Roger Williams University
Chemical and Biological Hygiene Plan

Marine and Natural Sciences Building

Chemistry, Biology, Marine Biology and Environmental Science Departments

Revised Summer 2019

ROGER WILLIAMS UNIVERSITY – CHEMICAL HYGIENE PLAN

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Chapter 1 – Chemical Hygiene Plan

Section 1: Foreword

Roger Williams University has a fundamental obligation to preserve the health and safety of students and personnel. It is the policy of the University to provide and maintain a safe and healthful campus environment.

The University recognizes its obligation to employees and students alike and, in turn, expects them to pursue their authorized rights and privileges conscientiously and in the safest manner possible, respecting the administrative authority of those directing these activities. As such, every member of RWU's community – faculty, staff, and student body, are responsible for complying with established health and safety regulations. This includes taking necessary precautions to prevent injury to one's self and to others; for promptly reporting all accidents, injuries, hazardous conditions, practices and operating procedures to the Office of Environmental Health and Safety and the Marine and Natural Sciences (MNS) Health and Safety Committee, and for constantly practicing sound safety principles in all activities undertaken on campus.

It is the intent of this policy and the procedures that follow to prevent accidents and injuries and to comply with the OSHA 29 CFR 1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" and to promote a comprehensive safety program based on applicable health and safety standards, as well as published standards of nationally recognized professional health and safety groups.

The purpose of this plan is to provide a framework for recognizing, evaluating and controlling hazards associated with laboratory operations. Implementation of the plan relies upon the cooperation of Department Chairs, faculty, laboratory staff, students, and RWU's Office of Environmental Health and Safety and the MNS Safety Committee.

Section 2: Administrative Responsibilities

Individual faculty members are responsible for implementation of the University's safety policies and this Chemical Hygiene Plan within their laboratories. The Chairpersons of the Departments of Chemistry and Physics, Marine Biology and Biology Department, and Environmental Science program have the responsibility for ensuring compliance with established health and safety policies. The Office of Environmental Health and Safety will appoint a Chemical Hygiene Officer.

Responsibilities of Department Chairpersons

1. Disseminate and inform faculty and staff of University health and safety policies.
2. Designate a Safety Committee representative.
3. Require attendance at pertinent training sessions.

Responsibilities of Faculty Members

1. Implement all applicable health and safety and waste management policies in the laboratory.
2. Develop written safety procedures applicable to their research, lab workers, and students.
3. Mandate laboratory practices and engineering controls that reduce the potential for exposure to hazards.
4. Inform all laboratory staff and students of the potential hazards associated with laboratory operations and procedures for dealing with accidents.
5. Ensure employees and students are trained as required by the OSHA right-to-know law and the Chemical Hygiene Plan.
6. Supervise the laboratory to ensure that safe practices and engineering controls are employed.
7. Instruct the laboratory staff on the location and use of all safety equipment in the facility.
8. Report accidents and any other safety problems to the MNS Health and Safety Committee.
9. Address issues identified in the semi-annual laboratory inspections.
10. Ensure that pertinent safety data sheets (SDS) are available. If the material is new to the chemical inventory, a copy of the SDS may be included with the shipment. If it is sent, stockroom personnel insert the SDS into the master binder kept in the Faculty Office Area. A copy is also to be sent to the Office of Environmental Health and Safety so the SDS can be added to their master electronic and hardcopy SDS libraries. If the SDS is not sent, it can be obtained from the internet. Faculty members are to ensure that the SDSs are added to both the Department binder and the Office of Environmental Health and Safety Libraries.

Responsibilities of Employees and Students

1. Follow all safety and health and waste management procedures specified in the Chemical Hygiene Plan and by the faculty supervisor in the laboratory.
2. Complete required health and safety and waste management training sessions.
3. Report accidents, unhealthy and unsafe conditions to the faculty supervisor, Health and Safety Committee Representative, or the Office of Environmental Health and Safety.
4. Notify the faculty supervisor of any health conditions that could lead to serious health situations in the laboratory.
5. Maintain chemical labels, including applying and completing Globally Harmonized System (GHS) labels.
6. Ensure access to all Safety Data Sheets (SDS) for the chemicals in the laboratory.

Responsibilities of Stockroom Personnel

1. Ensure that SDSs are on file for all chemicals used by the Chemistry and Physics Department, Marine Biology and Biology Department, Environmental Science Program.
2. Update the MNS department SDS binders when new chemicals are added to the chemical inventory. Provide a copy of new SDSs to the Office of Environmental Health and Safety when material shipments are received.
3. Maintain chemical inventory for the MNS building and update weekly.
4. Store chemicals in a safe manner, keeping incompatible materials separate.
5. Receive, inspect, inventory, and store all chemicals immediately upon delivery to the MNS building. The stockroom notifies professors upon delivery that chemicals have been received. Notification should consist of direct communication between stockroom personnel and the professor (third party messages are not a sufficient means of chemical receipt notification).
6. Maintain original container labels whenever possible and keep materials labeled as required by the Chemical Hygiene Plan. Supplemental HMIS labels will be required when materials are dispensed into unlabelled containers.
7. Test eyewash equipment by flushing for 3 minutes weekly.

Responsibilities of the Office of Environmental Health and Safety

1. Provide personnel to act as the designated Chemical Hygiene Officer. The Chemical Hygiene Officer will perform the laboratory inspections.
2. Provide technical guidance on matters of laboratory safety and assist with remediation of safety issues.
3. Investigate accidents and recommend action to reduce the potential for recurrence.
4. Coordinate clean-up operations in the event of a large chemical or biological spill or if a spill reaches the environment.
5. Develop and conduct training programs in laboratory safety.
6. Work with state and local officials on matters of codes and enforcement.

7. Assist laboratory personnel with evaluating, preventing, and controlling hazards and in establishing safety procedures for individual laboratories.
8. Maintain training and lab inspection documentation.
9. Coordinate and oversee disposal of all hazardous waste. Ensure all hazardous waste disposal complies with local, state, and federal regulations.

Safety Committee

RWU has established the Marine and Natural Sciences Health and Safety Committee for the Department of Chemistry and Physics, Marine Biology and Biology Department, and Environmental Science program. This committee oversees the implementation of the Chemical Hygiene Plan and establishes other safety and health policies when needed and in accordance with federal, state, and local regulations. The committee also evaluates research and instructional practices being conducted on the RWU campus for safety and health considerations.

Laboratory Construction and Renovation Projects

Facilities Management and the Office of Environmental Health and Safety must review all design, construction and/or modifications of laboratory facilities, whether executed by an outside contractor or internal personnel. In order to ensure the safety of new and renovated laboratories, specific design and construction features are required by state and federal codes.

Chapter 2 – Laboratory Practices & Safety Equipment

Section 1: General Laboratory Safety Procedures

Know the hazards and properties of the chemicals you are working with. Refer to the written laboratory protocols and review Safety Data Sheets (SDS). Consider the toxicity of the materials, the health and safety hazards of each procedure, the knowledge and experience of laboratory personnel, and the safety equipment available. Microchemistry or efforts to minimize chemical usage should be employed whenever practical.

1. No experiments are to be conducted by students ALONE. This includes mixing reagents and any work involving the use of chemicals.
2. Faculty permission is REQUIRED for laboratory use, including research and independent study.
3. Make sure all exit doors are accessible open from both directions. Check door latches and switch door latches if necessary.
4. Proper personal protective equipment (PPE) must be worn at all times. At a minimum, gloves and eye protection must be worn when working with chemicals in the laboratory.
5. Never wear or take gloves or lab coats outside of the laboratory.
6. Gloves or other PPE contaminated with hazardous waste must be placed in hazardous waste receptacles.
7. For safety purposes, students are expected to record the following in their lab books:
    - The experiment name
    - List of all reagents
    - Hazards of each reagent

Lab books will be checked by faculty members for this information.

8. When solutions are prepared, they must be immediately labeled using HMIS/NFPA labels with the reagent name.
9. Chemical should always be segregated into compatible groups (See Appendix A for classes of incompatible chemicals).
10. Use form "CAUTION – Chemical Reaction in Progress" for reactions that are left unattended.
11. Once the experiment is complete, dispose of unused reagent, or properly store any recovered solvent (ROTOVAP). Neutralize reagents only as part of the experiment – it is illegal to "TREAT" hazardous waste without a permit!
12. Always wear appropriate clothing (e.g. pants, shirts, shoes) and personal protective equipment (e.g. safety goggles, lab coats or aprons, gloves) in the laboratory. Open-toed or perforated shoes are not permitted.
13. Use a properly operating fume hood when working with hazardous chemicals.
14. Do not smell or taste chemicals.
15. Do not eat, drink, smoke, prepare food or apply cosmetics in the laboratory.
16. Secure long hair and loose clothing, including neckties.
17. Non-laboratory and non-assistance animals are not allowed in campus buildings.

Section 2: Laboratory Security

1. Keep laboratory doors locked when unoccupied.
2. Keep stocks of organisms locked during off hours or when the laboratory is unoccupied.
3. Stockroom access is limited to faculty, Office of Environmental Health and Safety, and Public Safety personnel.
4. Faculty and staff are to keep accurate record of chemicals, stocks, cultures, project materials, growth media and those items that support research and teaching activities.
5. Notify Department Chair and RWU Public Safety if materials are missing from laboratories.
6. Inspect all packages arriving at the work area. If suspicious or leaking packages are encountered, call the Office of Environmental Health and Safety.
7. When research is completed for the day, ensure that chemicals and biological materials have been stored properly and securely.
8. Notify Public Safety of any suspicious activities or persons (x3333).

Section 3: Laboratory Equipment

The following safety equipment should be available whenever working with hazardous materials.

Drench Showers

Drench showers and other emergency wash systems are used in an emergency to flush chemicals that have accidentally come in contact with laboratory personnel. In order to wash the body properly, clothing should be removed as water is applied. The drench shower can be used to extinguish a clothing fire but this is not recommended if the shower is more than a couple of feet away. The best method of extinguishing a clothing fire is to "Stop, Drop, and Roll," and then remove clothing.

At least 3 feet of space in each direction is required beneath the shower and this area must be kept free of all obstacles. MNS Stockroom staff inspects drench showers weekly for proper flow and operation. (Note that the ANSI standard requires that safety showers be activated weekly to ensure that they are working properly. It is recommended that a record be kept of such tests.) A "DO NOT USE" notice is placed on the unit if the shower is not properly functioning.

Eye and Face Washes

The best treatment for chemical splashes to the eye and face is immediate flushing with copious amounts of water for 15 minutes. Eye and face washes are equipped with a stay-open valve. All plumbed eye and face washes are to be flushed on a weekly basis by allowing the water to flow for approximately 3 minutes to remove stagnant water from the pipes. Plastic eye wash bottles are not recommended.

In general, the emergency eyewash equipment should be installed within 10 seconds walking time from the location of a hazard. The path of travel from the hazard to the equipment should be free of obstructions and as straight as possible.

Fire Extinguishers

Fire extinguishers are placed in or just outside laboratories depending on the hazards. A dry chemical (ABC) type extinguisher is located in laboratories where flammable liquids might be or are used. A carbon dioxide type extinguisher is located in laboratories with computers and electrical equipment (i.e. mass spectrometers, gas chromatographs, and NMR equipment). Metal-X extinguishing agent, a graphite material, is used to smother a Class D (flammable solids) fire and is distributed to laboratories when appropriate. Training is required before fire extinguishers are to be used. Faculty will receive this training and students will be informed that they are only to use them on very small fires or as a last resort.

First Aid Kits

First aid kits should be available in each laboratory. At a minimum, the kits should contain the following:

- Adhesive bandages
- Ice packs
- Sterile pads

These kits should not have topical creams, liquids or ointments than can cause further discomfort.

Laboratory Safety Information

Safety procedures, including this Chemical Hygiene Plan, SDSs, emergency procedures and other references should be readily available to laboratory personnel. A hardcopy RWU SDS Library is kept in the Faculty Office Area. A separate hardcopy master RWU SDS library is kept in the Office of Environmental Health & Safety. An online RWU SDS Library can be accessed via http://hq.msdsonline.com/rogerwilliamsuniversity. The Chemical Hygiene Plan is kept on the EHS website at: http://ehs.rwu.edu. Emergency procedures are outlined further in the Roger Williams University Emergency Response Plan (ERP), Hazardous Waste Contingency Plan, and Spill Prevention Control and Countermeasures (SPCC) Plan. These plans may also be found on the EHS website.

Door Postings and Other Signs

A hazard and emergency information sign should be posted on the outside of the laboratory door, facing the corridor. The stockroom should have a NFPA diamond outside the door. This sign is for use by emergency response personnel. The sign identifies hazards within the facility, the responsible faculty member and other persons to be contacted in the event of an emergency. In the event of an accident, chemical spill, fire or personal injury, assistance from a person familiar with the laboratory may be requested. The faculty member should review signs at least annually or in the event that information on the door posting needs to be updated.

Sharps Containers and "Glass-Only" Boxes

Red biological sharps containers are for biologically contaminated or clean needles, syringes, razor blades, and other sharp items. One-gallon puncture-proof "mayo jars" are for chemically contaminated sharps. When ¾ full, all sharps containers should be sealed and labeled with the building/room number and placed in the lab's Satellite Accumulation Area. All sharps containers can be obtained from the stockroom

"Glass Only" boxes are used for the disposal of "clean" broken glassware only. Broken glassware from Microbiology is first to be autoclaved and the placed with the "Glass Only" boxes. "Glass Only" boxes can be

obtained from the MNS Stockroom and can be disposed of in a dumpster. Chemically contaminated glass must be placed in the lab's "Chemically Contaminated Glassware" disposal drum.

Mechanical Pipetting Aids

Mechanical pipetting aids must be used. Mouth pipetting is prohibited.

Placement of Safety Equipment

Laboratories are equipped with drench showers, eyewashes and fire extinguishers. Hazards such as chemicals that may pose a risk of fire or toxic vapors, or any situation that may cause personal injury, should not be permitted to come between any occupant of a laboratory and safe egress from the room. In addition to the aforementioned safety equipment, emergency gas shut-offs and electric panels are not generally accessible. Facilities Management should be contacted when it is necessary to shut off the supply of electricity or gas.

Laboratory Viewing from Outside the Corridor

Labs have open glass walls in the area facing the corridor. These can be used by emergency response personnel to identify internal problems (e.g. small fire, chemical spill, injured persons). These windows should not be blocked unless it is necessary to maintain darkness for optical work, spectroscopy, or photography.

Section 4: Laboratory Safety Inspections

Laboratories are audited for compliance with this plan at least once a year. The Chemical Hygiene Officer, appointed through the Office of Environmental Health and Safety, has responsibility for conducting these inspections. The form for conducting these inspections entitled "Laboratory Safety Inspection" is included in this plan. The safety inspection includes: chemical labeling, fume hood operation, laboratory safety techniques, emergency and safety equipment, chemical storage, electrical safety, and general housekeeping.

Following the laboratory safety survey, a report listing the hazard(s) is sent to the faculty member responsible for the laboratory. The faculty member is responsible for correcting the operational hazards. RWU Facilities Management is responsible for correcting all infrastructure deficiencies. If the faculty member fails to correct the hazard, a second notice is sent to the department head and the MNS Health and Safety Committee, with a copy to the faculty member. Follow-up surveys are conducted in laboratories with extremely hazardous conditions and/or numerous violations.

In addition to these annual laboratory safety surveys, safety walk-throughs are performed regularly by the Office of Environmental Health and Safety or their designee. At this time, an inspection of hazardous waste containers is conducted. It is recommended that laboratory personnel update the chemical inventory and periodically conduct their own safety inspections.

Chapter 3 – General Safety Principals

Section 1: Housekeeping

Keeping the laboratory work area organized and clean is essential to safe handling of chemicals. Only the equipment and chemicals necessary for the particular procedure being performed should be kept in the work area. This is particularly important when working in a fume hood as storage of numerous containers or pieces of equipment can severely diminish the effectiveness of the hood. If several people are working in the same laboratory, requirements for space and hood access should be discussed and work areas agreed upon.

Floors and surfaces should be kept clean and spills cleaned up immediately. The entire work area should be cleaned-up at the end of each day.

Section 2: Unattended Operations

Avoid leaving operations unattended. When it is necessary to leave an experiment unattended, provide for containment of hazardous chemicals in the event of equipment failure. Additionally, leave the lights on and place a warning sign on the door if, in the event of an emergency, there exists a hazard to persons entering the room.

Section 3: Personal Hygiene

Good personal hygiene practices are essential to minimize chemical exposure and potential injury from other hazardous conditions in the laboratory such as broken glass.

- The storage or consumption of food or beverages, application of make-up, and smoking are prohibited in all laboratories and chemical storage areas.
- Avoid "routine" exposures. Do not smell, taste, or mouth pipette any chemicals.
- Always wash hands immediately upon contamination, after handling chemicals and before leaving the laboratory.
- Long hair and loose clothing must be confined.
- Wash contaminated clothing or lab coats separately from other clothing.

Section 4: Personal Protective Equipment Policy

The personal protective equipment described in the following sections of this chapter must be available for laboratory personnel who are working with hazardous materials. Laboratories must provide personal protective equipment (i.e. safety glasses, laboratory coat or apron) for visitors and post a sign indicating that eye protection is always required where hazardous materials are in use.

Section 5: Eye and Face Protection

Eye and Face Protection must always be worn in the laboratory when there is a potential for contact with hazardous chemical or other agents (e.g. biohazardous materials, aerosolized material, flying objects). All protective eye and face wear must meet ANSI Z87.1-1998 and ANSI Z136.1-2000 standards. Prescription glasses are not acceptable for laboratory procedures.

The type of protection needed depends on the hazard (e.g. chemical, ultraviolet light, impact). For instance, when laboratory chemicals are used, approved eye protection is mandatory and chemical splash goggles are recommended. When chemicals are used, goggles must be worn. Goggles should be worn over eyeglasses or prescription safety glasses. If biological materials are being handled that do not require the use of goggles, safety glasses or prescription safety glasses with side shields should be worn. Ordinary prescription glasses do not meet these standards. Face shields should be worn when working with an agent that may adversely affect the skin on the face (including liquid nitrogen and other cryogenic liquids).

Eye, skin and face protection are required when working with severely corrosive or strongly reactive chemicals, with glassware under extreme pressure, in combustion and other high temperature operations, and whenever there is a possibility of an explosion or implosion. Special safety glasses and face shields may also be required for work with UV light, and other types of radiation which is absorbed by the eyes or skin (chemical splash goggles are not adequate for these types of work).

Section 6: Laboratory Coats, Gloves and Other Protective Clothing

Proper laboratory attire must be worn at all times in the labs. Proper laboratory attire means: no skin is visible below the waist (full coverage shoes and full coverage pants), hair that is long enough to tie or clip back is secured away from the face and off the shoulders, all long or dangling items are removed or, if unable to be removed, are constrained beneath appropriate protective equipment (loose clothing, jewelry, neckties, lanyards, head coverings), and if working in a wet area (e.g., Shellfish Hatchery, Aquatic Diagnostic Laboratory, Wet Lab, etc.), shoes or boots must be slip-resistant. **Minimum personal protective equipment requirements include a laboratory coat (cotton with limited fire resistance or NOMEX IIIA for reactive/fire risk), splash goggles or safety glasses (depending on hazard), and disposable vinyl or nitrile gloves.** Depending on the type of work, additional personal protective equipment, such as specialized gloves and aprons may be necessary. Lab coats, aprons and gloves are to be removed when leaving the laboratory. Gloves should be replaced immediately if they are contaminated or torn. In situations involving extremely hazardous chemicals, double gloves and chemically resistant aprons with sleeve protectors or chemically resistant lab coats (not fabric) are recommended. Gloves should be carefully selected for their degradation and permeation characteristics to provide proper protection. The thin latex, vinyl, or nitrile gloves, popular for their dexterity are not appropriate for highly toxic chemicals or solvents. When using chemicals, consult chemical compatibility charts, safety data sheets, and protective equipment manufacturers to aid in the selection of proper gloves and other protective clothing.

Gloves should be inspected prior to each use. A glove should not be used and should be immediately discarded if any signs of wear are detected.

RWU practices "Universal Precautions" for glove disposal. In practical terms, this means that ALL gloves will be treated as if they are contaminated (ie. for disposal purposes there will be no separation of contaminated and non-contaminated gloves). Every lab at RWU is equipped with foot operated self-closing receptacles, that are both fire safe and odor control effective, for glove waste disposal. The Universal Precautions glove disposal policy simplifies glove disposal, increases overall lab safety, and prevent inadvertent disposal of contaminated gloves in non-hazardous waste receptacles (and any related custodial chemical contact). It should be noted that classroom and research gloves contaminated with microbiologicals will still be separated from gloves contaminated with chemical hazardous waste. Microbiological contaminated gloves will then be autoclaved prior to disposal as a contaminated glove (dedicate a separate autoclave bag).

There is no one glove material that protects against all chemicals. It is very important that the appropriate glove is used when handling chemicals. A glove compatibility chart is attached for reference, and glove manufacturers may need to be contacted for specific recommendations.

Resistant gloves include natural rubber, neoprene, nitrile, butyl, Viton, and polyvinyl chloride. General categories of chemical resistance are listed below. Recommendation of the glove manufacturer and the Safety Data Sheet for the particular chemical should be used in choosing the appropriate gloves. Additional resistance information is included in Appendix E.

CHEMICAL RESISTANCE

Natural Rubber	*many acids, alkalis, salts, ketones*
Neoprene	*chlorinated solvents, alcohol, alkalis, petroleum products*
Nitrile	*chlorinated solvents, alcohol, alkalis, petroleum products (generally outperforms natural rubber and neoprene)*
Butyl Rubber	*acids, ketones, esters (highest permeation resistance available for gas and water vapors)*
Viton*	*solvents, PCB, aniline (best polymer for protection from solvents)*
Polyvinyl Chloride	*acids, alkalis, fats, alcohols*

* A registered trademark of Dow Elastomers.

Source: Kilby, J.A., Kinsler, J.M., *Effective glove selection: Match the materials to the hazards.* American Laboratory, August 1989.

Section 7: Respiratory Protection

The use of air purifying respirators for laboratory work is not permitted. Chemical hazards are to be removed by use of fume hoods whenever exposure could occur when handling hazardous chemicals, and by always using minimum quantities. Respirator use requires periodic medical monitoring, specific training and fit testing before effective use. Properly operating fume hoods provide the best overall protection from inhalation hazards in the laboratory. (See Chapter 4 for more discussion on the use of fume hoods.)

Section 8: Protective Clothing Beyond the Laboratory

University policy requires the use of appropriate gloves, safety glasses, lab coats, and other personal protective equipment within the laboratory. All contaminated, potentially contaminated clothing and equipment worn outside the lab may create a hazard.

- Wearing gloves outside the laboratory should be minimized, except to move hazardous materials between laboratories. If possible, transport chemicals from place to place on a cart, in a clean secondary container, or in a bottle with secure handles.
- If there is a need to transport hazardous materials, use a clean, ungloved hand to touch common surfaces and a gloved hand to carry the item: the one-glove rule. Alternatively, package the material so it may be handled without gloves.
- Gloves should never come into contact with door handles, elevator buttons, telephones, lavatory faucets, vending machines, or other surfaces outside the laboratory.
- For the sake of safety, appearances, and courtesy, do not wear contaminated, stained or potentially contaminated lab coats and other lab clothing and equipment outside of the laboratory.
- Do not carry specimen containers, dewar flasks, or covered, polystyrene boxes with dry ice or cryogenic liquid in a private vehicle. Be aware that strict federal and state regulations address the transport of hazardous (biological and chemical) materials on public roads.

Chapter 4 – Ventilation

Section 1: Laboratory Ventilation Policy

Ventilation is used to remove hazards and minimize exposure to personnel. All work with hazardous materials must be conducted in the appropriate fume hood, glove box or biological safety cabinet. General room ventilation does not provide adequate protection against hazardous gases, vapors, and aerosols. All work with corrosive, flammable, odiferous, toxic or other dangerous materials shall be conducted only in a properly operating chemical fume hood or glove box. Vacuum systems may be acceptable if approved by the MNS Health and Safety Committee. Ductless fume hoods are not acceptable for minimizing chemical exposure.

Prior to Facilities Management personnel conducting any exhaust system work on the MNS building roof, MNS building occupants will be formally notified and appropriate signage will be placed on the fume hoods to guard against inadvertent exposure to hazardous chemical exhaust.

Section 2: Fume Hoods

All fume hoods are equipped with a continual display of airflow and alarms that sound when the airflow is insufficient. Generally, when conducting experiments, the sash of the fume hood should be closed as much as possible.

Hoods that do not meet the minimum airflow requirements are to be posted with a sign indicating "DO NOT USE". Contact Facilities Management for repair. Once the repairs have been made, proper operation will be indicated by the air velocity display.

Procedures for Proper Use of Fume Hoods

Before using the hood, make sure air is entering the hood and the hood is functioning properly. Report any problems to Facilities Management. Do not block baffle openings or place bulky items in the hood that will prevent air from entering the baffle opening. In most cases, proper use of fume hoods should eliminate the need for respiratory protection. If a particularly hazardous is to be handled, air testing can be conducted to evaluate whether the fume hood is providing adequate protection from respiratory hazards.

a. Conduct work at least six inches from the edge of the hood ("working depth").

b. Lower the sash to protect yourself from dangerous reactions, and raise the sash no higher than the marked maximum operating height.

c. Keep hood clean and uncluttered. Wipe up spills immediately.

d. Fume hoods are not to be used for chemical storage. If a fume hood is needed for this purpose, it is to be designated for storage with the appropriate signage and not to be used for conducting laboratory procedures.

e. Be aware that drafts from open windows, open doors, fans, air conditioners, or high traffic walkways may interfere with normal hood exhaust.

Fume Hood Alarms

Fume hood alarms indicate substandard operation of fume hoods. They are installed on every fume hood. These alarms are constantly monitored by an electronic meter that sounds the alarm if it is deactivated for any reason. The fume hood alarm will indicate an exhaust flow malfunction by an audio and visual alarm. If the fume hood alarm sounds, close the sash and notify the Department of Environmental Health and Safety. Do not use until the repairs have been made by Facilities Management and removal of the "Do Not Use" sign has been approved by the Department of Environmental Health and Safety.

Fume Hood Inspection and Testing

The performance of a laboratory fume hood in providing protection for the worker at the face of the hood is strongly influenced by the aerodynamic design of the hood, the ventilation of the laboratory room, and by other features of the laboratory in which it is installed. Additional non-static conditions that influence fume hood performance are ventilation settings, laboratory arrangements, and fume hood mechanical efficiency. Therefore, the Office of Environmental Health and Safety will conduct periodic fume hood inspections, performance testing, and equipment calibration. These test will be performed to the ANSI / ASHRAE 110-1995 (Method of Testing Performance of Laboratory Fume Hoods) Standard as required, and will otherwise be tested for appropriate function and air velocity.

Section 3: Glove Boxes/Glove Bags

Glove boxes can be used for work with particularly hazardous substances including select carcinogens, reproductive toxins, air reactive chemicals and substances with a high degree of acute or chronic toxicity. When correctly used, these units prevent vapors, gases and particulates from escaping into the laboratory.

Glove bags can be used to prevent air sensitive compounds from being exposed to air.

Section 4: Gas Storage

Toxic and flammable gases are to be stored in the ventilated storage cabinet, currently located in Room 208. If highly hazardous gases are to be used, a more secure gas storage cabinet may be necessary. The MNS Health and Safety Committee and the Office of Environmental Health and Safety must approve use of such gases. (Examples of these gases are arsine, phosphine, silane, hydrogen chloride, ammonia, hydrogen phosgene, and nickel carbonyl).

Section 5: Laminar Flow Hoods

These clean benches provide a clean environment but do not provide protection from hazardous chemicals. These clean benches must be used only for the manipulation of non-hazardous materials. This equipment must never be used for the handling of toxic, infectious or sensitizing materials, including volatile chemicals, cell culture materials (except plant cell cultures), or drug formulations.

Chapter 5 – Emergencies and Accidents

Section 1: Emergency Assistance

To request emergency assistance on campus (fire, police or ambulance) dial extension x333 (401-254-3333 from a non-campus phone). Public Safety will determine if the local hospital and/or fire and police departments will be contacted. Public Safety may contact the Emergency Coordinator who will make the determination. RWU Public Safety has emergency medical technicians (EMTs) as well as individuals trained in First Aid and CPR. All staff and students are instructed to first contact Public Safety in the event of accident or fire so that the need for outside help can be assessed and any response from local agencies can be directed immediately to the site of the emergency.

Section 2: Preparation

In order to be prepared for an emergency, know the hazards of each compound with which you work. Assess the risks before using any chemical. Use of acute toxins and reactive chemicals requires a written plan in place prior to use. A template for an acute toxin and reactive chemical protocol is contained as an Appendix to this plan. This protocol is to include the experimental procedures, protective equipment to be used, a description of chemical and physical hazards of the acute toxin, and emergency procedures. This protocol is to be reviewed with and given to students and other workers using the chemical and is to be submitted to RWU's office of Environmental Health and Safety prior to use of the chemicals.

Reactive Chemicals

Reactive chemicals are chemicals that can, under certain conditions, release very large and potentially dangerous amounts of energy. Reactive chemicals can lead to reactions that progress at a very rapid rate. A chemical reaction can be considered routine if the reaction rate is relatively slow or can be easily controlled. Further discussion of handling reactives is presented in Chapter 8, Section 8, "Particularly Hazardous Chemicals". Reactive chemicals include oxidizers, water exposure sensitive, air exposure sensitive, and temperature sensitive materials.

EXAMPLES OF REACTIVE CHEMICALS

Manufacturer's Safety Data Sheets of chemical references should be consulted to determine the specific reactive characteristics of a particular chemical. In addition, chemical lists (not all inclusive) are presented in Chapter 8 of this manual.

Peroxides and Peroxide Formers

Many common laboratory compounds can form peroxides when exposed to air over a period of time. A single opening of a container to remove some of the contents can introduce enough air for peroxide formation to occur. Peroxides are sensitive to heat, friction, impact, and light and are among the most hazardous chemicals that are encountered in laboratories. Their hazard potential may be greater because they may not be suspected or detected in commonly used solvents or reagents. Many explosions have occurred during distillation of peroxide-containing substances particularly when the distillation has been taken to or near to dryness.

Crystal formation or cloudy appearance inside a container is a possible sign of peroxide formation. Crystal formation is most likely (and most hazardous) around the cap. Friction caused just by turning the cap can cause an explosion that ignites flammable solvent in the container.

Peroxide formation can also occur in many polymerizable unsaturated compounds. These peroxides can initiate an uncontrolled, and sometimes explosive, polymerization reaction.

Further discussion on handling peroxide formers and a list of these chemicals is presented in Chapter 8.

Section 3: Chemical Spills

In the event of an incident involving chemicals (large or dangerous spill, smoke, fire, extreme pressure, violent reaction, toxic mist or fumes, explosion) department personnel MUST immediately trigger the fire alarm system by using the red pull boxes located throughout the building. The activation of the fire alarm will automatically: a) signal building evacuation and b) notify the Bristol Fire Department and RWU Public Safety.

EMERGENCY RESPONSE: CALL 254-3333

In the event of a chemical spill inside the MNS building, the following steps should be taken:

1. Evacuate
   - Alert others in the area and direct/assist them in leaving.
   - Without endangering yourself: remove any injured persons to fresh air, remove contaminated clothing and flush contaminated skin and eyes with water for 15 minutes. If anyone has been injured or exposed to toxic chemicals or vapors, call 254-3333, and seek medical attention immediately.
2. Confine
   - Close all doors and isolate the area.
   - Prevent people from entering the spill area.
3. Report
   - From a safe place, call 254-3333.
   - Report the emergency. Give the following information:
     - Your name, location and phone number.
     - Location of the spill.
     - The name and amount of the material spilled.
     - The extent of the injuries.
     - The safest route to the spill, if known.
   - Keep the phone line open if possible, and stay in location given if possible.
   - Emergency services will respond to stabilize spills or clean up and provide medical attention.
4. Secure
   - Until emergency response personnel arrive, inform others not to enter areas leading to the spill, if possible.

- Post personnel near commonly used entrances to the area to direct people to use other routes.
- Notify supervisor or faculty member in charge of laboratory.

5. Reference RWU Spill Prevention Control and Countermeasures (SPCC) Plan, Hazardous Waste Contingency Plan, and Emergency Response Plan for next steps and additional information (http://ehs.rwu.edu)

At the time the emergency is over (eliminated or under control), the Department of Facilities Management will provide for treating, storing, and/or disposing of waste, contaminated soil, and/or surface water or any other material that results from a release, fire, or other incident at the facility.

Section 4: Environmental Chemical Release

If a spill reaches the environment (floor drain, sink drain, etc.) or results in a vapor release that may be significant, immediately contact the Office of Environmental Health and Safety (401-952-4694 or 774-955-4406). Attempt to contain the spill/release at the source without endangering yourself and others by following these procedures:

1. Extinguish all sources of ignition.
2. Isolate all potential environmental receptors (e.g. drains, sumps, soil, etc.). Drains for safety showers can be isolated using vermiculite or other spill absorbents.
3. Immediately report the spill/release to the Office of Environmental Health and Safety.
4. Reference the RWU Hazardous Waste Contingency Plan
5. Wait for a representative from the Office of Environmental Health and Safety or other Emergency Coordinator to arrive on the scene.

Section 5: Fire or Explosion

In the event of a fire or explosion:

1. Evacuate the fire area.
2. Notify the occupants nearby.
3. Close the door to the fire area.
4. Activate the building fire alarm system.
5. Dial extension 3333 and report the exact location of the fire.
6. Evacuate and stay clear of the building.
7. From a safe location, if possible, contact public safety with information about the location of the fire, and if known, the materials involved.
8. Reference the RWU Hazardous Waste Contingency Plan

There is no requirement to use a fire extinguisher in the event of a fire.

Section 6: Accidents and Injuries

Serious injuries that require an ambulance must be reported to Public Safety at 401-254-3333.

A medical care provider should assess all other injuries. A doctor is available through RWU Health Services for students (phone 254-3156), and for employees, one's own physician or other medical personnel can be consulted. Employees must bring a "return to work note" with them if they leave their shift injured or ill. The note must state either "no restrictions" or what restrictions are in place. RWU supports light duty and other return to work accommodations – Human Resources and the department manager must be notified in advance.

Any injury is to be reported as soon as possible to the faculty member, Department Chairperson, and the Office of Environmental Health and Safety. Any injury involving chemicals within the eyes should be treated by a qualified medical professional as soon as possible. For chemical exposure, medical personnel should be given the following information:

- Identity of chemical(s)
- Conditions under which exposures occurred
- Signs and symptoms of exposure
- Whenever possible, a SDS should be provided to health care providers.

Incident/Injury/Illness forms must be completed and submitted with 24 hours of the occurrence. For students in the classroom, use the "Student Form" on the EHS website (click on the "Occupational Safety" tab). For all employees, including students whose incident occurs while they are performing compensable work (regardless of funding source, work study, or payroll status), use the "Employee Form" on the EHS website (click on the "Occupational Safety" tab).

In addition, an incident report form must be completed within 24 hours of occurrence. The head of the laboratory should forward a written report to the Department Chair, RWU Human Resources, and the Office of Environmental Health and Safety. The RWU Laboratory Injury form is provided as an appendix of this document.

Chapter 6 – Exposure Monitoring & Medical Treatment

Section 1: Exposure Monitoring

Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical may consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable. If formaldehyde is to be used, the Office of Environmental Health and Safety must be notified at least 2 weeks prior to use to assess whether exposure monitoring is warranted.

For most of the laboratory work anticipated to be performed, regular environmental or employee exposure monitoring of airborne concentrations is not warranted in because the chemicals are used for relatively short periods of time and in small quantities. All laboratory procedures are to be designed to minimize possible exposures. Sampling may be conducted when highly toxic substances that personnel could be exposed to are used regularly, or if formaldehyde is used. Laboratory employees or students who suspect that they have been overexposed to a toxic chemical should report to Roger Williams University Public Safety at extension 3333. Notify the department of Environmental Health and Safety (401-254-3494) of the exposure as well. An initial exposure assessment will be made and if warranted, specific monitoring will be conducted.

Section 2: Medical Examination and Consultation

The staff of Roger Williams University Health Services is available to respond to general health concerns for all RWU faculty, staff, and students. A medical provider should be consulted when:

- An employee or student develops signs and symptoms of exposure.
- An event takes place resulting in the likelihood of exposure or actual exposure.
- Exposure monitoring indicates levels above the OSHA "action level".
- There are special concerns about chemicals such as reproductive toxins.
- Any incident where chemicals get into the eyes.

If laboratory work is planned which involves working with human pathogenic agents, recommendations may be made for immunization or medical surveillance. Referrals to an occupational health provider can be obtained by calling the Office of Environmental Health and Safety (254-3494).

Chapter 7 – Training & Information

Section 1: Chemical Safety Training

This training is required for all incoming undergraduate students who will be working with hazardous chemicals. Any students working with hazardous chemicals that have not previously had this training must attend. Faculty and staff are required to attend. Chemical Safety Training will include:

- General information on physical and health hazards of hazardous chemicals, signs and symptoms of exposure, and measures employees can take to protect themselves.
- Proper use of chemical fume hoods.
- Methods that may be used to detect the presence of a hazardous chemical.
- General information on safety equipment and personal protective equipment.
- Proper disposal of chemical wastes.

Section 2: Hazardous Waste Management Training

Hazardous Waste Management Training is provided as part of the fall semester training session. State and Federal regulations mandate this training or all those handling, generating or managing regulated waste. Regulations require annual refresher training for personnel handling hazardous waste. Faculty members may need to provide training to laboratory personnel and students to supplement the training provided. This will include:

- Identification and proper disposal of chemical wastes.
- Management of hazardous waste containers.
- Separation of incompatible wastes and completion of the RWU waste log.
- Laboratory procedures for spills and emergencies involving hazardous materials.

Section 3: Training and Information Policy

Faculty members are responsible for insuring that their employees and students receive proper training as specified in this plan.

Training is hosted on the RWU Bridges site. Visit http://bridges.rwu.edu for access, and from the "Membership" tab, choose the "Joinable Sites" link. The EHS site name is "EHS Lab and Shop Safety Training."

Training is required for faculty, staff, students and other employees.

Training records are kept and are to include the following information:

1. Date of training session.
2. Contents or summary of the training.
3. Names of persons attending the training.
4. Name(s) of persons conducting the training.

Records for training conducted by or coordinated by the Office of Environmental Health and Safety will be maintained in the EHS office. Records of training conducted or coordinated by departments or individual faculty members are kept in department offices or by the responsible faculty member.

Section 4: Biological Safety and Animal Care Training – IACUC

Investigators and other personnel using animals for research shall be appropriately qualified and experienced in conducting procedures on living animals. Adequate arrangements shall be made for in-service training, including the proper and humane care and use of laboratory animals.

The only vertebrate animal allowed to be used at the present time for research is fish. Individuals who use animals must know, understand, and comply with applicable laws, regulations, and policies. They are responsible for properly instructing students and employees. All faculty, staff and students preparing to submit a protocol to the IACUC (Institutional Animal Care and Use Committee) must first complete the online training course at http://citiprogram.org

Section 5: Laser Safety Training

Roger Williams University operates a Class IV high power laser. The beam from this laser is a fire and safety hazard. Diffuse and specular beam reflections can cause severe eye and skin damage. Laser Safety training is required for anyone operating this equipment. Training covers the basic modes of exposure and use of personal protective equipment.

The outputs of the laser are invisible, making them even more dangerous. Infrared radiation passes easily through the cornea, which focuses it onto the retina, where it can cause instantaneous permanent damage or blindness. Even small doses from scattered radiation can be harmful. Eye and skin exposure to direct or scattered radiation is to be avoided.

A key is required to operate the laser. Required use of the key minimizes the chance of untrained personnel activating the equipment.

General Safety Rules

- The laser is only to be used by authorized personnel who have received laser safety training.
- The laser is to be placed in standby or is to be shut off when not in use.
- No volatile substances are to be located in the area of the laser, which the laser could ignite.
- At all times, a fire-resistant background is to be placed behind target areas.
- Surrounding work areas are coated with a radiation absorbing material.
- All windows, doorways, open portals, etc., should be covered or restricted to reduce any escaping laser beams.
- Persons unnecessary to the laser operation should be kept away. For those who do enter a laser area, appropriate eye protection and instruction are required.
- Appropriate laser warning signs must be posted in the area where the laser is used.

Optical Safety Rules

- Eye safety is of the greatest concern. The Class IV laser is the highest and most dangerous classification. Even a main beam reflection from a polished surface can cause severe and permanent eye damage. Never look at a beam or a reflection directly.
- Always wear laser goggles appropriate for the wavelength and beam intensity generated.
- Do not wear or use any object that may reflect laser light such as a watch, ring, pen, reflecting tool, etc.
- Light the area around the laser so that the operator's pupils are constricted normally.
- Operate the laser without its covers only when adjusting it; replace and rebolt covers promptly.
- Always use the LOW ENERGY MODE when the laser head cover is off.
- Expand the beam whenever possible to reduce beam intensity.
- Close beam exit shutter when laser is not in use.
- Use an infrared detector or energy detector to verify that the laser beam is off before working in front of the laser.
- Set up experiments so the laser beam is not at eye level.
- Provide enclosures for beam paths whenever possible.
- Avoid blocking the output beam or its reflection with any part of the body.

Personal Protective Equipment

Eye-protection devices designed to protect against radiation shall be used eliminate the possibility of potentially hazardous eye exposure. All laser eyewear shall be clearly labeled with Optical Density (OD) values and wavelengths for which protection is afforded.

Skin protection can best be achieved through engineering controls. Skin covers and or sunscreen creams are recommended. For the hands, gloves will provide some protection against laser radiation. Tightly woven fabrics and opaque gloves provide the best protection. A laboratory jacket or coat can provide protection for the arms. For Class IV lasers, flame-resistant materials may be best.

Section 6: Formaldehyde

The OSHA Formaldehyde Standard requires annual training for all users of formaldehyde containing products containing greater than 0.1 percent formaldehyde or capable of releasing in excess of 0.1 ppm. That training is the responsibility of the faculty member supervising the use of formaldehyde containing products. The training must include:

- a discussion of the contents of the regulation (required for employees only) and the SDS,
- a description of the potential health effects of symptoms of exposure,
- reporting requirements for symptoms of exposure,
- description of safe work practices and engineering controls (e.g., fume hoods),
- the purpose of personal protective equipment (e.g., goggles and gloves), and

- instructions for handling emergencies.

The fact sheet provided in Appendix H may be used to accomplish this training and should be distributed or posted in all laboratories using formaldehyde in concentrations greater than 0.1 percent. The requirements for training will be discussed during initial faculty/staff Chemical Hygiene Plan training.

Chapter 8 – Handling and Disposal of Chemicals

Section 1: Chemical Procurement and Receipt

1. Plan experiments with safety in mind. Substitute less hazardous chemicals in laboratory procedures when possible. Examples include substituting methyl tertiary-butyl ether (MTBE) for ethyl ether, toluene for benzene, and dichloromethane for carbon tetrachloride. Even the recommended substitute materials are toxic, just less so.
2. Before ordering new chemicals, faculty must discuss the ability to share chemicals and check with the stockroom or other laboratories or the most current chemical inventory to see if the needed chemical is available within the Department. This is an important part of the University's Pollution Prevention (P2) program as a hazardous waste-generating entity.
3. Orders for all hazardous chemicals should be shipped **to the stockroom** using the instructions listed below:
   - When faculty place independent orders for research or teaching labs, a Purchase Order Request (POR) and a MNS Order Cover Sheet (OCS) is to be provided to the front desk for order database entry and routing. See Appendix N for MNS Purchase Order and Receipt Procedures and a copy of the MNS Order Cover Sheet.
   - The staff member ordering the chemical(s) is to ensure that safety data sheets (SDSs) are on file for the chemicals. If there is not a SDS on file, the staff member ordering the chemicals will obtain the material safety data sheet(s), either by downloading the sheet from the internet or obtaining the MSDS from the chemical vendor.
4. All chemicals will be initially received, inspected, and inventoried at MNS Room 206 (Chemical Stockroom) by a RWU Laboratory Technician. Before opening a package containing chemicals, inspect the packaging carefully for any signs of breakage or leakage of material. If there are signs of leakage, place package in a chemical fume hood, if this can be done safely. Protect yourself and others from exposure to the material and call the Office of Environmental Health and Safety for assistance.

Section 2: Chemical Storage

The number and amounts of chemicals that need to be stored should be reduced to a minimum. Chemicals must be stored based on their chemical compatibility. Acids, flammable liquids, oxidizers, and highly reactive chemicals should all be separated and stored properly to avoid unwanted chemical reactions. Chemical compatibility information is provided in Appendix A and references on chemical compatibility are listed. The following are general storage guidelines:

- Large containers of reagents and chemical waste should be stored on low shelving, preferably in trays to contain leaks and spills.

- Chemicals should not be stored on the floor, on bench tops or inside fume hoods.
- Inventories of storage areas, including those within labs, should be conducted periodically and at least annually and made available to staff and the Office of Environmental Health and Safety.
- Odiferous chemicals should be stored inside vented cabinets or fume hoods, or stored within refrigerators if the refrigerator temperature is low enough to minimize odors.
- Flammables requiring refrigeration shall be stored in explosion-proof refrigerators.

Section 3: Labeling Chemicals

All containers must be dated and labeled indicating the chemical constituents and hazard(s). It is recommended that the user's name or initials also appear on the label. Labels on incoming containers must not be removed or defaced. Indicating the date that a chemical is received is mandatory in the case of compounds that have a specific shelf life, such as those that can form peroxides. A partial list of peroxide formers is found on pages 38 – 40.

Identifying unknown materials for disposal is extremely costly. All laboratory personnel who are leaving the University are responsible for identifying and properly disposing of the chemical waste in their laboratory. Contact the Office of Environmental Health and Safety for additional information.

Section 4: Chemical Inventory

The OSHA Hazard Communication Standard requires RWU to maintain an inventory of hazardous chemicals. A hazardous chemical is defined as any liquid, solid, or gas that could present a physical or health hazard. RWU updates its chemical inventory at least annually to meet this requirement. Any chemical that has a safety data sheet should be included in the inventory.

Upon receipt of a chemical shipment, stockroom personnel open boxes checking for completeness of shipment and the integrity of the containers within the shipment. If a material is being received for the first time, a SDS should be included in the shipment. Stockroom personnel are to formally notify faculty that materials have been received. SDSs are to be added to the SDS Library kept in the Faculty Office area and a copy is to be sent to the Office of Environmental Health and Safety. If the material is new to the RWU chemical inventory and a SDS has not been received, it should be retrieved via the online RWU SDS search engine located at the following website address:

http://hq.msdsonline.com/rogerwilliamsuniversity

Note that it is the ultimate responsibility of the faculty member ordering the chemical to ensure that the SDS is added to the binders in the MNS building and Public Safety. The Chemical Stockroom Lab Technicians should perform periodic reviews to ensure that all chemicals in the inventory have a SDS in the MNS hardcopy SDS library. The Office of Environmental Health and Safety will perform periodic reviews to ensure that all chemicals in the university inventory have a SDS in the online RWU SDS library.

Section 5: Transportation of Chemicals

Secondary containment of chemicals is required when transporting bottles of chemicals outside the laboratory. Secondary containment is a durable container (e.g. "Rubber Maid" tote, plastic pail or bottle carrier) capable of containing the contents of the original container in the event of a spill. Secondary containers should be used when chemicals are carried through corridors, stairways, and inside elevators. Under no circumstances should anyone transport chemical containers in a passenger elevator without the use of secondary containers.

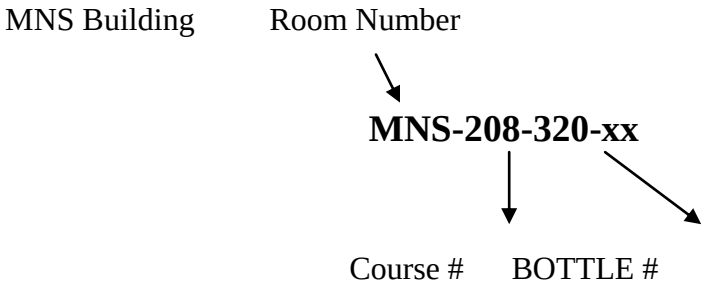
Section 6: Chemical Waste

Most of the waste chemicals resulting from laboratory experiments are hazardous and their generation, storage and disposal must be given consideration in **every** experiment. Each laboratory must follow the proper procedures for disposal of hazardous waste.

Waste will be routinely removed from laboratories at the end of each semester and be shipped by a commercial chemical waste disposal company. Individual faculty members are responsible for the proper containment, labeling, and inventory of all of their waste.

Waste Containers:

1. At a minimum, the label must have the words "Hazardous Waste" and some indication of the contents of the container. A waste log is used when adding waste to containers. The waste log is completed for the container and has a bottle ID#. Waste logs will be related to waste bottles using the following id#:



2. Chemical waste containers must be kept closed AT ALL TIMES, unless waste is being added to or removed from the container. For bottles, this means that the cap must be securely tightened onto the container. All waste containers are to be placed in secondary spill containment bins for additional protection.
3. Glass containers are not to be used unless the contents of the container are incompatible with plastic.
4. Storage of hazardous waste in the laboratories is only permitted in an approved Satellite Accumulation Area (SAA). All laboratory SAAs are posted with the appropriate signage and demarcated with yellow and black striped tape. Laboratory Technicians should contact the Office of Environmental Health and Safety when hazardous waste containers become full. The Office of Environmental Health and Safety will be solely responsible for all RWU hazardous waste disposal.
5. Waste containers are not to be moved from the lab by students or staff unless they have received proper training in waste handling and emergency procedures (Hazardous Waste Training).
6. The Office of Environmental Health and Safety cannot remove waste unless it is properly labeled and the container is in good condition.

See the RWU Laboratory Waste Disposal and Management Guide for a full description of waste management procedures (available on the EHS webpage on the "Chemical Safety" tab).

Section 7: Special Handling for Chemicals

Flammable Liquids

Limits for the storage of flammable solvents are based on the materials' flammability. The following practices are required for the storage of flammable materials:

- Quantities stored in the laboratory are to be kept to a minimum.
- Flammable liquids are not to be stored next to incompatible materials, such as oxidizers.
- Storage of flammable liquids (including waste) outside of approved flammable storage cabinets and safety cans must not exceed 10 gallons per 100 square feet of laboratory space. Refer to the tables below for allowable maximum quantities.
- With flammable storage cabinets and approved safety cans, storage must not exceed 20 gallons per 100 square feet of laboratory space. Refer to the tables below for allowable maximum quantities.

CLASSES OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

CLASS	BOILING POINT °C (°F)	FLASH POINT °C (°F)	EXAMPLES
Flammable 1A	<37.8 (100)	<22.8 (73)	ethyl ether, pentane
Flammable 1B	≥37.8 (100)	<22.8 (73)	acetone, ethyl alcohol
Flammable 1C	-	22.8 (73) ≤ and <37.8 (100)	butanol, isoamyl acetate
Combustible 2	-	37.8 (100) ≤ and <60 (140)	formalin, cyclohexanone
Combustible 3A	-	60 (140) ≤ and <93.3 (200)	phenol, dichlorobenzene
Combustible 3B	-	≥93.3(200)	ethylene glycol, mineral oil

Source: National Fire Protection Association, 1996. *Flammable and Combustible Liquids Code, NFPA 30.*

LABORATORY STORAGE OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

outside of flammable storage cabinets and safety cans

Lab Type	Liquid Class	Per 100 ft^2 floor space
Instructional	1A,1B,1C total	1 gallon
	1A-C, 2, 3A total	2 gallons
All Other (NFPA Class C)	1A,1B,1C total	2 gallons
	1A-C, 2, 3A total	4 gallons

Source: National Fire Protection Association, 1991. *Fire Protection for Laboratories Using Chemicals, NFPA 45*.

Safety Cans

Underwriters Laboratories (UL) or Factory Mutual (FM) approves safety cans for flammable and (non-corrosive) combustible materials. They are made of 22-guage steel or plastic and have a self-closing lid or quarter turn spigot.

Flammable Storage Cabinets

Flammable storage cabinets are designed to contain a fire for 10 minutes, enough time for escape. The NFPA does not require that flammable storage cabinets be vented. If the cabinet is equipped with ventilation openings, the opening must either be sealed with materials providing fire protection at least equivalent to that of the construction of the cabinet, or the cabinet must be vented outdoors by using fire protection piping.

- Flammable storage cabinets should not be located near exits, electrical panels, or sources of heat or ignition.
- Flammable storage cabinets must be listed by Factory Mutual, Underwriters Laboratories, or other qualified testing agency.
- The cabinet must be clearly labeled "Flammable – Keep Fire Away".
- Materials stored inside of the flammable storage cabinet should be compatible with the cabinets design. Capacities and weight limits of shelving is not to be exceeded.
- Only components (such as shelving) made for the storage cabinet by the cabinet manufacturer are to be used within the cabinet.
- Acids should not be stored in a flammable storage cabinet due to possible corrosion of the cabinet and incompatibility with organic solvents.

Flammable Storage Refrigerators

If refrigeration of volatile flammable chemicals is required, the refrigerator or freezer must meet NFPA Standards for flammable storage. Flammable materials' refrigerators and freezers have spark free interiors. Explosion-proof units also have spark free exteriors and are designed for use in hazardous environments. All units designed for flammable storage should be clearly marked as "approved for flammable storage". All units not approved should be clearly marked "not for flammable storage" or other similar wording.

Typical laboratory solvents stored in domestic refrigerators could create a significant hazard. According to the NFPA, refrigerator temperatures are "almost universally" higher than the flash points of flammable liquids stored in them. A domestic refrigerator contains ignition sources such as thermostats and light switches within or exposed to the refrigerated storage compartment.

Refrigerators for storage of flammable materials are designed to prevent internal explosions by preventing flammable vapors from coming into contact with ignition sources. Explosion proof refrigerators should have an explosion proof interior and exterior. These refrigerators and freezers must meet UL and NFPA standards.

All classes of flammable liquids are not to be stored in household-type refrigerators. In laboratories storing or using flammable liquids, refrigerators should be clearly marked to indicate whether or not it is safe for storage of flammable materials. Recommended wording is "approved for flammable storage" or "not for flammable storage". Other similar wording can be used.

Food and beverages are prohibited in the laboratories. If food or beverages are being used for research or experimental purposes, they must be labeled, "For Experimental Use Only" or "Not for Human Consumption". Food and beverages must never be stored in any laboratory refrigerator in which chemicals or biological materials are kept.

Corrosive Chemicals

Corrosive chemicals include strong acids and bases, dehydrating agents, nonmetal chlorides, and halogens. These chemicals are acute health hazards and present problems in handling and storage. In addition to general procedures for handling of chemicals detailed in the Chemical Hygiene Plan, the following procedures should be followed for corrosive chemicals:

- Purchase corrosives in containers with a protective plastic coating, if available.
- Store corrosives on low shelving, in storage cabinets, or in a fume hood designated for storage.
- Gas cylinders (lecture bottles) should not be stored in the same cabinet with corrosive liquid because of possible cylinder valve damage.
- Properly segregate hazardous materials to minimize the likelihood of fire, explosion or release of toxic gas.

Compressed Gases

Compressed gases may present both physical and health hazards. Gases may be flammable, reactive, corrosive and/or toxic and these properties must be considered when developing experimental procedures and designing apparatus. In addition, compressed gases, when not handled properly or not contained in properly designed vessels, can be extremely hazardous with a high potential for explosion. All procedures and experimental apparatus used in the handling of extremely toxic gases and gases with a high potential for explosion (See appendix J) should be approved by the Office of Environmental Health and Safety prior to use.

Although each approved gas cylinder is designed, constructed, and tested to safely contain its contents, the following procedures should be followed for handling and storing compressed gases:

- Cylinders must be clearly marked with their contents.
- Door signs should be posted in rooms in which flammable compressed gases are present.
- Regulators must be compatible with gas cylinders. Adapters are not to be used.
- Cylinders must be secured to a wall or bench. A gas cylinder cart or stand is also acceptable.
- Cylinders must be stored in a cool, dry, and well-ventilated area away from ignition sources, electrical supply sources, and heat.
- A safety cap or regulator must always be attached to the cylinder.
- Transport capped cylinders on an approved cylinder cart.
- Be familiar with the special hazards associated with compressed gases or cryogenic liquefied gases in use.
- Store oxidizers away from flammable gases.
- Do not store gas cylinders with acids and/or bases.
- Keep flammable gases away from doorways.
- Particularly hazardous gases require use of approved gas storage cabinets. Use and storage should be reviewed with the Office of Environmental Health and Safety.
- Oxygen and fuel gases must be separated by a distance of at least 25 feet or by a 5-foot high noncombustible wall when stored. As an alternative, oxygen can be moved directly to the area of use.

- Corrosive gases should be stored for the shortest possible time period: under three months is preferable.
- When set up for use, bond and ground all cylinders and piping containing flammable gases to prevent the hazards caused by the buildup of static electricity.
- Never completely empty a cylinder. Leave a slight pressure (about 25 pounds) to keep out contaminates that may react with the contents or corrode the cylinder.

Start the gas flow with the following procedure:

a. With the regulator secured to the cylinder valve outlet, turn the delivery-pressure adjusting screw counterclockwise until it turns freely.

b. Next, slowly open the cylinder valve until the cylinder pressure gauge on the regulator reads the cylinder pressure. The cylinder valve should be opened by hand; never use a wrench or other tool unless the vendor supplies a special tool for that purpose.

c. With the cylinder valve open and the flow control valve (the outlet from the regulator) in closed position, set the desired delivery pressure by turning the delivery-pressure adjusting screw clockwise until the desired pressure is reached.

d. Flow from the cylinder can now be commenced by opening the flow control valve at the outlet of the regulator.

SPECIAL PRECAUTIONS

Acetylene

1. Gaseous acetylene under pressure may also decompose with explosive force, and should not be used at pressures in excess of 15 psig (30 psi absolute pressure). Acetylene pressure gauges should have a warning red line at this point.

2. Acetylene in cylinders is dissolved in a liquid (e.g., acetone) and should always be used in an upright position. Do not use a cylinder that has been stored or handled in a non-upright position until it has remained in an upright position for at least 30 minutes.

3. The outlet line of an acetylene cylinder must be protected by a flash arrester.

4. Use the correct kind of tubing to transport the gaseous acetylene. Some tubing materials, such as copper, form explosive acetylides.

Oxidizers

Oxidizers under pressure (oxygen, chlorine, etc.) will rapidly oxidize organic material, such as oil or grease, resulting in an explosion. Never use oil or grease on valves or gauges intended for oxygen cylinders.

Moving Compressed Gas Cylinders

Only faculty members, staff, or employees of the gas supplier can move large compressed gas cylinders from the delivery area to the laboratory.

1. Always consider cylinders full and handle them accordingly; the same hazards exist even if the cylinder is only partially full.

2. Use a hand truck to transport cylinders that cannot be easily carried. Do not drag, roll, or slide cylinders.

3. The valve protection cap should remain on until the cylinder has been secured in its final position and is ready for use.

4. Never drop a cylinder or permit cylinders to strike each other violently.

5. Protect cylinders from any object that will produce a cut or abrasion in the surface of the metal.

6. Mount cylinders so that the valve is easily accessible and the label is readable.

7. Always chain or strap cylinders immediately. Cylinders must be secured individually. Do not leave a cylinder in a laboratory if equipment is not available to secure it.

Section 8: Particularly Hazardous Chemicals

Highly Reactive Chemicals

Highly reactive chemicals are inherently unstable and can react in an uncontrolled manner to liberate heat, toxic gases, or explosive force. The include shock sensitive chemicals, high-energy oxidizers (see Appendix K) and peroxide formers (see below). Before working with these materials, safety information should be reviewed to evaluate proper storage and handling procedures. In addition to the general procedures above, the following procedures are recommended:

- Secure reaction equipment.
- Use impact protection (shields and guards) in addition to chemical splash protection (i.e. eye protection, face shields, gloves, and aprons).
- Handle shock-sensitive chemicals gently to avoid friction, grinding, and impact.
- Dispose of reagents if their age or purity is suspect.

High-risk experiments should not be performed!

There are some additional hazardous conditions that are not usually attributed to “reactive chemicals” but should be mentioned. Extreme differences in physical state can cause an uncontrollable release of energy. For example, bringing a hot liquid such as an oil into contact with a liquid with a lower boiling point such as water will cause instantaneous vaporization of the lower boiling point liquid and a violent release of energy.

EXAMPLES OF REACTIVE CHEMICALS

The following list of examples is compiled from several general references.[1] Manufacturer's Safety Data Sheets or the references cited should be consulted to determine the specific reactive characteristics of a particular chemical.

OXIDIZERS

These chemicals can readily provide reactive oxygen under certain conditions. When in contact with organic materials (including wood, paper, organic chemicals) or other easily oxidizable compounds (e.g. metal powders), oxidizers can form unstable and explosive compounds sensitive to shock. Examples include:

Bromine and compounds
Chlorine and compounds
Chromates and dichromates
Chromium trioxide
Chromic acid
Fluorine
Iodine and compounds
Manganese dioxide
Nitrates
Nitric acid
Nitrites
Nitrogen trioxide
Permanganates
Peroxides
Persulfates
Phosphomolybdic acid
Picrates
Sodium bismuthate
Sulfuric acid
permanganates

[1] REFERENCES:

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WATER EXPOSURE SENSITIVE

Water reactive chemicals can develop pressure; generate flammable, explosive, corrosive or toxic gases; or ignite or explode when exposed to water or moisture. Examples include:

alkali and alkaline-earth metals (sodium, lithium, calcium, potassium, magnesium)

aluminum chloride

anhydrous metal halides (aluminum tribromide, germanium tetrachloride)

anhydrous metal oxides (calcium oxide)

benzoyl chloride

calcium carbide

calcium oxide

nonmetal halides (boron tribromide, phosphorous pentachloride)

nonmetal halide oxides (inorganic acid halides, phosphoryl chloride, sulfuryl chloride, chlorosulfonic acid)

nonmetal oxides (acid anhydrides, trioxide)

AIR EXPOSURE SENSITIVE

Air exposure sensitive chemicals can develop pressure, generate flammable or explosive gases, ignite or explode when exposed to air. Examples include:

alkylmetal derivatives (ethoxydiethylaluminum and dimethylbismuth chloride)

analogous derivatives of nonmetals including diborane, dimethylphosphine, triethylarsine, dichloro(methyl)silane

carbonyl metals (pentacarbonyliron and octacarbonyldicobalt)

finely divided metals (calcium, titanium)

metal hydrides (potassium hydride and germane)

partially or fully alkylated metal hydrides (diethylaluminum hydride, triethylbismuth)

sodium methoxide

sec-butyl lithium

triethylaluminum

white phosphorus

TEMPERATURE SENSITIVE

Temperature sensitive chemicals may decompose when held above their maximum safe storage temperature resulting in pressure buildup, flammable or explosive gas generation, ignition or explosion. Examples include:

certain oxidizers (perchlorates, chlorates, nitrates, bromates, chlorites, iodates)

certain "azo" compounds

lithium nitrate

organic peroxides

phenylhydrazine hydrochloride

SPONTANEOUS DECOMPOSITION

Spontaneous Decomposition - chemicals which change structure over time and with no apparent stimulation will develop pressure, generate flammable or explosive gases, ignite or explode. Examples include:

benzoyl peroxide (dry)

contaminated concentrated hydrogen peroxide

nitroglycerine

Shock, Friction, and Static Discharge Sensitive - chemicals that will violently decompose when initiated by shock, friction, or static discharge. Examples include:

acetylides

azides

contaminated oxidizers

diazo compounds

explosives

fulminates

halamine

nitro compounds

nitroso compounds

organic nitrates

organic and inorganic peroxides (see below)

ozonide

picric acid (trinitrophenol)

Peroxidizable Compounds

Peroxides can form and accumulate under normal storage conditions. Peroxides may also explode violently when chemicals are subject to thermal or mechanical shock. To prevent accidents, it is important that information on the age of peroxide forming chemicals be maintained and that these chemicals are tested or disposed of on a regular basis. The Departments' chemical inventories identify peroxide formers and the Chemical Hygiene Officer checks their status at least every 6 months.

The peroxidizable compounds listed in the following tables must be labeled upon receipt with preprinted labels that read:

PEROXIDIZABLE COMPOUND, DATE OPENED _____, DISCARD OR TEST WITHIN ___ MONTHS AFTER OPENING (or similar wording).

These labels should also be placed on any other compounds known to be peroxide formers.

The date and discard period should be filled-in the first time the container is opened.

The level of peroxides can be tested using peroxide test strips that are available from the stockroom and the test will be performed by the Chemical Hygiene Officer. The following are recommendations for testing or disposal of potential peroxide forming chemicals.

Group A- Chemicals that form explosive levels of peroxides without concentration

(Safe storage time after opening - 3 months)

1,1- Dichloroethylene	75-35-4 (Vinylidene chloride)
2-Chloro-1,3-Butadiene	126-99-8 (Chloroprene)
Butadiene	106-99-0
Divinyl acetylene	821-08-9
Isopropyl Ether	108-20-3
Tetrafluoroethylene	116-14-3
Vinyl Ether	109-93-3 (Divinyl ether)

Group B-Chemicals that form explosive levels of peroxides on concentration

(Safe storage time after opening - 12 months)

2-Butanol	78-92-2
2-Cyclohexan-1-ol	822-67-3
2- Hexanol	626-93-7
2-Pentanol	6032-29-7
3-Methyl-1-Butanol	123-51-3 (Isoamyl alcohol)
4-Heptanol	589-55-9
4-Methyl-2-Pentanol	108-11-2
Acetal	105-57-7
Acetaldehyde	75-07-0
Alpha-Methyl-Benzyl Alcohol	98-85-1 (Phenyl Ethanol)
Benzyl Alcohol	100-51-6
Cyclohexanol	108-93-0
Cyclohexene	110-83-8
Cyclooctene	931-87-3
Cyclopentene	42-29-0
Decahydronaphthalene	91-17-8
Diacetylene	460-12-8
Dicyclopentadiene	77-73-6
Dioxane	123-91-1 (1,4 Dioxane)
Ethylene Glycol Dimethyl Ether	110-71-4
Ethyl Ether	60-29-7 (Diethyl Ether)
Furan	110-71-4
Isopropyl Benzene	98-82-8 (Cumene)
Methylcyclopentane	96-37-7
Methyl Isobutyl Ketone	108-10-1
Penten-1-ol	821-09-0
Propyne	74-99-7 (methyl acetylene)
Tetrahydrofuran	109-99-9
Tetrahydronaphthalene	119-64-2

Other Secondary Alcohols

Group C- Chemicals which may autopolymerize as a result of peroxide accumulation

(Safe storage time after opening: inhibited chemicals- 12 months; uninhibited chemicals: - 24 hours)

Note: Do not store inhibited chemicals in this group under inert atmospheres

1,1-Dichloroethylene	75-35-4 (Vinylidene Chloride)
2-Chloro-1,3-Butadiene	126-99-8 (Chloroprene)
Acrylic Acid	79-10-7
Acrylonitrile	107-13-1
Buten-3-yne	689-97-4 (Vinyl acetylene + Butenyne)
Chlorotrifluorethylene	79-38-9
Methyl Methacrylate	80-62-6
Phenethyl Alcohol	60-12-8 (Phenyl Ethanol)
Styrene	100-42-5
Tetrafluoroethylene	116-14-3
Vinyl acetate	108-05-4
Vinyl chloride	75-01-4 (Monochloroethylene)

Source: Ernest Orlando Lawrence Berkley National Laboratory, Chemical Hygiene Plan, 2001.

Do not purchase more of a peroxidizable chemical than can be reasonably used in three months' time. Peroxides can build up over time as solvent evaporates and/or air seeps into the bottle. If possible, purchase material that contains an appropriate peroxide inhibitor such as BHT. If non-inhibited material must be stored, be sure to store the material under an inert atmosphere.

Do not distill, evaporate or concentrate the material unless it has been tested for the presence of peroxides. Peroxides are usually less volatile than their parent material and tend to concentrate upon distillation.

Do not store peroxide forming materials in clear glass bottles. (Light can accelerate the chemical reactions that form peroxides.) It is recommended that an amber transparent bottle be used. Do not store the material in a metal can or other container that must be opened to see inside.

Do not store peroxide-forming chemicals near heat, sunlight or ignition sources. Avoid places that undergo temperature variations that can cause the bottle to "breath in" oxygen.

Do not purchase or use high-risk items such as diisopropyl ether: use less hazardous alternatives.

NEVER touch or attempt to open a container of a peroxide-forming liquid if there are crystals around the cap and/or in the bottle. The friction of turning the cap could detonate the bottle with disastrous results.

Chemicals of High Acute and Chronic Toxicity

Certain chemicals have been identified as causing acute health effects or long-term chronic health effects. Substances of high acute toxicity cause immediate health effects at very low concentrations.

Moderately toxic:	LD_{50} 500 – 5,000 mg/kg
Very toxic:	LD_{50} 50 – 500 mg/kg
Extremely toxic:	LD_{50} 5 – 50 mg/kg
Super toxic:	LD_{50} < 5 mg/kg

A written protocol is required for any use of a toxin with an LD_{50} value less than the following:

LD_{50} - ingestion: $\leq$ 50 mg/kg

LD_{50} - contact (24hrs): $\leq$ 200 mg/kg

LD_{50} - inhalation: $\leq$200ppm/1hr

The protocol must include the experiment procedure, necessary protective equipment, safety precautions, emergency procedures, user training, including type and location of training records, and waste disposal. The protocol must be submitted by the faculty member to the Office of Environmental Health and Safety and reviewed with other faculty, students and staff working in the lab. A sample protocol form is included in Appendix F.

Procedures for Handling Highly Toxic Chemicals

- An acute toxin protocol must be submitted and approved by the Office of Environmental Health and Safety prior to using any Highly Toxic Chemicals.
- Approval must be obtained from the Office of Environmental Health and Safety for students to handle highly toxic chemicals.
- Notify all employees of the particular hazards associated with this work.
- Minimize contact with these chemicals by any route of exposure (inhalation, skin contact, mucous membrane contact or injection.)
- Work only in a properly operating chemical fume hood or glove box.
- Remove all protective clothing before leaving the area where the chemical was used and discard or decontaminate protective clothing.
- Establish and emergency plan for each operation. This plan must be presented in the acute toxin protocol.
- Decontaminate work surfaces after completing procedures.
- Do not conduct normal laboratory work in the designated area until it is decontaminated.

Chapter 9 – Biological Safety

Section 1: Pathogenic Microorganisms

For the purposes of this plan, a pathogen is defined as any organism known to cause infection or suspected of causing infection in humans, animals, insects or plants.

Roger Williams University currently only allows the ordering, use, and storage of BSL-1 organisms. Roger Williams University follows the safety requirements of CDC BSL-1, which may be found in the fifth edition of the BMBL (http://www.cdc.gov/biosafety/publications/bmbl5/bmbl.pdf).

Roger Williams University currently allows the handling of wild oysters which may be host to *Vibrio cholerae* (cholera; BSL-2) only in the biological safety cabinet of Lab 110B (Aquatic Diagnostic Laboratory – Necropsy Room). All handling is performed by staff and faculty only.

Section 2: Laboratory Animals

In accordance with ethical principals set forth by the National Institutes of Health (NIH), Roger Williams University has appointed and Institutional Animal Care and Use Committee (IACUC). This committee oversees the protocols relating to the care and use of animals for research and teaching purposes at RWU. Roger Williams University recognizes the scientific and ethical responsibility for the humane care and use of animals involved in research and education and requires all individuals involved to maintain the highest standards of animal care and consideration.

The IACUC Policies and Procedures for RWU are attached to this document as Appendix L. At the present time, the only vertebrate laboratory animals that are used for experimental purposes at Roger Williams University are fish. The IACUC policies include procedures for bringing any animal products from vertebrate animals to the campus for research and training. There are also procedures for bringing live animals into campus facilities for the purpose of obtaining animal products. (Animal products include blood, urine, tissues, organs, and carcasses.)

Section 3: Biological Waste Disposal

Wastes generated from research using and handling of organisms are decontaminated by autoclaving. Once material has been properly decontaminated by autoclaving, it may be disposed of as regular trash. To ensure the sterility of materials and adequate decontamination of wastes, it is important for all departments to maintain autoclaves and to train personnel in their proper use. All autoclaves should be checked monthly with chemical strips or by spore testing to make sure they are operating properly and the procedures are adequate for the decontamination of biohazardous waste.

Section 4: Biological Spills

The only spills that are anticipated to occur that could contain a harmful biological agent are from accidents involving human body fluids. RWU's Department of Facilities Management has personnel trained to address these spills. Should an accident or incident occur involving human body fluids, RWU Public Safety should be contacted at 254-3333.

Section 5: Flow Cytometry for Live and Fixed Cells

Flow cytometry is a method of quantifying structural or biochemical features of cells or other small particles by using a laser as an excitation light source and photodetectors for measurement. This is generally accomplished by either light scatter and/or fluorescence. Flow cytometry may further be defined as a technology to measure properties of particles as they move or flow, in liquid suspension.

In some flow (or sorting) cytometers, the liquid containing the particles is broken into droplets by the reciprocating motion of a nozzle. Individual particles are captured in small droplets and then those droplets are electrostatically charged and deflected through a high potential. If a plug or other obstruction (bubbles, clumps of cells, etc.) occurs, then this stream of droplets can go awry, generating aerosols. There is potential for aerosol exposure to individuals near a flow cytometer because modern sorting units operate with 14 to 40 pounds per square inch of pressure (some units can operate at 100 psi). Even non-sorting flow cytometers, which do not suspend cells in droplets, operate under pressures near 5 psi and can develop leaks and generate aerosols.

The following requirements must be followed when using a flow cytometer at RWU due to the potential for aerosol exposure to individuals:

1. Flow cytometry may only be performed by individuals trained in the proper use of the unit.
2. Proper personal protective equipment should be worn when using a flow cytometer. This may include gloves, lab coats and safety glasses.
3. The flow cytometer and lab bench must be cleaned and properly disinfected after each use.
4. The catch basin should have an adequate disinfectant (i.e. bleach) added when the unit is in use.
5. When possible, biological samples should be fixed before being run through the flow cytometer. Special precautions apply if using formaldehyde.
6. For toxic materials, flow cytometry must be conducted in a chemical fume hood, biological safety cabinet, or other negative pressure exhaust ventilation system. Flow cytometry must be conducted in a negative pressure laboratory.

Section 6: Ethidium Bromide Handling and Disposal

Ethidium bromide is used commonly as a non-radioactive marker for identifying and visualizing nucleic acid bands in electrophoresis and in other methods of gel-based nucleic acid separation. Ethidium bromide is a dark red, crystalline, non-volatile solid, moderately soluble in water, which fluoresces readily with a reddish-brown color when exposed to ultraviolet light. Although it is an effective tool, its hazardous properties require special safe handling and disposal procedures.

Handling

Ethidium bromide is a potent mutagen and is moderately toxic after an acute exposure. Ethidium bromide can be absorbed through the skin, so it is important to avoid any direct contact. Ethidium bromide is also and irritant to the skin, eyes, mouth and upper respiratory tract. It should be stored away from strong oxidizing agents in a cool, dry place and the container must be kept undamaged and tightly closed. Individuals using ethidium bromide should follow these safety procedures:

- Ethidium bromide users should receive documented training on its hazards.

- Ethidium bromide must appear on the laboratory's chemical inventory, with accurate estimates of on-hand quantities.
- Pure ethidium bromide should only be handled in a fume hood, with the user wearing protective equipment that include lab coat or apron, closed-toe shoes, chemically resistant (nitrile) gloves, and chemical safety goggles.

All wastes containing ethidium bromide are to be handled and disposed of as hazardous waste.

Section 7: Formaldehyde

OSHA has established a separate Standard for formaldehyde, 29 CFR 1910.1048 that applies to laboratories as well as other users of formaldehyde. Under that Standard employee exposure monitoring is required to determine if a particular experiment results in overexposure to formaldehyde. As with the requirements of the OSHA Laboratory Standard, the same standards of protection with regard to formaldehyde exposure will be applied to students.

To accomplish the required monitoring, faculty members should notify the Office of Environmental Health and Safety at least 2 weeks before any experiment where formaldehyde is used in concentrations greater than 0.1 percent. If monitoring has been conducted in previous semesters for that experiment, notification is not required unless the Office of Environmental Health and Safety has informed the faculty that additional monitoring is necessary. Additional requirements of the Standard may apply based on the results of monitoring, and these requirements will be discussed with individual faculty members as needed.

The Formaldehyde Standard also establishes hazard communication requirements, labeling, MSDS, and training, for the use of all solutions greater than 0.1 percent or materials capable of releasing formaldehyde in excess of 0.1 ppm.

Labeling. For products capable of releasing 0.1 to 0.5 ppm, labels must include a warning that the product contains formaldehyde and that more information is available on the MSDS. For products capable of releasing greater that 0.5 ppm, the label must also address health hazards and include the words "Potential Cancer Hazard". Products purchased after December 1992 should be properly labeled by the vendor. Products purchased before that date or that are not in their original labeled container must be labeled with the appropriate warning. Material Safety Data Sheets must be readily accessible for all formaldehyde containing products.

Information and Training. Annual training is required for all formaldehyde product users. That training is the responsibility of the faculty member supervising the use of the formaldehyde product. Specific requirements are described in Chapter 7.

Chapter 10: Nuclear Magnetic Resonance Safety

NMR or nuclear magnetic resonance equipment produces a static magnetic field and also uses radio frequency fields that remain local to the magnet enclosure. The radio frequency fields range from 1 to 100 MHz.

Cardiac pacemakers and other metallic devices may be sensitive to elevated static magnetic fields. Other materials and devices can be influenced by strong magnetic fields (computers and other electronics). Cards that have a magnetic strip on the back, such as credit cards, may be adversely affected by strong magnetic fields. Such cards and other personal items (watches, glasses with metallic frames, pens, etc.) should be removed before approaching a NMR unit.

Boundaries have been established around the equipment used at RWU to warn personnel implanted with a pacemaker or other metallic device. Standard operating procedures for use of the NMR equipment have been established and are provided as an attachment to this document. Only personnel trained in the use of the NMR equipment are permitted to operate it.

Appendix A - COMPATIBLE CHEMICAL STORAGE

Chemicals should always be segregated into compatible groups during storage to prevent hazardous reactions in the event of an accident. Storage areas and shelves should be clearly labeled as to appropriate hazard class. The major laboratory chemical distributors have established color-coded systems for chemical storage based on compatibility. Be aware that the systems vary somewhat between distributors.

CLASSES OF INCOMPATIBLE CHEMICALS

CHEMICALS IN COLUMN A AND B SHOULD BE KEPT SEPARATE

A	B
acids	bases
alkali and alkaline earth metals	water
carbides	acids
hydrides	halogenated organic compounds
hydroxides	oxidizing agents
oxides	chromates, dichromates CrO_3
peroxides	halogens
	halogenating agents
	hydrogen peroxide and peroxides
	nitric acid, nitrates
	perchlorates and chlorates
	permanganates
	persulfates
inorganic azides	acids
	heavy metals and their salts
	oxidizing agents (see list above)
inorganic cyanides	acids, strong bases
inorganic nitrates	acids, nitrites
	metals, sulfur
inorganic nitrites	acids
	oxidizing agents

inorganic sulfides		acids
organic compounds		oxidizing agents (see list above)
organic acyl halides		bases
organic anhydrides		organic hydroxy compounds
organic halogen compounds		aluminum metal
organic nitro compounds		strong bases
powdered metals		acids
		oxidizing agents (see list above)

Source: National Research Council, 1981. *Prudent Practices for Handling Hazardous Chemicals in Laboratories*.

Other references:

1. American Chemical Society, 1995, *Safety in Academic Chemistry Laboratories*, Sixth Edition.
2. Alaimo, Robert J., 2001, *The Handbook of Chemical Health and Safety.* Oxford University Press.

Appendix B – HMIS Labeling- HMIS DETAILED EXPLANATIONS

BLUE, HEALTH RANKINGS EXPLANATION:

SEVERE or EXTREME 4	***Highly** toxic material. One of more of the following apply:* *1. On short exposure, could cause death or major residual injury, even though prompt medical treatment is given* *2. A known or suspected human carcinogen, mutagen (could cause mutation), or teratogen (could cause birth defects)*
SERIOUS 3	***Toxic** material. One or more of the following apply:* *1. May cause serious temporary or residual injury on short term exposure even though prompt medical attention is given* *2. Known or suspected small animal carcinogen, mutagen, or teratogen.*
MODERATE 2	***Moderately** toxic. Will have one or both of the following characteristics:* *1. Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.*
SLIGHT 1	***Slightly** toxic. One or more of the following characteristics:* *1. May cause irritation but only minor residual injury even without treatment.* *2. Recognized as innocuous when used with reasonable care.*
MINIMAL 0	*"**Normal**" Material. No chemical is without some degree of toxicity.*

SOURCE: Fire Protection Guide to Hazardous Materials, 1994 Edition, Appendix B

HMIS DETAILED EXPLANATIONS

BLUE, **HEALTH** RANKINGS EXPLANATION BASED ON LD_{50}:

SEVERE OR EXTREME **4**	***Highly toxic material. One of more of the following apply:*** 1. LD_{50} (acute oral toxicity) = **5 or less**, mg/kg of body weight 2. LD_{50} (acute dermal toxicity) = **40 or less**, mg/kg of body weight 3. LC50 = **.5 or less**, mg/l (acute inhalation toxicity, dusts and mists) LC_{50} (acute inhalation toxicity, gases) = **1000 ppm**
SERIOUS **3**	***Toxic material. One or more of the following apply:*** 1. **5** < LD_{50} (acute oral toxicity) < **50**, mg/kg of body weight 2. **40** < LD_{50} (acute dermal toxicity) < **200**, mg/kg of body weight 3. **.5** < LC_{50} < **2** mg/l (acute inhalation toxicity, dusts and mists) 4. **1000** ppm < LC_{50} < **3000** ppm (acute inhalation toxicity, gases)
MODERATE **2**	***Moderately toxic. One or more of the following apply:*** 1. **50** < LD_{50} (acute oral toxicity) < **500**, mg/kg of body weight 2. **200** < LD_{50} (acute dermal toxicity) < **1000**, mg/kg of body weight 3. **2** < LC_{50} < **10** mg/l (acute inhalation toxicity, dusts and mists) 4. **3000** ppm < LC_{50} < **5000** ppm (acute inhalation toxicity, gases)
SLIGHT **1**	***Slightly toxic. One or more of the following apply:*** 1. **500** < LD_{50} (acute oral toxicity) < **2000**, mg/kg of body weight 2. **1000** < LD_{50} (acute dermal toxicity) < **2000**, mg/kg of body weight 3. **10** < LC_{50} < **200** mg/l (acute inhalation toxicity, dusts and mists) 4. **5000** ppm < LC_{50} < **10,000** ppm (acute inhalation toxicity,
MINIMAL **0**	***No hazard on short exposure.*** 1. LD_{50} > **2000** mg/kg of body weight (acute oral toxicity) 2. LD_{50} > **2000** mg/kg of body weight (acute dermal toxicity) 3. LC_{50} > **200** mg/l (acute inhalation toxicity, dusts and mists) 4. LC_{50} > **10,000** ppm (acute inhalation toxicity, gases)

HMIS DETAILED EXPLANATIONS

RED, FLAMMABILITY RANKINGS EXPLANATION BASED ON FLASH POINT:

SEVERE OR EXTREME **4**	***Extremely flammable. Flash point below 73°.***
SERIOUS **3**	***Flammable*** *material. One or more of the following apply:* *1. **Vaporizes readily** and can be ignited under almost all ambient conditions.* *2. May form **explosive mixtures** with or **burn rapidly in air**.* *3. May burn rapidly due to self-contained oxygen.* *4. May ignite spontaneously in air.* *5. Flash point at or above 73°F but below 100°F.*
MODERATE **2**	***Moderate. Combustible**. Will have one or more of the following characteristics:* *1. Must be moderately heated or exposed to relatively high temperatures for ignition to occur.* *2. Solids that rapidly give off flammable vapors.* *3. Flash point at or above 100° less than 200°F.*
SLIGHT **1**	***Slightly** combustible. One or more of the following characteristics:* *1. Must be preheated for ignition to occur.* *2. Will burn in air when exposed at 1500°F for 5 minutes.* *3. Flash point at or above 200°F.*
MINIMAL **0**	***Minimal**. Will not burn, exhibit a flash point or burn in air when exposed at 1500°F for 5 minutes.*

YELLOW, REACTIVITY RANKINGS EXPLANATION:

SEVERE OR EXTREME **4**	***Extremely Reactive***. *Will have one or more of the following characteristics:* *1. Can **explode or decompose violently** at normal temperature and pressure.* *2. Can undergo **violent** self-accelerating heat producing **reaction with common materials** or by itself.* *3. May be **sensitive to mechanical or local thermal shock** at normal temperature and pressure.*
SERIOUS **3**	***Serious***. *One or more of the following apply:* *1. Can **detonate or explode** but requires a strong initiating force or combined heating before ignition.* *2. Rapidly promotes oxidation with combustible materials and **may cause fires**.* *3. Is **sensitive to thermal or mechanical shock** at elevated temperatures.* *4. May **react explosively with water** without requiring heat.*
MODERATE **2**	***Moderate.*** *Will have one or more of the following characteristics:* *1. Normally unstable and readily **undergoes violent change** but **does not detonate**.* *2. May undergo chemical change with rapid release of energy at normal temperature and pressure.* *3. May undergo violent change at elevated temperature and pressure.* *4. May react violently with water.* *5. Forms potentially explosive mixtures with air.*
SLIGHT **1**	***Slight.*** *One or more of the following characteristics:* *1. Normally stable material that can become unstable at high temperature and pressure.* *2. May react with water to release energy but not violently.*
MINIMAL **0**	***Normally stable material that is not reactive with water***.

Appendix C – Sharps

Sharps can be defined as any device having corners, edges or projections with the potential of cutting or piercing the skin. If biohazardous waste is generated it could contaminate sharps. Other non-contaminated sharps pose a safety hazard to custodial staff and other personnel.

The following item are examples of regulated sharps and must be disposed of in sharps containers and managed as medical waste, whether or not they are contaminated with biohazardous waste:

- Needles, including those with syringes
- Scalpels,
- Razors,
- Glass pipettes
- Glass slides

When disposing of glassware contaminated with biohazardous waste, it must be placed into a biohazardous waste box. These boxes are obtained from the Department of Facilities Management.

Sharps Classifications

There are three classes of sharps waste produced at RWU. This information complies with OSHA's Bloodborne Pathogens Standard (29 CFR 1910.1030). The disposal procedures for these classes are as follows:

Class 1: Non-chemically contaminated broken glass and
Non-biologically contaminated broken glass

This class consists of any type of broken glass that has been rinsed of any chemical contamination, including:

- Solvent bottles
- Chemical bottles
- Test tubes
- Broken flasks

Procedure for disposal:

1. Place waste in a sturdy leakproof, puncture-resistant broken glass box.
2. Securely close the box and label it with the building, room number and principal investigator.
3. Laboratory personnel should contact Facilities Management for disposal.

Class 2: Chemically contaminated broken glass

This class consists of any broken glass that is contaminated with acutely hazardous ("P" listed) hazardous waste. This includes flasks with irremovable residues.

Procedure for disposal:

1. Place waste in a puncture proof container that can be capped and sealed.
2. Label with the words "Hazardous Waste" and a description of the contents.
3. Call the Office of Environmental Health and Safety to be sure the box is included in the next hazardous waste pick up.

Class 3: Biologically contaminated sharps

This class consists of:

- All biologically contaminated sharps.
- All syringes and needles, whether they are biologically contaminated or not.

Procedure for removal:

1. Place waste in "SHARPS" container for removal by Environmental Health and Safety. Sharps containers must be leakproof, puncture-resistant and labeled with the biohazard symbol or the work "Biohazard". Sharps containers can be obtained from the Stockroom.
2. Place the sharps container in a biohazard box. (These boxes are to be incinerated.)
3. Secure the box, seal it with tape and label it with the building, room number, and name of the principal investigator.
4. Call the Office of Environmental Health and Safety to ensure that the box is included in the next medical waste pick-up.

The following are general guidelines for all sharps containers in the laboratory

- Never overfill sharps containers.
- Close the lid on sharps containers when they are ¾ full.
- Never re-use sharps containers.

Appendix D - LABORATORY SAFETY INSPECTION

ROGER WILLIAMS UNIVERSITY

Department:_____
Professor/Prin.lnvest:_____
Building:_____ Contact:_____
Tel:_____ Room(s):_____ Inspected by:_____
Date:_____

Notes:

x in the yes box means that no problem was observed at the time of the inspection
x in the no box means that action is required by the laboratory supervisor
x in the n/a box means the item is not applicable
**** in the No column indicates that a repeat violation exists**

A. Safe Practices

1. All work practices observed at the time of the inspection were being performed safely O yes O no O n/a
2. Good housekeeping practices are observed O yes O no O n/a

B. Emergency Equipment and PPE

1. RWU Emergency Information cards posted on hallway doors O yes O no O n/a
2. Fire extinguishers are appropriate, unobstructed, secured and inspected O yes O no O n/a (Number) Dry Chem._____ Halon_____ CO2_____ APW _____

   Date on Tag _____ _____ _____ _____

   Tamper Seal On _____ _____ _____ _____
3. Spill control kits appropriate and available O yes O no O n/a
4. First aid kit available O yes O no O n/a
5. Appropriate personal equipment is available, clean and in good condition O yes O no O n/a

   (goggles, gloves, lab coats and aprons)
6. Respirator users (including disposable masks) fit tested and trained O yes O no O n/a

   Names of users: _____no respirator use at this time_____
7. Eye wash stations accessible, operational, labeled and tested (date tested_____) O yes O no O n/a
8. Safety shower within 100 feet, unobstructed and tested (date tested_____) O yes O no O n/a
9. Door posted for hazards (flammables/toxic/biohazards) O yes O no O n/a

C. Chemical Safety

1. All containers are completely and appropriately labeled O yes O no O n/a
2. Incompatible chemicals stored separately O yes O no O n/a

3. All chemicals stored by hazard class O yes O no O n/a
4. All chemicals, especially peroxide formers, dated at time of receipt O yes O no O n/a

   and again at time of opening

5. Peroxide formers disposed of within one year of purchase O yes O no O n/a
6. All chemical containers are tightly closed when not in use O yes O no O n/a
7. Flammable liquids greater than 25 gallons stored in safety cabinets O yes O no O n/a
8. Flammable liquids in quantities over 1 gallon are stored in safety cans O yes O no O n/a
9. Flammable chemical storage areas free of ignition sources O yes O no O n/a
10. Flammables that need cold storage are stored in explosion-proof refrigerators O yes O no O n/a
11. There are no chemicals stored on floors, near floor drains or in/under sinks O yes O no O n/a
12. Food and beverages are not consumed in the lab or stored in the laboratory refrigerator O yes O no O n/a
13. No application of cosmetics allowed unless a personnel area is segregated by a doorway O yes O no O n/a
14. Chemical inventory is complete and up-to-date O yes O no O n/a
15. MSDS available for hazardous chemicals used in the lab (located_____) O yes O no O n/a
16. Written standard operating procedures/protocols developed for use of hazardous materials O yes O no O n/a

and use of laboratory equipment

17. Unstable nitro compounds (e.g. picric acid) are not dry in appearance O yes O no O n/a
18. No hazardous liquids are stored above the eye level of the shortest person in the lab O yes O no O n/a
19. All instruments exhausting hazardous gases are vented to the hood O yes O no O n/a

D. General Safety

1. Bunsen burner hose connections are undamaged and securely clamped O yes O no O n/a
2. All exit doors and the egress pathway leading to them are unobstructed O yes O no O n/a
3. Electrical plugs/cords are not visibly damaged and do not cross aisles O yes O no O n/a
4. Extension cords where used are of appropriate type O yes O no O n/a
5. Electrical outlets near water are GFI O yes O no O n/a
6. Fume and biological hoods are used properly and are not used for routine storage O yes O no O n/a
7. Fume hood in working condition and inspected within the past twelve (12) months O yes O no O n/a

   Hood #____ Date:_____ ____Average CFM_____
   Hood #____ Date:_____Average CFM_____
   Hood #____ Date:_____Average CFM_____
   Hood #____ Date:_____Average CFM_____

8. Laboratory equipment with moving parts are guarded (fan belts) O yes O no O n/a
9. Shielding on vacuum/pressurized glassware O yes O no O n/a
10. Are water lines secure O yes O no O n/a
11. Laboratory water lines to instruments do not drain back to the water supply (faucet) O yes O no O n/a

and water lines are below the water supply (faucet)

12. Is there an appropriate container for non-recyclable glass? O yes O no O n/a
13. Sharps O yes O no O n/a

E. Gas and Cryogen Safety

1. Gas cylinders are secured in the top third and stored away from heat sources O yes O no O n/a
2. Gas cylinders are capped if not in use O yes O no O n/a
3. Gas cylinders are properly labeled O yes O no O n/a

Type of Cylinder_____ Quantity:_____

Appendix E – Glove Compatibility Chart

(in Microsoft excel format)

Appendix F - ACUTE TOXIN/REACTIVE CHEMICAL USE PROTOCOL

Date: **Chemical Name:**

Faculty Name:

Use Location: **Quantity Used per Experiment:**

Storage Location: **Quantity Stored:**

Other User Names:

Experimental Procedure:

Chemical Hazards:

Emergency Procedures (include fire, spill, and personal contamination):

User Training:

Protective Equipment:

Waste Disposal:

Appendix G – Lab Injury/Accident Report Form

(submit to the Department Chair and the Office of Environmental Health and Safety within 24 hours of the injury)

Name of Injured Person: _____

Date of Injury: _____

Where Injury Occurred: Building: _____ Room No. _____

Description of the injury:

Description of how the injury took place:

Action taken in response to the injury:

_____ _____

Signature of Injured Person Date

_____ _____

Signature of Supervising Faculty Member Date

Received by:

_____ _____

Department Chair Date

Appendix H - FORMALDEHYDE FACT SHEET

The Occupational Health and Safety Administration (OSHA) has established a chemical specific standard to protect employees from overexposure to formaldehyde in the workplace. This document provides information on the potential health effects of formaldehyde exposure and on the requirements of the OSHA Formaldehyde Standard, 29 CFR 1910.1048, as they apply to the College. This information is provided to both employees and students who may be exposed to formaldehyde in the laboratory to increase awareness of the hazards of formaldehyde overexposure and of appropriate precautions to avoid overexposure. The precise hazards associated with exposure to formaldehyde depend both on the form (solid, liquid, or gas) of the material and the concentration of formaldehyde. For example, 37-50 percent solutions of formaldehyde present a much greater hazard to the skin and eyes from spills or splashes than solutions containing less than one percent formaldehyde.

Chemical Name: Formaldehyde

Chemical Family: Aldehyde

Chemical Formula: HCHO

Molecular Weight: 30.03

Chemical Abstract Service Number (CAS#): 50-00-0

Synonyms: formalin (37% solution), formic aldehyde, paraform, methyl aldehyde, methylene glycol, methylene oxide, tetraoxymethalene, oxomethane, oxymethylene

Description: as a gas, strong pungent odor, vapor density 1.067 (air=1), soluble in water and alcohol

Description: as a solution (37%), colorless liquid, pungent odor, specific gravity 1.08 (H_2O=1), vapor density 1.04 (air=1), odor threshold 0.8-1 ppm

Fire and Explosion Hazard: as a solution (37%), flash point 185^{o}F, lower explosion limit 7%, upper explosion limit 73%; auto ignition temperature 806^{o}F; aqueous solutions often contain methanol as an inhibitor increasing the fire hazard

Extinguishing media: use dry chemical, carbon dioxide or water

Reactivity: Formaldehyde solutions may self-polymerize to form paraformaldehyde.

Incompatible Materials: strong oxidizing agents (violent reaction), caustics, strong alkalies, isocyanates, anhydrides, oxides and inorganic acids; reacts with hydrochloric acid to form the potent carcinogen, bis-chloromethyl ether; reacts with nitrogen dioxide, nitromethane, perchloric acid, and aniline, or peroxyformic acid to yield explosive compounds

Health Hazard Data

Permissible Exposure Limits:

8-hr time weighted average: 0.75 ppm

15-min time weighted average: 2.0 ppm

Acute Effects of Exposure: Ingestion of liquids containing 10 to 40% causes severe irritation and inflammation of the mouth, throat, and stomach. Severe stomach pains will follow ingestion with possible loss of consciousness and death. Ingestion of dilute solution

(0.03-0.04%) may cause discomfort in the stomach and pharynx.

Inhalation of concentrations of 0.5 to 2.0 ppm may irritate the eyes, nose, and throat of some individuals. Concentrations of 3 to 5 ppm also cause tearing of the eyes and are intolerable to some individuals. Concentration of 10 to 20 ppm cause difficulty in breathing, burning of the nose and throat, cough, and heavy tearing of the eyes, and 25 to 30 ppm causes severe respiratory tract injury leading to pulmonary edema and pneumonitis. A concentration of 100 ppm is immediately dangerous to life and health.

Skin contact causes irritation and may cause white discoloration, smarting, drying, cracking, and scaling. Prolonged and repeated contact can cause numbness and a hardening or tanning of the skin. Formaldehyde is also a sensitizer. Previously exposed individuals may react to future exposure with an allergic eczematous dermatitis or hives.

Eye exposure can cause injuries ranging form transient discomfort to severe, permanent corneal clouding and loss of vision. The severity of the effect depends on the concentration and whether or not the eyes are flushed with water immediate after the accident.

Chronic Effects of Exposure: Formaldehyde has the potential to cause cancer in humans. Repeated and prolonged overexposure increases the risk. Various animal experiments have conclusively shown formaldehyde to be a carcinogen in rats. In humans, formaldehyde overexposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages. Formaldehyde is genotoxic in several in vitro test systems showing properties of both initiator and promoter. Prolonged or repeated overexposure may also result in respiratory impairment.

First Aid Procedures

If exposure occurs, call for emergency assistance (dial 911).

Ingestion: if the victim is conscious, dilute, inactivate, or absorb by giving milk, activated charcoal or water. Any organic material will inactivate formaldehyde. Keep person warm and at rest. Get medical attention immediately. If vomiting occurs, keep head lower than hips.

Inhalation: Remove victim to fresh air immediately. When concentrations are very high, rescuers must wear self-contained breathing apparatus. If breathing has stopped, give artificial respiration. Keep warm and at rest. Get medical attention immediately.

Skin Contact: Remove contaminated clothing immediately. Wash the affected area with soap and a large amount of water at least 15 to 20 minutes. If there are chemical burns or if irritation persists, get medical attention.

Eye Contact: Wash the eyes immediately with large amount of water at least 15 to 20 minutes. Get medical attention immediately.

Spill, Leak and Disposal Procedures

In the event of a leaking container, immediately place the container in a fume hood and transfer to a new container that has been properly labelled. Spills should be absorbed using vapor barrier pads and the pads collected for disposal as hazardous waste. Unused formaldehyde solutions must be disposed of as hazardous waste. Used concentrated solutions should also be collected for hazardous waste disposal. Used dilute solutions (less than one percent) can be further diluted and discharged to the sewer.

Material Safety Data Sheets and Container Labeling

The manufacturers of all hazardous chemicals purchased provide material Safety Data Sheets (MSDS). The formaldehyde MSDS will include information specific to that product such as the concentration of formaldehyde in a solution.

Products capable of releasing 0.1 to 0.5 ppm of formaldehyde must be labelled with a warning that the product contains formaldehyde and that more information is available from the MSDS. For products capable of releasing greater than 0.5 ppm, the label must also address health hazards and include the words "Potential Cancer Hazard". Labels are available from the Chemical Hygiene Officer.

Protective Clothing and Equipment

All contact with the eyes or skin of solutions containing 1% or more of formaldehyde must be prevented by use of chemical splash goggles, gloves, and laboratory coats (as needed). The Office of Environmental Health and Safety will address any situations where exposure levels would require the use of a respirator on an individual basis.

Work Practices

Work with formaldehyde solutions should be performed in a fume hood whenever possible. Containers should be closed when not in use. Other precautions specific to the experiment may be required by the faculty.

Exposure Monitoring Procedures

All uses of formaldehyde must be reported to the Office of Environmental Health and Safety so that the need for initial exposure monitoring can be determined. Initial exposure monitoring is conducted in all cases where exposures may be above 0.5 ppm as an 8-hr time weighted average, or 2.0 ppm as a 15-min time weighted average. If you are selected for exposure monitoring, you will be asked to wear a monitoring badge. Employees will be informed of the results of monitoring within 15 days of the receipt of the results. If initial monitoring demonstrates a potential for exceeding the permissible exposure limits, additional monitoring will be conducted.

Medical Surveillance

Medical surveillance is available in instances when routine exposures exceed 0.5 ppm as an 8-hr time weighted average or 2.0 ppm as a 15-min time weighted average, or you experience signs and symptoms related to formaldehyde exposure. Surveillance includes a medical disease questionnaire specified by OSHA and a physical examination if the physician determines it is necessary.

Questions

Any questions regarding formaldehyde exposure or the OSHA Standard should be addressed to the Office of Environmental Health and Safety.

Appendix J – Flammability of Some Commonly Used Gases

Substance	Ceiling (c) or TLV-TWA	flammability
Acetylene (C_2H_2)		High, Explosive
Ammonia (NH_3)	25	High
Arsine (AsH_3)	0.05	High, Explosive
Boron Trifluoride (BF_3)	(C)1	Low
1,3, Butadiene (C_4H_6)	2	High
Carbon Dioxide (CO_2)	5000	Low
Carbon Diosulfide (CS_2)	10	High
Carbon Monoxide (CO)	25	High
Chlorine (Cl_2)	0.5	Low
Cyanogen (CsH_2*)	10	High
Cyanogen Chloride (CNCl)	(C) 0.3	Low
Diazomethane (CH_2NO_2)	0.2	Explosive
Diborane (B_2H_6)	0.1	High
Ethylene (C_2H_4)		High
Ethylene Oxide (C_2H_4O)	1.0	High
Fluorine	1	Low
Formaldehyde (CH_2O)	(C) 0.3	High
Hydrogen (H2)		High, Explosive
Hydrogen Chloride (anhydrous) (HCl)	(C) 5.0	Low
Hydrogen Cyanide (HCN)	(C) 4.7	High
Hydrogen Fluoride (HF)	(C) 3.0	Low
Hydrogen Selenide (H_2Se)	0.05	High
Hydrogen Sulfide (H_2S)	10	High
Methane (CH_4)		High
Methyl Acetylene (C_3H_4)	1000	High
Methyl Acetylene Propadiene Mixture (MAPP)	1000	High
Methyl Bromide (CH_3Br)	1	High
Methyl Chloride (CH_3Cl)	50	High
Methyl Mercaptan (CH_4S)	0.5	High
Nickel Carbonyl ($Ni(CO)_4$)	0.05	High
Nitric Oxide (NO)	25	Low
Nitrogen Dioxide (NO_2)	3	Low
Nitrogen Trifluoride (NF_3)	10	Low
Oxygen Difluoride (OF_2)	(C) 0.5	Low
Ozone (O_3)	0.05 – 0.2	Low

Appendix J – Flammability of Some Commonly Used Gases

Substance	Ceiling (c) or TLV-TWA	flammability
Phosgene (CCl_2O)	0.1	Low
Phosphine (PH_3)	0.3	High
Propane (C_3H_8)	2500	High, Explosive
Propylene (C_3H_6)		High
Silane (Silicon Tetrahydride) (SiH_4)	5	High
Stibine (SbH_3)	0.1	High
Sulfur Dioxide (SO_2)	2	Low
Sulfur Tetrafluoride (SF_4)	(C) 0.1	Low
Trifluorobromomethane (Halon 1301) ($CBrF_3$)	1000	Low
Vinyl Chloride (C_2H_3Cl)	1	High

Appendix K – High Energy Oxidizers

Not all-inclusive!

Ammonium perchlorate (NH_4ClO_4)

Ammonium permanganate (NH_4MnO_4)

Barium Peroxide (BaO_2)

Bromine (Br_2)

Calcium chlorate ($Ca(ClO_3)_2 2H_2O$)

Calcium Hypochlorite ($Ca(ClO)_2$)

Chlorine Trifluoride (ClF_3)

Chromium anhydride or chromic acid (CrO_3)

Dibenzoyl peroxide ($(C_6H_5CO)_2O_2$)

Fluorine (F_2)

Hydrogen Peroxide (H_2O_2)

Magnesium perchlorate ($Mg(ClO_4)_2$)

Nitric acid (HNO_3)

Nitrogen peroxide (in equilibrium with nitrogen dioxide) N_2O_4:NO_2

Nitrogen trioxide (N_2O_3)

Perchloric acid ($HClO_4$)

Potassium bromate ($KBrO_3$)

Potassium chlorate ($KClO_3$)

Potassium perchlorate ($KClO_4$)

Potassium Peroxide (K_2O_3)

Propyl nitrate (normal) ($CH_3(CH_2)_2 NO_3$)

Sodium chlorate ($NaClO_3$)

Sodium chlorate ($NaClO_2$)

Sodium perchlorate($NaClO_4$)

Sodium peroxide(Na_2O_2)

Appendix L - Institutional Animal Care and Use Committee-GUIDELINES

I. Animal Care and Use Research Policy

A. Mission Statement

Roger Williams University recognizes the scientific and ethical responsibility for the humane care and use of animals involved in research and education and requires all individuals involved to maintain the highest standards of animal care and consideration. This concern extends to investigators to protect the animals as well as to comply with the specific regulations established and required by the sponsors of their research, University policies and/or Federal regulations.

B. Ethical Issues

The welfare of animals in education and research, carries with it significant obligations. Hence, each staff member, student, faculty member, or research investigator is directly responsible to promote and protect animal care and use within the instructional and research program of the University.

Roger Williams University is guided by the ethical principles set forth by the National Institutes of Health (NIH) Policy that requires the appointment of an Institutional Animal Care and Use Committee (IACUC). In accordance with this federal policy, this committee shall oversee protocols relating to the care and use of animals for research and teaching purposes at RWU.

C. Federal Regulations

The procurement, care, and use of the animals shall conform to the NIH Guide of the Care and Use of Laboratory Animals in Research (DHEW 78-23), reprinted in 1980 (DHEW 80-23 or succeeding editions) and shall be in accordance with the regulations established under the terms of the Animal Welfare Act, all applicable state and local laws, and the National Academy of Science's *Guide for the Care and Use of Laboratory Animals*. The housing, care, feeding, and daily observations of all animals must be supervised by individuals knowledgeable in such matters.

The "US Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training" were developed by the US Government's interagency research animal committee. Both the NIH Policy and the University Policy require that all uses of animals conform to these principles:

1. The transportation, care and use of animals should be in accordance with the Animal Welfare Act (7 U.S.C.2131 et. seq.) and other applicable federal laws, guidelines, and policies.

2. Procedures involving animals should be designed and performed with due consideration of their relevance to human or animal health, the advancement of knowledge, or the good of society.

3. The animals selected for a procedure should be of an appropriate species and quality and the minimum number required to obtain valid results.

4. The use of animals should be planned and conducted so as to avoid unnecessary discomfort, distress, and pain to any animal. Unless the contrary is established, investigators should consider that procedures that cause pain or distress in human beings may cause pain or distress in other animals.

5. Procedures with animals that may cause more than momentary or slight pain or distress should be performed with appropriate sedation, analgesia, or anesthesia. Surgical or other painful procedures should not be performed on unanesthetized animals.

6. Animals that would otherwise suffer severe or chronic pain or distress that cannot be relieved should be painlessly killed at the end of the procedure, or, if appropriate, during the procedure.

7. The living conditions of animals should be appropriate for their species and contribute to their health and comfort. Normally the housing, feeding, and care of all animals used for biomedical purposes must be directed by a veterinarian or other scientist trained and experienced in the proper care, handling, and use of the species being maintained or studied. In any case, veterinary care shall be provided as indicated.

8. Investigators and other personnel shall be appropriately qualified and experienced in conducting procedures on living animals. Adequate arrangements shall be made for in-service training, including the proper and humane care and use of laboratory animals.

9. Where exceptions are required in relation to the provisions of the Principles, the decisions should not rest with the investigators directly concerned, but should be made with due regard by an appropriate review group, such as an institutional animal research committee. Such exceptions should not be made solely for the purposes of teaching or demonstration

10. Procedures involving field observations on marine mammals require a General Authorization for Scientific Research issued by NOAA for Level B harassment, as per the Marine Mammal Protection Act of 1972.

D. General Policies and Procedures

Using animals for research, teaching, and testing is accompanied by both ethical and legal responsibilities to use them appropriately, both scientifically and humanely. Individual faculty members who use animals in their research or teaching, including those whose research consists of field work involving animals, are, by law, accountable for conforming to the basic regulations and policies governing animal use on campus. Policy decisions at RWU have been made to address research with limited groups of vertebrates (fish, amphibians and marine mammals). Policies may be modified when and if additional groups of animals are used at the institution. These regulations and policies involve:

1. the acquisition, care, and use of animals
2. efforts to minimize animal pain and distress
3. the training of personnel who use animals
4. consideration of alternatives to animal use
5. methods whereby deficiencies in animal care and treatment are reported

Individuals who use animals must know, understand, and comply with applicable laws, regulations, and policies. They are responsible for properly instructing students and employees. The laws governing the use of animals are framed to ensure compliance via both civil and criminal laws. Failure to comply may carry penalties that range from substantial fines to "cease and desist" orders that can suspend all animal research, and all funding for animal research at the offending institution. As a matter of educational policy, faculty who do not themselves use animals must be aware of these regulations and policies, since their students may use animals at a later time. All faculty, staff and students preparing to submit a protocol to the IACUC committee must first complete the online training course at http://www.ResearchTraining.org.

Any faculty member, staff member, or student who believes that any of the above mentioned principles are being violated may submit a written request to the Roger Williams University IACUC for a review of the procedure or situation. The Committee shall review all pertinent facts regarding the alleged violation, and if a violation has occurred, the Committee will recommend corrective action to the responsible individuals, including the appropriate Department Coordinator, Dean of the College, and Chief Academic Officer (Provost).

E. Occupational Health and Safety of Personnel

An occupational health and safety program shall be part of the overall animal care and use program. This program shall be consistent with federal, state, and local regulations and shall focus on maintaining a safe and healthy workplace.

F. Adjunct Faculty Research

All adjunct faculty research must be co-sponsored by the Dean of the College, where the research will be conducted. Research project proposals must then be submitted to Roger Williams University IACUC for review and approval.

G. Research at Other Institutions

If a collaborative research project to be conducted at RWU with live vertebrate animals has been reviewed and approved by another College or University, the research proposal and the signed cover sheet from the said Institution must be submitted to the Roger Williams University IACUC for review and approval.

H. Use of Animal Products:

The use of organs, parts and materials from vertebrate animals requires an approved RWU ANIMAL PRODUCTS application, but not a full protocol application, provided the animal products were obtained from vendors, suppliers or outside investigators supplying these materials as a standard product. However, if materials from vertebrate animals are made or obtained specifically for investigators, an approved RWU IACUC protocol or a copy of the IACUC approval document from the participating supplier is required.

"Standard" antibodies, serum, organs and other products of vertebrate animals obtained from licensed vendors do not require a full protocol. If antibodies, serum, organs and other products of vertebrate animals are made specifically for the investigator by the vendor, they are considered "custom", and the investigator must submit an ANIMAL PRODUCTS application and supply the vendor's PHS Assurance number. An investigator obtaining antibodies, serum, organs and other products of vertebrate animals from another investigator must file an ANIMAL PRODUCTS application and attach IACUC approval documentation from the investigator providing the materials.

II. Institutional Animal Care and Use Committee

A. Administrative Duties

Roger Williams University has delegated to the Institutional Animal Care and Use Committee (IACUC) the responsibility of review and written approval of all research and related teaching activities involving the use of vertebrate animals, conducted under the auspices of a school, department, or other unit within the University.

Administrative responsibility for overseeing these functions has been delegated to the chair of the IACUC who is appointed by the Chief Academic Officer (CAO) of the University. The CAO also serves as the research oversight official as required by federal policy. In essence, the CAO of the University shall serve as an ex officio member of the committee, but not as its chair. The CAO will sign off on all recommendations of the committee, as s/he has the legal authority to speak and act for the institution and thus bears responsibility for oversight of research conducted under the aegis of the University.

B. Membership

The Roger Williams University Institutional Animal Care and Use Committee (IACUC) shall include:

- A Doctor of Veterinary Medicine, who is certified or has training or experience in laboratory animal science and medicine or in the use of the species in question
- At least one practicing scientist experienced in research involving animals
- One member of the RWU administrative staff
- RWU safety officer
- One member from outside of the Science Unit (but within the College of Arts and Sciences)
- One public member who represents the general community interests in the proper care and use of animals. The public member shall not be a laboratory animal user, be affiliated with the institution, or be a member of the immediate family of a person who is affiliated with the institution. This individual shall be appointed by the CAO of the University and shall serve without compensation.

The members from the University shall be nominated by their deans and officially appointed to the committee by the CAO of the University. Deans should appoint members who are experienced in performing research with animals.

Each committee member shall serve a three-year term commencing and ending on September 1 each year. Committee member appointments are staggered so that only 2 new members will join the board at any given time.

C. Responsibilities of the Chair

- scheduling monthly IACUC meetings and leading the review of proposals;
- leading the process of developing and refining IACUC guidelines and processes;
- communicating to the faculty changes in guidelines as well as meeting times and Committee rulings;
- maintaining the IACUC information on the website;
- notifying the CAO when new committee members need to be chosen; and,
- maintaining IACUC records and archives.

The taking of minutes, including all rulings of the Committee, shall occur at every meeting. The responsibility for this shall rotate among the Committee members. Minutes and rulings shall be made available after the Committee meetings, as consistent with RWU policy.

After review and inspection, a written report, signed by a majority of the IACUC, shall be made to the responsible administrative officials of the institution on the status of the animal care and use program and other activities as required by federal, state, or local regulations and policies.

D. Responsibilities of the IACUC Committee

IACUC at Roger Williams University shall:

- Assure that all activities meet the ethical and legal requirements of the humane care and use of these animals.
- Review, at least every six months, the institutional program for the humane care and use of animals in research, education and training.
- Inspect, at least every 6 months, all animal facilities for compliance with approved standards for hygiene.
- Review and approve, require modifications, or withhold approval of all protocols for the use of animals in research, teaching or training.
- Review and approve, require modifications, or withhold approval of all changes or amendments to approved protocols.
- Re-review no less than once a year all protocols for the use of animals to include the current status of the activities, compliance with the protocol, and changes in IACUC policy or procedures. No less than once every three years, the IACUC will complete a substantive re-review and re-approval of such activities.
- Evaluate the quality of all personnel involved in the care and use of animals prior to a person being approved to participate in the protocol. The review qualifications include academic degrees, specific training, research experiences, and completion of the online training course.
- Review specific concerns or complaints about animal care or use.
- Present recommendations to the institutional official (Chief Academic Officer) regarding all aspects of RWU's animal care and use program. Significant deficiencies in the institutional program must be identified, and the institution must adhere to an approved plan and schedule for correction of the deficiencies.
- Authorize suspension of an activity involving the use of animals which is not being conducted in accordance with the current edition of the IACUC standards, or with applicable laws, regulations, or institutional policies.
- Assure that reviewers have no conflict of interest with the protocols that are brought before the committee.

Appendix M - STANDARD OPERATING PROCEDURE - NMR (Nuclear Magnetic Resonance)

Number: 03-1-05

ROGER WILLIAMS UNIVERSITY

SUBJECT: MAGNETIC FRINGE FIELDS-NMR (Nuclear Magnetic Resonance)

POLICY: The purpose of this Policy is to protect all RWU employees and any outside contractors' employees from hazards associated with Magnetic Fringe Fields.

APPLICABILITY: Policy applies to all RWU employees and all outside contractor employees and consultants that may from time to time be required to work in or near the NMR space in the MNS Building on the Bristol campus.

PURPOSE: To prevent personal injury, damage to equipment, tools and damage to the NMR machine.

PROCEDURE: The Procedure is attached as pages 2 and 3. The procedure must be read and signed by all persons who have occasion to work on the machine, work in the space, clean the space or have a reason to be in the space.

APPROVALS: **DATE:** July 1, 2019

ORIGINAL WITH SIGNATURES IS ON FILE IN THE EH&S OFFICE

_____

Director

Department of Environmental Health and Safety

_____

Coordinator

Department of Environmental Health and Safety

Page 2 – NMR SOP

Nuclear Magnetic Resonance (NMR) Area

SAFETY RULES FOR WORKING IN MAGNETIC FRINGE FIELDS

The following are rules for working in magnetic fields:

1) **People with medical implants should check with Facility personnel before entering the NMR area.**

2) **All magnetic objects should be kept outside the 5 gauss line of each magnet. This includes keys, wallets, pocket knives, tools, etc. ASSUME ANY PIECE OF METAL IS MAGNETIC UNTIL PROVEN OTHERWISE.**

3) **Keep electronics outside the 5 gauss line.**

4) **Use only non-magnetic tools inside the 5 gauss line.** No metal objects are to be brought close to the magnet. Keep all tools and equipment outside the 5 gauss area. See the instrument manager before you use any non-routine equipment with any of the NMR instruments. Metal objects can be attracted to the magnet causing flying metal projectiles. Ferromagnetic objects can reach speed approaching 45 miles per hour entering the bore of the magnet. These objects can cause personal injury or death if there is anyone between them and the center of the magnet. If the objects strike the magnet they can distort magnet's wires or internal dewars and/or become lodged inside the magnet bore.

   ASSUME ALL METAL OBJECTS ARE FERROMAGNETIC AND WILL BE ATTRACTED TO THE MAGNET UNLESS VERIFIED OTHERWISE BY THE INSTRUMENT MANAGER.

5) **When in doubt, ask NMR Facility personnel. The NMR system costs at least $500,000. Do not risk damage to the instrument or harm to your self. If you have any questions, get assistance from Facility Staff.**

6) **No one is to be present in the NMR Facility unless they have read and signed this form AND are present with the knowledge and explicit approval of NMR Facility Staff.**

   Magnetic fields can generate large attractive forces on ferromagnetic objects. Such objects include, but are not limited to, most tools, high-pressure gas cylinders, pocket knives, key rings, perfusion apparatus, mechanical ventilators, and most electronics. Any such object that gets too close to the magnet will be drawn towards the magnet with great force. A best case scenario is simply lost time and expense of removing the object from the magnet. The object striking the magnet could cause the magnet to *quench* (i.e., become resistive). A quench is when all the liquid helium inside the magnet suddenly boils off. This causes the magnet to lose its magnetic field and can damage the superconducting coils inside. A quench is caused when the magnet is damaged or the equilibrium inside the magnet is disturbed.

A QUENCH IS DANGEROUS SINCE THE RAPIDLY EXPANDING GASES WILL DISPLACE ALL THE AIR (OXYGEN) IN THE ROOM. IF A MAGNET APPEARS TO BE IN ANY DANGER OF QUENCHING – LEAVE THE AREA IMMEDIATELY AND NOTIFY EVERYONE NEARBY OF THE DANGER.

The most common danger from an object impacting a magnet is a quench. A quench can result in severe and expensive damage to the magnet.

Should any metallic object strike the magnet, get Facility Staff immediately! Do NOT attempt to pull the object off yourself.

In summary, **keep all magnetic objects outside the 5 gauss lines, which are clearly marked with yellow plastic chains or marked by tape on the floor. If you are in doubt, get clearance from Facility Staff.** The Facility has special non-magnetic tools for working in magnetic fields. Note that since people work around the magnets, the yellow safety chains may frequently be moved inside; thus strict attention should be paid to the tape markings on the floor.

Definitions:

Medical implants, electronic – Medical implants which have electronics (such as pacemakers) are set and/or reset through the use of magnetic fields. Thus exposure to magnetic fields can cause such devices to operate in an unintended manner or stop working altogether. People with such implants should **never** enter the NMR Facility. Signs are posted at all entrances to that effect.

Medical implants, non-electronic – Medical implants such as pins, surgical clips, etc. may be magnetic and may be subject to the same forces described above. People with such implants should stay outside the 5 gauss line described above.

Wallets, credit cards, watches, magnetic media – while not strictly a safety issue, large magnetic fields can wipe out the magnetic information on ATM and credit cards and magnetic media like computer discs. Keep your ATM and credit cards and magnetic media outside the 5 gauss line. Mechanical watches may also be permanently affected by large fields and thus should also be kept outside the 5 gauss line. Digital watches are usually OK within high magnetic fields, although some may have magnetic material. Each user is responsible for knowing if their watch is magnetic.

I HAVE READ AND UNDERSTAND THE ABOVE WARNINGS. I HAVE BEEN SHOWN THE WARNING SIGNS IN THE FACILITY WHERE THE MAGNETS ARE AND WHERE THE 5 GAUSS LINE AROUND EACH MAGNET IS.

_____

PRINT NAME

_____

SIGNATURE AND DATE

Appendix N: MNS Purchase Order and Receipt Procedure

Purchase Requests (includes purchases paid by credit card placed by front desk)

1. Faculty/staff prepare a Purchase Order Request (POR) and an MNS Order Coversheet (OCS), obtain the Chair's signature (or other consent), and hand the POR and MNS OCS to the front desk.
   Notes:
   Chemicals: PORs for chemicals must list only chemical items, chemical(s) should not be available in MNS stocks, an MSDS must be on file before placing the order for each chemical requested, and "CHEMICAL ORDER—MNS206" should be in the POR Special Instructions box.
   Other Instructions: Please note special storage (e.g., +4°C, -20°C, -80°C), details (e.g., live animals, perishable, …), receipt instructions, and destination room in the POR Special Instructions box.

2. The front desk will,
   - complete the OCS by entering an MNS Order Number, shipping information, and the date order information was entered in the J: drive spreadsheet, then
   - obtain the signature either of the Asst. Dean of MNS or of the Dean of FCAS, then
   - *if appropriate*, place the order using the appropriate credit card, then
   - submit the POR (labeled "Credit Card Payment" if appropriate) and the OCS to Purchasing.

   NOTE: The Purchasing Office will return MNS orders lacking a coversheet from the MNS front desk.

Credit Card Orders placed by faculty/staff (*only if a shipment results*; do not order chemicals with cards)

1. Faculty/staff prepare a Purchase Order Request (POR) and an MNS Order Coversheet (OCS), obtain the Chair's signature (or other consent) and "MNS Order Number" (MNS #) from the front desk.
2. Place the order using the following address format for delivery:

   [Purchaser Name]
   Marine and Natural Sciences Building
   NONCHEMICAL ORDER
   MNS Rm. _____; MNS #: _____
   Roger Williams University
   One Old Ferry Road
   Bristol, RI 02809

3. Turn the POR and OCS to the front desk before delivery, including *Other Instructions* (see above). The front desk will obtain Dean's signature (if required), record the order on the J: drive, complete the MNSCOS, and forward POR (marked "Credit Card Payment") and MNSCOS to the Purchasing Office.

Receipts

1. Deliveries are made first to the mailroom. Deliveries that cannot be properly received by the mailroom will be directed to MNS for direct delivery or refused at that point.
2. The mailroom will deliver packages to MNS206 around 1:00pm. The delivery should be met by a technician who will place packages with chemicals or unknown contents in MNS206. Other packages may then be delivered throughout the building.
   Notes:
   - If MNS206 is locked, the front desk will provide a key to open the room
   - If a technician is not available, packages verified as containing chemicals or of unknown content will be placed in MNS206 while all packages with "NONCHEMICAL ORDER" in the address or otherwise identifiable as not containing chemicals may be distributed throughout the building.
   - If MNS206 cannot be unlocked, all packages that cannot be confirmed to lack chemicals must be returned to the mailroom.

MNS Order Coversheet

To be completed by faculty/staff:

1. Chemical order (circle one)? YES NO. If YES, verify that listed chemicals are/have:
   - listed on a separate, dedicated order
   - not available from chemical stocks (check with lab techs)
   - an MSDS on file; if necessary, obtain a copy and place in the MNS file before placing the order
2. Living organisms (circle one)? YES NO. If YES, instructions: _____
3. Special receipt/storage conditions (circle if approp.): +4°C -20°C -80°C Other:_____
4. Notify upon delivery: _____ by email
5. Ordered with a credit card? YES NO. If YES, card name_____

To be completed by MNS front desk staff:

1. MNS order number: _____ Purchase Requisition number: _____
2. Vendor: _____
3. Description: _____
4. Date entered on J: drive: _____
5. Completed by (signature): _____ Date: _____
6. Additional Comments _____

To be completed by MNS Stockroom Staff

1. Email requisitioner
2. J Drive Updated: Y N Date received:
3. If a chemical the MNS Inventory is updated: Y N Storage Location_____
4. Additional Comments:

_____