LABORATORY SAFETY MANUAL

Environmental Health, Occupational Safety & Risk Management
Dalton State College
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INTRODUCTION

THE LABORATORY SAFETY STANDARDS MANUAL WAS DEVELOPED AS A READY SOURCE OF INFORMATION FOR YOUR USE WHILE WORKING WITH CHEMICAL SUBSTANCES AND EQUIPMENT AT DALTON STATE COLLEGE. THE GOAL IS TO PROVIDE LABORATORY EMPLOYEES WITH CLEAR DESCRIPTIONS OF SPECIFIC WORK PRACTICES AND PROCEDURES TO REDUCE THE RISK OF PERSONAL INJURY AND PROPERTY LOSS. THE LABORATORY SAFETY STANDARDS MANUAL DETAILS THE STANDARD BY WHICH ALL LABORATORY OPERATIONS MUST BE CONDUCTED. AT DALTON STATE COLLEGE, WE ALL HAVE THE RESPONSIBILITY FOR OUR OWN SAFETY, AS WELL AS THE SAFETY OF THOSE WE IMPACT.

1. **RESPONSIBILITIES SUMMARY:**
   - At Dalton State College (DSC), we are all responsible for our own safety as well as the safety of those we impact. That is why each of us is responsible for and evaluated on how well we know and follow safe work practices.
   - Safety is a part of every job, and the best person to ensure the safety of your job is you. Your role is to know the safety and health hazards related to your job. Become skilled at probing for and recognizing unsafe conditions or unsafe actions, so they may be reported and corrected. An important part of your job is to work safely and avoid risk to others.
   - In order to meet the above responsibility, all laboratory workers must read and Implement the safety procedures outlined in the Laboratory Safety Standards Manual. This Manual was established as the standard by which all laboratory operations are to be conducted.

     A. ENVIRONMENTAL HEALTH, OCCUPATIONAL SAFETY & RISK MANAGEMENT (EH&OS)
        - i. Work with the Lab Coordinators, Deans and Director of Public Safety to develop, implement and update appropriate health and safety policies and procedures.
        - ii. Assist the Lab Coordinator with procurement, use and disposal of chemicals and biohazard waste in the laboratory.
        - iii. Conduct audits and maintain records to assure compliance with established standards, and all applicable regulations.

     B. LABORATORY COORDINATORS
        - i. Ensure that all faculty/staff/students know and follow the standards established by the Laboratory Safety Standards Manual.
        - ii. Instruct faculty/staff/students on the availability of safety and protective equipment.
        - iii. Ensure that all faculty/staff receive appropriate training to safely do their jobs.
        - iv. Conduct routine inspections of work areas to assure compliance with established standards.
        - v. With the assistance of EH&OS, insure that a Risk Analysis of new or unfamiliar equipment or processes is done before beginning any experiment.

     C. LABORATORY PERSONNEL
        - i. Plan and conduct each operation in accordance with the standards outlined in the Laboratory Safety Standards Manual.
        - ii. Review Laboratory Safety Standards Manual.

3. PRUDENT LAB PRACTICES

A. GENERAL PRINCIPLES

i. Plan your work to avoid working alone in the laboratory.
ii. Know the safe ways to do your job.
iii. Do not perform any job task until you have been appropriately instructed on the equipment or process by your instructor or qualified individual.
iv. Follow all established safety rules and regulations.
v. Report all unsafe conditions or practices to your supervisor.
vi. NO PRACTICAL JOKES!
vii. NO HORSE PLAY!
viii. Know the location of and how to use emergency equipment in your area.
ix. Be familiar with emergency procedures.
x. Know the types of protective equipment necessary for the job.
xi. All mechanical equipment must have guards that prevent access to electrical connections or moving parts.

B. HOUSEKEEPING

i. Work areas should be kept clean and free from obstruction.
ii. Cleanup should follow the completion of any operation or at the end of each day.
iii. Spills should be cleaned up immediately and disposed of properly.
iv. Aisles and hallways are not to be used as storage areas.
v. Access to exits, controls, and emergency equipment should never be blocked.

C. GLASSWARE

i. Adequate hand protection must be used when inserting glass tubing into stoppers or when placing rubber tubing on glass hose connections.
ii. Only glassware designed for vacuum work should be used for that purpose.
iii. Hand protection should be used when picking up broken glass.
iv. When rinsing glassware that contained chemicals, discard the first rinse volume into the appropriate waste container. Subsequent water rinses can be discarded to the sink.

4. EMERGENCY PROCEDURES

A. SUMMONING EMERGENCY ASSISTANCE

i. The following actions are to be used to activate emergency assistance:

Emergency Type	Dial or Activate
Chemical spill	**Public Safety - ext. 4461**
First Aid	**Public Safety - ext. 4461**
Serious medical injury	**Public Safety - ext. 4461**
Fire	**Fire alarm pull box/ext. 4461/9-911**

B. PERSONAL INJURY.
   i. If you are injured, call DSC Public Safety x-4461 and obtain prompt medical assistance.
   ii. All accidents, injuries, illnesses, and near misses must be immediately reported to your supervisor.
   iii. An "Accident Report" must be completed immediately by calling Public Safety x-4461.
   iv. In case of chemical contact:
      (1) Flush exposed area with water in the nearest eye wash or safety shower for a minimum of 15 minutes.
      (2) Remove contaminated clothing and continue washing.
      (3) Get help by dialing Ext. 4461 and notify your supervisor and EH&OS.

C. EVACUATION
   i. Familiarize yourself with the evacuation routes and the location of the nearest exits.
   ii. When the building alarm sounds all persons must evacuate via the nearest designated emergency exit and proceed to the designated assembly areas.
   iii. Follow directions given to you by your instructor, lab coordinator or first-responder.

D. FIRE
   i. If a fire occurs, pull the nearest building alarm, located near the exits. If you feel you can use a fire extinguisher safely, then follow the instructions below:
   ii. NOTE: All fires do not use the same type of extinguisher media. Make sure to use the correct fire extinguisher for the specific class of fire.
   iii. Remove the fire extinguisher from the wall
   iv. Approach the fire with your escape route behind you.
      (1) **P** - Pull the pin.
      (2) **A** - Aim at the base of fire.
      (3) **S** - Squeeze trigger.
      (4) **S** - Sweep from the front of the fire to the back.
   v. If you don't know how to operate a fire extinguisher, do not attempt to fight the fire. Pull the alarm, close the door behind you and evacuate the area.

E. CHEMICAL SPILLS
   i. It is important that all chemical spills be responded to in a safe and expeditious manner by trained personnel.
   ii. All chemical spills are to be reported to your instructor, faculty member or the lab coordinator. If a chemical is spilled in a quantity that can be safely cleaned up by the person causing the spill, then do so.

iii. For any large chemical spills, call DSC Public safety 706-272-4461.
iv. Clean-up procedure
(1) All non-essential personnel must leave the area and barriers should be placed to prevent other personnel from entering the area on larger or hazardous spills.
(2) All spills must be evaluated and the appropriate personal protective equipment donned.
(3) The spill must be diked, neutralized (if possible) and placed in a container for disposal.
(4) Contact the hazardous waste coordinator for disposal instructions.
(5) A report must be completed by DSC Public Safety and forwarded to EH&OS

F. LOSS OF BUILDING POWER
i. The power sources to the following equipment should be shut off if possible:
(1) Heaters
(2) Agitation Equipment
(3) Motors
(4) Vacuum pumps
(5) UV lamps
(6) Air compressors
(7) Any electrical equipment (computers, monitors, printers, etc.)
ii. Leave cooling water on, if possible.
iii. Shut off all processes like water faucet, etc...
iv. Do not work with chemicals or equipment under emergency lighting.

G. CALLS REGARDING SPILLS OR OTHER EMERGENCIES
i. All calls regarding significant spills or other emergencies must immediately be reported to the Department of Public Safety x-4461.

5. RISK ASSESSMENT - PROCESS OPERATIONS

A. GENERAL
i. Each individual in a lab is always responsible for understanding the hazards of the chemicals which they handle and the procedures which they perform.
ii. Before any work begins, a risk assessment should be conducted. Work should proceed only if it can be done safely for the people and the environment.
iii. Address out-of-hours operations with appropriate Dean and Lab Coordinator including issues such as working alone, emergency response, and utility failures.
iv. In the absence of specific process/chemical risk assessment the following process monitoring is necessary.

(1) Active procedures generally **should not** be left unattended.
(2) Active procedures include weighing, charging, heating, refluxing, filtration, vacuum operations, pressure operations, flowing water, open containers, etc.

v. If the potential consequences of a procedure could not be predicted, even if it is supervised (attended), then the procedure must be evaluated using the risk assessment procedures.

6. RISK ASSESSMENTS

Risk Assessment: The risk assessment (or hazards analysis) is a comprehensive approach to evaluating the safety challenges presented by a scientific experiment, process, or chemical. Every aspect of a process must be thought out in advance so that the goal – safety – is achieved by identifying and controlling the hazards inherent in all steps of an experimental process. Each step is analyzed separately to identify the potential for an accident. Then, they are evaluated again collectively to determine if combinations of the elements could impact safety, and further reviewed to try to predict what could go wrong, and to assess the impact of a safety failure.

Safety Protocol (Safety SOP): The safety protocol is a document which describes the protective measures required for each hazard identified in the risk assessment. The safety document should be written so that any lab worker who will perform the experiment (for example the next group of students) would understand what hazards exist and how to safely conduct the work.

Follow the steps below to perform a risk assessment and develop a safety protocol:

1. For an experiment or scientific protocol or process, write the steps for the protocol.
2. Identify Hazards - for each step of the project, list potential hazards related to the materials used, equipment, the process, facilitiy,-concerns, human factors, and environmental conditions – anything that may raise a safety concern. Also list the hazards related to changing part of the project or the potential for synergistic effects. Do not forget to include hazards from routine storage, material transport, handling or disposal processes.
   a. Review published lab accidents and incidents involving these materials, equipment or processes
   b. For each hazard, think through the most likely accident scenarios including those that you may have found in your search. Note what could happen and the safety impact. For example, what might happen if a highly toxic chemical is spilled during weighing, or if a pyrophoric metal is exposed to air?
   c. Consult the DSC Lab Safety Manual, DSC Chemical Hygiene Plan, and review literature for well-tested safety protocols and guidance.

d. Using the information from these resources, equipment manuals and technical information to identify mitigating precautions that would eliminate or reduce the hazard.
e. Using the information from these resources and what you already know has been or could be implemented, identify a combination of precautions and controls that together create both a primary and secondary safeguard for each hazard and combined hazards. These would include administrative (safety rules, operating procedures, supervisory approval), engineering (exhaust equipment and glove boxes, interlock switches, automatic shut-down devices), work practices (e.g. buddy system, drills, scale-down, maintenance), and use of personal protective equipment (PPE) (gloves, lab coat, goggles).
f. **Develop a Safety Plan** that covers the entire process with all of the hazards and hazard mitigation strategies specifically identified. (The safety plan is a written document that describes the hazards and safety issues or concerns, and lists methods for eliminating or mitigating these hazards). List the steps of the scientific protocol and next to each step list the safety mechanisms to be employed. Don't forget to include emergency response procedures for chemical spills or lab accidents.
g. **Emergency Response Procedures** should be included in the safety plan. Identify what might go wrong that could result in a fire, spill or injury. Identify procedures to address these events, including emergency contact information.
h. **Submit your Hazard Analysis/Risk Assessment/Safety Plan** to your Dean and Lab Coordinators for review. Using the feedback provided, revise your safety plan.

7. EQUIPMENT

A. LABORATORY METHODS FOR HEATING SOLUTIONS

I. SOLUTION HEATING

a. Open flames are permitted under appropriate supervision and as required protocol.

II. HOT PLATES

a. Containers to be heated on hot plates should be no larger than the dimensions of the hot plate surface.
b. Where circular bottomed beakers are placed on square or rectangular hot plate surfaces, the diameter of the beaker should be no greater that the smallest dimension of the rectangle.
c. Large battery jars must not be heated on hot plates.
d. Appropriate quality glass should be used for hot plate heating.

e. Keep in mind that Pyrex, or similar brands of glass, can break if it contains surface flaws or bubbles.
f. Upon receipt, all new beakers should be inspected by the user for such flaws and imperfect glassware.

C. ELECTRICAL EQUIPMENT: GENERAL STANDARDS

I. ELECTRICAL SPECIFICATIONS FOR EQUIPMENT

a. Save all catalogs and manuals. Copy and save all important specifications (voltage, current limits).
b. Motor-driven electrical equipment used where volatile materials may be present must be equipped with a non-sparking induction motor rather than a series-wound motor that uses carbon brushes.
c. Electric power receptacles for operations in hoods should be located outside the hood.
d. FRAYED CORDS: Repair immediately
e. Tag defective electrical items to prevent their use while waiting for repair.
f. EXTENSION CORDS: Use only if necessary
    i. When necessary, they must be supported and secured.
    ii. They must not lie on the floor or across aisles (lab or office).
    iii. Locate variable transformer devices and other electrical items in a way which protects them from spills or leaks.
    iv. The choice of solution agitation equipment should take into account the flammability rating of the substances.
    v. Since flammable solvents pose a static discharge hazard during pouring, minimize the container-to-container free fall distance when transferring.
    vi. Switch off all appliances before removing plugs from outlets in order to avoid voltage surges when plug is reinserted to the outlet.
    vii. All appliances must have grounded plugs.
    viii. Remember to unplug all electrical equipment at the end of each workday.

ii. VACUUM PUMPS

a. Distillation or concentration operations using volatile materials should normally be performed using a water or steam aspirator instead of a mechanical vacuum pump.
b. Mechanical vacuum pumps should be used for the distillation of less-volatile materials, the removal of final traces of solvents, or other operations that require pressures lower than those obtained via aspiration.
    (1) Input lines from the system to the vacuum pump need to be fitted with a cold trap to collect volatile materials from the

system and minimize the amount that enters the pump and pump oil.

(2) Do not use liquid nitrogen or liquid air in cold traps. The use of these liquid materials increases the flammability hazard.

(3) The output of each pump should be vented to an exhaust system.

iii. DRYING OVENS

c. Volatile materials should not be dried in a conventional laboratory oven unless the oven has continuous ventilation of the atmosphere inside the oven.

d. "Explosion proof" drying ovens with rear blow-out panels should be used for volatile materials.

e. Bimetallic strip thermometers should be used for monitoring oven temperatures. Mercury thermometers should not be mounted through holes in the tops of ovens.

iv. AUTOCLAVES

f. High temperatures. Care must be taken when putting in or taking out items for sterilization

8. COMPRESSED GASES, PRESSURE REACTIONS, AND VACUUM WORK

A. COMPRESSED GASES

i. Gas cylinders must be firmly secured at all times.

ii. Only Compressed Gas Association (CGA) standard combinations of valves and fittings can be used in compressed gas installations.

iii. Compressed gas cylinders must be placed so that the cylinder valve is accessible at all times.

iv. When the cylinder is not in use, the main cylinder valve must be closed.

v. The main cylinder valve should be opened slowly and only to the extent necessary. It is never necessary to open the main cylinder valve all the way.

vi. Empty cylinders must be clearly tagged and marked as "empty". Lab Coordinator is to be notified when cylinder is empty so it can be replaced.

vii. Empty and full cylinders should not be stored in the same place.

B. PRESSURE VESSELS

i. Inspection and Testing

(a) You must always know the allowable working pressure of a vessel. The allowable pressure should be stamped on the vessel or be attached via a name plate.

(b) All pressure equipment must be tested or inspected periodically. Consult the equipment's instructions or manufacturer for the appropriate testing intervals.

(c) Assembly and Operation

a. Piping must not be used to support the weight of the equipment.

b. All threaded connections must match correctly and not be forced.

c. Sharp tubing bends should be avoided.
d. All pressure reactions must be shielded.
e. Adequate space should be left in all vessels to accommodate the expansion of liquids.
f. Signs or placards should be placed in the area to inform others of the reaction in progress.

(d) Pressure-Relief Devices

a. All pressure or vacuum systems and all vessels that will be subjected to pressure or vacuum must be protected by pressure relief devices. Rupture discs and spring-loaded valves are examples of pressure-relief devices.
b. The maximum operating pressure of the system must never exceed two-thirds of the rated working pressure of the vessel or system.
c. The maximum setting for the pressure-relief device must be less than the rated working pressure for the vessel or for the weakest member of the pressure system.
d. Shutoff valves must not be placed between the equipment and the pressure-relief device.
e. The discharge side of a pressure-relief device must be vented to a safe area (e.g.: a Lab Hood).

(e) Glass or Plastic Equipment

a. The use of glassware for work at pressure extremes should be avoided whenever possible.
b. Glass equipment should be provided with adequate shielding to protect from flying glass.
c. A liquid seal, Bunsen tube, or equivalent relief device is to be used for protecting glassware against excess pressure. Corks, rubber stoppers, and rubber or plastic tubing must not be used.
d. Plastic equipment for pressure or vacuum work must not be used unless it is rated for the pressure or vacuum work to be undertaken.

C. VACUUM WORK

(a) Equipment and Glassware

a. All glassware should be inspected for cracks or flaws before each use.
b. Only glassware specifically designed for operations at reduced pressure (e.g., Pyrex) can be used.
c. Flasks and desiccators must be shielded by a friction tape or by an enclosure

(b) Assembly and Operation

a. All vacuum work must be shielded.

b. All equipment should be set up to avoid equipment strain or stress.
c. Heavy apparatus should be supported from below as well as by the neck.

(c) Cold Traps

a. Input lines from the system to a mechanical vacuum pump need to be fitted with a cold trap to collect volatile materials from the system and minimize the amount that enters the pump and pump oil.
b. Do not use liquid nitrogen or liquid air in cold traps. The use of these liquid materials increases the flammability hazard.
c. The output of each pump should be vented to an exhaust system.
d. Change the vacuum pump oil regularly.
e. After the operation is complete, the system must be vented and the trap must be cleaned. This venting and cleaning is important because volatile substances that have collected in the trap may vaporize when the coolant has evaporated and cause a pressure buildup that could blow the apparatus apart.

9. CHEMICAL PROCUREMENT, LABELING AND STORAGE

A. Procurement of Chemicals

i. Prior to ordering, determine whether the chemical is in stock.
ii. Space must be allocated for storage of the chemical before ordering.
iii. Order only quantities that are necessary for the project. Remember: "Less is better".
iv. Upon receipt of the chemicals, make sure the information is entered into the Chemical Inventory and that the latest Safety Data sheet is on file on the “One” Drive.
v. If unused chemicals are not needed in the laboratory, return it to the Lab Coordinator.

B. Chemical Labeling

i. ALL Chemical containers must be labeled.
ii. Portable chemical containers, intended only for the immediate use of the employee, do not require labels. Remember, immediate use means that it cannot be left unattended
iii. Labels on incoming containers of hazardous materials should not be removed or defaced. Other information placed on the container should not obscure or detract from existing labels.
iv. Recommendations found on labels should be read and followed.

C. Chemical Storage
   i. All chemicals must be stored according to chemical compatibility.
   ii. Chemicals should be stored in areas designed for chemical storage. Storage rooms, storage cabinets, storage shelves and refrigerators are examples of appropriate areas.
   iii. Flammable liquids should be stored in approved flammable liquid storage cabinets.
   iv. Corrosives should be stored in approved corrosive storage cabinets
   v. Chemicals must not be stored in offices, desks or file cabinets.
   vi. Chemicals should not be stored on bench tops because they are unprotected from potential exposure to fire and they are more readily knocked over.
   vii. Chemicals should not be stored on the floor or in the aisles.
   viii. Nothing may be stored on top of cabinets, shelves or shelf racks in the laboratory.
   ix. Except for work in progress, chemicals and equipment should not be stored in lab hoods. Lab hoods are designed to provide protection when working with hazardous materials. Storing chemical and equipment in lab hoods can interfere with the air flow in the hood and compromise the protection afforded the hood operator.

10. HAZARDOUS AND BIOHAZARDOUS WASTE DISPOSAL

A. Each Chemist/Biologist is responsible for his/her own waste in terms of proper preparation for waste disposal. This is to include the use of proper containers and completing a waste identification tag in a neat and legible fashion with all the required information.
B. The use of laboratory sinks for the disposal of chemicals is strictly prohibited!
C. When rinsing glassware that contained chemicals, discard the first rinse volume into the appropriate waste container. Subsequent rinses can be discarded to the sink.
D. Separate waste containers are required to properly segregate waste for disposal. The following waste categories should be used.
   i. Flammables
   ii. Oxidizers
   iii. Reactants
   iv. Acids
   v. Bases
   vi. General
   vii. Health hazards
E. Dispose of chemically contaminated paper and disposable clothing in approved solid waste containers.
F. Reassigned samples must be re-labeled with the new custodian's name.
G. Dispose of all broken glass in those containers marked "Glass only".

H. Broken mercury filled thermometers require the use of special mercury spill clean-up kits.

11. PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Personal protective clothing and equipment, in conjunction with emergency procedures, help to minimize injuries or damage. Every laboratory worker must be familiar with the location and proper use of the available protective clothing and safety equipment.

A. EYE AND FACE PROTECTION
   i. Contact lenses may not be worn when working in a laboratory.
   ii. Safety glasses with side shields must be worn by all people (including visitors) entering into or working in a laboratory where chemicals are used or stored. Only glasses meeting the American National Standards Institute (ANSI) requirements or equivalent are acceptable.
   iii. Ordinary prescription glasses are not acceptable unless protective goggles are worn over them.
   iv. Goggles (or face shield) must be worn when splashing is a possibility.
   v. Full-face shields must be used when working with glassware under reduced or elevated pressure, glassware used in high-temperature operations, or any time there is a possibility of implosions or explosions.
   vi. Specialized eye protection may be needed when working with lasers, ultraviolet light sources, or intense lights sources. Consult with EH&OS when choosing specialized eye protection.

B. HAND AND ARM PROTECTION
   i. Chemical resistant gloves must be worn when handling corrosive materials, toxic materials, or materials of unknown toxicity.
   ii. Gloves must be selected on the basis of the material being handled and the operation being conducted. Not all types of gloves are suitable for all chemicals.
   iii. Before each use, gloves must be inspected for any defects.
   iv. Gloves must be discarded if any defects are found.
   v. Gauntlet style (elbow length) gloves should be worn when the potential exists for chemical exposure to the forearm.
   vi. Leather gloves or equivalent should be used for handling broken glassware or manipulating glass tubes.
   vii. Before removal, gloves should be washed appropriately.
      (NOTE: Some gloves are water permeable.)
   viii. Gloves must be removed before leaving the work area.

C. FOOT PROTECTION
   i. Laboratory personnel are required to wear closed-toe footwear.

D. RESPIRATORY PROTECTION
   i. Laboratories are designed so that respiratory protection is not usually needed because of the engineering controls in place (i.e. laboratory hoods).

ii. When effective engineering controls are not possible, respiratory protection should be provided.

E. SAFETY SHOWERS

i. Safety showers are provided in areas where chemicals are stored.
ii. Safety showers must be located in areas that are accessible and unblocked by obstacles.
iii. The shower should have a quick opening valve which requires manual closing.
iv. Safety showers should be flushed semi-annually.
v. Safety showers must be tested annually and records of that testing maintained by EH&OS.

F. EYEWASH FOUNTAINS

i. Eyewash fountains are provided where chemicals stored.
ii. Eyewash fountains must be capable of providing at least 15 minutes of water in a soft stream.
iii. Fountains should be co-located with the safety showers, if one is installed, so that, if necessary, the eyes can be washed while the body is showered.
iv. Eyewash fountains must be flushed at least monthly.
v. Eyewash fountains must be tested annually and records of that testing maintained by EH& OS.

9. VENTILATION

A. Laboratory Hoods

i. All chemical operations that may generate air contaminants are to be conducted in a hood.
ii. Conduct all work at least 6 inches back from the face of the hood. Hoods are to be kept clear and the sash at the proper working height.
iii. Air flows will be routinely monitored by EH&OS and the proper sash height noted.
iv. Hoods used for flammable liquids must be made of flame-proof materials with electrical outlets on the outside of the hood.
v. Do not put your head in the hood when contaminants are being generated.
vi. Do not use a hood for chemical or equipment storage. Store chemicals in an approved storage area.
vii. Keep the hood sash closed as much as possible.
viii. Keep the slots in the hood baffle free of obstruction by equipment or containers.
(1) Local exhaust is to be used when it is not possible to use a hood. Examples of equipment which need local exhaust include ovens, solvent cabinets, process equipment and instrumentation.
ix. Cold traps are to be used during distillations and vacuum drying in order to minimize the contact of fumes or vapors with the vacuum source and/or release to the atmosphere and to protect vacuum pumps.
x. All new ventilation additions need to be approved by EH&OS.
xi. Any lab or experiment generating hydrogen gas must be performed in a fume hood to minimize ignition risk associated with the labs.

10. ENVIRONMENTAL MONITORING

Environmental monitoring is not normally warranted or applicable in a laboratory setting. However, on occasion a situation will arise that requires environmental monitoring. In most cases, the monitoring is conducted to assess the effectiveness of the ventilation equipment.

A. General Exposure Reduction Principles
   i. Even for small substances of no significant hazard, exposure should be minimized.
   ii. It should be assumed that any mixture will be at least as toxic as its most toxic component.
   iii. All containers of chemicals must be capped or sealed to avoid escape into the work atmosphere.
   iv. Permissible exposure limits (PEL) and Threshold Limit Values (TLV) should never be exceeded. All routine exposures above 50% of these limits will require engineering or administrative control measures.
   v. Threshold limit values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.

B. Monitoring Requests
   i. If you are concerned about any exposures in your workplace, contact EH&OS.
   ii. A job review and workplace assessment will be conducted to determine if environmental monitoring is warranted.
   iii. If monitoring is conducted, you will be notified of the results obtained.

11. TRAINING

A. New Employees
   i. All new employees (including temporaries and student lab assistants) must receive training on; DSC Chemical Hygiene Policy, DSC Lab Safety Manual, and USG Right to Know, and others as required.
   ii. Prior to starting work in the laboratory all new employees must receive proper instruction in the operation of the equipment in the laboratory. This should include reading the equipment manual when appropriate.

B. All Employees
   i. All new chemistry or biology processes, must be reviewed and authorized by the appropriate Dean and Lab Coordinator.
   ii. Employees will review the DSC Chemical Hygiene Policy and DSC Laboratory Manual Yearly.

C. Students
   i. Students will be provided safety instruction and rules at the beginning of each semester and will be provided instruction on how to properly use PPE, lab equipment, and chemicals.

APPENDIX 1

JOB SAFETY ANALYSIS (JSA)
Job Description:
_____

Prepared By: _____

Department: _____ Date: _____

Sequence of Job Steps	Potential Incidents	Recommended Controls

APPENDIX 2

PRELIMINARY HAZARD ANALYSIS - For Laboratory Operations

Author: _____

Date: _____

Instrument or Procedure: (Attach Additional Pages as Needed)

_____

Lab location:

_____

Participants (other than author):

_____

_____

_____

Lab Safety Committee Review Recommended:_____Yes_____No

I. MATERIAL:
Are any new chemical substances involved?_____Yes*_____No

A. List ALL chemicals to be used in the operation. (Attach a list if more than 6.)

1. _____ 4. _____

2. _____ 5. _____

3. _____ 6. _____

B. Review the current Safety Data Sheets (SDS) for each of the chemicals listed in A.

C. List those materials (from above) which will require the use of special protection, handling, medical monitoring, storage, or disposal. Identify the HAZARD and the appropriate precaution to be taken.

MATERIAL	HAZARD	PRECAUTIONS REQUIRED
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

D. List the spill supplies needed at location of operation.

_____

_____

E. Identify the waste stream(s) (if applicable).

_____

_____

II. PROTECTION:

In addition to SAFETY GLASSES, list the minimum protective equipment for this operation:

Protection Required: (Yes/No)	**Protection Required: (Yes/No)**
Splash Goggles	Respirator
Face Shield	Safety Shoes
Gloves	Apron
Ear Plugs	Other (Specify)

Comments:

_____

III. HAZARDS ASSOCIATED WITH LABORATORY OPERATION:

Carefully consider each question as it applies to your operation. Check (X) those that require clarification and include what safeguards are in place to address the perceived hazards.

A.**REACTIONS/PROCEDURES:**

Is there a hazard due to any one of the following?

Runaway chemical reaction or side reactions

_____

_____

Loss of cooling

_____

_____

Blocked vent lines

_____

Equipment/power failure

_____

_____

Loss of temperature control

_____

_____

Loss of pressure control

_____

_____

Faulty pressure/temperature monitoring devices

_____

_____

Inadequate ventilation

_____

_____

Glassware/apparatus failure

_____

B.**EQUIPMENT:**

Radiation _____

Excessive noise

_____

Flammability hazard (ignition sources)

_____

_____

Ventilation

_____

_____

Instrument exhaust

_____

_____

Shielding (moving parts, hot or cold surfaces, high or low pressure sources, sharp edges

_____

Compressed gasses/cryogenic liquids

Vacuum

Accidentally changing control settings

Mislabeled feed/discharge lines

Spill large quantities of chemicals

Spills into sinks

Pump control failure

General power failure

Service failure (house/water pressure/hoods/compressed gasses/N2)

Instrument alarm failure

Control system loss (computer

_____

_____

Potential hazards not otherwise listed

_____

_____

Are there potential hazards associated (e.g., electrical shock)?

_____

_____

Out of hours' operation

_____

_____

C. **HAS A SAFETY PLAN BEEN DRAFTED?**_____YES_____NO

V. OUT OF HOURS OPERATION: Approved_____YES_____NO

V. EQUIPMENT EMERGENCY SHUTDOWN PROCEDURE:

Describe emergency shutdown for equipment. Post in lab at time of PHA.

_____

_____

_____

_____

VI. IMMEDIATE MODIFICATIONS TO BE DONE/GENERAL COMMENTS:

_____

_____

_____

_____

SUBMIT COMPLETED FORM TO APPROPRIATE DEAN AND LAB COORDINATOR.