DAVIDSON

Chemical Hygiene Plan

1.0 Introduction

This guide, entitled the *Davidson College Chemical Hygiene Plan,* is written in accordance with the requirements of OSHA's laboratory standard, 29 CFR 1910.1450, “Occupational Exposures to Hazardous Chemicals in Laboratories.” Davidson College is firmly committed to ensuring that the procedures, safety and containment equipment, personal protective equipment, and work practices outlined herein are capable of protecting employees from the health hazards presented by hazardous chemicals in laboratories.

The standard operating procedures (laboratory practices and engineering controls) recommended in this Chemical Hygiene Plan identify the safeguards that should be taken when working with hazardous chemicals. While these safeguards should protect laboratory workers from unsafe conditions in most situations, there is no substitute for personal knowledge and vigilance when working with hazardous chemicals. There are instances when the proposed use of a particular chemical will be such that either additional, or fewer, controls might be appropriate to protect the laboratory worker. Professional judgment is essential in the interpretation of these standard operating procedures, and individual laboratories may modify these procedures to meet their specific uses and operational needs.

1.1 Coverage

The policies set forth in this Chemical Hygiene Plan (CHP) are applicable to all laboratory employees. Laboratory employees include faculty, staff, teaching assistants, work-study students, and laboratory technicians who are paid by Davidson College. The departments covered under this Plan include Chemistry, Physics, Biology, and Psychology. The CHP does not specifically cover students enrolled at Davidson College, but it is strongly suggested that the faculty in each department discuss the elements of the CHP with each student working in a laboratory.

1.2 Organization, Roles and Responsibilities

The authority and responsibility for implementation of chemical hygiene policies at the operating level are delegated by the campus Chemical Hygiene Officer (CHO) to the science departments. To fully implement chemical hygiene policies, the assistance and cooperation of all laboratory staff is necessary. The following descriptions outline key roles and responsibilities of all Davidson College employees involved in implementation of this plan. See Attachment 1 for a listing of current assigned roles.

1.2.1 Chemical Hygiene Officer (CHO)

The campus Environmental Safety Specialist will serve as the Chemical Hygiene Officer. The CHO is responsible for providing technical guidance in the development of the provisions of the CHP and works with the science faculty, laboratory managers and staff to develop and implement appropriate chemical hygiene policies and practices and to continually seek to 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 cause a particular laboratory procedure or all laboratory operations to cease.

The CHO is also required to:

- Inspect laboratory facilities monthly to ensure compliance with the provisions of the CHP.
- Monitor health and safety conditions at laboratory facilities and investigate accidents/exposures.
- Maintain training records.

- Update the Chemical Hygiene Plan as necessary.
- Ensure that safety devices (i.e. safety showers, eye washes, fire extinguishers and fume hoods) are working properly and serviced as required.
- Remain abreast of regulatory and legal requirements associated with use of hazardous chemicals.

1.2.2 Departmental Chemical Hygiene Representative (CHR)

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

- Assist faculty and staff in adapting the CHP to the needs of individual laboratories.
- Serve as the liaison to the CHO to ensure compliance with the CHP.

1.2.3 Faculty

Each faculty member is required to:

- Ensure that workers/students know and follow chemical hygiene policies and practices.
- Ensure that control measures selected for the use of any material in their laboratory are adequate and that protective equipment is available.
- Follow recommendations of the CHO and correct any unsafe laboratory conditions.
- Inform the CHO of *any* accidents involving: exposure to hazardous chemicals, fire, significant property damage, or calling an external agency (police, fire, OSHA). Initiate “Davidson College Incident Report Form” (Attachment 2).
- Develop written standard operating procedures (lab manuals) for ongoing activities in teaching labs.
- Report hazardous conditions to the departmental CHR or CHO.

1.2.4 Laboratory Workers (teaching assistants, work-study students)

Laboratory Workers are expected to be familiar with the Davidson College Chemical Hygiene Plan.. Laboratory employees are also required to:

- Plan and conduct each laboratory operation in accordance with a standard written lab protocol.
- Become familiar with good standard practices with procedures and chemicals they are involved with by reviewing current literature, available Material Safety Data Sheets and applicable Davidson College safety policies.
- Wear the personal protective equipment required for each task to which they are assigned.
- Use engineering controls and safety equipment properly and according to the requirements outlined in this Chemical Hygiene Plan.
- Develop good personal chemical hygiene habits.
- Participate in all required training programs.
- Report to the responsible faculty, who will in turn report to the departmental CHR all facts pertaining to accidents resulting in exposure to hazardous chemicals, and any action or condition that may cause an accident and/or exposure to hazardous chemicals.

1.3 Revisions

Proposed revisions of the CHP can be submitted to the departmental CHR or the CHO. Changes to the CHP can be made as necessary by the Chemical Hygiene Officer. The CHP will be reviewed and updated annually by the CHO to ensure policies and procedures comply with applicable regulations and program revisions.

2.0 Standard Operating Procedures

The following Standard Operating Procedures (SOP) will apply to all employees (faculty, staff, and work-study students) in Dana, Watson, and Martin Building's laboratories. Specific course/lab SOPs may further outline procedures detailed for certain lab exercises. Students should also follow these procedures, after being made aware of them by their appropriate supervisors. Other college employees, such as Building Services (custodial), Physical Plant (maintenance and repair), etc., are not directly covered by this CHP. However they have had training in the Hazard Communication Standard and are aware of the hazards of chemicals and corresponding safety precautions.

2.1 General Rules

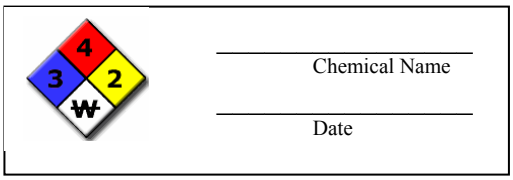
- NEVER carry out hazardous work alone in a laboratory or chemical storage area. Make sure someone is in visible or audible range to help you if something goes wrong. Regardless of the work function, there should be a check procedure established at some regular interval to determine the physical state of any person working alone. Keep aware of your neighbors.
- Report to the department CHR all unsafe conditions, unsafe acts and "near misses" which might cause future accidents. Use the "Davidson College Incident Report Form" (Attachment 2)
- Horseplay in any form is dangerous and prohibited. Do not run in the laboratory areas or halls.
- Maintain good housekeeping by keeping your work area clean and orderly.
- Wear proper clothing. Scarves, ties, cuffs, and other loose clothing should be secured.
- Proper shoes are required in the laboratory-no bare feet, sandals, or open toed shoes.
- Know the evacuation procedure for your area, location of fire exits, location of the nearest phone, location and use of fire extinguishers and proper method for reporting fires.
- Keep access to emergency equipment and exits open.
- Keep all aisles, walkways, hallways, and exits free of chemical containers, obstructions, and tripping hazards.
- Wash areas of exposed skin well before leaving the laboratory.
- Clean up spills and dispose of materials as necessary.
- Clean up the work area on completion of an operation or at the end of each day.
- Dispose of broken glassware in "GLASS ONLY" containers.
- Dispose of sharps (e.g., scalpels, needles) in approved sharps containers.
- Do not use lab hoods for chemical storage except as required and or noted by CHO.
- Never leave a reaction or experiment unattended unless you have told your lab partners enough about it to deal with potential hazards while you are away. **NOTE:** Any laboratory where an experiment is to be left unattended should be identified with the appropriate **Experiment in Progress Form** (see Attachment 3), available on the Biology Department website http://www.bio.davidson.edu/courses/safety/safety.html

2.2 Chemical and Hazard Identification

Chemical manufacturers or distributors perform an assessment of the physical and health hazards of each chemical they produce. This information is included in a material safety data sheet (MSDS) and, in part, on container labels.

The manufacturer's label should be kept intact. When a chemical is transferred to another container for storage, the new containers should be labeled with the name of the

product, the chemical constituents and hazard warnings. Labels are available from the departmental CHR or CHO.



Material safety data sheets received with chemical shipments must be maintained and readily accessible to laboratory workers. Departmental locations of MSDSs for laboratory chemicals are listed in Attachment 4. Links to manufacture's MSDSs for most laboratory chemicals also may be found through the EHS web page.

2.3 Procedures for Ordering and Receiving Chemicals:

- Ordering Responsibilities
  - All chemicals for use in the Biology and Psychology Departments are ordered through Amy Becton, Animal Care Facility Manager (x2617) using the Chemical Order Form found on the Davidson Biology Department web site: http://www.bio.davidson.edu/courses/safety/safety.html
  - All chemicals ordered for the Chemistry department are routed through the Chemistry stockroom manager (x2301).
  - All chemicals ordered for the Physics department are order through Ken Rathbun, Physics lab manager (x2649).
- The date received will be marked on each container.
- The MSDS must accompany the shipment or verify that a current MSDS is on file. If an MSDS is not on file, one must be obtained from the manufacturer.
- Chemical containers that are to be delivered by hand must be placed in shock-resistant carrying containers or buckets.
- Prepare the laboratory for the arrival of the substance (i.e.. establish storage location, post appropriate signs, obtain and check personal protective equipment).
- Review and observe information on the safe handling and storage of the chemical from the MSDS. Ensure the necessary Personal Protective Equipment (PPE) is available.

2.4 Chemical Storage

The proper storage of chemicals is complicated by the diverse individual physical properties of the numerous chemicals that may be present in the laboratory. Some general procedures for chemical storage are listed below. However, these procedures are not intended to be all-inclusive but rather to serve to supplement more specific procedures adopted for particular laboratory situations. Specific instructions on chemical storage may be obtained from the MSDS, container label, and by contacting the CHO.

- Ensure that all containers are in good condition and properly labeled.
- Stored chemicals should be examined periodically (at least annually) for replacement, inactive status, deterioration, and container integrity.
- Unneeded items shall be properly discarded in accordance with existing local, state, and federal regulations (see section 4.0 for disposal guidelines).
- Storage on bench tops, hoods, and sinks should be avoided.
- Ensure that all storage locations are dry and adequately ventilated.
- Use spill trays, spill and shatterproof containers, secondary containers, and proper receptacles as needed.
- Bottles of chemicals > 500 mL (especially corrosives and solvents) should not be stored on shelves higher than 5 feet.

- Store caustic or corrosive materials near the floor to minimize danger of bottles falling from the shelf.
- Organic acids should be stored separately from strong oxidizing agents to prevent interaction of vapors and corrosion of storage cabinets.
- Store highly reactive or corrosive liquids in spill trays.
- Gas cylinders must be fully secured at all times and away from heat sources. Refer to Section 2.5.8 “Safe Handling of Compressed Gases” for additional information.

Incompatible Chemicals

Some examples of commonly encountered incompatible chemicals are given below. An asterisk indicates chemicals that are sometimes placed erroneously in the same class.

Chemical	Incompatible with
Acetaldehyde	*Acetic Anhydride, *Ethanol, *Acetone,*Acetic Acid, Sulphuric Acid
Acetic Acid	*Acetaldehyde, Peroxides, *Chromic Acid, *Nitric Acid, *Perchloric Acid, Glycols
Acetone	Nitric/Sulfuric Acids Mixed, Hydrogen Peroxide
Acetonitrile	Nitric Acid, Perchloric Acid
Aniline	Nitric Acid, Chromic Acid, Peroxides
Bromines	Acetone, Acrylonitrile, Ethyl Ether, Hydrogen, Rubber
Carbon Tetrachloride	Diborane, Fluorine
Carbon Monoxide	*Oxygen, *Fluorine
Chlorine	*Ammonia, *Acetylene, *Propane, *Hydrogen, Benzene
Dimethyl Sulfoxide	Perchloric Acid, *Acetyl Chloride, Benzenesulfonyl Chloride, *Acetic Anhydride
Flammable Liquids	Chromic Acid, Peroxide, Nitric Acid, Bromine, Fluorine, Chlorine
Perchloric Acid	Acetic Anhydride, Ethanol, *Sulfuric Acid, Paper Sodium Acid All Acids
Sulfuric Acid	Any Perchlorate, Permanganate, Cyanide, or Chlorate Salts

Source: Prudent Practices for Handling Hazardous Chemicals in Laboratories

2.5 Handling and Transport of Hazardous Chemicals

Among the many tasks and operations performed daily by laboratory employees, 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 specific classes of chemical and physical hazards. It is recommended that personnel be familiar with the MSDS before working with hazardous chemicals

2.5.1 General Guidelines

- Use only chemicals for which the quality of the available ventilation system is appropriate, as indicated on the applicable MSDS.
- Protective equipment shall be worn during all operations that require chemical handling, per Section 3.0.
- Decontaminate the laboratory area when work is completed.
- Reactions involving pressure build-up are prohibited in lab hoods without the appropriate relief equipment and shielding.

- Whenever chemicals are transported outside the laboratory, the primary container should be placed in a secondary, non-breakable carrier.
- Carts should be used when possible.
- Before moving containers, check and tighten caps, taps, or other enclosures.

2.5.2 Corrosives

The following controls and handling techniques shall be employed when handling corrosives:

- As applicable, wear appropriate personal protective clothing, an acid-resistant apron, chemical-resistant gloves, and splash goggles/face shield.
- Conduct the procedure in a fume hood.
- Use proper pouring techniques when pouring acids into water. Use great care and add reagents slowly. Always add the acid to water; never water to acid. While adding, mix slowly by swirling.
- Use bottle carriers for transport of containers of corrosives greater than one liter.

2.5.3 Flammables

A flammable solvent is an organic liquid whose vapor can form an ignitable mixture with air. The solvent vapor is the fuel. The oxidizer is the surrounding atmosphere. For the mixture to burn, an ignition source must be present. Flammable solvents are the most common source of fires in industry.

- The following limits* for total flammables stored in a laboratory are not to be exceeded.

	Class 1 (flash pt. < 100°F)	All Other Classes
On Benches	10 gal	20 gal
In Lab	60 gal	120 gal

*These limits are based upon a 1,500 square foot laboratory. Limits may be lower for smaller laboratory spaces.

- Flammable liquids (flashpoint less than 100° F) in quantities greater than four liters, should be stored in metal safety cans.
    - Never disable the spring-loaded closure.
    - Always keep the flame arrestor screen in place; replace if punctured or damaged. (The flame arrestor screen is located at the opening of the safety can; it prevents flashback of flammable vapors into the can.)
- If a reagent must be stored in glass for purity, the glass container may be placed in a bottle carrier to lessen the danger of breakage.
- 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 No. 30 of the National Fire Protection Association (NFPA). The following safety practices shall be adhered to:
    - NFPA recommends that flammable storage cabinets be operated without forced venting in order to retain flammable vapors inside the cabinet.
    - Both vents must be kept sealed with the plugs provided with the cabinet. Should venting for noxious vapors be desired, however, the cabinet should be vented externally according to the manufacturer's instructions.
    - Flammable storage cabinet doors should be spring loaded to provide automatic closure.
    - Store only compatible materials inside a cabinet.
    - Do not store paper, cardboard, or other combustible packaging material in or on top of a flammable liquid storage cabinet.
    - Do not overload cabinets; follow manufacturers' established 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 employed when handling flammables:
  - Keep flammable compound away from ignition source such as an open flame.
  - Do not heat flammables over an open flame or glowing heating element.
  - When flammable liquids (greater than 5 gallons) are transferred in metal equipment, minimize generation of static sparks by using bonding and ground straps as appropriate.
  - Only reasonable, working quantities (less than 1 liter) of organic solvents may be stored on open shelves in the laboratory. Other quantities should be stored in well-marked containers in a safety cabinet as per OSHA regulations.
  - Volatile liquids should be kept away from heat sources, sunlight, and electrical switches.
  - Cool volatile liquids before opening.
  - Practically all solvents dissolve fat and oil from the skin, and as a result, the skin becomes dry, cracks, and is easily infected. The skin should always be protected from contact with solvents.
  - Do not store flammable solvents with oxidizers, e.g., perchlorate, nitrates, peroxide.
    - • Transfer solvents under a fume hood.
  - Perform operations with solvents having flash points below room temperature in a hood free of ignition sources.
  - Never heat flammable liquids with an open flame, hot plate, or non-insulated resistance heater.
  - The lids of safety cans must never be propped open.
  - All containers containing flammable and combustible liquids are to be clearly labeled.
  - For Class I flammable liquids, electrical driven stirrers are not to be used.

2.5.4 Perchlorates.

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

2.5.5 Peroxides

The following controls and handling techniques shall be employed when handling peroxides:

- Indicate the date of receipt and the date of opening on each container of peroxide forming chemicals.
- Do not return unused peroxides to storage container.
- Volatile solvents (such as ethyl ether) that may contain peroxides should not be evaporated 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 organics/solvents.
- Avoid all heat sources, friction sources, and all forms of impact.

- Test reagents for peroxide content as necessary.
- Store peroxides at the lowest possible temperature consistent with solubility or freezing point. (Liquid or solutions of peroxides should not be stored at or lower than the temperature at which the peroxide freezes or precipitates because peroxides in these forms are extremely sensitive to shock and heat.) Dispose of peroxide forming chemicals within one year of purchase or six months after opening.

2.5.6 Mercury

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

- Containers of mercury should be kept closed and stored in a well-ventilated area.
- Every effort should be made to prevent exposure to or spills of mercury.
- Metallic mercury should be handled only over impervious surfaces to prevent contamination.
- As applicable, wear appropriate personal protective equipment.
- Transfer of mercury from one container to another should take place inside a hood, over a tray or pan to confine any spills.
- Wash hands thoroughly with soap and water after handling operations and cleaning spills.

2.5.7 Carcinogens, reproductive toxins, chemicals with a high degree of acute toxicity, and chemicals of unknown toxicity

The following controls and handling techniques shall be employed when handling carcinogens, reproductive toxins, chemicals with a high degree of acute toxicity, and chemicals of unknown toxicity in greater than negligible quantities:

- Conduct procedure in a designated area (e.g., fume hood).
- Wear appropriate personal protection equipment including gloves, eye protection, and a lab coat.
- Care should be taken when weighing salts to avoid creation of a powder aerosol of the salt.
- Use the smallest amount of chemical that is consistent with the requirements of the work to be done.
- Decontaminate the area when work is completed.

2.5.8 Formaldehyde

Confirm that a hazard warning label (see next page) is affixed to all mixtures or solutions of formaldehyde composed of greater than 0.1 percent formaldehyde.

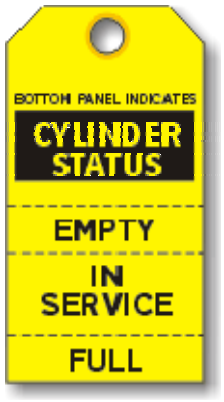
- Avoid contact of skin and eyes from liquids containing 1 percent or more formaldehyde. Always wear eye protection, lab coat or impervious apron, and gloves when working with formaldehyde.
- Place heavily contaminated articles of clothing (e.g., lab coats, scrubs) in closed containers labeled as containing a formaldehyde hazard. Contaminated personal protective equipment (PPE) (e.g., goggles, face shields) should be cleaned by flushing with water before re-use.
- Carry out operations with formalin in open vessels in an effectively functioning chemical fume hood.
- If skin becomes splashed with solutions containing 1 percent or greater formaldehyde, drench affected area immediately with water for at least 15 minutes.
- If eyes are splashed with solutions of formaldehyde containing 1 percent or greater formaldehyde, immediately use an eyewash to drench eyes with water for at least 15 minutes.
- Notify the lab supervisor immediately if exposure occurs. The lab supervisor shall arrange for medical follow-up with Student Health Services as necessary.

- Place formaldehyde contaminated waste in a sealed container labeled as containing a formaldehyde hazard.
- Dispose of waste appropriately. Solutions containing greater than 1 mg/L formaldehyde must be disposed as hazardous waste and not allowed to enter the sewer system.

2.5.9 Handling of Compressed Gases

Compressed gas cylinders are safe to use when handled by personnel who are properly trained and aware of the potential hazards inherent with each type of gas. To insure the safe use of compressed gas cylinders, regulations have been established in 29 CFR 1910.101 that refer to guidelines (Pamphlet P-1-1965) published by the Compressed Gas Association. They set forth the minimum safety rules and precautions to be followed when handling compressed gas cylinders. The following SOP outlines safe handling practices for compressed gases.

- Compressed gas cylinders should only be used in well-ventilated areas.
- Compressed gas cylinders should not be used as rollers, supports, or for purposes other than containing the gas as labeled.
- The contents of compressed gas cylinders should be clearly identified with the proper DOT label or alternative marking required for the compressed gas contained. Cylinders, at a minimum, should carry a label or marking identifying the contents by chemical name or commercially accepted name.
- Lines, piping, and compressed gas cylinders should be labeled with the identity of the gas contained there in and/or color-coded as appropriate.
- All cylinders should have a three-part tag attached to the body of the cylinder indicating whether the cylinder is “Full,” “In Service,” or “Empty.” These tags may be requested from CHO or Departmental CHR.



- Compressed gas cylinders must not contain gases capable of chemically combining with each other or with the container material.
- Never mix gases in a cylinder. Explosion, contamination, corrosion, and other hazards can result.
- Compressed gases should not be transferred from one cylinder to another except by the supplier or manufacturer.
- Tampering with pressure relief devices is prohibited and cylinder valves should not be altered or repaired except by the supplier or qualified instrumentation engineers.
- Compressed gas cylinder valves that become stuck must never be forced open or closed by hammering the valve handle. Report such cases to the laboratory supervisor who will take the appropriate action.
- Clothing should not be dusted off with compressed gas.

- Insure that all flammable compressed gas cylinders, lines, and equipment are grounded.
- Use cylinders only in an upright position.
- See Section 6.2 for labeling chemical storage areas containing compressed gases.

Maintenance of cylinders

- At no time should compressed gas cylinders be painted by personnel (only by the supplier).
- Cylinders and fittings should be inspected periodically for leaks. The lab supervisor should keep a record of all such inspections.
- The supplier of the compressed gas should be notified under *any* of the following conditions:
  - A harmful foreign substance enters.
  - The container leaks or becomes defective.
  - The container is exposed to fire.
  - Containers or valves become severely corroded.
  - Damage occurs that may impair the safety of the container

Leaking cylinder

Should a compressed gas cylinder show major signs of leakage, the following steps should be taken:

- Notify the Environmental Safety Office and Campus Police immediately. As this is a chemical release, only trained personnel may respond.
- For toxic gases, evacuate the area immediately.
- For flammable gases, turn off ignition sources (trip breaker) and evacuate immediately.
- Place an appropriate sign at the entrance of the laboratory or storage area warning others of the hazard present.
- Afterwards, notify the gas supplier, and follow instructions as to the return or disposition of the cylinder**.**

Handling of cylinders

The movement of both full and empty cylinders should be conducted by the contracted supplier, National Welders'. This is coordinated by Amy Becton (Biology/Psychology), Stockroom Manager (Chemistry) and Ken Rathbun (Physics).

- Do not drag, roll, or slide cylinders.
- Never drop cylinders, or permit them to strike each other or other surfaces.

Use of cylinders

- Compressed gas cylinder valves must be operated with the appropriate valve handle and the main valve closed during non-use periods, such as at night or over the weekend.
- Compressed gas cylinders must never be completely emptied of gas to prevent contamination from material being sucked into the cylinder. Let a slight positive pressure remain in the cylinder and use a trap between the cylinder and the equipment to prevent liquid from being sucked into the cylinder.
- Do not attempt to refill a compressed gas cylinder.
- Compressed gas cylinders should be tagged with the date of receipt and should not be allowed to remain in a laboratory for more than one year without approval of the departmental CHR.
- Toxic and corrosive gases should not remain in a laboratory for more than six months or the vendor's recommendation, whichever is shorter, without approval of the departmental CHR. When the time period has elapsed and the cylinder is still partially filled, it should be removed from service, properly sealed and tagged to indicate that compressed gas is still present, and returned to the vendor.

- Use the proper regulator for the particular gas. Make certain that the threads on the regulator are proper for the cylinder.
- Never force connections that do not fit.
- Use no more torque than needed to ensure a gas tight seal.
- Compressed gas cylinders must be used with piping and equipment that has been designed and built with materials of construction that are suitable for the gas.
- Oil or grease should never be used to lubricate oxygen fittings or valves, since these lubricants may ignite spontaneously in the presence of oxygen, even at low oxygen concentrations.
- Use only special lubricants specified for oxygen service.
- A suitable pressure-relief device should be used to protect a system utilizing a compressed gas where the system has a pressure rating less than the compressed gas supply source and where, due to the gas capacity of the supply source, the system *pressure* rating may be exceeded in case of a regulator failure.
- Before a regulator is removed from a cylinder, the cylinder valve should be closed and the regulator drained of gas pressure.
- Acetylene under pressure can decompose with explosive force. It can explode with extreme violence if ignited. Copper or brass (with more than 65% copper) can form explosive compounds in contact with acetylene.
- Ensure that tubing, manifolds etc. are made from materials that are chemically compatible (e.g., stainless steel) with acetylene.

Storage of cylinders

- Cylinders should *not* be placed in any area where:
  - They may become part of an electrical circuit.
  - They are subject to temperatures above 125° F (51.7° C) or are in contact with a flame.
  - They are subject to low temperatures extremes (unless approved by the supplier).
- Removable caps and plugs should be kept on compressed gas cylinders at all times except when connected to dispensing equipment.
- Compressed gas cylinders should be grouped by type of gas and groups arranged to take into account the gases contained.
- Gas cylinders should be stored in well-ventilated, dry areas. While in use or storage, all cylinders should be secured in place using chains, straps, or other devices, to prevent falling.
- Close valves and replace the cap on empty cylinders, mark them “EMPTY," and return to storage.
- Compressed gas cylinders should not be stored near readily ignitable substances or near combustibles in bulk.
- Cylinders, when stored inside, should not be located in front of exits, stairways or in areas normally used or intended for the safe exit of people.
- Separate flammable gas cylinders from non-flammable gases.
- If possible, segregate empty cylinders from full cylinders.

2.5.10 Safe Handling of Pyrophoric Materials

A pyrophoric material is a substance that ignites spontaneously in air. Some substances would not normally be considered pyrophoric; however, under special conditions such as slightly elevated temperatures, the presence of moisture, or in a finely divided state, the material may be capable of self-ignition. In order to avoid contact with air, many of the compounds are packaged and stored under water or a hydrocarbon. In addition, many of these compounds are also highly reactive with water.

Precautions

- In all cases, protect containers of pyrophoric materials from physical damage.
- All locations where pyrophorics are used and/or stored should have a hazard warning affixed to them.
- If a material must be stored under water or kerosene, maintain appropriate liquid levels.
- Water reactive materials must not be stored unprotected in areas where sprinklers are provided as fire protection, or with aqueous containers, or under sinks.
- Store pyrophoric chemicals separately from other materials, if needed. This should be determined by reading the label, safety literature, or MSDSs.
- Limit shelf life and follow special fire protection requirements if needed.

2.6 Spills

Spills of toxic substances or hazardous chemicals should be resolved immediately. All but very small spills (about 50-100 mL) will be handled by trained cleanup personnel by calling the CHO. **Laboratory instructors should be aware of the volume of material that could be released, its chemical, physical and hazardous properties, and any recommended unusual spill cleanup procedures.**

- If a spill is flammable, attempt to turn off ignition and heat sources.
- All cleanup material should be labeled and assessed for disposal as hazardous waste by the campus Environmental Health and Safety Specialist.
- Report all spill incidents using "Davidson College Incident Report Form" (Attachment 2)

Large spills (liters, gallons, etc)

- clear the area immediately
- pull the fire alarm
- evacuate the lab
- from a safe location call 911 and notify the Environmental Safety Specialist (704-361-6507)

2.7 Natural Gas Leaks

If a natural gas smell is detected in a room do not turn on any lights via switches or operate any other spark producing equipment.

- If a gas valve is open, close it.
- Leave the room
- Activate the fire alarm to evacuate the building.
- Contact Physical Plant Work Order Desk (PPWOD) at ext. 2595 or 704-894-2595. Describe the magnitude of the leak, buildings affected and source if possible.
- The Fire Department will verify the explosive gas levels and give the "all clear" to return to the building.

NOTE: When other "chemical smells" are detected, call the Environmental Safety Specialist (704-361-6507) to investigate.

3.0 Control Measures

3.1 Protective Clothing and Equipment

- Eye protection worn when working with chemicals should meet the requirements of the American National Standards Institute (ANSI) Z87.1. Wear chemical splash goggles over prescription glasses when working in the laboratory. Safety glasses (prescription or plano) with permanent side shield must be worn at all times in the laboratory. Where danger of splashing is enhanced, and/or chemicals are especially hazardous, wear chemical splash goggles, or a full-face shield over the safety glasses.

- When working with allergenic, sensitizing, or toxic chemicals, wear gloves made of material known to be, or tested and found to be, resistant to destruction or permeation by the chemical.
- Whenever exposure by inhalation is likely to exceed the threshold limits described in the MSDS, work in a hood.
- Do not use defective protective equipment**.**

3.2 Ventilation

- Fume hoods should typically provide a minimum of 60-100 linear feet per minute of airflow at the opening of the hood. The CHO will coordinate annual monitoring. An inspection sticker is affixed to each hood to document the evaluation and to provide information to the hood user regarding the measured performance of the hood.
- In the event that a hood does not appear to be operating properly, hood users may contact EHS at x2929 for a performance evaluation.
- Equipment used inside the hood for the experiment should be placed on the floor of the hood at least six inches away from the front edge
- Fume hood windows should be lowered but not completely closed at all times except when necessary to raise them to adjust the apparatus that is inside the hood.
- Lowering the sash will increase air velocity and offer greater protection from toxic vapors.
- When working in a hood, the sash opening should be kept at or below 18".
- The hood fan should be kept "on" whenever a chemical is inside the hood, even if no work is being done in the hood or the container is not open.
- Inspect hood vent ducts and fans at frequent intervals to be sure they are both clean and clear of obstructions. This maintenance should be performed by maintenance/repair personnel from, or contracted by, Physical Plant.
- Hoods should never be used as storage areas for chemicals, apparatus, or other materials. Such procedures decrease the hood's efficiency.

3.3 Eyewash Fountains and Safety Showers

- All laboratories are equipped with fountain or faucet eyewashes and safety showers. These are located so they can be reached from any point in the laboratory, as specified in ANSI Z358.1.
- EH&S will check the functioning of eyewash fountains monthly.
- Safety showers will be checked semi-annually by Physical Plant.
- All employees should be sure that access to eyewash fountains and safety showers is not restricted or blocked by temporary storage of objects or in any other way. Specifically, nothing is to be stored within the green/white striped areas on laboratory sinks, and nothing is to be stored so as to block access to a safety shower (which may have a set-off area marked on the floor).

3.4 Respirators

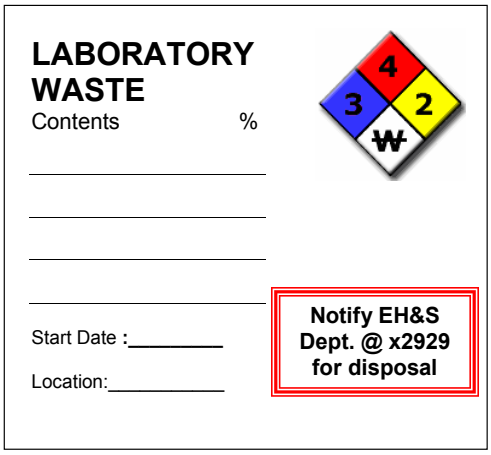
When feasible engineering controls are not adequate to reduce inhalation exposure to acceptable levels, a respirator may be used to minimize exposure to airborne contaminants. Use of a respirator is subject to approval by EHS and must be in accordance with the Davidson College Respiratory Protection Program.

4.0 Laboratory Waste

EHS coordinates disposal of hazardous waste, biohazard/medical waste, and universal waste from all college operations. The cost of waste disposal is borne by EHS, rather than the individual department or laboratory, in part to eliminate any hesitation to properly manage chemical wastes. The following procedures apply to any chemical substances generated from college laboratory operations.

- **Container** – Choose the correct container for your waste, something both chemically compatible with the material and appropriately sized. Do not put a small amount of waste in a large container unless you know you will be collecting a large amount.
- **Label** – Every container holding potentially hazardous waste MUST be labeled at the time the waste is first put in it. The label must have the following information.
    - LABORATORY WASTE
    - List of Ingredients (no abbreviations)
    - Concentration
    - Appropriate Hazards – ignitable, corrosive, reactive, toxic

  Note: . Do not list reactants, only products. For example, if a cyanide was used in a reaction but all of the material was oxidized to a cyanate before disposal, do not list cyanide on the label. Use IUPAC or common names, not symbols, structural diagrams or product trade names.



- **Storage** – Wastes in storage in your work area must meet the following requirements.
    - Secondary Containment for all liquid wastes.
    - Segregation from incompatible wastes.
    - Flammable wastes can only be stored in 1-gallon containers except for 2.5 gallon fireproof rated cans.
    - Waste containers must be kept closed at all times except when adding waste.
    - Non-chemical wastes (e.g., broken glass, paper, etc.) should be placed in designated containers only after ensuring that such wastes are free of residues of hazardous chemicals.
    - Call the EH&S Office for the procedure on disposal of unknown chemicals.
    - If your department has a large amount of waste due to a clean-out, contact EH&S for disposal procedures.
- **Request Pick-Up** – Once waste is ready to be moved to the central storage area, call EH&S for a pick-up.
    - No Davidson College employee or student is allowed to take hazardous waste to the central storage area, unless authorized by EH&S.
    - It is the chemical user's responsibility to identify and properly label all chemical wastes
    - Arrangements for chemical analysis of unknowns can be made through EHS. Costs associated with improper management of hazardous waste (e.g. characterization of unknowns, special handling or peroxide forming compounds, etc.) are charged back to the department.
    -

4.2 Special Wastes

- Mercury, Thallium, Beryllium, and Osmium pose special disposal problems – especially when in combination with other wastes. If you will be generating wastes containing these elements please contact EHS before you begin. *Note: metallic mercury is a recyclable waste.*
- Ethidium bromide usually does not need to be disposed of as hazardous waste.
    - Electrophoresis gels containing trace amounts of ethidium bromide (less than 0.1%) may be placed in regular laboratory trash.
    - Gels containing more than 0.1% (usually dark pink or red in color) should be placed in a biohazard waste box.

- Ethidium bromide solutions may be neutralized and disposed of down the drain. A filter system is available in Watson 147A.
- Silica gel, molecular sieves and desiccants are not considered hazardous waste unless they are grossly contaminated. Contaminated silica gel can be recycled.
- Uranium and thorium compounds, such as uranyl acetate, uranyl nitrate, uranyl formate, uranium oxide, thorium nitrate and thorium oxide are considered radioactive mixed waste rather than chemical waste. Chemical wastes that are combined with radioisotopes are considered **mixed waste**. Mixed waste is difficult to dispose of and should be minimized to the extent possible.

5.0 Exposure Assessments, Medical Consultations, and Examinations

When someone is exposed or suspects that they were exposed to hazardous chemical they are entitled to medical assessment and follow.

5.1 Criteria for Reasonable Suspicion of Exposure

- It is the policy of Davidson College to promptly investigate all employee-reported incidents in which there is a possibility of employee overexposure to a toxic substance.
- Events or circumstances that might reasonably constitute overexposure include:
  - A hazardous chemical leaked, was spilled, or was otherwise rapidly released in an uncontrolled manner.
  - A laboratory employee had direct skin or eye contact with a hazardous chemical.
  - A laboratory employee manifests symptoms such as headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment, etc., and some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air only to reappear soon after the employee returns to work with the same hazardous chemicals.

All complaints and their disposition, no matter what the ultimate disposition may be, are to be documented and reported to the CHO. If no further assessment of the event is deemed necessary, the reason for that decision should be included in the documentation. If the decision is to investigate, a formal exposure assessment will be initiated.

5.2 Medical Consultation and Examination

- All employees who work with hazardous chemicals will be provided an opportunity to receive medical consultation and examination when:
  - The employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
  - Monitoring, routine or otherwise, suggests that there could have been an exposure above the action level (or PEL if there is no action level) for a chemical for which an OSHA substance-specific standard has been established.
  - There is a spill, leak, or other uncontrolled release of a hazardous chemical.
- The CHO or a designee will provide the physician with:
  - The identity of the hazardous chemical or chemicals to which the employee may have been exposed.
  - The exposure conditions.
  - The signs and symptoms of exposure the victim is experiencing if any.
- Ordinarily, physicians will furnish to the employer in written form:
  - Recommendations for follow-up, if determined to be pertinent.
  - A record of the results of the consultation and, if applicable, of the examination and any tests that were conducted.

    - Conclusions concerning any other medical condition noted that could put the employee at increased risk.
    - A statement that the employee has been informed both of the results of the consultation or examination and of any medical condition that may require further examination or treatment.
- These written statements and records should not reveal specific findings that are not related to an occupational exposure.

ATTACHMENT 1

Current Assigned Chemical Hygiene Representatives

Campus Chemical Hygiene Officer Chris Healey

Environmental Safety Specialist

Ext.: 2929/2096

704-361-6507 (cell)

Departmental Chemical Hygiene Representatives:

- Biology Department — Amy Becton Ext.:2617
- Chemistry Department — Lab Manager (open) Ext.: 2195
- Physics Department — Ken Rathbun Ext.: 2649
- Psychology Department — John Kello Ext.: 2024

ATTACHMENT 2

DAVIDSON

Incident REPORT FORM

This form is to be completed by the supervisor / instructor as soon as possible after the occurrence of the accident. **Forward the original to the Environmental, Health & Safety (EH&S) Office at 8 Jackson Court** within 5 days of the incident. All accidents or incidents no matter how minor shall be reported to the EH&S Office.

Date/Time of Accident:_____/_____

Name of injured: **Dept.**

Campus Address **Phone**

Location of the accident:

Description of the accident:

Medical treatment:

Onsite:_____

Doctor's name/address/phone:_____

_____

Hospital:_____

Was accident the result of an: **unsafe act** **yes** **no**

(if yes to either explain below) **unsafe condition** **yes** **no**

Personal Protective Equipment being used at the time of the accident:_____

Witnesses: (name/phone)_____

_____ _____

Supervisor's signature/date **Safety Specialist/date**

Safety Committee Review _____

Disposition: (circle appropriate)

Near miss **Injury** **Recordable** **Illness** **Fatality**

Lost workdays (# days____) **Restricted workdays(#____)**

Corrective action/recommendation:_____

ATTACHMENT 3

Unattended Experiments Notification Form

DAVIDSON

UNATTENDED EXPERIMENT IN PROGRESS

This form is to be completed by the instructor/supervisor that is familiar with the experiment in progress and posted on the outside of the incubator housing the experiment.

In case of an emergency, contact

Name of instructor: _____

Address: _____ **Phone Number: (work)** _____

(home) _____

This experiment _____ a biohazardous experiment !

(is or is not)

This experiment is a culture of:

(what living material?) _____

The medium it is cultured in contains the following chemicals: _____

The following chemicals in this reaction are biohazardous: _____

Personal Protective Equipment that must be used when handling this experiment:

(gloves, safety glasses, goggles, face shield, etc) _____

The above information is correct to the best of my knowledge.

_____ _____

Signature of Investigator Date

ATTACHMENT 4

Material Safety Data Sheet (MSDS) Locations:

Biology Dept	Dana 147
Chemistry Dept	Martin G1 (chemistry stockroom)
Physics	Dana 170
Psychology	Watson B020 & B050