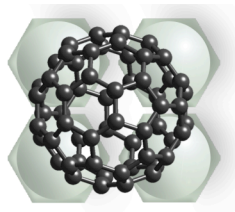




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**Chemical Engineering Department's
LABORATORY SAFETY INSPECTION GUIDE
(Revised September 29, 2006)**



**Chemical
Engineering**
University of Puerto Rico
at Mayagüez

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Section I. OBJECTIVES

The following document was developed by the Department of Chemical Engineering faculty at the University of Puerto Rico, Mayagüez, to establish a formal laboratory safety inspection procedure to be used in conjunction with the lab safety inspection form, provided at the end of this document. The objectives of the laboratory safety inspections presented in this document are:

- i) to conduct and document lab safety inspections periodically
- ii) obtain feedback from laboratory users
- iii) provide feedback and recommendations to laboratory users
- iv) improve laboratory safety and cleanliness
- v) minimize incidents and accidents
- vi) maintain documentation for regulatory agencies

Section II. GUIDELINES

A. GENERAL ADMINISTRATIVE

1. Laboratories must be secured against unauthorized entry. Lab doors must be kept locked when not attended. At least one lab door must be unlocked at all times while there is work being conducted. Lab personnel must challenge unauthorized entrants. Laboratory doors should be identified with appropriate labels or signs. An emergency contact card should be maintained on the outside AND inside of laboratory doors and should contain Faculty member's name and office/home phone number for emergency contacts. Postdoctoral Fellows and graduate students' names and numbers should also be available. Additionally it should contain university emergency phone extension, i.e. medical emergency, police, etc. This information should be updated regularly.
2. Laboratory members should not be allowed to work by themselves after hours when doing laboratory work involving hazardous materials. Consult the University's safety procedures.
3. Windows on laboratory doors should not be covered. Doors with windows should be clear to allow passersby to note any dangerous events or trouble in the lab.
4. Children, family, or any other person which is not registered or employed by the University and authorized to work in the laboratory should not be allowed in the laboratory. Lab doors should be kept locked when unoccupied to maintain security of hazardous materials such as radioactive, biological, and chemical materials.
5. Laboratories should have a chemical inventory established and readily accessible. Keep a binder with Material Safety Data Sheets for all chemicals and materials stored or used in the lab. Labs using biological and radioactive materials must also have an inventory of these materials.

6. All members of the lab must have Chemical Hygiene/Safety training certificates signed or documentation on file in the department office. The task and chemical specific training that is provided by the supervisor/principal investigator must be documented and kept on file as well. This includes faculty members.
7. A Job Hazard Analysis should be conducted on all laboratory procedures by the laboratory supervising faculty member. It should be revised whenever there is a change in procedure or a new procedure added. In some cases, a Standard Operating Procedure (SOP) should be developed.
8. Personal Protective Equipment (PPE), with the exception of lab coats and safety glasses, must be made available to all lab employees at no charge, if the Hazard Analysis identifies its use as a requirement. Designated PPE must be worn. Other PPE not established by the Hazard Analysis may be worn by students if they do not represent an additional safety hazard and if all safety procedures are followed.
9. Smoking, Eating, Drinking, and the application of cosmetics are prohibited in University laboratories.
10. Laboratory members should know the procedures to follow for a laboratory accident; i.e.: to pick up an emergency phone or dial 911 for help, where first aid kits are located. Accident reports have to be documented and kept on file with the department office and the safety department if it requires so.
11. Lab doors should remain closed at all times to assure optimum laboratory ventilation. Keeping lab doors closed also helps prevent the spread of smoke in the event of a fire.

B. ELECTRICAL

1. Adequate electrical service is necessary in the lab to avoid the use of unsafe practices such as permanent use of extension cords.
2. Circuit breakers that service laboratory equipment should be identified as such.
3. Outlets located near sinks or other sources of water should be on a ground fault circuit or otherwise ground fault protected.
4. Extension cords are allowed for temporary use provided the weight of the cord is adequate for the load applied. Check to be sure the extension cord is three pronged and that no cords are frayed.
5. Multiplug devices are allowed provided they are UL listed with a built-in circuit breaker and used in accordance with the manufacturer's intended use. Multiplug devices should not be connected in series.

C. GENERAL SAFETY

1. Housekeeping must be maintained so that the aisles are clear to allow for emergency egress. Could a person exit the lab quickly without tripping over moveable or permanently located objects? Storage is not permitted in exit ways (hallways).
2. Floors should be in good repair, i.e. no tripping hazards caused by cracks, holes, protrusions, missing tiles, etc.

3. Excess or surplus equipment should be disposed of or relocated to a storage location. When transferring equipment for disposal, be sure hazardous materials are removed prior to transfer.
4. Hot surfaces or equipment should be posted with an appropriate warning sign.
5. Laboratory refrigerators and freezers are not allowed to be used for the storage of food or drink for human consumption. Refrigerators and freezers used to store flammable and corrosive chemicals must be approved and certified. Make sure they are signed as such. Ice machines and microwave ovens must be treated likewise.
6. Safety showers and eyewash units should be located in the lab or nearby (within 10 seconds). They should be kept accessible at all times. They should have been inspected within the last year. Eye wash units should be tested frequently by lab occupants wherever possible.
7. Caution should be taken to prevent contamination of the potable water supply. Hoses connected to sink faucets should not extend below the plane of the sink surface or back flow preventers should be installed.
8. There should be a first aid kit available in case of minor injuries. It should be accessible during the hours of operation of the lab.
9. Needles and/or syringes must be kept secured at all times. This means kept in a locked drawer or cabinet or in a locked laboratory and under surveillance of lab personnel when the lab is unlocked. Do not leave uncapped needles in fume hoods or on laboratory benches.
10. Is there adequate emergency lighting? If there is a unit in the area, depress the test button to determine if the light is operational.
11. Blocked doors are not permitted, unless a formal request explaining the reason to close it is submitted and approved by the Director of the Department and the OSSOPA. Blocked doors must be properly labeled on both sides as such.

D. FIRE SAFETY CONCERNS

1. Fire extinguishers should be located nearby and accessible from the hallway. They should be inspected accordingly to the University and Fire Department's policies. Check to make sure the extinguisher is charged and is not damaged. Report any deficiencies to the departmental offices.
2. If there are smoke detectors or sprinklers in the lab, make sure that nothing is stored near them that would interfere with their intended operation. No storage within 18 inches of sprinkler heads.
3. Check for storage of combustibles near any hot surfaces or equipment. Maintain at least 18 inches from hot surfaces or equipment.
4. If drying operations are performed in the lab, are procedures written for safe operation; i.e. are lab personnel instructed not to use combustible trays for holding materials to be dried?
5. All fires must be reported to the departmental office even if they are extinguished without incident.

6. Some labs have automatic extinguishing systems. Visually check for physical damage or leaks. Report any deficiencies to the departmental office.

E. CHEMICAL CONCERNS

Refer to the Chemical Engineering's Identification and Management of Hazardous Materials Guide, available at <http://inqu.uprm.edu/safety.html>.

1. Chemical spill kits should be readily available during the hours of operation of the laboratory. They must be kept stocked at all times.
2. Chemicals need to be stored by hazard class, not alphabetically, i.e. Reactives, Flammables, Poisons, Oxidizers, Corrosives etc. Chemicals should be removed via the hazardous waste program before the expiration date is reached. Pay close attention to special storage requirements such as refrigeration, dry atmospheres created by desiccants, inert atmospheres, etc.
3. Flammables/combustibles may not be stored in refrigerators or freezers that are not lab safe or explosion proof. Regular refrigerators and freezers should bear the caution statement prohibiting storage of these materials.
4. All chemical containers must be labeled and the labels must be securely affixed to the container. Reaction flasks must be labeled as well. Abbreviations or trade names should not be used to label containers. Common chemical or IUPAC nomenclature should be used.
5. Quantities of chemicals kept in the lab should not be excessive. Outdated chemicals should be disposed of using proper disposal methods or moved to an adequate storage area.
6. Flammables should be stored in flammable storage cabinets and always kept away from ignition sources.
7. Chemicals should not be stored above eye level and liquids should be stored in secondary containers.
8. Whenever possible all shelves used to store liquid chemicals should have a lip.
9. All work with chemicals that are highly toxic or carcinogenic requires that a Standard Operating Procedure be developed.

F. WASTE MANAGEMENT

Refer to the Chemical Engineering's Identification and Management of Hazardous Materials Guide.

1. Chemical waste should be removed from a laboratory in a timely manner. Do not allow too much chemical waste to accumulate. A chemical waste collection can be arranged by calling the university's OSSOPA (extension 3506 or 3221).
2. Biological waste and/or biologically contaminated waste should be kept separated from other waste types. Contact the safety department for proper procedure.
3. Clean broken laboratory glass is to be collected in "glass only" boxes, closed up and taken to the outside dumpster by lab personnel. Chemical bottles must be triple rinsed and the labels defaced prior to disposal as laboratory glass. Bottles must be labeled as such. All other

- chemically contaminated glassware must be disposed of as hazardous waste. Solid waste should be kept in a properly labeled sturdy cardboard box lined with a heavy plastic bag.
4. All wastes must be labeled with tags or labels and stored according to the hazards associated with the waste. A supply of chemical waste labels should be readily available in the lab. The university's OSSOPA (extension 3506 or 3221) provides labels at no charge. Abbreviations or trade names must not be used to identify contents. Common chemical or IUPAC nomenclature must be used. Label every constituent added to the container, especially with heavy metals in the parts per million range. Unknowns are forbidden.
 5. Waste containers must be capped or sealed at all times unless material is actually being added.
 6. Waste containers must be compatible with contents. For example do not use metal containers to store acids or glass containers for hydrofluoric acid mixtures.
 7. All liquid waste must be stored in a secondary container. The university's OHOSEP (extension 3506 or 3221) provides trays at no charge. Solid waste should be kept in a properly labeled sturdy cardboard box lined with a heavy plastic bag.
 8. Do not fill liquid waste containers over 90% full.
 9. All chemical waste must be disposed of through the Chemical Waste Program. Normal trash cans or recycle bins should not contain inappropriate materials, i.e. used PPE or materials that can be construed as chemical waste. Sinks should be free of stains and waste containers should not be stored in close proximity to sinks unless they are in secondary containers.
 10. Anything that is capable of cutting or puncturing must be managed in a sharps container. Examples of sharps include needles, syringes, razor blades, slides, scalpels, pipettes, broken plastic or glassware, micropipettes and pipette tips. If a sharp is chemically contaminated, the container must be properly labeled.

G. PHYSICAL/ENVIRONMENTAL

1. Laboratory lighting should be adequate for the tasks being performed. Special task lighting may need to be provided. Contact Mrs. Audrey Arvelo at the departmental offices to report laboratory lighting repairs.
2. Some operations or equipment may produce noise at a level of concern. Ear plugs may be required.
3. Temperature ranges in the labs should be approximately between 65 and 85 degrees Fahrenheit.
4. All belts, blades or other moving parts on equipment should be guarded or otherwise protected.
5. If operations cause floors to be wet or slippery, mats to help prevent slippage should be used.
6. Check for sharp edges or points sticking out on equipment, furniture etc. that could cause struck by hazards.
7. Shields should be used when conducting experiments that could explode.

8. All lab equipment should be clean and in good working order.

H. PERSONAL PROTECTIVE EQUIPMENT (PPE)

1. In general, proper lab attire should consist of safety glasses, lab coats, gloves, and closed-toed shoes. Sandals and shorts are not appropriate for the lab.
2. Principal investigators in laboratories are responsible for providing necessary PPE to employees at no charge. Students may be required to obtain their own basic PPE, such as lab coats or safety goggles. The necessity for the use of personal protective equipment is usually determined after a job hazard analysis is completed for a specific task. Unnecessary use of PPE may in itself pose a safety threat.
3. Safety glasses are mandatory in all University laboratories except laboratories used exclusively for computers.
4. PPE contaminated with chemicals must be stored, labeled and disposed of as chemical waste.
5. Laboratory clothing and PPE, in general, should not leave the work site.

I. VENTILATION

1. If operations in the lab involve chemicals which present an inhalation exposure hazard, a fume hood must be available for use.
2. Fume hoods should be in working order and properly inspected. The acceptable flow rate is approximately between 80 and 120 linear feet per minute.
3. Fume hood work should be performed approximately six inches into the hood, i.e. not right at the front edge. The sashes should be positioned to produce the flow rate indicated in #2. Fume hoods should not be strictly used for storage of chemicals.
4. Biosafety cabinets should not be used in place of a fume hood. These cabinets should be certified annually and should have a current sticker. Check to be sure the cabinet is free from clutter.

J. COMPRESSED GASES

1. Gas cylinders should not be stored in laboratories unless they are being used.
2. Caps should be kept on the cylinders when not in use.
3. Cylinders need to be individually restrained by chains at approximately two-thirds height from the floor.
4. Regulators should be replaced or recertified on a regular basis. Laboratories must have a regulator inspection program in place. Regulator types are matched to the type of cylinder and gas being used. Contact the gas supplier or the department's laboratory technician with questions.
5. Gas cylinders must be labeled with the contents. Unknown gas cylinders are very hazardous and expensive to dispose of.

6. Gas supply lines need to be compatible with the gas being used. The suppliers can provide information about proper line material. The lines also must be rated to handle 2 ½ times the pressures used.
7. Some gas companies will accept their cylinders back empty or partially full. Companies such as this should be used to minimize chemical waste.
8. Incompatible gas cylinders, i.e. flammable and oxidative gases, must be stored separately.
9. Flammable gas cylinder must be grounded.

K. SPECIAL CONSIDERATIONS

1. The following areas require special consideration or specialized procedures:
 - a) Radioactive materials
 - b) Bloodborne Pathogens
 - c) Infectious materials, Recombinant DNA, or Select Agents
 - d) PCBs
 - e) Heavy Metals
 - f) Pesticides
 - g) Animals
 - h) Acutely toxic chemicals
 - i) Reproductive hazards
 - j) Carcinogens
 - k) Hydrofluoric Acid
 - l) Controlled substances
 - m) APHIS permits
 - n) High Pressure Operation
 - o) Nanomaterials
2. Strict requirements exist for the shipment of Biological, Chemical or Radiological materials off campus. Depending on the materials shipped they are regulated by USDOT, PR-DTOP, CDC, USDA, USNRC, USPO, or Homeland Security. Contact departmental office if any of these materials are shipped off campus.

Section III. LABORATORY SAFETY INSPECTION FORM

A. INSTRUCTIONS

The guidelines established in Section II of this document will be followed to complete Sections A to K of the form. Section L provides additional space for comments. Items marked as unsatisfactory will be reported to the Departmental Administration and/or Departmental Safety Coordinator and to the responsible PI in the lab. However, the lab users are exhorted to take corrective actions as soon as possible or establish a timeline to address those issues. Section M provides space to document the compromise of lab users to address unsatisfactory items by an established date. Plans for corrective actions will also be included in the report to the Departmental Administration or Departmental Safety Coordinator. After a plan is provided a Follow-Up Safety Inspection, documented in Section N, will be scheduled to verify that corrective actions were executed. Additional comments can be written in Section O. The legend of abbreviations is indicated at the end of the document. Detailed procedures, corrective actions and/or comments may be attached to the form.

B. FORM

**Department of Chemical Engineering
University of Puerto Rico - Mayaguez Campus**

Laboratory Safety Inspection Form

Room Number:	Date:				
Inspector (s):					
A. ADMINISTRATIVE					
Inspection Item	Ref	S	NS	N/A	Comments:
Lab Secured/Emergency Posting (Up-To-Date)?	1				
After hours work?	2				
No Windows Covered?	3				
No Unauthorized Occupants?	4				
Chemical Inventory Available?	5				
Biological Material Inventory Available?	5				
Material Safety Data Sheets in Lab?	5				
Right-To-Know/Chemical Hygiene Plan and Task Specific Training?	6				
Job Hazard Analysis?	7				
Personal Protective Equipment Available?	8				
No Smoking, Eating, Drinking?	9				
Emergency Training?	10				
Lab Doors and Windows Closed?	11				
B. ELECTRICAL					
Inspection Item	Ref	S	NS	N/A	Comments:
General Condition?	1				
Use of Extension Cords?	4, 5				
Breaker/Circuit Identification?	2				
Ground Fault Protection?	3				
C. GENERAL SAFETY					
Inspection Item	Ref	S	NS	N/A	Comments:
Housekeeping/Egress?	1				
Tripping/Slipping Hazards?	2				
Surplus Equipment?	3				

Hot Surfaces/Equipment?	4				
Refrigerators/Freezers (Labeled)?	5				
Safety Shower/Eye Wash?	6				
Potable Water Protection?	7				
First Aid Kits?	8				
Needles/Syringes Secured?	9				
Emergency Lights?	10				
Ice Machines/Microwave Ovens (Labeled)?	5				
Blocked Doors?	11				

D. FIRE SAFETY CONCERNS

Inspection Item	Ref	S	NS	N/A	Comments:
Fire Extinguishers?	1				
Detectors/Sprinklers?	2				
Combustible Storage?	3				
Extinguishing Systems?	6				
Special Concerns?	4				

E. CHEMICAL CONCERNS

Inspection Item	Ref	S	NS	N/A	Comments:
Spill Kits?	1				
Storage by Hazard?	2, 7, 8				
Flammables/Combustibles?	3, 6				
Container Labels?	4				
Excessive Quantities?	5				
Any materials which are highly toxic or carcinogenic require a Standard Operating Procedure developed.	9				

F. WASTE MANAGEMENT

Inspection Item	Ref	S	NS	N/A	Comments:
Quantity of Waste Accumulated?	1				
Segregated in Proper Containers?	2, 3				
Labels Available?	4				
Properly Labeled?	4				
Properly Stored/Secured?	5, 6, 7, 8				
Proper Waste Containers Available?	7, 8				
Evidence of Improper Waste Disposal?	1, 9				

G. PHYSICAL & ENVIRONMENTAL CONCERNS

Inspection Item	Ref	S	NS	N/A	Comments:
Equipment Clean and Operable?	8				
Laboratory Lighting?	1				
Moving Parts Guarded?	4				
Noise Levels?	2				

Sharp Edges, Points?	6				
Shields Used?	7				
Temperature?	3				
Wet Floors?	5				

H. PERSONAL PROTECTIVE EQUIPMENT

Inspection Item	Ref	S	NS	N/A	Comments:
Proper Lab Attire?	1				
Personal Protective Equipment Made Available?	2				
Safety Glasses Being Worn?	3				
Contaminated Personal Protective Equipment?	4				

I. VENTILATION

Inspection Item	Ref	S	NS	N/A	Comments:
Fume Hood in Use?	1				
Fume Hood Certified?	2				
Proper Use of Fume Hood?	3				
Fume Hood Cluttered?	3				
Biosafety Cabinets?	4				

J. COMPRESSED GASES

Inspection Item	Ref	S	NS	N/A	Comments:
Unnecessary Storage?	1				
Capped/Restrained/Labeled Cylinders?	2, 3				
Proper Lines and Regulators?	6				
Regulators Inspected?	4				
Proper Labeling?	5				
Only compatible gases stored together?	8				
Flammable gas tanks grounded?	9				

K. SPECIAL CONSIDERATIONS

Inspection Item	Ref	S	NS	N/A	Comments:
Special Materials (Specify)	1				
Shipment of Chemical, Radioactive or Biological Materials	2				

L. ADDITIONAL COMMENTS

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M. CORRECTIVE ACTIONS

Items marked as unsatisfactory will be reported to the Departmental Administration and/or Departmental Safety Coordinator and to the responsible PI in the lab. Items marked as unsatisfactory will be addressed as soon as possible by:

Action to be taken ¹	By	Date
1.		
2.		
3.		
4.		
5.		

N. FOLLOW-UP INSPECTION

A follow-up for the unsatisfactory item(s) was conducted:

By:			Date:	
Unsatisfactory items: (refer to items in Section M) ¹	A	IP	UnA	Comments:
1.				
2.				
3.				
4.				
5.				

O. FOLLOW-UP INSPECTION COMMENTS

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¹ Additional sheets can be attached with further information.

Abbreviations:

- S Satisfactory
- NS Not Satisfactory
- N/A Non-Applicable
- A Item was properly *addressed*.
- IP Items are being properly addressed.
- UnA Item has not been properly addressed.

Appendix A. EMERGENCY CONTACT INFORMATION

UPRM Medical Emergencies (Emergencias Medicas)	2333
University Police (Policia Universitaria)	3263 3872
Office of Health, Occupational Safety, and Environmental Protection (Oficina de Salud, Seguridad Ocupacional y Proteccion Ambiental)	3506 3221 3886
Medical Emergencies (Emergencias Medicas Estatal)	9 + 911