

### Important Telephone Numbers

Emergency	112		
Fire Services	234 429 979	(B. Velhos)	
	234 422 122		
	234 422 333	(B. Novos)	
	234 425 122		
Police (PSP)	234 422 022		
	234 400 290		
Anti-Poison Centre	217 950 143		
Aveiro Hospital	234 378 300		
University phone operator	234 370 200	9	
Campus Safety	234 370 945	22244	919727747
Campus Safety Supervisor		52206	

### Emergency Contacts

Mário Simões	23528	Room 15.2.20
Pedro Domingues	23511	Room 15.1.25
Artur Silva	23529	Room 15.2.22
General Office	23500	Room 15.1.4

### Laboratory Safety Coordinators

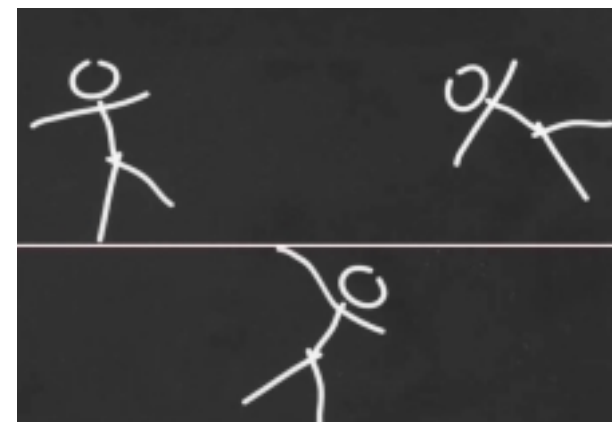
Inorganic Chemistry João Rocha	23550	Room 15.3.25
Analytical Chemistry João Oliveira	23542	Room 15.3.16
Organic Chemistry Graça Neves	23525	Room 15.2.17
Biochemistry and Food Chemistry Sílvia Rocha	23566	Room 15.2.26
Chemistry Physics and Mass Spectrometry Pedro Domingues	23511	Room 15.1.25
Technological Chemistry Carlos Pascoal Neto	23505	Room 15.1.6
Chemical Engineering Carlos Silva	23595	Room 12.1.15



**Aveiro University**

**Chemistry Department**

**2002**



## LABORATORY SAFETY GUIDE

**(SHORT VERSION)**

**The Safety Committee**

**Pedro Domingues \* Mário Simões**

acompanhamento”) must be signed by you and your Supervisor and placed in a visible place near the experiment.

- Only work of category 1 can be done outside the fume hood.
- Floods are avoidable. Please consult the Laboratory Safety Coordinator or your Supervisor if you need to leave an experiment overnight with a water refrigerating system.

## 5. References

The Laboratory Safety Guide was carried out using information available in the internet. Please consult the Chemistry Department home page (Portuguese version) under “**Páginas de Segurança**” for a list of links. We specially recommend the Chemical Hygiene Plan, University of California, Irvine, School of Biological Sciences (<http://www.abs.uci.edu/depts/ehs/programs/bschp/bschp.pdf>) or the Department of Chemistry Lab Safety Manual, Duke University (<http://www.chem.duke.edu/safety/>).

## **Important**

This guide is an English summary of the Laboratory Safety Guide in use in the Department of Chemistry of the University of Aveiro. You should be aware that, since this is only a summary, important information concerning safety, that you should know, may not be present in this guide. If you have any doubts, you should consult your supervisor about the appropriate procedures to be taken. It is also your supervisors responsibility to keep you informed about the safety rules in use in this department. Each research group has a Safety Coordinator (see important phone numbers table) that will provide you with further information.

## **WORKING OUTSIDE NORMAL WORKING HOURS**

All persons working in the Chemistry Department between 18:00 in the evening and 9:00 in the morning and on weekends must sign the register book, kept at the East entrance of the Chemistry Department. This register will be used by emergency services to account for personnel working outside normal hours. It will also assist night security patrol officers.

Category 1 work can be done anytime after hours, as it poses no threat to safety. Category 2 work should only be conducted until 23:30. However, it is recommended that category 2 work is completed by 22.00 every night. Category 3 work should not be carried out under any circumstances outside normal working hours. Any exception to this rule must be discussed with your supervisor and the Safety Committee.

### **4.2 Unattended Operations**

When laboratory operations are performed which will be unattended by laboratory personnel (continuous operations, overnight reactions, lunch time, etc.), the following rules must be complied with:

- Only category 1 and 2 work can be done unattended, after permission from your Supervisor.
- All unattended operations must be conducted in the fume hood. A form (see <http://www.dq.ua.pt/seguranca>, “Formulários”, “Formulário para equipamento ou experiência que decorra sem

### *Working with Potential Explosive Substances*

It is responsibility of the laboratory worker, in consultation with the laboratory supervisor, to evaluate each compound involved in his/her work. Students **MUST** consult their Supervisor before working with one of the following substances: acetylenic compounds, aluminum chloride, ammonia (reacts with iodine), benzoyl peroxide, carbon disulfide, chlorine, dimethyl sulfoxide (with halogenated compounds), diethyl, diisopropyl and other ethers, ethylene oxide sodium, potassium or other active metals, hydrogen peroxide stronger than 3%, liquid-nitrogen cooled traps, lithium aluminum hydride, oxygen cylinders, palladium or platinum on carbon, platinum oxide, Raney nickel and other catalysts, perchlorates, permanganates (are explosive when treated with sulfuric acid), peroxides (inorganic), phosphorus (red and white), phosphorus trichloride, sodium and m-Chloroperbenzoic acid. Residues from vacuum distillations have been known to explode when the apparatus was vented to the air before the residue was cool.

## **4. Access to the Chemistry Building and Laboratories**

### **4.1 Normal Working Hours**

The normal working hours of the Chemistry Department of the Aveiro University is from 9:00 to 18.00 from Monday to Friday. The presence of students in the building after 00:00 hours is not permitted. In case of special need, you must consult your Supervisor.

## **1. Procedures in case of emergency**

### **1.1 Injuries**

*In case of serious injury you should follow these basic rules:*

Remove the person(s) from danger if it is safe to do so;

Apply first aid if appropriate and only if you know what to do;

Phone the emergency services (**112**);

If you are working outside normal working hours, also phone the security staff: 22 244 or 234 370 945 or 919 727 747 (the security staff will call an ambulance, if required).

*Reporting accidents or safety hazards:*

All accidents, injuries and any potential safety hazard must be reported immediately to the Safety Committee members, to the Head of the Department or to the Laboratory Safety Coordinator.

### **1.2 Evacuation**

On hearing a continuous fire alarm or a request to evacuate the building, all occupants must leave in an orderly manner by the nearest exit. In the case of an alarm, it should never be assumed that the alarm is being tested or has developed a fault. The Laboratory Safety Coordinators will coordinate an evacuation. The Department Safety Committee and the Laboratory Safety Coordinators will ensure that all areas of the building have been evacuated.

### **1.3 Specific evacuation instructions**

When the alarm is raised, if possible, switch off all fume cupboards, all electric equipment, close all windows and leave the room/laboratory closed if you are the last to leave. Make sure that your experiments are left in safety (switch off the heating, vacuum lines, etc.). Do not stop to collect personal belongings. Proceed quickly (do not run) to the nearest exit.

After leaving the building, proceed as directed to the area near the bar. Do not return to the building until the "all clear" is given.

### **1.4 Raising the fire alarm**

If the alarm has triggered automatically, proceed as described in 1.2 above.

If the situation is serious (e.g. a major fire) and the alarm has not triggered automatically, activate the fire alarm by breaking the glass on the wall mounted fire alarm. If possible, locate a staff member and inform him/her of the situation.

## **2. First aid**

In case of accident your first action should be to ask for help, as described in 1.1. Apply first aid if appropriate and only if you know what to do. Never move the injured person, unless it is absolutely necessary. There are several first aid boxes (one on each floor) which should be used only in case of an accident. If you need to use any

### *Working with Embryotoxins*

You can find a partial list of embryotoxins that may be present in the Chemistry Department laboratories on the following web page: <http://www.dq.ua.pt/seguranca/embriotoxicos.htm>. The list is not intended to be complete, and it is the responsibility of the laboratory worker, in consultation with the Laboratory Safety Coordinator, to evaluate each compound involved in his/her work. Working with embryotoxins is not permitted for pregnant women. Embryotoxins must be handled accordingly with the norms established for compounds with special toxicity.

### *Working with Compounds with Special Toxicity*

You can find a partial list of substances with a high degree of acute toxicity that may be present in the Chemistry Department laboratories on the web page <http://www.dq.ua.pt/seguranca/toxicos.htm>. The list is not intended to be complete, and it is the responsibility of the laboratory worker, in consultation with the Laboratory Safety Coordinator, to evaluate each compound involved in his/her work. On this page you can also find the criteria for the classification of compounds with special toxicity. Working with this class of compounds is only allowed after consultation with the Safety Committee. Please do not acquire or handle any product of this class before consulting with your Supervisor and the Safety Committee.

### 3.3 Standard Operating Procedures for Working with Particularly Hazardous Substances

Some substances pose such significant threats to human health that they are classified as **Particularly Hazardous Substances** (PHSs). There are three categories of *Particularly Hazardous Substances*: carcinogens, embryotoxins and compounds with special toxicity.

#### *Working with Carcinogens*

A chemical product is considered a carcinogen if the International Agency for Cancer Research (IARC) has classified it as carcinogen or potentially carcinogen or if it is stated in the MSDS of the product. Consult the web page <http://www.dq.ua.pt/seguranca/carcinogeneas.htm> for the list of carcinogenic substances. Due to the lack of specific conditions, it is not permitted to use compounds classified as carcinogenic to humans (group 1) and probably carcinogenic to humans (group 2A) in the Chemistry Department of the Aveiro University. Please consult your Supervisor for more information about this issue. Work with compounds that are possibly carcinogenic to humans (group 2B) is permitted only after the submission of a form (see <http://www.dq.ua.pt/seguranca/Informações>), “Requisição para utilização de substâncias carcinogéneas, embriotóxicas e especialmente tóxicas”) for each product to the Safety Committee.

product from the box, please inform the Safety Officer so it can be replaced.

### 3. Identification, Classification and Standard Operation of Hazardous Substances

Many of the substances encountered in the laboratory are known to have hazardous properties, which could cause harm if handled improperly. Many lab chemicals used in research labs are toxic or corrosive, or both.

According to the Council Directive 67/548/EEC of the 27 June 1967, relating to the classification, packaging and labelling of dangerous substances, substances and preparations that are "dangerous", the following classifications may be used:

- (a) **Explosive**: substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene;
- (b) **Oxidizing**: substances and preparations which give rise to highly exothermic reactions when in contact with other substances, particularly flammable substances;
- (c) **Easily flammable**: i) substances and preparations which may become hot and finally catch fire in contact with air at ambient temperatures without any application of energy, ii) solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn

or to be consumed after removal of the source of ignition, iii) liquid substances and preparations having a flash point below 21°C, iv) gaseous substances and preparations which are flammable in air at normal pressure, v) substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities;

(d) **Flammable:** liquid substances and preparations having a flash point between 21°C and 55°C;

(e) **Toxic:** substances and preparations which, if they are inhaled or taken internally or if they penetrate the skin, may result in serious, acute or chronic health risks and even death;

(f) **Harmful:** substances and preparations which, if they are inhaled or taken internally or if they penetrate the skin, may result in limited health risks;

(g) **Corrosive:** substances and preparations which may, on contact with living tissues, destroy them;

(h) **Irritant:** non-corrosive substances and preparations, which through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.

The most important single generalisation regarding chemical safety in chemical research is to treat all compounds as potentially harmful, especially new and unfamiliar materials, and work with them under appropriate conditions to minimise exposure by skin contact and inhalation.

- Never heat a flammable substance with an open flame.

- A laboratory hood should be used whenever you work with appreciable quantities of flammable substances.

- Special precautions are required for the safe use of potentially explosive materials. It is responsibility of the researcher to evaluate the explosive hazards involved in his/her work and to consult with her/his supervisor to develop adequate standard operating procedures for any work involving potentially explosive substances.

- Organic peroxides are among the most hazardous substances handled in research laboratories. As a class, they are low-power explosives, hazardous because of their sensitivity to shock, sparks and even friction (as in a cap being twisted open).

### 3.2.4 Laboratory Waste Disposal

As a rule, the intentional elimination of waste to the environment is not permitted. This includes pouring down the sink, evaporation in the fume hood or using garbage cans. The Chemistry Department has procedures for the correct elimination of residues. Collect the residues in appropriate containers using the segregation rules. Label the containers using the appropriate label. Halogenated solvent wastes are to be collected in a separate waste bottle (labelled as halogenated residues) from other organic solvents. Consult your Supervisor or the Laboratory Safety Coordinator for specific instructions.

## **Levels of Risk**

### **Category 1 - Minimal Risk**

The procedure does not involve ionising radiation or laser exposure or the handling of chemicals except for spectroscopic or other measurements on small samples of non-hazardous material

### **Category 2 - Low Risk**

a) Fume hood recommended: Procedures involving exposure to low-risk chemicals e.g. small scale reactions, solvent transfers, drying and extraction, chromatography, refluxing.

b) Fume hood essential for the following: Procedures involving the small-scale use of chemicals known to be mildly toxic, irritant, corrosive or allergenic. Small quantities of non-commercial compounds not yet classified, where no data is available (could assume low risk based on personal experience of similar compounds). Reaction volumes restricted to less than 500 mL of flammable solvent or, if distilling, to less than 2 L of flammable solvent.

### **Category 3 - Significant Risk**

Special precautions will be required depending on the nature of the hazard.

## **3.2 Operating Procedures for Working with Hazardous Chemicals**

### **3.2.1 Acquisition of Chemical Products**

The decision to acquire a hazardous chemical is a commitment to handle and use the chemical properly from initial receipt to ultimate disposal.

Please consult your supervisor for details about this subject.

### **3.2.2 Hazardous Chemical Storage**

Received chemicals must be moved to the designated storage area. Chemicals should be segregated by hazard classification and compatibility in a well-identified area. The amounts of chemicals at the laboratory bench shall be as small as practical.

The Group Safety Coordinator shall conduct monthly inspections of the laboratory for chemicals outside of the storage area. Chemicals not in current use shall be returned to the storage area.

Substances that have been synthesised for the first time in the research laboratory shall be stored in a safe manner.

All products in the laboratory must be properly labelled.

### **3.2.3. Handling Hazardous Chemicals**

General precautions that shall be followed for the handling and use of all laboratory chemicals are:



- The use of lab coat and safety goggles is obligatory in the laboratories.
- Each laboratory worker is directly responsible for the cleanliness of the corresponding workspace.
- Wash all areas of exposed skin prior to leaving the laboratory.
- It is forbidden to eat, drink, smoke, chew gum or apply cosmetics in the laboratory.
- Mouth suction for pipetting or starting a siphon is prohibited.
- Refrigerators, glassware and utensils used for laboratory operations shall not be used for the storage, handling or consumption of food.
- Substances of unknown hazard shall be assumed to be hazardous, and any chemical mixture shall be assumed to be at least as hazardous as its most hazardous component.
- Laboratory workers must be familiar with the chemical's hazards, as determined from the **MSDS**.
- The presence of unlabeled chemical products is not permitted in the laboratory. Labels for correct labelling are available in the stores.
- Specific precautions based on the hazardous characteristics of individual chemicals must be discussed with your supervisor.
- Flammable substances are among the most common hazardous materials found in the laboratory; flammable substances should be handled only in areas free of ignition sources (open flames, ignition sources that include electrical equipment, static electricity and, for some materials, e.g. carbon disulfide, even hot surfaces).

### 3.1 Identification/Risk evaluation of hazardous substances

Before any experimental work, research area or new process can be started in the laboratory by staff or students, a **Risk Assessment** must be carried out with the help of the supervisor.

The aim of the assessment is to minimise the risk to health from working with hazardous substances, by ensuring the availability of adequate information about the substance, stipulating that assessments must be done to determine if there is a risk of exposure to hazardous substances and, if there is a risk of exposure, that it is controlled.

*The **risk assessment** process requires an examination of materials and processes as shown below:*

1. The available information on all substances to be encountered during the experimental procedure **MUST** be examined and reviewed (use Material Safety Data Sheets and consultation with supervisors). This information must be registered in your laboratory notebook, which should be always present in the laboratory. The MSDS of all the products you are going to work with must be archived in your laboratory notebook and in the safety folder of your laboratory.
2. Assessment of the risk to health using any hazardous substance or process under the experimental conditions proposed.
3. A decision as to the level of risk associated with the experiment must be made.