UNIVERSITY OF
NORTHERN COLORADO

Laboratory Safety Manual

August 2024

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I. Purpose

This manual provides procedures and guidance for maintaining a safe laboratory environment for faculty, staff, students, and visitors at the University of Northern Colorado (UNC). It is vital that those working within laboratories, whether chemical, biological, radiological, physical science, performing and visual arts, animal, or any other laboratories understand that they may be exposed to additional risks. Individuals in labs play an important role in controlling hazards inside the laboratory and surrounding environment.

The purpose of this manual is to eliminate and minimize the number of incidents that occur within UNC laboratories. Comments and suggestions regarding the further development and improvement of this manual are welcome. Please send comments to the Department of Environmental Health & Safety (EHS).

II. Emergency Contact List

In case of Emergency – Contact UNC Police Department at 911

Department	Phone
UNC Police Department	(970) 351-2245
Environmental Health & Safety	(970) 351-2446
Facilities Management	(970) 351-2446
Animal Research Facility	(970) 351-2842
Arts Annex	(970) 351-2515
Biology	(970) 351-2921
Chemistry & Biochemistry	(970) 351-2559
Crabbe Hall	(970) 351-2143
Frasier Hall	(970) 351-2991
Earth Science	(970) 351-2647
Gunter Hall	(970) 351-2403
Performing Visual Arts	(970) 351-2515
Physics	(970) 351-2961
Poison Control	(800) 222-1222

Each laboratory door should post an emergency contact list.

III. Responsibilities

Any personnel performing laboratory functions should receive proper training in laboratory safety, personal protective equipment (PPE), safe handling and disposal of all materials used in the lab, etc. Each individual is responsible for conducting activities in a safe manner that complies with the applicable requirements of the federal, state, and local regulations, as well as with the university policies and procedures. The following are listed responsibilities in this manual:

Laboratory Personnel (Faculty, Staff, and Students)

- Individual laboratory workers, whether they are faculty, staff, students, or visitors, are responsible for the safety of themselves and others while in the laboratory.
- Be knowledgeable of the policies and procedures and demonstrate that knowledge through responsible actions and attitudes.
- Are required to wear proper PPE; which may include, but is not limited to: a lab coat, gloves, mid-calf in length or mid-calf or lower pants, closed-toed shoes, and eye protection. Cotton material should be worn.
- Notify the Lab Safety Coordinator and UNC Police Department (UNCPD) of spills, accidents, injuries or other emergency situations. (See Section IV for Accidental Exposure/ Emergency Response.)
- Ensure that all flammable, corrosive, oxidizing, and reactive materials as well as any compressed gases are stored in the correct manner and location when they are not in use.
- Are required to participate in all required training programs.

A. Deans / Assistant Vice Presidents

- Ensures the safe operation of all laboratories where hazardous materials are used or laboratory procedures are conducted.
- Ensures compliance with all university policies and procedures pertaining to laboratory safety.
- Has independent enforcement authority to close a laboratory for safety violations.

B. Department Chairs and Directors

- Oversee laboratory safety within departmental laboratories.
- Ensures that laboratories within their departments are in compliance.
- After assessment and review, if needed, complete and update annually. Some procedures may include, Chemical Hygiene Plan, Exposure Control Plan, and any other procedures/plans that pertain to the laboratory process.
- Ensure that PIs and Lab Supervisors develop and implement written site-specific safety procedures.
- Ensure that laboratories complete and update the Chemical Inventory Management System (CHIM).
- Provide annually, to UNCPD and EHS, a laboratory phone contact list, including Laboratory Coordinators.
- Provide support for a departmental safety committee (if committee is active).

C. Principal Investigators (PIs) and Laboratory Supervisors

- Prepares laboratory methods that assure the safety of personnel within the laboratory and surrounding environment.
- Ensure that all personnel within the laboratory are informed of risks and hazards before entering the lab or conducting experiments.
- Provides site specific training on laboratory hazards.
- Writes Standard Operating Procedures (SOPs) for lab procedures not covered under department CHP.
- Maintains access to a current copy of Safety Data Sheets (SDS) for all chemicals used in the laboratory.
- Encourage responsible attitudes and actions within the lab.
- Ensure that appropriate PPE is available to all lab personnel and is being used properly whenever inside the laboratory.
- Ensures that all required safety equipment is accessible and that appropriate training for all safety equipment has been provided. (Safety equipment may include: fume hoods, liquid storage cabinets, eye washes, safety showers, and spill cleanup kits.)
- Report any issues, accidents, injuries, or previously unrecognized hazards within the lab to UNCPD. Report previously unrecognizable hazards to the lab coordinator as well.
- Monitor the creation, storage, labeling and movement of hazardous waste.

- Notify EHS when hazardous waste is being created and follow appropriate procedures as outlined in the Hazardous Materials Management Plan to ensure proper handling and disposal.
- Ensure that information regarding experiment specific hazards and safety procedures is given to lab personnel and students prior to entering the laboratory.
- Investigate all laboratory accidents and alter the laboratory environment, procedures or training as needed to avoid recurrence.
- Ensure that all flammable, corrosive, oxidizing and reactive materials as well as compressed gases are stored and secured at all times.
- Ensure that all hazardous chemicals have appropriate labels.
- Use tools such as the Risk Hazard Assessment (Appendix D) to ensure safety risks are identified within their lab.
- Ensure the safety of visitors.

D. Laboratory Coordinator

- Monitor the procurement, safe handling and disposal of hazardous materials with the assistance of EHS.
- Post appropriate signage and emergency information in laboratories.
- Update the CHIM System, if available.
- Acts as a liaison for EHS to ensure inspection issues are corrected. Notifies EHS if issues require immediate action.
- Provide faculty and researchers with technical guidance and advice on lab safety issues.
- Provides technical support for departmental safety committees.
- Notifies their supervisor of incidents and safety concerns.

E. UNC Police Department

- Respond to campus 911 calls.
- Contacts EHS for guidance and reporting.
- Contact the fire department and emergency medical responders if necessary.
- Provide guidance regarding security concerns for hazardous materials and controlled substances.
- UNCPD has independent enforcement authority to close a laboratory.

F. Environmental Health and Safety (EHS)

- Implements programs that create a safe environment for Faculty, staff, students and visitors.
- Provides a resource to faculty, staff, students, and safety committees on safety matters.
- Provides services regarding hazardous waste disposal and hazardous material spill clean-up.
- Provides guidance and recommendations for compliance with federal, state, and local regulations.
- Investigates laboratory incidents and conducts follow-up activities.
- Schedules annual fume hood surveys and testing.
- Conduct periodic and unannounced laboratory inspections to assure compliance with Federal, State, and local regulations, as well as the university policies and procedures.
- Conducts safety trainings, planning reviews, surveys, and exposure testing as needed.
- Provides recommendations and assistance in obtaining PPE.
- EHS has independent enforcement authority to close a laboratory for life-safety matters.
- Maintains records of accidents and hazardous waste disposals.
- Provides Hazard Communication training.

G. Facilities Management

- Facilities Management maintains facilities and facility-related safety systems to assure continuous operation of laboratories.
- Responsible for repairing fume hoods, mechanical and electrical systems.
- Should be knowledgeable of the labeling and hazard markings on chemicals.

- Should be knowledgeable of any potential energy sources present in a laboratory.
- Should report any spills, accidents, or otherwise hazardous situations to the laboratory supervisor and/or UNCPD.

H. Human Resources

- Maintains all records of all employment injuries
- Maintains all employee medical surveillance records

IV. Accidental Exposure / Emergency Response

Each individual lab and experiment will have its own unique hazards. It is important that each PI/Lab Supervisor be aware of emergency situations or accidents that could arise within their lab and understand how to properly handle those situations, whether that be an evacuation, spill containment, or ventilation.

A. Immediate Action Situations

When a situation arises that threatens the health or life of individuals inside a lab, UNCPD should be contacted at 911. Be sure to explain the details of the emergency as clearly as possible.

B. First Aid / Fire Response

Fire Department

The fire evacuation plan shall be followed (if approved by UNCPD and EHS); otherwise; follow the guidelines below.
In the event of a fire, activate the fire alarm. Remain calm. Only use the fire extinguisher if the fire can easily be extinguished and you are standing between an exit and the fire. If the fire cannot be extinguished with a fire extinguisher, then evacuate the building. PI/Lab Supervisor should be able to guide all lab personnel to the nearest fire exit and be knowledgeable of evacuation procedures. UNCPD should be contacted at 911 or 351-2245.

Skin/Eye Contact

Lab personnel should assist any person who has been exposed to harmful chemicals if it is not at great risk to their own health. Eyewashes or Emergency Showers should be used immediately after hazardous chemical contact. The eyewash should be used for at least 15 minutes and as quickly as possible. Any incident requiring the use of an emergency shower or eye wash should be reported to EHS.
Contact UNCPD for all incidents involving chemical exposures.

Ingestion

Immediately contact UNCPD and the Poison Control Center (800) 222-1222.

C. Spill Clean-up

If a major spill of hazardous chemicals occurs, it should be reported to a laboratory supervisor as quickly as possible. Notify persons in the vicinity of the spill, evacuating all personnel from the spill area and adjoining areas that may be impacted by potential vapors or fire.

If the spilled material is classified as flammable, turn off any potential ignition sources. Avoid breathing vapors of the spilled materials. Be aware that some materials either have no odors or have odors that are detectable only briefly.

Minor Spills

If you have been trained to respond, if necessary, use a spill clean-up kit to control the spilled material. If you have not been trained, notify your supervisor or UNCPD.

Determine the cleaning method by referring to the SDS. If the spill is minor and of known limited danger, clean up immediately.

Always wear proper PPE during cleanup. The protective equipment required will depend upon the material spilled, the amount, and the concentration.

Spill clean-up kits should include instructions, adsorbents, and PPE so that laboratory supervisors or staff can safely and effectively clean minor spills. General rules for spill clean-up includes:

- Cover liquid spills with absorbent such as spill pillows or vermiculite.
- Powdered materials should be covered with wet paper towels (if compatible).
- Corrosives should be neutralized prior to absorption.
- Clean spills from the outer areas, moving towards the center.
- Place recovered material into an appropriately labeled and compatible waste container.

Major Spills

It is the responsibility of all laboratory personnel to be aware of the hazards from chemicals being used. If lab personnel suspect that a spill cannot be remedied with a clean-up kit or doing so would pose a risk to their health they should contact UNCPD. Spills of hazardous material larger than one gallon or spills that are not manageable should be reported to UNCPD. Do not attempt to clean the spill unless instructed by EHS. Laboratories may need to be evacuated and spills professionally cleaned.

Radiation Exposure

Only attempt to correct or remedy hazardous situations with radiological material if you have been trained to do so, otherwise notify the PI/Lab Supervisor.

Remove all personnel from the spill area to a safe location. If it is safe to do so, attend to anyone who has been contaminated or injured. Use safety showers and eyewashes if appropriate. Shut off ventilation, if available, close windows and doors, and turn off hoods if possible. Do not do this if radioactive gas is involved. Notify UNCPD of any radiological spill or release.

D. Environmental Chemical Release

If chemicals are released in to a floor drain or spilled outside of buildings contact UNCPD to determine if the chemical release is subject to special regulatory reporting requirements. Be prepared to provide the name of the chemical(s) involved, quantities released, location and approximate time of the incident. EHS or UNCPD will make contact with the appropriate regulatory agencies and initiate reporting if necessary.

V. Principles of Laboratory Safety

A. Risk Assessment and Awareness

Understanding and recognizing the potential risks found in a laboratory environment is an important step to managing hazards and ensuring safety for all lab personnel. It is vital that any unreported hazards be recognized by laboratory supervisors and corrected.

Laboratory Risk Hazard Assessments (see Appendix D) shall be performed on each laboratory annually or if the function of the lab changes. Departments may use their own Risk Assessment if approved by EHS. The risk hazard assessment should be performed by the PI, Lab Supervisor, and/or Lab Coordinator. The risk hazard assessment shall analyze laboratory procedures including General Safety, Training, Engineering Controls, PPE, Hazardous Materials, etc.

A risk hazard assessment will result in control measures that can reduce laboratory hazards by utilizing smaller volumes of chemicals or by altering procedures. Completed laboratory risk hazard assessments will be maintained by each department. For additional assistance with risk hazard assessment, consult EHS.

B. Laboratory Inspection

The Department of Environmental Health and Safety will randomly inspect laboratories (Appendix E. Laboratory Inspection Checklist). Department created lab inspection checklist may be used if receiving prior approval from EHS. After an inspection, a copy of the report will be provided to the PI and/or Laboratory Supervisor.

C. Standard Operating Procedures (SOPs)

Once a risk hazard assessment has been completed for a project, Standard Operating Procedures (SOPs) can be developed. At a minimum SOPs shall include, but are not limited to the following information:

- PPE to be used
- Engineering controls such as fume hoods or other safety equipment
- Work practice controls such as designated work areas or restrictions
- Monitoring/Testing (if needed)
- Occupational Health requirements (if needed)
- Training requirements
- Storage, cleanup and waste disposal
- Emergency procedures

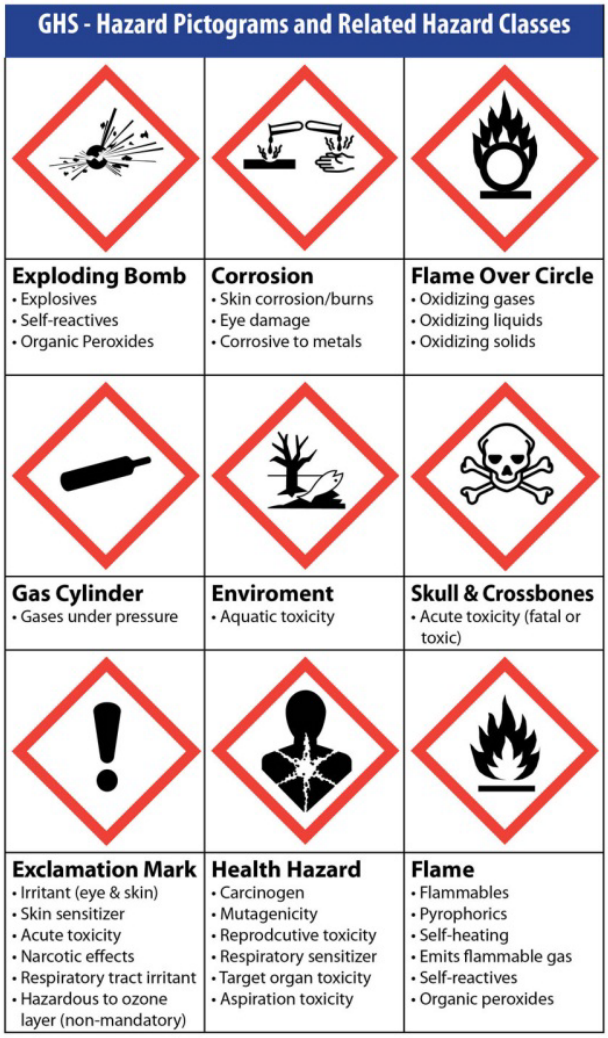
D. Signs and Labels

Hazard signage should be posted in an obvious location near the entrance of each laboratory. Hazard signage may include information regarding laboratory Biosafety Level, required PPE, notably hazardous materials, etc. The determination of information that should be posted is left up to the discretion of the Laboratory Supervisor or Coordinator.

Emergency call lists should be posted in plain sight within each laboratory. The list should include the PI and Laboratory Supervisor's office and cell phone numbers so that they may be a contacted in the event of an emergency as well as including general emergency phone numbers such as UNCPD, poison control, and EHS.

All primary chemical containers within the laboratory should be appropriately labeled, with any old or defaced labels removed. The label should include:

- The product name or identifier
- A hazard pictogram
- Physical, health, or environmental hazards
- Precautionary measures
- Personal Protective Equipment
- Name & address of company



To the right is a chart depicting the Globally Harmonized System (GHS) hazard signage with definitions. Hazardous waste that is generated shall be labeled and dated when placed into a new container for storage. Refer to Section V. (L) for information regarding Hazardous Waste labeling.

E. Training

All lab personnel and students shall be properly trained before beginning any laboratory operations. Initial training should be performed for all new employees and students. The main goal of training should involve informing Faculty, staff, students, and researchers about the hazards within the lab and the protective measures for minimizing exposure/injury. Site-specific training shall be conducted by designated laboratory personnel. Faculty, staff, and students should receive on-going annual refresher training or training whenever a program has changed or is updated. A written record of all training performed should be kept within each department for a minimum of 3 years, unless regulations require longer, and should be available when requested (some regulations may require retention if records longer).

Each department should create specific training plans in order to control risks when working within a laboratory. The following topics are applicable to many lab environments and may need to be included in training:

- Assessing the hazards of the chemicals or materials used and reviewing the assessment with employees.
- Lab-specific SOPs for the safe handling and use of hazardous materials (chemical, biological, radioactive, laser).
- Physical and health hazards (acute and chronic) associated with the materials.
- GHS signage and labeling requirements.
- Signs and symptoms associated with exposures to hazardous materials.
- Review the methods and observations that can be used to detect the presence of hazardous chemicals, such as odor, appearance and monitoring/instrumentation.
- Procedures for using safety equipment including fume hood, biosafety cabinets, special ventilation or other equipment.
- Location of signage including safety signs and emergency numbers.
- Inform lab personnel of the GHS/SDS symbols and hazard warnings.
- The lab's housekeeping procedures.
- The location and availability of the chemical inventory list (CHIM) (within the department), location of SDS, and the location of the University's Laboratory Safety Manuals (General, Biological Safety Manual, Hazardous Material Management Plan, etc.).
- The purpose and contents of Safety Data Sheets.
- An employee should be able to understand an SDS and obtain hazard, handling, and exposure control information from an SDS.
- Procedures for transporting hazardous materials safely.
- Storage location of chemicals and their segregation by compatibility.
- Requirements for chemical labeling on primary and secondary containers.
- Use, storage, and handling of gas cylinders and cryogenics.
- Use of hazardous chemicals that warrant exposure monitoring.
- Inform personnel how to request monitoring by EHS.
- Location of machine guards and their use.
- PPE requirements for personnel including; selection, maintenance and use.
- How personnel can obtain PPE and how to dispose of PPE after use.
- How to respond to an emergency including; exposures, first aid and evacuation route.
- Location of emergency equipment including; spill kits, fire-fighting equipment, alarms, emergency shut-offs, eyewashes and safety showers.
- Emergency procedures including how to clean up spills.
- How to contact UNCPD in the event of an accident/injury.
- Procedures for proper waste disposal including waste location(s) and the process for requesting waste disposal.
- Occupational Health requirements such as medical evaluation, respirator fit-testing, or vaccinations.

<u>Hazard Communication Training</u>

Hazard Communication training should be performed within any laboratory that uses hazardous materials. This training should include:

- Information regarding chemical labels and hazard signs
- Chemical transport
- Safety Data Sheets (SDS)
- Chemical storage guidelines
- Hazards specific to different chemical groups (i.e. oxidizers, acids, flammables)
- Detection of hazardous material exposure (i.e. odors, fumes, physiological effects)
- Definitions of hazardous waste and the regulatory environment
- Spill clean-up and chemical waste disposal procedures

- Waste Disposal
- Emergency Procedures

Refer to the campus Hazard Communication program for additional information.

Specialized training should be performed by PI, Lab Supervisors, or their designee. Specialized training shall be provided, as specified by laboratory procedures or regulatory requirements. The following topics may be required training.

Biohazards

Blood borne pathogens and biosafety training is required for all UNC personnel including faculty, staff, and graduate students who work in laboratories that perform procedures involving potentially pathogenic microorganisms, infectious agents, human tissue, and blood borne pathogens. For more information, refer to the UNC Biological Safety Manual.

Radiation

Radioactive materials pose a unique risk to researchers and laboratory personnel. Exposure to radioactive materials can result in increased morbidity and mortality even if direct contact never occurs. Lab Supervisors should ensure that the appropriate use of PPE is explained and understood. Lab personnel should be knowledgeable about the management of radioactive waste. For more information regarding radioactive material hazards and procedures refer to Section VI. (G).

Lasers

Lasers are devices that produce light at very specific frequencies of the electromagnetic spectrum. Depending on the strength of the laser and wavelength being emitted they may pose a serious risk to skin or eyes. Beams from lasers are often easily reflected from shiny or metallic surfaces. It is important for laboratory supervisors to inform personnel about proper labeling, appropriate PPE (notably eye protection), and safe handling of lasers.

F. Personal Protective Equipment (PPE)

All employees should be provided with the necessary PPE for required work within a lab. In most laboratories, the minimum PPE may include: gloves, mid-calf in length or lower pants, shirt or dress closed-toed shoes and eye protection. The PI and/or Laboratory Supervisor is responsible for deciding what PPE shall be required within their lab depending on the unique hazards present. For more information regarding PPE requirements and recommendations consult the SDS for the materials being used.

Clothing, Jewelry, and Hair

Personal clothing can increase the protection of laboratory personnel even when other PPE is being worn. Required personal clothing includes mid-calf in length or lower pants, closed toes shoes with slip resistant non-absorbent soles, and a shirt or dress. Personnel who wish to wear shorts/sandals to campus should change into appropriate attire prior to working in the lab. While performing lab functions, personnel should wear minimal jewelry and keep long hair tied back.

Eye Protection

Eye protection should be used at all times when working with hazardous materials. Eye protection must have side shields and be impact resistant. Prescription glasses may not be allowed as a substitute for safety goggles or safety glasses.

Students who wear contacts should place a clearly visible red dot on the left side of the goggles, so that in the event of an accidental spill, instructors and students will know that the person involved has

contacts in their eyes. Contacts may not be able to be removed and flushing should be done with contacts in if removal attempts fail.

Gloves

Protective gloves should be made available when hazardous materials are present. The composition of the glove should be determined by the laboratory supervisor based on the materials being handled. Consult the SDS for recommendations.

Gloves should be available in all appropriate sizes for lab personnel. Gloves should be disposed of properly and immediately before exiting the lab to avoid contamination.

Lab Coats

Laboratory coats, gowns or aprons may be worn over personal clothing, covering all exposed skin when hazardous materials are being used.

Other PPE

Additional PPE may be required or recommended to meet laboratory regulations. This equipment includes, but is not limited to hearing protection, thermal protection, or respirators.

Respirators

Respirators may be required in certain areas of research when chemicals and other hazards may be aerosolized, evaporated, sublimed, fumed, or otherwise air borne. If there are any suspicions that an experiment may create an atmosphere that could be hazardous to laboratory personnel, consult EHS for recommendations and monitoring. EHS can evaluate whether there is a need for a respirator and what type of respirator should be utilized. An annual medical respiratory evaluation and mask-fit is required if a respirator is recommended. For additional information on the selection, limitations, inspection, maintenance, storage, training, and medical monitoring for respirator protection and use, refer to the University Respirator Protection Procedure.

The Laboratory PPE Selection Guide can be found in Appendix B, to assist with the selection of materials.

G. Minors in Laboratory Facilities

This section of the manual provides guidance to laboratory personnel regarding minors (individuals under 18 years of age) in any University laboratory or other potentially hazardous facilities. The presence of minors in hazardous areas raises concerns for their safety as well as the safety of workers in the hazardous areas whose attention might be diverted by the presence of minors. This policy applies to all university laboratories and animal facilities. It covers all minors whether a student, employee, or volunteer.

Faculty and staff are directly responsible for compliance with this policy and for the safety of all minors who are approved to be in laboratories under this policy. Refer to Appendix C, to review the Minors in Laboratory Facilities Policy.

H. Service Animal in Laboratories

The Americans With Disabilities Act (“ADA”) defines service animals as dogs trained to do work or perform tasks for a person with a disability. In addition to dogs, revised ADA regulations have a separate provision about miniature horses that have been individually trained to do work or perform tasks for individuals with disabilities. Service animals may accompany people with disabilities in areas where members of the public are allowed. Dogs and other animals whose sole function is to provide comfort or emotional support do not qualify as service animals.

Requirements for Service Animals in Laboratories:

- Service animals must be harnessed, leashed, or tethered unless to do so interferes with the service animal's work or task it performs for the person with the disability or the individual's disability prevents using these devices.

- A person with a disability cannot be asked to remove his/her service animal unless:

    1) the dog or miniature horse is out of control and the handler does not take effective action to control it
    2) the dog or miniature horse is not housebroken

Additional Requirements for Miniature Horses:

- Generally, between 24-34 inches high and weight between 70-100 pounds
- Is housebroken
- Is under the owner's control
- Can facility accommodate its type, size and weight
- Its presence will not compromise legitimate safety requirements necessary for safe operation of the facility

Inquiries Allowed:

When it is not obvious what service an animal provides, only limited inquiries are allowed. UNC faculty and staff may ask two questions:

1) Is the service animal required because of a disability?
2) What work or task is the service animal trained to perform?

Restrictions

There are certain situations or environments that may be considered unsafe for service animals where there may be risks to the safety of the animal, the handler or others. These risks include potential hazards due to chemicals used and/or the layout of the space that may have both safe and potentially hazardous areas for service animals. Appropriate protective clothing and/or equipment for the service animal may need to be provided to mitigate the risk. Discussions about these issues will inform a decision on restrictions, if any, that should be implemented about the service animal's presence in the laboratory. The Disability Support Services (DSS) and Environmental Health and Safety (EHS) Departments will work together to decide what restrictions, if any, are implemented.

Review Process

If an individual requires a service animal in a restricted area, DSS and EHS will gather information to determine the best way to safely facilitate the presence of the service animal including:

- The work or task the service animal provides;
- The person's need for the animal's services during the work period and whether there are acceptable alternative ways of providing those services;
- The physical layout of the laboratory to identify safe and potentially hazardous areas for the animal;
- Potential hazards due to substances used and operation conducted in the laboratory;
- Emergency procedures for both the animal and the handler;
- Appropriate protective clothing and/or equipment for the service animal;
- The way the service animal alerts the handler to warn or protect them; and
- Steps to minimize or prevent negative impact to others in the laboratory

Service Animal Personal Protective Equipment

Service animals entering laboratories must be protected from exposure to hazards such as chemicals, sharp objects or other environmental hazards. Some examples of personal protective equipment are:

- Doggles (protective eyewear)
- Booties (protective footwear)
- Vests
- Plastic-backed absorbent paper for the animal to lie on (protect animal from whatever might be on the floor)

NOTE: Animal beds or fabric pads are not allowed for use in a laboratory.

I. Engineering Controls

Engineering controls are used to limit or remove a hazard from within a lab, and should be the first step to mitigate risks associated with working in a laboratory. Engineering controls may include the use of fume hoods, glove boxes, shielding, PPE, and safety cabinets.

For further guidance regarding the identification, handling, labeling, transporting, and training of hazardous materials please consult the UNC Hazardous Materials Management Plan.

J. Chemical Storage and Transport

General Storage Rules

Chemical materials should be stored in an appropriate place where spontaneous reactions can be avoided and/or contained. Chemicals should be stored in labeled cabinets for flammable, acidic, oxidative or compressed gas. For more information, see the chemical hazards chart in Appendix A. The following rules should be used as a guide regarding chemical storage:

- Read the label of all chemicals carefully before storing to ensure proper safety and risk control. All chemicals should be stored according to their hazard class. Note: this is a simplified scheme and that in some instances chemicals of the same category may be incompatible.
- If chemicals have multiple hazards, segregate by using the characteristic that exhibits the primary hazard.
- Do not store chemicals in alphabetical order. Chemicals should be segregated by their hazard class. Only within hazard groups may chemicals be stored in alphabetic order if deemed appropriate.
- Date chemicals when received and first opened. If a particular chemical can become unsafe while in storage, (e.g., diethyl ether) then an expiration date should also be included. Keep in mind that expiration dates set by the manufacturer do not necessarily imply that the chemical is safe to use up to that date.
- Do not use work surfaces as permanent storage for chemicals. In these locations, the chemicals could easily be knocked over, incompatible chemicals may be alongside one another, and the chemicals will be unprotected in the event of a fire.
- Do not use fume hoods as permanent storage locations, except in certain circumstances that may require this.
- Each chemical should have an appropriate and designated storage location.
- Make sure chemical lids are tightly closed to prevent chemicals from being released into the lab.
- Do not store bottles on the floor unless they are in a secondary container that would contain a spill.
- Chemicals that require refrigeration should be sealed with tight-fitting caps and securely placed within the refrigerator. Explosion proof refrigerators/freezers should be used for cold storage of chemicals. Refrigerators not specified as explosion proof can be a potential ignition source.
- Lab freezers and refrigerators should be clearly labeled with a statement such as “Laboratory Refrigerator” and “No Food Storage”.

- Do not store hazardous chemicals or any liquids above eye level.
- Do not store chemicals or combustible materials near heat sources such as ovens, Bunsen burners, hot plates, steam pipes or in direct sunlight.

K. Stockrooms

Stockrooms or areas where large volumes of chemicals are stored for multiple laboratories should adhere to the following guidelines:

- Certain chemicals may need to be segregated in a well-identified area.
- All stockrooms, laboratories, or other locations that have stored chemicals should perform an inventory check at least annually. Inventory checks should review expiration dates and visually inspect containers for damage, proper labeling, and general material deterioration. Chemicals that are expired or deteriorating should be properly disposed of as described in Section V. (L).
- Damaged containers should be remedied as soon as possible. It is the laboratory supervisor's duty to determine if the chemicals within the container are salvageable in such situations.
- Chemicals with defaced labels should have their labels immediately replaced.

L. Storage Cabinets

In order to ensure that chemicals have a maximum shelf-life and that Faculty, staff, students and visitors are protected, proper chemical storage is essential. Chemicals should be stored in a secure container and separated from incompatible materials. Storage such as cabinets or shelving should be periodically checked to analyze stability and corrosion.

<u>Flammable Storage Cabinets</u>

- The ideal location for flammable chemicals is in a fire cabinet labeled "FLAMMABLE" or in an explosion-proof or explosion-resistant refrigerator.
- Flammable storage cabinets are designed to protect the contents from the heat and flames of external fire rather than to confine burning liquids within. They can perform their protective function only if used and maintained properly.
- Always ensure that cabinet doors are kept closed unless removing or returning chemicals.
- Limit the amount of flammable materials available for immediate use by using as small of quantities as possible during experiments.
- Flammables that are not being used should be returned to flame resistant storage cabinets.
- Flammable storage cabinets should be used for all labs that regularly use flammable chemicals.

<u>Acid Storage Cabinets</u>

- Acids should be kept in acid storage cabinets specifically designed to contain spills and avoid corrosion.
- If acid cabinets are not available acids should be stored in plastic tubs on wooden shelves.
- Nitric acid should be stored in its own acid tray or acid cabinet compartment.

<u>Compressed Gas Cylinder Storage</u>

- Cylinders containing hazardous compressed gases that are acutely hazardous to human health should be kept in a continuous mechanically ventilated enclosure.
- All compressed gas cylinders having a NFPA Health Hazard Rating of 3 or 4 (e.g. ammonia, chlorine, phosgene) and those with a Health Hazard Rating of 2 but no physiological warning properties (e.g. carbon monoxide) should be kept in a gas cylinder cabinet.
- Storage locations should be maintained at appropriate temperatures (Check SDS for specific ranges).
- Never store or use cylinders in corridors, stairwells, near exits, or doorways.

- Chain or strap all cylinders to a sturdy object, like a wall or lab bench. Do not secure cylinders to water lines, gas piping or other utilities.
- Store empty and full cylinders separately (by hazard class) and clearly indicate whether they are full, empty or in use with status tags attached to the cylinders. Return empty cylinders to suppliers as soon as possible.
- Keep caps on all cylinders except when connected for use.
- For additional information refer to the UNC Compressed Gas Cylinder Guidelines.

M. Shipping/Transporting Chemicals

Only individuals who are familiar with the chemical/hazard being transported and are trained to respond to a release of such a hazard should transport hazardous materials. Any explosive, notably hazardous or unstable materials should be reported to EHS before being transported. The following general rules should apply whenever transporting chemicals:

- Containers and bottles must be labeled.
- Spill absorbent materials and the SDS for the chemicals should be available at all times.
- When chemicals are carried, they should be placed in a secondary container such as an acid-carrying bucket, or other appropriate container to protect against breakage and spillage.
- Use sturdy carts for transporting multiple, large, or heavy containers; the cart should have wheels large enough to negotiate uneven surfaces without tipping or stopping suddenly.
- Carts used for secondary containment should have a liquid-tight tray with lips on four sides.
- Chemicals should not be transported during busy times, such as during class changes, lunch break, events, etc.
- Stairs should be avoided if at all possible.
- Never leave chemicals unattended.

Outside of Campus or Inside a Vehicle

The US Department of Transportation (DOT) requires individuals that ship or receive hazardous goods to receive special training on the Shipment of Dangerous Goods. The materials must be packaged by EHS or personnel within the University who have been specifically trained to package these materials.

For information regarding biological shipments and transportation refer to the UNC Infectious Agents and Biological Materials Shipping Guidelines.

N. Hazardous Waste Disposal

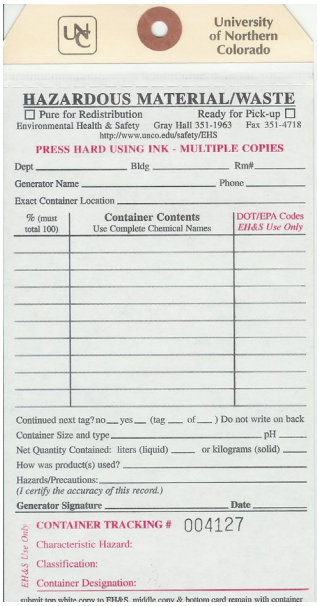
“Hazardous Material” is any material or substance, which if improperly handled, can be damaging to personal health and the environment. PI, Laboratory Supervisors, or Laboratory Coordinators are responsible for advising and training laboratory workers on how to handle all wastes generated in laboratory operations.

Chemical Waste Containers

Hazardous waste should be stored in appropriate waste containers that are composed of materials that are compatible with the chemicals they hold. Waste should not be placed into unwashed containers that previously held an incompatible material.

If a container holding hazardous waste is no longer in good condition or if it begins to leak, transfer the waste to a compatible container that is in good condition. If the material is unable to be transferred, pack the leaking container into a larger, non-leaking container, or provide some other secondary containment to prevent the accidental release of the material. Hazardous Waste containers should be clearly labeled with the fully written chemical name.

All chemical wastes should be properly labeled as “waste” and tagged with a completed UNC Hazardous Material / Waste tag. If the collection container contents contain a mixture, all components should be listed by percent or volume on the UNC waste tag. Hazardous waste should be placed in the designated hazardous waste storage accumulation area.


University of Northern Colorado

HAZARDOUS MATERIAL/WASTE

☐ Pure for Redistribution Ready for Pick-up ☐

Environmental Health & Safety Gray Hall 351-1963 Fax 351-4718

http://www.unco.edu/safety/EHS

PRESS HARD USING INK - MULTIPLE COPIES

Dept _____ Bldg _____ Rm# _____

Generator Name _____ Phone _____

Exact Container Location _____

% (must total 100)	Container Contents Use Complete Chemical Names	DOT/EPA Codes EH&S Use Only

Continued next tag? no ___ yes ___ (tag ___ of ___) Do not write on back

Container Size and type _____ pH ____

Net Quantity Contained: liters (liquid) ____ or kilograms (solid) ____

How was product(s) used? _____

Hazards/Precautions: _____

(I certify the accuracy of this record.)

Generator Signature _____ Date _____

EH&S Use Only

CONTAINER TRACKING # 004127

Characteristic Hazard:

Classification:

Container Designation:

Some general rules regarding hazardous waste disposal are:

- EHS should be contacted in advance by a PI, Laboratory Supervisor, or Laboratory Coordinator to schedule a request for the disposal of hazardous waste.
- Waste containers should be kept closed except when adding or transferring waste.
- Accumulation containers can be stored in a designated laboratory fume hood or on the floor (5 - 30 gallon containers), but not in an aisle. They should not be placed in front of or behind doors or windows, blocking means of egress or suspended from equipment. Accumulation container locations must be pre-approved by EHS.

For additional information regarding hazardous waste identification, handling, packaging, storage, and training consult the UNC Hazardous Materials Management Plan.

Biological Waste

Biological hazardous material is any biological material capable of causing harm to humans, animals or plants. This includes human waste products, animals, bacteria, fungi, parasites, prions, viruses, etc. The only acceptable treatment for biological waste at UNC is autoclaving. Autoclaving should be done to the extent that no portion of the container remains untreated.

Departments that are autoclaving waste shall maintain a written log on all waste that is autoclaved. This log shall contain the name of operator, date, time, approximate weight or volume of waste autoclaved, and the temperature of material.

For more information regarding the storage and handling of biohazard waste consult the UNC Biological Safety Manual.

O. Safety Equipment

Safety equipment includes spill kits, first aid kits, and fire extinguishers. All safety equipment should be labeled and stored in the same area so that it is easily accessible in the event of an emergency.

Spill Kits

Certain labs may need a spill kit with contents specific to the chemicals being used in that laboratory. It is the responsibility of the PI or Laboratory Supervisor to recognize hazards that are unique to their laboratory and create an effective spill kit for their environment. Consult the SDS for any unfamiliar chemicals for information on potential hazards and spill response.

The following items are suggestions for a general spill kit, as a guide to remedy most spills:

- Personal Protective Equipment (i.e. elbow length gloves, aprons, goggles)
- Scoops or shovel for solid spills and absorbent clean-up
- Hazardous Waste labels and containers
- Neutralizing agents (i.e. Sodium bicarbonate)
- Inert absorbents (i.e. vermiculite)
- Inert adsorbent pads and pillows

First Aid Kits

A First Aid kit should accessible to all laboratory personnel and visitors within the area. The items contained within the First Aid Kit should be consistent with the injuries that are probable in the laboratory. Supplies should be single-use to ensure sterility and protect against premature expiration.

Fire Extinguishers

Fire extinguishers should be placed in plain sight and easily accessible. Depending on the hazardous material used, ensure that the appropriate classification of fire extinguisher is readily available. If a fire extinguisher is used, submit a work request to Facilities Management, as it will need to be replaced.

P. Utility Systems

Laboratory staff may not perform any modifications to any utility systems in buildings or labs. No part of the ventilation, electrical, plumbing (water and gas) may be tapped into, repaired, removed, added, or tampered with in any way by anyone other than Facilities Management or licensed contractors. If work is needed or if there are any concerns regarding these systems, submit a work request or contact Facilities Management to assess system requirements.

Facilities Management maintenance employees who perform work on fume hoods such as entering or removing duct work, changing filters, shutting off fans or other maintenance that requires entering the inside of the exhaust system, should consult the UNC Fume Hood Procedure.

Ventilation

Ventilation systems for laboratories are generally designed to provide six to twelve air changes per hour at a slightly negative pressure relative to hallways and office space. It is important to keep laboratory doors and windows closed, as much as possible, for proper pressure balance and ventilation of the lab.

Fume Hoods

Chemical fume hoods are intended to remove vapors, gases and dusts of toxic, flammable, corrosive or otherwise dangerous materials. All laboratory personnel should be trained on the proper use of fume hoods.

If a fume hood low airflow alarm is sounding, the lab staff should immediately end work operations conducted in the hood, seal all chemical containers and close the sash. Do not mute, ignore or disconnect any fume hood alarm. It is the responsibility of laboratory staff to halt all work in a hood that is not functioning properly. Contact Facilities Management to have a fume hood evaluation conducted. Laboratory staff may need to clear the hood of chemicals and equipment.

Facilities Management or a designated contractor will conduct hood testing annually as mandated by various regulations and fire codes.

Plumbing Systems

Tap water should not be left flowing for prolonged periods unless needed for specific laboratory processes. A refrigerated re-circulating system should be used to cool experiments or equipment to minimize potential damage from leaks and flooding. The use of these closed loop systems is required to minimize wasting of water resources.

Isolated or unused sinks and floor drains may be a source of foul odors if water traps become dry. If a sink is located in an isolated area and will not be used for a significant amount of time, please contact Facilities Management for proper treatment.

VI. Working with Hazardous Materials

A. General Rules for Handling Hazardous Materials

Before starting any work in the lab, personnel should be trained on lab procedures and familiarized with equipment being used. Lab personnel should be made aware of any chemical hazards before beginning work operations. Personnel who are unfamiliar with the hazardous material or a new procedure should consult their supervisor.

Personal Safety Practices

- Always wear proper personal attire and PPE as needed when in the lab.
- Pets are not allowed in laboratories.
- Minors are only allowed in laboratories if they fulfill the requirements of Section V. (G).
- Do not mouth pipette.
- Secure any dangling jewelry, restrain loose clothing, and tie back long hair that might get caught in equipment before starting work.
- Avoid working alone in the lab. If you must work alone, ensure someone is aware of your location, such as a supervisor.
- Wash your hands frequently throughout the day and before leaving the lab.
- Do not wear lab coats, gloves, or other personal protective clothing outside of lab areas. This clothing may have become contaminated and you could spread the contamination.
- Cell phones and use of music headphones should be avoided while working in the lab. They can be distracting and thereby increase the potential for an accident to occur. They can also become contaminated if handled while working with hazardous materials.
- Food/Beverages and hazardous chemicals do not mix. No lab personnel or visitor shall be permitted to consume food or beverages, or chew gum in any area where hazardous chemicals may be present. These items cannot be stored in any refrigerator or freezer, within a laboratory, that contains hazardous materials.

Housekeeping and Decontamination

- Work areas should be kept clean and free of unnecessary chemicals. Clean the work area throughout the day and before leaving the lab for the day.
- If necessary, clean equipment after use to avoid the possibility of exposing the next person who uses it.
- Keep all aisles and walkways in the lab clear to provide a safe walking surface and an unobstructed exit. Do not block doors.
- Do not block access to emergency equipment (i.e. fire extinguishers, eyewashes, etc.), emergency shut-offs, and utility controls (i.e. electrical panels).

Steps to Prevent Routine Exposure

- Develop and encourage safe habits.
- Avoid unnecessary exposure to chemicals by any route.
- Do not smell or taste chemicals.
- Vent any apparatus which may discharge toxic chemicals (e.g., vacuum pumps, distillation columns) into approved local exhaust devices such as fume hoods.
- Inspect gloves and test glove boxes before use.
- Do not allow the release of toxic substances in cold rooms or warm rooms, since these have contained, re-circulated air.

Glassware

- Inspect all glassware before use. Discard any broken, cracked, or chipped glassware.
- Glassware used in vacuuming situations shall be shielded.

- When transporting chemical containers from lab to lab, use a cart if moving more than two bottles.
- Follow the proper safety techniques when inserting glass tubes or rods into stoppers (Wear heavy gloves, lubricate the glass, ensure compatibility, etc.).

Laboratory Apparatus Guidelines

- Only use equipment that is free from cracks, chips, or other defects.
- If possible, place a pan under a reaction vessel or other container, to contain liquid if the glassware breaks.
- Do not work with flammable liquids near burners or any other ignition sources.
- Properly support and secure condensers and water hoses with clamps and wires. Be sure to direct water hoses so that any drips that come off the hoses do not splash down onto any electrical wires.
- Position apparatus that is attached to a ring stand with the center of gravity over the base and not to one side.
- Assemble the apparatus so that burners or baths can be removed quickly.
- Use an appropriate vapor trap and confine the setup to a fume hood if there is a possibility of emitting hazardous vapors.
- Put the setup in a fume hood whenever conducting a reaction that could result in an implosion or explosion. Keep the sash pulled down. If it is not possible to use a fume hood, use a standing shield that is stabilized and secured.

Centrifuges

- Securely anchor centrifuges in a location that will not result in vibration. Do not leave the centrifuge on without ensuring there is no vibration.
- Use a bench top without equipment that could fall if the centrifuge vibrates.
- Keep the centrifuge lid closed when running.
- Regularly clean rotors and buckets and ensure that the centrifuge is serviced per the manufacturer's recommendations.
- Use sealed safety cups while centrifuging hazardous materials.

Ultraviolet Lamps

- Wear ultraviolet absorbing protective safety glasses while working with ultraviolet light.
- Protect your skin from potential burns due to ultraviolet light.
- Shield any project in which ultraviolet light is used to prevent escape of the direct beam or scattered radiation.

Lasers

- Always wear goggles that protect against the specific wavelength of the laser.
- Never look directly at the beam.
- Do not allow any reflective materials in or along the path of the beam.

Separatory Funnels

- Use extreme caution if the temperature of the material is elevated.
- When a volatile solvent is used, swirl the un-stoppered separatory funnel first to allow some solvent to vaporize and to release pressure.
- Vent the separatory funnel into a fume hood.
- Close the funnel and invert it with the stopper held in place, then immediately open the stopcock to release pressure.
- Do not vent the separatory funnel near a flame or any other ignition source.
- Close the stopcock, swirl the funnel, then immediately open the stopcock with the funnel in an inverted position to vent the vapors again.

Fume Hoods

- Use a fume hood for all procedures that might result in the release of hazardous chemical vapors or dust.
- You can confirm that the hood is working before use by holding a Kimwipe®, or other lightweight paper, up to the opening of the hood. If the hood is working properly, the paper will be pulled towards the hood.
- Leave the hood "on" when it is not in active use if toxic substances are stored inside or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."
- Equipment and other materials should be placed six inches behind the sash to maximize fume hood efficiency.
- When in use, keep the hood sash as pulled down as low as practical. The sash should be at or below 18 inches at all times.
- When the hood is not in use, pull the sash all the way down.
- If large equipment must be kept in a fume hood, raise it off the work surface to allow air to flow underneath. This dramatically reduces the turbulence within the hood and increases its efficiency.
- Do not place objects directly in front of a fume hood as this can disrupt the airflow and draw contaminants out of the hood.

B. Flammable Chemicals

- Flammable substances should be appropriately stored and safely used. Inappropriate use or storage could lead to vaporization, ignition, burns, or explosions. Consult Section V. (J) for storage information.
- The SDS should be consulted to determine the characteristics of any flammable chemicals that are unfamiliar to lab personnel. Information such as the flash point of the liquid should be understood in order to safely store chemicals.
- Flammable chemicals should be handled in areas free of ignition sources.
- Flammables should not be heated with an open flame.
- Flammable liquids should be used in a well-ventilated area or under a fume hood to avoid vapor accumulation.
- The proper storage location for flammable chemicals is in a fire cabinet labeled “FLAMMABLE” or in an explosion-proof or explosion-resistant refrigerator.
- Limit the amount of flammable material available for immediate use, by using as small of quantities as possible during experiments.
- Be aware of a liquid’s *Vapor Density.* Flammable vapors with densities greater than 1.0 (and thus “heavier” than air) are hazardous because they can accumulate at floor level and spread.

Flammable Acute Health Effects

- Inhalation - headache, fatigue, dizziness, drowsiness, narcosis (stupor and unresponsiveness).
- Ingestion - slight gastrointestinal irritation, dizziness, fatigue.
- Skin Contact - dry, cracked, and chapped skin.
- Eye Contact - stinging, watering eyes, and inflammation of the eyelids.

Flammable Chronic Health Effects

The chronic health effects will vary depending on the specific chemical, the duration of the exposure and the extent of the exposure. However, damage to the lungs, liver, kidneys, heart and/or central nervous system may occur. Cancer and reproductive effects are also possible.

C. Oxidizers

Oxidizers present fire and explosion hazards on contact with flammable and combustible materials. Depending on the class, an oxidizing material may increase the burning rate of combustibles which it

contacts; cause the spontaneous ignition of combustibles which it contacts, or produce an explosive reaction when exposed to heat, shock or friction.

Oxidizer Acute Health Effects

Some oxidizers such as nitric and sulfuric acid vapors, chlorine, and hydrogen peroxide act as irritant gases. All irritant gases may cause inflammation in the surface layer of tissues when in direct contact. They can also cause irritation of the upper airways, conjunctiva, and throat.

Oxidizer Chronic Health Effects

Nitrobenzene and chromium compounds can cause hematological and neurological changes. Compounds of chromium and manganese can cause liver and kidney disease. Chromium (VI) compounds have been associated with lung cancer.

D. Corrosive Chemicals

- Corrosive chemicals include acids, bases, oxidizing agents, and dehydrating agents.
- Secondary containment such as plastic tubs or bottle carriers should be used.
- Corrosives should be stored away from metals, flammables, and oxidizing materials.
- The ideal location for corrosive chemicals is in appropriately labeled individual cabinets labeled “ACIDS”, “BASES”, or OXIDIZERS”.
- If a spill occurs it is important to understand that proper clean-up may involve neutralization with an appropriate complementary compound.
- Add acid to water, but never add water to acid.
- Corrosives are most commonly acids and bases, but many other materials can be severely damaging to living tissue.
- Corrosives can damage tissue. Inhalation of the vapor or mist can cause severe bronchial irritation. Corrosives are particularly damaging to the skin and eyes.
- Certain substances considered non-corrosive in their natural dry state are corrosive when they come in contact with moist skin or mucus membranes.

Corrosive Acute Health Effects

- Inhalation - irritation of mucus membranes, difficulty in breathing, fits of coughing, pulmonary edema
- Ingestion - irritation and burning sensation of lips, mouth, and throat; pain in swallowing; swelling of the throat; painful abdominal cramps; vomiting; shock; risk of perforation of the stomach.
- Skin Contact - burning, redness and swelling, painful blisters, profound damage to tissues, and with alkalis; a slippery, soapy feeling.
- Eye Contact - stinging, watering of eyes, swelling of eyelids, intense pain, ulceration of eyes, loss of eyes or eyesight.

Corrosive Chronic Health Effects

Symptoms associated with a chronic exposure vary greatly depending on the chemical. For example, the chronic effect of hydrochloric acid is damage to the teeth; the chronic effects of hydrofluoric acid are decreased bone density, fluorosis, and anemia.

E. Compressed Gas

- Knowing the chemical characteristics of a compressed gas is important in understanding both the substance’s chemical and physical hazards.
- All compressed gas cylinders that pose a significant risk to human health such as ammonia, chlorine, phosgene, or carbon monoxide should be stored in a gas cylinder cabinet. If needed, EHS can assist with the determination of the Health Hazard Rating for compressed gases.
- Cylinders should be stored upright and secured with chains, straps, or racks at all times (unless manufacturers recommend different storage protocols).
- Reactive gases should be stored separately and flammable gases should be kept away from oxygen.

- All gas cylinders should be labeled with the compounds name, any hazard labels, and the stage of use (full vs empty).
- All compressed gas should be kept away from heat or ignition sources and be stored in a well-ventilated area.
- Report all damaged cylinders to the Lab Supervisor.
- Release pressure and close the valve after the gas cylinders have been used.
- Flexible tubing for compressed laboratory gases or vacuum lines should only be connected following the cylinder's regulator or the valve, but the length of the tubing should be minimized. It cannot be run across the lab, through doors or over the ceiling tiles.
- Do not store cylinders horizontally.
- Keep all compressed gas containers as close to room temperature as possible or the temperature recommended by the manufacturer.
- Ideally compressed gas should be purchased from suppliers who allow the exchange or return of unused gas and cylinders.
- For additional information review the UNC Compressed Gas Cylinder Guidelines.

F. Cryogenic Chemicals / Dry Ice

- Eye protection, thermal protective gloves, closed-toed shoes, long pants, and long sleeves should be worn.
- Cryogenic gases may cause asphyxiation due to the displacement of breathable air.
- Never lower your head into a dry ice chest; this may result in asphyxiation.
- Exposed glass portions should be taped to avoid flying glass due to breaks or implosions.
- If a Dewar or other cryogenic container fractures, vacate the area, vent the room, and contact EHS before returning to the area.
- Dry ice should be stored in a thermally insulated container to discourage sublimation.
- Do not transport cryogenic liquid or dry-ice in a closed vehicle.
- Seek medical attention if frostbite injuries occur.

<u>Cryogenic Acute Health Effects:</u>

- Liquid cryogens warmed above their critical temperature will generate high pressures that can cause a confining vessel to rupture or even explode. Fully containing a cryogenic fluid as a liquid at room temperature is usually not feasible. For example, the pressure required to maintain liquid nitrogen at room temperature is 43,000 psi.
- Inhalation - Cryogens have significant potential for creating oxygen deficiency because they have large liquid-to-gas expansion ratios.
- Skin Contact - Serious burns to the skin can result from direct contact with a cryogen or related equipment (Frost bite).
- Eye Contact – Permanent damage to the eyes can result from contact with liquid cryogenic materials.

G. Radioactive Materials

Radioactive materials pose a unique risk to researchers and laboratory personnel. Radioactive material can result in increased morbidity and mortality even if direct contact never occurs. The following information are minimum guidelines that should be followed when dealing with radiation in the laboratory:

- All radioactive material (i.e. source material, sealed sources, devices containing sources, labeled materials and waste) should be in constant attendance by the trained user, or otherwise locked or secured to prevent unauthorized removal or tampering
- Radiation producing devices are to be secured to prevent operation by unapproved persons. Security measures include limiting access to all devices and limiting access to keys that energize power systems.
- Radioactive material shall be stored in sealed containers to prevent accidental spillage, breakage, contamination and to prevent release.

- If the radionuclide requires shielding, containers will be shielded to prevent excessive or unnecessary exposure.
- Floors where nuclear materials are used should have smooth, nonporous, easily cleanable surfaces. Appropriate floor materials include vinyl, tile and sealed concrete. Benches should have nonporous, easily decontaminated surfaces. Surfaces of high-quality plastic laminate or stainless steel are preferable.
- Sinks should be stainless steel or of seamless molded construction.
- Microwave ovens in radionuclide laboratories should not be used for heating food or beverages for personal use.
- A “Caution-Radioactive Material” sign should be conspicuously posted at each entrance of a radionuclide laboratory.
- Locations within the laboratory where radionuclides are used or stored (hoods, refrigerators, microwave ovens, etc.) should also be labeled indicating the presence of radioactive material.
- When working with radioactive materials, adequate PPE must be worn to reduce exposure (i.e. lead aprons).
- An inventory record of the types and quantities of radionuclides possessed by each PI, Laboratory Supervisor, or Laboratory Coordinator at a given time should be maintained.

H. DEA Controlled Substances

DEA Controlled Substances regulations are expected to be general guidelines and do not cover all parts of federal or state controlled substance regulations. Laboratory Supervisors using controlled substances in their laboratory research (including animal research) are subject to federal and state regulatory requirements. These requirements (including licensing/registration) are separate from and in addition to any that apply to medical practitioners, i.e., MDs. MDs/PhDs conducting laboratory research who also must obtain licensure/registration for laboratory use of controlled substances.

It is the responsibility of each Laboratory Supervisor to obtain appropriate licenses and registration, and to adhere to applicable federal and federal regulatory requirements when working with controlled substances. UNC Purchasing and Contracts Department will assist with all appropriate license and registration agreements.

Storage:

To protect against theft or diversion, all controlled substances must be kept locked in their storage location except for the actual time required for authorized staff to remove, legitimately work with, and replace them.

Controlled substances must be stored in a substantially constructed cabinet. This cabinet must be kept locked at all times. The room in which the cabinet is located must have limited access during working hours and provide security after hours.

An inventory record of controlled substances must be maintained by the PI, Laboratory Supervisor, or Laboratory Coordinator.

Controlled substances possessed, kept, or otherwise stored in a manner or location not in compliance with federal or state law are subject to seizure by and forfeiture to federal, state, and university officials. Failure to comply with applicable requirements may also result in a suspension of purchasing privileges.

For additional information on laws and requirements for controlled substances, contact the UNC Police Department and review the DEA website.

VII. Record Keeping

Accident Reporting

Any accidents that result in direct injury or pose a threat to human or animal health should be immediately reported to the UNC Police Department.

Any near misses or potentially hazardous situations that are identified within the lab should be reported to EHS for evaluation.

Any spill or chemical release that could potentially contaminate the surrounding environment should be reported immediately to UNCPD and EHS (i.e. hazardous waste poured down drains). Any medical records associated with a person's exposure to hazardous materials will be maintained by the University in accordance with state and federal regulations.

Hazardous Chemical Inventory

Maintaining current records of hazardous chemicals assists in implementing proper storage and safety procedures and is necessary for emergency response pre-planning, both by EHS, UNCPD, and the Greeley Fire Department. It is the PI's, Lab Supervisor's, and/or Lab Coordinator's responsibility to keep an updated hazardous chemical inventory on file. The CHIM System should be updated at a minimum, annually. High-risk substance usage should also be recorded. These include acutely toxic chemicals, controlled-substances, and highly infectious biological materials.

Safety Data Sheets (SDS)

Safety Data Sheets provide specific information on hazardous materials. It is the responsibility of each laboratory to maintain an inventory of all SDSs for the chemicals used or brought into the lab. A hardcopy of this inventory, such as an SDS notebook, must be kept within easy access in case of an emergency. The SDS for new chemicals utilized in the lab should be added to the inventory/notebook before use. Each department is responsible for maintaining and updating SDS's as well as ensuring that lab personnel are aware of the location of the SDS notebook. For additional information on SDS requirements, refer to the UNC Hazard Communications Program.

Training Documents

All training documents should be maintained by the department from which they originated and should be readily available to be reviewed if requested. Refer to regulatory requirements for each document, regarding the required duration of document filing.

Appendix A. Incompatible Chemicals Table

CHEMICAL	IS INCOMPATIBLE WITH
ACETIC ACID	Chromic acid, nitric acid, hydroxyl-containing compounds, ethylene glycol, perchloric acid, peroxides, and permanganates
ACETONE	Concentrated sulfuric and nitric acid mixtures or chloroform and bases
ACETYLENE	Copper tubing, halides, silver, mercury and their compounds
ALKALI METALS	Aluminum, calcium, lithium, magnesium, potassium and sodium with water or chlorinated hydrocarbon, carbon dioxide, halogens
AMMONIA, ANHYDROUS	Mercury, halogens, calcium hypochlorite, hydrogen fluoride
ANILINE	Nitric acid and hydrogen peroxide
AZIDES	Acids
BROMINE	Ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine
CHLORATES	Ammonium salts, acids, metal powders, sulfur, finely divided organic and combustible materials
CHROMIC ACID	Acetic acid, alcohol, camphor, flammable liquids, glycerol, naphthalene
CHLORINE	Ammonia, acetylene, butadiene, benzene and other petroleum fractions, hydrogen, sodium carbides, powdered metals
COPPER SALTS	Acetylene, hydrogen peroxide
CYANIDES	Acids
ETHYLENEDIAMINE	Greater than 3 percent with methylene chloride (explosive)
FLAMMABLE LIQUIDS	Ammonium nitrate, chromic acid, hydrogen peroxide, halogens, nitric acid, sodium peroxide
HYDROCARBONS	Generally: fluorine, chlorine, bromine, chromic acid, sodium peroxide
HYDROGEN PEROXIDE	Copper, chromium, iron, most metals and their salts, flammable fluids, aniline, and nitromethane
HYDROGEN SULFIDE	Nitric acid and oxidizing gases
IODINE	Acetylene, ammonia
MERCURY	Acetylene, hydrogen
METHYLENE CHLORIDE	Greater than 3 percent ethylenediamine (explosive)
NITRIC ACID	Acetic, chromic and hydrochloric acids, aniline, carbon, hydrogen sulfide, flammable fluids, or gases which are readily nitrated
OXYGEN	Oils, grease, hydrogen, flammable liquids, solids, and gases
OXALIC ACID	Mercury, silver
PERCHLORIC ACID	Acetic anhydride, alcohol, bismuth - & its alloys, organic materials, e.g., wood, paper, grease, and oils
PHOSPHORUS	Air, alkalis, oxygen, reducing agents
PHOSPHORUS PENTOXIDE	Water
POTASSIUM PERMANGANATE	Glycerine, ethylene glycol, benzaldehyde, sulfuric acid
SODIUM	Carbon dioxide, carbon tetrachloride, water
SODIUM PEROXIDE	Any oxidizable substances; acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerol, ethylene glycol, ethyl acetate, methanol, furfural, glycerine
SULFURIC ACID	Potassium chlorate, potassium perchlorate, potassium permanganate

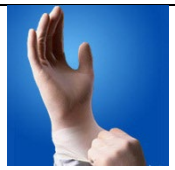
Appendix B. Laboratory PPE Selection Guide

UNIVERSITY OF
NORTHERN COLORADO

Laboratory PPE Selection Guide

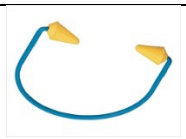
This document may be used by Laboratory Coordinators, Principal Investigators, and Laboratory Supervisors to devise an appropriate PPE recommendation for individuals within their lab.

For additional information regarding PPE, for specific hazards or chemicals, consult the appropriate SDS.

Light latex, vinyl or nitrile gloves		**Disposable latex** Powdered or un-powdered	Working with biological hazards (human blood, body fluids, tissues, blood-borne pathogens, specimens), BSL1, BSL2, BSL2+, BSL3
		**Disposable nitrile** Puncture, abrasion resistant, protection from splash hazards	Working with biological hazards and chemical splash hazards
		**Disposable vinyl** Economical, durable, similar to latex	Working with biological hazards, BSL1, BSL2, BSL2+, BSL3
Light chemical resistant gloves		**Natural rubber latex** Chemical resistant, liquid-proof	Working with small volumes of corrosive liquids, organic solvents, flammable compounds
Light to heavy chemical resistant gloves		**Nitrile** Chemical resistant, good puncture, cut, and abrasion resistance	Using apparatus under pressure, air or water reactive chemicals
Heavy chemical resistant gloves		**Butyl** High permeation resistance to most chemicals	Working with large volumes of organic solvents; small to large volumes of dangerous solvents, acutely toxic or hazardous materials
		**Viton® II** High permeation resistance to most chemicals	Same as butyl gloves, plus hazardous material spills

		**Silver shield** Extra chemical and mechanical protection	Same as butyl and Viton II gloves, added mechanical protection, hazardous material spills
Insulated gloves		**Terrycloth autoclave** Heat resistant	Working with hot liquids and equipment, open flames, water bath, oil bath
		**Cryogen** Water resistant or waterproof, protection against ultra-cold temperatures	Handling cryogenic liquids
Wire mesh gloves		**Wire mesh** Cut resistant	Working with live animals and exposed to potential cuts
Chemical resistant aprons		**Rubber-coated wash** Chemical splash protection, good abrasion resistance	Working with apparatus under pressure, air or water reactive chemicals, large volumes of corrosive liquids
		**Neoprene w/ sleeves** Chemical resistant, tear resistant	Working with water or air reactive chemicals, large volumes of corrosive liquids, small to large volumes of acutely toxic corrosives
		**Butyl/Silver shield w/ sleeves** Extra chemical and mechanical protection	Working with water or air reactive chemicals, large volumes of corrosive liquids, small to large volumes of acutely toxic corrosives
Lab coats		**Knee length** Protects skin and clothing from dirt, inks, non-hazardous chemicals	General use; Chemical, Biological, Radiation, and Physical Hazards
		**Flame resistant** Flame resistant (e.g. Nomex or flame- resistant cotton)	Working with water or air reactive chemicals, large volumes of organic solvents, potentially explosive chemicals
Gowns		**Knee length** Protects skin and clothing from dirt, inks, non-hazardous chemicals	General use; Chemical, Biological, Radiation, and Physical Hazards. Working with live animals

		**Flame resistant disposable** Flame resistant. Protects skin and clothing from dirt, dyes, debris, or non-hazardous chemicals	Working with water or air reactive chemicals, large volumes of organic solvents, potentially explosive chemicals. Working with live animals
		**Tyvek** High tear resistance, protection from particulates	Working with biohazards with potential for exposure to airborne transmissible disease
Cap		**Bouffant** Protection for hygienic work environments; protection from dirt, dust	Working with biohazards, especially in animal facilities
Footwear		**Slip resistant boot** Slip resistant sole. High permeation resistance to wet conditions	Working with biohazards, especially in animal facilities
		**Slip resistant** Slip resistant sole	Working in areas where liquids, slippery conditions are present
		**Slip resistant boot** Slip resistant sole. High permeation resistance to wet conditions	Working in environments where large amounts of water are present (e.g., cage washing)
Safety glasses		***Glasses*** *Polycarbonate lens, side shields for eye protection. Meets ANSI and OSHA specifications*	Working with chemical, biological, or physical hazards
Safety goggles		**General** Tight fitting, protects eyes from impact, spray, paint, chemicals, flying chips, dust particles, polycarbonate lens, indirect ventilation, meets ANSI and OSHA specifications	Working with large volumes of corrosive liquids, small to large volumes of acutely toxic corrosives. Working with large volumes of organic solvents, acutely toxic or hazardous chemicals, apparatus under pressure, air or water reactive chemicals
Shields		**Face shield** Chemical and/or UV resistant face shield	Working with mild acids, caustics, aromatic hydrocarbons, methylene chloride; splash hazard; air or water reactive or potentially explosive chemicals; UV radiological hazards
		**Safety shield** Acrylic, weighted shield, three sided, bench top shield, frosted edges	Working with chemical splash, beta radiation, exposure to Blood borne pathogens

Respirators		**Surgical masks** Protects against large droplets and splashes	Working with live animals; working with infectious material in BSL-2+ level lab
		**N-95** Protects against dusts, fumes, mists, microorganisms	Working with live animals or infectious materials with known airborne transmissible disease (e.g. Tuberculosis); dusty environments
		**Half face** Purifies air: protects against variety of particulates, vapors, dust, mists, fumes; depends on filter cartridge used	Working with live animals or infectious materials with known airborne transmissible disease; dusty environments; chemical vapors; particulates
		**Full face** Same as half face, with greater protection factor; eye protection, mucous membranes, and face; depends on filter cartridge used	Working with live animals or infectious materials with known airborne transmissible disease; dusty environments; chemical vapors; particulates
		**PAPR** Air supplying respirator; delivers steady supply of filtered air with loose fitting hoods	Working in BSL3 or dusty environments; chemical vapors, particulates; used when full-face or half–face respirator doesn't fit individual, or presence of facial hair
Earplugs		**Disposable** Polyvinyl Chloride (PVC) or Polyurethane foam, one time use design (no cleaning), one size fits all, light weight, low cost, blocks all sound	Working in areas where sound (dBa) average levels over 85, EHS can assist in assessments
		**Reusable** Silicone, tapered fit, reusable (needs cleaning), corded or un-corded, light weight, more durable than disposable	Working in areas where sound (dBa) average levels over 85, EHS can assist in assessments
		**Hearing Band** Ear plugs connected to a flexible band that can be worn around the neck when not needed	Working in areas where sound (dBa) average levels over 85, EHS can assist in assessments

Appendix C. Minors in Laboratory Facilities Policy

University of Northern Colorado
Minors in Laboratory Facilities Policy

The University of Northern Colorado is implementing this policy which governs the presence of minors (individuals under 18 years of age) in any University laboratory process, research, or animal program that uses chemicals, biohazard or infectious materials, radioactive materials, equipment, laser or physical hazards. This policy further prohibits minors under the age of 14 from entering laboratories except when participating in a tour approved by the University during which the minor students are supervised during their presence in such laboratories. A 'Laboratory' refers to any part of a facility used or intended to be used by the University for Scientific, Technical, Arts, and Health activities which may be hazardous.

The following mandatory forms and supporting documentation for minors (ages 14-17) and their parents/guardians shall be used to identify the risks found in these areas: Release and Indemnification, and Rules for Minors in Laboratories and Facilities.

Faculty, Staff, and Principal Investigators (PIs) must maintain a copy of all such documentation for all minors requesting permission to be present in any University of Northern Colorado laboratory and ensure that the minors and their parents/guardians receive appropriate laboratory facility information prior to allowing minors to be present in any University laboratory. The electronic form once signed will be stored in Slate and/or documents can be sent to EHS. In addition to the Laboratory Safety Manual, additional training requirements may apply depending on the work that will be conducted in the laboratory facility.

UNIVERSITY OF NORTHERN COLORADO
ACKNOWLEDGMENT OF LABORATORY RISK AND RULES
FOR MINORS IN LABORATORIES AND FACILITIES

There are certain risks and exposures that you will be assuming when you are participating in a laboratory environment. There is an inherent danger when working in any laboratory. You are responsible for observing both universal safety rules and specific safety guidance when participating in a University of Northern Colorado laboratory. By signing this document, you acknowledge the risks and agree to observe the prescribed safety rules and procedures.

- Laboratory hazards that you may be exposed to include but are not limited to:
  - Hazardous materials such as toxics, flammables, corrosives (acids and bases), oxidizers, bio hazardous materials, or radioactive materials.
  - Physical hazards such as loud noises, animal dander, sharp surfaces and objects, noxious odors, Bunsen burners and stoves, high speed equipment, excessive heat, and ultraviolet light.

Although the University of Northern Colorado complies with applicable local, state, and federal regulations and attempts to ensure its laboratories are as safe as possible, minors must maintain a continual vigilance when working in a laboratory.

- Persons who suffer from allergic reactions, are pregnant, have sensitive skin, or have other medical issues may want to consult with a physician prior to entering a laboratory.

Universal Safety Rules for a laboratory environment:

- Never participate in a scheduled assignment or process alone in any laboratory environment without direct, immediate adult supervision from a laboratory supervisor, sponsor or other person designated by the sponsor.
- Complete and follow safety training specific to the hazards in the laboratory**.**
- Always wear personal protective equipment (PPE) as directed and dispose of it appropriately. This PPE may include goggles, gloves, coats/gowns, and other face/body protection as dictated by the risks that may be present in the laboratory. Always remove PPE when leaving the laboratory or work area.
- Always follow the instructions of the sponsor or laboratory supervisor.
- Always report any accident (regardless of severity) immediately to the laboratory supervisor, sponsor or sponsor designee.
- Always keep your hands away from your face and wash them well with soap and water prior to leaving any laboratory area and after removing gloves.
- Never eat, drink, chew gum, apply lip balm, or touch your eyes or contact lenses while in any laboratory.
- Always wear closed-toe shoes while in any laboratory.
- Always tie back long hair while in any laboratory to prevent it from coming in contact with any hazardous materials or laboratory equipment.
- Always wear clothing while in any laboratory that reduces the amount of exposed skin.
- Follow applicable laboratory, research, or facility rules and regulations.
- Always ask questions if you don't understand any safety requirements regarding presence in a laboratory.

I have read, understand, and will adhere to the University of Northern Colorado, Acknowledgment of Laboratory Risk and Rules for Minors in Laboratories and Facilities.

_____ _____
Printed Name of Minor Child Signature of Minor

_____
Date

_____ _____
Printed Name of Parent/Legal Guardian Signature of Parent/Legal Guardian

_____
Date

PLEASE READ THIS DOCUMENT COMPLETELY BEFORE SIGNING.

RELEASE, WAIVER OF CLAIMS, ASSUMPTION OF RISK, AND INDEMNIFICATION

In consideration of the permission granted by the University of Northern Colorado to allow him/her _____, for whom I am the parent/legal guardian, to be present in laboratory facilities of the University, I represent and agree as follows:

- The minor identified in this document ("Minor") and I, HAVE READ AND UNDERSTAND this RELEASE, WAIVER OF CLAIMS, ASSUMPTION OF RISK AND INDEMNIFICATION and the ACKNOWLEDGEMENT OF RISK AND RULES FOR MINORS IN UNIVERSITY OF NORTHERN COLORADO LABORATORIES AND FACILITIES that describes the potential risks associated with the Minor's presence or involvement in a laboratory, with respect to the research and other activities that occur in such laboratory environment. I fully understand that there are potential risks associated with a person's presence in a laboratory environment including but not limited to exposure to hazardous materials or substances.

- With knowledge and understanding of these risks, I allow the Minor to participate on a scheduled assignment in University of Northern Colorado ("University") laboratories and, of my own free will, accept and assume all such associated risks.

- I UNDERSTAND that the Minor's involvement may be suspended at any time, at the discretion of the University of Northern Colorado if the safety of any person in the laboratory environment, including that of the Minor, is compromised in any way, due to the Minor's behavior.

- For the Minor and for myself and our respective estates, heirs, administrators, executors, and assigns, hereby release and discharge the Board of Trustees of the University of Northern Colorado, and their officers, employees, representatives, agents, and any other persons or entities acting on their behalf (collectively "Releases"), and the successors and assigns for any and all of the aforementioned persons and entities, from and against any and all claims, demands, and causes of action whatsoever, either in law or in equity, relating to injury, disability death or other harm, to person or property or both, arising out of, connected with, or in any manner pertaining to the Minor's presence at or participation in any laboratory or laboratory activity at the University of Northern Colorado, whether caused by the acts or failure to act of the Releases or otherwise, and further agree to defend, indemnify and hold harmless the Releases from any judgment, settlement, loss, liability, damage, or costs, including court costs and attorneys' fees that Releases may incur as a result of the Minor's presence or participation in any laboratory or laboratory activity at the University of Northern Colorado. .

By signing this agreement, I acknowledge and represent that I have and understand it and that I sign it voluntarily and for full and adequate consideration, fully intending to be bound by the same.

_____
Printed Name of Minor

_____ _____
Signature of Parent/Legal Guardian Printed Name of Parent/Legal Guardian

_____
Date

I have read, understand, and will adhere to the University of Northern Colorado Minors in Laboratory Facilities Policy. I understand that failure to comply with this Policy may be dangerous to my health and safety and that I may be removed from the facility immediately for any failures or deviations in compliance.

_____
Signature of Minor

_____
Date

Appendix D. Risk Hazard Assessment

UNIVERSITY OF
NORTHERN COLORADO

Laboratory Risk Hazard Assessment

Building Name:_____ Room Number:_____
Department:_____ Inspection Date: _____
Lab Contact: _____ Lab Contact Phone: _____

S - Satisfactory **N - Needs Improvement** **N/A - Not Applicable**

General Safety	**S**	**N**	**N/A**	Comments
Lab Personnel know where and how to obtain an SDS				
Lab is secure; door is locked when no one is in lab.				
Exits and aisles are unrestricted.				
Work and storage areas are clear of clutter.				
No food or drinks in the lab.				
Laboratory Procedures have been reviewed and are available.				
Lab personnel appear to be appropriately trained.				
Training	**S**	**N**	**N/A**	Comments
All lab personnel have taken Hazard Communication, Laboratory Safety training and other required training.				
All lab specific training has been completed and documented.				
Emergency	**S**	**N**	**N/A**	Comments
Lab personnel are familiar with emergency procedures.				
Spill control materials are stocked, inspected, and available.				
Personnel list is current				
Chemical Inventory has been reviewed and updated				
Emergency phone numbers are posted.				
Emergency Showers and Eyewashes are available, unobstructed, inspected, and documented by lab personnel.				
Signs identifying unusual hazards posted at the lab entrance				
PPE	**S**	**N**	**N/A**	Comments
Appropriate Personal Protective Equipment is available and in good condition.				
Lab personnel wear appropriate personal protective clothing while in the lab.				
Long pants and closed-toe shoes are worn in the lab				
Select Agents	**S**	**N**	**N/A**	Comments
Environmental Health and Safety has been contacted if Select Agent Toxins are stored or used in the lab.				
Engineering Controls	**S**	**N**	**N/A**	Comments
Fume hood sash is at or below required height (18 inches).				

Fume hoods are working properly and only essential items are stored in them.				
All equipment is properly inspected and/or certification is up to date.				
Storage	**S**	**N**	**N/A**	Comments
All chemicals are stored by hazard class (e.g., flammables, oxidizers, acids, bases, reactive, and toxins)/				
Hazardous materials or equipment are not stored in hallways				
All chemical containers in the laboratory are labeled appropriately.				
Storage is appropriately labeled (i.e. flammable, acid, etc.)				
All chemical containers are kept firmly closed.				
Fume hoods are not used as primary storage unless required by a chemical's characteristics.				
Flammables are stored away from ignition sources				
Flammables requiring cold storage are stored in lab safe refrigerators.				
Glass chemical containers not stored on the floor				
No hazardous chemical storage above shoulder height				
All compressed gas cylinders are secured and in an upright position.				
All compressed gas cylinders are capped when not in use.				
Storage containers and shelving are in good condition.				
Storage containers are compatible with the compounds they contain.				
Hazardous Waste	**S**	**N**	**N/A**	Comments
All containers are closed unless receiving waste				
No waste is poured down the drain without prior approval by EHS.				
Less than a total of one quart of “acutely” hazardous waste is present.				
Waste containers are marked with the words “Hazardous Waste” and their specific chemical contents are identified				
Each waste container has a properly labeled waste tag attached.				
Satellite Accumulation Area is located near where waste is generated and under supervision.				
Waste containers are compatible with their contents.				
Each container is in good condition (not rusted, leaking, dented, cracked, etc.)				
Secondary containment is in good condition.				
Biohazards are autoclaved appropriately.				
Medical waste, biohazards, and sharps are disposed of properly.				
Hazardous Waste (cont.)	**S**	**N**	**N/A**	Comments
All sharps (e.g., needles, broken glass) are deposited into sharp containers				
Fire Safety	**S**	**N**	**N/A**	Comments
All exits and walkways within the laboratory are clear and unobstructed.				

Hazardous materials, chemical storage cabinets, and compressed gas cylinders are not stored near primary means of egress				
Lab doors are kept closed to provide a fire and smoke barrier				
The storage of combustibles (e.g., cardboard boxes and paper towels) is minimized.				
Fire Extinguishers have been inspected, tested, and are up to date.				
Electrical Safety	**S**	**N**	**N/A**	Comments
All electrical cords are in good condition. Insulation in snot compromised.				
No electrical/extension cords are run above the ceiling or behind walls.				
The uses of extension cords are minimized and/or temporary.				
No electrical cords are placed in such a way that they are a tripping hazard.				
Radioactive Materials	**S**	**N**	**N/A**	Comments
The area is posted with “Caution Radioactive Materials” signs				
Waste containers are labeled “radioactive” and contents identified				
Dosimeters are stored away from sources of radiation or in a shielded container.				
Radioactive materials and waste are secured when not directly supervised				
Records of disposition of isotopes are current				
Radioactive materials authorization and applications are available				
Radioactive materials storage units are labeled with proper signs				
DEA	**S**	**N**	**N/A**	Comments
Controlled substances are stored in a locked and supervised cabinet				
Records of purchase, acquisition, dispensations, and disposal of controlled substances are kept o-site				
Outdated and unused controlled substances are disposed of appropriately considering the US DEA procedures				

Additional Comments

Certification of Assessment:

Print Name: _____ Job Title: _____

Signature: _____ Date: _____

Appendix E. Laboratory Inspection Checklist

UNIVERSITY OF
NORTHERN COLORADO

Laboratory Inspection Checklist

(For EHS and Head of Departments)

Building Name: _____ Room Number: _____

Department: _____ Inspection Date: _____

Lab Contact: _____ Lab Contact Phone: _____

S - Satisfactory **N - Needs Improvement** **N/A - Not Applicable**

Administrative Issues	**S**	**N**	**N/A**	**Comments**
Personnel working in the lab know the location of the Safety Data Sheet (SDS) for all the chemicals used in the lab				
Laboratory Risk Hazard Assessment is completed and documented				
Documentation of trainings is maintained and readily available				
Lab personnel observe and follow lab SOPs				
Lab Supervisors/PIs have appropriately trained their lab personnel				
Blood borne Pathogen	**S**	**N**	**N/A**	
Hypodermic needles, syringes, & other sharp instruments are used only when a safer technique is not feasible				
Hepatitis B vaccine was offered and documented (if applicable)				
Incidents Involving a potentially infectious agent/material are properly reported				
An emergency spill response protocol specific for the biohazard agents used or stored in the lab is prepared and readily available for all lab personnel				
Exposure Control Plan (ECP) is reviewed annually				
Paper towels & liquid soap are available at sink(s)				
Hand-washing facilities are readily available				
Chairs are covered with a non-porous material				
Procedures with potential for creating infectious aerosols are conducted in a BSC				
Vacuum lines are protected by a disinfectant trap				
Hands are washed after glove removals				
Used needles are not recapped, sheared, bent or broken before proper disposal				
Specimens of blood or other potentially infectious materials are placed in a secondary container during transport or shipping; containers are properly labeled				
Work surfaces are cleaned & decontaminated after contact with blood or other potentially infectious materials.				
Equipment used to store, contain or process biohazard materials is properly labeled with the biohazard symbol				
Rooms used to store, contain or process biohazard materials are properly labeled with the biohazard symbol				
Biological Waste	**S**	**N**	**N/A**	**Comments**
A user log or sterilization cycle record is maintained at the autoclave				
Autoclave waste is stored separately from untreated biological waste				
Biological waste containers are labeled with biohazard sticker (symbol)				
All biological waste is either treated (via autoclave) or stored and monitored				
Biological Safety Cabinet Safety	**S**	**N**	**N/A**	**Comments**
Biological Safety Cabinet (BSC) is in good condition				
No excessive chemical or equipment storage within BSC				
BSC has been certified within the last year				
Biosafety cabinets (BSC) have 12” ceiling clearance & 6” clearance on both sides				
No open flame is used within BSC				
Door / Room Sign	**S**	**N**	**N/A**	**Comments**
Contact information is legible & up to date				
Appropriate symbols are present on the lab’s door sign				
Room number is posted outside the door				
Signage for high risk areas or dangerous equipment is posted (i.e. BSL 2)				

PPE (Personal Protective Equipment)	S	N	N/A	Comments
Lab personnel wear appropriate PPE				
Acid gloves are present/worn when appropriate				
PPE remains in the laboratory after use				
Approved respirator is present/worn when appropriate				
Disposable gloves are present/worn when appropriate				
Disposable gloves are not kept for repeated use				
Face shield is present/worn when appropriate				
Lab coat / chemical protective apron is present/worn when appropriate				
Hearing protection is present/worn when appropriate				
Footwear completely covers the entire foot				
Legs are not exposed when working in the lab				
Safety glasses or goggles are present and worn				
Hair, jewelry, clothing is restrained while working with chemicals & equipment				
Chemical Inventory Management System (CHIM)	**S**	**N**	**N/A**	**Comments**
CHIM system is up to date				
CHIM is reviewed annually and updated				
Chemical Safety/Storage	**S**	**N**	**N/A**	**Comments**
Chemicals are stored in a secure location such as a cupboard, cabinet, or flammable materials storage cabinet; Containers are not stored on the floor				
Hazardous Chemicals are properly stored when not in use				
Incompatible chemicals are not stored together				
Corrosive chemicals are stored on a chemically resistant containment tray				
Chemicals are not stored in corridors				
No flammable liquids are allowed to be stored in refrigerators, cold rooms or freezers unless they are specifically designed for this purpose				
Secondary containment is used for large containers (greater than or equal to 10 gallons) to contain spills				
Hazardous chemical & chemical waste are not stored beneath sinks				
Flammable chemicals are not near sources of ignition				
Damaged hoses or tubing is not used				
The integrity of storage cabinet and shelves is not compromised				
Flammable liquid storage cabinet (FLSC) is not damaged				
The FLSC bung caps are in place				
Electrical	**S**	**N**	**N/A**	**Comments**
An unobstructed area of 36” is maintained in front of electrical panels				
All electrical service cords are periodically checked for integrity. If cord insulation is frayed, cracked or missing, the corresponding piece of equipment is removed from service until the cord is properly repaired or replaced				
There are no missing electrical panel covers				
Extension cords are not damaged				
Extension cords do not run through holes in wall, ceilings, floors, doors, windows or similar openings				
Extension cords are not covered by carpets or rugs				
“Daisy chaining” cords was not observed, e.g., multi-outlet plugged into another multi-outlet				
Extension cords and outlet extenders are not used as permanent electrical sources				
Emergency Shower and/or Eyewash	**S**	**N**	**N/A**	**Comments**
Emergency shower and/or eyewash are readily accessible at all times				
Paths towards emergency shower are free of clutter or trip hazards				
Emergency shower and/or eyewash is inspected				
Components of the emergency shower and/or eyewash station are not missing or damaged				
Dust caps are present on emergency eyewash station				
Environmental	**S**	**N**	**N/A**	**Comments**
Chemicals are not disposed to sanitary sewer or storm drain				
Sinks should be clearly labeled with signage (Do not pour chemicals down drain)				

Fire and Life Safety	S	N	N/A	Comments
Laboratory aisles were not cluttered with materials or equipment.				
Fire pull stations are accessible at all times				
There is no storage of chemicals and/or equipment in corridors (refrigerators, freezers, cabinets, etc.)				
Lab supplies are not stacked within 18” of sprinkler heads				
Fire doors remain closed at all times, unless they use a hold-open mechanism that is controlled by the building fire alarm panel. Fire doors are not propped open with wedges, rocks or other similar materials				
Fire extinguisher is mounted off floor, accessible and has been inspected				
Fire extinguisher tamper seal is present and intact				
A Class D extinguisher is readily available for working with combustible metals.				
Fume Hood Safety	**S**	**N**	**N/A**	**Comments**
Fume hood sash is able to freely move up and down				
Chemicals or equipment are not unnecessarily stored in the fume hood				
Fume hood is used with sash below sash stop				
Fume hood air flow monitor is not in alarm				
Fume hood has exhaust flow				
Fume hood is certified within the last year				
Gas Cylinder Problems	**S**	**N**	**N/A**	**Comments**
All tubing is periodically checked for integrity. If tubing is damaged, cracked or missing, it is removed from service until properly repaired or replaced				
Empty lecture bottles are not allowed to accumulate				
There is not an excessive quantity of flammable gases stored in the lab				
A chain, bracket or other restraining device is used at all times to prevent cylinders from falling				
Cylinders of oxygen and other oxidizers are stored at least 20 feet from flammable gas containers.				
Compressed gas cylinders are labeled with the name of the chemical and the primary hazard associated with that chemical, i.e., flammable, oxidizer, toxic, etc.				
Cylinders have valve protection caps on at all times except when they are secured and connected to dispensing equipment.				
All sizes of compressed gas cylinders are secured in an upright position away from excessive heat, highly combustible materials, and areas where they might be damaged.				
Cylinders are not stored in hallways, corridors, stairwells or near elevators				
Work Area Problems	**S**	**N**	**N/A**	**Comments**
Ladders do not have cracked steps or other damage making them unsafe for use				
All food and beverages are stored in designated food storage refrigerators outside of the lab				
All refrigerators and microwaves in the lab have appropriate labels identifying for non-food use				
Good housekeeping is observed. Work area is clean				
Hazardous Waste	**S**	**N**	**N/A**	**Comments**
Hazardous waste containers are closed at all times.				
The date when waste is first placed in that container is reflected as the Accumulation Start Date on the waste label.				
Hazardous Waste (cont.)	**S**	**N**	**N/A**	**Comments**
Hazardous waste is properly labeled				
Waste labels provided by EHS are used to label hazardous waste				
Hazardous waste containers are compatible with the waste and the original use intended for the container is suitable for the present use, i.e., waste not stored in beverage containers				
Sharps Waste	**S**	**N**	**N/A**	**Comments**
Broken glassware is not handled directly by hand, but is removed by mechanical means such as brush, dustpan, tongs or forceps				
All sharps are disposed of properly in labeled, puncture-proof containers				
Sharps containers are not filled above the “fill line” indicated on the container				
Training	**S**	**N**	**N/A**	**Comments**
All employees working with human blood/human blood products have received blood borne pathogens (BBP) training				

All lab employees have received the required training				
Personal Protection Equipment (PPE) training is provided				
Training documentation is available upon request				
All laboratory personal have received Hazard Communication Training				

Additional Comments

Certification of Inspector:

Print Name: _____ Job Title: _____

Inspector Signature: _____ Date: _____