Incident Response Procedures
for the FIU CEE Environmental & Water Resources Engineering Unit
Laboratories (Rooms EC 3625, EC 3630, EC 3760, EC 3765)

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INTRODUCTION

Purpose

To establish an Incident and Emergency Response for the FIU CEE Environmental & Water Resources Engineering Unit Laboratories that will enable personnel to respond to incidents and emergencies falling under three types of situations effectively:

I. Incidents and emergencies that may occur as a result of the typical activities in the laboratories EC 3625, EC 3630, EC 3760, and EC3765.
II. Response to fire events that may occur while working in those labs.
III. Preparation and recovery from severe weather events.

Definitions

Incident: Limited in scope and not considered a significant emergency. For the labs considered in this report, examples of incidents include minor cuts and puncture wounds, mild skin irritation, and minor spills. A minor chemical spill is one of a non-hazardous liquid and small enough that the student, teaching assistant, or instructor can handle it safely without disrupting the activities of the lab and without the assistance of the Environmental Health and Safety (EHS) personnel.

Emergency: An event or incident that constitutes an immediate or imminent risk to life, health, property, or environment. For the labs considered in this report, examples of emergencies include a chemical exposure to any part of the eye or eyelid, deep skin cuts or punctures, severe skin irritation, and major spills. A major chemical spill is one of a hazardous substance or a large volume such. These spills require the evacuation of the lab, and cleanup may require the assistance of the EHS personnel.

Personnel: Laboratory coordinator, faculty in charge, instructor, and students (undergraduate and graduate) directly engaged in instructional or research activities in laboratories EC 3625, EC 3630, EC 3760, and EC3765.

Visitors: A person visiting laboratories EC 3625, EC 3630, EC 3760, and EC3765; this includes any member of the University community or the public at large who come to the labs either to see the building, one of its occupants, or an event sponsored by the Department, College, or University and taking place in the laboratories.

Mitigation: Comprises any activities that prevent an emergency, reduce the chance of an emergency, or reduce the damaging effects of unavoidable emergencies. Mitigation activities take place before and after emergencies.

Preparedness: Comprises plans or preparations made to help respond to the emergency. Preparedness activities take place before an emergency occurs.

Response: Comprises actions taken to manage the emergency and to prevent further damage or loss to life and property. The response is putting the preparedness plans into action. Response activities take place during an emergency.

Recovery: Comprises the actions taken to return to a normal or safer situation following an emergency. Recovery activities take place after an emergency.

Description of the Facilities

Rooms are located on the third floor of the southeast (SE) quadrant of the Engineering Center and Computer building (Figure 1). Each room has an approximate area of 32' x 32' and is equipped with one chemical fume hood and three safety mechanisms including one each eye wash, emergency shower, and fire extinguisher. Each room is also equipped with a Cisco Systems telephone: the campus telephone system is the FIU communication platform available in the lab for emergency notification (a short text message will be displayed on the phone itself as well as broadcasting an audible message). Figures 2 to 5 show the layout of these rooms displaying the location of University safety equipment.

EC 3625

This room is furnished with laboratory glassware and apparatuses used for traditional environmental wet analysis. Approximately 60 distinct chemicals, about 15 of which are liquids, are kept in this lab (See Appendix Table A.1 and Table A.2. Note that these quantities refer to the number of unique chemical compounds; that is, the individual containers count is larger as multiple containers of some of the chemicals are available). The room is equipped with a chemical fume hood which shares one common exhaust blower with that installed in EC 3630.
EC 3625 is primarily used as an instructional laboratory for the courses Environmental Engineering Lab I (ENV 3001 L) and Environmental Engineering Lab II (ENV 4005 L). These curriculums serve approximately 100 students per year from the undergraduate populations of both the civil and the environmental engineering degree programs. Additionally, less than ten (10) graduate, undergraduate and high school students may use the laboratory during the summer conducting research under the mentoring of Dr. Walter Z. Tang or Dr. Anna R. Bricker.

EC 3760

This room contains both traditional environmental wet analysis and high voltage equipment. Approximately 200 chemicals, about 25 of which are liquids are kept in this laboratory (See Appendix Table A.3, Table A.4 and Table A.5. Note that these quantities refer to the number of unique chemical compounds; that is, the individual containers count is larger as multiple containers of some of the chemicals are available). The room is equipped with a chemical fume hood which shares one common exhaust blower with that installed in EC 3765.
EC 3760 is used as a research laboratory by students working mostly under the mentoring of Dr. Berrin Tansel. A maximum of ten (10) graduate and undergraduate students may be working in the laboratory.

EC 3765

This room is furnished with commercial equipment intended for higher education engineering instruction/demonstrations. The chemicals kept in this room include glycerin and motor oil. The room is equipped with a chemical fume hood which shares one common exhaust blower with that installed in EC 3760. EC 3765 is exclusively used as an instructional laboratory for the course Fluid Mechanics Lab (CWR 3201 L). This curriculum serves approximately 100 students per year from the undergraduate populations of both the civil and the environmental engineering degree programs.

Emergency Contact Information

Environmental Health & Safety (EH&S): 305-348-2621
Police (FIUPD): 305-348-2626

EC 3625	Lab Coordinator: Anna Bernardo-Bricker, Associate Teaching Professor (office: (305) 348-3825, email: abernard@fiu.edu) Research Faculty: Walter Z. Tang, Associate Professor (office: (305) 348-3046, email: tangz@fiu.edu) Research Faculty: Berrin Tansel, Professor (office:(305) 348-2928, email: tanselb@fiu.edu) Program Coordinator: Dayana Diaz Torres (office: (305) 348-4893, email: ddiaztor@fiu.edu)
EC 3630	Research Faculty: Hector H. Fuentes, Professor (office: (305) 348-2837, email: fuentes@fiu.edu) Research Faculty: Arturo S. Leon, Associate Professor (office: (305) 348-1370, email: arleon@fiu.edu) Research Faculty: Ali Ebrahimian, Assistant Professor (office: (305) 348-4883, email: alebrahi@fiu.edu) Program Coordinator: Dayana Diaz Torres (office: (305) 348-4893, email: ddiaztor@fiu.edu)
EC 3760	Research Faculty: Berrin Tansel, Professor (office:(305) 348-2928, email: tanselb@fiu.edu) Research Faculty: Hooman Vatankhah, Assistant Professor (office:(305) 348-2824, email: hvatankh@fiu.edu) Lab Coordinator: Anna Bernardo-Bricker, Associate Teaching Professor (office: (305) 348-3825, email: abernard@fiu.edu) Program Coordinator: Dayana Diaz Torres (office: (305) 348-4893, email: ddiaztor@fiu.edu)
EC 3765	Lab Coordinator: Cora Martinez, Assistant Chair and Teaching Professor (office: (305) 348-0258, email: cmart022@fiu.edu) Program Coordinator: Dayana Diaz Torres (office: (305) 348-4893, email: ddiaztor@fiu.edu)

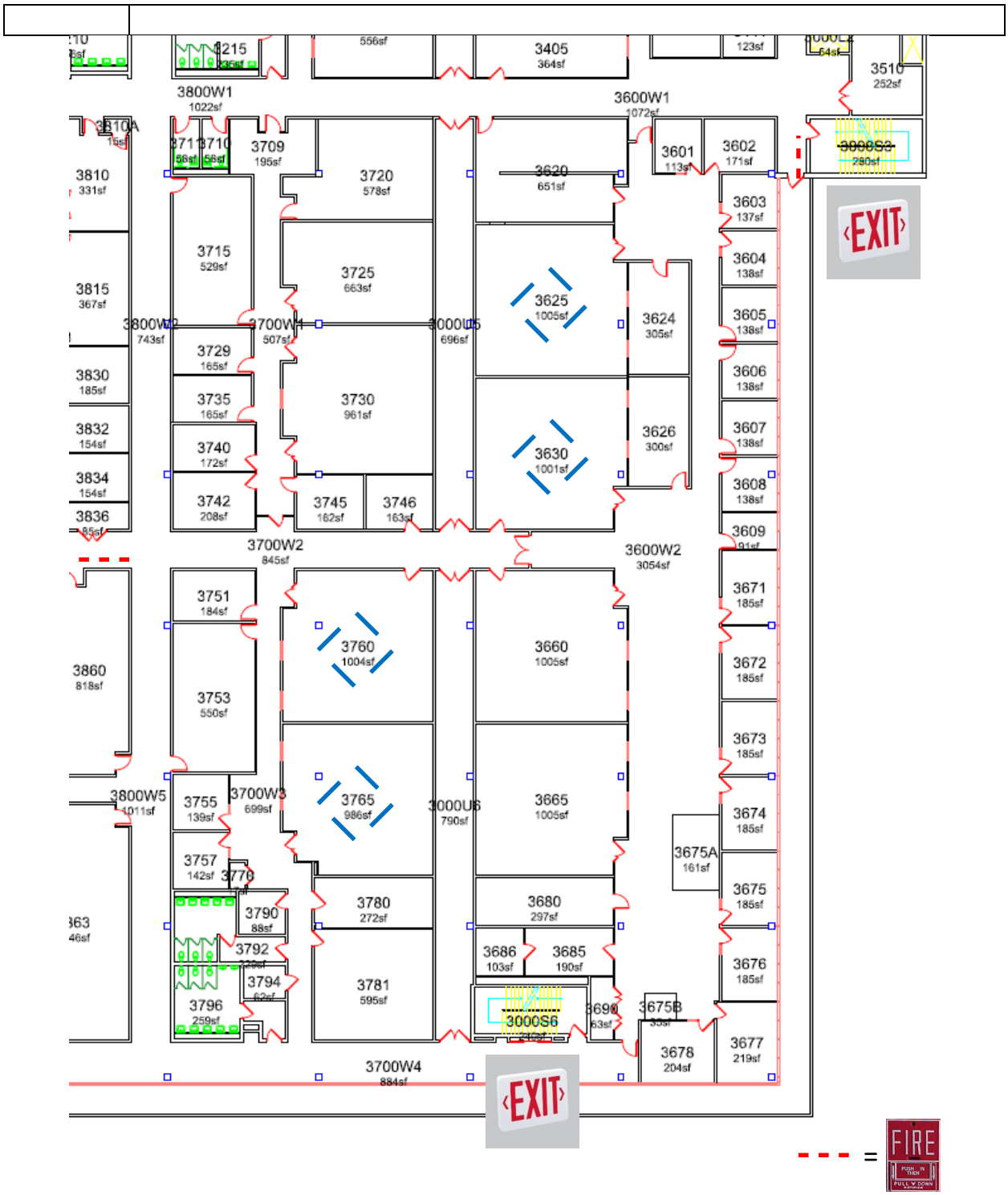


Figure 1. Southeast (SE) quadrant of the Engineering Center and Computer building, Florida International University (FIU), third floor. Layout shows the location of the four laboratory rooms that comprise the FIU CEE Environmental & Water Resources Engineering Laboratories and their nearest emergency exits. (adapted from source: Office of Academic Space Management at https://buildingplans.fiu.edu/building.php)

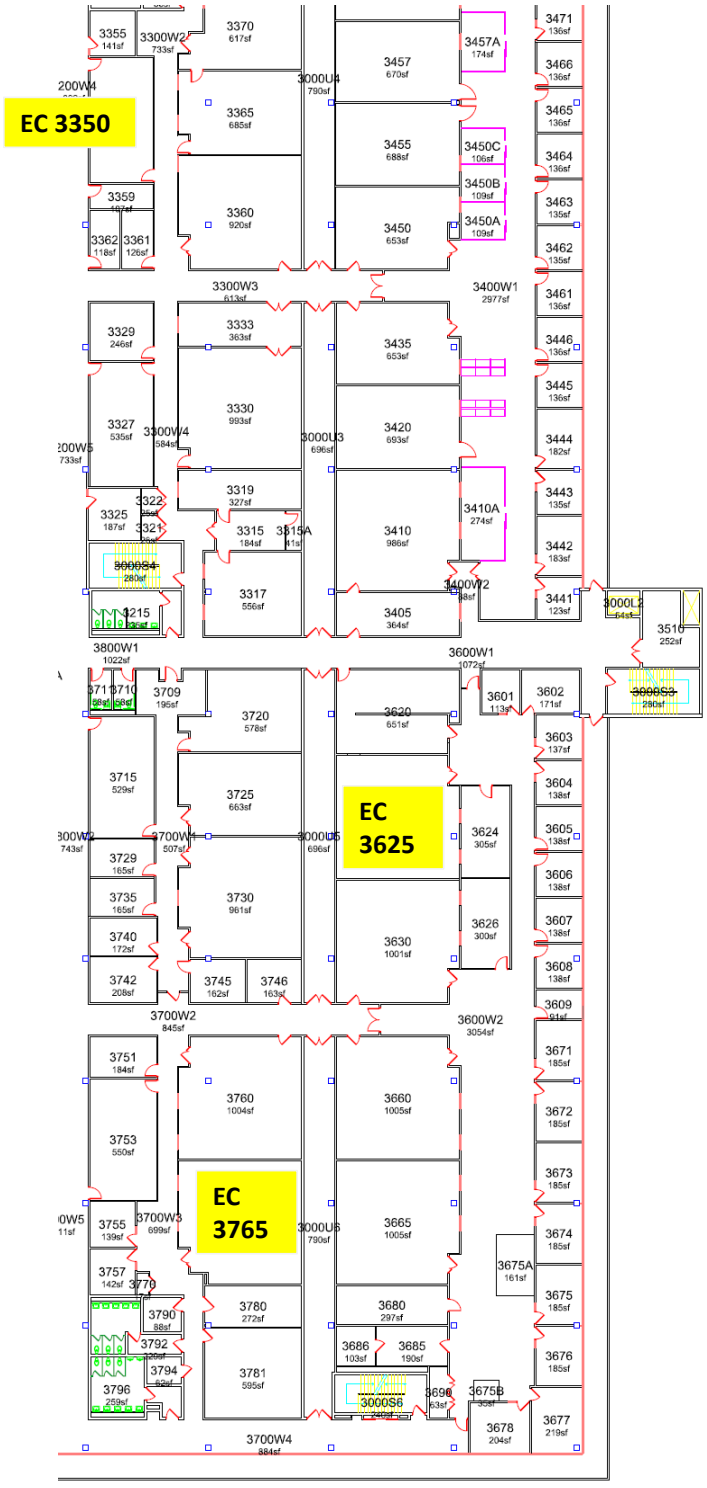


Figure 2. Layout of the third floor of the Engineering Center and Computer building, Florida International University (FIU) showing the relative location of the instructional laboratories' rooms EC 3625 and EC 3675 versus the large CEE-Conference room EC 3350, the possible shelter room in case of Tornado Warning. (adapted from source: Office of Academic Space Management at https://buildingplans.fiu.edu/building.php)

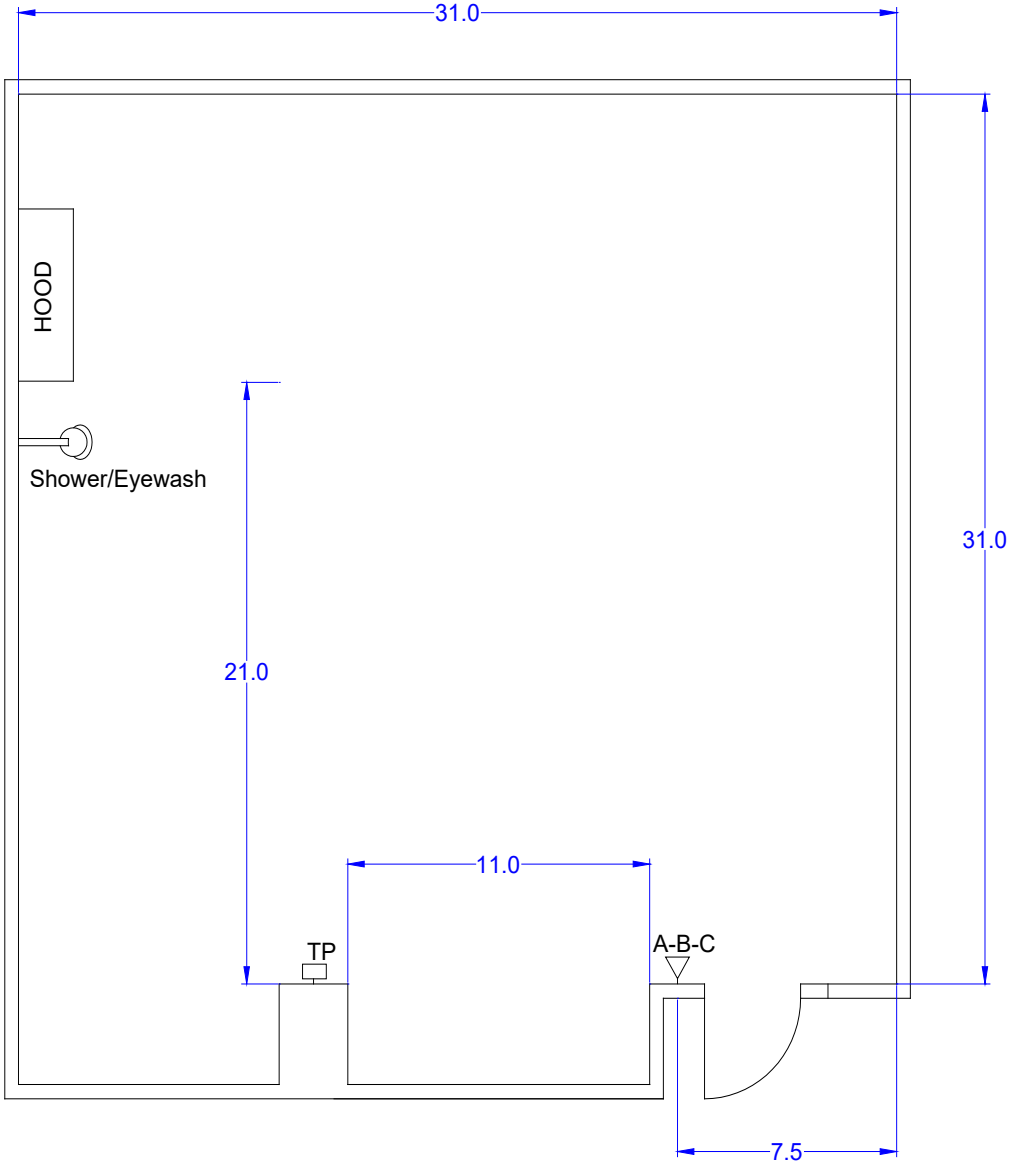


Figure 3. Layout of room EC 3625 showing location of University safety equipment.

A-B-C = Fire Extinguisher; that is, suitable for Class A fires (organic solids), Class B fires (flammable or combustible liquids) and Class C fires (flammable gases).

T P= Cysco Systems Phone 

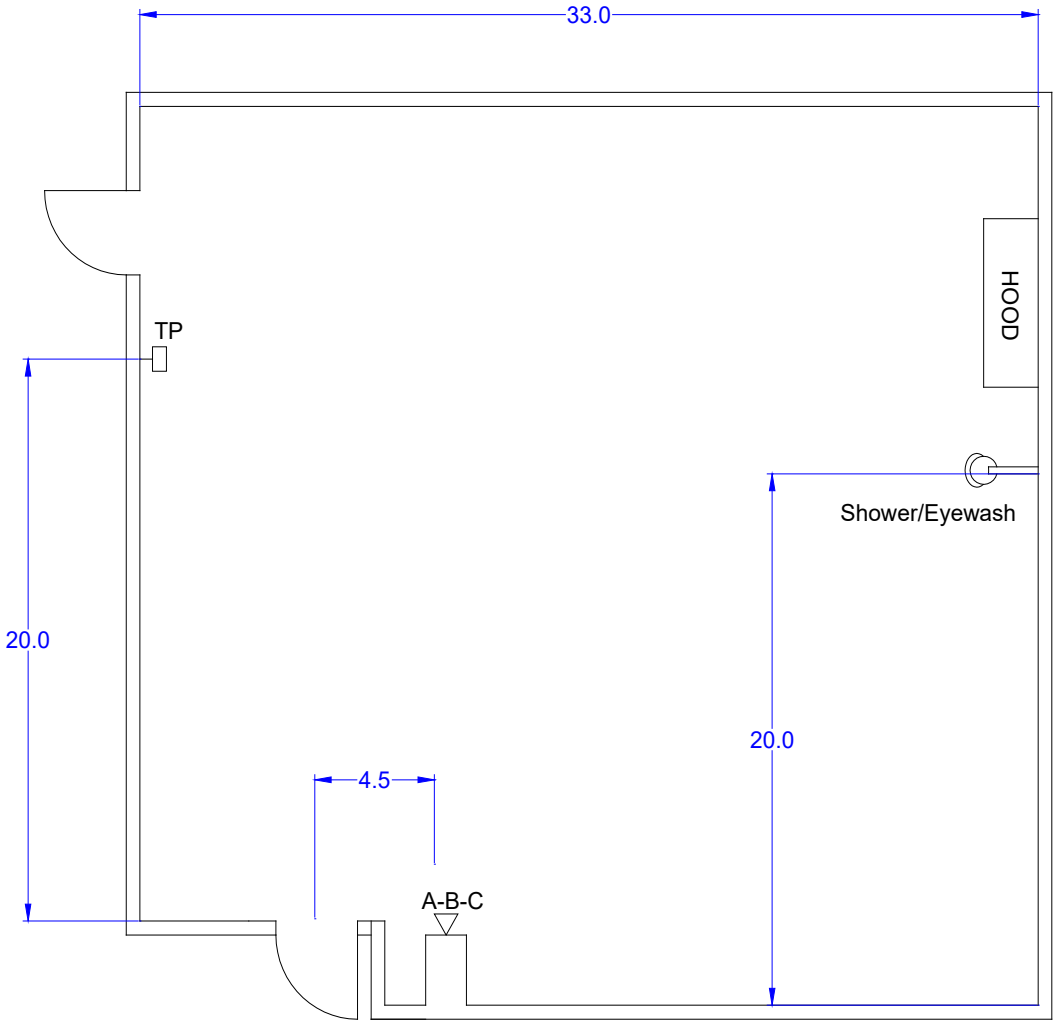


Figure 4. Layout of rooms EC 3630 showing location of University safety equipment.

A-B-C = Fire Extinguisher; that is, suitable for Class A fires (organic solids), Class B fires (flammable or combustible liquids) and Class C fires (flammable gases).

T P= Cysco Systems Phone 

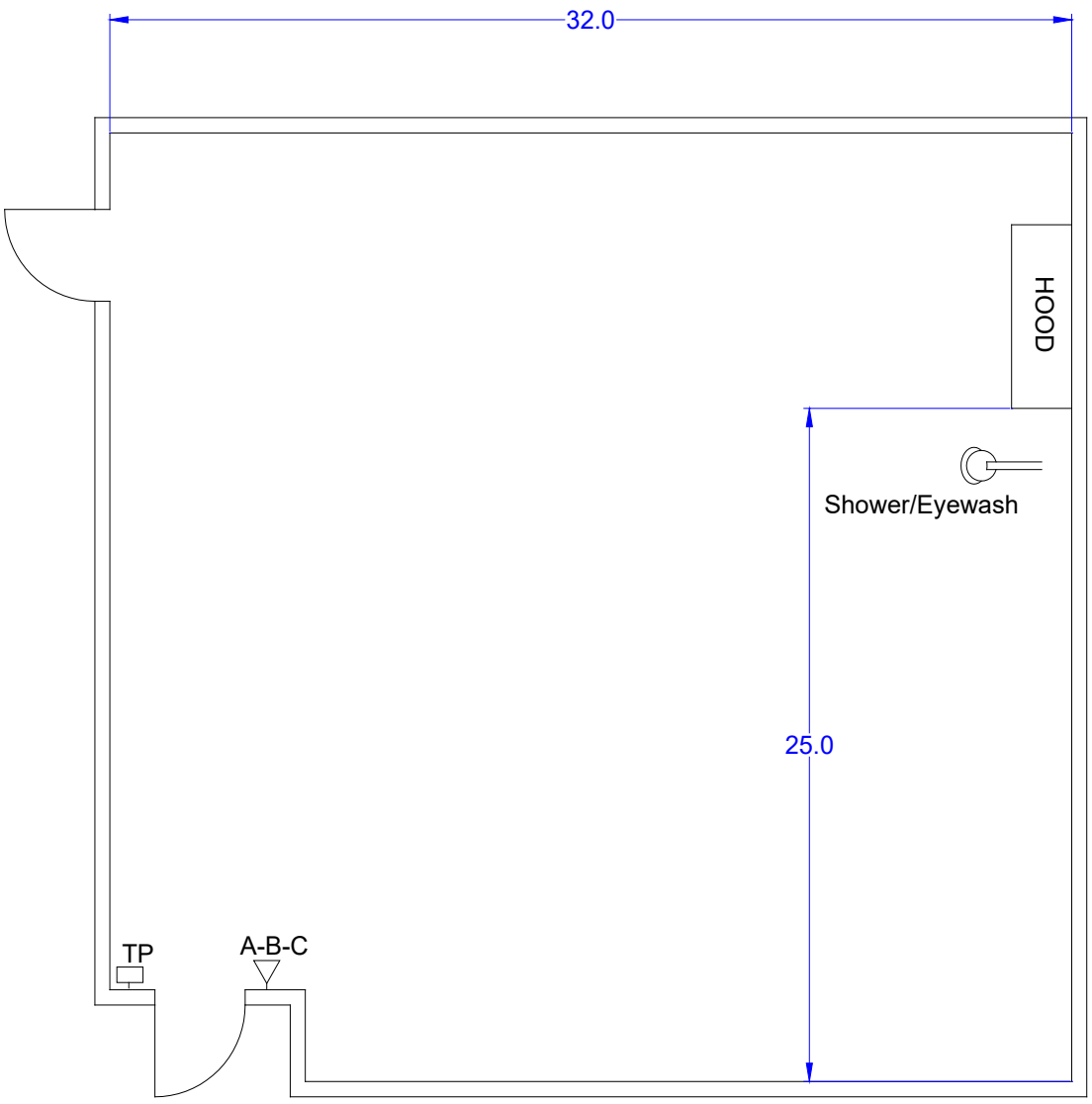


Figure 5. Layout of rooms EC 3760 showing location of University safety equipment.

A-B-C = Fire Extinguisher; that is, suitable for Class A fires (organic solids), Class B fires (flammable or combustible liquids) and Class C fires (flammable gases).

T P= Cysco Systems Phone 

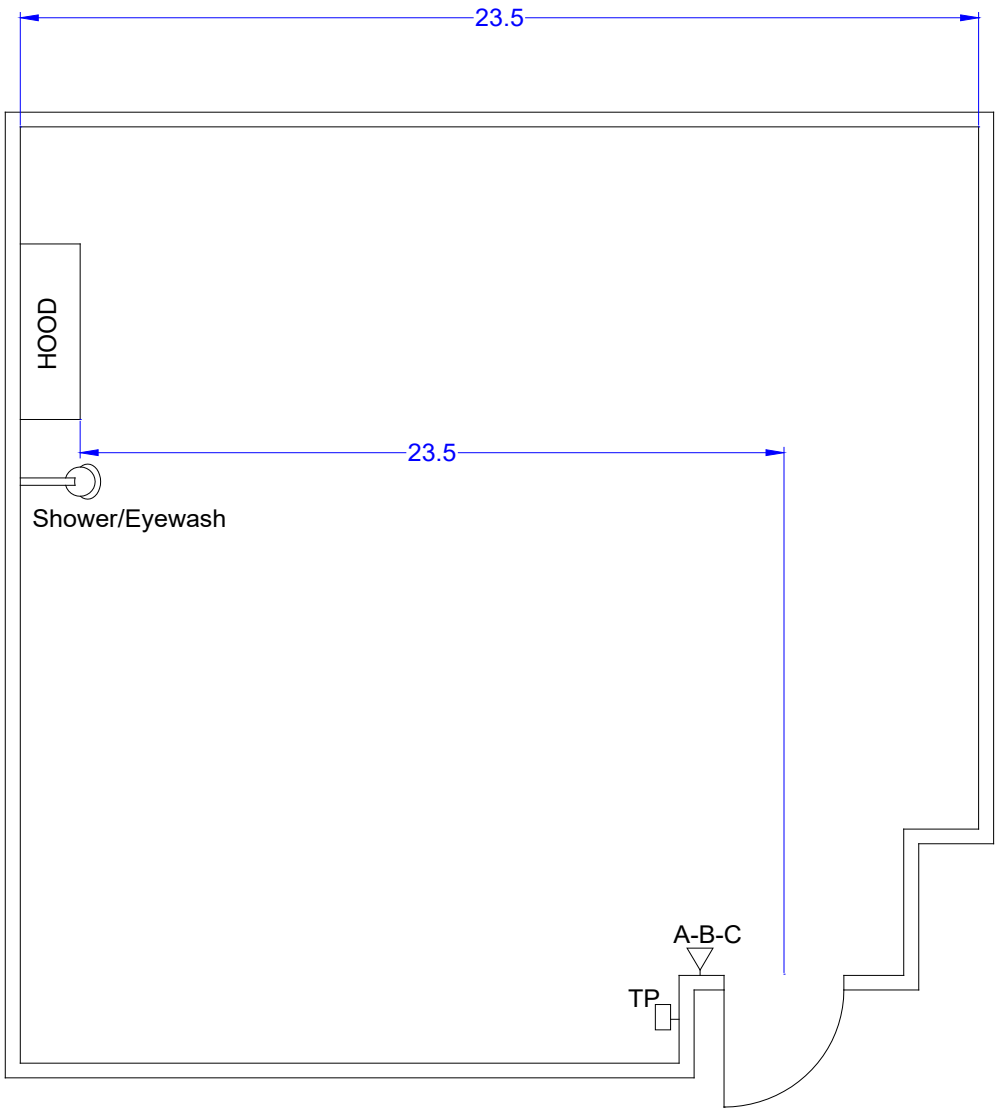


Figure 6. Layout of rooms EC 3765 showing location of University safety equipment.

A-B-C = Fire Extinguisher; that is, suitable for Class A fires (organic solids), Class B fires (flammable or combustible liquids) and Class C fires (flammable gases).

T P= Cysco Systems Phone 

I. Incidents and emergencies that may occur as a result of the typical activities in the laboratories EC 3625, EC 3630, EC 3760, and EC3765.

I.1 Background Information

In the context of the Occupational Safety and Health Administration (OSHA) laws and regulations affecting Florida International University, our Department of Environmental Health and Safety (FIU-EH&S) has in place a systematic approach to managing waste, complying with environmental regulations, and comprehensively addressing aspects of workplace safety that could affect the health and well-being of the University community. The rules and regulations associated to the purpose specified above are established in the University Safety Programs documents, with emphasis on the Sections General Safety, Environmental Compliance, and Laboratory Safety. The procedures outlined in this document are aligned with those prescribed within the University's compliance guides.

OSHA defines hazard as any source of potential damage, harm or adverse health effects. The three more important hazards associated to the type of work conducted in the Environmental and the Water Resources laboratories are the use of chemicals, broken glassware, and high voltage equipment. These are discussed in **Section I.2**. **Safety education** and **training** are the two pillars of preventing accidents and emergencies. Safety education refers to practicing awareness and learning to recognize and avoid hazards. Safety training refers to learning, preferably hands-on, the proper and safe use of each piece of laboratory equipment and chemicals and appropriate personal protection equipment. Safety education and training are how FIU ensures that employees have the knowledge and skills they need to do their jobs safely. The FIU-EH&S department, in its responsibility to OSHA, has established a list of Required Training by Lab Category. The online and in-person training courses are how FIU employees and researchers can satisfy safety training requirements associated with their job tasks. The full list of courses offered can be found at Courses Available. Based on the hazards identified for the laboratories discussed in this document, the required training is summarized in Table I.1. Personnel responsible for the labs should complete all courses indicated in the table. Additionally, since 2013, the lab instructor requires that all students taking courses in room EC 3625 take the Chemical Handling Safety – Basic Principles course.

Table I.1. List of required training for personnel working in rooms EC 3625, EC 3630, EC 3760 and EC 3765

Lab Category	Required Training Courses	Frequency
Core Training Modules (Must be completed by all labs)	- Laboratory Hazard Awareness - Hazard Communication (HAZCOM) - Fire Safety (online or instructor-led)	2 Years 2 Years 2 Years
Labs working with Chemicals (including nanoparticles EC 3625 EC 3760 EC 3765	- All Core Training Courses - Environmental Awareness - Small Spills and Leaks - EPA: Hazardous Waste Awareness & Handling - Personal Protective Equipment (Lab) - Safe Use of Fume Hoods - Safe Use of Emergency Eyewash & Shower - Chemical Handling Safety – Basic Principles	 Annually Annually Annually 2 Years 2 Years 2 Years 2 Years
Labs working with Chemicals AND Lasers EC 3760	- All Core Training Courses - All Chemical Lab Courses - Laser Safety	 3 Years
Compressed Gas EC 3760	- All Core Training Courses - All Chemical Lab Courses - Compressed Gas Safety Awareness	 2 Years

I.2 Hazard Identification: Evaluation of Chemical Hazards

Following is a list of the possible hazards related to the typical activities in the laboratories EC 3625, EC 3630, EC 3760, and EC3765.

A. Broken glassware (all rooms)
B. Chemical spill (mainly EC 3625 and EC 3760, to a minor extent EC 3765)
C. Mercury spill (a special case of hazardous chemical spill; affects room EC 3630, and to a minor extent EC 3760 and EC 3625 (thermometers))
D. Electrical (all rooms)
E. Compressed gases (EC 3760)
F. Vacuum operations (EC 3760: equipment not currently in operation)
G. Pressure operations (EC 3630)
H. Laser (EC 3760)

Chemical hazards are classified into two major groups, physical and health hazards. Each hazard group includes hazard classes that have specific hazardous properties.

Physical hazards group: based on the physical or chemical properties of the product – such as flammability, reactivity, or corrosivity to metals.

Health hazards group: based on the ability of the product to cause a health effect – such as eye irritation, respiratory sensitization (may cause allergy or asthma symptoms or breathing difficulties if inhaled), or carcinogenicity (may cause cancer).

For a chemical to become hazardous to a person's health, it must first contact or enter the body, and the chemical must have some biological effect on the body. There are three primary routes of hazardous exposure:

- Inhalation (through the nose)
- Absorption (through the skin and, especially, eyes)
- Ingestion (through the mouth)

Once toxic chemicals enter the body, they can cause various harmful effects, including immediate (acute) or long-term (chronic) effects that may not appear for several years after exposure. Toxic chemicals can also produce local and systemic effects, depending on the nature of the chemical and the route of exposure.

The Safety Data Sheets (SDS) are the cornerstone of chemical hazard communication and are central to the safe handling of hazardous substances. They provide all the essential information about a chemical's safe handling procedures and immediate hazards, necessary first aid procedures, and clean-up and disposal procedures. To be prepared for an emergency, all personnel must read the information for every chemical they use for their work.
The SDS sheets for all the chemicals in room EC 3625 are kept in a binder on an easily accessible bench location for quick reference, and the electronic pdf files are accessible from a shared drive. The SDSs for all chemicals in the EC 3760 laboratory are accessible as pdf files from a shared drive. In addition, all personnel should be responsible for acquiring the SDS for any special-order

chemical. The QR codes and other information for accessing the electronic files are readily available on the cover of the binder filing this emergency Response Procedures Manual.
OSHA Mandated SDS Information includes the following ten (10) items:

1) Chemical Identity and a list of all hazardous ingredients
2) Physical Data: vapor pressure, flash point, density, boiling point, etc.
3) Physical Hazards: Fire and explosion data, and reactivity data if applicable.
4) Health Hazards: Signs and symptoms of exposure, and any medical conditions generally recognized as being aggravated by exposure to the material.
5) Primary Route(s) of Entry: inhalation, ingestion,
6) Exposure Limits: Legal exposure limits (OSHA and other recommended limits).
7) Known carcinogenic risk
8) Precautions for Safe Handling and Use: including appropriate hygienic practices, protective measures required during handling of contaminated equipment, and procedures for clean-up of spills and leaks.
9) Control Measures: Any control measures known to the party preparing the SDS, such as engineering controls, work practices, or personal protective equipment.
10) Emergency and First-Aid Measures

Table I.2. National Fire Protection Association (NFPA) rating system definitions

Health (Blue)

4 Danger- May be fatal on short exposure. Specialized protective equipment required.
3 Warning - Corrosive or toxic. Avoid skin contact or inhalation
2 Warning – May be harmful if inhaled or absorbed.
1 Caution – May be irritating
0 No unusual hazard

Flammability (Red)

4 Danger – Flammable gas or extremely flammable liquid
3 Warning – Flammable liquid flash point below 100° F
2 Caution – Combustible liquid flash point of 100° F to 200° F
1 Combustible if heated
0 Not combustible

Instability (Yellow) (Reactivity)

4 Danger- Explosive material at room temperature.
3 Danger – May be explosive if shocked, heated under confinement, or mixed with water
2 Warning – Unstable or may react violently if mixed with water
1 Caution – May react if heated or mixed with water but not violently
0 Stable – Not reactive when mixed with water

Special Notice Key (White)

W Water reactive
OX Oxidizing Agent

Figure I.1 shows the typical sections found in an SDS. The National Fire Protection Association (NFPA) has developed a diamond label system for indicating the health (blue), flammability (red), and reactivity (yellow) hazards of chemicals. In addition, a special precaution symbol (in the white section) may be used where necessary. The rating numbers for each category range from 0 (no risk) to 4 (may be fatal), and are described as indicated in Table I.2. Appendix Tables A.1 to A.5 show the ratings for each of the chemicals listed; it can be seen that 70% of the chemicals fall within the health risk category 1 or higher and 20% within the health risk categories 3 and 4. In addition, 61% of the solvents kept in EC 3760 are considered flammables (NFPA "red" rating of 3 or 4).

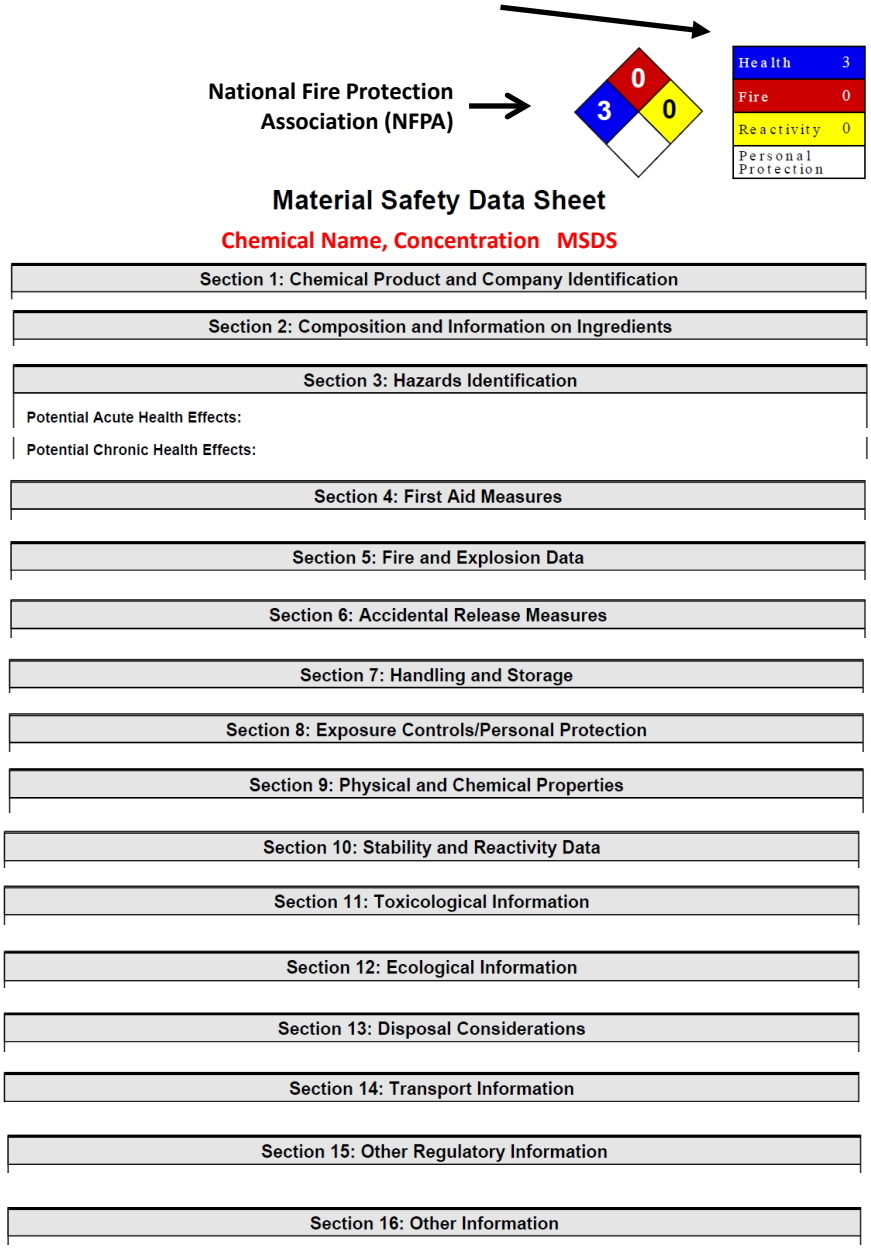


Figure I.1. Example of the Information provided in a typical Material Safety Data Sheet (SDS)

I.3 Response Procedures for Incidents and Emergencies

This section provides step by step response procedures for each of the hazards identified.

First Aid kits and all items necessary to carry out the clean-up are stocked in a specific location of the laboratory rooms EC 3625 and EC 3760 labeled “Broken Glassware and Chemical Spills Cleanup Supplies” and “Corrosive/Organic Solvent Cleanup Supplies”

Video illustrations of the clean-up procedures described here can be accessed at:

A. Broken glassware

Given the type of glassware used in the instructional laboratories (EC 3625 and EC 3765), decontaminated glassware breakages are likely to be minor accidents. In the case of Instructional Laboratories, students should be informed to report any incidence of broken glassware to the Instructor or TA in charge of the lab. Undergraduate and graduate students engaged in laboratory research work must be instructed on the proper cleanup procedure detailed below.

Before beginning cleanup, students working as research assistants should inspect themselves for cuts and embedded glass. In case of minor cuts, they should administer any necessary first aid from the First Aid kit. In instructional laboratory sessions, students should be inspected by the Instructor or Teaching Assistant (TA), who should carry out any required first aid help.

After cleanups, notify the Laboratory coordinator, who will promptly replace the materials used for the cleanup and evaluate the emergency to consider future preventative options.

To protect custodians from injury, broken glass is not to be disposed of in the regular trash. Laboratories must have Broken Glass Disposal Boxes to discard uncontaminated broken glass. Once the box is full, it must be appropriately sealed and directly disposed of in the outside trash dumpster located by the OU building. This procedure is aligned with in EHS-DOC606.00 - Lab Glassware Disposal Guidelines (Chemical Hygiene Plan Guidance Documents).

Procedure to cleanup broken glass:

1. Wear goggles and puncture-resistant gloves.
2. Use the appropriate size broom to sweep up as much as possible of the glass pieces into the dustpan. On a second sweeping it may help to dust the area lightly with Talco powder to keep the smallest fragments from sticking to the floor/bench or the broom's bristles.
3. Use a piece of damp paper towel to collect the last smallest pieces that might otherwise get away from the broom, and to wipe the dustpan clean before placing back into the "Broken Glassware and Chemical Spills Cleanup Supplies" cart.
4. Dispose of all broken glass in the specific container designated for clean broken glassware.
5. Shake the broom lightly into the container designated for broken glassware. Use best judgment to decide whether the broom is clear from all glass pieces and can be placed back in the kit for reuse, or if the broom head should be discarded.
6. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

B. Chemical Spills

To be prepared for a specific chemical spill emergency, all personnel must examine the SDS information for every chemical they use for work. Detailed Instructions for cleanup of accidental spills appear under "Section 6: Accidental Release Measures". Refer to Figure I.1, on page 17.

The cleanup procedures described here are aligned with EHS-DOC201.02 – Spill Response Procedures (Chemical Hygiene Plan Guidelines Documents). This document outlines recommendations for determining the response plan based on the spill's size, as shown in Table I.3. Appropriate cleanup responses should aim at protecting personnel's health and, whenever possible, reducing the toxicity of the spill so that it would be possible to discard it and the absorbing materials as regular waste rather than "hazardous waste." The spills that are most likely to occur in our instructional laboratory (room EC 3625) can be categorized as "small" in size. Furthermore, the most likely scenario involves spills of acids or bases with a concentration strength equal to or lesser than 1M. In these cases, the proper neutralizing agents are sodium bicarbonate (Na_2CO_3, commercial baking soda) if the spilled liquid is an acid, and either diluted acetic acid (CH_3COOH, commercial white vinegar is approximately 6% acetic acid) or sodium bisulfate ($NaHSO_4$) if the spilled liquid is a base. In addition, undergraduate and graduate students and any other person engaged in research work in rooms EC 3625 or EC 3760 may be handling concentrated corrosive acids, bases, and organic solvents (room EC 3760).

Table I.3. Categorization and Response Guidelines to Chemical Spills based on Spill Size

Category	Size	Response	Treatment materials
Small	Less than 10 gal	Chemical treatment (neutralizer) or absorbent	Acid/base neutralizing powder or pink PIG mats, absorbent pads
Large	Greater than 10 gal	Call FIU Police	Varies

Cleanup instructions for each spill-case scenario are provided here. All items needed to clean up a spill can be found in the "Broken Glassware and Chemical Spills Cleanup Supplies" cart, and the "Corrosive/Organic Chemical Cleanup Supplies" buckets in EC 3625 and EC 3765. In case of a minor chemical spill during an instructional laboratory session, the Instructor or TA in charge shall firstly move students away from spill and attend to any minor cuts by using the items in the First Aid Kit. **Marked with an asterisk (*) are the chemical spills more likely to occur in the settings of the instructional laboratory courses.**

Spill Cleanup Supplies:

- ✓ Goggles
- ✓ Chemical Resistant Gloves
- ✓ Neutralizing agents for acids and bases (baking soda or garden lime, white vinegar or sodium bisulfate)
- ✓ Absorbents (Yellow mats/pads, Zep™ commercial spill absorber, Vermiculite)
- ✓ Scraper and Scoop for collecting absorbed materials
- ✓ Plastic bags to contain solid waste which may be disposed in the regular trash
- ✓ Buckets with lids for collecting solid waste for proper disposal as "Hazardous Waste" (corrosive and organic solvents)

Procedure to cleanup spills of ACID solutions **Concentration strength ≤ 1M** **Spilled volume ≤ 300 mL ("Small")**	**GOAL:** **NEUTRALIZE spill** **and discard liquid waste in sink**

1. Wear goggles and chemical resistant gloves.

2. Contain spill from spreading by placing absorbent paper or yellow mats over it

High absorbency paper towel (blue)... Up to 10 mL spill
Yellow absorbent mats……..... One 10x10 mat will hold up to 150 ml of liquid

3. Sprinkle baking soda over the mats until fizzing completely stops. (1)

4. Mop up the spill and place the mats in a small bucket.

5. Take bucket with mats to the nearest sink and rinse the mats with plenty of water.

6. Wring the mats completely. (2)

7. Use pH paper to confirm neutralization of the spill surface area. Sprinkle baking soda if still needed and wipe the surface using paper towel, which may then be discarded in the regular trash.

8. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

(1) Approximate grams of baking soda required to neutralize acid (markings found on the dispensing container)

	Concentration of Acid Spill (M)		
Volume of Acid Spill (ml)	**0.1**	**0.5**	**1**
10	1	1	2
25	1	2	3
50	1	3	6
100	2	6	11
300	4	16	32

(2) Yellow mats may be dried and reused or discarded in the regular trash, as considered appropriate

Procedure to cleanup spills of ACID solution **Concentration strength ≤ 1M** **300mL < Spilled volume < 5 L ("Medium")**	**GOAL:** **NEUTRALIZE and ABSORB spill and discard solid waste in trash**

1. Wear goggles and chemical resistant gloves.

2. Contain spill from spreading by sprinkling a line of absorbent material, then continue to sprinkle absorbent towards the center of the spill until it is immobilized but soft and pulpy.

3. Sprinkle baking soda and thoroughly blend using the scraper provided. (1) Wait until fizzing completely stops.

4. Add more absorbent material until spill is completely absorbed and surface feels dry.

5. Sweep/scoop neutralized solid waste into the plastic bag.

6. Use pH paper to confirm neutralization of the spill surface area. Sprinkle baking soda if still needed and wipe the surface using paper towel, which may then be discarded in the regular trash.

7. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

(1) Approximate grams of baking soda required to neutralize acid (markings found on the dispensing container)

	Concentration of Acid Spill (M)		
Volume of Acid Spill (ml)	**0.1**	**0.5**	**1**
500	6	27	53
1000	11	53	106
2000	22	106	211
3000	32	158	316
5000	53	263	526

Video illustration of clean up procedure: ERP_HClcleanup_mediumSize

Procedure to cleanup spills of CAUSTIC (base) solution **Concentration strength ≤ 1M.** **Spilled volume ≤ 300 mL ("Small")**	**GOAL:** **NEUTRALIZE spill and discard liquid waste in sink**

1. Wear goggles and chemical resistant gloves.

2. Contain spill from spreading by placing yellow pads over it

   Yellow absorbent mats……..... Use one 10x10 mat for each 75 ml of liquid

3. Spray white vinegar over the mats until fizzing completely stops. (1) If necessary, use an additional yellow mat to absorb the liquids.

4. Mop up the spill and place the mats in a small bucket.

5. Take bucket with mats to the nearest sink and rinse the mats with plenty of water.

6. Wring the mats completely. (2)

7. Use pH paper to confirm neutralization of the spill surface area. Spray some white vinegar if needed and wipe the surface using paper towel.

8. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

(1) Approximate volume (mL) of white vinegar required to neutralize base

	Concentration of Caustic Spill (M)		
Volume of Caustic Spill (ml)	**0.1**	**0.5**	**1**
10	2	8	16
25	4	19	38
50	8	38	76
100	16	76	151
300	46	226	451

(2) Yellow mats may be dried and reused or discarded in the regular trash, as considered appropriate

Procedure to cleanup spills of CAUSTIC (base) solution 1 M < Concentration strength < 20 M (~2.5% to ~50%) Spilled volume ≤ 300 mL ("Small")	**GOAL: NEUTRALIZE spill and discard liquid waste in sink**

1. Wear goggles and chemical resistant gloves.
2. Absorb the spill by placing yellow pads over it

   Yellow absorbent mats…….... One 10x10 mat will hold up to 150 ml of liquid
3. Mop up the spill and place the mats in a small bucket.
4. Add Sodium Bisulfate ($NaHSO_4$) [(1)] and a volume of tap water equal to the size of the spill (i.e. if spill is 300 mL, then add ~300 mL of tap water). Mix thoroughly.
5. Use pH paper to confirm neutralization and wring the mats completely. [(2)]
6. Use pH paper to confirm neutralization of the spill surface area. Spray some white vinegar if needed and wipe the surface using paper towel.
7. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

[(1)] Approximate grams of $NaHSO_4$ required to neutralize the caustic spill

	Concentration of Caustic Spill (M)		
Volume of Caustic Spill (ml)	**5**	**10**	**20**
10	5	10	20
25	13	25	50
50	25	50	100
100	50	100	200
300	150	300	599

[(2)] Yellow mats may be dried and reused or discarded in the regular trash, as considered appropriate

Video illustration of clean up procedure: ERP_NaOHcleanup_mediumSize

Procedure to cleanup spills of CONCENTRATED ACID solutions Spilled volume is UP to a MAXIMUM of 50 mL	**GOAL: NEUTRALIZE spill and discard liquid waste in sink**

1. Wear goggles and chemical resistant gloves.

2. Wear fumes mask if spill happened outside the chemical hood.

3. Contain spill from spreading by sprinkling a line of absorbent material to encircle the spill.

4. Add garden lime over the spill gradually, alternating with small portions of water from the dispensing bottle and blending in using the scraper.
   A total of approximately 150 grams of garden lime are needed to neutralize 50 mL of sulfuric acid (see Appendix Table A.2 for other corrosive acids concentrations). Neutralization is complete when fizzing ceases.

CAUTION: Neutralization of such concentrated acid generates fumes and heat.

5. Use pH paper to confirm neutralization of the mound.

6. Sprinkle enough absorbent material until the mixture feels crumbly/dry.

7. Scoop neutralized solid waste into a plastic bag.

8. Use pH paper to confirm neutralization of the spill surface area. Sprinkle baking soda if still needed and wipe the surface clean using paper towel.

9. Place paper towels into the plastic bag together with the neutralized solid waste and fasten the bag.

10. Dispose of bag into general waste; it is no longer a hazard because it has been neutralized.

11. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

⚠ CAUTION *Neutralizers can help make corrosive liquids safer to clean up and handle and generate a non-hazardous waste. However, because the process of neutralizing acids and bases generates fumes and heat, attempting to neutralize corrosive acid spills larger than 50 mL in our laboratories is not only impractical but may also be potentially dangerous.*

Video illustration of clean up procedure: **spill of ~50 mL of H_2SO_4 in the fume hood**

Procedure to cleanup spills of CONCENTRATED ACID solutions Spilled volume > 50 mL	**GOAL: ABSORB spill and discard as solid "Hazardous Waste"**

1. Wear goggles and chemical resistant gloves.
2. Cover the spill with vermiculite, blending in using the scraper until the surface of the spill feels dry.
3. Sweep or scoop the solid waste into bucket and seal it.
4. Attach a properly filled "Hazardous Waste" label on the bucket.
5. Use pH paper to confirm neutralization of the spill surface area. Sprinkle baking soda if needed and wipe the surface clean using paper towel.
6. Dispose of paper towels into general waste.
7. Contact F.I.U.-Environmental Health and Safety to schedule a pick-up of the corrosive solid waste in the bucket. Hazardous Waste Pick-Up Request
8. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

Procedure to cleanup any size spills of ORGANIC SOLVENTS	**GOAL: ABSORB spill and discard as solid "Hazardous Waste"**

1. Wear goggles and chemical resistant gloves.
2. Cover the spill with vermiculite, blending in using the scraper until the surface of the spill feels dry.
3. Sweep the solid waste into bucket and seal it.
4. Attach a properly filled "Hazardous Waste" label on the bucket.
5. Contact F.I.U.-Environmental Health and Safety to schedule a pick-up of the solid waste in the bucket. Hazardous Waste Pick-Up Request
6. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

C. Mercury Spills

Elemental mercury (Hg) is a heavy, silvery metal element that is a liquid at room temperature. Liquid mercury has a density of 13.534 g/cm^3 and a vapor pressure of and the vapor pressure 0.2729 mmHg at normal room temperatures; therefore, it easily evaporates. Mercury vapors are invisible, odorless, and, at high levels, are very toxic. Inhalation of mercury vapors can harm the nervous system, cardiovascular system, digestive tract, kidneys, and the development of young children. For these reasons, prompt and proper cleanup and disposal of even minor spills is always taken very seriously.

In our laboratories metallic mercury is found in the following rooms/equipment/amounts:

- EC 3630/Armfield W3 Permeability-Fluidisation Studies Apparatus equipped with a mercury manometer containing 36 ml of mercury (equivalent to approximately 487 g)
- EC 3760/thermometers, about 0.5 mL (equivalent to approximately 5 to 7 g)
- EC 3625/thermometers, about 0.5 mL (equivalent to approximately 5 to 7 g)

What to do in the event of mercury spill in one of our laboratories?

The first decision to be made immediately after a mercury spill is who should clean it up. According to our EH&S department cleanups involving spills of 1 lb (454 g) of mercury or less should be handled by the person who caused it; furthermore, only one or two persons should remain in the room to clean the spill. If only one person stays inside for the cleanup, then one person shall remain immediately outside the room's door. Before starting the cleanup, place the sign "mercury spill, do not enter "outside the door

Additionally, <u>three important considerations prior to beginning the cleanup include</u>:

1) Avoid spreading spilled mercury. All persons near the spill shall check their clothing and shoe soles for residues of mercury. If these are found, the person shall take clothing and shoes off and wear the disposable coverall and shoe covers from the cleanup kit before leaving the room. Clothing that has come in contact with mercury should be discarded. Shoes' soles may be decontaminated by following the decontamination procedure described on page 28.

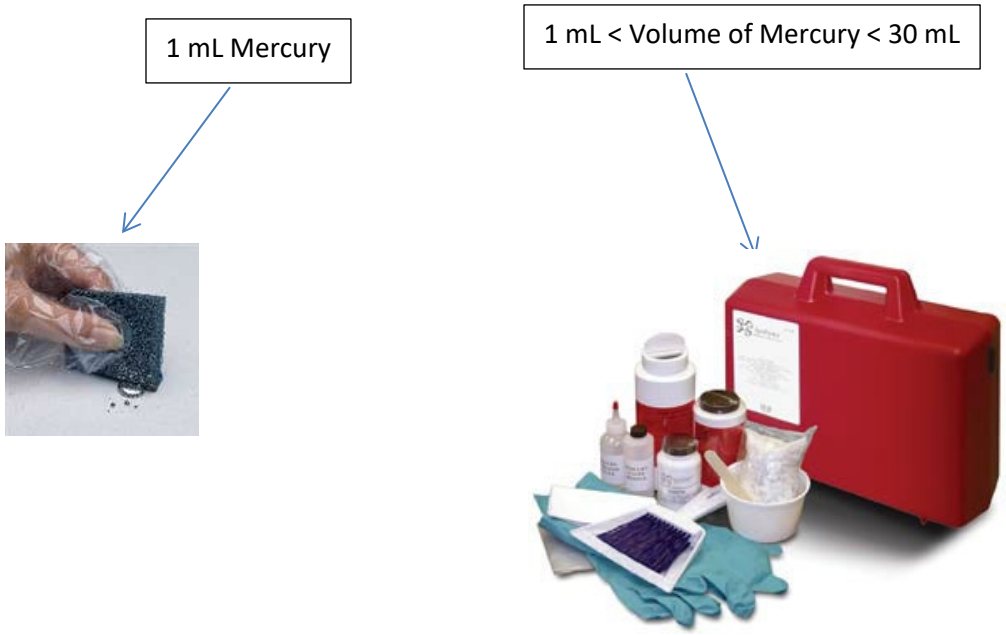
2) Keep the mercury from spreading into cracks, crevices, floor drains or onto sloped or porous surfaces which are difficult to clean. If necessary, masking tape or duct tape should be used to make a "fence" around the mercury droplets and confine them to a limited area for cleanup.

3) Remove all jewelry from hands and wrists. These can be permanently damaged by amalgamation with mercury.

A mercury spill involving about 3 mL of mercury is considered small, otherwise is medium to large. The three labs are equipped with Mercury Spill Kits. Following are the step-by-step cleanup procedure for each of these two cases.

Procedure to cleanup MAXIMUM 1 mL of mercury (approximately 13.5 g)	**GOAL: ABSORB spill and discard as solid "Hazardous Waste"**

1. Wear nitrile gloves and face mask. If spill spread over an area larger than 3x3 feet, cover shoes with disposable covers.
2. Pick up any broken pieces of glass or sharp materials. Place on a paper towel. Fold the towel and place in the waste disposing bag.
3. Begin the mercury cleanup by consolidating large droplets using an index card provided in the cleanup kit. To maintain control, use slow sweeping motions. The larger globules can be carefully collected onto an index card.
4. Use the Mercury Sponge to amalgamate the droplets (each sponge can amalgamate 5 grams of mercury).
5. Use the Mercury Cleanup Wipers to wipe off the area of the spill.
6. Place all mercury contaminated items in the disposing bag and label as Hazardous Waste.
7. Contact F.I.U.-Environmental Health and Safety at 7-2621 and schedule a pick-up of the hazardous waste. Hazardous Waste Pick-Up Request
8. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.



Procedure to cleanup a medium-size mercury spill: up to 25-30 mL (approximately 1 pound)

Use the SPILYFTER Mercury Spill Kit. Click for Video Instructions

Closely follow the Kit's instruction. In essence, the cleanup Kit is based on a two-step system: Vapor suppression, followed by amalgamation.

Prior to the amalgamation step described in the procedure for Small spill in the previous paragraph, the outer surface of the elemental mercury beads is first "stabilized" in order to prevent vaporization of the mercury. This first step is referred to as mercury vapor suppression; it consists on applying a proprietary formula product that works by immediately oxidizing the outer surface of the elemental mercury. Typically, the chemical change consists in converting the elemental mercury to the more stable non-vapor-producing mercuric sulphide.

1. Wear nitrile gloves and face mask, cover shoes with disposable covers.
2. Follow step-by-step the Kit's instruction to 1st stabilize and 2nd amalgamate the spilled mercury
3. Use the Mercury Cleanup Wipers to wipe off the area of the spill.
4. Place all mercury contaminated items in the disposing bag and label as Hazardous Waste.
5. Contact F.I.U.-Environmental Health and Safety at 7-2621 and schedule a pick-up of the hazardous waste. Hazardous Waste Pick-Up Request.
6. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

Procedure for decontamination of mercury from shoes' soles

1. Wear nitrile gloves and face mask, cover shoes with disposable covers.
2. Use the Mercury Sponge to amalgamate all visible droplets.
3. Use the Mercury Cleanup Wipers to wipe off the shoes' soles.
4. At the sink, wash shoes' soles with warm soapy water. Then dry with paper towel.
5. Place all mercury contaminated items in the disposing bag and label as Hazardous Waste.
6. Contact F.I.U.-Environmental Health and Safety at 7-2621 and schedule a pick-up of the hazardous waste. Hazardous Waste Pick-Up Request
7. Notify the Lab Coordinator of the accident as soon as possible after the cleanup.

D. Electrical Hazards

The general hazards associated with electricity use include electrical shock and electrical fires caused by shorts and overloaded circuits or wiring. Our laboratories use electrical equipment; therefore, they are not exempt from the possibility of these hazards. It is fundamental to remember that most incidents result from unsafe work practices, improper equipment use, and faulty equipment. Consequently, adherence to simple guidelines can significantly reduce the electrical hazards one might encounter in the laboratories and ensure compliance with OSHA regulations. The FIU EHS Chemical Hygiene Plan states, "*Attention must be paid to electrical safety, especially as it relates to the use of extension cords, proper grounding of equipment, overloading of electrical circuits, and electrical hazards related to wet work.*" Safety tips based on this statement include:

- Keep wires and cords out of pathways and away from feet.
- Do not route electrical, phone, or computer lines across isles or passageways.
- Do not overload plugs.
- Do not unplug equipment by pulling on the electrical cord; unplug it from the outlet.
- Do not use frayed cords, broken plugs, or equipment containing these defects.
- Avoid the use of extension cords.
- Use multi-plug power strips (with circuit breaker) for multiple plugs.
- Do not connect extension cords or power strips together (daisy-chain).
- Never interfere with lockout/tagout tags on equipment or power supplies.

Emergency Procedure in Case of Electric Shock	**EMERGENCY: 7-5911**
1. If someone suffers serious electrical shock, call the FIU emergency number (305) 348-5911, extension 7-5911 from the emergency phone in the laboratories. 2. If the victim is still in contact with the electrical current, do not touch the person* and immediately turn off the electrical power source. If you cannot disconnect the power source, try to separate the victim from the power source with a nonconductive object. * Do not touch a victim that is still in contact with a power source; you could electrocute yourself.	

E. Compressed Gases

The most important policy regarding compressed gases cylinders is prevention. This specifically refers to proper and responsible handling as established in the Guidance Document- Compressed Gas Cylinder Safety Manual.

Compressed gases cylinders are kept in laboratory EC-3760 as these are required by the Gas Chromatography systems; these systems are not continuously used. The cylinders comprise gases

of two nature: Non-flammable (Helium (He), Nitrogen (N_2) and Air), and Flammable (Hydrogen (H_2)).

It is imperative that personnel that work with the above-mentioned compressed gases or any other gas cylinders knows and understand:

- the gas properties, by studying the SDSs
- the functioning of the two fundamental parts of a compressed gas containment: the cylinder and the cylinder valve
- the need to secure face and breathing personal protection equipment as needed, and
- the emergency procedures detailed in this document.

Fortunately, emergencies involving compressed gases are unlikely, provided the recommendations are followed for their correct storage, handling, and use. The most foreseeable cause of emergency situations associated to gas cylinders is leaks:

<table>
<tr><th colspan="2">Cause</th><th>Hazard</th><th>Response: EVACUATION</th></tr>
<tr><td rowspan="3">Leaks</td><td>Inert gas leak (This is the case of He, N_2, and Air)</td><td>Asphyxiation: Inert gases are colorless and odorless; consequently, they can escape into the atmosphere undetected and rapidly reduce the concentration of oxygen. This is usually harmless; however, if in a confined space, asphyxiation of unprotected personnel can occur.</td><td rowspan="3">Unless training and knowledge of safe gas handling procedures has been demonstrated, personnel should not attempt to fix any type of leak in a compressed gas cylinder. If a leak is detected, particularly in the case of a leak from the H_2 cylinder, the response procedure should consist of:

• contact EH&S: 305-348-2621 and the police 305-348-5911

• alert everyone: activating the pull fire alarm and

• evacuate the building: exit the laboratory via the door near the fire extinguisher (Figure 5) and veer left towards the nearest exit (Figure 1)</td></tr>
<tr><td>Flammable gas leak (This is the case of H_2)</td><td>Fire and Explosion: All flammable gases will form explosive mixtures with air</td></tr>
<tr><td>Toxic gas leak</td><td>No toxic gases are kept in the CEE laboratories</td></tr>
</table>

*** If evacuation becomes difficult via a chosen route, continue via the nearest safe exit route**

II. Fire Safety and Emergency Evacuation Procedures

The FIU EHS Chemical Hygiene Plan states:

1- If the response action calls for the initiation of the building fire alarm, everyone must immediately stop what they are doing, and evacuate the building as quickly and as calmly as possible.

   In the event of any fire, do the following:

   - Move away from the source of the fire or smoke quickly.
   - Activate building fire alarm by locating nearest pull station and pulling the alarm.
   - Exit the building. If possible, close doors behind you as you exit the space where the fire/smoke is taking place.
   - Go as far away from the building as possible.
   - After safely exiting the building, call the University Police Department, 305-348-5911, and give a clear and accurate description of the location of the fire or smoke.

2- Your top priority, and what is expected from FIU, is that you exit the space/building immediately during a fire emergency. Preservation of your life is the most important matter! If you choose to fight a minor fire, however, do so only under the following conditions:

   - Fire alarm has already been activated.
   - The fire is contained to a small area.
   - There is minimal smoke.
   - You are able to breathe without coughing.
   - Visibility in the space is good and all doors, exits, and walkways can be seen clearly

   If these conditions have been met, proceed to fight the fire by doing the following:

   - Locate nearest fire extinguisher and grab it.
   - Stand approximately 6 – 10 feet away from the fire.
   - Activate the extinguisher.
   - Remember the acronym – P.A.S.S. – to use the extinguisher.
   - Pull the pin.
   - Aim extinguisher nozzle at the base of the flames.
   - Squeeze handle while holding the extinguisher upright.
   - Sweep the extinguisher

Emergency Procedure in Case of Fire that starts in the lab	**EVACUATION (Section 10.3 of FIU/EHS "Chemical Hygiene Plan"**

1. Instructor or TA:
   BEFORE anything else, the Instructor must lead students to the area immediately outside the laboratories.
   If trained to use the fire extinguisher, and is safe to do so, the Instructor **may decide** to use it to mitigate a small fire.

2. If the Instructor feels unable to handle the fire extinguisher, must immediately call the FIU emergency number (305) 348-5911, extension 7-5911 from the emergency phone in the laboratories.

3. Pull the Fire Alarm nearest to the laboratory (see Figure 1, page 7).

4. Lead the students out of the building by walking veering left toward the nearest EXIT stairs.

   - Stay on the right. Emergency response personnel need clear access along the left side.
   - Allow evacuees from 2nd floor to enter the stairwell.
   - Proceed to the first-floor street level.
   - Gather in the evacuation assembly area in the grassy and parking area located outside the stairs's emergency exits and stay away from the doors.

III. Hurricane Preparation Checklist

Laboratory Room # _____ **Date:** _____

Completed by: _____

Item	Initials	Comments or concerns
Move all glassware to appropriate storage locations		
Move all chemicals to appropriate storage locations		
Remove all chemicals from fume hoods and secure in appropriate storage areas		
Close fume hood sashes completely		
Cap gas cylinders and secure to a permanent fixture using a cylinder strap or chain		
Unplug all small electrical equipment (hotplates, magnetic stirrers, pH meters, etc.)		
Use surge protectors to protect sensitive equipment in the event of a power surge		
Turn refrigerators/freezers to coldest setting		
Remove equipment, chemicals, wastes and supplies from the floor in areas that may flood		
Cover exposed equipment with plastic covers/sheeting		
Move valuable files, papers, and other documents to cabinets or cover them with plastic sheeting		
Empty trash receptacles		
Document pre-event conditions/settings with photographs or videos (Image database)		