Davidson College
Chemical Hygiene Plan
OSHA 29 CFR 1910.1450
Environmental, Health & Safety Office

Revision 12 – December 8, 2025

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<u>List of Acronyms and Abbreviations</u>: Acronyms and abbreviations that will be used throughout this document and in everyday lab discussions

List of Acronyms and Abbreviations	
ANSI	American National Standards Institute
BSC	Biological Safety Cabinet
BSL	Biological Safety Level
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CHO	Chemical Hygiene Officer
CHIMERA	Chemical Inventory Management & Reporting Application
CHP	Chemical Hygiene Plan
CHR	Chemical Hygiene Representative
DEA	Drug Enforcement Agency
EHS	Environmental, Health & Safety
EPA	Environmental Protection Agency
HEPA	High Efficiency Particulate Air
IARC	International Agency for Research on Cancer
LD	Lethal Dose
LSTF	Laboratory Safety Task Force
NC DEQ	North Carolina Department of Environmental Quality
NFPA	National Fire Protection Association
NIH	National Institutes of Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PI	Principal Investigator
PPE	Personal Protective Equipment
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
WAR	Waste Accumulation Room

Terms and Definitions

Most of these definitions are directly extracted from OSHA Lab Standard 29 CFR§1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories and from OSHA Hazard Communication Standard §1910.1200, Toxic and Hazardous Substances.

Chemical Hygiene Plan: A written program developed and implemented by an employer which sets forth procedures, materials, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meet the requirements of paragraph (e) of the lab standard.

Chemical Hygiene Officer: Means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Emergency: Any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee: For the purposes of this CHP the term employee means an individual who is financially compensated by the College, and is employed in a laboratory workplace, who may be exposed to hazardous chemicals in the course of his or her assignments. This classification includes compensated student assistants.

Engineering Controls: Eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. Examples include chemical fume hoods and glove boxes.

Hazardous Chemical: Any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified. Hazard Communication Standard (§1910.1200(c)).

Health Hazard: A chemical that is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in appendix A of the Hazard Communication Standard (§1910.1200) and §1910.1200(c).

Laboratory: A facility where the “laboratory use of hazardous chemicals” occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production scale.

Laboratory Scale: Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. “Laboratory scale” excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type Hood: Means a device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Principal Investigator: For the purposes of this CHP the term "Principal Investigator" is used very broadly. It refers to the individual responsible for the oversight of a laboratory and may include individuals with the title of faculty Principal Investigator, Responsible Faculty, Laboratory Supervisor, Laboratory Instructor, Laboratory Manager, Laboratory Director, and Laboratory Administrator.

Select Carcinogen: means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or
(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or
(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(a) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;
(b) After repeated skin application of less than 300 (mg/kg of body weight) per week; or
(c) After oral dosages of less than 50 mg/kg of body weight per day.

Simple Asphyxiant: A substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death. Hazard Communication Standard (§1910.1200(c)).

Standard Operating Procedure: is a set of written instructions which details how to safely perform work involving hazardous chemicals, and includes processes, special handling instructions, engineering controls, and personal protective equipment. The OSHA Laboratory Standard requires that the Chemical Hygiene Plan include: "Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemical". No specific format is required but all relevant elements must be addressed by the SOP. Much of the pertinent information needed to develop a SOP can be found in the Safety Data Sheet or Technical Bulletin for a particular hazardous chemical.

I. Commitment to Safety

Purpose

The Davidson College Chemical Hygiene Plan (CHP) is written to comply with the Occupational Safety & Health Administration (OSHA) laboratory standard delineated in 29 CFR 1910.1450, "Occupational Exposures to Hazardous Chemicals in Laboratories." Davidson College is firmly committed to adherence to this standard so that employees and students are protected from chemical hazards in laboratories. Any concerns about EHS hazards or non-compliance to this Plan can be directed to the EHS Manager (currently Allen

Stowe) at alstowe@davidson.edu or (704) 894-2929. These concerns will be addressed in a confidential manner.

The standard operating procedures (laboratory practices and engineering controls) prescribed in this Chemical Hygiene Plan identify the appropriate safeguards that should be taken when working with hazardous chemicals. These generic procedures cannot address every issue that could arise when dealing with laboratory chemical safety. Best professional judgment is essential in the interpretation of these standards and these standards may be modified somewhat to address specific uses and operational needs.

Hard copies of the CHP will be maintained and will be readily available in the EHS Office and the offices of the departmental Chemical Hygiene Representatives (CHR).

Additionally, electronic copies of the CHP will be available by request from the Chemical Hygiene Officer (CHO), Department CHRs, or Laboratory Managers. The CHP can also be found on the EHS website:

http://www.davidson.edu/offices/environmental-health-and-safety/forms-and-policies

Proposed revisions to the CHP can be submitted to the Departmental CHR or the CHO. Modifications to the CHP will be made by the CHO. The CHP will be updated as necessary and will be reviewed by the CHO and Laboratory Safety Task Force on an annual basis, at a minimum.

In addition to complying with the CHP, laboratories performing work involving human/primate tissue, recombinant DNA, or pathogenic agents must comply with Centers for Disease Control (CDC) and National Institutes of Health (NIH) guidelines.

Scope

The provisions of the CHP apply to all Davidson College laboratory employees, students in these labs, other employees who routinely visit or occasionally work in the laboratories, and all contractors who might be exposed to laboratory hazards while at Davidson College. All laboratory employees and students are encouraged to contribute their skills and knowledge to supporting the CHP through items such as: routine activities, chemical safety, biological safety, radiological safety, proper hazardous material handling, or procedures to minimize chemical exposures. Other non-laboratory employees, such as Building Services (custodial) and Physical Plant (maintenance) are not addressed by this CHP. Rather, they have received other OSHA training that aligns with their job functions, such as Hazard Communication or Bloodborne Pathogen training.

II. Organization, Roles and Responsibilities

The authority and responsibility for the implementation of the CHP at the operational level are delegated by the campus Chemical Hygiene Officer (CHO) to the science department CHRs. To successfully implement the CHP, the assistance and cooperation of all laboratory staff are necessary.

The following descriptions outline key roles and responsibilities of all Davidson College employees involved in the implementation of this plan. See Appendix 1 for a listing of currently assigned officers.

Chemical Hygiene Officer (CHO)

The campus Environmental Health & Safety (EHS) Manager will serve as the Chemical Hygiene Officer. The CHO establishes, maintains and revises the CHP. The CHO is responsible for providing technical guidance in

the development of the provisions of the CHP and works closely with science department faculty members, laboratory managers and staff to implement appropriate chemical hygiene policies and continually improve the chemical hygiene program. In emergency situations or cases where there is a clear and present danger existing in a laboratory, the CHO has the authority to terminate operations indefinitely until safe working conditions are restored.

The CHO is also required to:

- Periodically inspect laboratory facilities to ensure compliance with the CHP.
- Review applicable state/federal regulatory requirements and implement changes as needed.
- Monitor environmental, health and safety conditions in laboratories.
- Investigate accidents and exposures.
- Maintain applicable CHP training records.
- Ensure that safety devices (i.e. safety showers, eye wash stations, fire extinguishers and fume hoods) are inspected as required and functioning properly.

Departmental Chemical Hygiene Representative (CHR)

Each department affected by the CHP will appoint a person to serve as the Chemical Hygiene Representative (CHR) for that department.

- Assist faculty and staff in implementing the CHP.
- Serve as the departmental single point of contact to the CHO to ensure compliance with the CHP.

Laboratory Safety Task Force

- Members appointed by the departmental chairs, includes CHO and CHRs.
- Hold regular meetings, at a minimum twice per year. Attendance by faculty members is encouraged.
- Maintain written records of all meetings, including meeting agendas and minutes. Have each department representative report back to their department on a regular basis.
- Formulate and recommend to the science departments policies that may affect the environment, health or safety.
- Ensure that laboratory inspections are conducted to locate, identify and document safety and health hazards on an annual basis and submit list of corrections to the appropriate department.
- Discuss any incidents, near misses, lessons learned and communicate to all affected stakeholders
- Make recommendations to various stakeholders as needed.
- Annually review the CHP for effectiveness and work with CHO to amend it as necessary

Principal Investigator (PI) and Supervisors

- Ensure that workers/students are aware and comply with the CHP.
- Assess the specific hazards in their laboratory, train personnel appropriately and document all training.
- Ensure that engineering controls and personal protective equipment utilized in their laboratories is available and adequate to protect human health.
- Adhere to the recommendations of the CHO and correct any unsafe laboratory conditions.
- Inform the CHO of any accidents or incidents and complete the Davidson College Incident Form:

  https://www.davidson.edu/offices-and-services/environmental-health-and-safety/incident-reporting

- Develop and maintain written standard operating procedures for activities in all labs.
- Report any unsafe or hazardous conditions to the CHR or CHO immediately.

Laboratory Workers (Teaching Assistants, Work Study Students)

Laboratory workers (including students) are expected to be familiar with the Davidson College CHP and are also required to:

- Plan and conduct each laboratory operation in accordance with written standard operating procedures.
- Work safely with chemicals and laboratory equipment by consulting the appropriate Safety Data Sheets (SDS), academic literature and Davidson EHS policies/procedures.
- Wear the appropriate Personal Protective Equipment (PPE) required for each task to which they are assigned.
- Utilize engineering controls and safety requirements in a proper manner.
- Participate in all required training programs.
- Report any hazardous or unsafe condition immediately to their responsible faculty member.

Guests

- Shall be informed of and adhere to all applicable laboratory safety requirements outlined in the CHP.
- Must be provided with the appropriate personal protective equipment.
- Should be accompanied by a college faculty, staff or student at all times.

III. Standard Operating Procedures (SOPs)

The following generic Standard Operating Procedures (SOPs) will apply to everyone working in the Davidson College science laboratories. Additional SOPs will likely be required based on the hazardous chemicals utilized in teaching or research laboratories. Individuals failing to adhere to these SOPs will be reported to their supervisor, departmental chair, PI, CHR or CHO. Students should also adhere to these procedures after being introduced to them by their supervisors or PIs.

A SOP template and a SOP example (sodium azide) are in Appendix 2.

General Laboratory Rules

- Always read and understand the applicable Safety Data Sheets (SDS) before handling chemicals. CHIMERA users have access to a large SDS inventory.
- All chemical containers such as beakers and flasks must be labeled with the full chemical name and other pertinent information in compliance with OSHA Hazard Communication standard.
- Containers should be closed and sealed before being transported into the hallways.
- Horseplay in any form is dangerous and strictly prohibited. Never run in the laboratory areas or hallways.
- Dispose of non-biologically contaminated sharps (e.g. scalpels, needles) in approved sharps containers.
- Wear proper clothing. It is recommended that lab coats, and long pants, or their equivalent shall be worn always in the laboratory to prevent contamination of personal clothing and skin. Use natural fabrics as much as possible. Scarves, ties, cuffs and other loose clothing should be secured. Confine long hair.
- Closed toe shoes are required in the laboratory at all times, no open toe shoes, sandals or bare feet allowed.
- Food and drink are always forbidden in the laboratory.
- Know the evacuation procedure for your area and the location of fire exits
- Ensure that fire extinguishers are readily accessible, not obscured from vision. Employees should be

trained in the use of the fire extinguisher in their laboratory.

- Maintain clear access to all emergency equipment and exits.
- Observe good housekeeping, the work area should be kept clean and uncluttered.
- Laboratory and prep room doors should be kept closed and never propped open.
- Ensure that all aisles, walkways, hallways, and exits are free of tripping or slipping hazards.
- Wash hands and forearms thoroughly before leaving the laboratory, even if a lab coat and gloves have been worn. Immediately wash skin after any chemical exposure.
- Clean up spills immediately and dispose of any cleanup material per guidance provided by the departmental CHR.
- A small amount of water should be added to laboratory sinks monthly to keep the traps filled.
- Broken glassware should be placed in designated broken glass receptacles.
- Never use laboratory fume hoods for laboratory storage.
- Refrigerators and freezers used to store flammable materials should be flammable safe or explosion proof.

Unattended Laboratory Operations

Never leave an experiment unattended unless your laboratory partners are informed to deal with any potential hazard while you are away. Any unattended experiment should be identified by completion of the Unattended Experiment Form, which may be accessed by the following link:

https://www.davidson.edu/offices-and-services/environmental-health-and-safety/biological-chemical-laboratory-safety/laboratory-safety/unattended-experiments

Working Alone in the Laboratory

Avoid working alone in a building if possible. Working alone is prohibited if hazardous chemicals are being used (see OSHA definition of Hazardous Chemical on page 4). If an individual needs to work alone, it is recommended that they limit their activity to routine tasks that have minimal risk. Additionally, the PIs and/or supervisors are strongly encouraged to utilize the Working Alone Risk Assessment Form in Appendix 8. Individuals working alone should always keep a charged cell phone with them. Emergency phones are located to the right of the elevator doors in Wall.

Laboratory Security

When authorized personnel are not present, each laboratory must be kept locked, even if it is only for a short period of time. Depending on the type of work performed in a particular laboratory, it may be prudent to keep that laboratory always locked. (Note: some laboratory side doors must remain unlocked to comply with fire code occupancy and egress requirements for the adjacent rooms).

Laboratory personnel must immediately, and politely, engage unknown individuals discovered in a laboratory to determine their reason for being there. This engagement can be accomplished with a simple question, “May I help you?” Please report any suspicious individuals to the Office of Public Safety (704-894-2178).

Accident and Incident Response Reporting

All accidents, incidents, and near misses that result in personal injury or illness, damage, and/or a potential for significant injury or property loss to Davidson College property shall be properly reported and investigated. The Davidson College Incident Form should be completed:

https://www.davidson.edu/offices-and-services/environmental-health-and-safety/incident-reporting

All accidents or near misses should be carefully investigated with the root cause results distributed to all who might benefit. Accidental chemical exposure can occur by inhalation, by skin exposure, by contact with the eyes, or by ingestion. In the event of exposure to a hazardous chemical, the steps described below must be taken. Calling the Public Safety Office at 704-994-2178 after calling 911 for emergency medical assistance will allow the Public Safety Office to lead emergency responders to the scene of the incident.

- **Respiratory Exposure:** In the event of respiratory exposure, immediately move the victim away from the source and into fresh air. Immediately call 911 for emergency medical services, and then notify the Office of Public Safety (704-894-2178) of the incident. Do not leave the victim until persons qualified to deal with the emergency have arrived.

- **Skin Exposure:** In the event of incidental skin contact with a hazardous material, remove any affected body coverings such as gloves, lab coats, and if necessary, clothing. Flush the affected area with water for 15 minutes. If affected body part cannot easily be rinsed under a faucet, the emergency showers must be used. Soap may be used to help remove materials that are not water soluble. Affected clothing should not be worn after removing. Immediately notify the Office of Public Safety of the incident. Emergency medical services must be notified via 911 if the emergency safety shower is used. Do not leave the victim until persons qualified to deal with the emergency have arrived.

- **Contact with the Eyes:** In the event of incidental contact of a hazardous material with the eyes, the affected eye(s) must be flushed immediately with water. It is important to note that the affected person may be blinded and unable to locate the emergency eyewash without assistance. After the emergency wash has begun, the affected eye must be flushed for 15 minutes. If it is possible, try to get the victim to hold their eyelids open while flushing. Immediately contact 911 for emergency medical assistance and notify the Office of Public Safety of the incident. If the emergency eyewash is used, emergency medical services should be notified. Do not leave the victim until persons qualified to deal with the emergency have arrived.

- **Ingestion:** In the event of incidental ingestion of a hazardous chemical, medical attention must be sought immediately by contacting 911. The Safety Data Sheet or a chemical first aid manual can be consulted to help aid the victim. The Office of Public Safety must also be notified immediately, and the Poison Control Center's emergency number (1-800-222-1222) should be called for further assistance.

- **Reporting:** All injuries and /or accidents must be reported to the Chemical Hygiene Officer and Human Resources. If emergency medical services are required, notify the Office of Public Safety, who will lead emergency responders to the scene of the incident.

- **Clean-up:** Incidental releases of hazardous substances, where the substance can be absorbed, neutralized, or otherwise controlled at the time of the release should be addressed by employees in the immediate release area, or by Building Services personnel. Contact the departmental Chemical Hygiene Representative to assist with cleanup once the spill is contained. Minuscule spills will be immediately cleaned up by trained laboratory personnel, or the CHR, using appropriate PPE. Safety Data Sheets and other information sources should be referenced for specific clean-up recommendations. Any residual from the spill clean-up will be compliantly labeled and

containerized. Contact the CHR for pick up and removal of spill cleanup materials to the Waste Accumulation Room (WAR) for chemical waste (Such spills are not considered to be emergency responses within the scope of this standard.) Contact the Office of Public Safety immediately for large chemical spills or highly toxic chemical spills.

Chemical Procurement – General Guidelines

Prior to ordering chemicals, the following considerations should be made:

- Consider less hazardous substitutes (in terms of both physical and health hazards).
- Order and store chemicals in the smallest feasible quantity and container size to minimize associated hazards/risks.
- Conduct a risk assessment to identify potential hazards (physical and health hazards). Evaluate the risk by considering the likelihood of an adverse event, and possible magnitude of an adverse event. Evaluate control strategies (e.g., substitution/elimination, engineering controls, administrative controls, PPE).
- Review the departmental inventory to determine if the chemical is already available in the laboratory. Also check with the Laboratory Manager to determine if the chemical is available at Davidson College.
- If the new chemical represents a new hazard class for the laboratory, update emergency information, handling procedures, and door or other postings as necessary.

Chemical Inventory

All chemicals received by Biology, Chemistry, Psychology and Environmental Studies will be tracked using the Chemical Inventory Management & Reporting Application (CHIMERA) system. A chemical resistant barcode label will be attached on every chemical received. These chemicals and their location will be entered into CHIMERA. Detailed information regarding the chemical inventory in each laboratory and the respective hazards is readily available to workers, regulators and emergency responders. To obtain CHIMERA training and user authorization, please contact the CHO, the Davidson CHIMERA administrator. Users must be trained before they will be granted access to CHIMERA. The departmental CHRs will conduct a chemical inventory annually, at a minimum.

The chemical inventory processes utilized by the Biology and Psychology Departments are in Appendix 3.

Chemical Storage

The proper storage is complicated by the diverse physical properties of most chemicals present in laboratories. Some general procedures for chemical storage are listed below. These procedures are generic in nature, specific storage instructions may be obtained by reviewing the SDS and by contacting the CHR or CHO.

All laboratory personnel and students must wear the proper PPE (as specified in the SDS) when handling chemicals. To prevent an accidental chemical release, secondary containment must always be used when transporting chemicals from one location to another. Using a cart to transfer chemicals is also strongly recommended.

- All containers should be in good condition and properly labeled.

- Stored chemicals should be examined periodically (at least annually) for replacement, inactive status, deterioration, and container integrity. Containers in poor condition should be replaced.
- Excess or obsolete chemicals should be reused by others, recycled or disposed in accordance with local, state and federal regulations.
- Chemical storage on bench tops, in fume hoods and sinks is not acceptable. Storing chemicals in the fume hood can interfere with the proper air flow, clutter the work space and increase the amount of material that could be involved in a hood fire.
- Ensure that all storage locations are dry and adequately ventilated.
- Use spill trays, spill/shatterproof containers, secondary containment, etc. as needed.
- Bottles of hazardous chemicals with volumes greater than 500 ml should not be stored on shelves greater than five feet high. Caustic and corrosive materials should be stored near the floor.
- Organic acids should be stored separately from strong oxidizing agents.
- Flammable chemicals should only be stored in approved flammable cabinets.
- Refrigerators used for the storage of flammable chemicals must be explosion-proof or laboratory safe (flammable safe) units, depending on the flashpoint of the material stored. When the air outside the unit is believed to be explosive, an explosion proof refrigerator should be used. This situation often occurs with materials having flashpoints less than 100 degrees Fahrenheit. Signage affixed on the outside of the refrigerator should clearly delineate contents to be stored (i.e. flammable, non-flammable chemicals).
- Acids in concentrations of 6 molar (M) or greater should be stored in cabinets approved for the storage of corrosive chemicals.

The table below lists commonly encountered chemicals and their generic incompatibilities.

The following list is to be used only as a guide. Consult the SDS for specific incompatibilities.

CHEMICAL:	INCOMPATIBLE WITH:
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetone	Concentrated nitric and sulfuric acid mixtures
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali and alkaline earth metals	Water, chlorinated hydrocarbons, carbon dioxide, magnesium, calcium, lithium, halogens, sodium, potassium
Aluminum (powdered)	Chlorinated hydrocarbons, halogens, carbon dioxide organic acids
Ammonia (anhydrous)	Mercury (e.g. in manometers), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenic materials	Any reducing agent
Azides	Acids
Bromine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Calcium carbide	Water, alcohol
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents

Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid	Acetic acid, naphthalene, camphor, glycerol, alcohol, turpentine, flammable liquids in general.
Chlorine	*See bromine*
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	All other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous) hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Mercuric oxide	Sulfur
Nitrates	Acids (especially sulfuric acid)
Nitric acid (concentrated)	Acetic acid, alcohols, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids and gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen; flammable liquids, solids and gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides organic	Acids (organic or mineral), avoid friction or shock, store cold
Phosphorous (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate	Sulfuric and other acids, *see also chlorates*
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethylacetate, methyl acetate, furfural

Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents
Zinc powder	Sulfur
Source: *Safety in Academic Chemistry Laboratories*, published by The American Chemical Society.	

Incompatible Chemicals and Wastes

Many chemicals, when mixed with other chemicals or materials, can produce effects which are harmful to human health and the environment, such as heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes, or gases, or flammable fumes or gases.

Below are examples of potentially incompatible chemicals or materials, along with the harmful consequences, that result from mixing materials in one group with materials in another group. The list is intended as a guide to indicate the need for special precautions when managing these potentially incompatible materials or components.

This list is not intended to be exhaustive.

Group 1 Potential consequences: Heat generation; violent reaction	
A	**B**
Acetylene sludge Alkaline caustic liquids Alkaline cleaner Alkaline corrosive liquids Alkaline corrosive battery fluid Caustic water Lime sludge and other corrosive alkalis Lime wastewater Lime and water Spent caustic	Acid sludge Acid and water Battery acid Chemical cleaners Electrolyte, acid Etching acid liquid or solvent Mixed acid Pickling liquor and other corrosive acids Spent acid Sulfuric acid

Group 2 Potential consequences: Fire or explosion; generation of flammable hydrogen gas.	
A	**B**
Aluminum Beryllium Calcium Lithium Magnesium Potassium Sodium Zinc powder Other reactive metals and metal hydrides	Any chemical or waste listed in **Group 1**

Group 3 Potential consequences: Fire, explosion, or heat generation; generation of flammable or toxic gases.	
A	**B**
Alcohols Water	Calcium Lithium Metal hydrides Potassium SO_2Cl_2, $SOCl_2$, PCl_3, CH_3SiCl_3 Other water-reactive waste Concentrated chemicals or wastes listed in **Group 1**

Group 4 Potential consequences: Fire, explosion, or violent reaction.	
A	**B**
Alcohols Aldehydes Halogenated hydrocarbons Nitrated hydrocarbons Unsaturated hydrocarbons Other reactive organic compounds and solvents	Concentrated chemicals or wastes listed in **Group 1**. Any chemical or waste listed in **Group 2-A.**

Group 5 Potential consequences: Generation of toxic hydrogen cyanide or hydrogen sulfide gas.	
A	**B**
Cyanide and sulfide solutions	Any chemical or waste listed in **Group 1-B**

Group 6 Potential consequences: Fire, explosion, or violent reaction.	
A	**B**
Chlorates Chlorine Chlorites Chromic acid Hyphochlorites Nitrates Nitric acid, fuming Perchlorates Permanganates Peroxides Other strong oxidizers	Acetic acid and other organic acids Concentrated mineral acids Other flammable and combustible chemicals/wastes Any chemical or waste listed in **Group 2-A** Any chemical or waste listed in **Group 4-A**

Chemical Waste Minimization

Disposing of hazardous chemicals is expensive and creates regulatory liabilities. To minimize the amount of chemical waste generated by the laboratories at Davidson College:

- Use micro-scale lab techniques as often as possible.
- Share surplus, unneeded or legacy chemicals with colleagues. Available chemicals can be determined by CHIMERA. A legacy chemical is a chemical that persists at Davidson College after the person responsible for it has left the institution, or its intended purpose has been discontinued. One study found that unwanted chemicals account for up to 40% of all hazardous waste at universities.
- Limit inventory on-hand to chemicals and quantities necessary for laboratory activities.

Hazardous Waste Management and Disposal

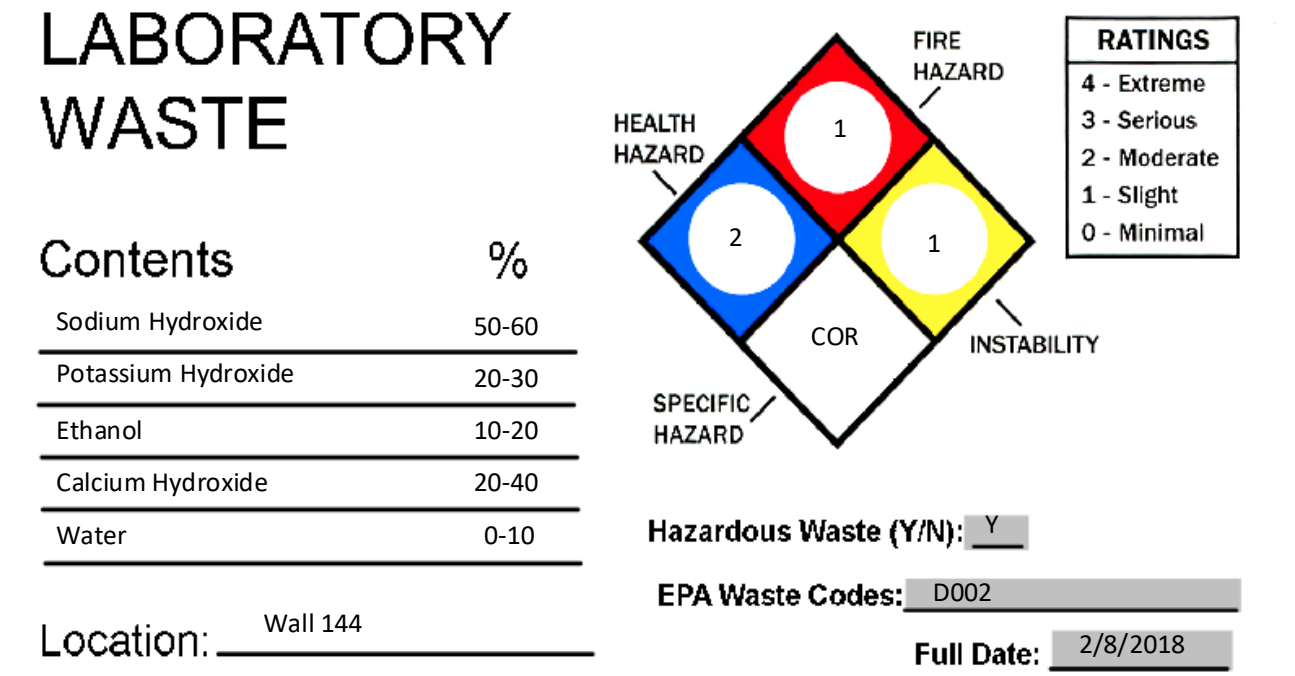
Hazardous wastes are regulated by the Environmental Protection Agency (EPA) and the North Carolina Department of Environmental Quality (NC DEQ). These regulations stipulate that hazardous wastes must be managed per prescriptive standards.

The hazardous waste management process for laboratory wastes is outlined in the following procedure:

1. As waste is initially generated, an appropriate container (i.e., chemically compatible with the waste and suitable to the rate of waste generation) is selected to collect this waste. The container is affixed with a waste characterization label. At a minimum, this label will contain the following information: PI/contact name, room number, description of waste stream, waste constituents, and relative percentage of each constituent (totaling 100%). (Note: Excess or obsolete commercial chemical products should be reused by others if possible, avoiding the cost and liability associated with declaring these chemicals as wastes). A hazardous waste determination must be made at the point of generation, consult the EHS Manager for assistance. If deemed hazardous, the container will be designated as hazardous waste on the label with EPA waste codes assigned. While it is a good practice to reuse compatible product containers to accumulate waste, one must ensure that the original chemical label is removed or marked out and the containers are free of chemical product residue by the appropriate cleaning method, such as triple rinsing with water. Once cleansed, the containers should be appropriately designated.

2. As the individual container nears capacity, a full date is written on the label by the PI (or his/her appointee) and this container will then be transported to the Waste Accumulation Room (WAR), which is located inside of the stockroom (Wall 124). Waste containers shall be provided as needed in the laboratories per step #1. An example of a completed label is illustrated in the guide below:

LABELING INSTRUCTION GUIDE



Contents – List each known chemical constituent in the waste
Percent (%) – List an estimated percent range for each constituent (such as 20-40%)
Hazard Rating – Insert appropriate rating in each quadrant of diamond
Location – Provide room number (such as Wall 144)
Hazardous Waste/EPA Waste Codes – Consult EHS Manager as needed

Notify your departmental laboratory manager when the waste container is full

3. Upon entering the WAR, the PI or appointee will complete an entry on the waste accumulation log sheet (see Appendix 4). The following information will be provided: PI/contact name, date, room number, description of waste stream, estimated volume, and any additional information.

4. When the waste in the WAR reaches approximately 75% capacity, the EHS Manager is notified by the Chemistry laboratory manager. The EHS Manager will coordinate the pickup and disposal of the waste by an approved hazardous waste vendor. Typically, waste pickups will be scheduled during the summer and winter breaks, though additional pickups may be arranged as needed.

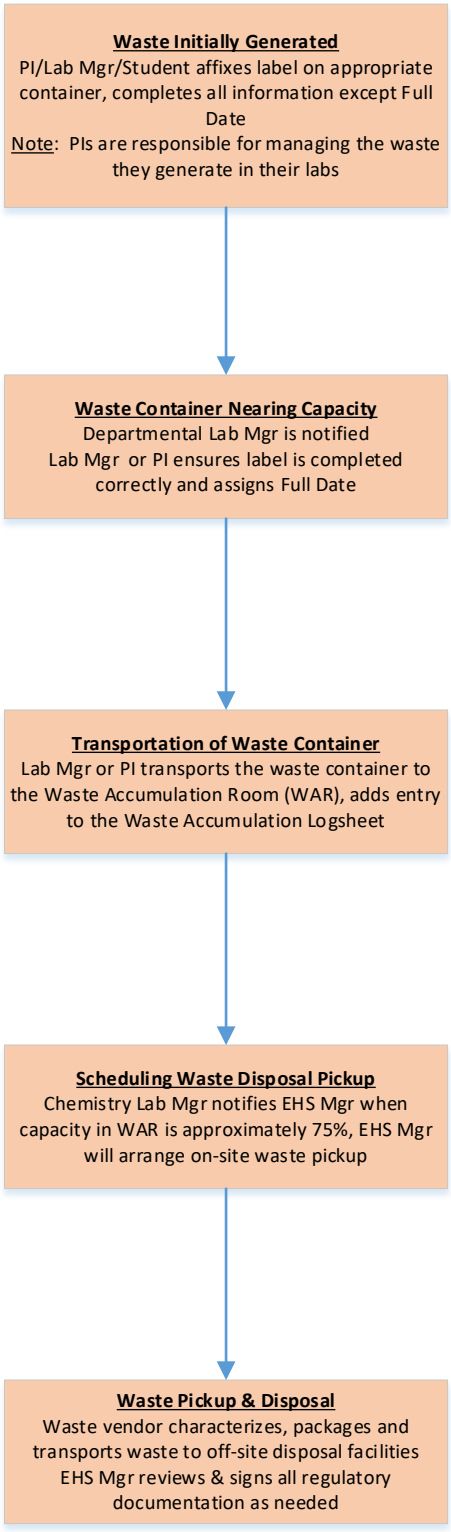
5. Upon arrival on campus, the hazardous waste vendor will evaluate the waste (and may assign the additional EPA waste codes) and package it for proper transportation to the appropriate disposal facility. The hazardous waste vendor will perform these functions outside of the WAR. Normally, a single pickup takes one or two working days. The EHS Manager will assist the hazardous waste vendor and may contact faculty/staff for additional information regarding the waste or logistical issues during this period.

6. Prior to transporting the waste off-site, the EHS Manager will review all paperwork provided by the hazardous waste vendor (EPA hazardous waste manifests, land disposal restriction forms, lab pack container content sheets, etc.). After all paperwork is deemed accurate, the EHS Manager will sign the hazardous waste manifest/land disposal restriction forms and the waste will be transported off-site for disposal.

The EHS Manager will retain all documentation, interface with regulators and provide reports as needed to ensure hazardous waste compliance. No waste is to be poured down a sink drain without prior approval from the EHS Office.

This hazardous waste management process is summarized in the following schematic:

Laboratory Waste Management Process



Biological Waste

Biological waste is characterized as waste which may pose a health hazard. Biological waste consists of contaminated animal carcasses, needles and syringes, cell culture wastes, and any biologically contaminated laboratory waste. All biological waste, except for sharps, shall be collected in the proper autoclave bags and autoclaved before disposal into the trash. After the trash has been autoclaved, the autoclaved "Bio-Hazard" bag shall be placed in a large (heavy-duty green or black) trash bag for disposal in the general waste. The Laboratory Manager will be responsible for ensuring that this bag is placed into the general waste in accordance with the protocols of the Building Services Department.

All other regulated medical waste must meet the following criteria prior to disposal:

- All regulated medical waste shall be double-bagged.
- Do not place leaking waste into the bags.
- Do not overfill bags.

Sharps Disposal

- All contaminated sharps (needles, syringes, broken glass, razor blades, glass pipettes, etc.) shall be disposed of in an approved sharps container.
- All used needles and syringes are considered contaminated sharps and should be disposed of in sharps containers.
- Syringes/needles used with potentially infectious materials shall be placed into the sharps container. Non-infectious sharps shall be accumulated and disposed separately from potentially infectious sources.
- All needle/syringe assemblies are to be disposed of intact. To prevent needle stick injuries, needles are not to be recapped, bent, or broken.
- When the sharps container is 75% full or as designated on container, cap the top of the container and affix the cap with tape. Notify the Laboratory Manager to schedule a pick-up and appropriate disposal.

Emergency Procedures

When an emergency occurs, or is imminent, the Department of Public Safety must be contacted (704-894-2178) as soon as possible. This single point of contact facilitates the emergency response for all types of incidents.

The Department of Public Safety initiates an appropriate emergency response. For incidents of sufficient magnitude or severity, Public Safety activates the Emergency Management Plan and the Emergency Notification System (SSAFER) at the direction of the Director of Public Safety.

It is the responsibility of the supervising faculty members to familiarize students with the College and Departmental plans that pertain to the laboratories, as well as the locations of fire alarm pulls, safety showers, eyewashes, spill kits, and emergency exits in each laboratory. An assembly area should also be designated, if an emergency evacuation of the laboratory is required.

Emergency contact numbers for responsible faculty and staff members will be recorded on the laboratory NFPA sign at the entrance of each laboratory as well as on a list of emergency numbers. Responsible

faculty members and the CHRs are responsible for ensuring that the contact information and hazard information is updated as needed and checked at least once per year as part of the laboratory inspection.

Emergency Exits

Emergency exits include not only exit doors but also the aisles, walkways, and stairwells which must be traveled to exit the area. Aisles or walkways leading to the exit must be a minimum of 48 inches wide and must not be blocked by trip hazards or other obstructions (i.e., boxes or equipment) that would slow or prevent exit in the event of an emergency. Stairwells may not be used as storage areas for equipment or supplies. Emergency exits must be clearly marked.

Emergency Equipment

Emergency equipment within each laboratory includes but is not limited to fire extinguishers, emergency showers, and emergency eyewashes. The location of emergency equipment must be clearly indicated by signs. All labs must contain fire extinguishers and have access to spill kits that are compatible for the hazardous materials in that area. All fire extinguishers must be inspected monthly. Emergency showers and eyewashes must be tested for fully compliant function annually. Showers and eyewashes must be inspected and flushed on a regular basis to ensure that they are not obstructed and that they will function properly in the event of an emergency. It is the responsibility of the Physical Plant to perform these tests and maintain records of the testing. Review of the safety equipment records will be part of the annual laboratory inspection.

Fire alarms are located throughout the buildings. Faculty, staff, and students should make themselves aware of the fire alarm locations. Fire blankets are located in Wall 104, 118, 143, 149, 218, 245, 316, 328, 215, 248, 316A, 325, 346 and should be used with caution. First aid kits are located in most labs.

Emergency shut-offs for natural gas and other plumbed gas shall be clearly marked. It is the responsibility of the faculty members to ensure students and staffs are aware of the location of the emergency shut-offs and how to use them.

Fire Extinguisher Use

Fire extinguishers should be used with the P.A.S.S. method outlined below:

Proper Fire Extinguisher Use

Fire extinguishers are classified for the types of materials on which they should be used. The chart below lists the types of extinguishers and their proper uses. Note: fire extinguishers should only be used to suppress small, incipient fires. For larger fires, leave the room immediately and pull the fire alarm.

Fire Extinguisher Class	Designated Use
A	Designed for fires including combustible solids such as paper and wood.
B	Designed for fires involving flammable liquids.
C	Designed for use on Class A and Class B fires. This type may also be used on electrical fires.
D	Designed for use on fires involving reactive metals such as sodium (Na), potassium (K), and magnesium (Mg) and reactive hydrides (NaH, KH, etc.).

The combination ABC fire extinguisher is most commonly employed in Davidson laboratories because they are effective on class A, B, and C type fires. Principle Investigators and laboratory managers should be

trained in the use of fire extinguishers. Notify the EHS Office immediately if non- or under pressurized fire extinguishers are discovered.

Spill Response and Remediation

Spill Kits

Spill kits are available which are compatible with the types of hazardous materials being used and stored. The main spill kit is located on a cart in the loading dock receiving area of the Wall Building (Wall 131). A basic spill kit can be found on the wall adjacent to the safety shower in Wall 216. At a minimum, spill kits must contain absorbent materials for use on acids, bases, and solvents. Spill kits for specific hazardous materials, such as mercury, should also be present in areas where these materials are used and stored. The locations of spill kit buckets in Wall are listed below:

Basement: inside the Vivarium - requires authorized access (1 bucket)

Wall 1st Floor: in Wall 102 (biology prep/ice room - need key to access (1 bucket)

Wall 2nd Floor: mid-hallway near Wall 200 (1 bucket), end-hallway near Wall 250 (1 bucket)

Wall 3rd Floor: mid-hallway near Wall 318 (1 bucket), mid-hallway near Wall 345 (1 bucket)

Spill Response Procedures

In the event of a spill or release of a hazardous material, the laboratory manager, CHR or responsible faculty must be notified so that they can determine if the spill is major or minor. Depending on the classification of the spill, one of the following procedures, outlined below should be followed. When in doubt about the nature, or severity, of a spill immediately notify the Office of Public Safety, who will direct emergency responders to the scene of the incident if needed.

Appropriate spill response activities will be dictated by the type of hazardous material released. Proper PPE must be worn when cleaning up spilled hazardous materials. Avoid skin contact or inhalation with all hazardous materials. For solvents and other flammable materials, all sources of ignition must be eliminated.

Absorbent materials used for the clean-up of hazardous materials must be properly disposed of through the college hazardous waste disposal program and must not be placed in trash cans or other general waste receptacles without prior approval by the EHS Manager.

Do not attempt to clean up a spill if untrained or feel unqualified.

Minor Spills

Minor spills are considered less than 1 liter (L) of material. In the event of minor spill, the person who discovers the spill should isolate the area. This measure will prevent others from accidentally traveling through the spilled material. Persons in the immediate area of the spill should be notified. Neutralize the spilled material as applicable and then proceed to clean up the spilled material using the proper spill kit or absorbent materials. Guidelines for hazardous material clean-up are outlined in the table below.

> **NOTE**: *Spills of extremely hazardous materials, or materials that pose an immediate risk to human health, will automatically be considered major*.

Major Spills
Major spills are considered greater than 1 L of material or any quantity of material which is considered extremely hazardous and/or poses an immediate risk to human health (i.e., highly toxic or flammable). In the event of a major spill, the discoverer of the spill should first determine if the situation poses an immediate risk to human health. In the event of a major spill which would require a building or area to be evacuated, the fire alarm system must be activated, and local emergency services must be notified. Further spill response should only be conducted by persons who have received a level of training which is adequate for the situation.

If the situation is deemed safe, the discoverer should proceed to shut off or contain the source of the spill as applicable. The discoverer must notify Public Safety and the CHO and request clean-up assistance as necessary. The spilled material should be contained or confined using proper spill kits and absorbent materials. The spilled material must be neutralized and cleaned up in a manner that will not further spread contamination. Guidelines for hazardous material clean-up are outlined in the table below. If the spilled material is in a quantity greater than the capacity of the available spill kits, and/or absorbent material, then additional resources or aid from an outside service (i.e., remediation vendor, fire department, or waste disposal contractor) may be required.

Reporting a Spill
Persons reporting a spill should be prepared to give the following information:

- Location of the incident
- Any injuries involved
- The nature of the spill (spilled material, fire, explosion, etc.)
- Chemicals involved
- Amount of material spilled
- Control measures that have been taken.

General Guidelines for Hazardous Material Clean-Up	
Hazardous Material	**Clean-Up Procedure/Absorbent Material To Be Used**
Acids (organic and inorganic)	Apply sodium bicarbonate. Absorb with a compatible spill pillow or other absorbent material. *NOTE: Hydrofluoric acid is an exception and requires special handling. (See below)*
Acid Chlorides	Absorb with sodium bicarbonate or sand. DO NOT USE WATER!
Aldehydes	Absorb with a compatible spill pillow or vermiculite.
Aliphatic Amines	Apply sodium bisulfate. Absorb with a compatible spill pillow or vermiculite.
Aromatic Amines	Absorb with a compatible spill pillow or vermiculite.
Aromatic Halogenated Amines	Absorb with a compatible spill pillow or vermiculite.
Azides	Neutralize with 10% ceric ammonium nitrate solution. Absorb with a compatible spill pillow or vermiculite.
Bases	Neutralize with citric acid or commercial chemical neutralizers. Absorb with a compatible spill pillow or vermiculite.
Carbon Disulfide	Absorb with a compatible spill pillow or vermiculite.
Cyanides	Cover solids with a damp cloth and push into an acceptable waste container. Absorb liquids with a compatible spill pillow or vermiculite.
Halides (organic & inorganic)	Apply sodium bicarbonate.
Halogenated Hydrocarbons	Absorb with a compatible spill pillow or vermiculite.

Hydrazine	Avoid organic matter. Apply calcium hydroxide (slaked lime). Absorb with a compatible spill pillow or vermiculite.
Hydrofluoric Acid	Apply calcium carbonate or calcium oxide. DO NOT USE sodium bicarbonate! Absorb with a compatible spill pillow.
Inorganic Salt Solutions	Apply anhydrous sodium carbonate (soda ash).
Mercaptans/Organic Sulfides	Neutralize with calcium hypochlorite solution. Absorb with a compatible spill pillow or vermiculite.
Mercury	Do not use general absorbents. Treat residue with zinc powder.
Nitriles	Sweep up solids. Absorb with a compatible spill pillow or vermiculite.
Nitro Compounds/Organic Nitriles	Absorb with a compatible spill pillow or vermiculite.
Oxidizing Agents	Apply sodium bisulfate. Absorb with a compatible spill pillow.
Peroxides	Absorb with a compatible spill pillow or vermiculite.
Phosphates (organic & related)	Absorb with a compatible spill pillow or vermiculite.
Reducing Substances	Apply anhydrous sodium carbonate (soda ash) or sodium bicarbonate. Absorb with a compatible spill pillow.

IV. **Procedures for Particularly Hazardous Substances** (Select carcinogens, reproductive toxins, highly toxic chemicals, and chemicals of unknown toxicity)

The following procedures must be followed when performing laboratory work with particularly hazardous substances:

- These substances must be used and stored only in areas with restricted access.
- Designated areas may be used for work with these materials and may encompass the entire laboratory, a glove box, an area of a laboratory, or a device such as a chemical fume hood. The designated areas must be clearly posted with signs that identify the hazards when the hazardous material is in use.
- No untrained personnel allowed in the work area.
- Clearly define the designated area.
- Only the smallest amount of a chemical required by the procedure should be used or stored.
- When possible, only order the required amounts to avoid unnecessary decanting or weighing out of the material.
- Spill procedures for the hazardous materials should be developed and posted in the designated area.
- All laboratory personnel and students working with these chemicals shall be familiar with the hazards and proper procedures for appropriately dealing with their accidental release.
- Appropriate PPE should always be worn when working with these materials, which may include safety glasses or goggles, appropriate gloves, long-sleeve laboratory coats, and closed-toe shoes. Floor length pants, or their equivalent, are also strongly recommended.
- Long hair and loose-fitting clothing should be confined.
- The designated work area shall always be decontaminated after the completion of each process or experiment.
- All wastes from the process shall be managed per Davidson waste management program. Contact the CHO if there are any questions.

Hazardous Chemicals – General Guidelines

Among the many tasks and operations performed by laboratories, those involving direct handling and/or transport of hazardous chemicals pose the greatest potential for exposure. For this reason, specialized handling precautions and good laboratory practices have been developed for particular classes of chemical and physical hazards. It is recommended that personnel review the applicable SDS before working with hazardous chemicals.

General Guidelines:

- Use only chemicals for which the engineering controls in the laboratory can accommodate per the SDS.
- Protective equipment shall be worn during all operations that require chemical handling.
- Decontaminate the laboratory area when work is completed. Good housekeeping is essential.
- Reactions involving pressure buildup are prohibited in laboratory hoods without the appropriate relief equipment and shielding.
- Whenever chemicals are transported outside of the laboratory, the primary container should be placed in a secondary, non-breakable carrier.
- Carts should be used whenever possible.
- Before moving containers, check and tighten caps, taps, or other enclosures.

Special Procedures for Handling Hazardous Chemicals

The PI/Supervisor shall ensure that all laboratory personnel are aware of the locations of hazardous chemicals in the laboratory, and the appropriate control measures for work involving hazardous chemicals. In some cases, laboratory-specific procedures may be required for working with extremely hazardous materials. Review the SDS for specific handling and storage requirements of hazardous chemicals. Some specific hazards that may be present in various laboratories at Davidson College are listed in the paragraphs below.

Allergens and Sensitizers

A chemical allergy is an adverse reaction by the immune system to a chemical. Allergic reactions result from previous sensitization to a chemical or a structurally similar chemical. After sensitization occurs, allergic reactions can result from exposure to extremely low doses of the chemical.

Allergic reactions can be immediate or delayed.

- An immediate reaction can occur a few minutes after an exposure. Anaphylactic shock can result from a severe, immediate, allergic reaction that can result in death if not treated quickly.
- A delayed reaction can take hours, or even days, to develop. It is important to recognize that a delayed chemical allergy can occur even some time after the chemical has been removed.

Examples of substances that may cause allergic reactions include diazomethane, formaldehyde, hydrazine, various isocyanates, benzylic and allylic halides, mold, and certain phenol derivatives. Allergens are also present in animal care settings in the due to presence of animal waste, dander, and dust from bedding and feed. Some individuals also develop a sensitivity to latex gloves.

Asphyxiants
Asphyxiants are substances that interfere with the transport of an adequate supply of oxygen to the vital organs of the body. Simple asphyxiants are substances that displace oxygen from the air being breathed to such an extent that adverse effects result. Acetylene, carbon dioxide, argon, helium, ethane, nitrogen, and methane are common asphyxiants. It is important to recognize that even chemically inert substances such as carbon monoxide can be extremely dangerous under certain circumstances.

Biological Materials
Biological materials are classified into four Biosafety Levels (BSLs) that have been established by the Centers for Disease Control. BSLs describe a set of safety practices and physical containment guidelines that must be used when handling biological materials. BSL 1 is the minimum level required for all labs using biological materials and is suitable for work involving well-characterized agents not known to cause disease and is of minimal potential hazard to lab personnel and the environment. BSL 2 is very similar to BSL 1 but requires more specialized training and safety requirements. The additional safety requirements include restricting access to laboratories, hazard signage on laboratory doors, and posting emergency response/contact information.

For work involving BSL 1 organisms, the following guidelines should be followed:

- Work should be conducted on bench tops that are impervious to water and can be easily decontaminated.
- Sinks for hand washing must be easily accessible.
- Fresh decontaminating solutions must be prepared on a timely basis.
- All biological organisms should be handled as biohazards even if they do not meet the definition of a biohazard.

Labs working with potentially hazardous biological materials should, at the minimum, also include door access and work surfaces that can easily be decontaminated. Bleach, alcohols, and commercially available disinfectants expressly intended for decontaminating surfaces can be used. If bleach is used, it should be made up in a 1/10 dilution with water and should be made fresh daily.

The Davidson College Biohazards Committee combines the functions of (1) the federally mandated Institutional Biosafety Committee (IBC), which is responsible for monitoring and ensuring compliance with NIH guidelines on all activities that involve recombinant DNA, and (2) a general biohazards committee that reviews and approves other biosafety issues. Any Davidson faculty member that plans to conduct research involving potentially hazardous biological materials or plans to implement laboratory teaching modules involving potentially hazardous biological materials must be trained in biosafety and must complete a Biosafety protocol submission form for Biohazards Committee approval of protocols that include potentially hazardous agents (e.g. infectious agents, carcinogens) or recombinant DNA that *is not exempt* from NIH guidelines for research involving recombinant or synthetic nucleic acid molecules:
https://osp.od.nih.gov/biotechnology/nih-guidelines/

The Biohazards Committee is composed of faculty, staff and individuals not affiliated with Davidson College and meets on an as needed basis. Additional information can be obtained by contacting the Biohazards Committee chair as identified in the online Faculty Committee List.

Biological Safety Cabinets (BSC) use HEPA filtration and directed airflow to provide primary containment for work with infectious materials. BSCs also protect personnel and the surrounding environment from infectious aerosols, create a contaminant-free work zone for the experiment, and are generally required for work at BSL-2 and higher. BSCs should never contain volatile chemicals or be used interchangeably with a laboratory chemical hood, since BSCs are generally vented directly back into the laboratory and do not filter out chemical vapors. Gas lines and open flames should not be used in recirculating BSCs. BSCs must be inspected by a professional cabinet certifier at the time of installation, annually after initial installation, and any time the unit is moved. Horizontal laminar flow "clean air benches" are not BSCs. These units discharge HEPA filtered air across the work surface and out the front of the cabinet, directly toward the user and provide product protection only. Clean air benches should never be used when handling potentially infectious materials or as a substitute for a biological safety cabinet

There are three different classes of BSCs that are not directly related to the Biological Safety Levels (BSLs) required for the microbiological agent being used. Generally, Class I and Class II cabinets can be used for work at BSLs 1 to 3.

Class I Biosafety Cabinet (BSC1)
A BSC1 is a ventilated cabinet for personnel and environmental protection, with non-recirculated inward airflow away from the user. The cabinet exhaust air is HEPA-filtered before it is discharged to the outside atmosphere. This cabinet resembles a chemical fume hood with a filtered exhaust and is suitable for work with low and moderate risk biological agents where no product protection is required.

Class II Biosafety Cabinet (BSC2)
A BSC2 is a ventilated cabinet for personnel, product and environmental protection having:

- An open front with inward airflow for user protection
- Downward HEPA-filtered, laminar airflow for product protection
- HEPA-filtered exhausted air for environmental protection. Class II cabinets are suitable for low-, and moderate- risk biological agents.

There are four recognized types of Class II biosafety cabinets that are widely used. These are Class II types: A, B1, B2, and B3. The nature of the research operation, the characteristics of a laboratory's exhaust system, and the mandated regulations will determine which type of Class II cabinet can be used.

Compressed Gas
Gas cylinders contain either compressed liquids or gases. Gas cylinders can represent a very dangerous hazard, as puncture, heat, faulty valves, or faulty pressure regulators may result in a rapid release of the entire contents, or an explosion. OSHA has developed a standard for compressed gases (29 CFR 1910.101). The following safety considerations should be implemented where applicable:

- The cylinder contents must be labeled and clearly identifiable.
- Always Keep the protective caps on the cylinders except when the cylinders are not in active use.
- Remove regulators when not in active use. Active use is defined as utilizing the compressed gas periodically. Before a regulator is removed from service, the cylinder valve should be closed, and the

regulator depressurized.

- Cylinders should not be in front of exits and stairways.
- Store cylinders in a well-ventilated area away from ignition sources, heat, flames, and flammable chemicals.
- Do not store flammable gas cylinders with oxidizers such as nitrous oxide or oxygen. They must be separated by a minimum of 20 feet or a 5-foot fire wall.
- Transportation of cylinders (both full and empty) should be conducted by the contracted supplier, if possible. If cylinders must be moved, use a cylinder cart. Handle cylinders carefully and do not roll, slide, or drop.
- Cylinders should be secured in an upright position using a chain or clamp around the upper section of the cylinder. Cylinders should not be stored, used or left unattended on a cylinder cart.
- Secure all cylinders while in storage, transport, or use. After use, return the cylinder carts to their original location, such as the Chemistry stockroom or inside the loading dock.
- Oil or grease should never be used to lubricate oxygen fittings or valves, because these lubricants may ignite spontaneously. Use only special lubricants designed specifically for oxygen gas.
- Do not lift a cylinder by its cap.
- Only use a regulator compatible with the cylinder contents.
- Close the cylinder valve when not in use.
- Label cylinders with a three-part tag indicating the current cylinder status - Full, In Service, or Empty. These tags may be obtained from the departmental CHR.
- Never tamper with cylinder valves, force connections, or use homemade adapters. Use only approved equipment. Never repair or alter cylinders, valves, or safety relief devices.
- Periodically check for gas leaks using soapy water around the connections. If leaks are detected, evacuate the area immediately and call 911.
- Lines and piping carrying compressed gas should be labeled with the identity of the gas.
- Ensure that all flammable compressed gas cylinders, lines and equipment are properly grounded.
- When empty, turn off the cylinder valve and label the cylinder as Empty. Store separately from full cylinders in receiving area.

Controlled Substances

A controlled substance is a drug or other substance, or immediate precursor, regulated by the DEA under schedules I-V. The use of controlled substances in the laboratory is subject to U.S. Drug Enforcement Administration (DEA).

Corrosive Chemicals

The Resource Conservation and Recovery Act (RCRA) defines a corrosive chemical as a liquid with a pH ≤2 or >12.5 Scientific Units (SUs). Acids and bases can cause severe tissue damage depending on the level of corrosivity of the chemical. The primary means of protection from corrosive chemicals is the use of gloves, goggles, face shields, aprons, lab coats, and other chemical-resistant clothing. Exercise extreme caution when handling corrosive chemicals. The following safety considerations should be implemented where applicable:

- Transport acids and bases in a bottle carrier, preferably on a cart. Do not handle by the neck alone; support the weight of the bottle from the bottom when handling or pouring.
- Do not store acid and bases with flammable liquids or oxidizing chemicals.
- Store perchloric acid by itself.
- Store nitric acid by itself in secondary containment.

- Isolate corrosive chemicals from incompatible chemicals.
- If a reagent must be stored in glass for purity, the glass container should be placed in a bottle carrier to lessen the danger of breakage.
- Reference the SDS for proper handling, PPE, and storage requirements.
- If an acid or base comes in contact with skin or clothing, thoroughly wash the affected areas utilizing the safety showers or eyewash units immediately.

Cryogenic Liquids

Cryogenic liquids are liquefied gases that are kept in their liquid state at very low temperatures and are associated with various hazards including: extreme cold, asphyxiation, explosion, cold contact burns, and toxicity. The most common cryogenic liquids at Davidson College are oxygen and nitrogen. Laboratory personnel and students should be thoroughly trained on the hazards and the proper steps to avoid them. Training should include emergency procedures, operation of equipment, safety devices, appropriate engineering controls, knowledge of the properties of the materials used, and personal protective equipment required. Insulated gloves should always be worn when handling anything that comes into contact with cryogenic liquids or the vapors. Considerations must be made to prevent cryogenic material from contacting skin. Clothing such as a lab coat, long pants, splash goggles, and face shields should be worn.

Ethidium Bromide

Ethidium bromide is a mutagen, possible carcinogen and reproductive toxin with significant health risks. Because alternate, less harmful DNA dyes are readily available, the use of ethidium bromide should be limited as much as possible. It should be properly decontaminated prior to disposal. Ethidium bromide should not be poured down the drain or disposed in the regular trash.

Flammable Chemicals and Solvents

A flammable solvent is an organic liquid with vapor can form an ignitable mixture with air. The solvent vapor is the fuel. The oxidizer is the surrounding atmosphere. For a mixture to burn, an ignition source must be present. The most common source of industrial fires is from flammable solids. The paragraph below lists the laboratory limits for total flammables in laboratory storage:

For each wing in the Wall Academic Center, all labs combined cannot exceed 60 gallons of flammable liquids (flashpoint < 100 degrees F) and 240 gallons of combustible liquids (flashpoint greater than or equal to 100 degrees F). Flammable liquids include methyl chloride, acetone, ethanol and gasoline whereas combustible liquids include formaldehyde, diesel fuel, and formic acid.

Flammable liquids (flashpoint less than 100 degrees Fahrenheit) in quantities greater than four liters should always be stored in metal safety cans or cabinets. Never disable the spring-loaded closure of the can. Always keep the spark arrestor screen in place, replace if punctured or damaged. The spark arrestor screen is located at the opening of the safety can, it prevents flashback of flammable vapors into the can.

Flammable chemicals should be stored in flammable liquid storage cabinets that have been approved by Factory Mutual and/or listed by Underwriter's Laboratory and designed in accordance with Code 30 of the National Fire Protection Association (NFPA). The following practices shall be adhered to:

- Both vents must be sealed with plugs provided with the cabinet. Should venting for noxious vapors be desired, the cabinet should be venting according to the manufacturer's specifications.
- Flammable storage cabinet doors should be spring loaded to provide automatic closure.
- Do not store flammable liquids in the domestic-type refrigerators. Use only refrigerators rated for

flammables (i.e., Flammable Safe or Lab-Safe). Liquids, solids, and gases with a flashpoints of less than 100 degrees Fahrenheit should often be kept in an explosion proof refrigerator because these substances can create an explosive atmosphere outside of the refrigerator.

- Do not store flammable liquids on the floor, unless protected by secondary containment.
- Only chemically compatible materials should be stored inside a cabinet.
- Do not store paper, cardboard, or other combustible materials in or on top of a flammable storage cabinet.
- Do not overload cabinets, follow manufacturer's established weight/quantity limits.
- Follow NFPA and local fire department guidelines for maximum allowable volumes.
- Do not store flammables in areas exposed to direct sunlight for prolonged periods.
- The quantities of flammable chemicals stored in the laboratories should be kept to a minimum.

The following controls and handling techniques shall be utilized when handling flammables:

- Keep flammable compounds away from ignition sources such as open flames. Do not heat flammables over an open flame or glowing heating element.
- When flammable liquids are transferred in metal equipment, minimize the generation of static sparks by using bonding and grounding devices as appropriate (see specific bonding and grounding guidelines below).
- Only reasonable, working quantities of flammable liquids are to be used in the laboratory. When the work or experiment is completed, the unused flammable liquids should be returned to a safety cabinet per OSHA regulations.
- Avoid clothing with synthetic fabrics, wear natural fabrics instead.
- Volatile liquids should be kept away from heat sources, sunlight, and electrical switches.
- Cool volatile liquids before opening containers.
- Skin should always be protected from solvents because they remove oil and fat from the skin, such that the skin cracks and become easily infected.
- Do not store flammable solvents with oxidizers, such as perchlorates, nitrates, and peroxides.
- Always transfer solvents under a fume hood.
- Perform operations with solvents having low flash points (i.e. below room temperature) in a hood that is free of ignition sources.
- Know the location of fire extinguishers, fire alarms and emergency equipment in the laboratory.
- The lids of safety cans must never be propped open.
- All containers used in the laboratory must be clearly labeled.
- For flammable liquids, electrically driven stirrers must not be used.

Bonding and Grounding

Bonding and grounding of flammables is extremely important to reduce the risk of explosion and fire due to static electricity that builds up during the transfer of flammable liquids. Bonding prevents the generation of static electricity by minimizing the electrical potential between two objects, such as a dispensing drum and a safety can. Grounding also minimizes the electrical potential between the containers and the ground. Bonding and grounding shall be used when employing metal equipment to transfer flammable liquids (i.e., those with a flash point below 100 degrees Fahrenheit) such as ethyl ether, benzene, xylene, and acetone, to avoid static generated sparks.

Formaldehyde

Aqueous solutions of formaldehyde are referred to as formalin. Pure (100%) formalin consists of an aqueous solution of formaldehyde (37% by mass) in water with a small amount of a stabilizer (e.g. methanol) to limit oxidation and polymerization. A hazard warning label must be affixed to all mixtures and solutions of formaldehyde composed of greater than 0.1 percent formaldehyde. For all materials capable of releasing formaldehyde at levels above 0.5 ppm during normal use, the label must contain the words "potential cancer hazard."

OSHA has promulgated a formaldehyde standard (29 CFR 1910.1048) to protect workers who are exposed to formaldehyde. This standard establishes action levels as well as short and long-term exposure levels for employees:

- The permissible long-term exposure limit (PEL) is 0.75 ppm formaldehyde as measured as an 8-hour Time Weighted Average (TWA).
- The short-term exposure limit (STEL) is 2 ppm formaldehyde, which is the maximum exposure allowed during a 15-minute exposure.
- An action level, which triggers increased industrial hygiene monitoring and the initiation of medical surveillance is 0.5 ppm when calculated as an eight-hour TWA.

If this action level or limits are exceeded, then warning signage must be placed in all laboratories (see example below). The monitoring entails workers wearing two small personal dosimetry badges each, one for eight hours and the other for 15 minutes.

Formaldehyde is a sensitizing agent that can cause an immune system response upon initial exposure. Subsequent exposure may cause more severe allergic reactions of the skin, eyes and respiratory tract. Workers can be protected from formaldehyde exposure by the following measures:

- Immediately notify the departmental CHR or PI if a formaldehyde exposure occurs. The CHR or CHO will arrange for medical follow-up as necessary.
- If the skin is exposed to formaldehyde solutions, wash affected area for at least 15 minutes.
- If eyes are splashed with formaldehyde solutions, immediately drench eyes using eyewash for at least 15 minutes.
- Always perform operations with open containers of formaldehyde under a functioning fume hood. Attempt to conduct all formaldehyde handling operations under a fume hood if feasible.

- Reassign workers who suffer significant adverse effects from formaldehyde exposure to functions with little or no exposure until their condition improves.
- Use appropriate Personal Protective Equipment (PPE), such as impervious clothing, gloves, aprons, chemical splash goggles to prevent skin and eye contact.
- Place contaminated articles of clothing in closed containers affixed with a formaldehyde label.
- Contaminated PPE should be cleaned thoroughly by washing with water before reuse.
- Confer with the CHO regarding the disposal of formaldehyde waste. Solutions containing greater than 1 ppm formaldehyde should not be poured down the drain.

Hepatotoxins

Chemicals that are toxic to the liver are called hepatotoxins. The effects of hepatotoxins depend on the amount, point of entry and distribution speed of the toxin, and on the health of the person. Signs and symptoms include jaundice and liver enlargement. Examples of hepatotoxins include carbon tetrachloride and nitrosamines. Hepatotoxins should be stored in a tightly closed container in a cool, dry, well-ventilated area away from incompatible substances. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits (PEL), such as a chemical fume hood or a biosafety cabinet (BSC).

Irritants

An irritant is a chemical that is not corrosive but causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic chemicals are irritants; therefore, skin contact with all laboratory chemicals should be avoided. Use a properly functioning chemical fume hood when handling irritants that can be inhaled. At minimum, safety glasses or goggles, lab coat, protective gloves, and closed-toe shoes should be worn. Floor length pants or their equivalent are also strongly recommended.

Mercury

The following controls and handling techniques should be employed when handling elemental mercury:

- Containers of mercury shall be kept closed when not in use and stored in a well-ventilated area.
- Efforts shall be made to limit mercury exposure to as low as possible.
- Spills of mercury should be cleaned up immediately.
- Wear the appropriate PPE when handling mercury.
- Mercury should only be handled over impervious surfaces to prevent contamination.
- Transfers of mercury should take place under a fume hood, over a containment tray to confine any spills.
- Wash hands thoroughly with soap and water after handling mercury.
- Treat spill residue with amalgamating material such as zinc powder or use a commercial product such as mercury sponges or powder. Use spill treatment product only after collecting as much free mercury as possible using a suction device.

Nephrotoxins

Nephrotoxins are chemicals that inhibit damage or destroy the cells and or tissues of the kidneys. Signs and symptoms include edema or proteinuria. Examples of nephrotoxins include halogenated hydrocarbons, heavy metals, and uranium. Both acute and chronic exposure to certain organic chemicals can cause inflammation, injury or severe damage to the kidneys. Use proper engineering controls such as a fume hood to minimize exposure.

Neurotoxins
Neurotoxic chemicals can induce an adverse effect on the structure or function of the central and/or peripheral nervous system, which can be permanent or reversible. Neurotoxic chemicals may cause narcosis, slurred speech, decrease in motor functions, and staggered gait. Many neurotoxins are chronically toxic substances with adverse effects that are not immediately apparent. Examples include mercury and carbon disulfide.

Perchlorates
Perchlorates should be considered as very explosive, especially on contact with organic materials. Many perchlorates are shock sensitive and powerful explosives. Periodates and chlorates pose similar hazards. Use of the acid and salts should be used only by capable personnel, chemical substitution is encouraged when feasible.

Peroxides
Peroxides and hydroperoxides are highly reactive materials and extremely shock sensitive explosives. Peroxides can form readily in certain organic chemicals, such as ethers. Simply moving or unscrewing a cap off a bottle that is contaminated with peroxides can lead to a serious explosion. The following controls and handling techniques shall be employed when handling peroxides:

- Indicate the date of receipt and the date of opening each container of peroxide forming chemicals.
- Limit the quantity of peroxides.
- Dispose of peroxide forming chemicals within one year or purchase or six months after opening.
- Do not return unused peroxides to the original container.
- Clean up all spills immediately. Solutions of peroxides can be absorbed using vermiculite or other absorbing material.
- Volatile solvents (such as ethyl ether) that may contain peroxides should not be allowed to evaporate to dryness unless precautions are taken to ensure the solvent is peroxide free.
- Use ceramic or wooden spatulas, do not transfer peroxides with metal spatulas because metal contamination can lead to explosive decomposition.
- Keep peroxides and all oxidizers segregated from all organics and solvents.
- Test reagents for peroxide content as necessary.
- Store peroxides at the lowest temperature that is consistent with the solubility or freezing point.
- Do not permit open flames, and other sources of heat near peroxides. Areas that contain peroxides should be labeled so that this hazard is evident.
- Avoid friction, grinding, and other forms of impact near peroxides, especially solid peroxides. Glass containers that have screw-cap lids or glass stoppers should not be used. Polyethylene bottles that have screw-cap lids may be used.
- Isolate from incompatible materials such as strong acids and bases, flammable and combustible liquids, and reducing agents.
- Peroxides that freeze or precipitate are extremely sensitive to shock and heat.

Oxidizers
Oxidizers are chemicals, other than a blasting agent, or explosive as defined in 29 CFR 1910.109(a), that initiates or promotes combustion in other materials, causing fire either of itself or through the release of oxygen or other gases. Examples include perchloric acid, potassium persulfate, and lead nitrate. Precautions for handling oxidizers should include the following:

- Minimize the amount of oxidizers used and stored.
- Isolate from incompatible chemicals (e.g., organics, flammable, dehydrating, or reducing agents).
- Do not store oxidizers in wooden cabinets or on wooden shelves.
- Do not return unused material to the original container.
- Store in a tightly closed container and in a cool, dry, ventilated area.
- Perchloric acid may not be used in any fume hood except those specifically designed for perchloric acid use.

Pyrophoric Chemicals

Pyrophoric chemicals are extremely reactive toward air and / or water and must never be exposed to the atmosphere. Examples include calcium hydride and sodium. Exposure of these chemicals to the air could result in spontaneous combustion, which could cause serious burns or other injuries to the person handling the chemical or others in the immediate area. In addition, all combustible materials, including paper products, should not be allowed to come in contact with any pyrophoric at any time. Pyrophorics can be handled and stored safely if all exposure to atmospheric oxygen and moisture is avoided. Solids must be transferred under an inert atmosphere in an efficient glove box. Glass bottles of pyrophorics should not be handled or stored unprotected. The metal container shipped with each bottle should be retained as a protective container for each bottle for transporting and storage

Reproductive Toxins

Reproductive toxins are chemicals that affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis). Reproductive toxins have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. Reproductive toxins can affect both men and women and can in some cases lead to sterility. Two well-known male reproductive toxins are ethylene dibromide and dibromochloropropane. When a pregnant woman is exposed to a chemical, generally the fetus is exposed as well because the placenta is an extremely poor barrier to chemicals.

Select Carcinogens

A carcinogen is a substance capable of causing cancer. Carcinogens are particularly insidious toxins because they may have no immediately apparent harmful effects. Carcinogens should be handled using prudent practices. A chemical is considered to be a carcinogen if:

- It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or
- It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or
- It is regulated by OSHA as a carcinogen.

Toxic Chemicals

Toxic is defined by OSHA 29 CFR 1910.1200 as a chemical that falls in any of these three categories:

- A chemical that has a median lethal dose (LD50) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

- A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.
- A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

Chemical toxicity levels can usually be found on SDSs.

Unknown Chemicals
Unknown chemicals, or those for which complete physical and chemical hazards are not known, must be assumed to be hazardous and highly toxic. Appropriate PPE and engineering controls should be utilized.

Water-Reactive Chemicals
Water-reactive chemicals are likely to become spontaneously flammable or give off flammable or toxic gas when in contact with water. Examples include aluminum powder, barium, calcium hydride, and sodium borohydride. Protect from moisture and separate from incompatibles. Store these chemicals in accordance with manufacturer or applicable SDS requirements.

V. Control Measures

For the laboratory use of OSHA-regulated substances, Davidson College shall assure that laboratory personnel and student exposure to such substances do not exceed the permissible exposure limits specified in 29 CFR 1910, subpart Z. To minimize laboratory personnel and student exposure to hazardous chemicals, the following hierarchy of control measures for reducing chemical exposure should be implemented:

1. Elimination
2. Substitution of less hazardous chemical or processes.
3. Engineering controls
4. Administrative controls
5. Personal protective equipment (PPE)

Elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE) are basic principles used to control hazards and exposures. Before the proper control(s) can be selected, a hazard assessment of the process, activity, or material should be conducted.

Elimination
Complete elimination of the hazard source is obviously the best method to prevent chemical exposure

Substitution
Every hazard assessment should first determine if the hazardous conditions can be prevented, e.g., substituting with a less hazardous chemical or process. Substitution is one of the most effective ways to eliminate or reduce exposures because it removes the hazard at the source.

Engineering Controls

Engineering controls eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. Engineering controls include process change, substitution, isolation, ventilation, and source modification.

- **Process change** consists of changing a process to make it less hazardous (e.g., paint dipping in place of paint spraying).
- **Isolation** is applied when a barrier is inserted between a hazard and those who might be affected by that hazard. Separating personnel from hazardous operations, processes, equipment, or environments using a physical barrier or distance may provide the necessary isolation.
- **Ventilation** can be either local (direct air movement) or general (dilution of air contaminants) that exhausts or supplies air properly.
- **Source modification** consists of changing a hazard source to make it less hazardous (e.g., wetting dust particles or lowering the temperature of liquids to reduce off-gassing and vaporization).

Administrative Controls

Administrative controls are changes in work procedures such as written safety guidelines, regulations, supervision, schedules, signs, labels, SDSs, and training to reduce employee exposure to hazardous chemicals.

Labels

Labeling of all chemical containers assists emergency personnel and others in identifying what is and what is not hazardous should a spill occur, or other emergency situations. Original labels on chemical containers must not be removed, covered, or defaced. Labels must be in English and they must contain the complete name of the chemical and be traceable or easily linked to the appropriate SDS (chemical formulas are not allowed). The manufacturer's label is generally sufficient to meet OSHA labeling requirements and should be replaced only if it becomes damaged or illegible. All containers into which chemicals are transferred (see secondary labeling requirements below) also need to be legibly labeled in English and include the full name of the chemical and appropriate hazard warnings (abbreviations and chemical formulas are not allowed).

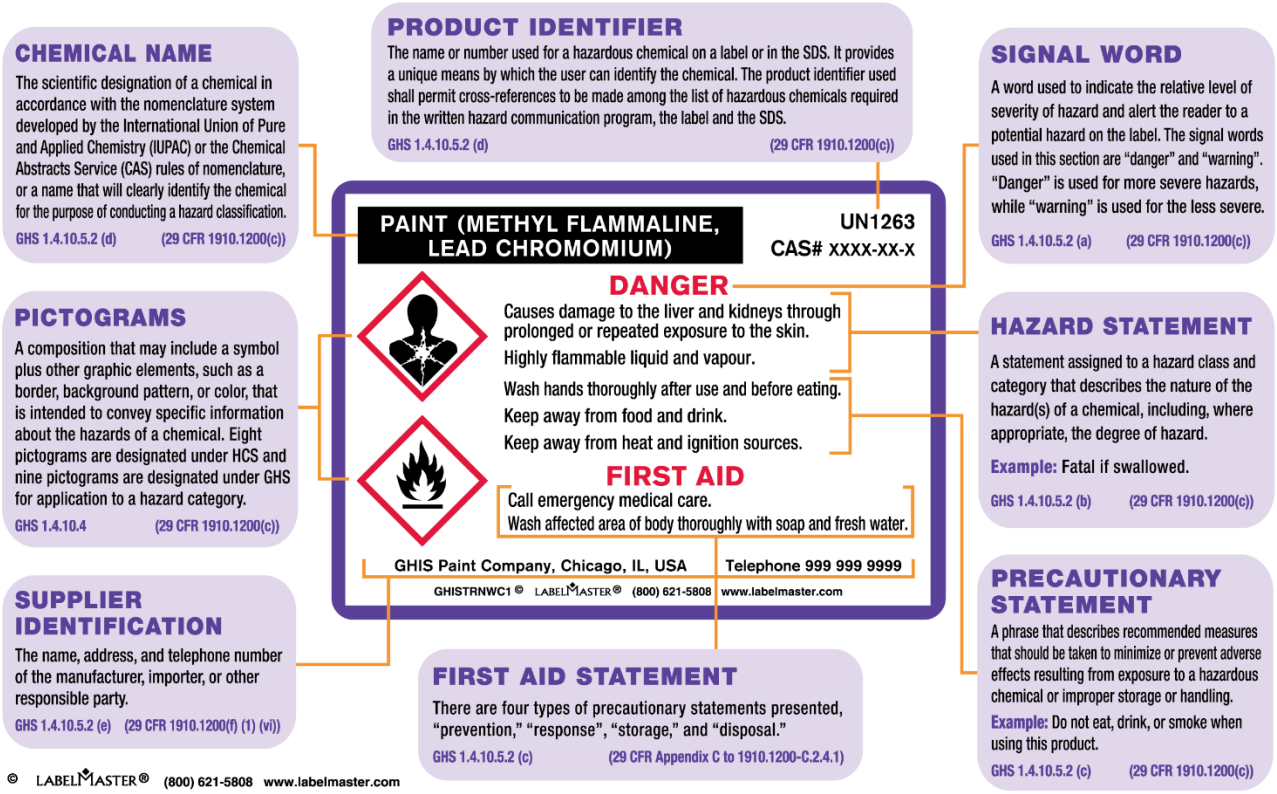
Refrigerators or freezers containing either chemicals or food should be appropriately labeled, e.g., "Chemicals Only, no food or drink", or "food and drink only". No food or drink, intended for human consumption, should ever be stored in a laboratory refrigerator or freezer.

Chemical and Hazard Identification

The OSHA Hazard Communication Standard requires all employers to provide information to their employees about hazardous chemicals they may potentially be exposed to. This information is disseminated using labels, signs, Safety Data Sheets (SDS) and training. SDSs should be maintained and easily accessible to laboratory employees. The CHIMERA chemical inventory system provides SDSs for all chemicals in each laboratory. Additionally, there is a CHIMERA SDS search engine that can be used for any chemical, irrespective of whether these chemicals are in a particular laboratory.

Recently OSHA modified the Hazard Communication Standard to better align with the international community. This modification, called the Global Harmonization Standards (GHS) significantly changed the labeling requirements. The GHS system of labeling requires the chemical name to be listed along with signal

words to quickly identify the main hazard, hazard statements, precautionary statements, and pictograms. The manufacturer's GHS label and instructions listed below reflect these changes:



Container Labeling

The label on each chemical container must include:

Product Identifier: Chemical name and ingredient disclosure.
Signal Words: "Danger" or "Warning" are used to emphasize hazards and indicate the relative level of severity of the hazard, assigned to a GHS hazard class or category.
Hazard Statements: Standard phrases assigned to a hazard class and category that describe the nature of the hazard.
Precautionary Statement: Supplements the hazard information by briefly providing measures to be taken to minimize or prevent adverse effects from physical, health or environmental hazards. First aid is included in the precautionary statement.
Supplier Information: The name, address and telephone number of the manufacturer or supplier of the product should be provided on the label.
Pictograms: Convey health, physical and environmental hazard information assigned to a GHS hazard class and category, as depicted below:

▪

GHS Pictograms and Hazard Classes		
		
▪ *Oxidizers*	▪ *Flammables* ▪ *Self Reactives* ▪ *Pyrophorics* ▪ *Self-Heating* ▪ *Emits Flammable Gas* ▪ *Organic Peroxides*	▪ *Explosives* ▪ *Self Reactives* ▪ *Organic Peroxides*
		
▪ *Acute toxicity (severe)*	▪ *Corrosives*	▪ *Gases Under Pressure*
		
▪ *Carcinogen* ▪ *Respiratory Sensitizer* ▪ *Reproductive Toxicity* ▪ *Target Organ Toxicity* ▪ *Mutagenicity* ▪ *Aspiration Toxicity*	▪ *Environmental Toxicity*	▪ *Irritant* ▪ *Dermal Sensitizer* ▪ *Acute toxicity (harmful)* ▪ *Narcotic Effects* ▪ *Respiratory Tract* ▪ *Irritation*

Secondary Labeling Requirements

When a chemical is transferred to another container or incorporated into a solution, the new container should be labeled such that employees will be provided with the information pertaining to the physical and chemical hazards associated with that chemical. This label should include product identifier and words, pictures, symbols, or any combination thereof, which describe the chemical hazards. Pre-formatted labels and pictogram stickers are available from the departmental CHR.

Signs

All hazardous materials, hazardous waste, and chemical storage areas shall be appropriately labeled, indicating the hazards present and any other relevant regulatory requirements.

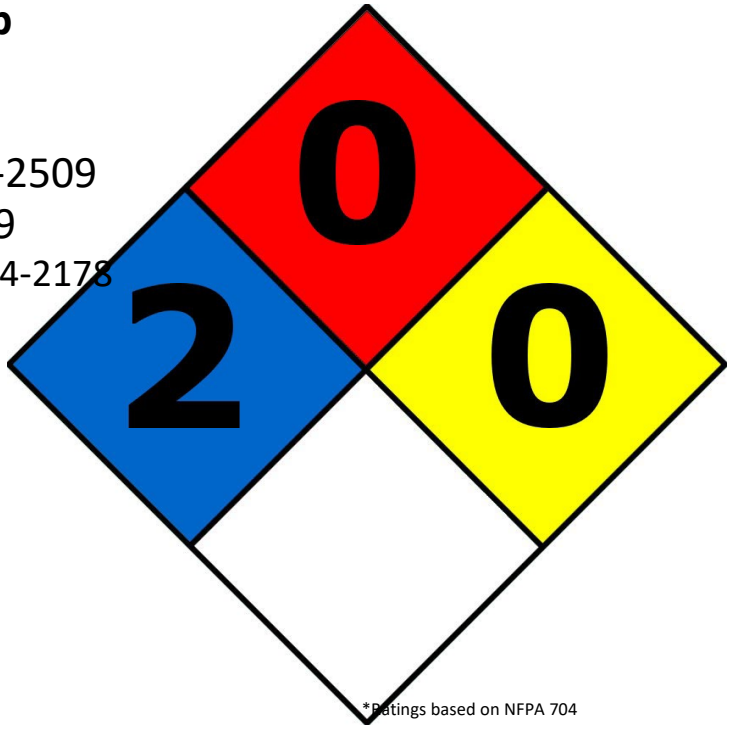
All laboratories shall be posted with signage addressing the hazards of the materials contained in the laboratory, requirements for personal protective equipment, and any special hazards located in the laboratory. Special hazards could include a sign indicating the presence of biohazardous or radioactive materials, if appropriate.

Each laboratory must have laboratory contact and emergency procedure information posted on the entrance to the laboratory. Additionally, each laboratory entrance sign shall include warnings about the hazards present in the laboratory to make people aware of the hazards before they enter. The sign should also include information about the appropriate PPE to be worn in the laboratory to minimize the risk from the hazards present. These signs can be created by using CHIMERA by selecting the NFPA Signs option (see example below). The information on these signs should be re-evaluated on a least an annual basis.

Bio 112/114 Teaching Lab

Biology Dept

Peggy Maiorano 704-894-2509
Allen Stowe 704-894-2929
Campus Public Safety 704-894-2178



*Ratings based on NFPA 704

Safety Data Sheets are available through any device connected to the campus network at: https://rms.unlv.edu/msds/

Small Containers
Where labeling the actual laboratory container is impractical due to its size or the conditions under which it is used, other methods of providing the information can be used, for example a secure swing tag, a sign attached to supporting apparatus or labelling an outer container. For example, for a rack of test tubes, rather than label each individual test tube containing the same hazardous chemical, a label may be attached to the rack using a swing tag.

Personal Protective Equipment (PPE)

Davidson College requires that a determination be made by faculty or staff to ascertain what PPE should be used to protect their laboratory personnel and students. PPE should be used in conjunction with shields, engineering controls, and administrative controls. PPE may be required to reduce laboratory personnel and students' exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. PPE should always be worn if there is a possibility that personal clothing could become contaminated with hazardous materials. Examples include: laboratory coats, safety glasses, aprons, jumpsuits, boots, shoe covers, and gloves. Review the SDS to determine the necessary PPE to limit exposure. The kind of PPE needed depends on how the chemical enters the body. These entry points are called routes of exposure and are listed on the SDS. The four major routes of exposures are skin absorption, inhalation, ingestion, and injection.

Laboratory Attire
When performing work with hazardous materials, laboratory personnel and students should cover all exposed parts of their body to prevent unnecessary chemical exposure. Tie long hair back, avoid loose clothing such as neckties, scarves, and flowing sleeves. Use natural fabrics as much as possible. Long pants, or their equivalent, are strongly recommended. Rings, bracelets, watches, or other jewelry that could trap chemicals close to the skin, come in contact with electrical sources, or get caught in machinery should not be worn.

Foot Protection
Closed-toe shoes shall be worn in areas where hazardous chemicals are in use or mechanical work is being done. Clogs, perforated shoes, bare feet, sandals, and cloth shoes do not provide protection against chemicals. Shoe covers may be required for work with especially hazardous materials.

Hand Protection (See Appendix 5 for a guide to selecting appropriate gloves.)
When handling hazardous chemicals, laboratory personnel and students shall select and wear the appropriate gloves. No single glove can provide appropriate protection in every work situation. It is important to assess the hazards in each task and select a glove that provides the required protection. Below are general recommendations for glove selection and use:

- Similar gloves supplied by different manufacturers may not offer the same level of protection; therefore, the manufacturer's glove selection chart should be reviewed.
- Select gloves which are resistant to the chemicals you may be exposed to. Consult the relevant SDS which may recommend a particular glove material.
- Select gloves of the correct size and fitting; gloves that are too small are uncomfortable and may tear whereas larger gloves may interfere with dexterity.
- Before use, check gloves (even new ones) for physical damage such as tears and pin holes.
- When removing gloves, do so in a way that avoids having the contaminated exterior of the glove coming in contact with the skin.
- Wash hands after removing gloves.

Many factors affect the breakthrough times of gloves including: thickness of glove material, chemical concentration, amount of chemical that contacts the glove, length of time the glove is exposed to the chemical, temperature at which the work is done, and possibility of abrasion or puncture. Glove selection guides are available from most manufacturers.

If chemicals do penetrate the glove material, they could be held in prolonged contact with the hand and cause more serious damage than in the absence of a proper glove. Gloves should be replaced immediately if they are contaminated or torn. The use of double gloves may be appropriate in situations involving chemicals of high or multiple hazards. Leather gloves are appropriate for handling broken glassware and inserting tubing into stoppers, where protection from chemicals is not needed. Gloves should be replaced periodically, depending on the frequency of use.

Lab Coats, Protective Suits & Aprons
Laboratory coats should be fully covering and should be worn, buttoned, with the sleeves rolled down. Laboratory coats or laboratory aprons made of special materials are available for high-risk activities, these may include fire resistant lab coats. Laboratory coats that have been used in the laboratory should be left there to minimize the possibility of spreading chemicals to eating and office areas, and they should be cleaned as needed if reused.

Eye and Face Protection
Safety glasses with side shields that conform to ANSI standard Z87.1-1989 are required for work with hazardous chemicals (splash goggles are preferred). Ordinary prescription glasses with hardened lenses do not serve as safety glasses. If prescription glasses are required, safety glasses or goggles that cover the prescription glasses should be used.

Although safety glasses can provide protection from injury from flying particles, they offer little protection against chemical splashes. Splash goggles should be worn if there is a splash hazard in any operation involving hazardous chemicals. Full face shields are worn in conjunction with either safety glasses or splash goggles. When there is a possibility of liquid splashes, both a face shield and splash goggles should be worn; these protective measures are especially important for work with highly corrosive liquids. Full-face shields with throat protection and safety glasses with side shields should be used when handling highly hazardous chemicals. If work in the laboratory could involve exposure to lasers, ultraviolet light, infrared light, or intense visible light, specialized eye protection should be worn. Safety glasses should be provided for visitors in the laboratory.

Respiratory Protection
Any operation that generates harmful airborne levels of dusts, fumes, sprays, mists, fog, smoke, vapors, or gases or that may involve oxygen-deficient atmospheres requires the use of effective exposure controls. When effective engineering controls are not feasible or while they are being implemented, appropriate respiratory protection must be used. Davidson College shall provide, at no cost to the laboratory personnel and students, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134. Contact the CHO for further information.

VI. Equipment, Maintenance, Inspections

Fume Hoods
The laboratory fume hood is the most common local exhaust method used in laboratories. When working with hazardous chemicals, the use of the fume hood is required at Davidson College. A properly operating

and correctly used fume hood will control vapors, dusts, and mists released from volatile liquids. Fume hoods can also protect from accidental spills. Fume hoods need to be inspected and certified on an annual basis. Each PI/Supervisor is responsible for ensuring that their fume hood(s) has an updated certification label and is functioning properly. Except when adjustments to the apparatus are being made, the hood should be kept closed, with vertical sashes down and horizontal sashes closed, to help prevent the spread of a fire, spill, or other hazards into the laboratory. Basic guidelines for operating a fume hood include the following:

- Confirm that the fume hood has been certified within the last year (label with date).
- Confirm, by checking the SDS, that the chemical can be used in the fume hood.
- All work should be conducted no closer than 6 inches behind the plane of the face (sash opening) of a fume hood.
- Never put your head inside a fume hood to check an experiment.
- Work with the sash at the lowest position possible to protect your face and body.
- Fume hoods are not designed for storage. Items (equipment, chemicals, etc.) within the fume hoods should be minimized. Remove all items not required for procedures in progress.
- Immediately report any suspected fume hood malfunctions to the Physical Plant, label the hood as out of service, and discontinue use until it is functioning properly again.
- Limit foot traffic behind you while performing operations in the hood.

Special-Purpose Hoods

Certain research activities involve the use of substances that can create dangerous conditions or have clearly defined health hazards. These activities will require specially designed fume hoods to deal with these unique conditions. The most common special-purpose fume hoods are perchloric acid and radioisotope fume hoods.

Safety Showers and Eyewash Stations

In case of an exposure to hazardous substances, a reliable, clean source of water must be available to rinse contaminants from the body. Safety showers and eyewash stations are in laboratories throughout the Wall, Watson or Dana buildings. PIs/Supervisors must ensure that access to safety showers and eyewash stations is free from obstruction. PIs/Supervisors are responsible for ensuring that all laboratory personnel are aware of the nearest safety shower and eyewash station location and how to use the device. The Physical Plant is responsible for ensuring that routine inspections of safety showers and eyewash stations are being performed and documented. The Physical Plant will coordinate and conduct routine tests of the safety showers and eyewash stations to ensure that they are functionally compliant with ANSI/ISEA Z358.1.

Inspections

The Laboratory Safety Task Force will coordinate and schedule an annual laboratory safety inspection. The CHO will accompany the PI in the inspection of his/her laboratory. The laboratory safety form used for these inspections is in Appendix 6. Inspections will include a walk-through of the selected area(s) and will cover lab safety, PPE, waste management, records, and related topics. PIs should use the results as a guide to identify and correct these and/or other environmental, health and safety issues in their area(s).

VII. Information and Training

Information

Davidson College will provide the following information to laboratory personnel and students prior to working with any hazardous chemical. All new laboratory personnel or students utilizing the effected laboratories will be required to review and understand the CHP as part of their new employee orientation.

- The availability and location of the CHP.
- Access to SDSs for all hazardous chemicals.
- Standard Operating Procedures (SOPs) for operations conducted.
- Additional information on the hazards, safe handling, storage and disposal of hazardous chemicals that can be obtained from the CHO, OSHA website, NIOSH website, chemical manufacturers, and other relevant references.

Training

All laboratory personnel and students working in a laboratory shall be trained to the contents of the CHP and all applicable SOPs that are pertinent to a procedure, experiment, or task. Training shall include but is not limited to:

- Provisions of the CHP.
- Hazards in the laboratory.
- OSHA-regulated substances or recommended exposure limits.
- Signs and symptoms associated with exposures to hazardous chemicals.
- Safe handling, storage, and disposal of hazardous chemicals.
- How to interpret a SDS.
- The selection and use of PPE.

Because the PIs have the most immediate knowledge of the hazards present in their laboratories, it is their responsibility to ensure that all laboratory personnel and students are trained to work safely with the specific hazards present in their laboratories.

Frequency of Training

Training shall be provided for laboratory personnel and students:

- Prior to starting work in the laboratory (or at the beginning of each semester or school year).
- Before each new possible hazard exposure.
- Before use on new or altered equipment.
- Whenever changes are made to SOPs or the CHP.

Recordkeeping

Each department and laboratory group are responsible for establishing and maintaining records for training, environmental monitoring, and compliance records. Review of these records will be part of the annual laboratory inspection.

VIII. Medical Support

Medical Examinations and Consultations

Davidson College shall provide their laboratory personnel and students who work with hazardous chemicals the opportunity for medical attention and follow-up by a competent physician if they show signs and symptoms of exposure.

Medical Surveillance

Laboratory personnel and students shall be provided an opportunity to receive an appropriate medical examination performed by a licensed physician at a reasonable time and free of cost under the following circumstances:

- Any time laboratory personnel and students believe they have been significantly exposed to hazardous materials.
- Whenever laboratory personnel and students develop signs or symptoms associated with a hazardous chemical to which they may have been exposed in the laboratory.
- If an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure.
- Where exposure monitoring reveals an exposure level routinely above the action level for an OSHA regulated substance.

To initiate the medical consultation process, affected employees and students should contact the Davidson Human Resources (HR) department at (704) 894-2213.

Appendix 1
Chemical Hygiene Plan Officers

Title	Name	Department	Contact Information
Chemical Hygiene Officer (CHO)	Allen Stowe	EHS Office	(704) 894-2929
Chemical Hygiene Representative (CHR)	Becca Vance	Biology	(704) 894-2731
Chemical Hygiene Representative (CHR)	Chris Alexander	Chemistry	(704) 894-2258
Chemical Hygiene Representative (CHR)	TBD	Environmental Studies	TBD
Chemical Hygiene Representative (CHR)	Stephanie Cudo	Physics	(704) 894-2649
Chemical Hygiene Representative (CHR)	Johanna Ferguson	Psychology	(704) 894-2628

Appendix 2

Standard Operating Procedure Template

For working with (enter chemical name with CAS#) or process:

PI:					**Building(s):**
PI Signature:					**Room Number(s):**
Date:					**Designated Work Area:**
Departmental Approval?	**Yes**	☐	**No**	☐	**Departmental Chair Signature:**
Biohazards Committee Approval?	**Yes**	☐	**No**	☐	**Biohazards Committee Chair Signature:**

1. **Hazard Identification**

a. Preparation and Use:

Note: If identified as a **process**, provide additional detailed procedural steps for the use of **each** hazardous chemical in **Section 5**, below.

b. Potential Hazards and Risk:

2. **Hazard Control**

a. **Chemical Selection/Substitution:**

b. **Engineering Controls:**

c. **Administrative and Work Practice Controls:**

d. **Personal Protective Equipment (PPE):**

e. **Storage and Transportation:**

3. **Emergencies, Spill Procedures, and Exposures/Unintended Contact**

4. **Waste Management**

5. **Details of Process**

6. **Safety Data Sheets**

7. **Training**

All personnel are required to complete an introduction to general chemical safety. Furthermore, all personnel shall read and fully adhere to this SOP when handling the chemical.

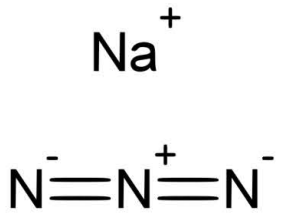
"I have read and understand this SOP. I agree to fully adhere to its requirements."

Last	First	Signature	Date

BIOLOGY SOP #: 005	**SUPERCEDES: N/A**
VERSION NO.: 1.0	**EFFECTIVE DATE: December 2017**
PREPARED BY: John Doe	**LAST REVISED: December 12, 2017**

Standard Operating Procedure
For

Sodium Azide



PURPOSE:

Describe proper handling and disposal procedures for Sodium Azide and Sodium Azide solutions.

Sodium Azide is a colorless, odorless, crystalline solid that is readily soluble in water. It is used as a preservative of samples and stock solutions in laboratories. Typically, it is used in strengths of 0.1 to 2.0%. Pure Sodium Azide and concentrated solutions of Sodium Azide are acutely toxic and can be reactive when heated near their decomposition temperature. Dilute solutions of Sodium Azide should not be poured down the drain because it can react with metals in plumbing systems to form explosive metal halides.

Sodium Azide is also used as an explosive trigger in automobile airbags, as well as a chemical reagent in organic synthesis labs.

HEALTH EFFECTS:

Sodium Azide is extremely toxic. Ingestion of small amounts can be fatal, LD50 Oral – Rabbit – 10mg/kg. Skin contact may also be fatal, LD50 Dermal – rabbit – 20mg/kg. Inhalation may also be fatal, LC50 Inhalation – rat – 37mg/m^3. Sodium Azide prevents oxygen from being used by the cells in the body, thus killing them.

Signs of acute exposure:

Eyes: Redness, pain, irritation

Skin: Irritation, redness, blisters. May be fatal if absorbed through the skin.

Ingestion: Irritation of the digestive tract, abdominal pain, nausea, sweating, vomiting, and diarrhea. May cause low blood pressure, rapid heart rate, skin discoloration, and possible coma.

Inhalation: Severe irritation of the respiratory tract with sore throat, cough, clear drainage from the nose, blurred vision, dizziness, shortness of breath, respiratory failure leading to death.
(Note: Hydrazoic Acid, generated when sodium azide reacts with acid or water, in gaseous form is lighter than air.)

Signs of chronic exposure: Liver and Kidney damage. Repeated exposure may cause spleen damage. Laboratory studies have shown mutagenic effects, development of tumors in animals, and blood effects. Survivors of Sodium Azide poisoning may exhibit brain and heart damage.

REGULATORY LIMITS:

NIOSH: Recommended exposure limit is 0.3 mg/m^3 - ceiling (skin) - as Sodium Azide. 0.1ppm as Hydrazoic Acid.

ACGIH: Recommended threshold limit value – ceiling – of 0.3mg/m^3 as Sodium Azide. 0.1ppm as Hydrazoic Acid.

REQUIREMENTS:

Based on the risk associated with the use of Sodium Azide, the safety procedures outlined below are required by all research staff when working with Sodium Azide.

Administrative Controls:

- Anyone who uses Sodium Azide is required to review this SOP and the attached Safety Data Sheet (SDS) prior to work.
- Storage should take place in a secure, cool, ventilated area, with a tightly closed container.
- Keep segregated away from acids and other incompatibles such as metals and oxidizing or reducing reagents.
- Keep quantities to a minimum and only order what you will be using.
- An eye wash should be available in the room with a safety shower accessible nearby.
- If using large quantities or heating sodium azide in a chemical reaction, a blast shield should be in place.
- Never use a metal spatula when manipulating Sodium Azide.

Engineering Controls:

- Sodium Azide powder must be used in a functioning chemical fume hood including when weighing out powders or if being used in a chemical reaction.
- Concentrating solutions on a rotary evaporator or drying under vacuum should also take place within a chemical fume hood.

Personal Protective Equipment (PPE):

- For sodium azide solutions: Nitrile gloves, a lab coat, and safety glasses.

- If using large quantities or heating sodium azide in a chemical reaction, nitrile gloves (double gloving recommended), a lab coat, safety glasses and a face shield should be used during manipulations.

Waste Disposal:

- All Sodium Azide waste, including dilute solutions and contaminated solid waste (weigh paper, pipet tips, gloves, etc) will be managed through the EHS Office for proper disposal. Contact the Biology Laboratory Manager or the EHS Office at 704-894-2929.
- Do not discard Sodium Azide waste down the sink. Do not mix Sodium Azide waste with acidic waste.

Accidents or Injuries:

- If Sodium Azide is splashed on an individual or in eyes, flush for 15 minutes with copious quantities of water and immediately contact 911.
- Spill procedures:
    - Do not attempt to clean-up if you feel unsure of your ability to do so or if you perceive the risk to be greater than normal laboratory operations.
    - If a small spill occurs within a chemical fume hood, Sodium azide crystals should be swept up and surfaces or equipment cleaned with pH-adjusted water (pH greater than 9.0). Cover spills of sodium azide solution with absorbent material, and clean surfaces with pH-adjusted water. Collect spilled material and clean up material into appropriately labeled, non-metallic waste container. All spill clean-up material should be disposed of as hazardous waste.
    - If a large spill occurs, notify others in the area and evacuate room immediately. Contact Public Safety (704-994-2178) during working hours and 911 if after hours.

SAFETY DATA SHEET

Version 6.7
Revision Date 05/28/2014
Print Date 06/17/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Sodium azide

Product Number : S2002
Brand : Sigma-Aldrich
Index-No. : 011-004-00-7

CAS-No. : 26628-22-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 2), H300
Acute toxicity, Dermal (Category 1), H310
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H300 + H310 Fatal if swallowed or in contact with skin
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P262 Do not get in eyes, on skin, or on clothing.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.

P302 + P350	IF ON SKIN: Gently wash with plenty of soap and water.
P310	Immediately call a POISON CENTER or doctor/ physician.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P361	Remove/Take off immediately all contaminated clothing.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Contact with acids liberates very toxic gas.
Sodium Azide may react with lead and copper plumbing to form highly explosive metal azides., Rapidly absorbed through skin.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	N_3Na
Molecular Weight	:	65.01 g/mol
CAS-No.	:	26628-22-8
EC-No.	:	247-852-1
Index-No.	:	011-004-00-7

Hazardous components

Component	Classification	Concentration
Sodium azide		
	Acute Tox. 2; Acute Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H300 + H310, H410	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Dry powder

5.2 Special hazards arising from the substance or mixture
Sodium oxides

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Never allow product to get in contact with water during storage. Do not store near acids.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Sodium azide	26628-22-8	C	0.1 ppm	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential for dermal absorption		
		C	0.3 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		
		C	0.1 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		
		Skin notation		
		C	0.11 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Lung damage Cardiac impairment Not classifiable as a human carcinogen		

		C	0.29 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Lung damage Cardiac impairment Not classifiable as a human carcinogen		

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: white
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	10 at 65 g/l at 25 °C (77 °F)
e)	Melting point/freezing	275 °C (527 °F)

	point	
f)	Initial boiling point and boiling range	no data available
g)	Flash point	no data available
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	0.01 hPa (0.01 mmHg) at 20 °C (68 °F)
l)	Vapour density	no data available
m)	Relative density	1.850 g/cm3
n)	Water solubility	65 g/l at 20 °C (68 °F) - completely soluble
o)	Partition coefficient: n-octanol/water	no data available
p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	300 °C (572 °F) -
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information

Bulk density	0.8 kg/m3

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
An explosion occurred when a mixture of sodium azide, methylene chloride, dimethyl sulfoxide, and sulfuric acid were being concentrated on a rotary evaporator.

10.5 Incompatible materials
Halogenated hydrocarbon, Metals, Acids, Acid chlorides

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rabbit - 10 mg/kg

LC50 Inhalation - rat - 37 mg/m3
Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Other. Behavioral:Convulsions or effect on seizure threshold. Lungs, Thorax, or Respiration:Structural or functional change in trachea or bronchi.

LD50 Dermal - rabbit - 20 mg/kg

no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

no data available

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: VY8050000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Nausea, Headache, Vomiting, Laboratory experiments in animals have shown sodium azide to produce a profound hypotensive effect, demyelination of myelinated nerve fibers in the central nervous system, testicular damage, blindness, attacks of rigidity, and hepatic and cerebral effects.

Liver - Irregularities - Based on Human Evidence
Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia pulex (Water flea) - 4.2 mg/l - 48 h

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1687 Class: 6.1 Packing group: II
Proper shipping name: Sodium azide
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 1687 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: SODIUM AZIDE
Marine pollutant: No

IATA
UN number: 1687 Class: 6.1 Packing group: II
Proper shipping name: Sodium azide

15. REGULATORY INFORMATION

SARA 302 Components
The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Sodium azide	26628-22-8	2007-07-01

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Sodium azide	26628-22-8	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Sodium azide	26628-22-8	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Sodium azide	26628-22-8	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Sodium azide	26628-22-8	2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H300	Fatal if swallowed.
H300 + H310	Fatal if swallowed or in contact with skin
H310	Fatal in contact with skin.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	4
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 6.7 Revision Date: 05/28/2014 Print Date: 06/17/2014

Appendix 3

Biology Department Plan for Implementing CHIMERA Chemical Inventory System (May 2024)

1. Staff members Becca Vance, Jessica Spillman, Johanna Ferguson and Alyssa Flynn will receive CHIMERA chemical inventory training (via webinar if possible) prior to the start of the 2017-2018 academic year.

2. Allen Stowe will give each CHIMERA-trained staff member access to CHIMERA for all Biology rooms.

3. Staff members will barcode and record in CHIMERA all existing chemicals in their designated prep rooms and teaching labs, continuing this practice into the future as new chemicals are received. Chemicals to be barcoded are defined as those in the original manufacturer's container, not including single use containers. Kits will receive one barcode. Antibodies, oligonucleotides, primers, and restriction enzymes do not require barcoding or inventory entry. Items too small for barcoding may be entered as "static" (see CHIMERA manual) or may be placed in a small plastic bag with the barcode on the bag. Compressed gas cylinders and one-time use products will be entered as static. Bar code labels are available in a dispenser located at the Chemistry stockroom desk. If additional barcode labels are needed, please contact Becca Vance.

4. Each faculty member is paired with a specific staff member for the purpose of barcoding and recording existing chemicals in research labs. Staff members will instruct each faculty member partner in CHIMERA use through one-on-one tutorials as each research lab is being initially barcoded or for newly arriving chemicals after the barcoding of existing chemicals has been completed.

5. When all chemicals in a room have been initially barcoded, staff members will create and post NFPA safety sheets on doors. These sheets will be updated as needed (at least annually as part of the annual chemical inventory performed by Biology staff members using a barcode reader every May).

6. After a faculty member is proficient with CHIMERA, the staff member will request that Allen Stowe grant the faculty member access to all Biology rooms in CHIMERA. From that point on, that faculty member is responsible for barcoding and recording in CHIMERA each new chemical received for his/her research lab. *Before a faculty member has CHIMERA access, if existing chemicals in his/her research lab have already received barcodes, he/she must use the paper log in the stockroom and attach a barcode to new chemicals. No chemical can leave the stockroom without a barcode and CHIMERA entry. Staff members will check the paper log periodically and transfer the information into CHIMERA. After all faculty members have been trained in CHIMERA the paper log will serve merely as a backup for extenuating circumstances.*

7. Plastic collection bins are located in each Biology lab for temporarily holding barcoded chemical containers that need to be discarded because they are empty, contents have expired, etc. Periodically, the designated staff member will collect the barcoded containers, delete those chemicals from the CHIMERA inventory, and discard containers. Faculty members may be responsible for deletions from CHIMERA in the future. Barcoded containers are never to be thrown in the trash (or repurposed as waste containers) until after after they have been deleted from CHIMERA.

8. All existing chemicals in the Biology Department lab spaces will be entered into CHIMERA by December 31, 2024. Faculty members who do not comply with this chemical inventory procedure may lose P-card privileges.

BIO Staff Member	Rooms/Faculty Partners
Alyssa Flynn	Wall 102, 104, 104B, 128, 179, 245, 247 Campbell (325), El Bejjani (248), Wessner (225), D. Thurtle-Schmidt (142), Wadgymar (121), Paradise (146), Hales (323)
Jessica Spillman	Wall 118, 120, 122, 129, 143, 144, 145, 147, 149 Sarafova (240), Smith (115), Faculty Research Lab (127)
Johanna Ferguson	All Bio rooms in basement (Animal Facility) Biology faculty training back-up/assistant/consultant as needed
Becca Vance	Wall 212, 216, 218, 220, 222, 316, 316A, 318, 324, 326, 328 B Thurtle-Schmidt (346), Lom (217), Bernd (215)

Psychology Department Plan for Implementing CHIMERA Chemical Inventory System (December 2024)

1. Psychology staff members and CHR (currently Johanna Ferguson) will receive CHIMERA chemical inventory training (via webinar if possible).

2. Allen Stowe will give CHIMERA-trained psychology staff member access to CHIMERA for all Psychology rooms.

3. Staff members will barcode and record in CHIMERA all existing chemicals in their designated prep rooms and labs, continuing this practice into the future as new chemicals are received. Chemicals to be barcoded are defined as those in the original manufacturer's container, not including single use containers. Kits will receive one barcode. Antibodies, oligonucleotides, primers, and restriction enzymes do not require barcoding or inventory entry. Items too small for barcoding may be entered as "static" (see CHIMERA manual) or may be placed in a small plastic bag with the barcode on the bag. Bar code labels are available in a dispenser located at the Chemistry stockroom desk. If additional barcode labels are needed, please contact Becca Vance.

4. Chemical orders will be placed through the Psychology Department CHR. When these chemicals are received they will be barcoded, entered in CHIMERA, and delivered to a previously specified storage space.

5. When all chemicals in a room have been initially barcoded, staff members will create and post NFPA safety sheets on doors. These sheets will be updated as needed (at least annually as part of the annual chemical inventory performed by Psychology staff members using a barcode reader every May).

6. Plastic collection bins are located in each research lab for temporarily holding barcoded chemical containers that need to be discarded because they are empty, contents have expired, etc. Periodically, the designated staff member will collect the barcoded containers, delete those chemicals from the CHIMERA inventory, and discard containers. Faculty members may be responsible for deletions from CHIMERA in the future. Barcoded containers are never to be thrown in the trash (or repurposed as waste containers) until after they have been deleted from CHIMERA.

Appendix 4
Waste Accumulation Log Sheet

PI/Contact Name	Room Number	Date	Description of Waste	Hazardous Y or N	Estimated Volume (gals or lbs)	Additional Information

Appendix 5

Glove Selection Guide

This guide only provides general PPE guidance. Always review the safety data sheet for the chemical(s) being used and the PPE manufacturer's specifications before selecting appropriate PPE.

Glove Type	Photo	Use Type	Advantages	Disadvantages
Nitrile, Disposable		• Incidental chemical contact use only • General lab chemical use • Commonly used in the medical field	• Good general lab use glove, adequate protection from many organic solvents, oils, greases, and some acids and bases • Good protection from blood, cell lines, and tissue • Clear indication of tears and breaks • Excellent dexterity • Non-allergenic	• Not effective for direct contact use • Not effective for use with many halogenated solvents
Neoprene, Disposable		• Incidental chemical contact use only • General lab chemical use	• Good protection from many acids, bases, peroxides, fuels, alcohols, and phenols • Clear indication of tears and breaks • Excellent dexterity	• Not effective for direct contact use • Not effective for use with many halogenated solvents
Latex, Disposable		• Incidental chemical contact use only • Commonly used in the medical field • Not suitable for many lab settings	• Good protection from many biological agents, including blood, cell lines, and tissue • Provides good protection from some acids and bases • Excellent dexterity	• Not effective for direct contact use • Not effective for use with many organic solvents • Allergenic • Difficult to detect tears and breaks
Butyl Rubber		• Suitable for direct contact with some chemicals	• Good protection from many ketones, esters, gases, vapors, acids, and bases • Can be decontaminated reused • Puncture and tear resistant	• Not effective for use with gasoline, aliphatic, aromatic, and halogenated hydrocarbons • Poor dexterity
Viton		• Suitable for direct contact with some chemicals	• Good protection from many chlorinated and aromatic hydrocarbons • Can be decontaminated reused • Puncture and tear resistant	• Not effective for use with ketones • Average dexterity
Polyvinyl Chloride		• Suitable for direct contact with some chemicals	• Good protection from many acids, bases, oils, fats, peroxides, and amines • Can be decontaminated reused • Puncture and tear resistant	• Not effective for use with many organic solvents • Average dexterity

General Purpose Nitrile Coated		• Incidental chemical contact use only	• Good all-purpose work glove where very minor chemical contamination is possible; provide minimal chemical resistance • Can be decontaminated reused • Puncture and tear resistant • Good dexterity and grip	• Not effective for direct and/or prolonged exposure to chemicals
Leather		• Non-hazardous material handling; not to be used with chemicals	• Good all-purpose work glove for non-hazardous material handling • Puncture and tear resistant	• Not effective for use with hazardous chemicals; leather absorbs liquids • Poor dexterity
Cut-Resistant		• Used when handling sharp objects • Incidental chemical contact use only	• Excellent cut resistance to sharp objects such as razor blades and pipette tips • Some provide minimal chemical resistance • Can be decontaminated and reused • Good dexterity and grip	• Not effective for direct and/or prolonged exposure to chemicals
Cryogenic Gloves		• Used when handling cryogenic surfaces	• Excellent protection from cryogenic surfaces and liquids such as liquid nitrogen • Designed to be reused for long periods of time	• Not effective for direct and/or prolonged exposure to chemicals • Poor dexterity
Heat Resistant Gloves		• Used when handling hot surfaces	• Excellent protection from hot surfaces such as autoclaves and drying ovens • Designed to be reused for long periods of time	• Not effective for use with hazardous chemicals; leather absorbs liquids • Poor dexterity

Appendix 6

Laboratory Safety Checklist – Davidson College

Building Name: _____ Date of Inspection: _____
Room(s): _____ Auditor Name(s): _____
Principal Investigator: __

Mark each item as Y, N, NA as appropriate.

Documentation & Training

Y/N/NA	
	Lab entrance signs with current contacts and emergency numbers posted
	Davidson Chemical Hygiene Plan accessible and up to date
	Other required manuals accessible and up-to-date
	Chemical Inventory has undergone annual review/update
	Lab personnel know where and how to obtain Safety Data Sheets (SDS)
	Specialized training (Bloodborne Pathogen, BSL-2, Laser, Formaldehyde) as needed
	Lab specific policies (Working Alone, Standard Operating Procedures, etc.)

Emergency Equipment

Y/N/NA	
	Fire Extinguisher (FE) available
	FE unobstructed and located at designated location (40" top)
	FE has annual inspection, sealed and charged
	Appropriate FE for fire hazard (Class A, B, C, or D)
	Safety Shower (SS) present (within 75 feet or 10 second travel)
	SS unobstructed
	SS checked/tested by Physical Plant
	Eye Wash (EW) present (within 75 feet or 10 second travel)
	EW Unobstructed
	EW Checked/tested by Physical Plant routinely (verify work requests)
	Spill kit available and lab personnel are trained in spill clean-up procedures

Personal Protective Equipment (PPE)

Y,N,NA	
	PPE (eyewear, gloves, lab coats) available and used in lab
	Proper eye protection use (safety glasses/goggles/face shield)
	Visitor glasses readily available (if visitors permitted)
	Proper chemical resistant/heat resistant/cryogenic gloves
	Long pants and closed toe shoes (no open toe shoes) worn
	Rubber apron available (in concentrated acid/base use)

General Hazards

Y/N/NA	
	Corridors and exit doors unobstructed
	Adequate lighting for tasks
	Excess trash, boxes, and paper removed
	No eating/drinking/food storage in lab (except designated areas)
	Hand washing facility (with liquid soap) available
	Proper disposal of needles and sharp objects (plastic red for biohazards)
	Proper disposal of broken glass in lined cardboard box.

Electrical

Y/N/NA	
	Proper power cord use (good housekeeping, no trip hazard)
	Extension cord – temporary use, single only (no daisy chains)
	Power strips with surge protection
	No cording through walls, floors or ceiling
	Electrical cords not frayed and good insulation
	Three pronged plugs not altered, grounding pins in place
	Ground Fault Circuit Interrupters on outlets in wet locations
	Electrical Panels should not be obstructed.

Laboratory Refrigerator/Freezer

Y/N/NA	
	“No Food or Drink” sign posted on door
	Food/drink not stored in laboratory
	Flammables stored in approved safety refrigerators, either Flammable Safe or Explosion Proof

Chemical Storage

Y/N/NA	
	Chemicals stored by compatibility group (flammables, oxidizers, bases, acids, reactives)
	Incompatible chemicals physically separated
	Chemicals properly labeled (no chemical formulas)
	Storage areas labeled with compatibility group
	No excess chemicals on bench tops/in hoods/under sinks
	Flammable storage: <10 gallons (38L) outside flammable cabinet
	Unstables, reactives, or explosives marked with date received and date opened
	Peroxide formers marked with date to be discarded/tested

Chemical Waste

Y/N/NA	
	Timely waste pickup requests (no build-up of waste in lab)
	Containers closed except when actively receiving waste
	Containers are clearly labeled with the words “waste” and their specific chemical contents
	No hazardous waste is poured down the drain without prior approval from the EHS Office
	No chemical waste stored in fume hoods

Engineering Controls

Y/N/NA	
	Exhaust and alarm working properly
	Chemical fume hood annual inspection sticker up to date
	Sash kept at or below marked height except for set-up
	Sash kept closed when not in use
	Hood is not being used for long-term chemical storage
	Biosafety cabinets certified within the past year (if required)

Physical Hazards

Y/N/NA	
	Belts, pulleys, rotating parts guarded (especially vacuum pumps)
	Electrical disconnect unobstructed
	Unattended operating equipment labeled/posted

Gas Cylinders

Y/N/NA	
	Properly secured (individual chain/cable recommended)
	Cylinders are storage labeled as empty or full or in use
	Caps on cylinders when not in use

Biohazard Waste

Y/N/NA	
	Red sharps containers properly labeled with biohazard symbol
	No sharps containers are greater than 2/3 full
	Autoclave log maintained when treating biological waste

Biosafety Level 2 (BSL2)

Y/N/NA	
	Easily cleanable surfaces and laboratory furniture (nonporous chairs)
	Hand washing sink
	Safety eye wash and emergency shower
	Biohazard symbol on lab equipment used for BSL2 work
	Entryway signs denoting BSL2 lab space

Lasers (Class 3B and 4)

Y/N/NA	
	Laser signs are posted on doors
	Protective eyewear is available and in good condition
	Warning signs and lights are in proper order
	Interlocks are working properly
	Keys are not left in an unattended control panel

Select Agent Toxins

Y/N/NA	
	Toxins registered on Schedule F in lab safety plan
	Inventory in place and up to date
	Current inventory is secure

Other Concerns

Appendix 7

Regulations and Laws Governing Laboratory EHS

OSHA General Duty Clause

Section 5 (a) (1) requires that employers "shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees." Therefore, even if an OSHA standard has not been promulgated that deals with a specific hazard or hazardous operation, protection of workers from all hazards or hazardous operations may be enforceable under section 5(a)(1) of the OSH Act. For example, best practices that are issued by non-regulatory organizations such as the National Institute for Occupational Safety and Health (NIOSH), the Centers for Disease Control and Prevention (CDC), the National Research Council (NRC), the American National Standards Institute (ANSI), and the National Institutes of Health (NIH), can be enforceable under section 5(a)(1).

Other Applicable Regulations (Note: This list is not all inclusive)

- Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450)
- Hazard Communication Standard (29 CFR 1910.1200)
- Bloodborne Pathogen Standard (29 CFR 1030)
- Personal Protective Equipment Standard (29 CFR 1910.132)
- Eye and Face Protection Standard (29 CFR 1910.133)
- Respiratory Protection Standard (29 CFR 1910.134)
- Hand Protection Standard (29 CFR 1910.138)
- Control of Hazardous Energy Standard (29 CFR 1910.147)
- Electrical Safety (29 CFR 1910 Subpart S Electrical)
- Fire Safety (29 CFR 1910.157)
- Department of Transportation (49 CFR HMR)
- Slips, Trips and Falls (29 CFR 1910 Subparts D, E, J)
- Formaldehyde (29 CFR 1910.1048)
- Compressed Gases (29 CFR 1910.101)
- Hazardous Wastes (40 CFR 260-268)
- National Fire Protection Association (codes and standards)

Appendix 8

Working Alone Risk Assessment Form

Working alone in a laboratory, art studio, or workshop may include circumstances where assistance would not be readily available to the employee(s) or student(s) (referred to as "the Worker" hereafter) in case of an emergency, injury, or poor health.

As a Principal Investigator (PI)/Instructor/supervisor ("Supervisor"), you are responsible for protecting the safety and health of those who work under your supervision, whether they are working with others, working by themselves, or in isolated locations.

The purpose of this risk assessment (the Assessment) is to identify hazards and subsequently eliminate or control them. The Assessment is to be completed by the Supervisor in consultation with the Worker(s) assigned to work alone.

Worker's/Student's Name:

Student's Academic Status: ☐First Year ☐Second Year ☐Third Year ☐Fourth Year

Worker's/Student's Email Address:

Worker's/Student's Phone Number:

Department/Area:

Building Name(s) Where Work May Occur:

Room Number(s) Where Work May Take Place:

Supervisor's Name:

Supervisor's Email Address:

Supervisor's Phone Number (Optional):

Emergency Contact Information (Name, Relation to the Worker, and Cell Phone):

NOTE: It is strongly recommended that someone checks on the Worker(s) periodically – by a phone call, video chat, or other method(s). Prior to working alone, the Worker is highly advised to check if the work area has a good internet connection and cell phone reception.

Nature of the Work	Yes, No, or Not Applicable (N/A)	Corrective Actions to be Taken (Write "Not Required" if no action is required to be taken)
Are there hazards associated with the facility where the Worker will be working, including any maintenance, tools, equipment, or machinery?		

Are there hazards associated with tasks such as: • Biological material • Extreme temperatures • Noise • Lasers • Slips, trips, and falls • Working at heights • Electricity • Hazardous substances • Driving or transporting goods • Confined spaces • Other		
Is there a risk of violence or confrontation with the general public?		
Is there a risk of contact with the wildlife?		
Has the hazard assessment for personal protective equipment been performed and reviewed with the Worker so adequate PPE can be worn while performing assigned work?		
Are there adequate supplies present in the work area to complete the assigned work? (e.g., equipment, tools, chemicals, waste containers, etc.)		
Work Location		
Has the length of time the Worker will be working been identified and approved?		
Has the communication procedure been reviewed for regular worker contact, if applicable, including start and stop times for the job? (e.g. who to contact for emergencies, how to use office/lab phones, etc.)		
Nature of the Work	**Yes, No, or Not Applicable (N/A)**	**Corrective Actions to be Taken (Write "Not Required" if no action is required to be taken)**
Work Location		
Is there adequate lighting in the hallways, workspaces, entrances, and exits for the work being conducted?		
Is the Worker required to leave the site for the purpose of work (such as driving) and have applicable		

policies and procedures been reviewed for the task?		
Are there controls to restrict access to the workspace(s)?		
Length of Time		
Has the length of time the Worker will be working been identified and approved?		
Have contact individuals been identified and contact information exchanged between the Worker, contact individuals, and the Campus Police?		
Training/Education		
Has the Worker received appropriate training to perform assigned work independently?		
First Aid/Emergency Protocols		
Is the Worker aware of emergency procedures, if ever encountered?		
Is the Worker aware of the location of first aid kit(s), spill kits, emergency showers, eyewash, and water and gas shut-off valve?		
Does the Campus Police need to check on the Worker? If so, explain what is being done.		
Have contact individuals been identified and contact information supplied to the Worker?		
All serious injuries must be reported to Davidson College (HR & EHS) within 8 hours, even if it is a weeknight, weekend, or a holiday		