

CHEMICAL HYGIENE PLAN

for

BARRY UNIVERSITY LABORATORIES



Barry University
11300 NE 2nd Avenue
Miami Shores, FL 33161

July 2025

Table of Contents

1. INTRODUCTION	6
1.1 Chemical Hygiene Officer	6
1.2 Fine Arts and Sciences Safety Committee	6
1.3 Emergency Contacts	8
1.4 Summary of Employer Responsibilities	8
 2. STANDARD OPERATING PROCEDURES	 10
2.1. General Rules	10
2.1.1 Personal Hygiene	10
2.1.2 Protective Clothing and Equipment	11
2.1.3 Housekeeping	11
2.1.4 Prior Approval	12
2.1.5 Custodial Workers	13
2.1.6 Facilities Maintenance Workers	13
2.1.7 Spills and Accidents	14
2.1.8 First Aid Kit Policy	14
2.1.9 Service Animals in Labs	16
2.2 Procedure-Specific Safety Procedures	16
2.2.1 Procedures for Toxic Chemicals	16
2.2.2 Procedure for Flammable Chemicals	17
2.2.3 Procedures for Reactive Chemicals	17
2.2.4 Procedure for Corrosive Chemical and Contact-Hazard Chemicals	18
2.2.5 Procedure for Peroxide-Forming Compounds	18
2.2.6 Inventory of Hazardous Chemicals and Safety Data Sheets	20
2.2.7 Working with Compressed Gases	21
2.2.8 Working with Cryogenics and Dry Ice	24
2.2.9 Working with Nuclear Magnetic Resonance	26
2.2.10 Working with Atomic Absorption Spectrophotometer	28
2.3 Small Quantity Generator	29
2.3.1 Hazardous Waste Containers	29
2.3.2 Tier 2 Calculations, Emergency Planning and Community Right-to-Know Act	30
2.3.3 Universal Waste	30
2.4 Control Measures and Equipment	31
2.4.1 Ventilation	31
2.4.2 Flammable-Liquid Storage	32
2.4.3 Eyewash Fountains and Safety Showers	32
2.4.4 Respirators	33

2.4.5 Vapor Detection	33
2.4.6 Fire Extinguishers	33
2.5 Procedures for Carcinogens, Reproductive Toxins, Substances That Have a High Degree of Acute Toxicity, and Chemicals of Unknown Toxicity	35
2.6 Policy Regarding Dispensing Chemicals to Other Institutions	36
3. RECORDS AND RECORD KEEPING	38
4. EMPLOYEE INFORMATION AND TRAINING	40
5. EXPOSURE ASSESSMENTS, MEDICAL CONSULTATIONS, AND EXAMINATIONS	41
5.1 Suspected Exposures to Toxic Substances	41
5.1.1 Criteria for Reasonable Suspicion of Exposure	41
5.1.2 Exposures	41
5.2 Exposure Assessment	41
5.3 Notification of Results of Monitoring	42
5.4 Medical Consultation and Examination	43
5.4.1 The following provisions apply to medical consultations and examinations:	43
5.4.1a Documentation	44
5.4.1b Notification	44
5.4.1c Exposure Records, Safety Data Sheets	44
6. LABORATORY CLOSEOUT PROCEDURE	46
6.1 Vacating Procedure	46
6.2 Vacating Inspection	46
7. THE ELEMENTS OF AN EMERGENCY PROCEDURE PLAN	47
7.1 Hurricane Preparedness Plan	47
8. LABORATORY SELF-INSPECTION	49

APPENDICES	50
<i>Appendix A: Standard Operating Procedure and Personal Protective Equipment Hazard Guidelines</i>	51
<i>Appendix B: Safety Checklist Forms</i>	56
Emergency Exit Lights	57
Emergency Eyewash and Shower	58
Compressed Gas Cylinders	59
Oxygen Monitor, NMR area	60
Satellite Accumulation Area, Hazardous Waste	61
Central Accumulation Area, Hazardous Waste	62
First Aid Kit	63
<i>Appendix C: Safety Training Forms</i>	64
C-1: College of Arts & Sciences, Biology	65
1.1 General Rules for Students in Teaching Laboratories	66
1.1.a Safety Rules in the Laboratory	67
1.1.b Safety Rules for Laboratories Delivered Remotely	70
1.1.c Procedures to Follow in Case of Fire	71
1.2 General Rules for Teaching Assistants in Laboratories	73
1.2.a Personal Protective Equipment (PPE)	74
1.2.b Introduction to Biosafety	75
1.3 Laboratory Manager Safety Procedures	76
1.4 Laboratory Instructor Safety Procedures	77
1.5 Research Students Safety Procedures	78
1.5.a Biomedical Responsible Conduct of Research	79
1.6 Researcher/Principal Investigator Safety Procedures	80
C-2: College of Arts & Sciences, Chemistry & Physics	81
2.1 General Rules, Teaching Labs, Chemistry	82
2.2 General Rules, Teaching Labs, Physics	84
2.3 Laboratory Assistant, Chemistry	86
2.4 Laboratory Assistant, Physics	89
2.5 Laboratory Instructor, Chemistry	92
2.6 Laboratory Instructor, Physics	96
2.7 Laboratory Manager	99
2.8 Research Lab (CHE 395/495), Students	103
2.9 Researcher/Principal Investigator	106
2.10 Visitors, Chemistry	110
2.11 Working with the NMR in Adrian 105	111
2.12 NMR Maintenance and Cryogen Fills	114
2.13 Lab Safety for Vendors Working in NMR Room	115

C-3: College of Arts & Sciences, Fine Arts	120
3.1 Photography Lab Expectations and Policies	121
3.2 How Chemicals Enter the Body	121
3.3 Photography Chemistry Details	123
3.3.1 Developing Baths	123
3.3.2 Stop Baths	123
3.3.3 Fixing Baths	124
3.3.4 Intensifiers and Reducers	125
3.3.5 Toners	125
3.3.6 Other Photographic Materials	126
C-4: College of Health Professions & Medical Sciences	129
4.1 Safety Review Acknowledgement Form	130
4.2 Hold Harmless Agreement Form	131
C-5: School of Podiatric Medicine	132
5.1 Rules of the Lab	133
5.2 Pledge of Respect	135
C-6 Service Animal and Emotional Support Animal in Labs	137
6.1 Safety Guidelines for Service Animal and Emotional Support Animal in Labs	138
6.2 Lab Safety Sheet for Service Animal in Labs	139
<i>Appendix D: Incident Report Forms (Minor Incidents Only)</i>	141
<i>Appendix E: Exposure Assessment, Formaldehyde</i>	142
Substance Technical Guidelines for Formalin	143
Sampling Strategy and Analytical Methods for Formaldehyde	150
<i>Appendix F: Laboratory Clearance Report—Vacating a Research Laboratory</i>	161
<i>Appendix G: OSHA’s Globally Harmonized System of Classification and Labeling of Chemicals (GHS)</i>	162
<i>Appendix H: Laboratory Self-Inspection</i>	165
<i>Appendix I: Chemical Release Form</i>	170
Waiver, Release of Liability, Indemnification, and Assumption of Risk for Barry University, Inc.’s Donation	171
REFERENCES	173
REVISION HISTORY	176

CHEMICAL HYGIENE PLAN FOR BARRY UNIVERSITY

1. INTRODUCTION

“OSHA’s Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450), referred to as the **Laboratory Standard**, specifies the mandatory requirements of a **Chemical Hygiene Plan (CHP)** to protect laboratory workers from harm due to hazardous chemicals. The CHP is a written program stating the policies, procedures and responsibilities that protect workers from the health hazards associated with the hazardous chemicals used in that particular workplace”.

<https://www.osha.gov/sites/default/files/publications/OSHAfactsheet-laboratory-safety-chemical-hygiene-plan.pdf>

1.1 Chemical Hygiene Officer

Under 29 CFR 1910.1450(b), OSHA defines a **Chemical Hygiene Officer (CHO)** as “an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.”

Chemical Hygiene Officer

Maria Aloya, MS in Chemistry, NRCC-CHO

Laboratory Director & Chemical Stockroom Manager

College of Arts & Sciences, Department of Chemistry & Physics

Tel: 305-899-3434 maloya@barry.edu

Project and Fire / Life Safety Compliance Manager

Adrian Aguilar, BS in Health Services Administration

Division of Business and Finance, Facilities Management

Tel: 305-899-3882 Cell: 305-801-2216 aaguilar@barry.edu

1.2 Fine Arts and Sciences Safety Committee

In March 2009 the College of Arts & Sciences created a safety committee, but now includes representatives from various scientific disciplines. The committee communicates with all necessary units within the university to recommend policies and procedures and monitor the compliance of various local, state, and federal standards and regulations.

Karen Callaghan, PhD
Dean, College of Arts & Sciences
Professor of Sociology
Lehman Hall 313, (305) 899-3402

College of Arts & Sciences
Biology Department

- Bailey Dorta, BS
Biology Laboratory Manager, (305) 899-3297, bdorta@barry.edu
- Elisabeta Vajda, MS
Biology Laboratory Director, (305) 899-3233, evajda@barry.edu

Chemistry & Physics

- Maria Aloya, MS, NRCC-CHO (Committee Chair)
Laboratory Director and Chemical Stockroom Manager, (305) 899-3434, maloya@barry.edu
- Bartosz Fornal, PhD
Assistant Professor of Physics, (305) 899-3436, bfornal@barry.edu

Fine Arts

- Remijin Camping, MFA
Assistant Professor of Photography, (305) 899-3460, rcamping@barry.edu
- Nicole Beltran, MFA
Chairperson and Associate Professor of Graphic Design, (305) 899-3049, nbeltran@barry.edu

College of Health Professions & Medical Sciences

- Daniel Packert BS, HT(ASCP)CM, HTL (Committee Co-Chair)
Assistant Professor of Clinical Biology, (305) 899-3184, dpackert@barry.edu

School of Podiatric Medicine

- Hassan Azari, PhD
Associate Professor of Anatomy and Anatomy Lab Director, (305) 899-7894, hazari@barry.edu

The Chemical Hygiene Officer, along with the Fine Arts and Sciences Safety Committee, would like to thank the following for their invaluable assistance with safety policies and procedures:

- Karon Coleman, JD
Associate Vice President for Legal Affairs and Chief Legal Officer, (305)-899-4786
Barry University
- Robert (Bob) C. Prior, MS, CSP, ARM-P
Senior Consultant, Aon
Commercial Risk Solutions

1.3 Emergency Contacts

Barry University Security can be reached from any campus phone by dialing extension **3333**. A registered nurse is available full-time in Student Health Services located in **Landon Student Union, room 104**, extension **3750**. For other emergencies such as fire call the Miami-Dade County emergency number **9-911**. One or more of the above Chemical Hygiene Officers should be contacted when an employee believes there has been overexposure to any hazardous chemical.

1.4 Summary of Employer Responsibilities

As the employer, Barry University shall be responsible for the following:

1. Keep records of employee exposures to hazardous chemicals:
 - a. These records should include measurements made to monitor exposures, if any, as well as any medical consultation and examinations, including written opinions.
 - b. Maintain these records as mandated in 29 CFR 1910.20, Access to Employee Exposure and Medical Records.
2. Provide employees with:
 - a. training and information regarding chemical and physical hazards.
 - b. identification of other hazards.
 - c. access to medical consultation and examinations.
 - d. respirators, when necessary.
3. For incoming hazardous chemicals:
 - a. Do not remove or deface labels.
 - b. Keep all SDS that are received.
 - c. Make SDS available to employees.
4. When hazardous chemicals are generated in a laboratory, if the:
 - a. hazardous properties are known, train employees.
 - b. hazardous properties are *not* known, treat the chemical as though it is hazardous and provide protection as described in this CHP.
 - c. chemicals are produced for use elsewhere, follow 29 CFR 1910.20 and the various Environmental Protection Agency (EPA) and Department of Transportation (DOT) regulations that apply to that chemical.
5. If it is believed that the action level, *or* Permissible Exposure Level (PEL) if there is no action level, has been exceeded by any chemical for which a substance-specific standard has been established, the concentration of that chemical in the air must be measured.
6. If the level measured is greater than the PEL or action level, then:
 - a. notifies all laboratory employees of the results of the measurement, *and*
 - b. complies with OSHA exposure-monitoring provisions for that chemical, as stated in 29 CFR 1910.1000 through 1910.1199.

7. Recognize our employees' right to receive, at no cost, medical consultation, and examination when an:
 - a. employee develops signs or symptoms of exposure,
 - b. action level, or PEL if there is no action level, is routinely exceeded for any chemical for which a substance-specific standard has been established.
 - c. there is a spill, leak, or explosion that makes employee exposure likely.
8. If respirators are necessary to keep exposures below the PEL or action level, follow the requirements of the Respiratory Protection Standard, 29 CFR 1910.134.
9. If select carcinogens, reproductive toxins, or acute toxins that are very highly toxic are used in the laboratory, identify, and post one or more areas as "designated area(s)".
10. Before a principal investigator separates from the University, relocates to a new lab, or disposes of specialized laboratory equipment, the department head and/or lab manager will schedule an inspection with the principal investigator. The inspection will include a checklist to evaluate the vacating conditions and a clearance report based on these findings will be filed by the department head and/or lab manager. The inspection checklist may be found under section 6, "Laboratory Closeout Procedure".

2. STANDARD OPERATING PROCEDURES

The following standard operating procedures shall apply to all employees working in any Barry University area or laboratory where there might be exposure to hazardous chemicals.

(The Standard Operating Procedure and Personal Protective Equipment Guidelines may be found in Appendix A.)

2.1. General Rules

1. NEVER work alone in a laboratory or chemical storage area.
2. Wear appropriate eye protection at all times; see section 2.1.2.
3. When working with flammable chemicals, be certain that there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or liquid spill.
4. Use a tip-resistant shield for protection whenever an explosion or implosion might occur.

For the chemicals they are working with, all employees should know and constantly be aware of:

1. The chemicals' hazards, as determined by the SDS, and other appropriate references.
2. Appropriate safeguards for using that chemical, including personal protective equipment.
3. The location and proper use of emergency equipment.
4. How and where to properly store the chemical when it is not in use.
5. Proper personal hygiene practices.
6. The proper methods of transporting chemicals within the facilities.
7. Appropriate procedures for emergencies, including evacuation routes, spill clean-up procedures and proper waste disposal.

2.1.1 Personal Hygiene

1. Wash promptly whenever a chemical has contacted the skin.
2. Avoid inhalation of chemicals; do not "sniff" to test chemicals.
3. Do not use mouth suction to pipet anything; use suction bulbs.
4. Wash well with soap and water before leaving the laboratory; do not wash with solvents.
5. Do not drink, eat, smoke, or apply cosmetics in the laboratory.
6. Do not bring food, beverage, tobacco, or cosmetic products into chemical storage or use areas.

2.1.2 Protective Clothing and Equipment

1. Eye protection worn when working with chemicals should meet the requirements of the American National Standards Institute (ANSI) Z87.1. Wear splash-proof safety goggles for chemical splash, spray, and mist hazards. When working with more than 10mL of a corrosive liquid, also wear a face shield, type N, large enough to protect the chin, neck, and ears, as well as the face.
2. When working with corrosive liquids, also wear gloves made of material known to be resistant to permeation by the corrosive chemical and tested by air inflation (do not inflate by mouth) for the absence of pin-hole leaks.
3. Always wear either a high-necked, calf- or ankle-length, rubberized laboratory apron or a long-sleeve, calf- or ankle-length, chemical- and fire- resistant laboratory coat. Always wear long-sleeved/long-legged clothing; do not wear short sleeved shirts, short trousers, or short skirts.
4. When working with allergic, sensitizing, or toxic chemicals, wear gloves made of material known to be or tested and found to be resistant to permeation by the chemical and tested for the absence of pin holes.
5. Always wear low-heeled shoes with fully covering "uppers"; do not wear shoes with open toes or with uppers constructed of woven material.
6. Whenever exposure by inhalation is likely to exceed the threshold limits described in SDS, use a fume hood; if this is not possible, a proper respirator must be worn. Consult with your supervisor before doing any such work.
7. Carefully inspect all protective equipment before using. Do not use defective protective equipment.

2.1.3 Housekeeping

1. Access to emergency equipment, showers, eyewashes, and exits should never be blocked by anything, not even a temporarily parked chemical cart.
2. Aisle space of 36 inches should be maintained for a clear passageway. Hallways having minimal thru-traffic, items may be placed in the hallway with a 6-foot clearance maintained.
3. In the absence of sprinklers, the vertical clearance between ceiling and materials on storage shelves is at least 24 inches. (In the presence of sprinklers, a minimum of 18 inches of vertical clearance is required). Exception—for those shelves that are along the perimeter of a room, items of non-hazardous materials may be stored up to the ceiling.
4. Keep all work areas, especially laboratory benches, clear of clutter.

5. Keep all aisles, hallways, and stairs clear of all chemicals.
6. All chemical containers must be labeled with at least the identity of the contents and the hazards those contents present to users.
7. Do not store chemicals in direct heat or sunlight, unless conducting a chemical experiment requiring such exposure.
8. Do not stack chemicals. Avoid storing chemicals more than two-deep on a shelf. Have chemical containers facing forward so that labels may be clearly read. Store chemicals along shelves that have anti-roll off lips.
9. Do not store chemicals directly on the floor. If a chemical container must be placed on the floor, then keep away from all traffic aisles. Use a secondary container.
10. Do not store any chemicals under the sink.
11. No chemicals are to be stored in fume hoods or on desks. Chemicals that are in the fume hoods and on laboratory benches should only be those that are in immediate use.
12. Promptly clean up all spills; properly dispose of the spilled chemical and cleanup materials.
13. Use special containers for collecting only broken glass. No chemicals, trash, or broken mercury thermometers should be placed in these containers.
14. All chemicals should be placed in their assigned storage areas (based on compatibility) at the end of each workday. Use designated (clearly marked) refrigerators for storing chemicals. Do not store flammable liquids in a refrigerator unless that refrigerator is designed and approved for such storage.
15. At the end of each workday, the contents of all unlabeled containers are to be considered and treated as waste.
16. Wastes should be properly labeled (on container the words “hazardous waste” should appear along with the complete chemical name(s)—not just “symbols” or chemical formulas) and stored in their proper containers.
17. All working surfaces and floors should be cleaned regularly.

2.1.4 Prior Approval

Employees must obtain prior approval from the employer or his or her designee to proceed with a laboratory task whenever:

1. A new laboratory procedure or test is to be carried out.

2. It is likely that toxic limit concentrations could be exceeded or that other harm is likely.
3. There is a change in a procedure or test, even if it is very similar to prior practices. "Change in a procedure or test" means:
 - a. 10% or greater increase or decrease in the amount of one or more chemicals used.
 - b. substitution or deletion of any of the chemicals in a procedure.
 - c. any change in other conditions under which the procedure is to be conducted.
4. There is a failure of any of the equipment used in the process, especially of safeguards such as fume hoods or clamped apparatus.
5. There are unexpected results.
6. Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

2.1.5 Custodial Workers

1. May sweep and mop floors as well as remove regular trash from bins.
2. Do not touch anything on the lab bench or inside any of the fume hoods.
3. If any laboratory materials, especially chemicals, need to be moved to perform job duties, contact the laboratory staff.
4. If there is any spilled material on the floor, do NOT touch or attempt to clean. Either contact the laboratory staff or your immediate supervisor.

2.1.6 Facilities Maintenance Workers

1. Prior to working in the lab, inform the laboratory staff as to what work will be performed.
2. If any laboratory materials, especially chemicals, need to be moved to perform the assigned work, contact the laboratory staff.
3. If performing any work in a fume hood or any part that is associated with ductwork, notify the laboratory staff, prior to starting the work.
4. If the work requires moving any lab equipment, then notify the laboratory staff to assure that the equipment is free of any chemical hazards.
5. There are times when chemical hazards cannot be completely removed such as when chemical experiments are taking place. In those cases, laboratory staff will

provide the necessary personal protective equipment including safety goggles, nitrile gloves, etc.

2.1.7 Spills and Accidents

Spills of hazardous substances may be cleaned by laboratory staff, *if*:

- they have the correct spill control materials
- they have been trained in the proper and safe handling of such materials
- the clean-up may be performed in a safe manner.

Any spill or contaminated area that may not be cleaned in a safe manner by trained laboratory staff should be resolved immediately following Barry University's Emergency Procedure Plan.

In the event of a fire, explosion or other release that could threaten human health **outside of the facility** or if you know that the spill has reached surface water.... Call the National Response Center 24-hour number: 800-424-8802.

Provide the following information (information posted along with each chemistry lab phone):

- Location
- US EPA Identification Number
- Date / Time of accident / Type of accident (spill or fire)
- Quantity of hazardous waste involved
- Extent of injuries, if any.

2.1.8 First Aid Kits

BARRY UNIVERSITY LABORATORY FIRST AID KIT POLICY

The purpose of the first aid kit is to provide tools to render temporary treatment to a person who has suffered a minor cut or burn. If the injury is more serious than a minor cut or burn, the injured person shall:

- Contact 911 first and then Campus Safety at 305-899-3333 if emergency services are needed.
- Go directly to the Student Health Center located in Landon 104 for assessment and treatment during Student Health Center hours, if a student.

Incident Report Forms (Minor Incidents Only) may be found in Appendix D.

Form also available online:

<https://forms.office.com/Pages/DesignPage.aspx#FormId=FCRJdf9mfEgn8Wxnh0E9MO0TsJEhfOdNot4CRygRrUBUNDRRTExISDRaQ0gwMTkyQkxDUjU2VTRHHC4u>

- File an Incident Report with Human Resources if the individual is an employee.

1. First aid kits shall be readily accessible preferably in a highly visible location. If the kit is not visible, the area where the kit is stored shall be clearly marked.
2. Whenever the kit is used, a Barry University Laboratory Incident Report Form (Minor Incidents Only) (hereinafter, "Incident Report") shall be completed and submitted to the Laboratory Director for Biology Labs or the Laboratory Director for Chemistry & Physics, as applicable, who in turn shall submit a copy to the Campus Safety Department. A copy of the Incident Report is attached to this policy and shall be included in the first aid kit.
3. The kit shall be always maintained in serviceable condition. Whenever the kit has been used, items have been removed, and an Incident Report generated, the kit shall be checked and restocked as needed by the Laboratory Director for Biology Labs or the Laboratory Director for Chemistry & Physics, as applicable, or their designee, including blank incident report forms.
4. The number and content of first-aid kits shall be reviewed and approved annually by the Compliance Manager in conjunction with the Student Health Center.
5. The OSHA standard 29 CFR.1910 151 App A is non-mandatory, which allows a laboratory to customize the first aid kits to the hazards that might be encountered. The OSHA standard references as a guideline the American National Standards Institute—Minimum Requirements for Workplace First Aid Kits, ANSI Z308.1-2003. Therefore, the first aid kits shall contain:

Item and Minimum Size	Minimum Quantity
Absorbent Compress, 4x8	1
Adhesive Bandages, 1x3in	16
Adhesive Tape, 5yd roll	1
Medical Exam Gloves	2 pairs
Sterile Pad, 3x3in	4
Triangular Bandage, 40x40x56 in.	1
Antiseptic Applications, 0.5g each	10
Burn Treatment Applications, 0.9g each	6

2.1.9 Service Animals in Labs

The ADA (American with Disabilities Act) defines a service animal under 28 CFR Part 35: “any dog that is individually trained to do work or perform tasks for the benefit of an individual with a disability, including a physical, sensory, psychiatric, intellectual, or other mental disability. Other species of animals, whether wild or domestic, trained, or untrained, are not service animals for the purposes of this definition.” *(A provision was made to include miniature horses.)*

A service animal is allowed to accompany the individual with a disability, wherever that individual is allowed to go. However, a service animal is not allowed in an area if “the animal is out of control and the handler does not take effective action to control it” or if “the animal is not housebroken”.

https://www.ada.gov/regs2010/titleII_2010/titleII_2010_regulations.htm#a35136

Student with a service animal that is planning to enroll in a teaching or research lab involving chemicals needs to register the service animal with the Office of Accessibility Services:

Voice / TDD: 305-899-3488

Fax: 305-899-3056

E-mail: accessibilityservices@barry.edu

Web: <http://www.barry.edu/accessibility-services/>

Consultation with the department’s Chairperson (and Lab Director) that oversee the labs should be made before the semester begins, to allow ample time for accommodation for the safety of all involved.

Safety Sheet for Service Animal in Labs may be found in Appendix C.

2.2 Procedure-Specific Safety Procedures

All laboratory procedures must contain a written description of specific safety practices incorporating the applicable precautions described in this section. Employees should read and understand these practices before commencing a procedure.

(Specific safety procedures for experiments may be found in the student’s lab manual or in the hand-outs provided by the lab instructors.)

2.2.1 Procedures for Toxic Chemicals

The SDS for any of the chemicals used in the laboratory will state recommended limits or OSHA-mandated limits, or both, as guidelines for exposure. Typical limits are threshold limit values (TLV), permissible exposure limits (PEL), and action levels. When such limits are stated, they will be used to assist the chemical hygiene officer in determining the safety precautions, control measures, and safety apparel that apply when working with toxic chemicals.

1. When a TLV or PEL value is less than 50ppm or 100 mg/m³, the user of the chemical must use it in an operating fume hood, glove box, vacuum line, or similar device, which is equipped with appropriate traps and/or scrubbers. If none are available, no work should be performed using that chemical.
2. If a TLV, PEL, or comparable value is not available for that substance, the animal or human median inhalation lethal concentration information, LC₅₀, will be assessed. If that value is greater than 200ppm or 2000 mg/m³ (when administered continuously for one hour or less), then the chemical must be used in an operating fume hood, glovebox, vacuum line, or similar device, which is equipped with appropriate traps and/or scrubbers. If none are available, no work should be performed using that chemical.
3. Whenever laboratory handling toxic substances with moderate or greater vapor pressures will be likely to exceed air concentration limits, laboratory work with such liquids and solids will be conducted in a fume hood, glove box, vacuum line, or similar device, which is equipped with appropriate traps and/or scrubbers. If none are available, no work should be performed using that chemical.

2.2.2 Procedure for Flammable Chemicals

In general, the flammability of a chemical is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions.

1. Chemicals with a flash point below 200°F (93.3°C) will be considered "fire-hazard chemicals".
2. OSHA standards and the National Fire Protection Association (NFPA) guidelines on when a chemical is considered flammable apply to the use of flammable chemicals in the laboratory. In all work with fire-hazard chemicals follow the requirements of 29 CFR, subparts H and L; NFPA Manual 30, "Flammable and Combustible Liquids Code"; and NFPA Manual 45, "Fire Protection for Laboratories Using Chemicals".
3. Fire-hazard chemicals should be stored in a flammable-solvent storage area or in storage cabinets designed for flammable materials.
4. Fire-hazard chemicals should be used only in vented fume hoods and away from sources of ignition.

2.2.3 Procedures for Reactive Chemicals

The most complete and reliable reference on chemical reactivity is found in the current edition of "Handbook of Reactive Chemical Hazards" by L. Bretherick, published by Butterworths. Reactivity information is sometimes given in manufacturers' SDS and on labels. Guidelines on which chemicals are reactive can be found in regulations promulgated by the Department of Transportation (DOT) in 49 CFR and by the Environmental Protection Agency (EPA) in 40 CFR. Also see NFPA Manual 325M, "Fire Hazard Properties of Flammable Liquids, Gases, Volatile

Solids"; Manual 49, "Hazardous Chemicals Data"; and Manual 491 M, "Manual of Hazardous Chemical Reactions".

1. A reactive chemical is one that:
 - a. is described as such in Bretherick or the SDS,
 - b. is ranked by the NFPA as 3 or 4 for reactivity,
 - c. is identified by the DOT as an:
 - oxidizer
 - organic peroxide
 - explosive, Class A, B, or C,
 - d. fits the EPA definition of reactive in 40 CFR 261.23,
 - e. fits the OSHA definition of unstable in 29 CFR 1910.1450,
 - or f. is known or found to be reactive to other substances.
2. Handle reactive chemicals with all proper safety precautions, including segregation in storage and prohibition on mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.

2.2.4 Procedure for Corrosive Chemical and Contact-Hazard Chemicals

Corrosivity, allergenic, and sensitizer information is sometimes given in manufacturers' SDS and on labels. Also, guidelines on which chemicals are corrosive can be found in other OSHA standards and in regulations promulgated by DOT in 49 CFR and the EPA in 40 CFR.

1. A corrosive chemical is one that:
 - a. fits the OSHA definition of corrosive in Appendix A of 29 CFR 1910.1200,
 - b. fits the EPA definition of corrosive in 40 CFR 261.22 (has a pH greater than 12 or less than 2.5), or
 - c. is known or found to be corrosive to living tissue.
2. A contact-hazard chemical is an allergen or sensitizer that is:
 - a. so identified or described in the SDS or on the label,
 - b. so identified or described in the medical or industrial hygiene literature, or
 - c. known or found to be an allergen or sensitizer.
3. Except as noted in 2.1.3(1), handle corrosive chemicals with all proper safety precautions, including wearing both safety goggles and face shield, gloves tested for absence of pin holes and known to be resistant to permeation or penetration, and a laboratory apron or laboratory coat.

2.2.5 Procedure for Peroxide-Forming Compounds

1. Inventories of these chemicals should be limited—only order amounts needed for the immediate experiment(s).

2. Date when chemical is first received and when container is first opened should be marked clearly on the label.
3. Store chemicals in air-tight containers, away from heat, sunlight, and ignition sources.
 - Do NOT refrigerate. Do not store at or below temperatures at which peroxide freezes or solution precipitates.
4. Before distilling, always test the chemical first with peroxide test strips to ensure there are no peroxides present. NEVER distill to dryness. There should be 10-20% residue.
5. After opening, test the chemical after 6 months with peroxide test strips. (It is recommended to test for peroxides regularly—preferably before each use). The results of peroxide tests and test dates should be marked on the outside of container.

Results of Peroxide Test Strip	Conclusion
< 25ppm	Safe
25—100ppm	Not recommended for distilling or concentrating
> 100ppm	Avoid handling. Disposal required.

6. Visual detection of dangerous high peroxide levels: peroxide crystals, precipitate, or oily viscous layer in the material. Disposal required.
7. Method of preventing peroxide formation: peroxide-forming chemicals such as diethyl ether are also sold with inhibitors such as ethanol and/or BHT (butylated hydroxytoluene).
 - If these inhibitors interfere with the chemical reactions that need to be performed, another method of stabilizing the diethyl ether is to add a freshly prepared solution of iron (II) sulfate (for each liter of ether, use 5 g iron (II) sulfate dissolved in 20ml water).

Class A: Chemicals known to form explosive levels of peroxides without concentration

Suggested safe storage period:

If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first. After opening, materials should be discarded or evaluated for peroxides within 3 months. Store under nitrogen, if possible.

Examples:

Butadiene	Isopropyl ether	Sodium amide
Chlorobutadiene (Chloroprene)	Potassium, metal	Tetrafluoroethylene
Divinyl acetylene	Potassium amide	Vinylidene chloride
Divinyl ether		

List B: Chemicals known to present peroxide hazards upon concentration (distillation/evaporation)

Suggested safe storage period:

If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first. After opening, materials should be discarded or evaluated for peroxides within 12 months.

Examples:

Acetal	Dioxane (p-dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan
Cyclooctene	Methyl acetylene
Cyclopentene	Methyl cyclopentane
Diacetylene	Methyl isobutyl ketone
Dicyclopentadiene	Tetrahydrofuran
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene
Diethyl ether	Vinyl ethers

List C: Chemical that may polymerize because of peroxide accumulation if inhibitors have been removed or are depleted

Suggested safe storage period:

If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first.

After opening, materials without inhibitors should not be stored for longer than 24 hours.

After opening, materials with inhibitors should be discarded or evaluated for peroxides within 12 months.

Examples:

Acrylic acid*	Styrene
Chlorotrifluoroethylene	Vinyl acetate
Ethyl acrylate	Vinyl chloride
Methyl methacrylate*	Vinyl pyridine

**Although these chemicals form peroxides, no explosions involving these monomers have been reported.*

2.2.6 Inventory of Hazardous Chemicals and Safety Data Sheets

An inventory of hazardous chemicals that employees may be exposed to shall be kept by the respective divisions listed above. For each division the laboratory manager will oversee the chemical inventory of the department's stockroom and teaching labs, while the principal investigator will oversee the chemical inventory for his or her research lab. This inventory

shall be reviewed annually and revised when appropriate, such as addition or deletion of specific chemicals.

Safety Data Sheets (SDS) for these chemicals are readily available to all employees through the following link: <https://chemmanagement.ehs.com/9/14b153fa-c358-415f-a4d3-a155f3f7fa84/ebinder>

For help in navigating the system, employees are asked to click on the “Help Center”. The “Help Center” has instructional materials that will help walk the employee through the system. Divisions may choose to keep printed copies of the SDS for their chemical database. Chemicals used by employees are only at levels below the action level or Permissible Exposure Limits (PEL).

2.2.7 Working with Compressed Gases

Gases are chemicals and must be included in the departmental chemical inventory. Some gases have a limited shelf life. Check with the manufacturer’s Safety Data Sheet to determine if a gas cylinder should be returned after a specific storage time.

Because of their inherent high internal pressure, gas cylinders may become projectiles, if not stored and transported properly. Leaking gas cylinders are a concern, as these may displace the oxygen in the air which can lead to unconsciousness or death.

The following should be followed, whenever working with compressed gases:

1. Before accepting any gas cylinder, perform a visual inspection. Do not accept gas cylinders that are rusted or if the valve or fixtures appear damaged.
2. To move a gas cylinder,
 - a. remove the regulator (if any) and secure it with its valve-cap.
 - b. never lift or move the cylinder by its valve-cap. Do not roll a cylinder on its sides or drag across the floor.
 - c. strap or chain it securely to a utility dolly (hand truck). Make sure to inspect the cart and wheels to make sure these are in good condition, before each use.
 - d. roll utility dolly (hand truck) over smooth, level surfaces.
 - e. Carefully maneuver the gas cylinder, creating an open path.
 - f. If you need to transport gas cylinder between floors, make sure that only the person pushing the hand truck (and if there is a second person to assist) goes on the elevator. Wait until elevator is free of all other passengers to transport a gas cylinder.
3. Store cylinders in well-ventilated areas. Do not allow storage temperature to exceed 52°C (125°F).
4. Areas where flammable gas cylinders are stored, such as oxygen and hydrogen, must have a fire extinguisher that is immediately accessible. Do not allow smoking or open flames.
5. Never expose gas cylinders to corrosive materials.

6. Gas cylinders should be secured by using a wall bracket or by clamping to a laboratory bench. Under no circumstances should a gas cylinder be stored by strapping it to a utility dolly / hand truck! Lecture bottles may be stored on their sides by using a rubber stop or rack to secure them in place.



Cylinders secured to a wall.



Cylinders secured to a bench.

7. Do not tamper with gas cylinders in any way. Leave their markings, valve threads, and safety-relief devices intact.
8. Wear appropriate PPE, including but not limited to indirect-vent chemical splash proof goggles, whenever working with a gas cylinder. Check its Safety Data Sheet.
9. Only use regulators that are approved for that specific gas. Contact vendor for appropriate gas regulator.

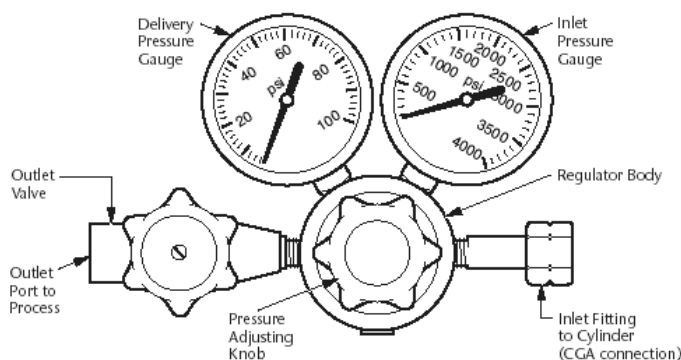


Figure 1, Front View – Typical Cylinder Pressure Regulator

<http://www.asge-online.com/Regpg20.html>

When installing a regulator,

- a. do not force the connection. If the connection cannot easily be made by hand, then it may be the wrong regulator, or the threads may be damaged.
- b. tighten using a regulator wrench, an open-end wrench, or an adjustable wrench. Do not overtighten!

- c. only use Teflon tape on tapered pipe threads where the seal is formed in the threaded areas.
- d. check for leaks, use a dilute soap solution where the valve attaches to the cylinder and around all the other thread connections. If any leaks are discovered, then depressurize, tighten, and recheck the connections.

When operating a regulator,

- a. stand alongside the regulator on the opposite side of the cylinder. Slowly open the cylinder valve. The pressure gauge should rise to full cylinder pressure.
- b. slowly turn the regulator's adjusting knob to raise the delivery pressure to the desired working pressure. Do not exceed the maximum delivery pressure for the regulator!
- c. slowly open the outlet valve on the regulator to supply gas to the system. Monitor the delivery pressure, as it may need to be adjusted.
- d. open the gas cylinder valve by standing clear of the regulator and valve outlet while operating the valve. Follow the directions of the arrows to open the valve. Under no circumstances pry it open using a hammer or wrench!

When shutting down a cylinder with a regulator, never use a regulator as a shut-off valve!

- a. If it is a temporary shutdown (gas will be used within a lab period), then close the gas cylinder valve completely.
 - b. If it is a complete shutdown (gas will no longer be used until the next lab period),
 - 1) close the gas cylinder valve completely.
 - 2) set the pressure of the regulator to zero by turning the adjusting knob. If the system contains an outlet control valve that is downstream of the regulator, then open the valve to purge gas from the delivery line and then close it.
10. When the gas cylinder will not be used for the remainder of the semester, then the gas cylinder must be stored with its valve-cap in an upright position. Lecture bottles usually does not have a valve-cap. These need to be stored in a secure manner to prevent any damage caused by leaks.
11. A gas cylinder is considered empty when the cylinder pressure is approximately 25 to 30 psi. For empty gas cylinders, these should be capped and clearly labeled with the word "EMPTY". Vendors should be contacted for pick-up. Empty lecture bottles should be labeled as "Hazardous Waste" and placed in the Central Accumulation Area for disposal. The same guidelines are to be followed when the gas cylinder/lecture bottle is partially full and is deemed to be of no further use.
12. Weekly visual inspections should be performed for any indication of leakage or visible signs of damage. Check for odors, visible fumes, or hissing sounds. Corrosive gases such as hydrogen chloride should be checked to ensure that its valve has not corroded or clogged. (***See Appendix B for Weekly Inspection Form.***)

For minor leaks,

- a. If the leak cannot be stopped, move the cylinder into a fume hood or to an isolated, well-ventilated area to vent cylinder contents. If it is necessary to move a leaking cylinder through a populated portion of a building, then secure a plastic bag over the top of the cylinder to confine the leaking gas. Flammable or oxidizing gases must be kept away from combustible materials.
- b. Evacuate the immediate area and post warning signs.
- c. Notify the Lab Director and Environmental Health & Safety Administrator of the incident. (Yosef Shapiro, cell: (305) 790-5789)
- d. Remain outside the immediate area until cylinder contents have been completely exhausted.

For major leaks (large, uncontrollable release of gas that may cause serious harm to occupants, facilities and/or the environment),

- a. Pull the fire alarm and immediately call 911.
- b. Evacuate the area, secure entrances, and aid others on the way out.

13. Gas cylinders should be returned to the vendor for all repairs.

14. In the case of a fire, shut off the gas at the source, only if it is safe to do so. Pull the fire alarm and immediately call 911.

2.2.8 Working with Cryogenics and Dry Ice

See Appendix C-2 for Lab Safety Sheet

A cryogen is a liquid with a normal boiling point below -150°C . Commonly used cryogenics in the lab are liquid nitrogen (boiling point of -196°C) and liquid helium (boiling point of -269°C). Although not a cryogenic, solid carbon dioxide (commonly known as “dry ice”) converts from solid to a gas at -78°C . Both cryogenics and dry ice can be hazardous, if not handled properly.

1. Inspect the dewar /container for any dents or other physical damage. Frost around the top of a venting container is normal, as the cold venting vapors are condensing the moisture in the air. However, frost at the bottom or on the side of the dewar indicates that the dewar is faulty and damaged. Contact the vendor immediately and ask them to exchange the dewar.
2. Liquid nitrogen and helium dewars should have a pressure relief valve to release any excess pressure.
3. Avoid eye contact. Wear indirect-vent chemical splash proof goggles and/or face shield.
4. Avoid skin contact. Extreme cold temperatures may cause cold burns and frostbite. Do NOT use rubber gloves. Only wear gloves that are designed specifically for cryogenics. These gloves should be loose fitting in case these need to be readily removed if the

cryogen splashes or dry ice falls into them. Wear long-sleeved shirts and pants along with closed-toe shoes.

5. Do not use or store in confined areas without proper ventilation. A leak may cause an oxygen-deficient atmosphere resulting in asphyxiation.
6. Never store in a sealed, air-tight container at a temperature above the boiling point of the cryogen. The pressure resulting from the production of gaseous nitrogen, helium, or carbon dioxide may cause an explosion.
7. Use only fitted transfer tubes / lines designed specifically for that cryogenic liquid.
8. When transferring to a secondary container, do not fill the secondary container to more than 80% capacity.
9. Do not lower warm experiments into cryogen dewars. Use non-metallic tongs to add or remove materials from cryogenic liquids.
10. Provide proper venting for any dewars used in an experiment. Do NOT use cryogens or dry ice in a walk-in cold room, which may not have sufficient air exchange and the cold room could become oxygen deficient.
11. Only use dewars designed to hold cryogens. Transporting filled cryogen dewars larger than 5 liters must be moved on a sturdy wheeled cart. Make sure that dewars remained closed during transportation.
12. Avoid transporting filled cryogen dewars in an occupied elevator. Wait until elevator is free of all other passengers.
13. Wear appropriate PPE (indirect-vent chemical splash-proof goggles and /or face shield along with gloves designed specifically for cryogens) when transferring cryogenic liquids in dewars between buildings. An emergency may occur at a moment's notice.

First Aid

In case of exposure to cryogenic liquids or dry ice,

1. Remove clothing that is not frozen to the skin. Do NOT rub frozen body parts, because tissue damage may result.
2. Immerse the affected part of the body in a warm water bath (below 40°C, 105°F) or expose the area to warm air of the same range. Never use dry heat.
3. Use warm water (below 40°C, 105°F) to flush eyes exposed to cryogen liquids or gases for at least 15 minutes.
4. Seek immediate medical attention.

2.2.9 Working With Nuclear Magnetic Resonance

See Appendix C-2 for Lab Safety Sheet

The Chemistry & Physics Department has an NMR (Nuclear Magnetic Resonance). This instrument is used to analyze a sample by characterizing its molecular structure according to the functional groups present. Because the NMR produces strong magnetic and electromagnetic fields, precautions must be taken when working with the instrument.



<https://www.bruker.com/en/products-and-solutions/mr/nmr/avancecore.html>

Bruker AvanceCore 400 MHz NMR instrument in Adrian 105.

1. The superconducting magnet is always on. Keep NMR room door locked, while not in use.
2. Post clearly marked warning signs in areas with strong magnetic fields. Restrict public access to areas of 5-gauss or higher.
3. The magnetic fields generated may interfere with users of pacemakers and other implanted ferromagnetic medical devices. A person with a pacemaker must be restricted to areas where the magnetic field is less than 5-gauss. Before entering the NMR room, people with pacemakers and other similar medical devices must consult with their physician.
4. Liquid nitrogen and liquid helium dewars, gas cylinders, stepladders, tools, and all other equipment entering the room must be non-magnetic. Check with vendors for supplies.
5. Keep all tools, equipment and personal items containing ferromagnetic material at least 6 feet away from the magnet (leave items out in the hallway). The strong magnetic field can pull nearby unrestrained objects towards the magnet with great force.
6. Though not a safety issue, before entering the NMR room, people should be advised to leave personal belongings such as analog watches, ATM cards, credit cards, etc. out in the hallway. The magnetic field may erase magnetic media and disable equipment.
7. As with all other chemicals, when working with deuterated solvents, must wear appropriate PPE including indirect-vent chemical splash proof goggles. NMR tubes are thin walled. Handle these carefully.
8. At the end of an NMR run, if the sample is no longer needed, then thoroughly rinse the NMR tube with methanol. Collect the contents from the Hazardous Waste bottle on bench.

Allow NMR tube to dry on rack. If a more thorough cleaning of NMR tube is required, contact the Lab Manager, at 305-899--3886, to have the tube cleaned with an NMR tube cleaner.

9. When the NMR magnet is being filled with liquid nitrogen or liquid helium, ensure that ventilation is sufficient by keeping door propped open.

The Quench

The superconducting magnet is immersed in liquid helium. It contains an outer layer/dewar of liquid nitrogen. When the superconductivity in an NMR magnet is lost, it is called a quench. This results in the stored energy of the magnet to be released as heat.

During a quench, the liquid helium will quickly convert into gas and will vent out of the magnet dewar, filling the room. Helium is lighter than air, so it will fill the room from the top down. A cloud near the ceiling will be observed. Effects from oxygen deficiency may become noticeable at levels below 19.5%.



***Oxygen monitor, Single Gas Clip
See Appendix B for its maintenance.***

When a quench occurs (oxygen monitor alarm will sound / observe sudden exhaust of gases from magnet),

1. Evacuate the room immediately. Leave the door open upon egress.
2. No one should enter the room until the helium has completely boiled off. Check the oxygen monitor to ensure that it is safe to re-enter the area.
3. Contact the Lab Manager or Lab Director.
4. If anyone is injured, call 911.

First Aid

In case of exposure to liquid nitrogen or helium,

1. Remove clothing that is not frozen to the skin. Do NOT rub frozen body parts, because tissue damage may result.
2. Immerse the affected part of the body in a warm water bath (below 40°C, 105°F) or expose the area to warm air of the same range. Never use dry heat.
3. Use warm water (below 40°C, 105°F) to flush eyes for at least 15 minutes.
4. Seek immediate medical attention.

2.2.10 Working with Atomic Absorption Spectrophotometer

The Atomic Absorption Spectrophotometer is widely used in science labs for trace metal analysis. It requires two main gases and at Barry University we mostly use air as an oxidant and acetylene as a fuel gas.



210 VGP Atomic Absorption Spectrophotometer, Siena 116

The following safety guidelines are to be used when carrying out analysis using the atomic absorption spectrophotometer:

1. Must wear appropriate PPE including indirect-vent chemical splash proof goggles.
2. Refer to a chemical's Safety Data Sheet for proper handling and clean-up in the event of a spill.
3. Room must be equipped with an ABC dry chemical fire extinguisher (average 10—20 lbs.) near the instrument.
4. Gas cylinders need to be secured to a wall or bench by using brackets. Check regularly for leaks. Regularly inspect tubing and connectors to ensure the integrity of the gas system.
5. Never use copper tubing in acetylene supply lines—acetylide compounds may form and cause explosions. Always use stainless steel tubing and fittings.
6. Gas cylinders should be changed when pressure falls to 80 psig (pounds per square inch, gage). Line pressure from gas tank to instrument should not exceed 15 psig.
7. Maintain the integrity of the burner by regularly cleaning the burner head. Clogs may cause flame flashback. Allow the burner head to cool to room temperature before handling.
8. Whenever the flame ignites, the burner chamber safety cover should be closed. Clean the burner chamber whenever switching from an organic to aqueous or an aqueous to organic solution.
9. Never leave the flame unattended. Keep all flammable materials clear of flame.
10. An exhaust vent should always be on while the instrument is in use. The exhaust vent is to be installed over the flame, as toxic and corrosive fumes may be generated.
11. Before handling, always turn off lamps and allow them to cool to room temperature.

12. Check the integrity of the drain. Whenever running organic solvents, should make sure that the drain bottle is emptied frequently.
13. Flush thoroughly the spray chamber with water after analyzing copper, silver or mercury compounds that are aspirated into the acetylene flame. Unstable acetylide compounds may form. Once dry, may cause explosions.
14. Whenever working with cyanide containing compounds, do not allow these to contact acidic solutions in the drain. Toxic hydrogen cyanide may form.
15. Any instrument malfunction, immediately turn off the instrument as well as the fuel source to prevent the build-up of flammable gases. Contact the Laboratory Manager.
16. When the instrument is not in use, remove the gas regulators from the air and acetylene cylinders and place the gas cap on each.

2.3 Small Quantity Generator

EPA enacted in 1976 the **Resource Conservation and Recovery Act (RCRA)**. This federal law governs the disposal of solid waste and hazardous waste through a management system often referred to as “cradle to grave”.

To be classified as hazardous waste, a chemical must display one or more of the following: toxicity, reactivity, corrosivity, or ignitability. Acute hazardous waste is any hazardous waste with one of the following waste codes: beginning with the letter “P”; state-only hazardous waste code “ORP”, or any of these “F” codes—F020, F021, F022, F023, F026, and F027. Complete lists may be found on the EPA website, www.epa.gov

The main campus of Barry University is designated as a Small Quantity Generator (SQG). This means that it accumulates between 100 and 1000 kg per month of hazardous waste and 1 kg or less of acute hazardous waste per month. The maximum total of hazardous waste on-site is 6000 kg. As an SQG, Barry University has 180 days where the hazardous waste may be stored in its designated Central Accumulation Area. Note: if the **Treatment, Storage, and Disposal Facility (TSDF)** is 200 or more miles away, then 270 days is the allowed storage limit.

2.3.1 Hazardous Waste Containers

The EPA’s Hazardous Waste Generator Improvements is now in effect in Florida as of June 18, 2018: <http://retailcrc.org/Pages/State-Tracking-Matrix.aspx>

The following needs to be included when labeling hazardous waste containers:

- Print all information in ink.
- The words “Hazardous Waste” should be labeled on top.
- Chemical names of compounds collected should be completely written (No molecular formulas or abbreviations)

- The hazardous waste labels now need to include the hazard(s) present: e.g., *flammable, corrosive, oxidizer, reactive, toxic*, etc. This information may be found on the label of the chemical's stock bottle as well as its Safety Data Sheet.
- Place the date on the container when the full container is moved to the CAA (Central Accumulation Area). (**See Appendix B for Safety Checklist.**)

Items to keep in mind:

- Always keep container securely closed when not in use. No open funnels or covering by Parafilm or watch glass, etc.
- Choose an area in the lab / room as the SAA (Satellite Accumulation Area) to collect the waste.
- When container is deemed "full" (leaving at least 1-inch headspace for liquid expansion), then move the container from the SAA to a designated CAA (Central Accumulation Area) within 3 calendar days.
- Write the date when the container is placed inside the CAA. If there is limited space, then clearly separate the bottles in the SAA from the CAA. Once the container reaches the CAA, the university has 180 days from that date for the containers to be picked up by the disposal company.

2.3.2 Tier 2 Calculations, Emergency Planning and Community Right-to-Know Act

Under Section 312 of the **Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)**, facilities should annually evaluate their chemical inventories and perform calculations to determine whether to submit a Tier II Report by the March 1st deadline in Florida. If a Tier 2 report is required, state and local officials as well as the public are informed as to the types of hazards and amounts stored in a facility (only officials are given locations of these hazardous chemicals). This information helps first responders (including firefighters and hazmat personnel) to pre-plan in case of an emergency.

The Chemistry & Physics department takes a snapshot of their chemical inventory along with quantities reported by the Biology and Fine Arts departments, College of Health Sciences, and School of Podiatric Medicine. All masses and volumes of EHS (Extremely Hazardous Substances) are converted to pounds. Total quantities are compared to those listed under EPA's Appendix A, List of Lists, Section 302. The reporting threshold is 500 pounds, or the threshold planning quantity (TPQ) whichever value is lower.

Because Barry University is designated by the EPA as a Small Quantity Generator, the amounts stored of any extremely hazardous substance on its main campus may never reach a reportable threshold. In any case, the calculations are performed each year and copies are submitted to Facilities/ Environmental Health & Safety, Campus Safety and Office of Legal Affairs Risk Management for their records.

2.3.3 Universal Waste

There are five types of Universal Waste under EPA's Title 40 of the Code of Federal Regulations in part 273 <https://www.epa.gov/hw/universal-waste> :

- Batteries
- Pesticides
- Mercury-containing equipment
- Lamps
- Aerosol cans

Laboratories use various equipment containing batteries. When labeling containers for used batteries, the following should be included:

- Print all information in ink.
- The words “Universal Waste” should be labeled on top.
- The word “Batteries”.
- Accumulation Start Date—date when the first battery is placed inside the container. The university then has one year from that date to have a company dispose of the batteries accumulated.

Aerosol Cans

The EPA has ruled that aerosol cans are considered Universal Waste.

Posted by the *Federal Register*, December 9, 2019. Final rule effective on February 7, 2020:

<https://www.federalregister.gov/documents/2019/12/09/2019-25674/increasing-recycling-adding-aerosol-cans-to-the-universal-waste-regulations>

Florida has adopted the latest EPA rules on aerosol cans. Posted by *Florida Administrative Code & Florida Administrative Register, Standards for Universal Waste Management, Rule 62-730.185*. Final rule effective on October 30, 2020:

<https://www.flrules.org/gateway/ruleNo.asp?id=62-730.185>

2.4 Control Measures and Equipment

Chemical safety is achieved by continual awareness of chemical hazards and by keeping the chemical under control by using precautions, including engineering safeguards such as fume hoods. Laboratory personnel should be familiar with the precautions to be taken, including the use of engineering and other safeguards. Laboratory supervisors should be alerted to detect the malfunction of engineering and other safeguards. All engineering safeguards and controls must be properly maintained, inspected on a regular basis, and never overloaded beyond their design limits. ***(Forms used for safety checks of emergency equipment may be found in Appendix B.)***

2.4.1 Ventilation

1. Laboratory ventilation should be not less than eight air changes per hour (calculated). Thus, flow is not necessarily sufficient to prevent accumulation of chemical vapors. Working with toxic chemicals that have low air concentration limits, or that have high vapor pressures, should always be done in a fume hood.
2. Fume hoods should provide 80 to 120 linear feet per minute of air flow.
3. Laboratory employees should understand and comply with:
 - a. A fume hood is a safety backup for condensers, traps, or other devices that collect vapor and fumes. It is not used to "dispose" of chemicals by

evaporation unless vapors are trapped and recovered for proper waste disposal.

- b. The apparatus inside the fume hood should be placed on the floor of the fume hood at least six inches away from the front edge.
- c. Fume hood windows should be always lowered (closed) except when necessary to raise (open) them to adjust the apparatus that is inside the hood.
- d. The fume hood fan should be kept "on" whenever a chemical is inside the hood, whether any work is being done in the hood.
Personnel should be aware of the steps to be taken in the event of power failure or other fume hood failure.
- e. Inspect fume hood vent ducts and fans at frequent intervals to be sure they are both clean and clear of obstructions. [Depending on local circumstances, this maintenance is performed by laboratory employees or by maintenance/repair personnel.]
- f. Fume hoods should never be used as storage areas for chemicals, apparatus, or other materials.

2.4.2 Flammable-Liquid Storage

- 1. Fire-hazard chemicals (see paragraph 2.2.2a) in quantities greater than 500mL should be kept in metal safety cans designed for such storage. The cans should be used only as recommended by the manufacturer, including the following safety practices:
 - a. Never disable the spring-loaded closure.
 - b. Always keep the flame-arrestor screen in place; replace if punctured or damaged.
- 2. Cabinets designed for the storage of flammable materials should be properly used and maintained. Read and follow the manufacturer's information and follow these safety practices:
 - a. Store only compatible materials inside a cabinet.
 - b. Do not store paper or cardboard or other combustible packaging material in flammable-liquid storage cabinet.
 - c. The manufacturer establishes quantity limits for various sizes of flammable- liquid storage cabinets; do not overload a cabinet.

2.4.3 Eyewash Fountains and Safety Showers

- 1. Equip all laboratories with eye washes and safety showers. These must be located so they can be reached from any point in the laboratory as specified in ANSI Z358.1.
- 2. Check the functioning of eyewash fountains and safety showers and measure the

water flow at intervals specified in ANSI Z358.1. Promptly repair any facility that does not meet the water flow requirements of ANSI Z358.1.

3. Be sure that access to eye wash fountains and safety showers is not restricted or blocked by temporary storage of objects or in any other way.

2.4.4 Respirators

1. Employees should wear respirators whenever it is possible that engineering controls or work practices could become or are ineffective and that employees might be exposed to vapor or particulate concentrations greater than the PEL, action level, TLV, or similar limit, whichever is the lowest.
2. The requirements of 29 CFR 1910.134 should be followed, including in particular:
 - a. Written standard operating procedures governing the selection and use of respirators.
 - b. All employees who are likely to need to use respirators must be trained in their proper use, inspection, and maintenance. (See "NIOSH Guide to Industrial Respiratory Protection", DHHS Publ. No. 87-0116, NIOSH, Cincinnati, 1987, for details.)

2.4.5 Vapor Detection

Do not use odor as a means of determining whether inhalation exposure limits are or are not being exceeded. Whenever there is reason to suspect that a toxic chemical inhalation limit might be exceeded, whether a suspicious odor is noticed, notify the supervisor.

Laboratory workers should wear a respirator suitable for protection against the suspect chemical until measurements of the concentration of the suspect vapor in the air show that the limit is not exceeded. Under this circumstance and if there is no reason to anticipate an increase in the concentration of the chemical, and if the supervisor approves, the respirator can be removed, and the work may continue.

2.4.6 Fire Extinguishers

Fire Extinguisher Use Policy (for the laboratories and stockrooms)

Introduction

OSHA guidelines, 29 CFR 1910.157(g)(2), states the following regarding employees using portable fire extinguishers: "Where the employer has provided portable fire extinguishers for employee use in the workplace, the employer shall also provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved with incipient stage firefighting."

In Practical terms this means that OSHA rules prohibit workers from using fire extinguishers unless they have received an educational program in their proper use. Additionally, this means that employees must be trained to recognize the types of fires that can be controlled with portable extinguishers; correctly operate the portable fire

extinguisher, and to utilize effective firefighting techniques.

The Purpose of this Policy is to provide clear guidance in the use of portable fire extinguishers in laboratories and stockrooms: specifically, who may use them and under what circumstances.

Policy

1. **Tampering.** Tampering with a fire extinguisher is strictly prohibited. No one (faculty/staff/students) shall tamper with a fire extinguisher in laboratories, stockroom or anywhere else. Tampering includes removal of a pin as well as the removal of the plastic seal that holds the pin in place. The plastic seal contains the company name that performed the extinguisher's certification. When inspections are conducted, any visible tampering of the fire extinguisher shall result in a work ticket submitted requesting Facilities to replace the fire extinguisher.
2. **Educational Program.** All faculty/staff/students who utilize the laboratories and stockroom shall participate in an education program to become familiar with the general principles of fire extinguisher use and the hazards involved with incipient stage firefighting upon initial utilization of laboratories and stockroom and at least annually. The educational program shall include information regarding how to: recognize the types of fires that can be controlled with portable extinguishers; correctly operate the portable fire extinguisher, and utilize effective firefighting techniques
3. **Activate Alarm.** Before trying to control a fire with a portable fire extinguisher, the person who discovers the fire should activate the alarm, enabling other workers to evacuate to safety.
4. **When to Use.** Fire extinguishers should be used to fight only containable, small fires.
Demonstrations. An employee may not discharge an extinguisher for demonstration purposes, without permission of department chairperson/supervisor or Environmental Health and Safety Administrator. A demonstration extinguisher is one that is labeled and set aside for such purposes only. A fire extinguisher located inside a laboratory, classroom, stockroom, or office shall not be used for demonstration purposes. There are two different ways to demonstrate proper extinguisher use.
 - i. **Passive Demonstration:** Extinguisher use is discussed. The equipment is displayed. But the pin is not pulled/the seal is not broken and the unit is not discharged. If the pin is pulled or the seal is broken, then the extinguisher must be recertified. This is the recommended method for a classroom setting. **Do not break the seal or pull the pin unless the extinguisher is being used in an emergency.**

- ii. **Active Demonstration:** An active demonstration should only be performed outside as it can become messy. Seek permission of the department chair/supervision or the Environmental Health and Safety Administrator prior to such demonstration so that plans can be made to replace the extinguisher.
5. Replacing Extinguisher. If an extinguisher is discharged for any reason, contact the Facilities Department immediately at 305-899-3785 so that the extinguisher can be replaced. Contact Campus Safety. If the extinguisher is used to fighting a fire, contact Campus Safety at 305-899-3333 so that an incident report can be completed.

2.5 Procedures for Carcinogens, Reproductive Toxins, Substances That Have a High Degree of Acute Toxicity, and Chemicals of Unknown Toxicity

Follow the procedures described in this section when performing laboratory work with any select carcinogen, reproductive toxin, substance that has a high degree of acute toxicity, or a chemical whose toxic properties are unknown, when using or handling amounts greater than the amount specified for each such chemical in the current list available from the Chemical Hygiene Officer.

1. The following definitions will apply:
 - a. Select carcinogen: Any substance defined as such in 29 CFR 1910.1450 and any other substance described as such in the applicable SDS.
 - b. Reproductive toxin: Any substance described as such in the applicable SDS, or any substance identified as a reproductive toxin by the Oak Ridge Toxicology Information Resource Center (TIRC), (615) 576-1746; or for teratogens only: Any substance identified as such in Thomas H. Shepard, "Catalog of Teratogenic Agents", 6th ed., Johns Hopkins Press, 1989.
 - c. Substance with a high degree of acute toxicity: Any substance for which the LD₅₀ data described in the applicable SDS cause the substance to be classified as a "highly toxic chemical" as defined in ANSI Z129.1.
 - d. Chemical whose toxic properties are unknown: A chemical for which there is no known statistically significant study conducted in accordance with established scientific principles that establishes its toxicity.
 - e. For the purposes of this CHP, chemicals in the above four categories will be called "inimical".
 - f. Designated area: A fume hood, glove box, portion of a laboratory, or an entire laboratory room designated as the only area where work with quantities of the inimical chemicals more than the specified limit shall be conducted.

2. Designated areas shall be posted, and their boundaries clearly marked. Only those people trained to work with inimical chemicals will work with those chemicals in a designated area. All such people will:
 - a. Use the smallest amount of chemicals that is consistent with the requirements of the work to be done.
 - b. Use high-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.
 - c. Store inimical chemicals or remove them from storage.
 - d. Decontaminate a designated area when work is completed.
 - e. Prepare waste from work with inimical chemicals for waste disposal in accordance with specific disposal procedures consistent with the Resource Conservation and Recovery Act (RCRA) and as designated by Barry University's hazardous waste officer.
3. Store all inimical chemicals in locked and enclosed spaces with slight negative pressure compared to the rest of the building.
4. Because the decontamination of jewelry may be difficult or impossible, do not wear jewelry when working in designated areas.
5. Wear long-sleeved disposable clothing and gloves known to resist permeation by the chemicals to be used when working in designated areas.

2.6 Policy Regarding Dispensing Chemicals to Other Institutions

PURPOSE: From time to time, Barry University's chemical laboratories will receive a request from a neighboring college, university, and other academic institution in need of a small amount of a certain chemical for its teaching laboratory (i.e., an order has already been placed, but the chemical would not be delivered for at least a week, etc.). However, at times, the chemical requested is hazardous according to the Safety Data Sheets. This policy is to articulate when and with which institutions the University may at its sole discretion dispense chemicals.

POLICY: The University is under no obligation to dispense chemicals belonging to the University to any neighboring college, university, or other academic institution (hereinafter "institution") for any reason whatsoever. There may be times when the University may want to extend a professional courtesy to another institution and dispense a chemical at the request of that institution.

To do so, the institution must meet the following requirements:

1. The institution must be within a fifty (50) mile radius of the University.
2. The institution must have professional science staff such as a laboratory or stockroom manager or research faculty.
3. The University shall not dispense unstable, explosive, or acutely hazardous material.
4. The University shall not dispense cryogenic liquids.

5. The institution shall demonstrate that it has a break-resistant secondary container with which it can when transporting the chemicals.
6. The institution shall comply with all applicable federal, state, and local laws and regulations related to the handling and transportation of chemicals.
7. The institution shall execute an indemnification, waiver, and release of liability in favor of the University and demonstrate appropriate levels of insurance.
(Chemical Donation Release Form may be found in Appendix I.)

However, even if the institution meets the above requirements, the University is under no obligation to dispense chemicals to the institution and may chose at its sole discretion not to do so.

3. RECORDS AND RECORD KEEPING

This section reviews the value of documenting an employer's compliance with the Laboratory Standard, which is required by 29 CFR 1910.20. This information is general; it does not include the details necessary for compliance.

1. The Laboratory Standard requires that records of air concentration monitoring results, exposure assessments, medical consultations, and examinations be maintained for at least 30 years and that these be accessible to employees or their representatives.

Acknowledgement of monitoring results either in the form of an e-mail or copy of the signed assessment are to be documented at the department level and copies forwarded to the Environmental Health & Safety Administrator.

2. It is desirable to develop a system that retains documents related to distribution and maintenance of safety data sheets, to the safety training of employees, and to significant employee suggestions for many years, perhaps for the lifetime of the institution.

Specific records may be required in the event of lost work time resulting from an exposure or accident on the job. Use OSHA form 300 to record lost workdays that occur. Contact your local OSHA office for details.

3. In addition to required records, it is often desirable to keep records developed internally that document employee exposure complaints and suspected exposures, regardless of the outcome of an exposure assessment. Other incidents also might be documented for future reference.

Examples include:

- a. Major safety suggestions from employees to improve laboratory safety; keep these records. A suggestion that is unusable today might be useful tomorrow. Even when a suggestion is clearly non-workable, it should be taken seriously, examined, and recorded.
- b. Near-miss reports. An employee participating in or witnessing events that could have caused harm, but fortunately did not, should prepare reports of the incidents. These reports are used to develop changes in procedures that will prevent a future more serious occurrence.
- c. Repair and maintenance records for control systems. These are useful; they suggest corrective actions and indicate that equipment was or was not well maintained and kept in working condition.
- d. Complaints from employees. It is useful to keep a record of all complaints, investigations, and outcomes. Even when not justified, especially when a complaint correctly or incorrectly involves defects in and difficulties with operating equipment, the record may prove to be invaluable if that equipment develops a defect or malfunction later.

4. The EPA and other Federal and State agencies have special record keeping requirements. For example: Record keeping of allegations and the reporting of suspect hazards from the adverse effects of chemical exposure are required under Sections 8(c) and 8(e) of the Toxic Substances Control Act; see 40 CFR 7@6 and 717.

4. EMPLOYEE INFORMATION AND TRAINING

A formal session in a classroom setting to impart information or to train employees is not required, though it is often desirable for this purpose. Informal group or individual discussions with a supervisor, posted notices or handout booklets can be effective. Commercially prepared "canned" programs can also be effective, especially if supplemented with details that pertain specifically to local conditions.

OSHA does not mandate the details of the instructional method to be used. OSHA requires that, if asked by an OSHA inspector, the employees must be able to answer the issues. Hence, whatever technique or combination of techniques are used to impart information and to train, the effectiveness of the instruction should be evaluated prior to an OSHA inspection.

Some laboratory employees may not wish to participate in instructions that they perceive would be boring and repetitive. They believe that their professional or graduate training in chemistry and their accomplishments as a distinguished researcher obviate the need for further instruction. Clearly, if an employee can "pass" an evaluation of the effectiveness of instruction in matters pertaining both to safety and health hazards and to the precautions to be taken under the variety of circumstances extant in the laboratory where he or she works, then, whether the employer has provided such instruction, there is no reason for that employee to "sit through" any additional instructional exercises. ***(Lab Safety Training Forms may be found in Appendix C.)***

1. The employer provides all laboratory employees with information and training concerning the hazards of chemicals in Barry University's laboratories.
2. The employer will provide such information and training when an employee is initially assigned to a laboratory where hazardous chemicals are present and also prior to assignments involving new hazardous chemicals and/or new laboratory work procedures.
3. Employee information. Barry University will be sure that employees are informed of:
 - a. content and requirements of the Laboratory Standard.
 - b. content, location, and availability of the Chemical Hygiene Plan.
 - c. PEL, action levels and other recommended exposure limits for hazardous chemicals used in Barry University's laboratories.
 - d. signs and symptoms associated with exposures to the hazardous chemicals used in the laboratory.
 - e. location and availability of SDS and other reference materials.
4. Employee training shall include:
 - a. methods and observations that may be used to detect the presence or release of a hazardous chemical.
 - b. hazards associated with the chemicals used in Barry's laboratories.
 - c. measures employees can use to protect themselves from these hazards including specific procedures such as appropriate work practice, personal protective equipment to be used, and emergency procedures.
 - d. Barry University's Chemical Hygiene Plan.

5. EXPOSURE ASSESSMENTS, MEDICAL CONSULTATIONS, AND EXAMINATIONS

5.1 Suspected Exposures to Toxic Substances

There may be times when employees or supervisors suspect that an employee has been exposed to a hazardous chemical to a degree and in a manner that might have caused harm to the victim. If the circumstances suggest a reasonable suspicion of exposure, the victim is entitled to a medical consultation and, if so, determined in the consultation, also to a medical examination at no cost with no loss of workday time attributed to the victim.

(Incident Report Forms may be found in Appendix D.)

5.1.1 Criteria for Reasonable Suspicion of Exposure

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

5.1.2 Exposures

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

5.2. Exposure Assessment

In case of emergency, exposure assessments are conducted after the victim has been treated. It is not the purpose of an exposure assessment to determine that a failure on the part of the victim, or others, to follow proper procedures was the cause of an exposure. The purpose of an exposure assessment is to determine whether there was, or was not, an exposure that might have caused harm to one or more employees and, if so, to identify the hazardous chemical or chemicals involved.

Other investigations might well use results and conclusions from an exposure assessment, along with other information, to derive recommendations that will prevent or mitigate any future exposures. However, exposure assessments determine facts; they do not make recommendations.

1. Unless circumstances suggest other or additional steps, these actions constitute an exposure assessment:
 - a. Interview the complainant and the victim, if not the same person.
 - b. List the essential information about the circumstances of the complaint, including:
 - the chemical under suspicion
 - other chemicals used by the victim
 - all chemicals being used by others in the immediate area
 - other chemicals stored in that area
 - symptoms exhibited or claimed by the victim
 - how these symptoms compare to symptoms stated in the SDS for each of the identified chemicals
 - were control measures, such as personal protective equipment and hoods, used properly?
 - were any air sampling or monitoring devices in place? If so, are the measurements obtained from these devices consistent with other information?
2. Monitor or sample the air in the area for suspect chemicals, if there is reason to believe that the exposure level may exceed the action level or permissible exposure level.

Cadavers used in gross anatomy labs and tissues used in research will usually contain formaldehyde (formalin) solution as the main component of the embalming fluid. During the dissection process, formaldehyde vapors are emitted resulting in exposure to both students and the instructor.

*OSHA has published several guidelines on the use and monitoring of formaldehyde: **29 CFR 1910.1048 App A, "Substance Technical Guidelines for Formalin" and 29 CFR 1910.1048 App B, "Sampling Strategy and Analytical Methods for Formaldehyde" may be found in Appendix E.***

3. Determine whether the victims' symptoms compare to the symptoms described in the SDS or other pertinent scientific literature.
4. Determine whether the present control measures and safety procedures are adequate.

5.3 Notification of Results of Monitoring

Within 15 working days of receipt of the results of any monitoring, notify employees of those results.

5.4 Medical Consultation and Examination

The details of medical consultations and examinations are determined by the physician. The purpose of a medical consultation is to determine whether a medical examination is warranted. When, from the results of an exposure assessment, it is suspected or known that an employee was overexposed to a hazardous chemical or chemicals, the employee should obtain medical consultation from or under the direct supervision of a licensed physician.

When warranted, employees also should receive a medical examination from or under the direct supervision of a licensed physician who is experienced in treating victims of chemical overexposure. The medical professional should also be knowledgeable about which tests, or procedures are appropriate to determine if there has been overexposure; these diagnostic techniques are called "differential diagnoses".

5.4.1 The following provisions apply to medical consultations and examinations:

1. The employer must provide all employees who work with hazardous chemicals an opportunity to receive medical consultation and examinations when:
 - a. the employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
 - b. monitoring, routine or otherwise, suggests that there could have been an exposure above the action level, or PEL if there is no action level, for a chemical for which a substance-specific standard has been established.
 - c. there is a spill, leak, or other uncontrolled release of a hazardous chemical.
2. Provide the physician with the:
 - a. identity of the hazardous chemical or chemicals to which the employee may have been exposed.
 - b. exposure conditions.
 - c. signs and symptoms of exposure the victim is experiencing, if any.
3. Ordinarily, physicians will provide the employer in written form:
 - a. recommendations for follow-up, if determined to be pertinent.
 - b. a record of the results of the consultation and, if applicable, of the examination and any tests that were conducted.
 - c. conclusions concerning any other medical condition noted that could put the employee at increased risk.
 - d. a statement that the employee has been informed of both results of the consultation or examination and of any medical condition that may require further examination or treatment.
4. These written statements and records should not reveal specific findings that are not related to occupational exposure.

5.4.1a Documentation

All memos, notes, and reports related to a complaint of actual or possible exposure to hazardous chemicals are to be maintained as part of the record, as specified under section 3: “Records and Record Keeping” of the plan.

5.4.1b Notification

Employees shall be notified of the results of any medical consultation or examination about any medical condition that exists or might exist because of overexposure to a hazardous chemical.

5.4.1c Exposure Records, Safety Data Sheets

For Chemistry & Physics Department, Safety Data Sheets from 1985—2020 have been stored on a portable hard drive and uploaded to the CAS Safety Committee SharePoint site as “Safety Data Sheets Archive”. Other departments have chosen to store old Safety Data Sheets for their areas as printed copies.

Current Safety Data Sheets may be found online:

<https://chemmanagement.ehs.com/9/14b153fa-c358-415f-a4d3-a155f3f7fa84/ebinder>

Individual departments may choose to store printed copies of current Safety Data Sheets as well.

<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1020>

Excerpts from 29 CFR 1910.1020—Access to Employee Exposure and Medical Records

1910.1020(c)(5)(iii)

Material safety data sheets indicate that the material may pose a hazard to human health; or

1910.1020(c)(5)(iv)

In the absence of the above, a chemical inventory or any other record reveals where and when used and the identity (e.g., chemical, common, or trade name) of a toxic substance or harmful physical agent.

1910.1020(d)(1)(ii)

"Employee exposure records." Each employee exposure record shall be preserved and maintained for at least thirty (30) years, except that:

1910.1020(d)(1)(ii)(A)

Background data to environmental (workplace) monitoring or measuring, such as laboratory reports and worksheets, need only be retained for one (1) year so long as the sampling results, the collection methodology (sampling plan), a description of the analytical and mathematical methods used, and a summary of other background data relevant to interpretation of the results obtained, are retained for at least thirty (30) years; and

1910.1020(d)(1)(ii)(B)

Material safety data sheets and paragraph (c)(5)(iv) records concerning the identity of a substance or agent need not be retained for any specified period as long as some record of the identity (chemical name if known) of the substance or agent, where it was used, and when it was used is retained for at least thirty (30) years (**see Footnote 1 below**);

Footnote(1) Material safety data sheets must be kept for those chemicals currently in use that are effected by the Hazard Communication Standard in accordance with 29 CFR 1910.1200(g).

1910.1020(d)(1)(ii)(C)

Biological monitoring results designated as exposure records by specific occupational safety and health standards shall be preserved and maintained as required by the specific standard.

1910.1020(d)(1)(iii)

"Analyses using exposure or medical records." Each analysis using exposure or medical records shall be preserved and maintained for at least thirty (30) years.

6. LABORATORY CLOSEOUT PROCEDURE

Laboratory supervisors (such as the principal investigator) are responsible for the “cradle to grave” management of all hazardous materials in their labs. Thus, it is important for the lab supervisor to follow a laboratory closeout procedure prior to separation from the University, relocation to a new lab, or disposal of specialized laboratory equipment.

6.1 Vacating Procedure

The following procedure should be completed before the responsible individual leaves the University or transfers to a different location on campus:

- Assure that all containers of chemicals are:
 - ✓ labeled with the name of the chemical
 - ✓ securely closed.
- All laboratory glassware must be emptied and cleaned.
- Equipment and chemical inventory **MUST** be updated.
- Hazardous chemical waste must be collected and labeled for disposal. Contact the lab manager for pick-up at least two weeks before vacating the laboratory to assure proper coordination of disposal.
- Check refrigerators, freezers, ovens, fume hoods, storage cabinets and bench tops for hazardous materials, bio-hazardous materials and cultures and thoroughly clean these locations.
- Assure that all electrical equipment is turned off and the cords unplugged from their outlet.
- Chemicals that may still be used must be specifically transferred to another principal investigator or lab manager.
- Gas cylinders must have the regulator removed and the cap secured in place. Return the gas cylinders to the supplier or specifically transfer them to another principal investigator or lab manager.

6.2 Vacating Inspection

The principal investigator must schedule an inspection with the department head and/or lab manager to evaluate the vacating conditions. The department head and/or lab manager will inspect the lab according to the items listed under section 6.1, “Vacating Procedure”, and will file a clearance report based on the findings. ***The Laboratory Clearance Report for Vacating a Research Laboratory may be found in Appendix F.***

7. THE ELEMENTS OF AN EMERGENCY PROCEDURE PLAN

The essence of a plan to handle emergencies is summarized in the acronym "**NEAR**":

Notify, Evacuate, Assemble, Report

- **Notify:** establish who notifies whom. Usually, "who notifies" is the person involved in or witnessing the incident. Depending upon the severity and complexity of the incident, that person may or may not be able to evaluate and wisely determine the actions to be taken next. For example, even for a small fire, people closest to the scene may inadvertently choose an inappropriate means to extinguish the flames and thereby intensify the consequences.

Although at first it may seem foolish to notify someone else instead of acting immediately to control events, it is often wiser to notify instead of acting directly. Obviously, the person to be notified should be known to be capable of making proper and prompt decisions.

- **Evacuate:** evacuation may or may not be in order; the decision should be made by the person who is notified.
- **Assemble:** evacuees should assemble at a pre-established location.
- **Report:** evacuees should report their arrival to a prior-named person or to his or her prior-named alternate. It is important to be certain that people are or are not missing.

Note particularly that it may be unwise to conclude too quickly based on incomplete information that people are not present at the assembly point and are, therefore, trapped within the incident area.

This brief discussion emphasizes the obvious: the best emergency plan requires detailed planning by management as well as employee training in advance of an accident, with frequent drills to make sure that those involved will act prudently and promptly should an accident occur.

7.1 Hurricane Lab Preparedness

Barry University has guidelines online under Emergency Preparedness, Laboratory Preparations: <https://www.barry.edu/en/emergency-preparedness/laboratory-preparations/>

- When a hurricane watch is issued, make necessary arrangements to suspend ongoing experiments involving biological cultures and hazardous chemicals.
- When a hurricane warning is issued, implement activities to suspend operations in the laboratory. Plan to shut down operations within three hours of initial hurricane

warning. Remember, do not count on the availability of power, water, or climate control.

- Due to the possibility of power outages, volatile, toxic and materials displaying respiratory hazards should not be stored in fume hoods or refrigerators but in tightly sealed, impervious, and break-resistant containers.
- Coordinate with Facilities Management for spot coolers and power generators in key lab areas.
- Laboratories with outside windows should develop a secure area for the storage of water reactive chemicals and biological agents. These secure areas should be waterproof and heavy enough to not be affected by the wind.
- Hazardous chemicals and biological agents should not be stored below ground level during a hurricane. Find a secure area to store these materials in case of flooding.
- Keep plenty of plastic waterproof containers on hand to store lab notes, research documentation, computer media, and any other materials that you cannot afford to have damaged.
- Keep plenty of warning labels appropriate for the hazards of the materials you work with on hand. These may be needed after the hurricane.
- Check emergency phone numbers. Update lab personnel and researcher contact numbers and make them available to the Campus Safety office, if appropriate. Ensure that emergency contacts are available in print (manual format) as the power may be out.
- Forward to Campus Safety a complete list of faculty/staff that will need to be allowed on campus to access rooms/labs after the storm.

8. Laboratory Self-Inspections

The Arts & Sciences Safety Committee developed a Laboratory Self-Inspection Checklist (*see Appendix H*). The goal is to assist and educate laboratory personnel, including researchers, with a wide range of safety regulations, including but not limited to:

- General housekeeping
- Signage on doors, refrigerators, and ice machines
- Chemical inventory
- Compressed gas cylinders and cryogens
- Proper storage (chemicals, glassware, biological specimens, etc.)
- Safety Data Sheets
- Safety Training / Standard Operating Procedures
- Laboratory equipment, operation manuals
- Personal Protective Equipment
- Emergency eyewash and shower stations
- First Aid Kits
- Spill kits
- Emergency egress/exits
- Fire extinguishers and fire blankets
- Location of nearest pull stations
- Location of lab gas and electric shutoffs
- Annual inspection of fume hoods, chemical & biological
- Hazardous waste disposal, chemical and bio-hazardous
- Universal waste
- Waste Manifests
- Electrical cords/GFIC (ground fault circuit interrupter)
- Electric panels

Lab self-inspections should be performed, preferably, at least once a year. Any deficiencies found should be presented to the department's safety officer and/or chairperson. A definitive time period should be established for corrective action(s). Environmental Health & Safety may be used as a means of secondary authority to ensure compliance.

APPENDICES

Appendix A

Standard Operating Procedure & Personal Protective Equipment Guidelines

New laboratory procedures or experiments will be reviewed
by faculty and departmental Safety Officer to ensure that all chemical and physical hazards
have been addressed in the experimental write-ups.
Subcommittees document changes and forward updates at department meetings.

#1	PROCESS OR EXPERIMENT DESCRIPTION
Chemicals that will be used, step-by-step procedure.	
#2	SAFETY LITERATURE REVIEW & HAZARD SUMMARY
<p><u>Hazard Summary</u> <i>Physical and health hazards associated with the procedure used in the lab.</i></p> <ul style="list-style-type: none"> ___ <i>Acutely Toxic (Irritant to skin, eyes or respiratory tract, skin sensitizer)</i> ___ <i>Acutely Toxic (substances that can cause death, disability, or serious injury after a single, relatively low-level exposure)</i> ___ <i>Corrosives (reactive with metals, burns skin, damages eyes)</i> ___ <i>Oxidizers</i> ___ <i>Flammables</i> ___ <i>Compressed Gases / Substances Under Pressure</i> ___ <i>Pyrophorics</i> ___ <i>Self-heating substances</i> ___ <i>Explosive (Self Reactive, Organic Peroxides)</i> ___ <i>Carcinogen, Mutagen, Reproductive Toxins</i> <p><u>Safety Literature</u></p> <ul style="list-style-type: none"> ▪ Safety Data Sheets ▪ "Prudent Practices in the Laboratory Handling and Management of Chemical Hazards", 2011 edition ▪ Other Safety Literature associated with experiment or procedure. 	

#3	STORAGE REQUIREMENTS															
<i>Special handling and storage requirements for hazardous chemicals in the lab, especially for highly reactive/unstable materials, highly flammable materials, and corrosives.</i>																
#4	STEP-BY-STEP OPERATING PROCEDURE															
<p>Designate work area(s) - The intent of a designated work area is to limit and minimize possible sources of exposure to these materials.</p> <p>Decide whether the work area will encompass:</p> <p><input type="checkbox"/> On lab benches</p> <p><input type="checkbox"/> Chemical fume hood(s) only</p>																
<table border="1"> <thead> <tr> <th>Personal Protective Equipment / Emergency Safety Equipment</th> </tr> </thead> <tbody> <tr> <td> <p>1. PPE (Personal Protective Equipment)</p> <p><input type="checkbox"/> Appropriate clothing (long pants, close-toed shoes, etc.)</p> <p><input type="checkbox"/> Lab coat</p> <p><input type="checkbox"/> Gloves</p> <p><input type="checkbox"/> Safety goggles</p> <p><input type="checkbox"/> Safety glasses</p> <p><input type="checkbox"/> Face shield</p> </td> </tr> <tr> <td> <p>2. Safety equipment that serves the lab.</p> <table border="1"> <thead> <tr> <th>ITEM</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>Laboratory Fume Hood/Glove Box or other Ventilation Control</td> <td><input type="checkbox"/> chemical fume hoods. Inspected and certified once a year.</td> </tr> <tr> <td>Eyewash/Safety Shower</td> <td><input type="checkbox"/> Activated/checked weekly.</td> </tr> <tr> <td>First Aid Kit</td> <td><input type="checkbox"/> Checked monthly. Refilled, as necessary.</td> </tr> <tr> <td>Chemical Spill Kit</td> <td><input type="checkbox"/> Spill Control Kit (Acid Neutralizer, Caustic Neutralizer, and Organic Adsorber) and <input type="checkbox"/> Mercury Spill Kit.</td> </tr> <tr> <td>Fire Extinguisher</td> <td><input type="checkbox"/> Inspected and tagged yearly.</td> </tr> </tbody> </table> </td> </tr> </tbody> </table>		Personal Protective Equipment / Emergency Safety Equipment	<p>1. PPE (Personal Protective Equipment)</p> <p><input type="checkbox"/> Appropriate clothing (long pants, close-toed shoes, etc.)</p> <p><input type="checkbox"/> Lab coat</p> <p><input type="checkbox"/> Gloves</p> <p><input type="checkbox"/> Safety goggles</p> <p><input type="checkbox"/> Safety glasses</p> <p><input type="checkbox"/> Face shield</p>	<p>2. Safety equipment that serves the lab.</p> <table border="1"> <thead> <tr> <th>ITEM</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>Laboratory Fume Hood/Glove Box or other Ventilation Control</td> <td><input type="checkbox"/> chemical fume hoods. Inspected and certified once a year.</td> </tr> <tr> <td>Eyewash/Safety Shower</td> <td><input type="checkbox"/> Activated/checked weekly.</td> </tr> <tr> <td>First Aid Kit</td> <td><input type="checkbox"/> Checked monthly. Refilled, as necessary.</td> </tr> <tr> <td>Chemical Spill Kit</td> <td><input type="checkbox"/> Spill Control Kit (Acid Neutralizer, Caustic Neutralizer, and Organic Adsorber) and <input type="checkbox"/> Mercury Spill Kit.</td> </tr> <tr> <td>Fire Extinguisher</td> <td><input type="checkbox"/> Inspected and tagged yearly.</td> </tr> </tbody> </table>	ITEM	STATUS	Laboratory Fume Hood/Glove Box or other Ventilation Control	<input type="checkbox"/> chemical fume hoods. Inspected and certified once a year.	Eyewash/Safety Shower	<input type="checkbox"/> Activated/checked weekly.	First Aid Kit	<input type="checkbox"/> Checked monthly. Refilled, as necessary.	Chemical Spill Kit	<input type="checkbox"/> Spill Control Kit (Acid Neutralizer, Caustic Neutralizer, and Organic Adsorber) and <input type="checkbox"/> Mercury Spill Kit.	Fire Extinguisher	<input type="checkbox"/> Inspected and tagged yearly.
Personal Protective Equipment / Emergency Safety Equipment																
<p>1. PPE (Personal Protective Equipment)</p> <p><input type="checkbox"/> Appropriate clothing (long pants, close-toed shoes, etc.)</p> <p><input type="checkbox"/> Lab coat</p> <p><input type="checkbox"/> Gloves</p> <p><input type="checkbox"/> Safety goggles</p> <p><input type="checkbox"/> Safety glasses</p> <p><input type="checkbox"/> Face shield</p>																
<p>2. Safety equipment that serves the lab.</p> <table border="1"> <thead> <tr> <th>ITEM</th> <th>STATUS</th> </tr> </thead> <tbody> <tr> <td>Laboratory Fume Hood/Glove Box or other Ventilation Control</td> <td><input type="checkbox"/> chemical fume hoods. Inspected and certified once a year.</td> </tr> <tr> <td>Eyewash/Safety Shower</td> <td><input type="checkbox"/> Activated/checked weekly.</td> </tr> <tr> <td>First Aid Kit</td> <td><input type="checkbox"/> Checked monthly. Refilled, as necessary.</td> </tr> <tr> <td>Chemical Spill Kit</td> <td><input type="checkbox"/> Spill Control Kit (Acid Neutralizer, Caustic Neutralizer, and Organic Adsorber) and <input type="checkbox"/> Mercury Spill Kit.</td> </tr> <tr> <td>Fire Extinguisher</td> <td><input type="checkbox"/> Inspected and tagged yearly.</td> </tr> </tbody> </table>	ITEM	STATUS	Laboratory Fume Hood/Glove Box or other Ventilation Control	<input type="checkbox"/> chemical fume hoods. Inspected and certified once a year.	Eyewash/Safety Shower	<input type="checkbox"/> Activated/checked weekly.	First Aid Kit	<input type="checkbox"/> Checked monthly. Refilled, as necessary.	Chemical Spill Kit	<input type="checkbox"/> Spill Control Kit (Acid Neutralizer, Caustic Neutralizer, and Organic Adsorber) and <input type="checkbox"/> Mercury Spill Kit.	Fire Extinguisher	<input type="checkbox"/> Inspected and tagged yearly.				
ITEM	STATUS															
Laboratory Fume Hood/Glove Box or other Ventilation Control	<input type="checkbox"/> chemical fume hoods. Inspected and certified once a year.															
Eyewash/Safety Shower	<input type="checkbox"/> Activated/checked weekly.															
First Aid Kit	<input type="checkbox"/> Checked monthly. Refilled, as necessary.															
Chemical Spill Kit	<input type="checkbox"/> Spill Control Kit (Acid Neutralizer, Caustic Neutralizer, and Organic Adsorber) and <input type="checkbox"/> Mercury Spill Kit.															
Fire Extinguisher	<input type="checkbox"/> Inspected and tagged yearly.															

Telephone	___ Have emergency numbers posted next to phone.
Fire Alarm Manual Pull Station	___ Know nearest location.
3. Collection of hazardous chemical materials. <i>How to collect and store hazardous chemical materials generated by the procedure.</i>	
4. Clean up work area and lab equipment. <i>Specific cleanup procedures for work areas and lab equipment that must be performed after completion of your process or experiment.</i>	
5. Remove PPE and wash hands.	

#5

EMERGENCY PROCEDURES**A. Health-Threatening Emergencies**

Examples: fire, explosion, health-threatening hazardous material spill or release, compressed gas leak, or valve failure

1. Call 911 (and then Campus Safety at 305-899--3333)
2. Alert people in the vicinity and activate the local alarm systems.
3. Evacuate the area and go to your Emergency Assembly Point (EAP).
4. Remain nearby to advise emergency responders.
5. Once personal safety is established, call Facilities at 305-899--3785.
6. Provide local notifications.

Lab Director:

Dept Chairperson:

Emergency Response Agencies

Ambulance (American Medical Response)	305-718-6400
Miami Shores Police	305-759-2468
North Shore Hospital	305-835-6000

If personnel are exposed or injured:

1. Remove the injured/exposed individual from the area unless it is unsafe to do so (because of the medical condition of the victim or the potential hazard to rescuers).
2. **Call 911** if immediate medical attention is required.
3. Call Campus Safety at 305-899-3333 to report the exposure.
4. Administer first aid, as appropriate.
5. Flush contamination from eyes/skin using the nearest emergency eyewash/shower for at least 15 minutes. Remove any contaminated clothing.
6. Either fax or provide hard copies of the SDS for all chemicals the victim was exposed to the Fire-Rescue personnel or to the hospital.

B. Non-Health Threatening Emergencies

For non-health threatening injuries and exposures

Student Health Center is located in Landon 104, at 305-899-3750.

For hazardous material spills or releases which have impacted the environment (via the storm drain, soil, or air outside the building) or for a spill or release that cannot be cleaned up by local personnel:

American Compliance Technologies

CHEMTREC (chemical information)	800-424-9300	
(Chemical Emergency Transportation Center)		
Miami-Dade County Health	305-324-2400	
DCA Florida State Warning Point	850-413-9911	(Dept of Community Affairs)
Dept of Environmental Protection Agency	561-681-6600	(Southeast District Office)
Florida Poison Center	800-282-3171	
Florida Power & Light	800-468-8243	
Miami-Dade DERM	305-372-6955	
(Dept of Environmental Resources Management)		
Miami-Dade Water & Sewer	305-274-9272	
National Response Center	800-424-8802	
TECO People's Gas (North Miami Beach)	305-940-0139	

C. Small Spills/Local Cleanup:

In the event of a minor spill or release that can be cleaned up by local personnel using readily available equipment (Spill Kit):

1. Notify personnel in the area and restrict access. Eliminate all sources of ignition.
2. Review the SDS for the spilled material or use your knowledge of the hazards of the material to determine the appropriate level of protection.
3. Wearing appropriate personal protective equipment, clean up spill. Collect spilled cleanup materials in a tightly closed container. Manage spill cleanup debris as hazardous waste.
4. Have Lab Director transfer the chemical hazardous waste to the Storage Area (Chemical Stockroom).

D. Building Maintenance Emergencies (e.g., power outages, plumbing leaks):

Call Facilities Management at 305-899-3785.

#6

WASTE DISPOSAL

Once a hazardous waste container is deemed full, contact the departmental Safety Officer to move the container from the Satellite Accumulation Area to Central Storage Area.

#7	TRAINING REQUIREMENTS		
<p>Training may be obtained by one or more of the following (depending on job duties or responsibilities), depending on whether for teaching and research labs:</p> <ul style="list-style-type: none"> ___ Departmental safety training by the Lab Director (Safety Officer) ___ Safety training by the Principal Investigator / Researcher ___ Online training. ___ On-campus training/workshops. ___ Off-campus training/workshops. 			
<table border="1"> <tr> <td> Location Where Records Maintained: </td> <td></td> </tr> </table>		Location Where Records Maintained:	
Location Where Records Maintained:			
<ul style="list-style-type: none"> ___ Safety sheets (teaching lab check-in sheet, research safety sheet) ___ Safety Data Sheets 			

Appendix B

Safety Checklist Forms

Daily:

- Oxygen monitor for NMR Room, Adrian 105.

Once a week:

- Emergency Exit Lights Above Doors
- Eyewash / Safety Shower
- Compressed Gas Cylinders
- Satellite Accumulation Area
- Central Accumulation Area

Once a month:

- First Aid Kit (bandages, etc.)
- Fire Extinguishers (pin in place, pressure gauge ok, etc.) *safety checks are documented on the tag on the fire extinguisher*

Once a year: (coordinate with Facilities / Maintenance)

- Fire Extinguishers and Fire Hose(s)—*company tags equipment*
- Biological and Chemical Fume hoods--*company tags equipment*

Emergency Exit Lights

Location: _____ **From** _____ **to** _____ **(dates)**

[illegible]

Emergency Eyewash & Shower Station

Location: _____ **From** _____ **to** _____ **(dates)**

[illegible]

Compressed Gas Cylinders

Location: _____ From _____ to _____ (dates)

Gas cylinder(<i>circle</i>):	Acetylene	Helium	Nitrogen
	Air	Hydrogen	Oxygen
Lecture bottle (<i>circle</i>):	Hydrogen chloride	Nitrogen dioxide	

- Check for odors, fumes, hissing sounds, visible damage—dents/cracks, corrosion

[illegible]

Oxygen Monitor NMR Area

Date of installation: _____ MSA Altair O₂ monitor good 2 years after activation date

Fresh Air Setup (FAS): once per month. Test n fresh, uncontaminated air and do not breathe on the sensor.

- ✓ Enter the FAS Calibration mode by pressing the **TEST** button.
- ✓ When Test Gas? displays, press, and hold the **TEST** button to enter the calibration mode.
- ✓ Press the **TEST** button at the FAS? Screen to perform a calibration at 20.8% O₂.

Perform an alarm function check and a bump test before each day's use.

[illegible]

Satellite Accumulation Area

Hazardous Waste

Location: _____ From _____ to _____ (dates)

[illegible]

First Aid Kit

Checked once a month

- ▣ Bandages, assortment
- ▣ Adhesive tape, roll
- ▣ Cold pack
- ▣ Antiseptic applications and Burn Cream (check expiration date)

Location: _____ Dates: _____ to _____

Date	Initials	Status

Appendix C: Safety Training

- **College of Arts & Sciences, Biology**
- **College of Arts & Sciences, Chemistry & Physics**
- **College of Arts & Sciences, Fine Arts**
- **College of Health and Wellness**
- **School of Podiatric Medicine**
- **Service Animals in Lab**

Appendix C-1: Lab Safety Training

College of Arts & Sciences, Biology

- **C-1.1 General Rules for Students in Teaching Laboratories**
 - 1.1a Pre-Laboratory on Safety: General Guidelines Reading Assignment**
 - 1.1b Safety Rules for Laboratories Delivered Remotely**
 - 1.1c Procedures to be Followed in Case of a Laboratory Fire or Fire in Dormitory**
- **C-1.2 General Rules for Teaching Assistants in Laboratories**
 - 1.2a Personal Protective Equipment (PPE)**
 - 1.2b Introduction to Biosafety**
- **C-1.3 Laboratory Manager Safety Procedures**
- **C-1.4 Laboratory Instructor Safety Procedures**
- **C-1.5 Research Students Safety Procedures**
 - 1.5a Biomedical Responsible Conduct of Research**
- **C-1.6 Researcher/Principal Investigator Safety Procedures**

C-1.1 General Rules for Students in Teaching Laboratories

All registered laboratory students in teaching labs are required to wear Personal Protective Equipment (PPE), including laboratory lab coats, goggles for eye protection and gloves when necessary. Disposable laboratory coats are provided for non-biology majors for lab sessions that require PPE. General laboratory safety training is done during the first day of lab, and specific procedures are discussed at the beginning of each pertinent laboratory. All biology teaching laboratories require student instruction and training that at the minimum include:

1. Written instruction provided to students in all laboratory sessions during the first day of class. The instructor reads, explains, and discusses the procedures. Students are asked to locate the exits, fire extinguishers, safety shower and safety eyewash in each of the teaching-laboratory rooms in Siena, Wiegand and Adrian Buildings (Appendix C-1.1. a).
2. Written instruction provided to students enrolled in laboratories with remote delivery in which materials are sent home directly from the manufacturer. Chemicals used in home-delivered kits are accompanied by pertinent safety data from the manufacturer. Students are made aware at the beginning of the semester of general precautions and where to find information (Appendix C-1.1. b).
3. Written instruction on the proper procedure to handle fires due to chemicals, or other sources, with oral descriptions of scenarios in the laboratory and the dorms. These procedures are also applicable in other living arrangements (Appendix C-1.1.c).
4. After students have been informed about the safety guidelines, an online form is available for the students to review and become familiar with safety in their laboratories. To complete the form, the link is provided to students by their laboratory instructor and listed below.

<https://forms.office.com/r/BJQTkZRTBd>

C-1.1a Pre-Laboratory on Safety: General Guidelines Reading Assignment

1. Notify the instructor immediately if you are pregnant, color blind, allergic to any insects or chemicals, taking immunosuppressive drugs, or have any other medical condition (e.g., diabetes, immunologic defect) that may require special precautionary measures in the laboratory.
2. Upon entering the laboratory, place all books, jackets, purses, backpacks, etc. in designated areas, not on bench tops.
3. Locate and when appropriate, learn to use exits, fire extinguisher, fire blanket, chemical shower, eyewash, first aid kit, broken glass container, and cleanup materials for spills.
4. Locate the fire extinguisher – in case of a small fire, take the hose and aim at the base of the fire, pull the pin out, press the handle. Do not stay to fight a large fire - evacuate the room and assemble outside the building.
5. In case of fire – once in a safe place call 911 and alert Barry University Security 305-899-3333. If you believe someone is still in the room notify 911 and security.
6. **Do not eat, drink, smoke, or apply cosmetics in the laboratory.**
7. Confine long hair, loose clothing, and dangling jewelry.
8. Wear closed-toed shoes at all times in the laboratory.
9. Cover any cuts or scrapes with a sterile, waterproof bandage before attending lab.
10. Wear eye protection when working with chemicals.
11. Never pipet by mouth; use mechanical pipetting devices.
12. Wash skin immediately and thoroughly if contaminated by chemicals or microorganisms.
13. Do not perform unauthorized experiments.
14. Do not use equipment without instruction.
15. Report all spills and accidents to your instructor immediately.
16. Never leave heat sources unattended. When using hot plates, note there is no visible sign that they are hot (such as red glow); always assume that hot plates are hot.
17. Use appropriate apparatus when handling hot glassware.
18. Keep chemicals away from direct heat or sunlight.
19. Keep containers of alcohol, acetone, and other flammable liquids away from flames.
20. Dispose hazardous chemical waste in appropriately labeled container, following EPA guidelines.
21. Do not allow any liquid to come into contact with electrical cords; handle electrical connectors and cords with dry hands. Do not attempt to disconnect electrical equipment that cackles, snaps, or smokes.
22. Upon completion of laboratory exercises, place all materials in the disposal areas designated by your instructor and clean up your work area.
23. Do not pick up broken glassware with your bare hands; use a broom and dustpan and discard in designated glass waste containers. Never discard with paper waste.
24. Wear disposable gloves when working with blood, other bodily fluids, or mucous membranes. Change gloves after possible contamination and wash hands immediately after gloves are removed.
25. Place gloves, swabs, toothpicks, etc. that may have come in contact with body fluids in a disposable autoclave bag.
26. Leave the laboratory clean and organized for the next student.
27. Wash your hands with soap prior to leaving the laboratory.



28. The red biohazard symbol indicates procedures that may pose health concerns.



29. The yellow caution symbol points out instruments, substances, and procedures that require special attention to safety.

29. The Hazard Communication Standard (HCS) requires pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

See pictograms on the next page.

Students have the Right to Know the possible hazards from chemicals that they are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 240 and online. The link is included below.

MSDSonline
— a WileyInterscience solution —










<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

I agree to follow the safety rules as described above. If I have any questions, then I will ask the Laboratory Instructor or the Safety Officer Mrs. Elisabeta Vajda.

Print name: _____

Signature: _____ Date: _____


GHS Pictograms and Hazards

<p style="text-align: center;">Health Hazard</p>  <ul style="list-style-type: none"> • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity 	<p style="text-align: center;">Flame</p>  <ul style="list-style-type: none"> • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides 	<p style="text-align: center;">Exclamation Mark</p>  <ul style="list-style-type: none"> • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
<p style="text-align: center;">Gas Cylinder</p>  <ul style="list-style-type: none"> • Gases Under Pressure 	<p style="text-align: center;">Corrosion</p>  <ul style="list-style-type: none"> • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals 	<p style="text-align: center;">Exploding Bomb</p>  <ul style="list-style-type: none"> • Explosives • Self-Reactives • Organic Peroxides
<p style="text-align: center;">Flame Over Circle</p>  <ul style="list-style-type: none"> • Oxidizers 	<p style="text-align: center;">Environment (Non-Mandatory)</p>  <ul style="list-style-type: none"> • Aquatic Toxicity 	<p style="text-align: center;">Skull and Crossbones</p>  <ul style="list-style-type: none"> • Acute Toxicity (fatal or toxic)

C-1.1. b Safety Rules for Laboratories Delivered Remotely

Students are not permitted to conduct any Remote Learning Science Laboratories without completing the required safety training and signing this agreement. Specific instructions on how to handle materials sent to the student's home will accompany the materials necessary to complete the at-home laboratories.

I, _____ acknowledge and agree to all the following:
(print full name)

1. I have access to the *Remote Learning Science Laboratory Safety Instructions Manual* for this laboratory (posted on Canvas).
2. I have carefully read and acknowledge all of the information presented in the *Manual*.
3. I have taken and passed the *Remote Learning Science Laboratory Safety Course* assigned to me for this laboratory.
4. I will carefully read each Remote Learning Science Laboratory Investigation before starting the laboratory, and I will follow all safety precautions as advertised by the laboratory procedure.
5. I acknowledge that I am responsible for following safety procedures in the Manual and learned in the Safety Course at all times.
6. I acknowledge that I will read and follow all the safety precautions specific to each laboratory.
7. I acknowledge that failure to follow safety guidelines contained in the Manual, Course and each laboratory could result in a serious accident or injury to myself and others.
8. I acknowledge that the laboratory kits delivered to my home may contain hazardous materials, which require specific storage, and disposal.
9. I acknowledge that the laboratory kits delivered to my home may contain hazardous materials that if not stored or disposed properly may cause harm to me, others in my home, especially children and pets.
10. I acknowledge that the laboratory kits delivered to my home may contain hazardous materials to individuals with certain health conditions, or who are pregnant or nursing.
11. I will consult my physician or personal healthcare provider about potential risks if I have a medical concern for myself or someone in my household.
12. I acknowledge and assume all liability if I decide to remain in the laboratory.
13. Students have the Right to Know the possible hazards from chemicals that they are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 240 and online 

<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

I agree to follow the safety rules as described above. If I have any questions, then I will ask the Laboratory Instructor or the Safety Officer Mrs. Elisabeta Vajda.

Signature: _____ Date: _____

C-1.1.c Procedures to be Followed in Case of a Laboratory Fire or Fire in Dormitory

If your clothes or the clothes of another person catch on fire:

If a person's clothing is on fire, he/she must not be allowed to run, as this will fan the flames and cause a more serious burn. Remember! STOP, DROP and ROLL. Clothing fires must be extinguished immediately, before anything else is done, in order to minimize skin burns. Try not to use your hands for they will also burn.

1. Put the person under a shower or wrap him/her in a fire blanket, use an extinguisher, or whatever is available to smother the flames.
2. Roll the person on the floor if necessary.
3. After calling the emergency numbers, place clean, wet, ice-packed cloths on small, burned areas wrap the person warmly to avoid shock, and secure medical assistance.

In the case of any fire or any other emergency, Campus Safety must be notified immediately.

Fire-fighting procedures for controllable fires

1. For all fires, the fire alarm must be given to ensure Fire Department response. Call 911 and then Campus Safety (305) 899-3333.

In the case of any fire or any other emergency, Campus Safety must be notified immediately.

2. The decision of whether to fight the fire oneself or to wait for fire-fighting help must be made according to the type and size of the fire, its location, and the circumstances of the fire. A small fire in a container may be easily snuffed out by the placement of a nonflammable cover across the container opening. A small fire in an area free of other fuels can be extinguished with appropriate available extinguishers before calling for help. When extinguishing a burning solid, direct the extinguisher discharge at the base of the flame; in the case of burning liquids, direct it at the leading edge. Larger or rapidly growing fires are best left to the Fire Department.

To extinguish a MINOR fire with a fire extinguisher:

Remember! PASS:

Pull Pin

Aim

Squeeze handle

Sweep from side to side

3. Check your extinguisher in your dorm. If your extinguisher needs to be replaced, call Project& Fire /Life Safety Manager at 305-801-2216.

Evacuation procedures for uncontrollable fires

1. Leave the area of danger. **DO NOT** stay to fight a large fire. Rescue anyone in immediate danger. On your way out, if it can be done safely, turn off equipment and move any explosive or flammable materials away from possible contact with hot surfaces or other sources of ignition. Using the laboratory circuit breaker is often the quickest and most effective way to turn off all the laboratory's electrical equipment simultaneously. For this reason, the circuit breaker must always be readily accessible. Your safe exit, however, must be given the highest priority.
2. Transmit the fire alarm by pulling the pull station in the hallway, notify your resident assistant if in the dorms, your professor or teaching assistant if in a teaching laboratory, any of the professor if in the research laboratories or aquarium AND Call 911 and then Campus Safety (305) 899-3333.
3. Leave by means of one of the predetermined evacuation routes for your laboratory, classroom, or dorm area. If possible, confine the fire by closing doors as you leave. Evacuate promptly and meet outside the building away from the entrance. Be aware that your roommate is also outside, or if you suspect someone may still be inside notify the fire department on site. Help to make sure all are accounted for. If not, notify the on-scene Fire Department immediately.


I agree to follow the safety rules as described above. If I have any questions, I will ask the Laboratory Instructor.

Signature: _____ Date: _____

C-1.2 General Rules for Teaching Assistants in Laboratories

All Teaching Laboratory Assistants (TA) are required to read and acknowledge the laboratory safety procedures provided to laboratory students during the first day of class. In addition, TAs are required to wear lab coats, use goggles for eye protection and gloves when necessary and are instructed to ensure laboratory students follow safety procedures. TAs are also required to undergo additional on-line training provided by the University free of charge to the TAs. The on-line training includes modules are provided by the Collaborative Institutional and Training Initiative (CITI) program <https://about.citiprogram.org/en/homepage/>

The required modules are self-paced and are on average 3 hours each. TAs are paid for their time while completing the modules and must provide a certificate of completion to the Laboratory director Mrs. Elisabeta Vajda. The certificates are uploaded to the Biology SharePoint Site. The specific modules include Personal Protective Equipment (PPE), and Basic Introduction to Biosafety. A snapshot of the objectives is provided in C-1.2. a and a snapshot of the Basic Introduction to Biosafety is provided in C-1.2.b

Teaching Assistants have the Right to Know the possible hazards from chemicals that they are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 240 and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

I agree to follow the safety rules as described above. If I have any questions, then I will ask the Laboratory Instructor or the Safety Officer Mrs. Elisabeta Vajda.

Print name: _____

Signature: _____ Date: _____

After Teaching Assistants have been informed about the safety guidelines, an online form is available for the teaching assistants to review and become familiar with safety in the laboratories assigned to them. To complete the form, the link (see below) is provided to them by the Laboratory Director.

<https://forms.office.com/r/PjgRdeHUgs>

Appendix C-1.2.a Personal Protective Equipment (PPE)

A snapshot of the 'Introduction' and 'Summary' from the required training <https://about.citiprogram.org/en/homepage/> is included below:

Introduction

This module reviews personal protective equipment (PPE) or protective clothing worn by researchers to protect themselves when working with biohazards. In addition to protecting workers, PPE can also be used to protect the work, research materials, research animals, or biological products in research settings. This module also reviews the most common protective clothing encountered in the laboratory, including gloves, lab coats, gowns, garments, face protection, and respirators.

Learning Objectives

By the end of this module, you should be able to:

- Recognize the various types of PPE used for protection against biohazards (gloves, face protection, lab coats, and respirators).
- Describe the responsibilities of employers and employees for the provision, use, and handling of PPE.
- Identify the appropriate work practices associated with the use of gloves, face protection, lab coats, and respirators for the protection against biohazards.

Summary

This module reviewed the risk management strategy of the selection and use of PPE. PPE is commonly referred to as the last line of defense for worker protection. The basic types of PPE for the safe handling of biohazards were covered in this module, along with information on their selection, use, and limitations. The module also covered responsibilities and work practices associated with a PPE program.

C-1.2.b Introduction to Biosafety

A snapshot of the 'Introduction' and 'Summary' from the required training <https://about.citiprogram.org/en/homepage/> is included below:

Introduction

CITI Program's *Biosafety and Biosecurity (BSS)* modules provide a solid foundation in the principles of the containment of biohazards. They are designed for individuals who work with biohazards and for those responsible for the management or oversight of such work. The term biohazard includes:

Humans

Animal and plant pathogens

Prions

Genetically modified organisms and microorganisms

Potentially infectious human material, such as blood, body fluids, tissues, toxins of biological origin, and animals used in research

Known pathogens, pets, noxious weeds, and arthropods and insects not indigenous to a certain area may also represent a biohazard

Summary

This module provided an overview of key biosafety concepts, including laboratory associated infections, risk assessment, and risk management. It also provided additional resources for further exploration of the biosafety profession.

C-1.3 Laboratory Manager Safety Procedures

Biology Laboratory Manager is required to read and acknowledge the laboratory safety procedures provided in the Chemical Hygiene Plan, Appendix C - Biology section. Barry University's Chemical Hygiene Plan is online on the Campus Safety's website, under Safety Plans: <https://www.barry.edu/en/campus-safety/>. A printed copy of the updated edition is also located in the Biology Department main office, Adrian 206. The lab manager must adhere to the safety rules and enforce safety upon all Teaching Assistants and Laboratory Assistants that are in his or her supervision. The Laboratory Director will give a tour of the biology labs and Microbiology Prep Lab. The tour will also include all safety features of the labs. The Lab Manager must also undergo additional online training provided by the University for free. The on-line training includes modules that are provided by the Collaborative Institutional and Training Initiative (CITI) program <https://about.citiprogram.org/en/homepage/>. The completed certificates will be uploaded to the Biology SharePoint site. The required modules are Personal Protective Equipment (PPE) (Appendix C-1.1.a), Basic Introduction to Biosafety (Appendix C-1.1.b) and Biomedical Responsible Conduct of Research (Appendix C-1.5.a).

The Lab Manager has the Right to Know the possible hazards from chemicals they are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 240 and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>


I agree to uphold the above duties and follow the safety rules as described. If I have any questions, then I will ask the lab director for assistance.

Print name: _____

Signature: _____ Date: _____

C-1.4 Laboratory Instructor Safety Procedures

All Biology Laboratory Instructors are required to read and acknowledge the laboratory safety procedures provided in Chemical Hygiene Plan, Appendix C-Biology section. Barry University's Chemical Hygiene Plan is online on the Campus Safety's website, under Safety Plans: <https://www.barry.edu/en/campus-safety/>. A printed copy of the updated edition is also located in the Biology department main office, Adrian 206. The Lab Instructor must adhere to the safety rules and must enforce that safety procedures are followed by all students and Teaching Assistants under their supervision. The Laboratory Director will give a tour of the Biology labs and Microbiology Prep Lab to the instructor if he/she is unfamiliar with its layout and safety mechanisms. The tour will also include all safety features of the labs. The Lab Instructor is required to also undergo additional on-line training provided by the University free of charge. The on-line training includes modules that are provided by the Collaborative Institutional and Training Initiative (CITI) program <https://about.citiprogram.org/en/homepage/>. The completed certificates will be uploaded to Biology SharePoint site. Most certificates are valid for a year. Yearly recertification is required, or as indicated by the pertinent modules. The required modules are: Personal Protective Equipment (PPE) (Appendix C-1.1.a), and Basic Introduction to Biosafety (Appendix C-1.1.b).

The Lab Instructor has the Right to Know the possible hazards from chemicals that they are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 240 and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

I agree to uphold the above duties and follow the safety rules as described above. If I have any questions, I will ask the Lab Director for assistance.

Print name: _____


Signature: _____ Date: _____

C-1.5 Research Students Safety Procedures

All **Biology Research Students (RS)** are required to read and acknowledge the laboratory safety procedures provided in the Chemical Hygiene Plan, Appendix C-Biology section. Barry University's Chemical Hygiene Plan is online on the Campus Safety's website, under Safety Plans: <https://www.barry.edu/en/campus-safety/>. A printed copy of the updated edition is also located in the Biology department main office, Adrian 206.

In addition, RSs are required to wear lab coats, use goggles for eye protection and gloves when necessary and follow all laboratory safety rules. Research Students are not allowed to work alone, they need to be supervised at all the times by a qualified person. Research Students are also required to undergo additional on-line training provided by the University free of charge to the RSs. The on-line training includes modules provided by the Collaborative Institutional and Training Initiative (CITI) program <https://about.citiprogram.org/en/homepage/>

The required modules are self-paced and are on average 3 hours each. RSs must provide a certificate of completion to the Laboratory director Mrs. Elisabeta Vajda. The certificates are uploaded to the Biology SharePoint Site. The specific modules include Personal Protective Equipment (PPE) (Appendix C-1.1.a), Basic Introduction to Biosafety (Appendix C-1.1.b) and Biomedical Responsible Conduct of Research (Appendix C-1.5.a).

Research students have the Right to Know the possible hazards from chemicals that they are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in the research lab and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, then I will ask the Principal Investigator (PI) on in the laboratory I do my research for assistance. If I have any additional questions or concerns, I will ask the Laboratory Director Mrs. Elisabeta Vajda.

Print name: _____

Signature: _____ Date: _____

C-1.5.a Biomedical Responsible Conduct of Research

A snapshot of the 'Introduction' and 'Summary' from the required training <https://about.citiprogram.org/en/homepage/> is included below:

INTRODUCTION

This module introduces concepts and principles related to what has come to be known as the Responsible Conduct of Research (RCR), and provides an overview of the subject matter covered in CITI Program's RCR courses.

The term RCR is sometimes used interchangeably with **research integrity** or **research ethics** but these phrases do not always mean the same thing. RCR comprises the ethics of research practice and legal-regulatory compliance.

Receiving instruction in RCR has emerged as a requirement from some of the U.S. federal funding agencies and is increasingly becoming a standard element of each researcher's training. The goal of such instruction is to better familiarize researchers with the standards of their field and with the responsibilities that they have to society.

SUMMARY

At the core of RCR is the concept of **stewardship**; every researcher and research community has an ethical obligation to use the resources available to conduct the best research possible. They are entrusted with some level of independence in order to pursue knowledge that will benefit society. What follows from that privilege is a responsibility to avoid abusing this trust by learning what constitutes appropriate research practice and by acting in a manner consistent with that knowledge.

C-1.6 Researcher / Principal Investigator Safety Procedures

All Biology Researchers/ Principal Investigators (PI) are required to read and acknowledge the laboratory safety procedures provided in Chemical Hygiene Plan, Appendix C-Biology section. Barry University's Chemical Hygiene Plan is online on the Campus Safety's website, under Safety Plans: <https://www.barry.edu/en/campus-safety/> . A printed copy of the updated edition is also located in the Biology department main office, Adrian 206. . PIs must adhere to the safety rules and must enforce that safety procedures are followed by all research students, teaching assistants, and students under their supervision. The Laboratory Director will give a tour of the Biology labs and Microbiology Prep Lab to any PI that is not familiar with the layout of the laboratories or safety mechanism in place. The tour will also include all safety features of the labs. The PI is required to also to undergo additional on-line training provided by the University free of charge. The on-line training includes modules that are provided by the Collaborative Institutional and Training Initiative (CITI) program <https://about.citiprogram.org/en/homepage/>. Once completed the certificates will be uploaded to the Biology SharePoint Site. Most certificates are valid for a year. Yearly recertification is required or as required by the pertinent modules. The required modules are Personal Protective Equipment (PPE) (Appendix C-1.1.a), Basic Introduction to Biosafety (Appendix C-1.1.b) and Biomedical Responsible Conduct of Research (Appendix C-1.5.a).

The Principal Investigator has the Right to Know the possible hazards from chemicals they are working with or being exposed to in the lab. The chemical safety information may be found online



<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

I agree to uphold the above duties and follow the safety rules as described above. If I have any questions, I will ask the Biology Chair for assistance or the Laboratory Director Mrs. Elisabeta Vajda.

Print name: _____

Signature: _____ Date: _____

Appendix C-2: Lab Safety Training

College of Arts & Sciences, Chemistry & Physics

- **C-2.1: General Rules, Teaching Labs, Chemistry**
- **C-2.2: General Rules, Teaching Labs, Physics**
- **C-2.3: Lab Assistants, Chemistry**
- **C-2.4: Lab Assistants, Physics**
- **C-2.5: Lab Instructors, Chemistry**
- **C-2.6: Lab Instructors, Physics**
- **C-2.7: Lab Manager**
- **C-2.8: Chemistry Research Students**
- **C-2.9: Chemistry Researcher / Principal Investigator**
- **C-2.10: Chemistry Visitors**
- **C-2.11: Working with the NMR in Adrian 105**
- **C-2.12: NMR Maintenance and Cryogen Fills**
- **C-2.13: Lab Safety Rules for Vendors Working in NMR Room**

Section C-2.1

Laboratory Safety

General Rules for Chemistry Teaching Lab

Students

Personal Safety

- You may not work unsupervised—the lab instructor or lab assistant must be present. Unless permitted by the instructor, you may only enter the lab during your scheduled lab period.
- No smoking, eating, or drinking in the lab. No smoking in the immediate outside hallway to the lab.
- Wear...
 - chemical splash-proof safety goggles (indirect vent) while working in the lab. Absolutely NO exceptions!
 - lab coat required. Wear lab coat buttoned or snapped with the sleeves down. Cotton or polyester/cotton blend recommended. When working with pyrophoric chemicals, use a fire-resistant lab coat, such as fire-resistant treated cotton or Nomex.
 - long pants, like blue jeans or sweats—NO leggings or similar tight-fitting pants, shorts or short skirts are allowed.
 - shoes that cover the *entire* foot—NO Crocs, sandals, or cloth sneakers.
 - long hair tied back, especially when working with a Bunsen burner or hot plate.
 - nitrile gloves. If nitrile gloves become discolored or torn, replace immediately. Do NOT go outside of lab wearing gloves. Before leaving the lab, remove nitrile gloves and wash hands thoroughly.
 - If you wear a face mask, then disposable face masks will be provided to prevent contamination of the face mask with chemicals. At the end of lab, wash hands thoroughly, throw away disposable face mask, and put back original face mask.

Lab Procedures

- Pay special attention during the pre-lab for specific safety instructions including where to dispose hazardous chemical materials.
- Work cautiously and do not perform any unauthorized procedure. Report any incident *immediately* to the instructor. Broken mercury thermometers are to be disposed by the instructor.
- To smell a chemical use an “indirect” technique such as wafting. Use a fume hood when working with any volatile substance.
- Never leave a Bunsen burner flame, hot plate, or any reaction unattended!!! Once finished, make sure to turn off all Bunsen Burners, hot plates, and any other electrical equipment used.
- Keep your work area as organized as possible—label any flask, beaker or test tube containing chemicals. Clean your work area when finished with the experiment.

- **WASH YOUR HANDS** before leaving the lab.

Safety Equipment: know the location...

- First Aid Kit
- Emergency Eyewash and Safety Shower station
- Fire Extinguishers and 1 Fire Blanket
- Primary Safety Exits
- Fire Alarm

Student Health Services is in Landon 104, 305-899-3750. After 5pm, call Campus Safety at 305-899-3333.

OSHA's Hazard Communication Standard: you have the **Right to Understand** the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical information may be found in the SDS (**Safety Data Sheets**) located in Wiegand 121

and online  a velocity985 solution

<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Medical Condition / Pregnancy: consult with your physician as to whether or not you can work in the lab. (You may request a list of all the chemicals you will be working with during the semester from the lab director to take to your physician.)

Section C-2.2

Laboratory Safety

General Rules for Physics Teaching Lab

Students

Personal Safety

- You may NOT enter the lab outside of your scheduled lab period unless you are permitted by the instructor.
- No smoking, eating, or drinking in the lab.
- Wear appropriate attire...
 - Avoid wearing overly bulky or loose-fitting clothing that may become entangled with the experimental apparatus. Roll up loose sleeves.
 - Long pants, like blue jeans or sweats—no shorts or short skirts.
 - Shoes that cover the entire foot—no sandals, Crocs, or cloth sneakers.
 - Long hair should be tied or pinned back.
 - Wear impact resistant, direct vent safety goggles, when working with small projectiles. Goggles are available in the lab.
 - If you wear a face mask, please note you may wear your original face mask to perform physics experiments, since there are no chemical or biological hazards. If at any time during the lab session, your face mask needs to be replaced with a disposable one, then please inform the instructor.

Lab Procedures


- Pay special attention during the pre-lab for specific safety instructions including where to dispose of hazardous chemical materials.
- Work cautiously and do not perform any unauthorized procedure. Report any incident *immediately* to the instructor. Broken mercury thermometers are to be disposed by the instructor.
- Electrical equipment
 - Keep hands dry during an experiment, *especially* when using electrical equipment.
 - Do not use any electrical device with frayed wiring, broken insulation, or exposed wiring.
 - If you must connect an electrical circuit, ask the instructor to check the wiring *before* turning on any electrical devices. Special attention required when working with capacitors, high voltage, and high current power supplies.
 - With optics experiments, be cautious of light bulbs and white light sources which may become hot enough to burn you.
- Low power diode and helium neon lasers
Do NOT put your eyes directly in the path of a laser beam. (These lasers are not dangerous to the skin but if a laser beam hits the retina of the eye, it may damage it permanently.)
- In the event of an emergency, call 9-1-1.

Safety Equipment: know the location...

- First Aid Kit
- 2—Fire Extinguishers and 1 Fire Blanket.

- 2—Primary safety exits in Wiegand 150 lab and the secondary exit (door leading into Wiegand 151 lab).
- Fire Alarm—pull-station is located on wall adjacent to office Wiegand 129.

Student Health Services is in Landon 104, 305-899-3750. After 5pm call Campus Safety at 305-899-3333.

OSHA's Hazard Communication Standard: you have the **Right to Understand** the possible hazards from chemicals that you are working with or being exposed to while in lab. The chemical safety information may be found in the SDS (Safety Data Sheets) located in Wiegand 121 and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Medical Condition / Pregnancy: consult with your physician as to whether you can work in the lab. (You may request a list of all the chemicals you will be working with during the semester from the lab director to take to your physician.)

Section C-2.3

Chemistry Laboratory Assistant

Safety Training

Conduct in Lab

Lab Assistants must behave in a respectful manner. “Students are expected to act responsibly and to avoid conduct detrimental in its effect upon themselves, their fellow students, and the university, both on-and-off-campus. Students are expected to know and abide by all university rules, regulations, policies, and standards, and by local, state, and federal laws. Students are expected to uphold both the mission of the university and the Student Code of Conduct in action and deed while they attend Barry University” as described in the Student Code of Conduct Handbook. <http://www.barry.edu/student-handbook/handbook/student-conduct.html>

Personal Safety

- Safety goggles must be always worn during an experiment or preparations of any solution.
- Wear long pants, like blue jeans. NO leggings or similar tight-fitting pants, shorts, or short skirts are allowed.
- Lab coat required. Lab coat must be buttoned or snapped with the sleeves down. Cotton or polyester/cotton blend recommended. When working with pyrophoric chemicals, use a fire-resistant treated cotton or Nomex.
- Wear shoes that cover the entire foot—NO Crocs, sandals, or cloth sneakers.
- If you wear a face mask, then disposable face masks will be provided to prevent contamination of the face mask with chemicals. At the end of lab, wash hands thoroughly, throw away disposable face mask, and put back original face mask.
- nitrile gloves. If nitrile gloves become discolored or torn, replace immediately. Do NOT go outside of lab wearing gloves. Before leaving the lab, remove nitrile gloves, and wash hands thoroughly.
- NO smoking, eating, or drinking in the lab. No smoking in the immediate outside hallway to the lab or to the stockroom.
- Know the location and use of safety features in the stockroom and/or lab.
Safety features include safety exits—primary and secondary. Know the location of the nearest Fire Blanket. If there is a fire or suspected fire: follow the “R.A.C.E.” acronym:
Rescue – Alarm – Contain – Extinguish / Evacuate

Rescue

Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.

Alarm

Activate the nearest fire alarm pull stations (if applicable).

Call 911 to report the location and current extent of the fire. Then call University Campus Safety

at 305-899-3333 so they can assist fire rescue upon arrival to campus.

Contain

Close all doors and windows that you can safely reach to contain the fire.

During evacuation close the doors behind you.

Extinguish / Evacuate

The instructor or lab personnel will attempt to extinguish the fire ONLY if it is safe to do so.

They will follow the "P.A.S.S." procedure:

P = Pull the pin breaking the plastic seal

A = Aim at the base of the fire

S = Squeeze the handles together

S = Sweep from side to side.

- Eyewash and shower stations: rinse for at least 15 minutes with water. Check Safety Data Sheets for First Aid measures in case rinsing requires a longer period.
- First Aid Kit: for minor injuries, instructor completes an Incident Report Form and forwards to the lab director. For major accidents/emergencies, call 911 and Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Instructor will work with Campus Safety to file an incident report.
- Chemical spill kits: know their location and general usage.
- In case of an emergency, important phone numbers
(These numbers are also posted by the phones in the Physical Sciences labs)
Student Health Services: Landon 104, 305-899-3750.
Fire Alarm: dial 9-1-1
Campus Security: 305-899-3333
Florida Poison Center: 800-282-3171
Physical Sciences
Lab Director: 305-899-3434
Chairperson: Dr. Zajickova, 305-899-3238
- If you must smell a chemical, then use an "indirect" technique such as wafting.
- Mouth pipetting is prohibited. Use pipette bulbs.

Safe Disposal of Hazardous Materials

- Hazardous waste does not go down the drain (sink). Place in an appropriate, labeled container:
 - ✓ Print clearly, using blue or black ink (may use Sharpie)
 - ✓ words "Hazardous Waste".
 - ✓ Underneath, list the chemical names (no chemical formulas or abbreviations) of chemicals collected for that experiment(s).

Note: for organic chemistry lab (Adrian 104), hazardous waste is collected into two streams:

- organic, halogenated (F, Cl, Br, I)
- organic, non-halogenated
- ✓ List the hazards (Corrosive, Reactive, Flammable, and/or Toxic)

When container is deemed "full", Parafilm container and place aside. Lab Director will transfer

container from lab (Satellite Storage Area) to stockroom (Central Storage Area).

- All broken glassware (except mercury thermometers) is placed in the blue and white cardboard box.
- Broken mercury thermometers should be taped and left aside while the spilt mercury is placed in a mercury waste container.
- Any spilled chemical must be taken care of immediately. Contact the lab director for assistance.
- Wash your hands thoroughly with soap and water when you have finished working in a lab or stockroom.

Universal Waste

Batteries are disposed in appropriate, labeled container: label as “Universal Waste”, print content(s), and start date. Tape the ends/terminals of the batteries, before placing in container. Container is disposed one year after start date.

OSHA’s Hazard Communication Standard

You have the Right to Understand the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 121 and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Medical Condition

If you are pregnant or have a medical condition that might be affected by working with chemicals, then consult your physician as to whether you may work in the lab.

Clean-up

At the end of a lab session, do the following checks....

- Cap all reagent bottles tightly and return to designated lab bench.
- Close all containers located in the fume hood. Clean any spills.
- By each sink, close containers collecting acetone rinse.
- Turn off and unplug from electrical outlets all hot plates, melting point apparatus, etc.
- Gas valves must be completely closed.
- Turn off lights and lock all doors to the lab.

Tardiness/Absence

Show up to work on time. If for whatever reason you cannot show up to work or will be late, then please notify the lab director (call or send an e-mail). You may work only during your scheduled hours under the supervision of the lab director or laboratory instructor.

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, I will ask the lab director for assistance.

Section C-2.4

Physics Laboratory Assistant

Wiegand 150


Safety Training

Conduct in Lab

Lab Assistants must behave in a respectful manner. “Students are expected to act responsibly and to avoid conduct detrimental in its effect upon themselves, their fellow students, and the university, both on-and-off-campus. Students are expected to know and abide by all university rules, regulations, policies, and standards, and by local, state, and federal laws. Students are expected to uphold both the mission of the university and the Student Code of Conduct in action and deed while they attend Barry University” as described in the Student Code of Conduct Handbook.

<http://www.barry.edu/student-handbook/handbook/student-conduct.html>

OSHA’s Hazard Communication Standard: you have the Right to Understand the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 121 and online

 <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Student Health Services is in Landon 104, 305-899-3750. After 5pm call Campus Safety at 305-899-3333.

Medical Condition / Pregnancy: if you have any medical condition that might keep you from working in the physics lab, please confirm with your physician.

Personal Safety

- Students may NOT enter the lab outside of your scheduled lab period, unless permitted by the instructor.
- No smoking, eating, or drinking in the lab.
- Wear appropriate attire...
 - Avoid wearing overly bulky or loose-fitting clothing that may become entangled with the experimental apparatus. Roll up loose sleeves.
 - Long pants, like blue jeans or sweats—no shorts or short skirts.
 - Shoes that cover the entire foot—no sandals, Crocs, or cloth sneakers.
 - Long hair tied or pinned back.
 - Use direct-impact safety goggles when working with small projectiles (such as Ballistic Pendulum experiment).
 - If you wear a face mask, please note you may wear your original face mask to perform physics experiments, since there are no chemical or biological hazards. If at any time during the lab session, your face mask needs to be replaced with a disposable one, then please inform the instructor.

- Know the location and use of safety features in the lab.
 - Safety exits: two primary safety exits and one secondary exit (leads into Wiegand 151 lab).
 - Know the location of the nearest Fire Blanket.
Rooms contains two Fire Extinguishers.
If there is a fire or suspected fire, follow the “R.A.C.E” acronym: Rescue – Alarm – Contain – Extinguish/ Evacuate

Rescue

Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.

Alarm

Activate the nearest fire alarm pull station—located in the hallway, next to Wiegand 129.
Call 911 to report the location and current extent of the fire. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus.

Contain

Close all doors that you can safely reach to contain the fire.
During evacuation, close the doors behind you.

Extinguish / Evacuate

The instructor of lab personnel will attempt to extinguish the fire ONLY if it is safe for them to do so.

They will follow the “P.A.S.S.” procedure:

- P Pull the pin, breaking the seal
- A Aim at the base of the fire
- S Squeeze the handles together
- S Sweep from side to side

- First Aid Kit: for minor injuries, instructor completes an Incident Report Form and forwards to the lab director. For major accidents/ emergencies, call 911 and Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Instructor will work with Campus Safety to file an incident report.

Lab Procedures

- Pre-lab will offer specific safety instructions.
- Students must work cautiously and not perform any unauthorized procedure. Students must report any incident *immediately* to the instructor. Broken mercury thermometers are to be disposed by the instructor.
- Universal Waste: label new container as “Universal Waste”, print content(s) and write the start date when first item is placed inside container. For batteries, tape the ends/terminals of the batteries, before placing in container.

- Electrical equipment
 - Keep hands dry during an experiment, *especially* when using electrical equipment.
 - Do not use any electrical device with frayed wiring, broken insulation, or exposed wiring.
 - If you must connect an electrical circuit, ask the instructor to check the wiring *before* turning on any electrical devices. Special attention required when working with capacitors, high voltage, and high current power supplies.
 - With optics experiments, be cautious of light bulbs and white light sources which may become hot enough to burn you.

- Low power diode and helium neon lasers
Do NOT put your eyes directly in the path of a laser beam. (These lasers are not dangerous to the skin but if a laser beam hits the retina of the eye, it may damage it permanently.)

- At the end of a lab session, perform the following checks....
 - Return lab materials to designated areas.
 - Turn off and unplug hot plates from electrical outlets.
 - If using Bunsen burners, check that gas valves are completely closed.
 - Turn off lights and lock all doors to the lab.

Tardiness / Absence

Show up to work on time. If for whatever reason you cannot show up to work or will be late, then notify the lab director (call or send an e-mail).

You may work only during your scheduled hours under the supervision of the lab director or lab instructor.

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, I will ask the lab director for assistance.

PRINT Name: _____

Signature: _____

Date: _____

Section C-2.5

Chemistry Laboratory Instructor

Safety Guidelines

Training Procedure

Tour the lab(s), including location and use of all safety features.

Instructor (and Lab Assistant) must adhere to the safety rules and enforce the safety rules upon those students attending the lab.

Chemical Hygiene Plan

OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories (also known as the Laboratory Standard) requires a Chemical Hygiene Plan to protect workers from potential chemical hazards. The Arts & Sciences Safety Committee updates the Plan each year, with final revisions by the university's designated Chief Safety Officer and two Chemical Hygiene Officers.

Barry University's Chemical Hygiene Plan is online under Policies and Procedures: <http://bucwis.barry.edu/includes/docs/policy/pdf/chemical-hygiene-plan.pdf> A printed copy of the updated edition is also located in the Physical Sciences department main office, Wiegand 121.

OSHA's Hazard Communication Standard

You have the Right to Understand the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 121 and online  a safetyfirst solution

<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Medical Condition

If you are pregnant or have a medical condition that might be affected from working with chemicals, then consult your physician as to whether you may work in the lab.

Personal Safety

- Safety goggles must be always worn during an experiment or preparations of any solution.
Note: Even if only one person is working with chemicals in the lab, everyone in that lab must continue to wear their safety goggles.
- Wear long pants, like blue jeans. NO leggings or similar tight-fitting pants, shorts or short skirts are allowed.
- Lab coat required. Lab coat must be buttoned or snapped with the sleeves down. Cotton or polyester/cotton blend recommended. When working with pyrophoric chemicals, use a fire-resistant lab coat, such as fire-resistant treated cotton or Nomex.
- Wear shoes that cover the entire foot—no Crocs, sandals, or cloth sneakers.

- If you wear a face mask, then disposable face masks will be provided to prevent contamination of the face mask with chemicals. At the end of lab, wash hands thoroughly, throw away disposable face mask, and put back original face mask.
- nitrile gloves. If nitrile gloves become discolored or torn, replace immediately. Do NOT go outside of lab wearing gloves. Before leaving the lab, remove nitrile gloves and wash hands thoroughly.
- NO smoking, eating, or drinking in the lab. No smoking in the immediate outside hallway to the lab. Absolutely no food or drinks on the lab benches, lab refrigerators/freezer, or using a lab microwave/oven for heating food.
- If you must smell a chemical, then use an “indirect” technique such as wafting.
- Mouth pipetting is prohibited. Use pipette bulbs.
- Know the location and use of safety features which include:
 - Safety exits—primary and secondary
 - nearest Fire Blanket. If there is a fire or suspected fire: follow the “R.A.C.E.” acronym: Rescue – Alarm – Contain – Extinguish / Evacuate

Rescue

Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.

Alarm

Activate the nearest fire alarm pull stations (if applicable).

Call 911 (to report the location and current extent of the fire. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus.

Contain

Close all doors and windows that you can safely reach to contain the fire.

During evacuation close the doors behind you.

Extinguish / Evacuate

The instructor or lab personnel will attempt to extinguish the fire ONLY if it is safe to do so.

They will follow the “P.A.S.S.” procedure:

P = Pull the pin breaking the plastic seal

A = Aim at the base of the fire

S = Squeeze the handles together

S = Sweep from side to side.

- Eyewash and shower stations: rinse for at least 15 minutes with water. Check Safety Data Sheets for First Aid measures in case rinsing requires a longer period.
- First aid kits: for minor injuries, complete an Incident Report form and forward to the Lab Director. For major accidents/emergencies, call 911 and Campus Safety at 305-899-3333 so they

can assist fire rescue upon arrival to campus. Work with Campus Safety to file an incident report.

- Chemical spill kits: know their location and general usage.
- In case of an emergency, refer to the emergency numbers posted by the telephone in the lab.

Safe Disposal of Hazardous Materials

- Hazardous waste must be disposed of in appropriate, labeled containers, following EPA guidelines.
 - Print clearly, using blue or black ink (may use Sharpie)
 - Words “Hazardous Waste”
 - Underneath, list the chemical names (no chemical formulas or abbreviations) of chemicals collected for the experiment(s).

Note: for organic chemistry lab in Adrian 104, the hazardous waste is collected as two separate streams: organic, halogenated, and organic, non-halogenated.
 - List the hazard(s): corrosive, reactive, flammable and/or toxic.
 - Do NOT write a date on container!
 - When container is deemed “full”, Parafilm container and place aside. Lab Director will transfer container from lab (Satellite Accumulation Area) to the stockroom (Central Storage Area) and note the date.
- All broken glassware (except mercury thermometers) is placed in the blue and white cardboard box.
- Broken mercury thermometers should be taped and left aside while the spilt mercury is placed in a mercury waste container.
- Any spilled chemical must be taken care of immediately. Contact the Lab Director for assistance.
- Make sure students keep their work area as organized as possible students should label any flask, beaker or test tube containing chemicals.
- **WASH YOUR HANDS** before leaving the lab.

Universal Waste

Batteries are disposed in appropriate, labeled containers: label as “Universal Waste”, print content(s) and write start date of collection. Tape the ends/terminals of the batteries, before placing in container.

Laboratory Housekeeping

Good housekeeping in labs reduces the risks of accidents.

- Personal belongings should be stored in a designated area.
- Keep aisles clear. Safety equipment and fire exits must be easily accessible—do not block access—not even with a rolling cart.
- Reduce clutter on lab benches. Students should clean dirty glassware during the experiment. Students should not leave glassware soaking in sink. This could lead to breakage. Instead, students should place soaking glassware on lab bench.
- Label ALL glassware containing chemicals.

- Prevent trips or falls by immediately cleaning up spills. Students should clean weighing balances, as soon as they spill a solid. They should ask for assistance, if necessary.
- When an experiment is in progress, keep lab doors unlocked, but closed.
- Never store chemicals directly on the floor. Make sure to use secondary containers.
- Regularly check the hazardous waste containers inside the fume hood. Waste bottle is deemed “full” once the solvent level reaches the neck of the flask. Use new container to collect waste.
- When not in use, keep drawers/cabinets closed and flammable cabinets locked.
- Contact the Lab Manager for any equipment repairs.

At the End of the Lab Session

Perform the following checks (you may have your Lab Assistant help).

- Cap all reagent bottles tightly and return to designated lab bench.
- Close all containers located in the fume hood. Clean any spills.
- Turn off and unplug from electrical outlets all hot plates, melting point apparatus, etc.
- Gas valves must be completely closed.
- Turn off lights and lock all doors to the lab.

Tardiness/Absence

Show up to work on time. If for whatever reason you cannot show up to work or will be late, notify the Lab Director or Chairperson.

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, I will ask the lab director for assistance.

Print name: _____

Signature: _____

Date: _____


Section C-2.6

Physics Laboratory Instructor

Wiegand 150

Safety Guidelines

OSHA's Hazard Communication Standard: you have the Right to Understand the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 121 and online

 a safety solution
<https://msdsmanagement.msdsolution.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Student Health Services is in Landon 104, 305-899-3750. After 5pm call Campus Safety at 305-899-3333.

Medical Condition / Pregnancy: consult with your physician as to whether you can work in the lab.

Personal Safety

- Students may NOT enter the lab outside of your scheduled lab period, unless permitted by you.
- No smoking, eating, or drinking in the lab.
- Wear appropriate attire...
 - Avoid wearing overly bulky or loose-fitting clothing that may become entangled with the experimental apparatus.
 - Roll up loose sleeves. Long pants, like blue jeans or sweats—no shorts or short skirts.
 - Shoes that cover the entire foot—no sandals, Crocs, or cloth sneakers.
 - Long hair tied or pinned back.
 - Use direct-impact safety goggles, when working with small projectiles (such as Ballistic Pendulum experiment).
 - If you wear a face mask, please note you may wear your original face mask to perform physics experiments, since there are no chemical or biological hazards. If at any time during the lab session, your face mask needs to be replaced with a disposable one, then please inform the instructor.
- Know the location and use of safety features in the lab.
 - Safety exits: two primary safety exits and one secondary exit (leads into Wiegand 151 lab).
 - Know the location of the nearest Fire Blanket.
Rooms contains two Fire Extinguishers.
If there is a fire or suspected fire, follow the “R.A.C.E” acronym: Rescue – Alarm – Contain – Extinguish/ Evacuate
Rescue
Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.

Alarm
Activate the nearest fire alarm pull station—located in the hallway, next to Wiegand 129.

Call 911 to report the location and current extent of the fire. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus.

Contain

Close all doors that you can safely reach to contain the fire.

During evacuation, close the doors behind you.

Extinguish / Evacuate

Instructor or lab personnel may attempt to extinguish the fire ONLY if it is safe to do so.

They will follow the "P.A.S.S." procedure:

- P Pull the pin, breaking the seal
- A Aim at the base of the fire
- S Squeeze the handles together
- S Sweep from side to side

- First Aid Kit: for minor injuries, instructor completes an Incident Report Form and forwards to the lab director. For major accidents/ emergencies, call 911 and Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Instructor will work with Campus Safety to file an incident report.

Lab Procedures

- Pre-lab will offer specific safety instructions.
- Students must work cautiously and not perform any unauthorized procedure. Students must report any incident *immediately* to the instructor. Broken mercury thermometers are to be disposed by the instructor.
- Universal Waste: batteries are disposed in appropriate, labeled container. Tape the ends/terminals of the batteries, before placing in container. For new container, label as "Universal Waste", print its contents, and write the date on the container, when first battery is placed inside. The container will be disposed one year after indicated date.
- Electrical equipment
 - Keep hands dry during an experiment, *especially* when using electrical equipment.
 - Do not use any electrical device with frayed wiring, broken insulation, or exposed wiring.
 - If you must connect an electrical circuit, ask the instructor to check the wiring *before* turning on any electrical devices. Special attention required when working with capacitors, high voltage, and high current power supplies.
 - With optics experiments, be cautious of light bulbs and white light sources which may become hot enough to burn you.
- Low power diode and helium neon lasers

Do NOT put your eyes directly in the path of a laser beam. (These lasers are not dangerous to the skin but if a laser beam hits the retina of the eye, it may damage it permanently.)

- At the end of a lab session,
 - Students return lab materials to designated areas.
 - Students turn off and unplug hot plates from electrical outlets.
 - If using Bunsen burners, check that gas valves are completely closed.
 - Turn off lights and lock all doors to the lab.

Tardiness / Absence

Show up to work on time. If for whatever reason you cannot show up to work or will be late, then notify the lab director (call or send an e-mail).

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, I will ask the lab director for assistance.

PRINT Name: _____

Signature: _____

Date: _____

Section C-2.7 *Laboratory Manager* Safety Training

Training Procedure

Tour of all physics and chemistry labs, including stockrooms, and location of safety features.

Chemical Hygiene Plan

OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories (also known as the Laboratory Standard) requires a Chemical Hygiene Plan to protect workers from potential chemical hazards.

The Arts & Sciences Safety Committee updates the Plan each year, with final revisions by the university's designated Chief Safety Officer and two Chemical Hygiene Officers.

Barry University's Chemical Hygiene Plan is online under Policies and Procedures: <http://bucwis.barry.edu/includes/docs/policy/pdf/chemical-hygiene-plan.pdf> _A printed copy of the updated edition is also located in the department's main office, Wiegand 121.

OSHA's Hazard Communication Standard

You have the Right to Understand the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 121 and online  a safetyfirst solution

<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Medical Condition

If you are pregnant or have a medical condition that might be affected from working with chemicals, then consult your physician as to whether you may work in the lab.

Personal Safety

- Safety goggles must be always worn during an experiment or preparations of any solution.
- Wear long pants, like blue jeans. NO leggings or similar tight-fitting pants, short or short skirts are allowed.
- Lab coat required. Wear lab coat buttoned or snapped with the sleeves down. Cotton or polyester/cotton blend recommended. When working with pyrophoric chemicals, use a fire-resistant lab coat, such as fire-resistant treated cotton or Nomex.
- Wear shoes that cover the entire foot—no sandals, Crocs, or cloth sneakers.
- If you wear a face mask, then disposable face masks will be provided to prevent contamination of the face mask with chemicals. At the end of lab, wash hands thoroughly, throw away disposable face mask, and put back original face mask.

- nitrile gloves. If nitrile gloves become discolored or torn, replace immediately. Do NOT go outside of lab wearing gloves. Before leaving the lab, remove nitrile gloves and wash hands thoroughly.
- For the NMR: use gloves specifically for cryogenics when dispensing liquid nitrogen and doing liquid nitrogen and helium fills. Use safety goggles / face shield. Keep NMR room door propped open, whenever performing a nitrogen or helium fill.
- NO smoking, eating, or drinking in the lab. No smoking in the immediate outside hallway to the lab. Absolutely no food or drinks on the lab benches, lab refrigerators/freezer, or using a lab microwave/oven for heating food.
- If you must smell a chemical, then use an “indirect” technique such as wafting.
- Mouth pipetting is prohibited. Use pipette bulbs.
- Electrical equipment
 - Keep hands dry during an experiment, *especially* when using electrical equipment.
 - Do not use any electrical device with frayed wiring, broken insulation, or exposed wiring.
 - If you must connect an electrical circuit, double-check the wiring *before* turning on any electrical devices. Special attention required when working with capacitors, high voltage, and high current power supplies.
 - With optics experiments, be cautious of light bulbs and white light sources, which may become hot enough to burn you.
- Low power diode and helium neon lasers
Do NOT put your eyes directly in the path of a laser beam. (These lasers are not dangerous to the skin, but if a laser beam hits the retina of the eye, it may damage it permanently.)
- Know the location and use of safety features which include:
 - Safety exits—primary and secondary
 - nearest Fire Blanket. If there is a fire or suspected fire: follow the “R.A.C.E.” acronym:
Rescue – Alarm – Contain – Extinguish / Evacuate

Rescue

Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.

Alarm

Activate the nearest fire alarm pull stations (if applicable).

Call 911 to report the location and current extent of the fire. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus.

Contain

Close all doors and windows that you can safely reach to contain the fire. During evacuation close the doors behind you.

Extinguish / Evacuate

The instructor or lab personnel will attempt to extinguish the fire ONLY if it is safe to do so.

They will follow the "P.A.S.S." procedure:

P = Pull the pin breaking the plastic seal

A = Aim at the base of the fire

S = Squeeze the handles together

S = Sweep from side to side.

- Eyewash and shower stations: rinse for at least 15 minutes with water. Check Safety Data Sheets for First Aid measures in case rinsing requires a longer period of time.
- First aid kits: for minor injuries, complete an Incident Report form and forward to the Lab Director. For major accidents/emergencies, call 911 and Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Work with Campus Safety to file an incident report.
- Chemical spill kits: know their location and general usage.
- In case of an emergency, refer to the emergency numbers posted by the telephone in the lab.

Safe Disposal of Hazardous Materials

- Hazardous waste must be disposed of in appropriate, labeled containers, following EPA guidelines:
 - Print clearly, using blue or black ink (may use Sharpie)
 - Words "Hazardous Waste"
 - Underneath, list the chemical names (no chemical formulas or abbreviations) of chemicals collected for the experiment(s).

Note: for organic chemistry lab in Adrian 104, the hazardous waste is collected as two separate streams: organic, halogenated, and organic, non-halogenated.
 - List the hazard(s): corrosive, reactive, flammable and/or toxic.
 - Do NOT write a date on container!
 - When container is deemed "full", Parafilm container and place aside. Lab Director will transfer container from lab (Satellite Accumulation Area) to the stockroom (Central Storage Area) and note the date.
- All broken glassware (except mercury thermometers) goes in the blue and white cardboard box.
- Broken mercury thermometers should be taped and left aside while the spilt mercury is placed in a mercury waste container.
- Any spilled chemical must be taken care of immediately. Contact the Lab Director for assistance.
- Wash your hands thoroughly with soap and water when you have finished working in a lab or stockroom.

Universal Waste

Batteries are disposed in appropriate, labeled containers: label as "Universal Waste", print the content(s),

and write the date on container, when first item is placed inside. Tape the ends/terminals of the batteries, before placing in container. Container is disposed one year after start date. Notify lab director for pick-up.

Laboratory Housekeeping

Good housekeeping in labs reduces the risks of accidents.

- Personal belongings are stored in a designated area.
- Keep aisles clear. Safety equipment and fire exits must be easily accessible—do not block access—not even with a rolling cart.
- Prevent trips or falls by immediately cleaning up spills.
- Reduce clutter on lab benches. Clean dirty glassware during the experiment. Do not leave glassware soaking in sink. This could lead to breakage. Instead, place soaking glassware on lab bench.
- Label ALL glassware containing chemicals. Follow the Safety Data Sheets on how to store and work with these chemicals.
- When an experiment is in progress, keep lab doors unlocked, but closed.
- Never store chemicals directly on the floor. Use secondary containers.
- Before discarding or reusing empty stock bottles, triple rinse with compatible solvent and collect rinses inside hazardous waste bottle.
- Hazardous Waste bottle is deemed “full” once solvent level reaches neck of the flask. Within three days of container being full, notify lab director, for pick-up. Obtain new container to collect waste.
- Fume hoods are not for storage. Only keep those materials inside the fume hood that are for immediate use. Keep all chemical containers closed.
- When not in use, keep drawers/cabinets closed and flammable cabinets locked.
- For gas cylinders:
 - Upon receiving cylinder, secure with bracket to wall or bench. Write the date on the cylinder.
 - Check the Safety Data Sheet or manufacturer paperwork to note the shelf life of the cylinder’s contents.
 - Regularly check the condition of the gas cylinder for any signs of rust or leaks.
 - If container is still full, but not in immediate use, remove regulator and cap the gas cylinder.
 - Transport gas cylinder with dolly and use straps to secure.
- Regularly update the chemical inventory, including gas cylinders and cryogenics, on the departmental SharePoint site.

Hurricane Preparedness

During the summer, follow the hurricane checklist for the teaching labs and assist faculty with their research areas: <http://www.barry.edu/prepare/plan-at-work/laboratory-preparations.html>

Tardiness/Absence

Show up to work on time. If for whatever reason you cannot show up to work or will be late, then please notify the Lab Director or Chairperson.

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, then I will ask the lab director for assistance.

Section C-2.8

Chemistry Research Student


CHE 395/495

Safety Training

As student pursuing research, you have a right to understand the hazards that may be encountered when working in a lab. You have an obligation to follow the proper lab safety procedures. By signing, you are indicating that you have been instructed on the proper safety procedures to be followed in the research lab, have understood these instructions, and agree to abide by them.

Medical Condition

If you are pregnant or have any medical condition that might be affected from working with chemicals, biological reagents, or tissues, then consult with your physician as to whether you may work in the lab.

1. Advised on professional laboratory behavior.
 - Do not drink, eat, or smoke in the lab.
 - Wash and dry used glassware and return to storage location, before leaving the laboratory.
 - Students not conducting research are not allowed in the laboratory.
 - Place personal belongings only in the designated area.
2. Informed of OSHA's Hazard Communication Standard (the "Right to Understand" policy) and the location of the Safety Data Sheets.
 - Right to Understand - everyone has the right to understand the hazards that they may be exposed to when working with chemicals.
 - SDS – Safety Data Sheets are in Wiegand 121-- should be consulted once working with unfamiliar chemicals and online  <https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>
3. Informed of proper attire to be worn in the lab.
 - Wear chemical splash-proof safety goggles (indirect vent), while a chemical experiment is being performed in the lab.
 - Wear long pants (no leggings or similar tight-fitting pants, shorts or short skirts), shoes without open toes (no sandals, Crocs, or cloth sneakers), and buttoned or snapped lab coat (cotton or polyester cotton blend) with the sleeves down. When working with pyrophoric chemicals, use a fire-resistant lab coat, such as fire-resistant treated cotton or Nomex.
 - Wear proper gloves when handling chemicals (check the chemical's SDS). Do NOT go outside of lab wearing gloves. Before leaving the lab, remove gloves and wash hands thoroughly.
4. Instructed on the updated hazard pictograms under the GHS (Globally Harmonized System of Classification and Labeling of Chemicals).
5. Advised of proper chemical handling, storage, and disposal procedures in the lab.
 - Handle volatile or highly corrosive materials inside the fume hood.
 - Pay extreme caution to material label(s) and be familiar with their meaning(s).
 - Label secondary containers with the name of the chemical(s) and hazard warnings

- Store chemicals based on compatibility.
 - Return all chemicals to proper storage location, before leaving the laboratory.
 - Lock flammable cabinets, when not in immediate use.
 - Dispose chemical hazardous waste into appropriate, labeled containers. As soon as waste container is full, inform lab director. Do not store full waste container in the lab for more than three days.
 - Consult your supervisor if you have ANY questions on the correct procedure for waste disposal.
 - When working with biohazardous materials, decontaminate work surfaces and instruments with 1:10 solution of bleach. Wash hands thoroughly with effective detergent.
 - Dispose of biohazardous wastes in the appropriate, labeled container.
 - If working with animal or human tissues, then vaccination against hepatitis B is recommended.
6. Advised and trained of the location and proper use of safety features in the labs.
- Safety features include:
 - Chemical Spill Kits
 - Safety exits—primary (and secondary)
 - Fire blanket and fire extinguishers. If there is a fire or suspected fire: follow the “R.A.C.E.” acronym: Rescue—Alarm—Contain—Extinguish/Evacuate
- Rescue
Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.
- Alarm
Activate the nearest fire alarm pull stations (if applicable).
Call 911 to report on the location and current extent of the fire. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus.
- Contain
Close all doors (and windows) that you can safely reach to contain the fire.
During evacuation close the doors behind you.
- Extinguish/Evacuate
The research professor or lab personnel will attempt to extinguish the fire ONLY if it is safe to do so.
They will follow the “P.A.S.S.” procedure:
P = Pull the pin breaking the plastic seal
A = Aim at the base of the fire
S = Squeeze the handles together
S = Sweep from side to side.
- Eyewash and emergency shower station: rinse at least 15 minutes with water. Check Safety Data Sheets for first aid measures in case rinsing requires a longer period.
 - Emergency phone numbers are located by telephone.
 - First Aid Kit: report any injury, no matter how minor, to your research supervisor. Completed Incident Report is forwarded to lab director. Student Health Services is at Landon 104, 305-899-3750.

For major accidents/injuries, call 911 and University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Research supervisor will work with Campus Safety to file an incident report.

7. Advised on asking the research supervisor or qualified person any questions about proper lab procedures.
 - NEVER work alone in the lab, always make sure that your supervisor or qualified person is present.
 - Take special care at all times to follow the advice and instructions of your supervisor
 - If in doubt about the proper chemical handling, STOP work immediately and contact your supervisor.
8. Advised on refreshing the safety guidelines once a year as well as obtaining training whenever learning a research procedure that introduces new hazards.

I agree to abide by the above duties and follow the safety rules as described. If I have any questions, I will ask the research professor or lab director for assistance.

<hr/> <div style="text-align: center;">Student's Name (Please Print)</div>	<div>Research Lab: <hr/></div> <div style="text-align: right;">Building/Room number</div>
<hr/> <div style="text-align: center;">Signature of Student</div>	<hr/> <div style="text-align: center;">Date</div>
<hr/> <div style="text-align: center;">Signature of Researcher</div>	<hr/> <div style="text-align: center;">Date</div>

Section C-2.9

Chemistry Researcher / Principal Investigator Safety Guidelines

Researcher / PI must adhere to the safety rules and enforce the safety rules for those students performing research in his/her lab.

Chemical Hygiene Plan

OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories (also known as the Laboratory Standard) requires a Chemical Hygiene Plan to protect workers from potential chemical hazards.

The Fine Arts and Sciences Safety Committee updates the Plan each year, with final revisions by the university's designated Chemical Hygiene Officer and/or Environmental Health & Safety Administrator.

Barry University's Chemical Hygiene Plan is online under Policies and Procedures: <http://bucwis.barry.edu/includes/docs/policy/pdf/chemical-hygiene-plan.pdf> . A printed copy of the updated edition is also located in the Physical Sciences department main office, Wiegand 121.

OSHA's Hazard Communication Standard

You have the Right to Understand the possible hazards from chemicals that you are working with or being exposed to while in the lab. The chemical safety information may be found in the SDS (Safety Data Sheet) located in Wiegand 121 and online  a velocityfirst solution

<https://msdsmanagement.msdsonline.com/company/14B153FA-C358-415F-A4D3-A155F3F7FA84>

Medical Condition

If you are pregnant or have a medical condition that might be affected from working with chemicals, consult with your physician as to whether you may work in the lab.

Personal Safety

- Safety goggles must be always worn during an experiment or preparations of any solution.
Note: Even if only one person is working with chemicals in the lab, everyone in that lab must continue to wear their safety goggles.
- Wear long pants, like blue jeans. NO leggings or similar tight-fitting pants, shorts, or short skirts are allowed.
- Lab coat required. Lab coat must be buttoned or snapped with sleeves down. Cotton or polyester/cotton blend recommended. When working with pyrophoric chemicals, use a fire-resistant lab coat, such as fire-resistant treated cotton or Nomex.

- Wear shoes that cover the entire foot—no Crocs, sandals, or cloth sneakers.
- If you wear a face mask, then disposable face masks will be provided to prevent contamination of the face mask with chemicals. At the end of lab, wash hands thoroughly, throw away disposable face mask, and put back original face mask.
- Wear appropriate gloves, when handling chemicals. If the gloves become discolored or torn, then replace immediately. Do NOT go outside of lab wearing gloves. Before leaving the lab, remove gloves and wash hands thoroughly.
- NO smoking, eating, or drinking in the lab. No smoking in the immediate outside hallway to the lab. Note: if an office is part of the research lab, then designate that office area for eating or drinking only. Under no circumstances should anyone be eating or drinking in the lab. Absolutely no food or drinks on the lab benches, lab refrigerators/freezer, or using a lab microwave/oven for heating food.
- If you must smell a chemical, then use an “indirect” technique such as wafting.
- Mouth pipetting is prohibited. Use pipette bulbs.
- Know the location and use of safety features which include:
 - safety exits—primary and secondary
 - nearest Fire Blanket. If there is a fire or suspected fire: follow the “R.A.C.E.” acronym: Rescue – Alarm – Contain – Extinguish / Evacuate

Rescue

Immediately stop what you are doing and remove anyone in immediate danger from the fire to a safe area.

Alarm

Activate the nearest fire alarm pull stations (if applicable).

Call 911 to report the location and current extent of the fire. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus.

Contain

Close all doors and windows that you can safely reach to contain the fire.

During evacuation close the doors behind you.

Extinguish / Evacuate

The instructor or lab personnel will attempt to extinguish the fire ONLY if it is safe for them to do so.

They will follow the “P.A.S.S.” procedure:

P = Pull the pin breaking the plastic seal

A = Aim at the base of the fire

S = Squeeze the handles together

S = Sweep from side to side.

- Eyewash and shower stations: rinse for at least 15 minutes with water. Check Safety Data Sheets for First Aid measures in case rinsing is required for a longer period.

- First aid kits: for minor injuries, complete an Incident Report form and forward to the Lab Director. For major accidents/emergencies, call 911 and Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Work with Campus Safety to file an incident report.
- Chemical spill kits: know their location and general usage.
- In case of an emergency, refer to the emergency numbers posted by the telephone in the lab.

Laboratory Housekeeping

Good housekeeping in labs reduces the risks of accidents. Periodically, researchers should perform a Laboratory Self-Inspection. Checklists may be found under Appendix H in the Chemical Hygiene Plan.

For day-to-day (general) operation:

- Personal belongings should be stored in a designated area.
- Keep aisles clear. Safety equipment and fire exits must be easily accessible—do not block access—not even with a rolling cart.
- Prevent trips or falls by immediately cleaning up spills. Contact lab staff to place work ticket with Facilities to replace broken floor tiles.
- Avoid clutter by putting away any clean glassware. Try to clean dirty glassware before leaving for the day—dried up material is much harder to remove. Do not leave glassware soaking in sink—the glass may easily break. Instead, store soaking glassware on bench.
- Before discarding or reusing empty stock bottles, triple rinse with compatible solvent and collect rinses inside hazardous waste bottle.
- When an experiment is in progress, keep lab doors closed.
- Make sure to label all glassware containing chemicals. Follow the Safety Data Sheets on how to store and work with these chemicals.
- Never store chemicals directly on the floor. Make sure to use secondary containers.
- When not in use, keep drawers/cabinets closed and flammable cabinets locked.
- Fume hoods are not for storage. Only keep those materials inside the fume hood that are for immediate use. Keep all chemical containers closed.
- Contact the Lab Manager for any equipment repairs.
- Regularly update the chemical inventory for the research section on the departmental SharePoint site.

Safe Disposal of Hazardous Materials

- Hazardous waste must be disposed of in appropriately labeled containers following EPA guidelines:
 - Print clearly, using blue or black ink (may use Sharpie)
 - Words “Hazardous Waste”
 - Underneath, list the chemical names (no chemical formulas or abbreviations) of chemicals collected for the experiment(s).
 - List the hazard(s): corrosive, reactive, flammable and/or toxic.
 - Do NOT write a date on container!

- When container is deemed “full”, Parafilm container and place aside. Lab Director will transfer container from lab (Satellite Accumulation Area) to the stockroom (Central Storage Area) and note the date.
- All broken glassware (except mercury thermometers) is placed in the blue and white cardboard box.
- Broken mercury thermometers should be taped and left aside while the spilt mercury is placed in a mercury waste container.
- Any spilled chemical must be taken care of immediately. Contact the Lab Director for assistance.
- Wash your hands thoroughly with soap and water when you have finished working in a lab or stockroom.

Universal Waste

Label new containers as “Universal Waste”, print content(s), and write the start date when the first item was placed inside container. The container is disposed one year after the indicated start date. For batteries, these should have the ends/terminals taped, before placing them in container.

Hurricane Preparedness

Before leaving for the summer, make sure to follow the hurricane checklist for your lab: <http://www.barry.edu/prepare/plan-at-work/laboratory-preparations.html>

I agree to uphold the above duties and follow the safety rules as described. If I have any questions, I will ask the lab director for assistance.

Print name: _____

Signature: _____

Date: _____

Section C-2.10 **Chemistry Lab Visitors** Safety Guidelines

As a visitor to Barry University, you have a right to know and an obligation to follow proper safety procedures while in the laboratory.

By signing below, you are indicating that you have been instructed on the proper safety procedures to be followed in the lab, have understood these instructions, and agree to abide by them.

- 1. If bringing hazardous chemicals to campus, Safety Data Sheets must be provided. Must have prior approval by department chairperson and/or safety personnel.**
- 2. Must supply containers to collect chemical and/or biological hazardous waste. Will be responsible for disposing of any hazardous waste.**
- 3. No Smoking, Eating, or Drinking inside the lab.**
- 4. Personal Protective Equipment.**
 - Always wear chemical splash-proof safety goggles while working in the lab. If you forget to bring goggles, then ones will be provided.
 - Wear long pants (no leggings or similar tight-fitting pants, shorts, or short skirts), button or snapped lab coat with sleeves down and shoes without open toes (no sandals, Crocs, or cloth sneakers).
 - Wear appropriate gloves when handling chemicals (nitrile gloves are available, upon request). Do NOT wear gloves outside of lab. Before leaving the lab, throw away gloves and wash hands thoroughly.
 - If you wear a face mask, then disposable face masks will be provided to prevent contamination of the face mask with chemicals. At the end of lab, wash hands thoroughly, throw away disposable face mask and put back original face mask.
- 5. Personal belongings must be placed in the designated area only.**
- 6. Location (and proper use) of safety features in the lab.**
 - Safety features include:
 - ✓ Fire Exits
 - ✓ Fire alarm pull station
 - ✓ Fire blanket
 - ✓ First Aid Kit
 - ✓ Emergency eyewash and safety shower
- 7. In the event of an emergency, call 9-1-1.**

Visitor's Name (Please Print)

Signature of Visitor

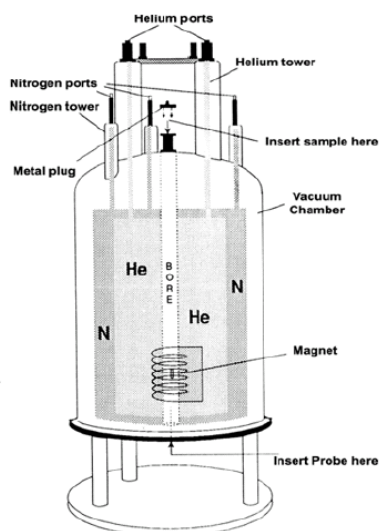
Date

Section C-2.11 Lab Safety: Working with the NMR in Adrian 105

Nuclear Magnetic Resonance

The Chemistry & Physics Department has an NMR (Nuclear Magnetic Resonance). This instrument is used to analyze a sample by characterizing its molecular structure according to the functional groups present. Because the NMR produces strong magnetic and electromagnetic fields, precautions must be taken when working with the instrument.

1. Magnetic fields generated may interfere with users of pacemakers and other implanted ferromagnetic medical devices. A person with a pacemaker must be restricted to areas where the magnetic field is less than 5-gauss. Before entering the NMR room, people with pacemakers and other similar medical devices must consult with their physician.
2. Cryogen dewars, gas cylinders, stepladders, tools, and all other equipment entering the room must be non-magnetic. Keep all magnetic items at least 6 feet away from the magnet (leave items out in the hallway). The strong magnetic field can pull nearby unrestrained objects towards the magnet with great force.
3. Though not a safety issue, before entering the NMR room, leave personal belongings such as analog watches, ATM cards, credit cards, etc. either out in the hallway or at the computer station. The magnetic field may erase magnetic media and disable equipment.
4. While working inside NMR room, keep door propped open.
5. When preparing samples, as with all other chemicals, wear appropriate PPE including indirect-vent chemical splash proof goggles. NMR tubes are thin walled. Handle these carefully.
6. At the end of an NMR run, if a sample is no longer needed, thoroughly rinse the NMR tube with methanol. Collect the contents in the Hazardous Waste bottle on bench. Allow NMR tube to dry on rack. If a more thorough cleaning of NMR tube is required, ask the researcher on how to use the NMR tube cleaner.
7. The superconducting magnet is always on. Lock NMR room door, when finished.



https://www.google.com/search?q=varian+nitrogen+and+helium+dewar+inside+magnet&source=lnms&tbn=isch&sa=X&ved=2ahUKEwivtIKbt6f1AhUhTDABHbZNDfoQ_AUoAXoECAEQAw&biw=1600&bih=789&dpr=1#imgsrc=zzk19fSRqwGkXM

Cryogenics

A cryogen is a liquid with a normal boiling point below -150°C . Commonly used cryogenics in the lab are liquid nitrogen (boiling point of -196°C) and liquid helium (boiling point of -269°C).

The Quench

The superconducting magnet is immersed in liquid helium. It contains an outer layer/dewar of liquid nitrogen. When the superconductivity in an NMR magnet is lost, it is called a **quench**. This results in the stored energy of the magnet to be released as heat.

During a quench, the liquid helium will quickly convert into gas and will vent out of the magnet dewar, filling the room. Helium is lighter than air, so it will fill the room from the top down. A cloud near the ceiling will be observed. Effects from oxygen deficiency may become noticeable at levels below 19.5%.



Oxygen monitor, Single Gas Clip

When a quench occurs (oxygen monitor alarm will sound / observe sudden exhaust of gases from magnet),

- 1) Evacuate the room immediately. Leave the door open upon egress.

- 2) If there are labs running in Adrian 104 / 106, then notify the instructor(s). They will evacuate the room(s).
- 3) Contact Lab Manager at 305-899-3886 or Lab Director at 305-899-3434.
- 4) No one should enter the NMR room until the helium has completely boiled off. Lab personnel will check oxygen monitor to ensure that it is safe to re-enter the area.
- 5) If anyone is injured, call 911. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Lab Manager or Lab Director will work with Campus Safety to file an Incident Report.

I agree to follow the safety rules as described. If I have any questions, I will ask the Lab Manager or Lab Director for assistance.

Name (Print): _____

Signature: _____

Date: _____

Section C-2.12

Lab Safety: **NMR Maintenance and Cryogen Fills**

Cryogenics

A cryogen is a liquid with a normal boiling point below -150°C . Commonly used cryogenics in the lab are liquid nitrogen (boiling point of -196°C) and liquid helium (boiling point of -269°C). Cryogenics can be hazardous, if not handled properly.

1. Inspect the dewar /container for any dents or other physical damage. Frost around the top of a venting container is normal, as the cold venting vapors are condensing the moisture in the air. However, frost at the bottom or on the side of the dewar indicates that the dewar is faulty and damaged. Contact the lab manager or director immediately, to exchange the dewar.
2. Liquid nitrogen and helium dewars have a pressure relief valve to release any excess pressure. Periodic, loud venting from the pressure relief valve is normal.
3. Avoid eye contact. Wear indirect-vent chemical splash proof goggles and/or face shield.
4. Avoid skin contact. Extreme cold temperatures may cause cold burns and frostbite. Do NOT use rubber gloves. Only wear gloves designed specifically for cryogenics. These gloves need to be loose fitting in case gloves need quick removal. Wear lab coat (cotton or polyester/cotton blend)snapped or buttoned with sleeves down, long pants, and closed-toe shoes.
5. Do not use or store cryogenics in confined areas without proper ventilation. A leak may cause an oxygen-deficient atmosphere resulting in asphyxiation. Best to prop door open, while performing a nitrogen fill.
6. Use proper container / dewar for transporting liquid nitrogen.
Never store cryogen in a sealed, airtight container at a temperature above the boiling point of the cryogen. The pressure resulting from the production of gaseous nitrogen, helium, or carbon dioxide may cause an explosion.
7. Use only fitted transfer tubes / lines designed specifically for that cryogenic liquid. Before performing a fill, check cryogen transfer tube for cracks.
8. When transferring to a secondary container, do not fill the secondary container to more than 80% capacity.
9. Do not lower warm experiments into cryogen dewars. Use **non**-metallic tongs to add or remove materials from cryogenic liquids.

10. Provide proper venting for any dewars used in an experiment. Do NOT use cryogenics in a walk-in cold room, which may not have sufficient air exchange, resulting in the cold room becoming oxygen deficient.
11. Only use dewars designed to hold cryogenics. Transporting filled cryogen dewars larger than 5 liters must be moved on a sturdy wheeled cart. Make sure that dewars remained closed during transportation.
12. Avoid transporting filled cryogen dewars in an occupied elevator. Wait until elevator is free of all other passengers.
13. Wear appropriate PPE (indirect-vent chemical splash-proof goggles and /or face shield along with gloves designed specifically for cryogenics) when transferring cryogenic liquids in dewars between buildings. An emergency may occur at a moment's notice.

First Aid

In case of exposure to cryogenic liquids,

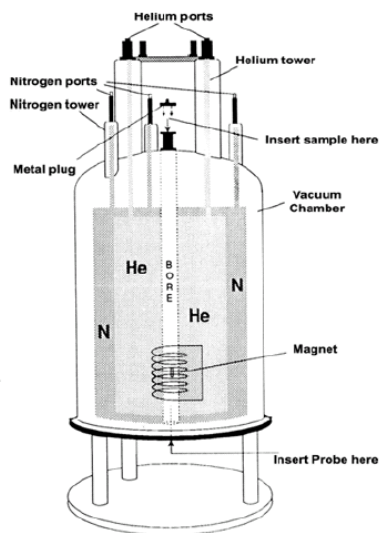
- 1) Remove clothing that is not frozen to the skin. Do NOT rub frozen body parts, because tissue damage may result.
- 2) Immerse the affected part of the body in a warm water bath (below 40°C, 105°F) or expose the area to warm air of the same range. Never use dry heat.
- 3) Use warm water (below 40°C, 105°F) to flush eyes exposed to cryogen liquids or gases for at least 15 minutes.
- 4) Seek immediate medical attention. For major injuries, call 911. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Lab Manager or Lab Director will work with Campus Safety to file an incident report.

Nuclear Magnetic Resonance

The Chemistry & Physics Department has an NMR (Nuclear Magnetic Resonance). This instrument is used to analyze a sample by characterizing its molecular structure according to the functional groups present. Because the NMR produces strong magnetic and electromagnetic fields, precautions must be taken when working with the instrument.

1. The superconducting magnet is always on. Keep NMR room door locked, while not in use.
2. Restrict public access to areas of 5-gauss or higher. Magnetic fields generated may interfere with users of pacemakers and other implanted ferromagnetic medical devices. A person with a pacemaker must be restricted to areas where the magnetic field is less than 5-gauss. Before entering the NMR room, people with pacemakers and other similar medical devices must consult with their physician.
3. Liquid nitrogen and liquid helium dewars, gas cylinders, stepladders, tools, and all other equipment entering the room must be **non-magnetic**.

4. Keep all tools, equipment and personal items containing ferromagnetic material at least 6 feet away from the magnet (leave items out in the hallway). The strong magnetic field can pull nearby unrestrained objects towards the magnet with great force.
5. Though not a safety issue, before entering the NMR room, people should be advised to leave personal belongings such as analog watches, ATM cards, credit cards, etc. either out in the hallway or at the computer station. The magnetic field may erase magnetic media and disable equipment.
6. As with all other chemicals, when working with deuterated solvents, must wear appropriate PPE including indirect-vent chemical splash proof goggles. NMR tubes are thin walled. Handle these carefully.
7. At the end of an NMR run, if the sample is no longer needed, then thoroughly rinse the NMR tube with methanol. Collect the contents in the Hazardous Waste bottle on bench. Allow NMR tube to dry on rack. If a more thorough cleaning of NMR tube is required, contact the Lab Manager, at 305-899--3886, to have the tube cleaned with an NMR tube cleaner.
8. When the NMR magnet is being filled with liquid nitrogen or liquid helium, ensure that ventilation is sufficient by keeping door propped open.



<https://www.google.com/search?q=varian+nitrogen+and+helium+dewar+inside+magnet&source=lnms&tbn=isch&sa=X&ved=2ahUKEwivtIKbt6f1AhUhTDABHbZNDfoQAUoAXoECAEQAw&biw=1600&bih=789&dpr=1#imgsrc=zzk19fSRqwGkXM>

The Quench

The superconducting magnet is immersed in liquid helium. It contains an outer layer/dewar of liquid nitrogen. When the superconductivity in an NMR magnet is lost, it is called a **quench**. This results in the stored energy of the magnet to be released as heat.

During a quench, the liquid helium will quickly convert into gas and will vent out of the magnet dewar, filling the room. Helium is lighter than air, so it will fill the room from the

top down. A cloud near the ceiling will be observed. Effects from oxygen deficiency may become noticeable at levels below 19.5%.



Oxygen monitor, Single Gas Clip

When a quench occurs (oxygen monitor alarm will sound / observe sudden exhaust of gases from magnet),

- 1) Evacuate the room immediately. Leave the door open upon egress.
- 2) No one should enter the room until the helium has completely boiled off. Check the oxygen monitor to ensure that it is safe to re-enter the area.
- 3) Contact the Lab Manager or Lab Director.
- 4) If anyone is injured, call 911. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Lab Manager or Lab Director will work with Campus Safety to file an incident report.

You may work only during your scheduled hours under the supervision of the lab director or laboratory instructor.

I agree to follow the safety rules as described. If I have any questions, I will ask the Lab Manager or Lab Director for assistance.

Name (Print): _____

Signature: _____

Date: _____

Lab Safety Rules for Vendors: Working in NMR Room (Adrian 105)

Nuclear Magnetic Resonance (NMR)

The Department of Chemistry and Physics at Barry University houses a Bruker AvanceCore 400 MHz NMR spectrometer in an NMR room (Adrian 105) specifically designated for this instrument. The NMR spectrometer is routinely used in teaching and research to characterize and identify structures of chemical compounds.

The NMR spectrometer produces strong magnetic and electromagnetic fields and precautions must be taken when working around the instrument.

10. Magnetic fields generated may interfere with users of pacemakers and other implanted ferromagnetic medical devices. A person with a pacemaker must be restricted to areas where the magnetic field is less than 5-gauss. **Before entering the NMR room, persons with pacemakers and other similar medical devices must consult with their physician.**
11. Cryogen dewars, gas cylinders, stepladders, tools, and all other equipment entering the room must be **non**-magnetic. Keep all magnetic items at least 6 feet away from the magnet (leave items out in the hallway). The strong magnetic field can pull nearby unrestrained objects towards the magnet with great force.
12. Though not a safety issue, before entering the NMR room, leave personal belongings such as analog watches, ATM cards, credit cards, etc. either out in the hallway or on top of the computer station. The magnetic field may erase magnetic media and disable equipment.
13. While working inside the NMR room, keep the door propped open.
14. The **superconducting magnet is always on**. All individuals working inside the NMR room must always be escorted by either the Laboratory Manager (305-899-3886) or Laboratory Director (305-899-3434).
15. Do not shut off the power or airflow to the Adrian building. **Must contact the Laboratory Manger (305-899-3886) or Laboratory Director (305-899-3434) prior to shut down.** Damage to the instrument may occur if the appropriate shutdown procedure is not performed.
16. When finished working, lock the NMR room door.

Cryogenics

A cryogen is a liquid with a normal boiling point below -150°C. The superconducting magnet

is immersed in liquid helium (boiling point of -269°C) with an outer layer/dewar of liquid nitrogen (boiling point of -196°C).

The Quench

When the superconductivity in an NMR magnet is lost, it is called a **quench**. During a quench, the liquid helium will quickly convert into gas and will vent out of the magnet dewar, filling the room. Helium is lighter than air, so it will fill the room from the top down. A cloud near the ceiling will be observed. Effects from oxygen deficiency may become noticeable at levels below 19.5%.



Oxygen monitor, Single Gas Clip, Model BW

When a quench occurs (oxygen monitor alarm will sound / observe sudden exhaust of gases from magnet),

5. Evacuate the room immediately. Leave the door open upon egress.
6. If there are labs running in Adrian 104 / 106, then notify the instructor(s). They will evacuate the room(s).
7. Contact the Lab Manager at 305-899-3886 or Lab Director at 305-899-3434.
8. No one should enter the NMR room until the helium has completely boiled off. Lab personnel will check oxygen monitor to ensure that it is safe to re-enter the area.
9. If anyone is injured, call 911. Then call University Campus Safety at 305-899-3333 so they can assist fire rescue upon arrival to campus. Lab Manager or Lab Director will work with Campus Safety to file an Incident Report.

I agree to follow the safety rules as described. If I have any questions, I will ask the lab manager or lab director for assistance.

Name (Print): _____

Signature: _____

Date: _____

Appendix C-3: Lab Safety Training

College of Arts & Sciences, Fine Arts

- **C-3.1: Photography Lab Expectations and Policies**
- **C-3.2: How Chemicals Enter the Body**
- **C-3.3: Photography Chemistry Details**
 - 4.3.1 Developing Baths**
 - 4.3.2 Stop Baths**
 - 4.3.3 Fixing Baths**
 - 4.3.4 Intensifiers and Reducers**
 - 4.3.5 Toners**
 - 4.3.6 Other Photographic Materials**

POLICIES OF THE BARRY UNIVERSITY PHOTOGRAPHY LABS

Health and safety are important issues, and no one in the University has a right to endanger either themselves or anyone else through uninformed or negligent use of implements, materials, or machinery. This manual has been compiled to provide basic information on safe practices and procedures in the photographic arts. It is intended to protect you and those around you. It is a basic requirement that you read and understand this manual before beginning to work in the Department of Fine Arts Photography Program. If you have any questions about the contents, please contact the department technicians or the department chair.

ACCESS TO SAFETY DATA SHEETS: In accordance with the law, the Fine Art Department maintains Safety Data Sheets on all chemicals in the studio areas. The MSD sheets are on file in the department office in a black and yellow notebook. These are open files for anyone wanting information about the safe handling of chemicals. Photography technicians, monitors and the department secretary or chair can provide assistance in accessing this information.

3.1 PHOTOGRAPHY LAB EXPECTATION AND POLICIES

Students in the Fine Arts Department shall:

1. familiarize themselves with the University's expectations of student conduct, and policies and procedures, and departmental regulations associated with all of their University related activities. These policies can be found in the student handbook and in the following manual for use of the photography labs.
2. familiarize themselves with safe handling and use of all photography supplies and materials.
3. seek guidance from their instructors or supervisors concerning safety-related knowledge and skills required to ensure safe performance in their activities and actively follow and directions they receive.
4. attend safety training programs and meetings when instructed.
5. immediately report to their instructor or supervisor any accident, near miss, hazardous practice, or condition with respect to their activities.
6. comply with the Health and Safety policies and procedures of other departments and institutions when they are engaged in activities in these other institutions.

Visitors shall:

1. comply with the University and photography lab's policies and procedures and all other pertinent departmental regulations.
2. agree not to use any equipment, handle any chemistry, or use the labs unless given specific special permission from the department chair, and after reading the following manual and signing an acknowledgement form.

SPECIFICS ON PHOTOGRAPHY

To take preventative measures, it is important to note the following:

3.2 How Chemicals Enter the Body:

Inhalation: This is the major route of entry for airborne chemicals. The chemicals can have a direct effect

on the nose, upper respiratory tract and the lungs or they can enter the blood stream and thus affect the blood, bone, heart, brain, liver, kidneys, or bladder.

Ingestion: This is not normally a direct route of entry from exposure except by willful or accidental ingestion. Materials can also enter the stomach through indirect means. For example, the lung has a cleaning mechanism which pushes material out of the lung where it can be swallowed. This can result in exposure to most of the internal organs or even in a local action on the stomach wall.

Skin Contact: Some materials are absorbed through the skin and therefore when they enter the bloodstream they can be transported throughout the body and accumulate in, or affect, the most sensitive areas of the body. Skin contact can also result in allergic reactions, the removal of the protective skin oil, or dermatitis. In some cases, the chemical contact may result in a cancerous lesion. Note: More detailed information on the hazards of chemicals found in art materials can be found in the Reading Room.

Arts and Reproduction:

Many chemicals used in art can also affect the reproductive system. Some chemicals have specific effects on the male reproductive system, e.g., cadmium, manganese, and lead. Others have specific effects on the female reproductive system, e.g., toluene and xylene, which cause menstrual irregularities. All these chemicals are common in art materials.

High Risk Groups:

Pregnant and Breast-feeding Women: Chemicals and other factors which are thought to cross the placental barrier and possibly cause damage and birth defects, include lead, cadmium, mercury, copper, carbon monoxide, dyes, noise, vibration, and many organic solvents. The amount of material necessary to damage the fetus or embryo is much smaller than the amount which can injure the adult. The most sensitive time for chemical interference with normal development is from the 18th to the 60th day after conception. Other hazards include materials that can affect respiratory and circulatory systems. Examples include solvents, dyes, metals, toxic dust, and gases, as well as strenuous activity and other stresses. Many chemicals, especially heavy metals and solvents can be found in a woman's milk several hours after exposure and can affect the infant. AVOID USE OF SOLVENTS AND AEROSOLS.

Children: Children are more susceptible to the effects of hazardous chemicals than adults are, and they should be closely supervised in the studio environment.

Smokers and Heavy Drinkers: These individuals are at a higher risk of damage to their lungs and liver respectively. Nicotine and/or alcohol mixed with toxic chemicals in art materials can cause synergistic and multiplicative reactions.

Individuals on Medications: Medications also create greater risk. Consult your physician to ensure that no medication will interact with substances in art materials to cause illness.

Note: Also, within the high-risk group are the physically disabled, the elderly, and those with allergies or illnesses.

3.3 PHOTOGRAPHY CHEMISTRY DETAILS

3.3.1.)Developing Baths

The most commonly used developer are hydroquinone, monomethyl para-aminophenol sulfate, and phenidone. Other common components of developing baths include an accelerator. often sodium carbonate or borax, sodium sulfite as a preservative and potassium bromide as a restrainer or antifogging agent.

Health General

Developers are commonly available in powder form and must be dissolved to make the developing bath. They are skin and eye irritants, and some are strong sensitizers. Monomethyl para-aminophenol sulphate creates many skin problems and allergies to it are frequent. Hydroquinone can cause depigmentation and eye injury after 5 or more years of continual exposure. Catechol and pyrogallol can be absorbed through the skin to cause severe poisoning. Phenidone is only slightly toxic by skin contact. Most developers are highly toxic by ingestion (some fatalities have occurred by accidentally drinking developer solution). Inhalation of powders is also hazardous.

Specifically:

1. Para-phenylene diamine and some of its derivatives are highly toxic by skin contact, inhalation, and ingestion. They cause very severe skin allergies and can be absorbed through the skin.
2. Sodium hydroxide, sodium carbonate, and other alkalis used as accelerators are moderately to highly corrosive by skin contact or ingestion. This is a particular problem with the pure alkali or with concentrated stock solutions.
3. Potassium bromide is moderately toxic by inhalation or ingestion and slightly toxic by skin contact. Symptoms of systemic poisoning include somnolence and depression. Lack of coordination, mental confusion, hallucinations, and skin rashes.
4. Sodium sulfite is moderately toxic by ingestion or inhalation causing gastric upset, colic, diarrhea, circulatory problems, and central nervous system depression. It is not appreciably toxic by skin contact. If heated or allowed to stand for a long period in water or acid, it decomposes to produce sulfur dioxide which is highly irritating by inhalation.

Precautions

1. Wear rubber gloves and goggles when handling developers in powder form or liquid solution. Wash gloves off before using them again. Wear an approved dust respirator when pouring developer dust.
2. Do not put your bare hands in developer baths. Use tongs instead. If developer solution splashes on your skin or eyes, immediately flush with water and report to the campus health center.
3. Label all solutions carefully to avoid accidental ingestion.
4. Do not use para-phenylene diamine or its derivatives if possible.

3.3.2.) Stop Baths

Stop baths are usually weak solutions of acetic acid. Acetic acid is commonly available as pure glacial acetic acid or 28% acetic acid. Some stop baths contain potassium chrome alum as a hardener.

Health Hazards

1. Acetic acid, in concentrated solutions, is highly toxic by inhalation, skin contact and ingestion. It can cause dermatitis and ulcers and can strongly irritate the mucous membranes. The final stop bath is only slightly hazardous by skin contact. Continual inhalation may cause chronic bronchitis. However, contamination of the stop bath by developer components can increase the hazard.
2. Potassium chrome alum or chrome alum (potassium chromium sulfate) is moderately toxic by skin contact causing dermatitis, allergies, and skin ulcers which might take a long time to heal. It is highly toxic by inhalation.

Precautions:

1. Wear gloves and goggles when handling concentrated solutions of acetic acid or when handling chrome alum. Always add acids to water, never the reverse.
2. All darkrooms require good ventilation to control the level of acetic acid vapors and other vapors and gases produced in photography. Kodak recommends at least 10 air changes per hour for work rooms and local exhaust ventilation for processing and mixing tanks which produce toxic vapors or gases.
3. Cover the acid bath (and other baths) when not in use to prevent evaporation or release of toxic vapors and gases.
4. Store concentrated acids and other corrosive chemicals on low shelves so as to reduce the chance of eye or face injury in case of breakage.

3.3.3) Fixing Baths

Fixing baths contain hypo or sodium thiosulfate as the fixing agent, acetic acid to neutralize developing action, and sodium sulfite as a preservative. Some fixing baths are hardened with alum (potassium aluminum sulfate) and boric acid (as a buffer).

Health Hazards:

2. In powder form sodium thiosulfate is not significantly toxic by skin contact. By ingestion it has a purging effect on the bowels. Upon heating or long standing in solution, it can decompose to form highly toxic sulfur dioxide, which can cause chronic lung problems.
3. Alum (potassium aluminum sulfate) is only lightly toxic. It may cause skin allergies or irritation in a few people.
4. Boric acid is moderately toxic by ingestion or inhalation and slightly toxic by skin contact (unless the skin is abraded or burned, in which case it can be highly toxic).
5. See previous sections for hazards of sodium sulfite and acetic acid.

Precautions

1. Ventilate the fixing bath as described in the previous section.
2. Follow the named precautions for mixing, handling, and using chemicals as described in previous section.

3.3.4) Intensifiers and Reducers

A common after treatment of negatives (and occasionally prints) is either intensification or reduction. [Intensification involves bleaching of the negative and subsequent redeveloping of the image. In this process, other heavy metals are usually added to the silver. Common intensifiers include mercuric chloride followed by ammonia or sodium sulfite, Monckhoven's intensifier consisting of a mercuric iodide/sodium sulfite, potassium bromide, and uranium nitrate. Reduction of negatives is usually done with Farmer's reducer, consisting of potassium ferrocyanide and hypo. Reduction can also be done with iodine/potassium cyanide, ammonium persulfate, and potassium permanganate/ sulfuric acid.

Health Hazards

2. Potassium or sodium cyanide are highly toxic by inhalation and ingestion. Stomach acids can convert salt into the highly poisonous gas hydrogen cyanide. This can also happen if cyanide salts are treated with acid.
3. Potassium ferrocyanide, although only slightly toxic by itself, will release hydrogen cyanide gas if heated, if hot acid is added, or if exposed to strong ultra-violet light.
4. Potassium chlorochromate can release highly toxic chlorine gases if heated or if acid is added.

Precautions:

1. Dichromate intensifiers are probably the least toxic you can use. However, gloves and goggles should still be worn when preparing and using them.
2. Do not expose potassium chlorochromate to acid or heat.
3. If possible do not use cyanides. If it is necessary to use them, do so only in a fume hood or other local exhaust hood. Take very careful precautions to ensure that cyanide solutions do not become contaminated with acids. Have an antidote kit available.
4. The safest reducer to use is farmer's reducer. Do not expose farmer's reducer to hot acid, ultraviolet light, or heat.

3.3.5.) Toner

Toning a print usually involves replacement of silver by another metal, for example gold, selenium, uranium, platinum, or iron. In some cases, the toning involves the replacement of silver metal by the brown silver sulfide, for example, in the various types of sulfide toners. A variety of other chemicals are also used in the toning solutions.

Health Hazards

2. Many of the metals used in toning are highly toxic, particularly by ingestion.
3. Sodium and potassium sulfide release the highly toxic gas hydrogen sulfide when treated with acid. Similarly, treatment of selenium salts with acid may release highly toxic hydrogen selenide gas.
4. Thiourea is a suspected carcinogen since it causes cancer in animals.

Precautions:

1. Carry out normal precautions for handling toxic chemicals as described in previous sections. Wear gloves, goggles, and dust respirator when mixing and handling acids and alkalis.
2. Take precautions to make sure that sulfide or selenium toners are not contaminated with acids. For example, with two bath sulfide toners, make sure you rinse the print well after bleaching in acid solution before dipping it in the sulfide developer.

3.3.6) Other Photographic Chemicals

Many other chemicals are also used in black and white processing, including formaldehyde as a pre-hardener, a variety of strong oxidizing agents such as hypo eliminators (e.g., hydrogen peroxide and ammonia, potassium permanganate, bleaches, and potassium persulfate), sodium sulfide to test for residual silver, silver nitrate to test for residual hypo, solvents such as methyl chloroform and freons for film and print cleaning, and concentrated acids to clean trays.

Health Hazards

Concentrated sulfuric acid mixed with potassium permanganate or potassium dichromate produces highly corrosive permanganic and chromic acids. Hypochlorite bleaches can release highly toxic chlorine gas when acid is added, or it is heated. Potassium persulfate and other strong oxidizing agents can be explosive when in contact with easily oxidizable materials such as many solvents and organic materials. Formaldehyde is a throat, eye, and respiratory system irritant, which can also cause dermatitis and asthma. It is a suspected carcinogen.

Precautions

1. Cleaning acids should be handled with great care. Wear gloves and goggles and make sure the acid is always added to the water when diluting. An acid-proof apron should be worn to protect your body against splashes. The acid should be disposed of by pouring down the sink very slowly and flushing with water continually for at least 15 min. afterward.
2. Do not add acid to hypochlorite bleaches and do not heat.
3. Keep potassium persulfate and other strong oxidizing agents separate from flammable and easily oxidizable substances.
4. The hazards of formaldehyde can be minimized through dilution ventilation, such as an exhaust fan.

Note:

Most photographic chemicals, diluted in solutions normally used in processing, contain relatively low concentrations of toxic substances, and therefore have low toxicity ratings for ingestion. Swallowing these solutions may produce mild transient gastro-intestinal symptoms. However, some toxicologists believe that major potential for hazards lies in continuous inhalation and skin absorption of these chemicals over long periods of time. Photographers expose themselves to vapors rising from large surfaces of trays, especially when darkroom temperatures exceed 21 C. and ventilation is poor. They expose the skin of their hands to all these chemicals as they handle prints and move them through the various stages of processing. Low-level exposure to photographic chemicals is believed to have a cumulative effect on the various organs, such as the liver and kidneys, which must metabolize, store, or excrete them, and on the

central nervous system and respiratory tract. Such exposure has also led to the development of asthma and the worsening of other pre-existing lung conditions for some photographers, students and other people living near unventilated darkrooms.

WHAT YOU SHOULD DO

Everyone who works with photographic chemicals should have a basic understanding of the nature of chemicals and their interaction with each other. Photographers and artists should adhere to the following procedures in order to avoid injury or illness:

1. ALWAYS check that the ventilators are turned on in the darkroom.
2. Wear eye protection when using power equipment, filing, sanding, grinding, polishing an object or when mixing or pouring chemistry.
3. Wear a dust mask or ventilator when sanding, filing, or spraying any materials or mixing and pouring chemistry.
4. Use good housekeeping practices. Wipe up all spills and splashes promptly; dispose of rags and papers contaminated with chemicals.
5. Use aerosol spray products only in a spray booth or with efficient exhaust ventilation.
6. Avoid skin contact with chemicals by using protective gloves or tongs.
7. Wash hands frequently and thoroughly.
8. Change work clothes and launder them frequently. Wash hands well before eating, smoking, or using the toilet.
9. Do not smoke, eat, or drink in photograph labs. This includes classrooms.
10. Never lean over trays, tanks, or open containers while printing or mixing chemistry or for prolonged periods without a mask and goggles.
11. Avoid injury by lifting heavy objects properly and with help.
12. Do not light fires or use heat equipment in the presence of chemistry and in areas that are not set up for that usage.
13. Label materials and chemistry clearly and properly store them in safe containers.
14. SUBSTITUTE less hazardous materials or techniques when possible. There are many instances where highly toxic chemicals can be replaced by less toxic materials.
15. KNOW the materials and their hazards. If labels do not adequate information regarding contents, hazards, and precautions, use resource books to research the product your health is worth the effort.
16. ASK if you are unsure about the operation of any equipment. Misuse of tools leads to accidents. No equipment is to be altered or modified unless on manufacturers recommendation.
17. In case of serious emergency, first dial 9-11, *then* call Campus Safety.
18. Phone numbers and procedures for dealing with any injuries in the lab are posted in the main classroom near the computers in case of emergency.

DARKROOM SAFETY PROCEDURES ACKNOWLEDGEMENT AND AGREEMENT

In signing this form, I acknowledge that I have read thoroughly and understand the risks, procedures and expectations set forth in safely handling materials in the photography lab.

I also agree to follow these policies and procedures as well as adhere to the Barry University student code of conduct, as outlined in the student handbook, when I am working in the photography labs.

Student

Date

Technician

Date

<p style="text-align: center;">Appendix C-4: Lab Safety Training College of Health Professions & Medical Sciences</p>

- **C-4.1: Safety Review Acknowledgement**

- **C-4.2: Hold Harmless Agreement Form**

Section C-4.1

Safety Review Acknowledgement

Semester:

Student Name:

- ☐ Review of laboratory Evacuation Plan
- ☐ Location of Safety Data Sheets and instructions on use.
- ☐ Location of Protective Equipment and demonstrated use (eye protection, footwear, gloves, laboratory coat, surgical mask, biological safety cabinet, fume hood).
- ☐ Review of emergency procedures for spills of hazardous chemicals.
- ☐ Identification of emergency equipment location and procedures (emergency eyewash, emergency shower, fire alarm pull station, fire extinguisher, telephone, etc.)
- ☐ Location of waste disposal areas and knowledge of waste disposal procedures for tissue specimens, bio-hazardous material, chemicals, sharps/broken glass.

Student/Participant Signature: _____

Date: _____

Laboratory Supervisor Signature: _____

Date: _____

Program Director Signature: _____

Date: _____

Section C-4.2

HOLD HARMLESS AGREEMENT

FOR BARRY UNIVERSITY'S COLLEGE OF HEALTH PROFESSIONS & MEDICAL SCIENCES

AND LABORATORIES

I HEREBY ACKNOWLEDGE AND AGREE that my participation in classes, activities and open labs organized and sponsored by Barry University's College of Health Professions & Medical Sciences Clinical Biology Laboratories may carry with it certain inherent risks, including those normally associated with laboratory equipment and materials that may cause bodily harm if improperly used. All participants in the laboratory setting are informed of the potential hazards to which they may be exposed while in the laboratory, as well as the appropriate precautions to protect themselves. This information may be provided by signage, instruction, discussion, or other means.

In consideration of my participation in the laboratory activities, I, the undersigned, on behalf of myself, my heirs, representatives, executors, administrators and assigns, do hereby release, indemnify, and hold harmless Barry University their Trustees, officers, agents, and employees from any cause of action, claims, or demands of any nature whatsoever, which I, my heirs, representatives, executors, administrators, and assigns may now have, or have in the future against Barry University on account of person injury, property damage, death or accident of any kind, arising out of or in any way related to my participation in Barry University's College of Health Professions & Medical Sciences Clinical Biology Laboratory, whether that participation is supervised or unsupervised, however the injury or damage is caused, other than those injuries resulting from sole negligence of Barry University.

I certify that I am in good health and that I have no physical limitations that would preclude my safe participation in these educational activities.

I further certify that I am therefore of lawful age (18 years or older) and otherwise legally competent to sign this agreement. I understand that the terms of this agreement are legally binding, and I certify that I am carefully signing this agreement, after having carefully read same, of my own free will.

Signature of Participant _____ **Date** _____

Print Name _____

In case of emergency please leave the contact information of whom we may contact

Name:

Phone:

Address

Appendix C-5: Lab Safety Training

School of Podiatric Medicine



- **C-5.1: Rules of the Lab**
- **C-5.2: Pledge of Respect, Anatomical Board of the State of Florida**



Section C-5.1

RULES OF THE LAB:

- 1) Respect must be shown to the cadavers at all times. No crude jokes in the lab will be tolerated.
- 2) Human remains must be properly handled and stored.
 - a) All tissue must be disposed of in their proper container
 - b) Cadavers must be kept moist with wetting solution. They should be kept covered with a sheet when not in use.
 - c) Cadaver organs or parts may not be removed from the bag without permission.
 - a) Bones and other models are to be handled with bare hands or clean gloves.
 - b) Anatomical waste must be disposed of in assigned containers.
 - c) Human remains or models must not be taken out of the lab.
- 3) Students must be properly dressed and prepared to dissect when entering the lab.
 1. Enclosed shoes, lab coat, and scrubs (Barry scrubs) and gloves must be worn at all times.
 2. All head-coverings (hats, caps, bandanas, etc.) must be removed during lab time. Head attire for religious reasons IS PERMITTED. Long hair must be held back.
 3. Protective eye wear must be worn when using a chisel or a saw.
 4. REMOVE lab coats and gloves, wash hands prior to exiting the lab.
 5. Students who are pregnant or have a medical condition sensitive to formaldehyde exposure should notify the course director so precautionary measures can be implemented. (see syllabus)
 6. Injuries must be reported to the lab director immediately.
- 4) Scalpel blades must be disposed of in the Sharps container only. Dissecting tools must be removed from cadaver bags and cleaned at the end of lab.
- 5) Cameras or other image capturing devices are not allowed in the anatomy lab without authorization of the anatomy lab director. PHOTOGRAPHS ARE NOT ALLOWED.
- 6) Tablets provided by Barry University must only be used for Anatomy study. Social media or other personal activities are not allowed. Only clean hands should touch electronic devices.

- 7) No food or drink material are permitted in the lab.
- 8) Students are not allowed to be in the lab without an assigned Teaching Assistant or Instructor present.
- 9) Visitors are not allowed in the anatomy lab without the permission of the anatomy lab director. This includes 2-4th year students, residents, faculty, staff, visitors, researchers, and outside vendors.
- 10) Unauthorized use of the lab is not permitted. Use for research must be approved by the Lab Director.
- 11) Only course directors and the anatomy lab directors may have keys. Keys for emergent use will be kept with the Operations Manager basic sciences admin office.
- 12) Those who do not adhere to the above rules will be dismissed from the lab and further action may be taken. The anatomy lab director has the right to refuse admittance to anyone disruptive to the learning environment of the anatomy lab.

Hassan Azari, PhD
Associate Professor of Anatomy, Anatomy Lab Director

I have read and understand the rules of the lab.

Sign _____

Date _____

February 4, 2020

Print name _____

Section C-5.2



**ANATOMICAL BOARD OF THE
STATE OF FLORIDA**

**University of Florida
College of Medicine
PO Box 100235
Gainesville, Florida 32610-0235
Telephone: 352-392-3588
1-800-628-2594**

Pledge of Respect

**Policies and Procedures Applicable to _____
Students and Residents/Fellows**

Once a donated human anatomical specimen is made accessible to a faculty member of The _____, the responsibility for the security and proper storage of the human anatomical specimen is that of the faculty member and the faculty member's program. Consonant with this responsibility, every student and resident having access to human anatomical specimens under the supervision of the faculty member will be required to sign the following pledge prior to having access to a donated human anatomical specimen provided by the Anatomical Board:

Pledge of Respect for the Sanctity of Donated Human Anatomical Specimens

I, the undersigned student, resident or fellow, recognize that the bequest of human remains to the Anatomical Board of the State of Florida represents a direct and important contribution to medical teaching and research. Such donations allow health professional faculty and students the opportunity to closely examine, evaluate, and understand the detailed structure of the human body. Further, the caring and thoughtfulness of such bequests provides physicians and research scientists with the opportunity to gain knowledge that may prolong, improve, or save someone's life. Without such bequests, medical science and health care would suffer devastating setbacks.

In recognition of the generosity of such bequests, I understand that the policy of the Anatomical Board of the State of Florida is to treat donated human anatomical specimens with the utmost respect and gratitude at all times, and I pledge to comply with this policy. I acknowledge that NO PHOTOGRAPHY of any part of any human specimen is permitted without permission from the Executive Director of the Anatomical Board. I further pledge that the donated human anatomical specimens to which I have access will remain in specific teaching/research rooms or storage space approved for such use by the Anatomical Board, unless a signed authorization for transfer elsewhere has been executed by the Executive Director of the Anatomical Board of the State of Florida or his/her authorized designee. I further pledge to

comply with all applicable requirements for timely return of human anatomical specimens to the Anatomical Board of the State of Florida.

Signature

Date

Typed or Printed Name: _____

Title: _____

Department/College: _____

Miami Office:

University of Miami
School of Medicine
Department of Anatomy - R124
PO Box 016960
Miami, FL 33101-6960
Telephone: 305-243-6691

Tampa Office:

University of South Florida
College of Medicine
Department of Anatomy, MDC-006
12901 Bruce B. Downs Blvd.
Tampa, FL 33612-4799
Telephone: 813-974-2843

Tallahassee Office:

Florida State University
College of Medicine
Tallahassee, FL
32306-4300
Telephone: 850-644-7501

EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

Form last modified November 4, 2003

Appendix C-6: Service Animal and Emotional Support Animal in Labs
--

**C-6.1 Lab Safety Guidelines for Service Animal and Emotional
Support Animal in Labs**

C-6.2 Lab Safety Sheet for Service Animal in Labs

Section C-6.1

Safety Guidelines for Service Animal and Emotional Support Animal in Labs

All service animals and ESA (emotional support animals) must be registered with Barry University's OAS (Office of Accessibility Services).

Contact information:

- Office Director & University ADA/504 Coordinator Dr. Rebecca Murray rmurray@barry.edu
- Accessibility Accommodations Coordinator Aneesa Mandani amandani@barry.edu
- Accessibility Accommodations Coordinator Maria DeMartino mdemartino@barry.edu

OAS location: Landon Student Union 304.

Tel / TDD: 305-899-3488

E-mail: accessibilityservices@barry.edu

The OAS has policies on both Service Animals and ESA:

<https://www.barry.edu/en/academic-affairs/accessibility-services/?r=rdt&rdts=my.barry.edu>

Key differences between service animals and ESA:

- ⇒ Only service animals are approved by the ADA (Americans with Disabilities Act). Service animals are working animals, allowed to accompany their handlers in most public places. https://www.ada.gov/service_animals_2010.htm
- ⇒ An ESA is a pet that provides therapeutic support or comfort for a person with a documented disability. ESAs are allowed in the residence halls, following the Fair Housing Act stipulations.

Even if an ESA is registered with the Office of Accessibility Services, it is up to the instructor / department to decide whether the lab is a good environment for the ESA.

Should the instructor/department decide to allow an ESA into the lab, then the ESA must follow the same safety guidelines that a service animal would follow.

Section C-6.2

Lab Safety Sheet for Service Animal in Labs

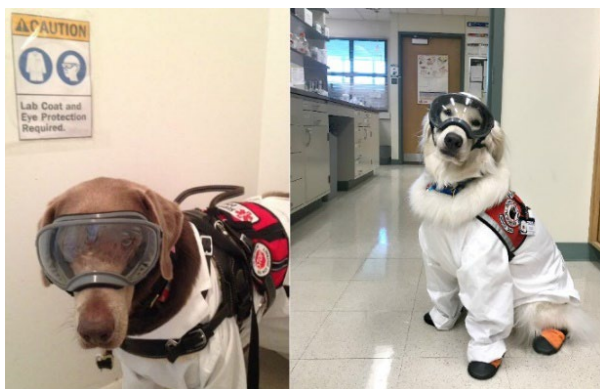
Chemical Hazards

The lab director will provide the handler (student) with a list of all the chemicals that will be involved in the experimental procedures for that semester, so that the student may make an informed decision regarding the service animal.

Personal Protective Equipment

The general guidelines are that whatever PPE the student wears in a lab, so must the service animal. When there is a “dry lab” (no chemical or physical hazards), then the service animal must wear protective footwear as described below.

- The department will provide a lab drawer containing the PPE for the service animal:
 - chemical splash-proof safety goggles (indirect vent)
 - disposable lab coat (waterproof and tear resistant)
 - protective footwear—disposable boots (waterproof and tear resistant)



<https://www.the-scientist.com/news-opinion/the-challenges-of-bringing-service-dogs-into-the-lab-64812>

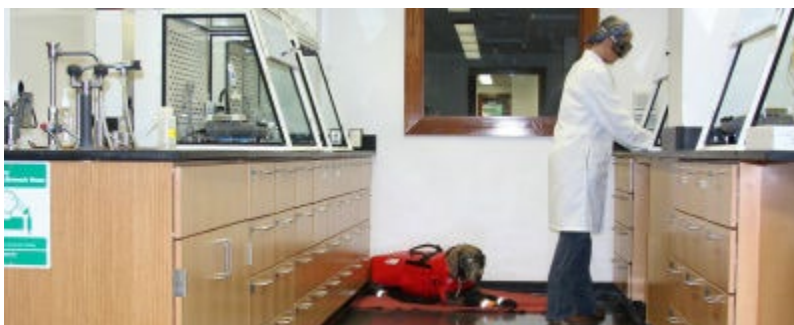
Potential Vendors:

- Eye Protection and Protective Footwear
 - Chewy <https://www.chewy.com/doggles-ils-dog-goggles-pink-x-small/dp/145714>
 - Petco <https://www.petco.com/shop/en/petcostore>
 - Rex Specs <http://www.rexspecs.com>
 - Pawz Dog Boots <http://pawzdogboots.com/>
- Disposable Lab Coats
 - Maytex http://maytexcorp.com/products_apparel.htm

- To protect the service animal while it lies on the floor, protective padding such as plastic-backed lab paper (or mat with rubber backing) will be provided.

Lab Protocols

- The service animal may be present in the lab—as long as the animal is under the control by its handler at all times.
- The service animal is expected to be willing to stand under a safety shower, if necessary, either for itself or if its handler needs to be under the safety shower.
- The designated workspace will be located close to an egress as to allow for easier access and keep the service animal away from traffic in the space.



<https://www.the-scientist.com/news-opinion/the-challenges-of-bringing-service-dogs-into-the-lab-64812>

- Before class begins, reagents and equipment for that day's experiment will be placed on the assigned bench area. Service dog team need to coordinate with Instructor for access to communal equipment.
- The service animal should be trained NOT to retrieve items off the floor.
- For experiments that involve the use of chemicals or instrumentation that may interfere with the service animal's ability to provide its service, an alternative assignment or modification to the experimental procedure will be provided.
- Service animals need to remain leashed or tethered at all times, unless doing so prevents them from performing their necessary service.
- At the end of the lab period, the service animal's safety goggles will be stored in its designated lab drawer. The disposable lab coat and boots worn for that experiment will be discarded.

I have read and understood the above safety rules for my service animal (or emotional support animal), and I agree to abide by them.

PRINT Name: _____

Course & Section #: _____

Signature: _____

Date: _____

Appendix D: Incident Report Form

Barry University Laboratory Incident Report Form (Minor Incidents Only)

THIS FORM IS TO BE USED WHEN THE FIRST AID KIT IS USED AND IS FOR MINOR INCIDENTS ONLY. FOR EMERGENCY MEDICAL CARE, CALL 911 FIRST AND THEN CAMPUS SAFETY AT 305-899-3333 (if using campus phone, x-3333).

Name of Injured Person: _____

Status (Check One): _____ Student: _____ Instructor: _____ Other _____ (Specify)

Name of Lab instructor: _____

Date of incident: _____; Time of Incident: _____

Building & Room number: _____; Course number & section: _____

Description of Injury / Incident: _____

Action Taken/Resolution: _____

- ☐ **For major, life-threatening injury**, 911 and Campus Safety were called
- ☐ **For minor injuries received by student**, please check one of the following:
 - ☐ Student **agreed** to go to the Student Health Center for evaluation and treatment.
 - ☐ Student **refused** to go to the Student Health Center for evaluation and treatment.
- ☐ **For injuries received by employee**, report was made to Human Resources.

Report Prepared by _____; Date _____

Laboratory Instructor's Signature _____; Date _____

Injured Person's Signature _____; Date _____

SUBMIT TO LABORATORY DIRECTOR.

Appendix E: Exposure Assessment, Formaldehyde

- **OSHA 29CFR 1910.1048 App A**
Substance Technical Guidelines for Formalin

- **OSHA 29CFR 1910.1048 App B**
Sampling Strategy and Analytical Methods for Formaldehyde



UNITED STATES
DEPARTMENT OF LABOR

• Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	Z
• Subpart Title:	Toxic and Hazardous Substances
• Standard Number:	1910.1048 App A
• Title:	Substance technical guidelines for formalin

The following Substance Technical Guideline for Formalin provides information on uninhibited formalin solution (37 percent formaldehyde, no methanol stabilizer). It is designed to inform employees at the production level of their rights and duties under the formaldehyde standard whether their job title defines them as workers or supervisors. Much of the information provided is general; however, some information is specific for formalin. When employee exposure to formaldehyde is from resins capable of releasing formaldehyde, the resin itself and other impurities or decomposition products may also be toxic, and employers should include this information as well when informing employees of the hazards associated with the materials they handle. 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 present. 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 1 percent formaldehyde. Individual Substance Technical Guidelines used by the employer for training employees should be modified to properly give information on the material actually being used.

Substance Identification

Chemical Name: Formaldehyde

Chemical Family: Aldehyde

Chemical Formula: HCHO

Molecular Weight: 30.03

Chemical Abstracts Service Number (CAS Number): 50-00-0

Synonyms: Formalin; Formic Aldehyde; Paraform; Formol; Formalin (Methanol-free); Fyde; Formalith; Methanal; Methyl Aldehyde; Methylene Glycol; Methylene Oxide; Tetraoxymethalene; Oxomethane; Oxymethylene

Components and Contaminants

Percent: 37.0 Formaldehyde

Percent: 63.0 Water

(Note.-Inhibited solutions contain methanol.)

Other Contaminants: Formic acid (alcohol free) Exposure Limits:

OSHA TWA-1 ppm

OSHA STEL-2 ppm

Physical Data

Description: Colorless liquid, pungent odor
Boiling point: 214 deg. F (101 deg. C)
Specific Gravity: 1.08 (H₂O=1 at 20 deg. C)
pH: 2.8-4.0
Solubility in Water: Miscible
Solvent Solubility: Soluble in alcohol and acetone
Vapor Density: 1.04 (Air=1 at 20 deg. C)
Odor Threshold: 0.8-1 ppm

Fire and Explosion Hazard

Moderate fire and explosion hazard when exposed to heat or flame.

The flash point of 37 percent formaldehyde solutions is above normal room temperature, but the explosion range is very wide, from 7 to 73 percent by volume in air.

Reaction of formaldehyde with nitrogen dioxide, nitromethane, perchloric acid and aniline, or peroxyformic acid yields explosive compounds.

Flash Point: 185 deg. F (85 deg. C) closed cup
Lower Explosion Limit: 7 percent
Upper Explosion Limit: 73 percent
Autoignition Temperature: 806 deg. F (430 deg. C)
Flammability (OSHA): Category 4 flammable liquid

Extinguishing Media: Use dry chemical, "alcohol foam", carbon dioxide, or water in flooding amounts as fog. Solid streams may not be effective. Cool fire-exposed containers with water from side until well after fire is out.

Use of water spray to flush spills can also dilute the spill to produce nonflammable mixtures. Water runoff, however, should be contained for treatment.

National Fire Protection Association Section 325M Designation:

Health: 2-Materials hazardous to health, but areas may be entered with full-faced mask self-contained breathing apparatus which provides eye protection.

Flammability: 2-Materials which must be moderately heated before ignition will occur. Water spray may be used to extinguish the fire because the material can be cooled below its flash point.

Reactivity: D-Materials which (in themselves) are normally stable even under fire exposure conditions and which are not reactive with water. Normal firefighting procedures may be used.

Reactivity

Stability: Formaldehyde solutions may self-polymerize to form paraformaldehyde which precipitates.

Incompatibility (Materials to Avoid): Strong oxidizing agents, caustics, strong alkalies, isocyanates, anhydrides, oxides, and inorganic acids. Formaldehyde reacts with hydrochloric acid to form the potent carcinogen, bis-chloromethyl ether. Formaldehyde reacts with nitrogen dioxide, nitromethane, perchloric acid and aniline, or peroxyformic acid to yield explosive compounds. A violent reaction occurs when formaldehyde is mixed with strong oxidizers.

Hazardous Combustion or Decomposition Products: Oxygen from the air can oxidize formaldehyde to formic acid, especially when heated. Formic acid is corrosive.

Health Hazard Data

Acute Effects of Exposure

Ingestion (Swallowing): Liquids containing 10 to 40 percent formaldehyde cause 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 formaldehyde solutions (0.03-0.04 percent) may cause discomfort in the stomach and pharynx.

Inhalation (Breathing): Formaldehyde is highly irritating to the upper respiratory tract and eyes. 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 persons. Concentrations 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. Deaths from accidental exposure to high concentrations of formaldehyde have been reported.

Skin (Dermal): Formalin is a severe skin irritant and a sensitizer. Contact with formalin causes white discoloration, smarting, drying, cracking, and scaling. Prolonged and repeated contact can cause numbness and a hardening or tanning of the skin. Previously exposed persons may react to future exposure with an allergic eczematous dermatitis or hives.

Eye Contact: Formaldehyde solutions splashed in the eye can cause injuries ranging from transient discomfort to severe, permanent corneal clouding and loss of vision. The severity of the effect depends on the concentration of formaldehyde in the solution and whether or not the eyes are flushed with water immediately after the accident.

Note.-The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

Acute Animal Toxicity:

Oral, rats: LD50=800 mg/kg

Oral, mouse: LD50=42 mg/kg

Inhalation, rats: LCLo=250 mg/kg

Inhalation, mouse: LCLo=900 mg/kg

Inhalation, rats: LC50=590 mg/kg

Chronic Effects of Exposure

Carcinogenicity: Formaldehyde has the potential to cause cancer in humans. Repeated and prolonged exposure increases the risk. Various animal experiments have conclusively shown formaldehyde to be a carcinogen in rats. In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages.

Mutagenicity: Formaldehyde is genotoxic in several in vitro test systems showing properties of both an initiator and a promoter.

Toxicity: Prolonged or repeated exposure to formaldehyde may result in respiratory impairment. Rats exposed to formaldehyde at 2 ppm developed benign nasal tumors and changes of the cell structure in the nose as well as inflamed mucous membranes of the nose. Structural changes in the epithelial cells in the human nose have also been observed. Some persons have developed asthma or bronchitis following exposure to formaldehyde, most often as the result of an accidental spill involving a single exposure to a high concentration of formaldehyde.

Emergency and First Aid Procedures

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

Inhalation (Breathing): Remove the victim from the exposure area to fresh air immediately. Where the formaldehyde concentration may be very high, each rescuer must put on a self-contained breathing apparatus before attempting to remove the victim, and medical personnel should be informed of the formaldehyde exposure immediately. If breathing has stopped, give artificial respiration. Keep the affected person warm and at rest. Qualified first-aid or medical personnel should administer oxygen, if available, and maintain the patient's airways and blood pressure until the victim can be transported to a medical facility. If exposure results in a highly irritated upper respiratory tract and coughing continues for more than 10 minutes, the worker should be hospitalized for observation and treatment.

Skin Contact: Remove contaminated clothing (including shoes) immediately. Wash the affected area of your body with soap or mild detergent and large amounts of water until no evidence of the chemical remains (at least 15 to 20 minutes). If there are chemical burns, get first aid to cover the area with sterile, dry dressing, and bandages. Get medical attention if you experience appreciable eye or respiratory irritation.

Eye Contact: Wash the eyes immediately with large amounts of water occasionally lifting lower and upper lids, until no evidence of chemical remains (at least 15 to 20 minutes). In case of burns, apply sterile bandages loosely without medication. Get medical attention immediately. If you have experienced appreciable eye irritation from a splash or excessive exposure, you should be referred promptly to an ophthalmologist for evaluation.

Emergency Procedures

Emergencies: If you work in an area where a large amount of formaldehyde could be released in an accident or from equipment failure, your employer must develop procedures to be followed in event of an emergency. You should be trained in your specific duties in the event of an emergency, and it is important that you clearly understand these duties. Emergency equipment must be accessible, and you should be trained to use any equipment that you might need. Formaldehyde contaminated equipment must be cleaned before reuse.

If a spill of appreciable quantity occurs, leave the area quickly unless you have specific emergency duties. Do not touch spilled material. Designated persons may stop the leak and shut off ignition sources if these procedures can be done without risk. Designated persons should isolate the hazard area and deny entry except for necessary people protected by suitable protective clothing and respirators adequate for the exposure. Use water spray to reduce vapors. Do not smoke and prohibit all flames or flares in the hazard area.

Special Firefighting Procedures: Learn procedures and responsibilities in the event of a fire in your workplace. Become familiar with the appropriate equipment and supplies and their location. In firefighting, withdraw immediately in case of rising sound

from venting safety device or any discoloration of storage tank due to fire.

Spill, Leak, and Disposal Procedures

Occupational Spill: For small containers, place the leaking container in a well-ventilated area. Take up small spills with absorbent material and place the waste into properly labeled containers for later disposal. For larger spills, dike the spill to minimize contamination and facilitate salvage or disposal. You may be able to neutralize the spill with sodium hydroxide or sodium sulfite. Your employer must comply with EPA rules regarding the clean-up of toxic waste and notify state and local authorities, if required. If the spill is greater than 1,000 lb/day, it is reportable under EPA's Superfund legislation.

Waste Disposal: Your employer must dispose of waste containing formaldehyde in accordance with applicable local, state, and Federal law and in a manner that minimizes exposure of employees at the site and of the clean-up crew.

Monitoring and Measurement Procedures

Monitoring Requirements: If your exposure to formaldehyde exceeds the 0.5 ppm action level or the 2 ppm STEL, your employer must monitor your exposure. Your employer need not measure every exposure if a "high exposure" employee can be identified. This person usually spends the greatest amount of time nearest the process equipment. If you are a "representative employee", you will be asked to wear a sampling device to collect formaldehyde. This device may be a passive badge, a sorbent tube attached to a pump, or an impinger containing liquid. You should perform your work as usual but inform the person who is conducting the monitoring of any difficulties you are having wearing the device.

Evaluation of 8-hour Exposure: Measurements taken for the purpose of determining time-weighted average (TWA) exposures are best taken with samples covering the full shift. Samples collected must be taken from the employee's breathing zone air.

Short-term Exposure Evaluation: If there are tasks that involve brief but intense exposure to formaldehyde, employee exposure must be measured to assure compliance with the STEL. Sample collections are for brief periods, only 15 minutes, but several samples may be needed to identify the peak exposure.

Monitoring Techniques: OSHA's only requirement for selecting a method for sampling and analysis is that the methods used accurately evaluate the concentration of formaldehyde in employees' breathing zones. Sampling and analysis may be performed by collection of formaldehyde on liquid or solid sorbents with subsequent chemical analysis. Sampling and analysis may also be performed by passive diffusion monitors and short-term exposure may be measured by instruments such as real-time continuous monitoring systems and portable direct reading instruments.

Notification of Results: Your employer must inform you of the results of exposure monitoring representative of your job. You may be informed in writing, but posting the results where you have ready access to them constitutes compliance with the standard.

Protective Equipment and Clothing

[Material impervious to formaldehyde is needed if the employee handles formaldehyde solutions of 1 percent or more. Other employees may also require protective clothing or equipment to prevent dermatitis.]

Respiratory Protection: Use NIOSH-approved full facepiece negative pressure respirators equipped with approved cartridges or canisters within the use limitations of these devices. (Present restrictions on cartridges and canisters do not permit them to be used for a full work shift.) In all other situations, use positive pressure respirators such as the positive-pressure air purifying respirator or the self-contained breathing apparatus (SCBA). If you use a negative pressure respirator, your employer must provide you with fit testing of the respirator at least once a year.

Protective Gloves: Wear protective (impervious) gloves provided by your employer, at no cost, to prevent contact with formalin. Your employer should select these gloves based on the results of permeation testing and in accordance with the ACGIH

Guidelines for Selection of Chemical Protective Clothing.

Eye Protection: If you might be splashed in the eyes with formalin, it is essential that you wear goggles or some other type of complete protection for the eye. You may also need a face shield if your face is likely to be splashed with formalin, but you must not substitute face shields for eye protection. (This section pertains to formaldehyde solutions of 1 percent or more.)

Other Protective Equipment: You must wear protective (impervious) clothing and equipment provided by your employer at no cost to prevent repeated or prolonged contact with formaldehyde liquids. If you are required to change into whole-body chemical protective clothing, your employer must provide a change room for your privacy and for storage of your normal clothing.

If you are splashed with formaldehyde, use the emergency showers and eyewash fountains provided by your employer immediately to prevent serious injury. Report the incident to your supervisor and obtain necessary medical support.

Entry Into an IDLH Atmosphere

Enter areas where the formaldehyde concentration might be 100 ppm or more only with complete body protection including a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a supplied air respirator with full facepiece and operated in a positive pressure mode. This equipment is essential to protect your life and health under such extreme conditions.

Engineering Controls

Ventilation is the most widely applied engineering control method for reducing the concentration of airborne substances in the breathing zones of workers. There are two distinct types of ventilation.

Local Exhaust: Local exhaust ventilation is designed to capture airborne contaminants as near to the point of generation as possible. To protect you, the direction of contaminant flow must always be toward the local exhaust system inlet and away from you.

General (Mechanical): General dilution ventilation involves continuous introduction of fresh air into the workroom to mix with the contaminated air and lower your breathing zone concentration of formaldehyde. Effectiveness depends on the number of air changes per hour. Where devices emitting formaldehyde are spread out over a large area, general dilution ventilation may be the only practical method of control.

Work Practices: Work practices and administrative procedures are an important part of a control system. If you are asked to perform a task in a certain manner to limit your exposure to formaldehyde, it is extremely important that you follow these procedures.

Medical Surveillance

Medical surveillance helps to protect employees' health. You are encouraged strongly to participate in the medical surveillance program.

Your employer must make a medical surveillance program available at no expense to you and at a reasonable time and place if you are exposed to formaldehyde at concentrations above 0.5 ppm as an 8-hour average or 2 ppm over any 15-minute period. You will be offered medical surveillance at the time of your initial assignment and once a year afterward as long as your exposure is at least 0.5 ppm (TWA) or 2 ppm (STEL). Even if your exposure is below these levels, you should inform your employer if you have signs and symptoms that you suspect, through your training, are related to your formaldehyde exposure because you may need medical surveillance to determine if your health is being impaired by your exposure.

The surveillance plan includes:

- (a) A medical disease questionnaire.
- (b) A physical examination if the physician determines this is necessary.

If you are required to wear a respirator, your employer must offer you a physical examination and a pulmonary function test every year.

The physician must collect all information needed to determine if you are at increased risk from your exposure to formaldehyde. At the physician's discretion, the medical examination may include other tests, such as a chest x-ray, to make this determination.

After a medical examination the physician will provide your employer with a written opinion which includes any special protective measures recommended and any restrictions on your exposure. The physician must inform you of any medical conditions you have which would be aggravated by exposure to formaldehyde.

All records from your medical examinations, including disease surveys, must be retained at your employer's expense.

Emergencies

If you are exposed to formaldehyde in an emergency and develop signs or symptoms associated with acute toxicity from formaldehyde exposure, your employer must provide you with a medical examination as soon as possible. This medical examination will include all steps necessary to stabilize your health. You may be kept in the hospital for observation if your symptoms are severe to ensure that any delayed effects are recognized and treated.

[71 FR 16673, April 3, 2006; 78 FR 9313, Feb. 8, 2013]



UNITED STATES
DEPARTMENT OF LABOR

• Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	Z
• Subpart Title:	Toxic and Hazardous Substances
• Standard Number:	1910.1048 App B
• Title:	Sampling strategy and analytical methods for formaldehyde

To protect the health of employees, exposure measurements must be unbiased and representative of employee exposure. The proper measurement of employee exposure requires more than a token commitment on the part of the employer. OSHA's mandatory requirements establish a baseline; under the best of circumstances all questions regarding employee exposure will be answered. Many employers, however, will wish to conduct more extensive monitoring before undertaking expensive commitments, such as engineering controls, to assure that the modifications are truly necessary. The following sampling strategy, which was developed at NIOSH by Nelson A. Leidel, Kenneth A. Busch, and Jeremiah R. Lynch and described in NIOSH publication No. 77-173 (Occupational Exposure Sampling Strategy Manual) will assist the employer in developing a strategy for determining the exposure of his or her employees.

There is no one correct way to determine employee exposure. Obviously, measuring the exposure of every employee exposed to formaldehyde will provide the most information on any given day. Where few employees are exposed, this may be a practical solution. For most employers, however, use of the following strategy will give just as much information at less cost.

Exposure data collected on a single day will not automatically guarantee the employer that his or her workplace is always in compliance with the formaldehyde standard. This does not imply, however, that it is impossible for an employer to be sure that his or her worksite is in compliance with the standard. Indeed, a properly designed sampling strategy showing that all employees are exposed below the PELs, at least with a 95 percent certainty, is compelling evidence that the exposure limits are being achieved provided that measurements are conducted using valid sampling strategy and approved analytical methods.

There are two PELs, the TWA concentration and the STEL. Most employers will find that one of these two limits is more critical in the control of their operations, and OSHA expects that the employer will concentrate monitoring efforts on the critical component. If the more difficult exposure is controlled, this information, along with calculations to support the assumptions, should be adequate to show that the other exposure limit is also being achieved.

Sampling Strategy

Determination of the Need for Exposure Measurements

The employer must determine whether employees may be exposed to concentrations in excess of the action level. This determination becomes the first step in an employee exposure monitoring program that minimizes employer sampling burdens while providing adequate employee protection. If employees may be exposed above the action level, the employer must measure exposure. Otherwise, an objective determination that employee exposure is low provides adequate evidence

that exposure potential has been examined.

The employer should examine all available relevant information, e.g., insurance company and trade association data and information from suppliers or exposure data collected from similar operations. The employer may also use previously conducted sampling including area monitoring. The employer must make a determination relevant to each operation although this need not be on a separate piece of paper. If the employer can demonstrate conclusively that no employee is exposed above the action level or the STEL through the use of objective data, the employer need proceed no further on employee exposure monitoring until such time that conditions have changed, and the determination is no longer valid. If the employer cannot determine that employee exposure is less than the action level and the STEL, employee exposure monitoring will have to be conducted.

Workplace Material Survey

The primary purpose of a survey of raw material is to determine if formaldehyde is being used in the work environment and if so, the conditions under which formaldehyde is being used.

The first step is to tabulate all situations where formaldehyde is used in a manner such that it may be released into the workplace atmosphere or contaminate the skin. This information should be available through analysis of company records and information on the MSDSs available through provisions of this standard and the Hazard Communication standard.

If there is an indication from materials handling records and accompanying MSDSs that formaldehyde is being used in the following types of processes or work operations, there may be a potential for releasing formaldehyde into the workplace atmosphere:

- (1) Any operation that involves grinding, sanding, sawing, cutting, crushing, screening, sieving, or any other manipulation of material that generates formaldehyde-bearing dust
- (2) Any processes where there have been employee complaints or symptoms indicative of exposure to formaldehyde
- (3) Any liquid or spray process involving formaldehyde
- (4) Any process that uses formaldehyde in preserved tissue
- (5) Any process that involves the heating of a formaldehyde-bearing resin. Processes and work operations that use formaldehyde in these manners will probably require further investigation at the worksite to determine the extent of employee monitoring that should be conducted.

Workplace Observations

To this point, the only intention has been to provide an indication as to the existence of potentially exposed employees. With this information, a visit to the workplace is needed to observe work operations, to identify potential health hazards, and to determine whether any employees may be exposed to hazardous concentrations of formaldehyde.

In many circumstances, sources of formaldehyde can be identified through the sense of smell. However, this method of detection should be used with caution because of olfactory fatigue.

Employee location in relation to source of formaldehyde is important in determining if an employee may be significantly exposed to formaldehyde. In most instances, the closer a worker is to the source, the higher the probability that a significant exposure will occur.

Other characteristics should be considered. Certain high temperature operations give rise to higher evaporation rates. Locations of open doors and windows provide natural ventilation that tend to dilute formaldehyde emissions. General room ventilation also provides a measure of control.

Calculation of Potential Exposure Concentrations

By knowing the ventilation rate in a workplace and the quantity of formaldehyde generated, the employer may be able to determine by calculation if the PELs might be exceeded. To account for poor mixing of formaldehyde into the entire room, locations of fans and proximity of employees to the work operation, the employer must include a safety factor. If an

employee is relatively close to a source, particularly if he or she is located downwind, a safety factor of 100 may be necessary. For other situations, a factor of 10 may be acceptable. If the employer can demonstrate through such calculations that employee exposure does not exceed the action level or the STEL, the employer may use this information as objective data to demonstrate compliance with the standard.

Sampling Strategy

Once the employer determines that there is a possibility of substantial employee exposure to formaldehyde, the employer is obligated to measure employee exposure.

The next step is selection of a maximum risk employee. When there are different processes where employees may be exposed to formaldehyde, a maximum risk employee should be selected for each work operation.

Selection of the maximum risk employee requires professional judgment. The best procedure for selecting the maximum risk employee is to observe employees and select the person closest to the source of formaldehyde. Employee mobility may affect this selection, e.g., if the closest employee is mobile in his tasks, he may not be the maximum risk employee. Air movement patterns and differences in work habits will also affect selection of the maximum risk employee.

When many employees perform essentially the same task, a maximum risk employee cannot be selected. In this circumstance, it is necessary to resort to random sampling of the group of workers. The objective is to select a subgroup of adequate size so that there is a high probability that the random sample will contain at least one worker with high exposure if one exists. The number of persons in the group influences the number that need to be sampled to ensure that at least one individual from the highest 10 percent exposure group is contained in the sample. For example, to have 90 percent confidence in the results, if the group size is 10, nine should be sampled; for 50, only 18 need to be sampled.

If measurement shows exposure to formaldehyde at or above the action level or the STEL, the employer needs to identify all other employees who may be exposed at or above the action level or STEL and measure or otherwise accurately characterize the exposure of these employees.

Whether representative monitoring or random sampling are conducted, the purpose remains the same-to determine if the exposure of any employee is above the action level. If the exposure of the most exposed employee is less than the action level and the STEL, regardless of how the employee is identified, then it is reasonable to assume that measurements of exposure of the other employees in that operation would be below the action level and the STEL.

Exposure Measurements

There is no "best" measurement strategy for all situations. Some elements to consider in developing a strategy are:

- (1) Availability and cost of sampling equipment
- (2) Availability and cost of analytic facilities
- (3) Availability and cost of personnel to take samples
- (4) Location of employees and work operations
- (5) Intraday and interday variations in the process
- (6) Precision and accuracy of sampling and analytic methods, and
- (7) Number of samples needed.

Samples taken for determining compliance with the STEL differ from those that measure the TWA concentration in important ways. STEL samples are best taken in a nonrandom fashion using all available knowledge relating to the area, the individual, and the process to obtain samples during periods of maximum expected concentrations. At least three measurements on a shift are generally needed to spot gross errors or mistakes; however, only the highest value represents the STEL.

If an operation remains constant throughout the work shift, a much greater number of samples would need to be taken over the 32 discrete nonoverlapping periods in an 8-hour work shift to verify compliance with a STEL. If employee exposure is truly uniform throughout the work shift, however, an employer in compliance with the 1 ppm TWA would be in compliance with the 2 ppm STEL, and this determination can probably be made using objective data.

Need to Repeat the Monitoring Strategy

Interday and intraday fluctuations in employee exposure are mostly influenced by the physical processes that generate formaldehyde and the work habits of the employee. Hence, in-plant process variations influence the employer's determination of whether or not additional controls need to be imposed. Measurements that employee exposure is low on a day that is not representative of worst conditions may not provide sufficient information to determine whether or not additional engineering controls should be installed to achieve the PELs.

The person responsible for conducting sampling must be aware of systematic changes which will negate the validity of the sampling results. Systematic changes in formaldehyde exposure concentration for an employee can occur due to:

- (1) The employee changing patterns of movement in the workplace
- (2) Closing of plant doors and windows
- (3) Changes in ventilation from season to season
- (4) Decreases in ventilation efficiency or abrupt failure of engineering control equipment
- (5) Changes in the production process or work habits of the employee. Any of these changes, if they may result in additional exposure that reaches the next level of action (i.e., 0.5 or 1.0 ppm as an 8-hr average or 2 ppm over 15 minutes) require the employer to perform additional monitoring to reassess employee exposure.

A number of methods are suitable for measuring employee exposure to formaldehyde or for characterizing emissions within the worksite. The preamble to this standard describes some methods that have been widely used or subjected to validation testing. A detailed analytical procedure derived from the OSHA Method 52 for acrolein and formaldehyde is presented below for informational purposes.

Inclusion of OSHA's method in this appendix in no way implies that it is the only acceptable way to measure employee exposure to formaldehyde. Other methods that are free from significant interferences and that can determine formaldehyde at the permissible exposure limits within + or - 25 percent of the "true" value at the 95 percent confidence level are also acceptable. Where applicable, the method should also be capable of measuring formaldehyde at the action level to + or - 35 percent of the "true" value with a 95 percent confidence level. OSHA encourages employers to choose methods that will be best for their individual needs. The employer must exercise caution, however, in choosing an appropriate method since some techniques suffer from interferences that are likely to be present in workplaces of certain industry sectors where formaldehyde is used.

OSHA's Analytical Laboratory Method

Method No: 52

Matrix: Air

Target Concentration: 1 ppm (1.2 mg/m(3))

Procedures: Air samples are collected by drawing known volumes of air through sampling tubes containing XAD-2 adsorbent which have been coated with 2-(hydroxymethyl) piperidine. The samples are desorbed with toluene and then analyzed by gas chromatography using a nitrogen selective detector.

Recommended Sampling Rate and Air Volumes: 0.1 L/min and 24 L

Reliable Quantitation Limit:16 ppb (20 ug/m(3))

Standard Error of Estimate at the Target Concentration: 7.3 percent

Status of the Method: A sampling and analytical method that has been subjected to the established evaluation procedures of the Organic Methods Evaluation Branch.
Date: March 1985

1. General Discussion

1.1 Background: The current OSHA method for collecting acrolein vapor recommends the use of activated 13X molecular sieves. The samples must be stored in an ice bath during and after sampling and also, they must be analyzed within 48 hours of collection. The current OSHA method for collecting formaldehyde vapor recommends the use of bubblers containing 10 percent methanol in water as the trapping solution.

This work was undertaken to resolve the sample stability problems associated with acrolein and also to eliminate the need to use bubblers to sample formaldehyde. A goal of this work was to develop and/or to evaluate a common sampling and analytical procedure for acrolein and formaldehyde.

NIOSH has developed independent methodologies for acrolein and formaldehyde which recommend the use of reagent-coated adsorbent tubes to collect the aldehydes as stable derivatives. The formaldehyde sampling tubes contain Chromosorb 102 adsorbent coated with N-benzylethanolamine (BEA) which reacts with formaldehyde vapor to form a stable oxazolidine compound. The acrolein sampling tubes contain XAD-2 adsorbent coated with 2-(hydroxymethyl)piperidine (2-HMP) which reacts with acrolein vapor to form a different, stable oxazolidine derivative. Acrolein does not appear to react with BEA to give a suitable reaction product. Therefore, the formaldehyde procedure cannot provide a common method for both aldehydes. However, formaldehyde does react with 2-HMP to form a very suitable reaction product. It is the quantitative reaction of acrolein and formaldehyde with 2-HMP that provides the basis for this evaluation.

This sampling and analytical procedure is very similar to the method recommended by NIOSH for acrolein. Some changes in the NIOSH methodology were necessary to permit the simultaneous determination of both aldehydes and also to accommodate OSHA laboratory equipment and analytical techniques.

1.2 Limit-defining parameters: The analyte air concentrations reported in this method are based on the recommended air volume for each analyte collected separately and a desorption volume of 1 mL. The amounts are presented as acrolein and/or formaldehyde, even though the derivatives are the actual species analyzed.

1.2.1 Detection limits of the analytical procedure: The detection limit of the analytical procedure was 386 pg per injection for formaldehyde. This was the amount of analyte which gave a peak whose height was about five times the height of the peak given by the residual formaldehyde derivative in a typical blank front section of the recommended sampling tube.

1.2.2 Detection limits of the overall procedure: The detection limits of the overall procedure were 482 ng per sample (16 ppb or 20 ug/m(3) for formaldehyde). This was the amount of analyte spiked on the sampling device which allowed recoveries approximately equal to the detection limit of the analytical procedure.

1.2.3 Reliable quantitation limits: The reliable quantitation limit was 482 ng per sample (16 ppb or 20 ug/m(3)) for formaldehyde. These were the smallest amounts of analyte which could be quantitated within the limits of a recovery of at least 75 percent and a precision ((+ or -)(1.96 SD) of + or - 25 percent or better. The reliable quantitation limit and detection limits reported in the method are based upon optimization of the instrument for the smallest possible amount of analyte. When the target concentration of an exceptionally higher than these limits, they may not be attainable at the routine operating parameters.

1.2.4 Sensitivity: The sensitivity of the analytical procedure over concentration ranges representing 0.4 to 2 times the target concentration, based on the recommended air volumes, was 7,589 area units per ug/mL for formaldehyde. This value was

determined from the slope of the calibration curve. The sensitivity may vary with the particular instrument used in the analysis.

1.2.5 Recovery: The recovery of formaldehyde from samples used in an 18-day storage test remained above 92 percent when the samples were stored at ambient temperature. These values were determined from regression lines which were calculated from the storage data. The recovery of the analyte from the collection device must be at least 75 percent following storage.

1.2.6 Precision (analytical method only): The pooled coefficient of variation obtained from replicate determinations of analytical standards over the range of 0.4 to 2 times the target concentration was 0.0052 for formaldehyde (Section 4.3).

1.2.7 Precision (overall procedure): The precision at the 95 percent confidence level for the ambient temperature storage tests was (+ or -) 14.3 percent for formaldehyde. These values each include an additional (+ or -) 5 percent for sampling error. The overall procedure must provide results at the target concentrations that are (+ or -) 25 percent at the 95 percent confidence level.

1.2.8 Reproducibility: Samples collected from controlled test atmospheres and a draft copy of this procedure were given to a chemist unassociated with this evaluation. The formaldehyde samples were analyzed following 15 days storage. The average recovery was 96.3 percent and the standard deviation was 1.7 percent.

1.3 Advantages:

1.3.1 The sampling and analytical procedures permit the simultaneous determination of acrolein and formaldehyde.

1.3.2 Samples are stable following storage at ambient temperature for at least 18 days.

1.4 Disadvantages: None. 2. Sampling Procedure

2.1 Apparatus:

2.1.1 Samples are collected by use of a personal sampling pump that can be calibrated to within (+ or -) 5 percent of the recommended 0.1 L/min sampling rate with the sampling tube in line.

2.1.2 Samples are collected with laboratory prepared sampling tubes. The sampling tube is constructed of silane treated glass and is about 8-cm long. The ID is 4 mm and the OD is 6 mm. One end of the tube is tapered so that a glass wool end plug will hold the contents of the tube in place during sampling. The other end of the sampling tube is open to its full 4-mm ID to facilitate packing of the tube. Both ends of the tube are fire-polished for safety. The tube is packed with a 75-mg backup section, located nearest the tapered end and a 150-mg sampling section of pretreated XAD-2 adsorbent which has been coated with 2-HMP. The two sections of coated adsorbent are separated and retained with small plugs of silanized glass wool. Following packing, the sampling tubes are sealed with two 7/32 inch OD plastic end caps. Instructions for the pretreatment and the coating of XAD-2 adsorbent are presented in Section 4 of this method.

2.1.3 Sampling tubes, similar to those recommended in this method, are marketed by Supelco, Inc. These tubes were not available when this work was initiated; therefore, they were not evaluated.

2.2 Reagents: None required.

2.3 Technique:

2.3.1 Properly label the sampling tube before sampling and then remove the plastic end caps.

2.3.2 Attach the sampling tube to the pump using a section of flexible plastic tubing such that the large, front section of the sampling tube is exposed directly to the atmosphere. Do not place any tubing ahead of the sampling tube. The sampling tube should be attached in the worker's breathing zone in a vertical manner such that it does not impede work performance.

2.3.3 After sampling for the appropriate time, remove the sampling tube from the pump and then seal the tube with plastic end caps.

2.3.4 Include at least one blank for each sampling set. The blank should be handled in the same manner as the samples with the exception that air is not drawn through it.

2.3.5 List any potential interferences on the sample data sheet.

2.4 Breakthrough:

2.4.1 Breakthrough was defined as the relative amount of analyte found on a backup sample in relation to the total amount of analyte collected on the sampling train.

2.4.2 For formaldehyde collected from test atmospheres containing 6 times the PEL, the average 5 percent breakthrough air volume was 41 L. The sampling rate was 0.1 L/min and the average mass of formaldehyde collected was 250 ug.

2.5 Desorption Efficiency: No desorption efficiency corrections are necessary to compute air sample results because analytical standards are prepared using coated adsorbent. Desorption efficiencies were determined, however, to investigate the recoveries of the analytes from the sampling device. The average recovery over the range of 0.4 to 2 times the target concentration, based on the recommended air volumes, was 96.2 percent for formaldehyde. Desorption efficiencies were essentially constant over the ranges studied.

2.6 Recommended Air Volume and Sampling Rate:

2.6.1. The recommended air volume for formaldehyde is 24 L.

2.6.2. The recommended sampling rate is 0.1 L/min.

2.7 Interferences:

2.7.1 Any collected substance that is capable of reacting 2-HMP and thereby depleting the derivatizing agent is a potential interference. Chemicals which contain a carbonyl group, such as acetone, may be capable of reacting with 2-HMP.

2.7.2 There are no other known interferences to the sampling method.

2.8 Safety Precautions:

2.8.1 Attach the sampling equipment to the worker in such a manner that it will not interfere with work performance or safety.

2.8.2 Follow all safety practices that apply to the work area being sampled.

3. Analytical Procedure

3.1 Apparatus:

3.1.1 A gas chromatograph (GC), equipped with a nitrogen selective detector. A Hewlett-Packard Model 5840A GC fitted with a nitrogen-phosphorus flame ionization detector (NPD) was used for this evaluation. Injections were performed using a Hewlett-Packard Model 7671A automatic sampler.

3.1.2 A GC column capable of resolving the analytes from any interference. A 6 ft x 1/4 in OD (2mm ID) glass GC column containing 10 percent UCON 50-HB-5100 + 2 percent KOH on 80/100 mesh Chromosorb W-AW was used for the evaluation. Injections were performed on-column.

3.1.3 Vials, glass 2-mL with Teflon-lined caps.

3.1.4 Volumetric flasks, pipets, and syringes for preparing standards, making dilutions, and performing injections.

3.2 Reagents:

3.2.1 Toluene and dimethylformamide. Burdick and Jackson solvents were used in this evaluation.

3.2.2 Helium, hydrogen, and air, GC grade.

3.2.3 Formaldehyde, 37 percent, by weight, in water. Aldrich Chemical, ACS Reagent Grade formaldehyde was used in this evaluation.

3.2.4 Amberlite XAD-2 adsorbent coated with 2-(hydroxymethyl-piperidine (2-HMP), 10 percent by weight (Section 4).

3.2.5 Desorbing solution with internal standard. This solution was prepared by adding 20 uL of dimethylformamide to 100 mL of toluene.

3.3 Standard preparation:

3.3.1 Formaldehyde: Prepare stock standards by diluting known volumes of 37 percent formaldehyde solution with methanol. A procedure to determine the formaldehyde content of these standards is presented in Section 4. A standard containing 7.7 mg/mL formaldehyde was prepared by diluting 1 mL of the 37 percent reagent to 50 mL with methanol.

3.3.2 It is recommended that analytical standards be prepared about 16 hours before the air samples are to be analyzed in order to ensure the complete reaction of the analytes with 2-HMP. However, rate studies have shown the reaction to be greater than 95 percent complete after 4 hours. Therefore, one or two standards can be analyzed after this reduced time if sample results are outside the concentration range of the prepared standards.

3.3.3 Place 150-mg portions of coated XAD-2 adsorbent, from the same lot number as used to collect the air samples, into each of several glass 2-mL vials. Seal each vial with a Teflon-lined cap.

3.3.4 Prepare fresh analytical standards each day by injecting appropriate amounts of the diluted analyte directly onto 150-mg portions of coated adsorbent. It is permissible to inject both acrolein and formaldehyde on the same adsorbent portion. Allow the standards to stand at room temperature. A standard, approximately the target levels, was prepared by injecting 11 uL of the acrolein and 12 uL of the formaldehyde stock standards onto a single coated XAD-2 adsorbent portion.

3.3.5 Prepare a sufficient number of standards to generate the calibration curves. Analytical standard concentrations should bracket sample concentrations. Thus, if samples are not in the concentration range of the prepared standards, additional

standards must be prepared to determine detector response.

3.3.7 Desorb the standards in the same manner as the samples following the 16-hour reaction time.

3.4 Sample preparation:

3.4.1 Transfer the 150-mg section of the sampling tube to a 2-mL vial. Place the 75-mg section in a separate vial. If the glass wool plugs contain a significant number of adsorbent beads, place them with the appropriate sampling tube section. Discard the glass wool plugs if they do not contain a significant number of adsorbent beads.

3.4.2 Add 1 mL of desorbing solution to each vial.

3.4.3 Seal the vials with Teflon-lined caps and then allow them to desorb for one hour. Shake the vials by hand with vigorous force several times during the desorption time.

3.4.4 Save the used sampling tubes to be cleaned and recycled.

3.5 Analysis:

3.5.1 GC Conditions

Column Temperature:

Bi-level temperature program - First level: 100 to 140 deg. C at 4 deg.

C/min following completion of the first level.

Second level: 140 to 180 deg. C at 20 deg. C/min following completion of the first level.

Isothermal period: Hold column at 180 deg. C until the recorder pen returns to baseline (usually about 25 min after injection).

Injector temperature: 180 deg. C

Helium flow rate: 30 mL/min (detector response will be reduced if nitrogen is substituted for helium carrier gas).

Injection volume: 0.8 uL

GC column: Six-ft x 1/4 -in OD (2 mm ID) glass GC column containing 10 percent

UCON 50-HB-5100+2 percent KOH on 80/100 Chromosorb W-AW.

NPD conditions:

Hydrogen flow rate: 3 mL/min

Air flow rate: 50 mL/min

Detector temperature: 275 deg. C

3.5.2 Chromatogram: For an example of a typical chromatogram, see Figure 4.11 in OSHA Method 52.

3.5.3 Use a suitable method, such as electronic integration, to measure detector response.

3.5.4 Use an internal standard method to prepare the calibration curve with several standard solutions of different concentrations. Prepare the calibration curve daily. Program the integrator to report results in ug/mL.

3.5.5 Bracket sample concentrations with standards.

3.6 Interferences (Analytical)

3.6.1 Any compound with the same general retention time as the analytes and which also gives a detector response is a

potential interference. Possible interferences should be reported to the laboratory with submitted samples by the industrial hygienist.

3.6.2 GC parameters (temperature, column, etc.) may be changed to circumvent interferences.

3.6.3 A useful means of structure designation is GC/MS. It is recommended this procedure be used to confirm samples whenever possible.

3.6.4 The coated adsorbent usually contains a very small amount of residual formaldehyde derivative (Section 4.8).

3.7 Calculations:

3.7.1 Results are obtained by use of calibration curves. Calibration curves are prepared by plotting detector response against concentration for each standard. The best line through the data points is determined by curve fitting.

3.7.2 The concentration, in ug/mL, for a particular sample is determined by comparing its detector response to the calibration curve. If either of the analytes is found on the backup section, it is added to the amount found on the front section. Blank corrections should be performed before adding the results together.

3.7.3 The acrolein and/or formaldehyde air concentration can be expressed using the following equation:
$$\text{mg/m}^3 = (A)(B)/C$$

where A = ug/mL from 3.7.2,
B = desorption volume,
and C = L of air sampled.

No desorption efficiency corrections are required.

3.7.4 The following equation can be used to convert results in mg/m³ to ppm.

$$\text{ppm} = (\text{mg/m}^3)(24.45)/\text{MW}$$

where mg/m³ = result from 3.7.3,
24.45 = molar volume of an ideal gas at 760 mm Hg
and 25 deg. C, MW = molecular weight (30.0).

4. Backup Data

4.1 Backup data on detection limits, reliable quantitation limits, sensitivity and precision of the analytical method, breakthrough, desorption efficiency, storage, reproducibility, and generation of test atmospheres are available in OSHA Method 52, developed by the Organics Methods Evaluation Branch, OSHA Analytical Laboratory, Salt Lake City, Utah.

4.2 Procedure to Coat XAD-2 Adsorbent with 2-HMP:

4.2.1 Apparatus: Soxhlet extraction apparatus, rotary evaporation apparatus, vacuum dessicator, 1-L vacuum flask, 1-L round-bottomed evaporative flask, 1-L Erlenmeyer flask, 250-mL Buchner funnel with a coarse fritted disc, etc.

4.2.2 Reagents:

4.2.2.1 Methanol, isooctane, and toluene.

4.2.2.2 2-(Hydroxymethyl)piperidine.

4.2.2.3 Amberlite XAD-2 non-ionic polymeric adsorbent, 20 to 60 mesh, Aldrich Chemical XAD-2 was used in this evaluation.

4.2.3 Procedure: Weigh 125 g of crude XAD-2 adsorbent into a 1-L Erlenmeyer flask. Add about 200 mL of water to the flask and then swirl the mixture to wash the adsorbent. Discard any adsorbent that floats to the top of the water and then filter the mixture using a fritted Buchner funnel. Air dry the adsorbent for 2 minutes. Transfer the adsorbent back to the Erlenmeyer flask and then add about 200 mL of methanol to the flask. Swirl and then filter the mixture as before. Transfer the washed adsorbent back to the Erlenmeyer flask and then add about 200 mL of methanol to the flask. Swirl and then filter the mixture as before. Transfer the washed adsorbent to a 1-L round-bottomed evaporative flask, add 13 g of 2-HMP and then 200 mL of methanol, swirl the mixture and then allow it to stand for one hour. Remove the methanol at about 40 deg. C and reduced pressure using a rotary evaporation apparatus. Transfer the coated adsorbent to a suitable container and store it in a vacuum desiccator at room temperature overnight. Transfer the coated adsorbent to a Soxhlet extractor and then extract the material with toluene for about 24 hours. Discard the contaminated toluene, add methanol in its place and then continue the Soxhlet extraction for an additional 4 hours. Transfer the adsorbent to a weighted 1-L round-bottom evaporative flask and remove the methanol using the rotary evaporation apparatus. Determine the weight of the adsorbent and then add an amount of 2-HMP, which is 10 percent by weight of the adsorbent. Add 200 mL of methanol and then swirl the mixture. Allow the mixture to stand for one hour. Remove the methanol by rotary evaporation. Transfer the coated adsorbent to a suitable container and store it in a vacuum desiccator until all traces of solvents are gone. Typically, this will take 2-3 days. The coated adsorbent should be protected from contamination. XAD-2 adsorbent treated in this manner will probably not contain residual acrolein derivative. However, this adsorbent will often contain residual formaldehyde derivative levels of about 0.1 ug per 150 mg of adsorbent. If the blank values for a batch of coated adsorbent are too high, then the batch should be returned to the Soxhlet extractor, extracted with toluene again and then recoated. This process can be repeated until the desired blank levels are attained.

The coated adsorbent is now ready to be packed into sampling tubes. The sampling tubes should be stored in a sealed container to prevent contamination. Sampling tubes should be stored in the dark at room temperature. The sampling tubes should be segregated by coated adsorbent lot number. A sufficient amount of each lot number of coated adsorbent should be retained to prepare analytical standards for use with air samples from that lot number.

4.3 A Procedure to Determine Formaldehyde by Acid Titration: Standardize the 0.1 N HCl solution using sodium carbonate and methyl orange indicator.

Place 50 mL of 0.1 M sodium sulfite and three drops of thymolphthalein indicator into a 250-mL Erlenmeyer flask. Titrate the contents of the flask to a colorless endpoint with 0.1 N HCl (usually one or two drops is sufficient). Transfer 10 mL of the formaldehyde/methanol solution (prepared in 3.3.1) into the same flask and titrate the mixture with 0.1 N HCl, again, to a colorless endpoint. The formaldehyde concentration of the standard may be calculated by the following equation:

$$\text{Formaldehyde, mg/mL} = \frac{\text{acid titer} \times \text{acid normality} \times 30.0}{\text{mL of sample}}$$

This method is based on the quantitative liberation of sodium hydroxide when formaldehyde reacts with sodium sulfite to form the formaldehyde-bisulfite addition product. The volume of sample may be varied depending on the formaldehyde content but the solution to be titrated must contain excess sodium sulfite. Formaldehyde solutions containing substantial amounts of acid or base must be neutralized before analysis.

Appendix F: Laboratory Clearance Report Vacating a Research Laboratory

Laboratory Clearance Report

Name of Principal Investigator: _____

Name of Department: _____

Building: _____ Room Number: _____

- ☐ Equipment (instrumental) has been updated. Electronic or hard copies provided.
- ☐ Lab drawers have been emptied of all chemical containing glassware. Clean, dried glassware has been placed either in boxes or in clearly labeled drawers.
- ☐ All broken glass has been placed in the Broken Glass container.
- ☐ Lab benches have been cleaned (disinfected, if necessary).
- ☐ Fume hoods have been emptied and cleaned.
- ☐ Chemicals (from fume hoods, refrigerators, freezers, ovens, and/or storage cabinets) that are in good condition are clearly marked to either be transferred to another principle investigator or be transferred to the lab manager to add these chemicals to the stockroom inventory.
- ☐ The regulators on gas cylinders have been removed and the caps secured in place. (Return the gas cylinder(s) to the supplier or specifically transfer to another principle investigator or lab manager.)
- ☐ All hazardous chemical waste has been identified and placed in a designated area for disposal.

Signature of Completion by Principal Investigator: _____

Date of inspection: _____ Time: _____

Inspection conducted by _____ / _____
Print Name Signature

Job Title: _____

Appendix G: OSHA's Globally Harmonized System of Classification and Labeling of Chemicals (GHS)



Occupational
Safety and Health
Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

OSHA 3491-02 2012




www.osha.gov/dsg/hazcom







The Hazard Communication Standard (HCS) is now aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). This update to the Hazard Communication Standard (HCS) will provide a common and coherent approach to classifying chemicals and communicating hazard information on labels and safety data sheets. Once implemented, the revised standard will improve the quality and consistency of hazard information in the workplace, making it safer for workers by providing easily understandable information on appropriate handling and safe use of hazardous chemicals.

Hazard Communication Standard Pictogram

As of June 1, 2015, the Hazard Communication Standard (HCS) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

HCS Pictograms and Hazards

Health Hazard	Flame	Exclamation Mark
		
<ul style="list-style-type: none">▪ Carcinogen▪ Mutagenicity▪ Reproductive Toxicity▪ Respiratory Sensitizer▪ Target Organ Toxicity▪ Aspiration Toxicity	<ul style="list-style-type: none">▪ Flammables▪ Pyrophorics▪ Self-Heating▪ Emits Flammable Gas▪ Self-Reactives▪ Organic Peroxides	<ul style="list-style-type: none">▪ Irritant (skin and eye)▪ Skin Sensitizer▪ Acute Toxicity▪ Narcotic Effects▪ Respiratory Tract Irritant▪ Hazardous to Ozone Layer (Non-Mandatory)

<p>Gas Cylinder</p>  <ul style="list-style-type: none"> ▪ Gases Under Pressure 	<p>Corrosion</p>  <ul style="list-style-type: none"> ▪ Skin Corrosion/Burns ▪ Eye Damage ▪ Corrosive to Metals 	<p>Exploding Bomb</p>  <ul style="list-style-type: none"> ▪ Explosives ▪ Self-Reactives ▪ Organic Peroxides
<p>Flame Over Circle</p>  <ul style="list-style-type: none"> ▪ Oxidizers 	<p>Environment (Non-Mandatory)</p>  <ul style="list-style-type: none"> ▪ Aquatic Toxicity 	<p>Skull and Crossbones</p>  <ul style="list-style-type: none"> ▪ Acute Toxicity (fatal or toxic)

Hazard Communication Safety Data Sheets

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products. As of June 1, 2015, the HCS will require new SDSs to be in a uniform format, and include the section numbers, the headings, and associated information under the headings below:

Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients includes information on chemical ingredients, trade secret claims.

Section 4, First-aid measures includes important symptoms/ effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment, chemical hazards from fire.

Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.

Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties lists the chemical's characteristics.

Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information*

Section 13, Disposal considerations*

Section 14, Transport information*

Section 15, Regulatory information*

Section 16, Other information, includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15(29 CFR 1910.1200(g)(2)).

Employers must ensure that SDSs are readily accessible to employees.

See Appendix D of 1910.1200 for a detailed description of SDS contents.

For more information: www.osha.gov

Effective Dates

The table below summarizes the phase-in dates required under the revised Hazard Communication Standard (HCS):

Effective Completion Date	Requirement(s)	Who
December 1, 2013	Train employees on the new label elements and safety data sheet (SDS) format.	Employers
June 1, 2015 December 1, 2015	Compliance with all modified provisions of this final rule, except: The Distributor shall not ship containers labeled by the chemical manufacturer or importer unless it is a GHS label	Chemical manufacturers, importers, distributors and employers
June 1, 2016	Update alternative workplace labeling and hazard communication program as necessary and provide additional employee training for newly identified physical or health hazards.	Employers
Transition Period to the effective completion dates noted above	May comply with either 29 CFR 1910.1200 (the final standard), or the current standard, or both	Chemical manufacturers, importers, distributors, and employers

Appendix H: Laboratory Self-Inspection

Department: _____ Name (Faculty/Staff): _____

Building/Room number: _____ Date(s): _____

General Safety	Comments
<input type="checkbox"/> Is main entrance properly signed? _____ Emergency Contact Information/Telephone _____ Notice Board (indicating use of safety goggles, NO Smoking, Eating, or Drinking, etc.) _____ Hazard warnings (NFPA diamond, Biohazard warning, etc.)	
<input type="checkbox"/> Good Housekeeping _____ Clear walkways, minimal clutter _____ Flooring in good condition—no cracked or missing tiles that may cause tripping hazard _____ Drain covers (on the ground) should not be missing or loose _____ Uncluttered work surfaces / lab benches _____ Chemicals organized by compatibility _____ Chemicals not stacked one on top of the other. _____ Refrigerators / Freezers / Microwaves are properly labeled: warning message of NO Food or Beverages Allowed, etc.)	
<input type="checkbox"/> PPE (Personal Protective Equipment) <i>depends on hazards present</i> _____ Closed shoes _____ Long pants _____ Lab coat _____ Long hair pulled back/secured _____ No loose or dangling jewelry _____ Gloves, appropriate to the hazard If necessary: _____ Badges monitoring for harmful vapors _____ Hearing Protection (loud machinery)	
<input type="checkbox"/> Safety Shower and Eyewash Station _____ Easily accessible—with 10 second travel (55ft) recommended by ANSI Standard _____ No chemicals or electrical equipment stored	

nearby ____ Signage ____ Weekly checks, log sheet posted	
<input type="checkbox"/> First Aid Kit ____ Readily available/ easily accessible? ____ Checked once a month, log sheet posted ____ Properly stocked, ANSI standard Z308.1-2003	
<input type="checkbox"/> Chemical Spill Kit ____ Readily available/ easily accessible? ____ Appropriate contents for lab? (acid/base, absorbents, mercury, etc.)	
<input type="checkbox"/> Paperwork / Documents ____ Chemical inventory available? ____ Safety Data Sheets—are these readily accessible? ____ Are Hazardous Waste Manifests kept on file? ____ Laboratory equipment operations manual(s) ____ Safety Training / Standard Operating Procedure ____ chemical hazards ____ physical hazards, instrumentation (if working with special machinery, appropriate safety guard is in place) ____ apparatus used as part of human subject investigations, documented training and maintenance	
<input type="checkbox"/> Proper Storage ____ Solids and liquids should be kept separately ____ Corrosives and flammables stored separately ____ Less than 10 gallons of flammables in an open room/lab ____ Acids and bases stored separately—at least separated by bins ____ Oxidizers and oxidizing acids stored separately from organic compounds/organic acids ____ Fire-rated flammable refrigerators (flammables should not be stored in household refrigerators)	

<p><input type="checkbox"/> Compressed Gases</p> <ul style="list-style-type: none"> _____ Adequately secured (bench bracket or wall bracket for large cylinders) _____ Clearly labeled, along with date received. _____ Stored by compatibility (fire codes) _____ Is cylinder is transported capped/using hand truck? _____ When not in use for long periods of time, cylinder should have regulator removed and capped. 	
<p><input type="checkbox"/> Chemicals</p> <ul style="list-style-type: none"> _____ Date on container, when received _____ Label should be legible with chemical name and in good condition _____ Outdated chemicals should be designated for disposal 	
<p><input type="checkbox"/> Lab Waste</p> <ul style="list-style-type: none"> _____ Designated "Satellite Accumulation Area" _____ "Hazardous Waste" should be labeled as such with contents clearly printed with complete names _____ Container should be closed, when not in immediate use. _____ Secondary container, where appropriate. _____ Broken glass kept in a heavy-duty box. _____ Plastic bottles or hard plastic boxes for needles/sharps _____ Universal Waste container for used batteries _____ Biohazard Waste containers for sterilization 	
<p><input type="checkbox"/> Fume Hoods</p> <ul style="list-style-type: none"> _____ Baffle opening (back part of fume hood) and airfoil entrance (front portion) clear of any obstructions _____ Not used for storage _____ No open containers of hazardous materials _____ Should have low-flow alarms _____ Inspected and calibrated annually, inspection tag posted 	

Electrical Safety	Comments
<input type="checkbox"/> Circuit breaker /Electrical Panel _____ Should be unobstructed (3-foot clearance) _____ Clearly labeled	
<input type="checkbox"/> Electrical Outlets _____ Receptacles used within 6 feet of sinks and wet areas should use GFCI (Ground Fault Circuit Interrupter) _____ Proper use of extension cords—must be used as a <i>temporary</i> means of electrical supply _____ Lab appliances should be plugged directly into outlets _____ Surge Protectors should not be overloaded—may cause fire	
<input type="checkbox"/> Electric shut-off valves _____ Location of emergency shut-off valve	
<input type="checkbox"/> Electrical Cords _____ Remove any items with frayed or damaged cords.	
Fire Safety	Comments
<input type="checkbox"/> Fire Alarms / Pull Stations _____ Location of nearest pull station	
<input type="checkbox"/> Lab Gas Shut-off valve _____ Location of emergency shut-off valve	
<input type="checkbox"/> Fire Blankets _____ Clearly available/ unobstructed access	
<input type="checkbox"/> Fire Extinguishers _____ Near or inside lab, easily accessible. _____ Signage _____ Tagged, inspected once a year _____ Pin in place, fully charged _____ Checked at least once a month (documented	

on back of date tag) ____ Employee training needed for use (annual training—provided by Compliance Manager)	
<input type="checkbox"/> Fire Exits ____ Exit Lights working (should be “on”). Note if Fire Exit is not in place, missing or has been removed. ____ Doorways designated as primary and secondary exits should be clear of any obstruction.	
<input type="checkbox"/> Flammable Cabinets ____ Used, if storing more than 10 gallons of flammable materials ____ Proper types and sizes, according to materials stored ____ Contents identified on door (categorized by functional groups such as alcohols or list of chemicals, etc.)	
<div> <div>ADA and NFPA Spacing and Clearance Regulations</div> <div>Comments</div> </div>	
<input type="checkbox"/> ADA ____ ADA requires door clearance 32 inches wide with aisle space of 36 inches for clear passageway. (Chapter 4: Accessible Routes of the ADA code). <input type="checkbox"/> NFPA / OSHA ____ Minimum vertical clearance between sprinklers and materials on storage shelves is 18 inches. ____ In the absence of sprinklers, the vertical clearance is 24 inches. Exception—for those shelves that are along the perimeter of a room, items of non-hazardous materials may be stored up to the ceiling. (OSHA regulation 29 CFR 1910.159(c)(10)) ____ Hallways having minimal through-traffic, Items may be placed in the hallway with a 6-foot clearance maintained. (NFPA 101. Fire Code)	

Appendix I: Chemical Release Form

As described in **Section 2.6 Policy Regarding Dispensing Chemicals to Other Institutions**, request from a neighboring college, university and other academic institution for a certain chemical for its teaching laboratory must complete and sign the Chemical Release Form (“Waiver, Release of Liability, Indemnification and Assumption of Risk For Barry University Inc.’s Donation”).

A copy of the signed form must be kept as part of departmental files as well as a copy sent to the Office of Legal Affairs.

**Waiver, Release of Liability, Indemnification and Assumption of Risk
For
Barry University Inc.'s Donation**

Description of

Donation: _____

This Waiver, Release of Liability, Indemnification and Assumption of Risk (the "Release") is executed in favor of Barry University, Inc., its affiliated organizations, directors, officers, employees, servants, students, volunteers and agents, and their successors and assigns (hereinafter referred to jointly as "University") for its donation of _____ (hereinafter "_____") to _____ (hereinafter "Recipient") at the following address _____. Recipient hereby freely and voluntarily without duress, accepts this donation and executes this Release under the following terms.

A. Recipient releases and forever discharges and holds harmless University from any and all liability, claims, and demands of whatever kind or nature, either in law or in equity, which arise or may hereafter arise from the _____, its use or this donation.

B. Recipient understands and acknowledges that this Release discharges University from any liability or claim against it, with respect to any bodily injury, personal injury, illness, death, monetary loss or property damage that may result from the _____, its use or its donation. Recipient understands that University assumes no responsibility for or obligation to provide financial assistance or other assistance in the event of injury, illness, death, accident, monetary loss or property damage.

C. Recipient hereby releases and forever discharges University from any claim whatsoever which arises or may hereafter arise from the _____, its use or this donation.

D. Recipient hereby expressly and specifically understands and assumes the risk of injury, illness, death, monetary loss or property damage resulting from the _____, its use and this donation.

E. Recipient covenants not to sue or present any claim for personal injury, property damage, or wrongful death against BARRY UNIVERSITY, INC., and its officers, employees, servants, students, volunteers and agents which is attributable to the _____, its use and this donation.

F. This _____ is donated in an AS-IS condition. The University disclaims all express and implied warranties related to the use of this _____. Recipient shall use the _____ at its own risk. The University hereby disclaims any and all other express and/or implied warranties including but not limited to any warranty of merchantability, fitness for a particular purpose, and any warranties arising from a course of dealing, course of performance, usage or trade practice. The foregoing warranties are Recipient's exclusive warranties and are in lieu of any oral representation and all other warranties. Recipient acknowledges and agrees that the foregoing warranties are the exclusive warranties related to the _____ and University shall not be liable for any damage, whether express, implied or statutory in connection with the _____ except as expressly set forth herein.

G. Recipient agrees that in the event that any clause or provision of this Release shall be held to be invalid by any court of competent jurisdiction, the invalidity of such clause or provision shall not otherwise affect the remaining provisions of this Release which shall continue to be enforceable. Recipient understands that any dispute concerning this Release which shall continue to be enforceable.

H. Recipient understands that any dispute concerning this Release or any aspect of acceptance of this donation shall be brought only in the state or federal courts in Miami-Dade County, Florida.

Page 1 of 2

**Waiver, Release of Liability, Indemnification and Assumption of Risk
For
Barry University Inc.'s Donation**

I. Recipient shall indemnify and hold harmless the University, its Trustees, officers, employees, servants, students, volunteers and agents ("the Indemnified Parties") from any and all liability, losses or damages, including reasonable costs, attorneys' fees, collection expenses, court costs and costs of defense, which the Indemnified Parties may incur as a result of claims, demands, suits, causes of actions or proceedings of any kind or nature arising out of: (1) the donation of [REDACTED] to Recipient and its use by Recipient; (2) any act, omission or negligence (whether active or passive), misconduct, or other fault in whole or in part (whether joint, concurrent or contributing) of Recipient, or any of its agents, its contractors, its employees, or invitees related to [REDACTED], its use or its donation; (3) any breach or default in the performance of any obligation on Recipient's part to be performed under the terms of this donation; or (4) the failure of Recipient to provide for workers' compensation. Recipient shall pay all claims and losses in connection therewith and shall investigate and defend all claims, suits or actions of any kind or nature in the name of the Indemnified Parties, where applicable, including appellate proceedings, and shall pay all costs, judgments, and attorneys' fees which may issue thereon.

Recipient recognizes the broad nature of this indemnification and hold harmless clause, including the provision of a legal defense to the Indemnified Parties, when necessary, and voluntarily makes this covenant. Recipient expressly acknowledges the receipt of such good and valuable consideration provided by Indemnified parties in support of these indemnification, legal defense and hold harmless contractual obligations in accordance with the laws of the State of Florida. Recipient expressly understands and agrees that any insurance protection required by this donation or otherwise provided by Recipient shall in no way limit the responsibility to indemnify, keep and save harmless and defend the Indemnified Parties as herein provided. This provision shall survive the termination or cancellation of this donation.

J. Insurance.

1. General Liability. Recipient, at its sole cost and expense, agrees to procure and maintain a policy of commercial general liability insurance in an amount of not less than one million dollars (\$1,000,000) single limit and two million dollars (\$2,000,000) aggregate, against claims for bodily injury, death and property damage occurring in connection with this donation.

2. Worker's Compensation. If Recipient has employees, Recipient shall provide the University with a certificate evidencing that it has worker's compensation insurance as required by Florida Law.

3. Barry University Inc. shall be named as an additional insured for all insurance coverage required of the Vendor by this Agreement.

TO EXPRESS THAT RECIPIENT HAS FULLY REVIEWED THIS RELEASE, THAT RECIPIENT UNDERSTANDS AND ACCEPTS THIS RELEASE, I SIGN MY SIGNATURE BELOW AS DULY AUTHORIZED REPRESENTATIVE OF RECIPIENT:

Signature

Name

Title

Organization

Date

Page 2 of 2

REFERENCES

Advanced Specialty Gas Equipment

www.asge-online.com

Air Products—Safe Handling of Cryogenic Liquids

<https://www.airproducts.com/~media/Files/PDF/company/safetygram-16.pdf>

American Chemical Society

<https://www.acs.org/content/acs/en.html>

American National Standards Institute

<https://www.ansi.org/>

Americans with Disabilities Act

https://www.ada.gov/service_animals_2010.htm

Atomic Absorption Spectroscopy Learning Module

<https://blogs.maryville.edu/aas/safety/>

Barry University's Office of Accessibility Services

<https://www.barry.edu/en/academic-affairs/accessibility-services/?r=rdt&rdts=my.barry.edu>

Bruker Instruments

<https://www.bruker.com/en/products-and-solutions/mr/nmr/avancecore.html>

BW Single-Gas Clip Detectors

<https://www.honeywellanalytics.com/en/products/BW-Clip>

Chapman University—Standard Operating Procedures: Personal Protective Equipment in Laboratories

https://www.chapman.edu/faculty-staff/environmental/_files/personal-protective-equipment-and-assessment-tool-d.pdf

Chewy

<https://www.chewy.com/doggles-ils-dog-goggles-pink-x-small/dp/145714>

Compressed Gas Cylinders, UC Berkeley, EHS

<https://www.ehs.berkeley.edu/sites/default/files/lines-of-services/hazardous-materials/gascylindersbooklet.pdf>

Crawford College of Arts & Design—Fine Arts Studios Health & Safety Manual

http://www.mycit.ie/contentfiles/ccad/guides/Studio_HandSManual.pdf

Dartmouth EHS—Peroxide Forming Chemicals

http://www.dartmouth.edu/ehs/essential-info/hazard_peroxide.html

Department of Environmental Resource Management

<https://www.miamidade.gov/environment/>

Emergency Planning and Community-Right-to-Know Act / Tier II Compliance

<https://www.floridadisaster.org/dem/response/technological-hazards/epcra/>

Fair Housing Act—Disability Rights Florida

https://disabilityrightsflorida.org/disability-topics/disability_topic_info/fair_housing_act

Florida Administrative Code and Florida Administrative Register

<https://www.flrules.org/>

Florida Department of Environmental Protection

<https://floridadep.gov/>

HRP Associates, Inc. on-campus training (RCRA and DOT)

<https://hrpassociates.com/>

Information and Technical Assistance on the Americans with Disabilities Act

<https://www.ada.gov/>

Lab Manager—Nuclear Magnetic Resonance (NMR) Safety Tips

<https://www.labmanager.com/lab-health-and-safety/nuclear-magnetic-resonance-nmr-safety-tips-19165>

Maytex

http://maytexcorp.com/products_apparel.htm

MSDSonline / Velocity EHS

<https://www.msdsonline.com/>

National Fire Protection Association

<https://www.nfpa.org/>

nexAir

<https://www.nexair.com/>

Pawz Dog Boots

<http://pawzdogboots.com/>

Petco

<https://www.petco.com/shop/en/petcostore>

Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version

https://www.google.com/search?ei=X5INXqLFEdCrytMPpPiNk&q=prudent+practices+in+the+laboratory&oq=prudent+practic&gs_l=psy-ab.1.0.0I9.11182.13453..15395...0.1..0.90.1012.15.....0....1..gws-wiz.....0i71j0i273j0i131j0i67j0i131i67j0i70i249.grvqrOlidyA

Retail Compliance Center

<http://retailcrc.org/Pages/State-Tracking-Matrix.aspx>

Rex Specs

<http://www.rexspecs.com>

Safety Guidelines for Operation of Atomic Absorption Spectrometer

<https://lab-training.com/2014/01/15/safety-guidelines-for-operation-of-atomic-absorption-spectrometer/>

Science Direct—Atomic Absorption Spectrometry

<https://www.sciencedirect.com/topics/nursing-and-health-professions/atomic-absorption-spectrometry>

Stanford University, EHS—Information on Peroxide-Forming Compounds

<https://ehs.stanford.edu/reference/information-peroxide-forming-compounds>

The Scientist—The Challenges of Bringing Service Dogs Into the Lab

<https://www.the-scientist.com/news-opinion/the-challenges-of-bringing-service-dogs-into-the-lab-64812>

UConn Peroxide-Forming Compounds—Safe Work Practices

<http://media.ehs.uconn.edu/Chemical/PeroxideFormingCompounds-SafeWorkPractices.pdf>

University of Alaska Anchorage—Accommodating Students with Service Animals in Teaching Laboratories

https://www.uaa.alaska.edu/about/administrative-services/departments/facilities-campus-services/ehsrms/_documents/service-animal-policy.pdf

U.S. Department of Occupational Safety and Health Administration

<https://www.osha.gov/>

U.S. Department of Transportation

<https://www.transportation.gov/>

U.S. Environmental Protection Agency

<https://www.epa.gov/>

REVISION HISTORY

Revision Date	Comments	Reviewed and Updated	Approved
September 1994	—	----	-----
August 1996	—	Michael Elliott	Michael Elliott
October 2000	Updated Sections—Chemical Hygiene Officers; Emergency Contacts; Inventory of Hazardous Chemicals; Summary of Employer Responsibilities; Housekeeping; Procedure-Specific Safety Procedures; Laboratory Closeout Procedure; and the form, “Laboratory Clearance Report—Vacating a Research Laboratory”.	Maria Aloya and Lynette Cupido	Maria Aloya and Lynette Cupido
July 2006			
June 2008			
May 2012	Updated Section 1.1—Chemical Hygiene Officers and Section 3. — Records and Recordkeeping. Removed Section 2.2.5 Procedures for use of Radioisotopes. (University no longer holds a radioactive license and has disposed of all radioactive material.)	CAS Safety Committee	Yosef Shapiro
May 2013	Updated Sections 1-Introduction, 2.1.3—Housekeeping, 2.2-Procedure-Specific Safety Procedures, 2.3.1—Ventilation, 5.2-Exposure Assessment. Added Sections 2.1.6—First Aid Kits and 2.2.5—Procedure for Peroxide-Forming Compounds. Also updated Material Safety Data Sheet (MSDS) to Safety Data Sheet (SDS) throughout document. Added Appendices.	CAS Safety Committee	Yosef Shapiro
May 2014	Updated Section 2.1.2—Protective Clothing and Equipment and Appendix C-1 thru C-5, Lab Safety Training Forms: Biology, Fine Arts, Physical Sciences, Health Sciences, and Podiatric Medicine; and Section 5.2 Exposure Assessment # 2 and added an Appendix with OSHA regulations regarding formaldehyde (formalin).	CAS Safety Committee	Yosef Shapiro
May 2015	Added Section 1.2 Arts & Sciences Safety Committee. Updated Lab Safety Rules: Appendix C-2, Biology (anatomy labs) and Appendix C-3, Physical Sciences (wearing safety goggles). Added Appendix G—OSHA’s Globally Harmonized System of Classification and Labeling of Chemicals (GHS), new pictograms. Added Appendix H—Laboratory Self-Inspection.	CAS Safety Committee	Yosef Shapiro
May 2016	Updated Section 1.2 Arts & Sciences Safety Committee. Added Section 2.3.6 Fire Extinguishers.	CAS Safety Committee	Yosef Shapiro
May 2017	Updated pages 6, 64, 69, and 74: changing NHS to “Siena”—new name of building. Updated Section 8, Laboratory Self-Inspections. Removal of “Inspection Summary” and “Follow-up Inspection” under Appendix H. Updated Appendix C-3 “Laboratory Safety Training” from Right to Know to the updated Right to Understand (Hazard Communication Standard). Section 1.4 Inventory of Hazardous Chemicals and Safety Data Sheets: addition of link to online SDS database.	CAS Safety Committee	Yosef Shapiro

Revision Date	Comments	Reviewed and Updated	Approved
May 2018	Updated Section 1.2 Arts & Sciences Safety Committee. Added Section 7.1 Hurricane Lab Preparedness. Updated Appendix B, First Aid Kit checklist. Added link of safety sheet database to each “Laboratory Safety Rules” in Appendix C-3: Lab Safety Training. Added links to Appendix E: Exposure Assessment, Formaldehyde.	CAS Safety Committee	Yosef Shapiro
May 2019	Updated Section 1.2 Arts & Sciences Safety Committee. Added Sections 2.3 Small Quantity Generator, 2.3.1 Hazardous Waste Containers, 2.3.2 Tier 2 Calculations, Emergency Planning and Community Right-to-Know Act and 2.6 Policy Regarding Dispensing Chemicals to Other Institutions. Updated safety training sheets for Lab Assistants in Appendix C-3: Lab Safety Training, Physical Sciences.	CAS Safety Committee	Yosef Shapiro
May 2020	Updated Section 1.2 Arts & Science Committee. Added Sections 2.1.7 Service Animals in Labs; 2.2.7 Working with Compressed Gases; 2.2.8 Working with Cryogenics and Dry Ice; 2.2.9 Working With Nuclear Magnetic Resonance; 2.2.10 Working With Atomic Absorption Spectrophotometer; 2.3.3. Universal Waste; Appendix B: Compressed Gas Cylinders Checklist and Oxygen Monitor; Appendix C-3: Researcher/Principal Investigator Safety Guidelines; and Appendix C-6: Safety Sheet for Service Animals in Labs. Updated Section 2.1.3 Housekeeping; Section 2.1.5 Spills and Accidents; and Section 7.1 Hurricane Lab Preparedness. Updated Appendix safety training forms for Biology, Physical Sciences, College of Nursing and Health Sciences, and School of Podiatric Medicine. Appendix H: Laboratory Self-Inspection, changed Specialty Labs section to ADA and NFPA Spacing and Clearance Regulations. Updated Section 2.6 Policy Regarding Dispensing Chemicals to Other Institutions to include statement on Chemical Release Form. Added Appendix I, Chemical Release Form: <i>Waiver, Release of Liability, Indemnification and Assumption of Risk For Barry University Inc.’s Donation</i> . Added Reference section.	CAS Safety Committee	Yosef Shapiro
July 2021	Updated Sections 1.1 Chemical Hygiene Officer; Section 2 Standard Operating Procedures; Section 2.3.3 Aerosol Cans; 2.2.9 Working with Nuclear Magnetic Resonance; Appendix A—Standard Operating Procedure and Personal Protective Equipment Guidelines and Appendix B—Oxygen Monitor, NMR Area.	CAS Safety Committee	Nicole Grein
July 2022	Updated Section 1.2 College of Arts & Sciences Safety Committee, Appendix C Lab Safety Training sheets (and added safety training sheet on NMR and cryogenics), and Appendix C-6 Service Animal and Emotional Support Animal in Labs. Added online link to Incident Report Forms under Section 2. 1. 6, First Aid Kit Policy. Updated name from Physical Sciences to Chemistry & Physics. Added Section 5.4.1c: Exposure Records and Safety Data Sheets. Removal of Section C-1.7, Instructions to Register for CITI Certification. This information was embedded into sections C-1.2 thru C-1.6. Updated name from College of Nursing and Health Sciences to College of Health and Wellness.	CAS Safety Committee	Maria Aloya

Revision Date	Comments	Reviewed and Updated	Approved
July 2023	Updated Section 1.1 for new Compliance Officer. Updated Section 1.2 Fine Arts and Sciences Safety Committee members. Added Section 2.1.5 Custodial Workers and Section 2.1.6 Facilities Maintenance Workers. Updated Section C-2.11 Working with the NMR in Adrian 105 and C-2.12 NMR Maintenance and Cryogen Fills. Added C-2.13 "Lab Safety Rules for Vendors Working in NMR Room". Updated Oxygen Monitor procedure in Appendix B. Updated Appendix H: Lab Self-Inspection Form. Updated contact information for OAS under Appendix Section C-6.1 Service Animals Safety Guidelines. Updated C-5.1 Rules of the Lab, Podiatric Medicine. Updated C-1: College of Arts and Sciences, Biology, Safety Training Forms.	Fine Arts and Sciences (FAS) Safety Committee	Maria Aloya
July 2024	Updated Section 1.2 Fine Arts and Sciences Safety Committee members. Replaced "Public" with "Campus" Safety for entire document. Under Section 7.1 Hurricane Lab Preparedness, updated link to hurricane preparations.	FAS Safety Committee	Maria Aloya
July 2025	Updated Section 1.2 Fine Arts and Sciences Safety Committee members. University uses new phone system, and updated campus telephone numbers. Updated Appendix C-2 safety training sheets for the Chemistry & Physics Department. Updated new name of College of Health and Wellness to College of Health Professions & Medical Sciences.	FAS Safety Committee	Maria Aloya