.
- All biosafety cabinets are inspected annually.
- Safety eye washes should be flushed once a month and safety showers once a semester. Repairs are made immediately to those found to be defective.
- Fire extinguishers are inspected during an annual Facilities Services inspection of the building.
- Laboratories (with the exception of designated laser labs) are maintained at negative pressure relative to the hallway.
- Problems with the building should be brought to the attention of the Building Proctor.

APPENDIX A, Matrix of Required Safety Training by Room

Research Pod	Lab Name	Room Number	Training Required for Lab Use
Bioanalytical Devices	Analytical Chemistry Lab	165	GST, HWT, Biosafety 1 & 2
	Bioanalytical Lab	169	GST, HWT, Biosafety 1 & 2
	Bioengineering Lab	171	GST, HWT, Biosafety 1 & 2
	Instrument Lab	180	GST, HWT, Biosafety 1 & 2
	Microfabrication/Fluidics	177	GST, HWT, Biosafety 1 & 2
	Optics Lab	178	GST, HWT, Biosafety 1 & 2, Laser Safety Training
Common	Walk-in Cold Room	163	GST, HWT, Biosafety 1 & 2
	Autoclave Room 1	182	GST, HWT, Biosafety 1 & 2 Equipment training for autoclave use and glassware washer use
	Loading Dock	188	Equipment training for liquid nitrogen dispensing
Systems and Synthetic Biology	Algae Lab	160	GST, HWT, Biosafety 1 & 2
	Equipment Room	166	GST, HWT, Biosafety 1 & 2
	Fermenter Lab	172	GST, HWT, Biosafety 1 & 2
	Microbial Cultivation Lab	174	GST, HWT, Biosafety 1 & 2
	Molecular Biology Lab	168	GST, HWT, Biosafety 1 & 2
	Phytotron	184A	GST, HWT, Biosafety 1 & 2
	Plant Cell Culture	184	GST, HWT, Biosafety 1 & 2
	Proteomics & Metabolomics	161	GST, HWT, Biosafety 1 & 2
Teaching	Chemical Storage Room	190	GST, HWT, Biosafety 1 & 2
Environmental Engineering	Constant Temperature Rooms	260A,B,C	GST, HWT, Biosafety 1 & 2
	Dark Room	290A	GST, HWT, Biosafety 1 & 2
	Env. Biotech Lab	290	GST, HWT, Biosafety 1 & 2
	Environmental Lab	276	GST, HWT, Biosafety 1 & 2
	Equipment Room	280/294	GST, HWT, Biosafety 1 & 2
	Instrument Lab	284	GST, HWT, Biosafety 1 & 2
	Pilot Lab	272	GST, HWT, Biosafety 1 & 2
	Walk-in Cold Room	288	GST, HWT, Biosafety 1 & 2
Teaching	Biomedical Engineering	271	In-class Safety Training
	Preparation Lab	269	In-class Safety Training
	Unit OPS/Thermal Fluids	261	In-class Safety Training
	Water Quality Teaching	268	Students: In-class Safety Training Researchers: GST, HWT, Biosafety 1 & 2
Biomedical Engineering	Keck Lab	384/384A	GST, HWT, Biosafety 1 & 2, Laser Safety Training
	Histology Reception	380	GST, HWT, Biosafety 1 & 2, Animal Training (LAR and IACUC)
	Electrical Characterization	360	GST, HWT, Biosafety 1 & 2
	Equipment Room	382	GST, HWT, Biosafety 1 & 2
	Lab Support	360A	GST, HWT, Biosafety 1 & 2
	Lab without hoods 8&9	377	GST, HWT, Biosafety 1 & 2
	Lab with hoods 1	372	GST, HWT, Biosafety 1 & 2
	Lab with hoods 2	374	GST, HWT, Biosafety 1 & 2
	Lab with hoods 3	376	GST, HWT, Biosafety 1 & 2, Blood Borne Pathogen Training
	Lab with hoods 4	378	GST, HWT, Biosafety 1 & 2
	Lab with hoods 6&7	371	GST, HWT, Biosafety 1 & 2
	Histology	380A	GST, HWT, Biosafety 1 & 2
	Mammalian Tissue Culture	367	GST, HWT, Biosafety 1 & 2
	Micromanipulation Lab	370B	GST, HWT, Biosafety 1 & 2, Laser Safety Training
	Microscopy labs	370/370A/370C	GST, HWT, Biosafety 1 & 2, Laser Safety Training
	Surface Characterization	362	GST, HWT, Biosafety 1 & 2
	Wet Lab 1	365	GST, HWT, Biosafety 1 & 2
	Wet Lab 2	361	GST, HWT, Biosafety 1 & 2
	Cell Culture	366	GST, HWT, Biosafety 1 & 2
	Radioisotope Lab	392	GST, HWT, Biosafety 1 & 2, Radiation Safety Training
Common	Walk-in Freezer	390	GST, HWT, Biosafety 1 & 2
	Autoclave Room 2	394	GST, HWT, Biosafety 1 & 2 Equipment training for autoclave use and glassware washer use

GST - General Safety Training; HWT - Hazardous Waste Training; LAR - Lab Animal Resources; IACUC - Institutional Animal Care and Use Committee

APPENDIX B, List of Biosafety Level 2 Organisms

Rooms 280 and 290

- Clostridium perfringens
- Pseudomonas aeruginosa
- Escherichia coli
- Enterococcus
- Staphylococcus aureus
- Salmonella enterica

Room 367

- Human blood

Room 376

- HEK293
- Vesicular Stomatitis Virus

Room 380A

- Pseudomonas aeruginosa
- Staphylococcus aureus

APPENDIX C, Scott Bioengineering Liquid Nitrogen Dispensing Training Agreement

I, _____, have been trained to dispense liquid nitrogen into personal containers by Ellen Brennan-Pierce. As a certified user of the Scott Bioengineering liquid nitrogen system, I agree to:

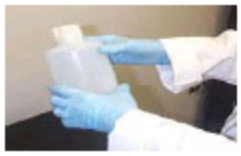
- Wear lab-appropriate attire, with the supplied cryogloves and safety glasses or face shield, when obtaining liquid nitrogen
- Inform another person when obtaining liquid nitrogen
- Open an outside door for ventilation when obtaining liquid nitrogen
- Log liquid nitrogen use in the iLab "request services" system when obtaining liquid nitrogen
- Secure the liquid nitrogen cage after dispensing
- Exercise caution when dispensing, transporting, and using liquid nitrogen
- Only use liquid nitrogen for university related research and academics as instructed by my advisor
- Not give unauthorized persons access to the liquid nitrogen system
- Contact the Scott Bioengineering Laboratory Manager if the tank is nearly empty or any other issues arise

_____ _____

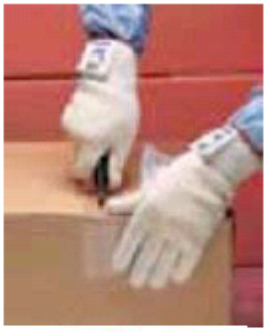
Signature Date

CSU ID#

APPENDIX D, Glove Selection and Usage

Glove material	Intended use	Advantages and disadvantages	Example Photos
Latex (natural rubber)	Incidental contact	• Good for biological and water-based materials. • Poor for organic solvents. • Little chemical protection. • Hard to detect puncture holes. • Can cause or trigger latex allergies	
Nitrile	Incidental contact (disposable exam glove) Extended contact (thicker reusable glove)	• Excellent general use glove. Good for solvents, oils, greases, and some acids and bases. • Clear indication of tears and breaks. Good alternative for those with latex allergies.	
Butyl rubber	Extended contact	• Good for ketones and esters. Poor for gasoline and aliphatic, aromatic, and halogenated hydrocarbons.	
Neoprene	Extended contact	• Good for acids, bases, alcohols, fuels, peroxides, hydrocarbons, and phenols. • Poor for halogenated and aromatic hydrocarbons. • Good for most hazardous chemicals.	

Norfoil	Extended contact	• Good for most hazardous chemicals. • Poor fit (Note: Dexterity can be partially regained by using a heavier weight Nitrile glove over the Norfoil/Silver Shield glove.	
Viton	Extended contact	• Good for chlorinated and aromatic solvents. • Good resistance to cuts and abrasions. • Poor for ketones. • Expensive.	
Polyvinyl chloride (PVC)	Specific use	• Good for acids, bases, oils, fats, peroxides, and amines. • Good resistance to abrasions. • Poor for most organic solvents.	
Polyvinyl alcohol (PVA)	Specific use	• Good for aromatic and chlorinated solvents. • Poor for water-based solutions.	

Stainless steel **Kevlar** **Leather**	Specific use	**Cut-resistant gloves.** Sleeves are also available to provide protection to wrists and forearms. (If potential for biological or chemical contamination: wear appropriate disposable gloves on top of your cut-resistant gloves and discard after use).	  
Cryogenic Resistant Material **Leather**	Specific use	For use with cryogenic materials. Designed to prevent frostbite. Note: Never dip gloves directly into liquid nitrogen.	
Nomex	Specific use	For use with pyrophoric materials. Consider wearing a flame-resistant glove such as a Nomex 'flight' glove with a thin nitrile exam glove underneath.	

Source: University of California, Berkeley, Office of Environment, Health, and Safety
http://www.ehs.berkeley.edu/hs/63-laboratory-safety/94-glove-selection-and-usage.html

APPENDIX E, Accident Reporting Forms

Accident Report

1. List the name, address, and telephone number of the person(s) experiencing the accident:____

_____

_____

_____

2. List the name, address, and telephone number of the person(s) injured: _____

_____

_____

_____

3. List the name, address, and telephone number of all witnesses, if any: _____

_____

_____

_____

4. List the building, room number and location in room where the accident occurred: _____

_____

_____

5. If accident occurred in an instructional course, list the course number and section: _____

_____

6. If accident occurred in a research group, list the name of the faculty member: _____

_____

7. Give the date and time of the accident: _____

8. Describe briefly, but sequentially, all the known facts concerning events leading up to and following the accident. These facts may be established with participants or witnesses. Avoid opinions and conclusions.

_____

_____

_____

9. If the accident resulted in injury, describe briefly the nature and extent of the injury, the type of first aid rendered and by whom, whether or not an ambulance was called and used, and the time involved. Also indicate the condition of the injured after treatment.

_____

_____

_____

10. If the accident resulted in a fire, how was the fire extinguished, was the fire alarm sounded, was the fire department called, how soon did the fire department arrive, and if hand fire extinguisher were used, were they submitted for refill?

_____

_____

_____

11. If the accident resulted in property damage, describe briefly the extent of damage. _____

_____

_____

_____

12. Give the name, address and telephone number of person preparing the report if someone other than listed under item 1 above. _____

_____

_____

13. Show a copy of this completed report your supervisor.

Colorado State University Incident Report or Worker's Compensation Report

(See Instructions on Back of This Form)

Mark if this is an Incident Report or a Workers' Comp claim: **Incident Report ( ) Workers' Comp. ( )**

This form is needed when an employee is injured while in the course of employment. Employee should complete Part I & II in full; Supervisor should complete and sign Part III. If employee is not able to complete form, supervisor should do so. Submit to Environmental Health Services (department 6021), 141 General Services Building, within four days of injury.

Part I – EMPLOYEE MUST COMPLETE THIS SECTION OF THE REPORT					
Employee's Name (First, Middle, Last) 1	CSUID 2	Sex 3	Home Phone No 4		
Employee' Street Address 5	City 6	State 7	Zip 8	Job Title 9	
Birthday (mo / day / yr) / / 10	Marital Status 11	Primary Language -English ( ) Spanish ( ) Other ( ) 12	CSU Health Insurance None ( ) Your Policy ( ) Spouse Policy ( ) 13		
Wages: a) Hourly _____(if paid hourly) OR b) Weekly_____(if salaried) 14	Course Name & No. if Student Intern 15				
Employment Classification: a) Fac or AdminPro ( ) b) State Classified ( ) c) Non-Student Hourly ( ) d) Work Study ( ) e) Student Hourly ( ) f) Student Intern ( ) g) Graduate Student ( ) h) Other ( ) Specify 16					
Part II – INJURY INFORMATION – EMPLOYEE MUST COMPLETE THIS SECTION OF THE REPORT					
Injury Date (mo/day/yr) / / Time of Injury (hr:min) _____:_____ AM ( ) PM ( ) 17					
What happened to cause this injury or illness? Describe employee's activities when injury or illness occurred with details of how event or exposure occurred; include name(s) of other individuals involved, tools, machinery, objects, vapors, chemicals, radiation, unnatural motions of employee, unsafe/hazardous conditions, etc. Also specify the items which directly injured the employee and caused the accident or illness. (If additional space is needed, use back of this form) 18					
Injury Description (State exactly the part(s) of the body affected and the nature of the injury or disease 19					
Name of Witnesses 20					
Name of employer representative notified 21					
Place of accident/exposure (Bldg. Name and Room Number), City, County, State, Zip Code 22					
Treatment received: 911 called ( ) Emergency Room ( ) Minor-Clinic ( ) Admitted to Hospital ( ) Surgery ( ) Incident Report Only ( ) 23					
Name & Address of Treating Doctor and/or Hospital 24					
Employee Signature: 25	Date: 26				
PART III – SUPERVISOR MUST COMPLETE THIS SECTION OF THE REPORT					
Employee's normal schedule: _____hrs/day, _____days/week Shift Start /End time: / Was employee on this schedule when injured Y( ) N ( ) 27					
Last Day Worked: / / 28	Date returned to work: / / OR Estimated date of return: / / 29				
Modified work available: Y ( ) N ( ) If NO, Why? 30	Did injury cause death Y ( ) N ( ) Date of death : / / 31				
If death, Name, relationship, and address of closest dependent 32					
Auto Accident ( ) Possible Drug/Alcohol Violation ( ) Possible Safety Violation ( ) Employer Questions Liability ( ) 33					
If Employee is State Classified, at time of injury the Sick Leave Balance is: the Annual leave balance is : 34					
Department & work unit 35					
Supervisor Printed Name 36	Supervisor Phone 37				
Supervisor Signature 38	Date 39				

Revised 9/13/06

Colorado State University Incident Report or Workers' Compensation Report Form Instructions

This section is completed by the employee:

Mark if this record will be an incident report or a workers' compensation claim.

Incident Report – The employee is reporting an incident but may not intend to see a physician or seek medical attention. The form will be filed with Environmental Health Services and can be used as a workers' compensation claim at a later date.

Workers' Comp. claim – The employee is submitting the record to be reported as a workers' compensation claim and will be seeing a physician or seeking medical attention.

1-3) Provide name, CSUID number and gender.
4-8) Provide current home phone, address, city, state and zip code.
9) Provide Job title as shown on personnel records.
10) Provide birth date.
11) Marital status must show single, married, divorced, or widowed, as the case may be. A divorced or widowed person should not be shown as single.
12) Check the primary language spoken. If other, write language spoken under primary language in box 12.
13) Check if you have no CSU insurance (None), or if you have CSU insurance and you are the primary insured (Your Policy) or if you have CSU insurance through your spouse (Spouse Policy).
14) Provide hourly wages if paid hourly or weekly wages if salaried. To determine weekly wage, for this purpose, multiply monthly wage by twelve (12) and divide by fifty-two(52).
15) Provide course name and number if you are a student intern.
16) Check your classification or other and specify if other classification.
17) Provide the injury date and time.
18) Describe what happened, details of how incident occurred. Include your activities, other individuals involved, tools, machinery, objects, vapors, chemicals, radiation, unnatural motions, unsafe/hazardous conditions, etc. Provide specific items which directly injured you.
19) Provide a description of the injury. Include part(s) of the body affected and the nature of the injury or disease.
20) Provide the names of any witnesses.
21) Provide CSU representative you notified of the incident.
22) Provide place of incident. Include building name, room number, city, county, state and zip code.
23) Check the treatment received. Check all that apply.
24) Provide name and address of treating doctor and/or the hospital.
25-26) Sign and provide the date Part I and Part II were completed, not the date of injury.

This section is completed by the supervisor:

27) Provide the normal schedule of employees work in hours per day, days per week, shift start and end time. Check "Y" if the employee was working this schedule when injured or "N" otherwise.
28-29) Provide the last day worked and either the date returned to work or the estimated date of return.
30) Check if modified work is available and provide a reason why if no modified work is available.
31) Check if incident caused death and provide the date of death. If the incident resulted in death, the death must be reported immediately to EHS.
32) Provide the name, relationship and address of closest dependent.
33) Check if the incident was related to an auto accident, possible drug/alcohol violation, safety violation or if you question liability. If any of these questions are answered yes, please attach a concise explanation of the circumstances so that the case can be properly evaluated. If failure to obey safety rules is reported, the explanation should show an actual written rule known to the employee and enforced by CSU or the department was violated.
34) If employee is State Classified, provide the sick leave balance and annual leave balance at time of incident.
35) Provide employees current work phone, work unit and employee's primary department to which assigned.
36-37) Print your name and provide your telephone number.
38) Signature of employee's supervisor. Supervisor, by signature, indicates concurrence with information as contained in the report form unless an addendum is attached.
39) Provide the date when the supervisor reviewed the report and completed Part III.

APPENDIX F, Effects of Different Oxygen Levels on Humans

The following is a list of different oxygen levels along with the corresponding effects it has on normal human life.

1. 23.5% is the maximum safe concentration established by the Occupational Health and Safety Administration (OSHA).
2. 20.9% is the normal oxygen concentration at sea level.
3. 19.5% oxygen is the minimum safe concentration established by OSHA.
4. At approximately 19.0% oxygen, there may be some impairment to judgment but it may be hardly noticeable.
5. At approximately 16.0-19% oxygen, hypoxic conditions will likely be experienced where the body is deprived of an adequate oxygen supply and there may be some impairment to judgment.
6. At between approximately 13%-16% oxygen, breathing becomes rapid as does the person's pulse rate. The individual will become emotionally upset.
7. At between approximately 10%-13% oxygen, a strong feeling of fatigue takes over with strained respiration. There is a distinct possibility that the person will be rendered unconscious without forewarning.
8. Below 10%, there is an increased inability to move, with fainting almost immediately upon exposure to the oxygen deficient atmosphere. Convulsions and death will follow as the oxygen levels approach approximately 7%.

APPENDIX G, Additional Resources on Handling Chemicals

Prudent Practices for Disposal of Chemicals from Laboratories, by National Research Council.

Hazardous Laboratory Chemicals Disposal Guide, by M. A. Armour.

Destruction of Hazardous Chemicals in the Laboratory, by George Lunn and Eric B. Sansone.

Matheson Gas Data Book, Sixth Edition, by William Braker and Allen L. Mossman.

The Sigma-Aldrich Library of Chemical Safety Data, two volumes, edited by Robert E. Lenga.

APPENDIX H, City of Fort Collins Waste Disposal Limits

The city of Fort Collins has set certain limits on what may be discharged into the sanitary sewer system. And the city monitors this by taking samples at random times. The portions of the law that apply to the chemistry department are shown below.

112-75-A-3 Waters having a pH less than 6.0 or greater than 9.0 may not be discharged to the sewer.

112-75-A-6 Wastes containing concentrated dyes may not be discharged to the sewer system.

112-75-A-9 Any liquid or vapor having a temperature higher than 65.5° C at the point of entrance to the public sewer may not be discharged.

112-75-A-10 Waste containing free, floating or insoluble oil may not be discharged to the sewer system.

112-75-A-14 Chemicals which cause noxious or malodorous conditions which either singly or by interaction with other wastes are sufficient to be hazardous to personnel in the maintenance and repair of the sewer utility may not be discharged to the sewer. This would include sulfides, cyanides, sulfites, nitrites, etc.

112-75-A-17 Waters or wastes having the following substances with a concentration greater than that shown may not be discharged to the sewer system.

Phenolic compounds as phenol	5.0 mg/l
Hydrogen sulfide	5.0 mg/l
Ammonia nitrogen as urea	10.0 mg/l
Cyanides	1.0 mg/l
Sulfur dioxide	5.0 mg/l
Nitrous oxide	5.0 mg/l

112-75-A-18 Water or wastes having a twenty-four hour proportionate composite sample concentration in excess of the following:

Hexavalent Cr as Cr	0.25 mg/l
Copper as Cu	3.0 mg/l
Nickel as Ni	5.0 mg/l
Cadmium as Cd	0.05 mg/l
Zinc as Zn	2.0 mg/l
Iron as Fe	15.0 mg/l
Lead as Pb	0.25 mg/l
Arsenic as As	0.25 mg/l
Manganese as Mn	0.25 mg/l
Selenium as Se	0.05 mg/l
Silver as Ag	0.25 mg/l
Mercury as Hg	0.025 mg/l

112-75-B Any discharge to the sewer system in which the concentration of any prohibited substance exceeds five (5) times the twenty-four hour concentration is prohibited.

The city of Fort Collins does not specify what chemicals may be discharged to the system and in the absence of such information "Prudent Practices for Disposal of Chemicals from Laboratories" may be taken as a guide. The following information is taken from that source. Notes in parentheses are modifications for Fort Collins laws.

Organic compounds

Organic compounds that are discharged to the sewer system should be water soluble to at least 3%, present a low toxicity hazard and be readily biodegradable. The following may be used as a guide.

Alcohols - Alcohols with less that 5 carbon atoms, alkanediols with less than 8 carbon atoms, glycerol, sugars and sugar alcohols, alkoxyalkanols with less than 7 carbon atoms.

Aldehydes - Aliphatic aldehydes with less than 5 carbon atoms.

Amides - Primary and Secondary aliphatic amides with less than 5 carbon atoms, tertiary aliphatic amides with less than 11 carbon atoms.

Amines - (Amines should be neutralized to a legal pH) Aliphatic amines with less than 7 carbon atoms, aliphatic diamines with less than 7 carbon atoms, benzylamine and pyridine.

Carboxylic acids - (Acids should be neutralized to a legal pH) Alkanoicacids with less than 6 carbon atoms, alkanedioic acids with less than 6 carbon atoms, hydroxyalkanoic acids with less than 6 carbon atoms, aminoalkanoic acids with less than 7 carbon atoms. Ammonium, sodium and potassium salts of the above acids classes with less than 21 carbon atoms. Chloroalkane-dioic acids with less than 4 carbon atoms.

Esters - Esters with less than 5 carbon atoms, isopropyl acetate.

Ethers - Tetrahydrofuran, dioxolane, dioxane.

Ketones - ketones with less than 6 carbon atoms.

Nitriles - Acetonitrile, propionitrile.

Sulfonic Acids - Sodium or potassium salts of most are acceptable.

Inorganic Chemicals

This list is of the low-toxic-hazard ions. The ions in parentheses are those which Fort Collins has special controls on disposal concentrations. Again solutions should be neutralized to the legal pH range before discharging to the sewer.

Cations: Al^{3+}, Ca^{2+}, (Cu^{2+}), ($Fe^{2+,3+}$), K^{+}, Li^{+}, Mg^{2+}, Na^{+}, (NH_4^{+}), Sn^{2+}, Sr^{2+}, $Ti^{3+,4+}$, (Zn^{2+}), Zr^{2+}

Anions: BO_3^{3-}, $B_4O_7^{2-}$, Br^{-}, CO_3^{2-}, Cl^{-}, (HSO_3^{-}), OCN^{-}, I^{-}, NO_3^{-}, PO_4^{3-}, SO_4^{-}, SCN^{-}

APPENDIX I, Chemicals That Should Not Be Stored Beyond 3 or 6 Months, and Peroxide Detection Procedures

1. The following items should not be stored beyond **three months** after opening.

Acetal	Cyclohexene	
Decahydronaphthalene (Decalin)	Diacetylene	
Dicyclopentadiene	**Diethyl ether**	
Diethylene glycol dimethyl ether (Diglyme)	(uninhibited) Dioxane	
Divinyl acetylene	(uninhibited) Glycol ether acetates	
Glycol monoethers (uninhibited)	Isopropyl ether	Methylacetylene
Potassium with Organic Material (e.g., oil)		
Sodium amide	**Tetrahydrofuran** (uninhibited)	
Tetrahydronaphthalene (Tetralin)	Vinyl ethers	
Vinylidene chloride		

2. The following items should not be stored beyond **six months** after opening.

Acrylonitrile	Butadiene
Chloroprene	Chlorotrifluoroethylene
Methyl methacrylate (uninhibited)	Styrene
Tetrafluoroethylene	Vinylacetylene
Vinyl chloride	Vinylpyridine

3. Peroxidizable solvents should always be regarded as containing peroxides. Accordingly, the practice of routinely testing for peroxides prior to running a distillation should be adopted. A little practice with standard peroxide detection procedures should enable a chemist to make a round estimate of the quantity of peroxide found. A qualitative test for peroxides follows.

   IODINE TEST METHOD based on the oxidation of iodide to iodine by the peroxide:

   This procedure is satisfactory for all of the common solvents but does not indicate the presence of dialkyl peroxides or some dimeric and trimeric ketone peroxides. Add 6 ml of the solvent to be tested to 3 ml of a 1% absolute ethanolic solution of sodium iodide (potassium iodide is insoluble) in a standard 6" test tube. Add one drop of 1% HCl solution, purge with N_2 and stopper. Mix and compare the color intensity developed after about three minutes with that of a standard prepared to represent 1:5000 parts of active oxygen (0.02%). If the test indicates this peroxide content or greater, the solvent should be discarded or the peroxide removed. The standard is prepared by dissolving 1.7 g of $FeCl_3 . 6H_2O$ in 100 ml of 5% HCl to reproduce the color obtained when 1.2 ml of 0.1N I_2 solution is diluted to 15 ml. The standard solution is stable.

APPENDIX J, Hazardous Chemical Spill

If a HAZARDOUS chemical spill occurs:

1. **Immediately alert all other people in the laboratory**
2. **Activate alarms if necessary.** Be familiar with the alarm system in your facility. If the incident could threaten the health of individuals in the building activate the alarm. If there is any doubt, activate the alarm.
3. **Treat Life Threatening Injuries.** The first priority in the event of an emergency is to protect life and health of individuals. Do not jeopardize your own safety.
    a. In the event **materials are splashed in the eyes**, go immediately to the **eye wash station and rinse the eyes with large amounts of water for at least 15 minutes**. Immediate, thorough washing of your eyes with water may save your vision in the event of an accident. **After a complete washing**, you should be taken to the emergency room for an eye examination.
    b. Use the **Safety Showers when large areas of the body are exposed to hazardous chemicals during a spill or accident**. Quickly remove all contaminated clothing while using the safety shower. Remove all clothing below the affected area and minimize further contact with the chemical by cutting away the clothing if necessary. It is especially important not to pull contaminated clothing over the face or eyes. Seconds count, and no time should be wasted because of modesty. Immediately flood the affected body area in cold water for at least 15 minutes. Resume if pain returns. Wash off chemicals with a mild detergent and water but **do not** use neutralizing chemicals, unguents, creams, lotions or salves. Get medical attention as soon as possible. Clothes must be laundered separately before reuse.
4. **Evacuate non-essential personnel and prevent access to the area.** Barricades of some sort should be set up to prevent inadvertent access to the area of the spill. This action may be necessary to prevent injury and to control the spread of contamination.
5. **<u>If necessary</u>, call the CSU Police (911) and the Building Proctor or Department Head.** Get as much information as you can about the chemical. If possible, locate a Material Safety Data Sheet (MSDS). Be sure the CSU Police and the Poudre Fire Authority HazMat Team are accurately informed as to the nature and location of the spill.
6. **Contain the Spill if it Can Be Done safely and Prevent Release to the Environment.** If the spill can be safely contained, prevent release to the sanitary sewer system, the storm sewer and the ground.
7. **Initiate Material Specific Clean-Up Procedures.** The Poudre Fire Authority Hazardous Materials Team will respond to the immediate emergency and stabilize the situation. However, spill clean up and disposal of the residue is the responsibility of the individual or department. Check Material Safety Data Sheets (MSDS) for proper spill clean-up methods and safety precautions. MSDSes should be available in each laboratory for all chemicals that are utilized. EHS will assist with determining the appropriate procedures for cleanup and disposal.
    a. Spills involving hazardous materials should be contained and treated as instructed on the Material Safety Data Sheet (MSDS).
    b. Small Spills - may be contained and adsorbed using appropriate commercial adsorbents if a respiratory hazard does not exist. Dispose of the recovered materials and waste through EHS.
    c. Large Spills – evacuate the area and contact the building proctor or EHS for help/advice in cleaning up the spill
    d. If a **volatile, flammable or toxic material** is spilled, immediately warn everyone to extinguish flames and turn off spark-producing equipment such as brush-type motors. Shut down all equipment and vacate the room until it is decontaminated. Contact the building proctor or EHS for help in cleaning up the spill

e. The following substances are very hazardous and clean up should be handled by experienced personnel only:

aromatic amines	nitro compounds	organic halides
bromine	carbon disulfide	ethers
cyanides	hydrazines	nitriles

f. Avoid skin contact and, to prevent inhalation, wear appropriate breathing apparatus.
g. If the spill presents no fire hazard and the material is not particularly volatile or toxic, cleanup is directed by the volume and state of material. To facilitate cleaning up liquids, use sorbent material which will neutralize the liquids if possible (trisodium phosphate or sand followed by sodium bicarbonate solution or powder for acids, sodium thiosulfate solution for bromine). Commercial sorbents (e.g., Oil-Dri, Zorb-All or Spill-X) of small particles (about 30 mesh) or other satisfactory clay absorbents are also recommended. (Dry sand can also be used, but it is less effective.) A dustpan and brush should be used and appropriate gloves should be worn. While wearing gloves, clean the contaminated area with soap and water and mop it dry. If the spill is on the floor, some absorbent should be sprinkled on the spot to prevent slipping. (Vermiculite may create a slipping hazard when wet.) Dispose of the residue through EHS.
h. For acid chloride spills, use calcined absorbent products, such as Oil- Dri, Zorb-All or dry sand. Avoid contact with skin.
i. A spill of an alkali metal should be smothered with powdered graphite or Metal-X extinguisher and removed to a safe location where it can be disposed of by reaction with a dry secondary alcohol. Particles of alkali metal splattered on the skin should be rapidly removed and the skin flushed quickly with water. If any metal on the skin becomes ignited, deluge it with cold water immediately.
j. Most small liquid spills (<100 ml) can be absorbed with paper towels, sand or an absorbent. Most solid spills can be brushed up and disposed of in solid waste containers, but care must be exercised to avoid mixtures of reactive combinations.

A spill of white phosphorus should be blanketed with wet sand or wet absorbent and disposed of by controlled burning outdoors. If any white phosphorus is splattered on the skin, flush the skin with cold water and remove adhering phosphorus. Copper sulfate solution provides a visual aid in removing particles because it produces a dark color in contact with phosphorus.

APPENDIX K, Examples of Incompatible Chemicals*

Chemical	Is Incompatible With
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and Alkaline Earth metals	Water, carbon tetrachloride or chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine, Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Alkali metals
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid & Chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	see bromine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Everything
Hydrocarbons (such as butane, propane, benzene)	Fluorine, Chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhyd)	Ammonia (aqueous or anhydrous)

Chemical	Is Incompatible With
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acid, Activated carbon
Iodine	Acetylene, ammonia (aqueous or anhyd), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium & sodium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate & perchlorate	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid ammonium compounds, fulminic acid
Sodium	see potassium
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

* Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Research Council, pg. 73-74, 1981

Flammable Solids 	Phosphorus Magnesium	Separate dry cool area	Acids Bases Oxidizers Poisons	Fire Hazard Heat Violent Reaction
Oxidizers 	Sodium Hypochlorite Benzoyl Peroxide Potassium Permanganate Potassium Chlorate Potassium Dichromate Peroxides Perchlorates Chlorates Nitrates	Spill tray that is separate from flammable and combustible materials	Reducing Agents Flammables Combustibles Corrosives	Fire Hazard Toxic Gas Generation
Poisons 	Cyanides Cadmium Mercury Osmium Acrylamide DMSO	Vented, cool, dry area in unbreakable chemically resistant secondary containers	Flammable Liquids Acids Bases Oxidizers Corrosives	Generation of Toxic & Flammable Gas Violent Reaction
Water Reactive Chemicals 	Sodium Metal Potassium Metal Lithium Metal Lithium Aluminum Hydride	Dry, cool location away from potential spray from fire sprinklers and other water sources, i.e. under sink	Aqueous Solutions Oxidizers	Heat Violent Reaction
Flammable Compressed Gases 	Methane Acetylene Propane Hydrogen	Cool, dry area away from oxidizing gases while securely attached to wall or bench	Oxidizing & Toxic Compressed Gases Oxidizing Solids	Fire Hazard Explosion Hazard
Oxidizing Compressed Gases 	Oxygen Chlorine Bromine	Cool, dry area away from flammable gases while securely attached to wall or bench	Flammable Gases	Fire Hazard Explosion Hazard
Poisonous Compressed Gases 	Carbon Monoxide Hydrogen Sulfide	Cool, dry area away from flammable gases or liquids while securely attached to wall or bench	Flammable Gases Oxidizing Gases	Release of Toxic Gas Violent Reaction

Partial Incompatibility Listing

Compound/Class	Avoid Storage Near or Contact With:
Acids	
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene, glycogen, perchloric acid, peroxides, permanganate
Hydrofluoric Acid	Ammonia (aqueous or anhydrous)
Nitric Acid (conc.)	Acetic acid, aniline, chromic acid, acetone, alcohol, or other flammable liquids, hydrocyanic acid, hydrogen sulfide, or other flammable gases, nitratable substances: copper, brass or any heavy metals (or will generate nitrogen dioxide/nitrous fumes) or organic products such as wood and paper
Sulfuric Acid	Light metals (lithium, sodium, potassium), chlorates, perchlorates, permanganates
Bases	
Ammonia	Mercury, chlorine, bromine, iodine, hydrofluoric acid, calcium hypochlorite
Calcium oxide	Water
Alkaline metals	Sodium, potassium, magnesium, calcium, aluminum, carbon dioxide, carbon tetrachloride or other chlorinated hydrocarbons, halogens, water
Bromine	Ammonia, acetylene, butadiene, methane, propane, butane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Carbon, activated	Calcium hypochlorite, oxidizing agents
Chlorine	Ammonia, acetylene, butadiene, methane, propane, butane, or other petroleum gases, hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Copper	Acetylene, hydrogen peroxide, nitric acid
Fluorine	Isolate from everything
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, ammonia, fulminic acid (produced in nitric acid ethanol mixtures)
Oxygen	Oils, grease, hydrogen, other flammable gases, liquids, or solids
Phosphorous (white)	Air, oxygen, caustic alkalis as reducing agents (or will generate phosphine)
Potassium	Carbon tetrachloride, carbon dioxide, water
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid (produced in nitric acid-ethanol mixtures), and ammonium compounds
Organics	
Acetone	Concentrated nitric acid and sulfuric acid mixtures
Acetylene	Fluorine, chlorine, bromine, copper, silver, mercury
Aniline	Nitric acid, hydrogen peroxide
Flammable Liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons (propane, butane, etc.)	Fluoride, chlorine, bromine, chromic acid, sodium peroxide
Nitroparaffins	Inorganic bases, amines
Oxalic Acid	Silver, mercury
Oxidizers	
Chlorates	Ammonia salts, acids, metal powders, sulfur, finely divided organics, or combustible materials
Chromic Acid (trioxide)	Acetic acid, naphthalene, camphor, glycerol, turpentine, alcohol or flammable liquids
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Chlorine Dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Cumene Hydroperoxide	Organic or inorganic acids
Hydrogen Peroxide	Copper, chromium, iron, most other metals or salts, alcohols, acetone, or other flammable liquids, aniline, nitromethane, or other organic or combustible materials
Hypochlorites	Acids (will generate chlorine or hypochlorous acid
Nitrates	Sulfuric acid (will generate nitrogen dioxide)
Perchloric Acid	Acetic acid, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides (Organics)	Organic or inorganic acids; also avoid friction and store cold
Potassium Chlorate	Acids, especially sulfuric acid
Potassium Permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Sodium Peroxide	Any oxidizable substance such as methanol, ethanol, glycerol, ethylene glycol, glacial acetic acid, acetic anhydride, benzaldehyde, furfural, methyl acetate, ethyl acetate, carbon disulfide
Alkaline metals	Sodium, potassium, magnesium, calcium, aluminum, carbon dioxide, carbon tetrachloride or other chlorinated hydrocarbons, halogens, water
Calcium oxide	Water
Cyanides	Acids (will generate hydrogen cyanide)
Phosphorous (white)	Air, oxygen, caustic alkalis as reducing agents (will generate phosphine)
Potassium	Carbon tetrachloride, carbon dioxide, water
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium Peroxide	Any oxidizable substance such as methanol, ethanol, glycerol, ethylene glycol, glacial acetic acid, acetic anhydride, benzaldehyde, furfural, methyl acetate, ethyl acetate, carbon disulfide
Sulfides	Acids (will generate hydrogen sulfide)
Reducing Agents	
Hydrazine	Hydrogen peroxide, nitric acid, other oxidants
Nitrites	Acids (will generate nitrous fumes)
Sodium Nitrite	Ammonium nitrate and other ammonium salts
Toxics/Poisons	
Arsenicals	Reducing agents (will generate arsine)
Azides	Acids (will generate hydrogen azide)
Cyanides	Acids (will generate hydrogen cyanide)
Hydrocyanic Acid	Nitric Acid, alkalis
Hydrogen Sulfide	Fuming nitric acid, oxidizing gases
Selenides	Reducing agents (will generate hydrogen selenide)
Sulfides	Acids (will generate hydrogen sulfide)
Tellurides	Reducing agents (will generate hydrogen telluride)

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APPENDIX L, Biosafety Level 2 – Rooms 280, 290, 367, 376, 380A

Contact the CSU Biosafety Office if you will be working with a new Biosafety Level 2 organism. All standard microbiological procedures apply to BSL-2. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that 1) laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures; 2) access to the laboratory is restricted when work is being conducted (i.e. doors are closed); and 3) all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment. The following special practices, safety equipment, and facility requirements apply to BSL-2:

1. Special Practices

a. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.

b. Laboratory personnel are offered appropriate immunizations for agents handled or potentially present in the laboratory. It may not be safe for immunocompromised people to work in BSL-2 laboratories.

c. The University and lab specific biosafety manual must be available and accessible.

d. The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with BSL-2 agents.

e. Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.

f. Laboratory equipment must be routinely decontaminated, as well as, after spills, splashes, or other potential contamination.

g. Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.

h. Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.

i. Incidents that may result in exposure to infectious materials must be immediately evaluated and treated according to procedures described in the laboratory biosafety manual. All such incidents must be reported to the laboratory PI/ supervisor and Biosafety Officer. Animals and plants not associated with the work being performed are not permitted in the laboratory.

j. All procedures involving the manipulation of infectious materials that may generate an aerosol should be conducted within a BSC or other physical containment device.

2. Safety Equipment (Primary Barriers and Personal Protective Equipment)

a. Properly maintained BSCs (preferably Class II), other appropriate personal protective equipment, or other physical containment devices must be used whenever:

(1) Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating, opening containers of infectious materials, inoculating animals intranasally, and harvesting infected tissues from animals or eggs.

(a) High concentrations or large volumes (greater than 10 L as per NIH rDNA Guidelines) of infectious agents are used.

(b) Such materials may be centrifuged in the open laboratory using sealed rotor heads or centrifuge safety cups.

b. Protective laboratory coats, gowns, smocks, or uniforms designated for laboratory use must be worn while working with hazardous materials.

c. Remove protective clothing before leaving for non-laboratory areas (e.g., cafeteria, library, administrative offices). Dispose of protective clothing appropriately. Laboratory clothing will not be taken home unless it has been decontaminated. Eye and face protection (goggles, mask, face shield or

other splatter guard) is used for splashes or sprays of infectious or other hazardous materials when the microorganisms is handled outside the BSC or containment device. Eye and face protection must be disposed of with other contaminated laboratory waste or decontaminated before reuse. Persons who wear contact lenses in laboratories should also wear eye protection.

d. Gloves must be worn to protect hands from exposure to hazardous materials.

i Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available.

ii Gloves must not be worn outside the laboratory.

iii In addition, BSL-2 laboratory workers should:

(a) Change gloves when contaminated, integrity has been compromised, or when otherwise necessary. Wear two pairs of gloves when appropriate.

(b) Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.

(c) Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste.

e. Eye, face and respiratory protection should be used in rooms containing infected animals as determined by the risk assessment. Every CSU employee or student who wears a respirator MUST participate in the Respiratory Use Surveillance Program. See the CSU Respiratory Protection Program website: http://www.ehs.colostate.edu/wresp/Home.aspx

3. Laboratory Facilities (Secondary Barriers)

a. Same as BSL-1 plus the following:

i Laboratory doors should be self-closing and have locks in accordance with the institutional policies.

ii Laboratories must have a sink for hand washing. The sink may be manually, hands-free, or automatically operated. It should be located near the exit door.

iii BSCs must be installed so that fluctuations of the room air supply and exhaust do not interfere with proper operations. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible airflow disruptions.

iv Vacuum lines should be protected with High Efficiency Particulate Air (HEPA) filters, or their equivalent. Filters must be replaced as needed. Liquid disinfectant traps are required.

v An eyewash station must be readily available.

vi There are no specific requirements on ventilation systems. However, planning of new facilities should consider mechanical ventilation systems that provide an inward flow of air without recirculation to spaces outside of the laboratory.

(1) The Biological Safety Cabinet (BSC) will be tested and certified annually, or after relocation and/ or repair, and operated according to manufacturer‟s recommendations. BSCs can also be connected to the laboratory exhaust system by either a thimble (canopy) connection or a direct (hard) connection. Provisions to assure proper safety cabinet performance and air system operation must be verified before each use.

(2) A method for decontaminating all laboratory wastes should be available and records maintained in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method).

APPENDIX M, Biosafety Clean-up of Biological Fluids

Cleanup Kit

- Gloves; latex and nitrile
- Lab coat; disposable gown
- Face mask, Face shield (preferable) or Eye goggles
- Booties to protect shoes
- Towels
- Disinfectant; not pre-mixed
    - 10% chlorox or 5% lysol (disinfectant may vary by organism)
- Brush, dustpan, tongs
- Puncture-proof container for sharps
- Tape
- Marker pen
- Biohazard bags
- Caution sign and instructions

Personal Protective Equipment (PPE)

- Always use PPE when there is the potential for exposure to blood borne pathogens
- Examine PPE to ensure that it is in good condition
- Damaged PPE must be thrown away
    - Don't store or stockpile for long periods of time

Use of PPE

- Use PPE when cleaning up blood or other potentially infectious material (OPIM)
- Always wear gloves and eye protection
- Disposal
    - Dispose of all cleanup supplies in the red biohazard bag
    - Close the biohazard bag
    - Contact Environmental Health Services for disposal

Sharps

- Sweep sharp objects, such as broken glass, with a broom and dust pan
- Place sharp objects in puncture resistant containers

Cleanup

1. Isolate the area; put up precaution sign
2. Get the bloodborne pathogens response supplies (kit)
3. Put on 2 pair disposable gloves and goggles (gown if available) and face mask
4. Dip towel in disinfectant
5. Gently place towels over the blood/vomit/etc.
6. Leave 15 minutes
7. Starting from outside of area, clean up moving inward
8. Repeat process
9. Dispose of towels in biohazard bag
10. Wipe surface again and wipe (mop) surrounding area (10 feet on each side)
11. Close the biohazard bag
12. Contact EHS for disposal (1-6745)

If You Are Exposed

1. Cleanse all exposed skin with soap and water
2. Rinse mucous membranes or eyes with water
3. Record the name, social security number and phone number of source individual (if they are willing to give this information to you)
4. Record the location and time of incident
5. Report the incident to your supervisor
6. Seek evaluation at University's medical provider
7. Fill out an accident report within 24 hours