

BASIC SAFETY INSTRUCTIONS IN LABORATORIES



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1-Basic safety rules of working in laboratories

Organisation:

- The laboratory should be kept neat and in a high state of cleanliness. All wastages, however small, should be immediately reported.
- New experiments and implementation of new systems or equipment should not be conducted without the express permission of the head of laboratory or without prior knowledge of their function, characteristics and both general and safety requirements.
- Personal Protective Equipment (PPE's): gloves, goggles, etc. or collective protection (fume cupboards, extraction cabinets, etc.), must be used according to the recommendations given in the evaluation of protective requirements.
- Do not work alone on hazardous operations or outside of normal hours.
- For safety reasons, do not work in laboratories with locked doors.
- Never use equipment without knowing its function. The person responsible for the apparatus must be asked for instructions and safety measures.

General Rules of Conduct:

- As a basic standard of hygiene, persons must wash their hands on entering or leaving the laboratory and always after contact with chemicals. Fastened work clothes, lab coats and tied up hair must be worn at all times, avoiding loose or hanging sleeves that may catch on apparatus or laboratory materials.
- Do not work away from the table of bench top, and do not place personal items on them.
- Working alone in the laboratory is not allowed, especially when it takes place outside of regular hours, at night, or in case of hazardous operations. When these are carried out, persons not involved in the same operations, but who may be affected must also be informed thereof.
- Smoking and eating are prohibited in the laboratory. When drinking, it is preferable to use the water fountains, a glass, or a bottle. When these are not available, never use laboratory vessels to contain food or drink, or food and drink containers to hold chemicals.
- Never touch or rub eyes when working.
- Laboratory personnel have banned the use of contact lenses. Use of prescription glasses is correct. Use of prescription safety glasses or wearing prescription glasses under safety glasses is preferable.
- Work with order, cleanliness without rushing, and with the correct materials for each operation.
- Keep the work benches clean of products, books, boxes and accessories unnecessary for the work being done.
- Ensure the disconnection of equipment, water and gas at the end of work.

Use of Products and Materials:

- Products and materials should always be tested before use, using only those guaranteed to be in good condition.
- Chemicals received in the laboratory should be checked for correct labelling, label prepared solutions correctly and do not re-use containers without removing the original label.
- Chemicals should be handled with care, not carrying them in pockets, nor touching or testing them and not pipetting them in the mouth, keeping in the laboratory the minimum amount necessary for daily work.
- Do not store chemicals in domestic refrigerators or food and drink in refrigerators intended for the storage of chemicals.
- Test tubes should not be filled more than 2 or 3cm, should be touched with fingers, never the hands, should always be heated sideways using forceps, should not be carried in pockets and racks should be used for storage. Suitable racks and supports should be used to hold labware.

- Minimise the use of open flames in the laboratory. It is preferable to use piezoelectric lighters to light Bunsen burners.
- At the end of a task or operation, collect all materials, reagents, etc. or avoid their accumulation outside of the specific storage areas and ensure the disconnection of apparatus, running water, gases, etc.
- Extraction hoods and cabinets should not be used to store products.
- It is obligatory to wear specific clothing to work (lab coat).
- Before starting an experiment, ensure the assembly is in perfect condition.
- Do not use a chemical product without knowing its physicochemical and toxicological characteristics (**Safety Data Sheets**). When using products for the first time, it is obligatory to read the label or consult the safety notes. Special attention should be paid to the H and P phrases of labels.
- Do not test or touch the chemicals with bare hands. Gloves must be worn to prevent pollutant contact with the skin. Pregnant women must request information about possible toxic effects on the fetus of chemical or biological substances. For this, they should contact the **Representative of the safety at work (PRL) or the PRL service**.
- Heat test tubes sideways and using forceps.
- Light burners with long piezo lighters, never matches or normal lighters.
- Transport substances on trays or in containers to avoid spills in the case of breakage. When going to the store, carry all relevant products on a trolley, if it is only one item, carry it in a safety basket or container.
- Special care should be taken to close bottles and flasks immediately after use. Special care should be taken to close the containers of waste.
- The temperature of materials should be checked before they are touched directly with hands.
- Use and store flammable substances in the necessary amounts.

Equipment, use, maintenance and reviews:

- Laboratory installations should be reviewed periodically to check that they are in good condition. Multiple connections and extensions in both the gas and electric should be avoided as far as possible.
- The general ventilation of the laboratory should be checked: work in depression, velocity of air circulation of zones with less pollution to those with more environmental pollution, sufficient renewal and humidity conditions.
- Work should be conducted, wherever possible and operative, in the gas extraction cabinets. Concerning these, fan operation, compliance with minimum suction flow, rate of uptake of the facade, general condition and that they are do not become makeshift chemical stores, must all be checked.

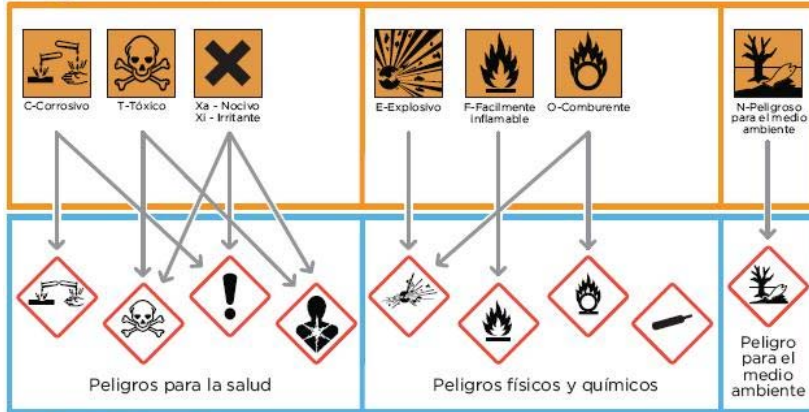
2-Chemical Products

- Check for proper labelling of containers and bottles.
- Properly label solutions prepared in the laboratory.
- Do not re-use containers for other products without removing the original label.
- Do not apply labels on top of old ones.

Labeled and Safety Data Sheets

The Safety Data Sheets contain information about composition, hazards, handling and storage tips, first aid procedures, toxicological information and exposure control and personal protection. Other very useful sources of information are scientific and technical publications, information provided by manufacturers and suppliers, Prevention Services, etc. The CLP regulation (on classification, labeling and packaging of substances and mixtures chemicals) specifies the standardized information that labels, pictograms and safety data sheets must have available to users. Also, they replace the old pictograms for new hazard signs.

Pictogramas actuales



Pictogramas nuevos

Sistema Globalmente Armonizado de clasificación y etiquetado de productos químicos





















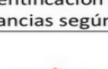


PELIGROS FÍSICOS			PELIGROS PARA LA SALUD HUMANA		
Clasas de peligro y categorías de peligro*	Elementos de la etiqueta NUEVO**	Elementos de la etiqueta ANTIGUO	Clasas de peligro y categorías de peligro*	Elementos de la etiqueta NUEVO**	Elementos de la etiqueta ANTIGUO
Explosivos • Explosivos inestables • Explosivos divisiones 1.1 a 1.3 Sustancias/mezclas que reaccionan espontáneamente, tipo A, B Peróxidos orgánicos, tipos A, B	 H200 H201, H202, H203 H240, H241 H240, H241	 (R2, R3)	Toxicidad aguda, categorías 1, 2 • Oral • Cutánea • Inhalación	 H300 H310 H330	 R28 R27 R26
Explosivos, división 1.4	 H204	Sin clasificación	Toxicidad aguda, categoría 3 • Oral • Cutánea • Inhalación	 H301 H311 H331	 R25 R24 R23
Gases inflamables, categoría 1 Aerosoles inflamables, categoría 1 Líquidos inflamables, categoría 1	 H220 H222 H224	 (R12) (R12) R12	Mutagenicidad en células germinales, categorías 1A, 1B Carcinogenicidad, categorías 1A, 1B Toxicidad para la reproducción, categorías 1A, 1B STOT*** tras exposición única, categoría 1 STOT*** tras exposiciones repetidas, categoría 1	 H340 H350 H360 H370 H372	 R46 R45, R49 R50, R51 R39 R48
Líquidos inflamables, categoría 2 Sólidos inflamables, categoría 2 Sólidos inflamables, categoría 2	 H225 H228 H228	 R11 (R11) (R11)	Sensibilización respiratoria, categoría 1 Toxicidad por aspiración, categoría 1	 H334 H304	 R42 R65
Aerosoles inflamables, categoría 2 Líquidos inflamables, categoría 3	 H223 H226	Sin símbolo (R10) R10 Sin clasificación. Punto de inflamación 56-60°C	Mutagenicidad en células germinales, categorías 2 Carcinogenicidad, categoría 2 Toxicidad para la reproducción, categoría 2 STOT*** tras exposición única, categoría 2 STOT*** tras exposiciones repetidas, categoría 2	 H351 H352 H361 H371 H373	 R68 R40 R62, R63 R68 R48
Líquidos pirofóricos, categoría 1 Sólidos pirofóricos, categoría 1 Sustancias/mezclas que, en contacto con el agua, desprenden gases inflamables, categorías 1, 2 y categoría 3	 H250 H250 H250 H261 H261	 R17 R17 (R15) (R15) (R15)	Toxicidad aguda, categoría 4 • Oral • Cutánea • Inhalación	 H302 H312 H332	 R22 R21 R20
Sustancias/mezclas que reaccionan espontáneamente, tipo B Sustancias/mezclas que reaccionan espontáneamente, tipos C y D y tipos E y F Sustancias/mezclas que experimentan calentamiento espontáneo, categoría 1 y categoría 2	 H241 H242 H242 H251 H252	 R12 R12	Corrosión cutánea, categorías 1A, 1B, 1C	 H314	 R34, R35
Peróxidos orgánicos, tipo B Peróxidos orgánicos, tipos C y D Peróxidos orgánicos, tipos E y F	 H241 H242 H242	 R12 R12	Lesión ocular grave, categoría 1	 H318	 R41
Gases comburentes, categoría 1 Líquidos comburentes, categorías 1 y 2 y categoría 3 Sólidos comburentes, categorías 1 y 2 y categoría 3	 H270 H271, H272 H272 H271, H272 H272	 R7 R7 R8, R9 R8, R9	Irritación cutánea, categoría 2 Irritación ocular, categoría 2 Sensibilización cutánea, categoría 1 STOT*** tras exposición única, categoría 3 • Irritación de las vías respiratorias	 H315 H319 H317	 R38 R36 R43
Gases a presión • Gas comprimido • Gas licuado • Gas licuado refrigerado • Gas disuelto	 H280 H280 H281 H280	 R7 R7 R8, R9 R8, R9	• Efectos narcóticos	 H335	R37
Sustancias/mezclas corrosivas para los metales, categoría 1	 H290	Sin clasificación	Peligros para el medio ambiente	 H336	Sin símbolo R67
			Peligroso para el medio ambiente acuático, agudo, categoría 1 Peligroso para el medio ambiente acuático, crónico, categoría 1	 H400 H410	 R50 R50/53
			Peligroso para el medio ambiente acuático, crónico, categoría 2	 H411	 R51/53

physical hazards

hazards to human health

Globally Harmonized System of Classification and Labelling of Chemicals

Hazard Pictograms

	Clases de peligros	Identificación de sustancia anterior a CLP	Identificación de sustancias según CLP
	Peligros físicos	EXPLOSIVOS	
INFLAMABLES			
COMBURENTES			
GASES A PRESIÓN		Sin pictograma específico	
CORROSIVOS			
		Clases de peligros	Identificación de sustancia anterior a CLP
PELIGROS PARA LA SALUD	TÓXICOS		
	CORROSIVOS		
	SENSIBILIZANTES RESPIRATORIOS O CUTÁNEOS	Sin pictograma específico	
	MUTAGENICIDAD EN CÉLULAS	Sin pictograma específico	
	CARCINOGENICIDAD	Sin pictograma específico	
	TÓXICOS PARA LA REPRODUCCIÓN Y EFECTOS SOBRE LA LACTANCIA O A TRAVÉS DE ELLA	Sin pictograma específico	
	TOXICIDAD ESPECIFICA PARA DETERMINADOS ÓRGANOS TRAS UNA EXPOSICIÓN ÚNICA	Sin pictograma específico	
	TOXICIDAD ESPECIFICA PARA DETERMINADOS ÓRGANOS TRAS EXPOSICIONES REPETIDAS	Sin pictograma específico	
	PELIGRO POR ASPIRACIÓN	Sin pictograma específico	
		Clases de peligros	Identificación de sustancia anterior a CLP
PELIGRO PARA EL MEDIO AMBIENTE	PELIGRO PARA EL MEDIO AMBIENTE		

Hazardous Products and Chemical Reactions

- Know the reactivity of the chemicals of the reaction.
- Ensure the availability of the appropriate materials.
- Install the experiment setup in a closed cabinet, or on a table between mobile screens.
- Use the minimum quantity of reagents.
- Wear the appropriate personal protection clothes and accessories.
- Have one or various fire extinguishers within reach hand (water spray, carbon dioxide,, halogenated compound, powder, as appropriate).
- Forewarn all laboratory personnel, as well as the safety officer.

Carcinogenics, Mutagenics and Toxics for Reproduction

- Information about the meaning of the data in the toxicological safety data sheets and consequences of exposure to carcinogens.
- Information about PPE must be used during the experiment.
- The containers must be properly labelled.
- Store these products in their own safe place.
- Compounds should not be touched directly, nor with bare hands without using gloves; always use spatulas, forceps or other appropriate utensils.
- After leaving the work area, personnel must, at least properly wash their hands, arms and face.
- Always work on trays covered in absorbant paper. When finished, put the waste in the biosafety containers.
- Waste should not be disposed of down the drain or into the atmosphere.

Storage of Chemicals

- Keep the minimum operating quantity stored and prepare a specific place (warehouse, preferable outside the laboratory) conveniently signposted, keeping only indispensable product of daily use on the laboratory.
- Store products and materials according to the criteria of compatibility, hazardousness, changeability and availability.
- Check that all chemicals are properly contained and stored.
- Ensure that the stored items can be easily identified. Remove labels from re-used containers before applying a new one, never apply them over old ones.
- Hazardous products should be closed tightly and properly labelled to avoid risks.
- The handling of chemicals especially harmful to health (carcinogenic, mutagenic and toxic for reproduction) will require the establishment of specific work plans. requerirá el establecimiento de planes específicos de trabajo. **Consult the Occupational Risk Assessment.**
- When transferring products to smaller containers for daily use, it is mandatory to label and identify this new packaging to avoid confusions.
- Keep an updated record of stored products.
- Use safety cabinets.
- Use flameproof or increased safety refrigerators for storing highly volatile flammable products. Do not work here.
- Storage areas should be clean and ordered.
- The store should be clearly marked. The signs should clearly reflect the type of stock, with its corresponding risks.
- Know the location of safety showers and eyewash systems.

3-Cryogenic liquids

- Use only containers designed and identified for the gas they use; these containers may vary according to use, from the smaller Dewar type to special storage tanks with spray.
- In environmental conditions, liquified gases are found at boiling temperatures. To fill containers that are open at that temperature, you should use protective clothing for the body, face and

hands, which consist of proper clothing, face shields and cryogenic gloves respectively. Follow the instructions in the Evaluation of Occupational Hazards.

- Appropriate personal protective clothing is made of natural fibres and will be dry and clean of grease. In any case, tight clothing will be used so that it can be removed quickly in the event of being struck by the liquid. The use of clothing with open pockets, rolled up sleeves or trousers with folds are prohibited as these are places where liquids are easily retained..
- Vessels, piping, etc., which must contain liquefied gases at low temperature, shall be exempt from moisture seeped into the gas because of its low temperature cause ice formation and the risk of malfunctioning items such as gauges, relief valves, etc.
- Special attention should be paid to the contraction that all materials present when their temperature drops, which depends not only the latter, but also on the characteristics of each material.. The use of materials with different coefficients of expansion could cause breakage, leakage to occur in items such as flanges, couplings, threaded connections, etc.
- If the formation of a dense cloud in the vicinity of the floor is observed in an installation of low-temperature liquefied gas, then a gas leak should be expected as the mixture of gas with atmospheric air moisture condenses. Note that in many cases the formation of the cloud is the first sign of a leak.
- In the case of liquefied hydrogen, antielectrostatic footwear is used.
- Make available any and all of the **International Chemical Safety Cards** relating to gases used in the laboratory, as well as any remaining relating to all the chemicals used.

4- Bottles and installation of gases

- **When Opening the Bottles:**
 - They must be identified. If not, return unused.
 - Ask the supplier for the Safety Data Sheets.
 - If there are any doubts, ask the supplier.
 - Only the bottles in use and the reserve bottles must be in the Workplace.
 - They should be properly secured to prevent falling.
 - They cannot be in underground or badly ventilated locations.
- **Accessories and Protection:**
 - Couplings, fittings and pressure regulators must be those recommended by the manufacturer for the pressure and type of gas used.
 - Specific accessories for a type of gas should not be used with other kinds of gases.
 - It is strictly forbidden to dismantle the valves, welding parts in bottles or repainting them.
 - Do not remove any mark or label placed by the supplier in order to identify the bottle.
 - The valve cap will always be set at the time of use.
 - The valve should always be closed except when the gas is being used, at which time it should be fully open.
 - Install backstop valves in all bottles of combustible and oxidising gases when the bottle may become contaminated by gases or liquids.
 - The valve guards shall not be used as vessels to contain any substance.
- **Use:**
 - The user is responsible for proper use and maintenance of the bottles and accessories.
 - When connecting the regulator, and before opening the cylinder valve, check that the pressure regulator adjusting screw is fully loosened.
 - The cylinder valve should always be opened slowly. The output thereof is placed opposite to the operator's position and never towards others.
 - Do not use tools on the valves. If the valves have difficulty opening or closing, or are stiff, ask the supplier for instructions.
 - Never connect the bottle to an electricity circuit.

- Keep the bottles away from sources of heat, furnaces, etc. and do not subject them to low temperatures without the consent of the supplier.
- Avoid contact with oils, greases and other fuel products and accessories with bottles of oxygen, nitrous oxide, etc., which can be combined, resulting in a violent explosion.
- Before disconnecting the control device of the cylinders, close the valve and remove the pressure regulating device.
- Once the bottle is empty, close the valve and apply the protector
- It is prohibited to change one gas bottle without being qualified. No compressed gases should ever be used to clean clothes or objects or for personal ventilation.
- Do not ever use bottles as rollers, support, or any other purpose which isn't the storage of gas.
- For handling bottles using safety shoes and gloves is recommended. View the **Evaluation of Occupational Hazards**.

5-Glassware

- Dispose of materials which have the slightest defect.
- Carefully check the temperature of the receptacles, connectors, etc.. which have undergone states of heat before applying hands directly.
- Remove the defective parts or fragments of broken pieces in special containers for glass, never in paper.
- Do not force flask lids, bottles, valves, containers or vessels, etc. which have been blocked with bare hands. For unclogging, use strong gloves, facial protection, and carry out the operation under a hood shield.
- Never force glassware. When inserting rubber, hoses or plugs may be moistened with water or silicone to ease sliding. If you must proceed with opening stoppered bottles and sealed ampoules, proceed as follows:
 - Wear facial protection
 - Conduct the operation under protective Hood and shield
 - The opening of products will take place on a tray or container, preferably in a material compatible with the contents of the jar being opened.
- To cut a glass rod, secure it with a cloth near the mark. The ends of the rod must be shaped in the flame to avoid sharp edges. A material capable of spreading the heat should be used (for example a metal grid).
- Hot glass should be left separate above a plate or similar until it cools down.
- Use Personal Protective Equipment (PPE's) in accordance with **Evaluation of Occupational Hazards**.

6- Electrical machinery and high-voltage equipment

- Before using any electrical appliance, check it is in perfect condition (free grounding, power cables, ventilation openings clear, outlet, switch and proper insulation and undamaged extension).
- Avoid temporary installations. The sockets for general use must be sufficiently numerous and properly distributed. Do not use extension cords or multi-connectors permanently.
- Provide specific ultra-high energy lines and special equipment, with an overview with differential and automatic lines. Users must know their location and disconnected mode. Do not handle electrical appliances that are wet or damp.
- In case of failure or malfunction of the machine, disconnect immediately. Will be informed of the fault responsible.
- Avoid the use of Transformers.
- Perform appropriate preventive maintenance with periodic inspections and checks.
- Know the emergency procedures for each team.
- Follow protocols when operating and handling equipment. View the **Evaluation of Occupational Hazards**.

7-Refrigerators

- Use enhanced security refrigerators that do not have internal electrical installation and preferably specially prepared for storing flammable products are approved.
- Do not keep open or uncovered containers in the refrigerator.
- Use containers able to withstand the internal pressure in case of accidental overheating.
- Always check the internal pressure and temperature.

8-Ovens and stoves

- If a stove/oven is used to evaporate volatile liquids, there should be a system of extraction and retention by filtration or condensation of the vapours produced. If vapors arising are flammable, it is advisable to use stoves of increased safety or with flameproof installation.
- Use stoves with security systems for temperature control (it is obligatory that they have a double thermostat).
- Perform proper maintenance and checking also the absence of leakage currents by material aging and correct grounding.

9-Centrifuges

- Distribute the load symmetrically.
- The centrifuge must carry a security mechanism, so that it will not start if the lid is not properly closed and preventing opening it if the rotor is in motion.
- Have a plan of action in case of breakage and / or formation of bioaerosols.

10-Vacuum pumps

- Any actions undertaken with the pump should always be carried out by at least 2 qualified and expressly authorised people.
- The electrical connections of the pump motor and all possible connections and electronic devices must only be carried out by someone authorised and competent to current standards.
- Handle the pump always with proper clothing (avoid clothes with wide sleeves, ties, necklaces, etc.) and elements of protection (goggles, gloves, shoes, etc..) appropriate to the operations required.
- Avoid wearing hair long or loose.
- Do not take off safety protection when the pump is working.
- Always re-apply the security measures, when they are removed from time to time, even if you have hardly solved the causes that led to their removal.
- Never operate the pump in the opposite direction of rotation to that indicated.
- Never put your hands or fingers in the holes or openings in the pump assembly.
- The electrical connections of the pump motor should always be operated by specialized, qualified and authorized personnel, according to the rules.
- Ensure the necessary measures are taken to prevent an eventual involuntary voltage connection.
- Ensure the proper isolation of the components and that the connection to the ground is made before connecting the power supply.
- The pump must always stop before being touched for any reason. Check that all points of closure of the facility are in the correct position to prevent fluid return.
- Where the pump and the pipes connect, there must not be pressurized while any work has to be carried out on it.
- When we need to control it, the pump should never be hot.
- Always take special care when handling a pump which has transported toxic or acidic gas.
- Never lean on the pump or the pipe joint.
- Always check the correct setting of the pump and its stability at all stages of the life of the machine (handling, installation, etc.).

11-Radioactive facility

The X-ray diffraction laboratory is perfectly regulated as to the use and protection thereof. It constitutes a radioactive Installation and entails an authorisation of use which involves meeting certain requirements and obligations, such as periodic inspections and the existence of **supervisors of the installation.**

12-Machines

- Follow the instructions provided in the manufacturer's equipment manual.
- Regularly check the proper functioning of the equipment.
- Establish a preventive maintenance program of work equipment to ensure proper operation.
- Use equipment only for the purpose intended by the manufacturer.
- Before starting a machine check the safety of the equipment and its condition.
- If equipment does not work properly, do not try to fix it.
- Never override or remove the machine's protective devices.
- Maintenance operations must be performed on unused machines, disconnected from the power supply.
- Never use equipment without the proper training.
- Use PPE's complementary to the collective protections included in the machine, including protective gloves against mechanical risks complying with the **Occupational Risk Assessment.**

13-Basic operations

Pouring

- Use a pump or siphon for transfers of large volume.
- Use safety glasses or face masks when pouring corrosive or irritant substances. For transferring acids and bases, PVC (polyvinyl chloride) or polychloroprene gloves are recommended. In all cases, always check that gloves are impermeable to the liquid being poured. Consult the Evaluation of Occupational Hazards.
- Remove sources of heat, flames and sparks from the vicinity of flammable liquid pouring. If the quantity of the substance to be transferred is important, the operation must be carried out in a specially equipped place, with sufficient ventilation.
- Recap the bottles after use.
- Transfer, whenever possible, small quantities of liquids. If not, use an area specifically for this purpose.
- Perform transfers of flammable substances away from heat sources.
- Perform transfers of toxic, irritant and corrosive substances with protective clothing appropriate to the risks of the substance.
- When the transfer is made from a metal container, a safety container must be used. If the products are flammable, all containers should be grounded and interconnected.
- Prevent spills occurring using funnels for transfer, dosing, siphons or waste trays.

Pipetting

- Mouth-pipetting is prohibited.
- Always use gloves impervious to the product handled.
- Use manual vacuum pumps or rubber zippers that are well adapted to the pipettes used.
- For some applications and reagents it is advisable to use an automatic dispenser permanently.

Operations with Vacuums

- Use special glass containers capable of withstanding a vacuum (thick walls or spherical shapes) and install the device in a place where there is no risk of mechanical shock.
- Cover the container in depression with adhesive tape or a metal net.
- The vacuum passage at atmospheric pressure should be done gradually and slowly.

Hazardous Chemical Reactions

- Control the reaction by adding the reagent in small quantities.
- Use a thermostat to control and do not exceed the indicated temperature.
- Consult the head of the Laboratory prior to use.

Transportation of containers with chemicals

- Transport glass containers in special containers. If multiple products are transported or too much, carts should be used to prevent crashes and breaks.
- Do not use the elevator meant for people.
- Do not transport the containers that are under vacuum.

14-Waste

- When handling waste packages, the maximum level of protection applies if unaware exactly the properties and characteristics of the product to be moved. If you have doubts about the nature of the product or the use of personal protective equipment, consult the Laboratory Manager as appropriate.
- Transport of the emptied containers will be performed, wherever possible, by mechanically loading. The container transport area must be completely vented and isolated from any source of ignition.
- All waste should be considered hazardous, assuming the highest level of protection in case of not knowing their properties and characteristics.
- Never handle waste alone.
- For liquid waste, do not use containers of more than 25 litres to facilitate handling and avoid unnecessary risks. Transport will be carried out with trucks to avoid the risk of breakage and spillage.
- Disposal of waste to the corresponding containers is to be performed in a slow and controlled manner. This operation will be interrupted if any abnormal phenomenon such as gas production or excessive temperature rise is observed. To transfer large amounts of fluids, use a pump, preferably manually operated; in the case of using an electric pump, it must be explosion proof. In all cases, the suitability of the material from the pump must be checked with the decanted residue.
- Once the operation is finished emptying the container, it is closed until next use. Thus, exposure of personnel to the products involved will be reduced.
- The containers are not filled beyond 90% capacity in order to avoid splashes, spills and overflowing.
- Whenever possible, the containers will be deposited on the floor to prevent falls at different levels. No waste will be stored more than 170 cm high.
- In the laboratory, the containers in use should not be left in corridors or places that may lead to tripping hazards. They should be closed to prevent evaporation.

15-Fire prevention

- Smoking is prohibited in laboratories.
- Do not overload power lines.
- Do not tamper with electrical lines or improvised fuses.
- Do not make improper electrical connections or adjustments.
- Avoid the use of multiple outlets.
- Do not place near sources of lighting, heating, etc. combustible materials.

- Beware handling flammable products. Store them in an isolated, ventilated, separate room, using only the necessary amounts.
- Beware of the processes that create flames, sparks, etc. Study the time and place where these are to be performed beforehand.
- Location of fire extinguishers shall not be changed, they shall be properly marked and in visible places.

16- Equipment and means of protection

Collective protection equipment

- **Safety Showers:** They are the most common emergency system in risk projections of chemical burns and even in cases of ignited clothing (in this case application is after the fire blanket). They are located near the main laboratory exit and the opening system is easy (triangular actuator).
- **Eyewash Systems:** They enable rapid and effective decontamination of the eyes. They consist of two sprinklers or nozzles capable of providing a jet of water to wash the eyes and face, a sink equipped with the corresponding drain and a manual actuator.

Recommendations for use:

- If the afflicted person wears contact lenses, they must remove them as quickly as possible to wash their eyes and remove the hazardous chemical substances. Lab personnel are prohibited from wearing contact lenses.
- The water should not be applied directly to the eyeball, but at the base of the nose, so that the water flows from the nose to the eyes. This means the the eyes will be washed more effectively, extracting the chemicals and/or particles, as a powerful jet of water could re-introduce particles to the eyes.
- The eyelids must be held open to ensure they are washed behind.
- Eyes and eyelids must be washed for at least 15 minutes.
- After washing, it is advisable to cover both eyes with sterile gauze.
- Regular check-ups must be conducted.
- **Fireproof Blankets:** Suitable for small fires and when clothing catches fire. Their use in some cases can avoid the movement of the person in flames, which helps to limit the effect and development of these. One alternative is less combustible or pre-dampened clothes and textiles.

It must never be used to put out ignited liquids, because they spread the fire rather than extinguish it.

- **Extinguishers:** Apparatus which contains an extinguishing agent substance that can be directed and projected over a fire by action of an internal pressure. Given that there are different types of fires, which are classified, according to the substance fuelling the fire, as a solid, liquid, gas or metal, in each case the appropriate extinguishing agent must be chosen: sprayed or jetted water, powder, polyvalent powder, foam or CO₂. Recommendations for use:

- For use in the laboratory, the most practical and universal type is CO₂, as, given the presence of delicate electrical instruments and reactive chemicals, other extinguishing agents could cause irreparable damage to equipment, or new outbreaks of fire. If this is found insufficient, resort to a powder extinguisher.
- Do not spray fire extinguishers at people.
- All personnel must know the locations of extinguishers.
- **Neutralizers:** Elements of action and protection for emergency situations in case of accidental spills or discharges. The necessary neutralizers and absorbants or adsorbants are used according to the activity of the laboratory and the materials used. Normally

specific agents for acids, bases, organic solvents and mercury should be available, which constitute the so-called “basic equipment”.

- **Extractors: (dilution ventilation):** for environmental control in the laboratory, removing a determined volume of air, exchanged for fresh air. Suitable for small quantities and some toxic substances.
- **Extraction cabinets, fume hoods (localized air extraction):**
 - Work within the Hood whenever possible to avoid the release of toxic substances.
 - Work must be at least 15cm under the Hood, and, as much as possible, with a maximum guillotine opening of 40cm. The guillotine must be completely lowered when not working in the cabinet.
 - The extraction cabinets must always be in good working condition. The employee cannot detect strong odours from the material inside. If anything is detected, the functionality of the extractor must be checked.
 - A simple check of the functionality of the extractor consists of lowering the guillotine 5cm from the base and place the paper at the output. This should be moved and even vacuumed.
 - Do not use the gas extraction cabinet as a chemical warehouse. The work surface should be kept clean and clear.
 - Although handled within the hood, gases, if used, also require the use of PPE, eg gloves.
 - Use less flammable solvents whenever possible, and the smallest possible volume containers. This will prevent breakage if large amounts of pollutants are emitted into the environment. Always keep solvent containers tightly closed.
 - Do not keep using solvents of any potential source of ignition (lit lighters, light bulbs, etc..). Complement any ventilation system with good practice.
 - The general interrupter, which disconnects all equipment inside, in case of danger, must be known.

Personal Protection Equipment (PPE's)

It is important to follow the instructions given in the Evaluation of Occupational Hazards and in the appropriate measures information for the elimination and control of risks taken for the service of PRL (prevention of risks in the laboratory).


- **General use equipment**, such as chemical protection gloves, are single use, so that the problem of ‘personalisation’ are meaningless.
- **Gloves for the cold** are normally located, with the refrigerators and freezers, dewar liquid nitrogen, etc., for the handling of their contents. Except when there are people entrusted specifically with these tasks, it is not necessary that their allocation is customized.
- **Gloves for heat** are located with the burning kilns, stoves or gas chromatographs and in general with all equipment that presents a risk of burning heat. Also, these must be used in all operations involving the handling of hot substances (extractions, distillations).
- **Safety glasses**, even after the general risk assessment on their obligation is established, personal allocation is recommended for all laboratory personnel, always provided in surplus for the temporary staff or visitors. It is important that the protection offered be clearly established: projections of solids or liquids, vapors irritating ocular mucosa, radiation.
- **Face shields, aprons and specific protective clothing** usually have a sporadic and occasional use. There should be a minimum stock in a centralized warehouse and its allocation may be personal, or not, depending on each case.
- **Respiratory protective equipment** will always have a custom mapping. An exception is the Disposable Masks to be stored in a central warehouse. Once requested, use will be customized.

- **Labcoats** not only protect the workers clothes but also prevent contaminant substances deposited in clothing from leaving the room. They will be saved in the laboratory or in lockers designed specifically for that purpose.

17- Actions in the event of accidents

First Aid: General Instructions

- Activate **PAS (Protect the injured, Advise healthcare services and Support the Injured)**:
 - Keep calm and protect against potential hazards.
 - Do not move the injured unless necessary.
 - Examine the injured well: awareness, breathing, wounds, etc..
 - Calm the injured, if they are conscious.
 - Keep the injured warm (blanket).
 - Always advise the healthcare personnel, however light the injury.
 - Appropriate transfer (ambulance) to the nearest health center.

 External Resources	
National Police	091
Local Police	092
Civil Guard	062
Civil Protection	061
Emergencies	112
Firefighters	080
Virgen Macarena Hospital	955008000
Virgen del Rocío Hospital	955012000
Ambulances	954425565

Accidental Spills

- If the **Spill is Small**
 - Alert staff in immediate areas or zones.
 - Increase the ventilation in the area of the spill (open the windows, connect the extraction hoods).
 - Use the appropriate PPEs, which should include at least, gloves, glasses, gown and shoe covers.
 - Act quickly towards absorption, neutralization or elimination. The specific procedures to follow for each substance must be determined by consulting the MSDS of the products. In general, for:
 - **Flammable liquids:** absorption should be with charcoal or specific products. Never use sawdust because of its flammability.
 - **Acids:** neutralize with bicarbonate or use specific products marketed for this purpose. Once neutralized, wash the surface with water and detergent.
 - **Bases:** neutralization with specific products marketed for this purpose. Should you not have them, neutralize with water of slightly acidic pH. After neutralization, wash the surface with water and detergent.
 - **Other, non-flammable, non-toxic and non-corrosive liquids:** other non-flammable or toxic or corrosive liquids can be absorbed with sawdust.

- **Mercury:**
 - ✓ Absorb with sulfur, calcium polysulfide or amalgamants (marketed there as pads).
 - ✓ If it has been deposited in grooves, it can be sealed with a fixative.
 - ✓ Aspirate with Pasteur pipette and store the collected metal.
- **Other non-corrosive or flammable liquids:** Absorb with vermiculite.
 - Once the spill is neutralized, clean the area with water.
- If the **spill is large**, we must act as follows:
 - Attend to injured or contaminated persons and remove them from the area or area of exposure.
 - Tell people that are in the lab to leave.
 - Turn off heat sources, especially if the spilled material is flammable. Close the doors of the area or affected area.
 - Inform the **Head of the Laboratory** giving accurate information on the spill.

Polluted atmosphere

The atmosphere of a laboratory can be toxic or explosive after an accident / incident: breakage of a bottle, pouring a reagent, gas leakage, etc. The actions to take to control risk are:

- **If the contamination is weak:**
 - Open all of the windows.
 - Switch on the cabinet with the panel completely open.
- **If the contamination is major:**
 - Conduct Self-Protection Plan. Contact the Head of Emergencies (cicCartuja manager, Ext-909000).
 - Evacuate personnel from the area.
 - Notify the Chief and Intervention Team provided protective material appropriate to the risk: respiratory protection, gloves, etc..
 - Close all devices with flame if the pollutant is volatile and flammable.
 - Open the windows.
 - Activate the cabinets.
 - If it originated from a spill, use an absorbent suitable to the spill and keep it in a sealed container, washing and rinsing with tap water, always using gloves. In the absence of suitable absorbent, use absorbent paper.
 - Prohibit entry to the area until the environmental concentration of the hazardous substance in the atmosphere is no longer a risk.

Splashes

- **On the skin or the eyes:**
 - Wash with plenty of water for 10-15 minutes if using an eyewash or eye safety shower.
 - Do not attempt to neutralize.
 - Obtain immediate medical attention.
- **In gowns or clothes:**

- Remove clothing quickly, washing or placing it under the shower, according to the extent of penetration of the substance.
- If there is contact with the skin, seek medical attention.

➤ **Skin Contact:**

- Wash with plenty of water for 10-15 minutes.
- If the affected area is large, remove clothes, and use the safety shower.
- If contact is with the eyes, use the eyewash for at least 15 minutes.

Ingestion

- If it is an acid, drink bicarbonate solution.
- If it is a base, drink acidic drinks.
- Provide information on products that are handled at their safety data sheets or the Institute of Toxicology whenever possible.
- Do not induce vomiting unless otherwise indicated.
- Go to the doctor with a product label and ingested dose.

Inhalation

- Take the person to a well-ventilated or airy place.
- In case of respiratory difficulty, employ mouth to mouth.
- If there are gases in the atmosphere, use the masks in first aid.
- Call the health services.

Burns

➤ **If clothing catches fire:**

- Put out the flames with a fire blanket or damp garment.
- Take victim to the emergency shower.
- When there are no flames, keep the person lying without cooling them.

➤ **In case of minor burns**

- Never burst blisters.
- Wash the area with cold water for 10 minutes.
- Cover the burn with gauze and bandages.

➤ **For acids:**

- Wash with plenty of water for 10 minutes with an alkaline solution (sodium bicarbonate and water).
- If the burn occurred with caustic soda, rinse with vinegar.

➤ **Thermal injuries:**

- Wash the burned area thoroughly with cold water to cool it.
- Do not remove clothing stuck to the skin; cover the burned area with clean clothes. Always refer to a physician, even if the affected area and depth are small. There are specific recommendations in these cases:
 - Do not apply anything to the skin (not ointment, fat, or disinfectants).
 - Do not over-cool the injured
 - Do not give them drinks or food.
 - Do not break blisters.
 - Do not leave the injured alone.

Cuts and wounds

- **If the wound is not deep:**
 - Wash with water and soap and disinfect the wound with antiseptic.
 - Leave them to dry in the open air or cover them with sterile dressings.
- **If they are deep or will not stop bleeding** immediate medical assistance is required, taking into account the first aid action in the case of hemorrhage:
 - Turn the wounded over, discovering the location of the bleeding.
 - If it is an extremity, keep it elevated.
 - Apply sterilized gauze or a clean cloth to the wound and compress for 5 minutes.
 - If the bleeding has stopped, apply a strong bandage.
- **If you suspect danger of tetanus infection**, see the doctor ASAP.

Foreign bodies in the eyes.

Recommendations:

- Avoid rubbing eyes when affected.
- Ensure that it can blink.
- Try to remove it with the tip of a clean handkerchief.

Electrocution

The actions to take when someone is "caught" by the current are the following:

- Cut the power to the device causing the accident before approaching the victim, to prevent another accident, and remove the injured.
- Initiate **PAS (protect the injured)** and, if necessary, begin cardio pulmonary resuscitation.
- Do not provide food, drinks and products to enable breathing.

Dizziness or loss of consciousness due to chemical leak

The actions to be performed:

- We must protect the environment with a breathing apparatus before approaching the victim.
- Move the injured person to a safe location and leave them lying on the left hand side.
- Loosen the clothes or anything that might constrict, checking missing feeling and breathing; also check the pulse.
- Initiate **PAS (protect the injured)** and, if necessary, begin cardio pulmonary resuscitation.
- Do not provide food, drinks and products to enable breathing.

18- Action in case of alarm, Emergency and Evacuation of cicCartuja

- If the General alarm signal is activated:
 - Exit the building. Follow the instructions of the head of emergencies.
 - Don't run.
 - Do not use the lifts.
 - Await instructions in the meeting point outside (will be indicated by the Security Service Center).
 - Do not go backwards or return under any circumstances.

- In case of emergency, report it immediately:
 - To the Security Service in "Entrance Control".
 - Through the Center staff next to you.
 - Press the alarm button.
 - Use the internal emergency phone (909501).
 - To the Head of intervention (909549).
 - To the Representative of the PRL (909547).
- In case of Intervention, Center staff will take control of the emergency situation.

Fire

- If a **small fire** occurs, follow the safety procedures indicated:
 - Do not be overcome by panic; we must act calmly but decisively.
 - Raise the alarm immediately.
 - Put out any small fires by covering them, without using water.
 - If the fire is larger and localized, use the proper extinguisher, as an alternative you can use the fireproof blanket.
 - It is important to remove waste of a flammable nature from the vicinity of the fire.
 - To choose the right type of extinguisher, consult the instruction manual.
 - If your clothes catch fire, use the shower or the safety blanket.
 - If the laboratory is evacuated, close the doors behind you.
- If instead **the fire reaches large proportions** and you cannot put it out with fire extinguisher, you should:
 - Evacuate the laboratory and apply the specific protocols of the **CicCartuja Self-Protection Plan**:
 - Keep calm and do not stop at exits.
 - Use the established evacuation paths in this regard.
 - Do not use lifts.
 - If you are surrounded by smoke, crouch and crawl.
 - Close the doors you go through.
 - Follow the instructions of the assigned emergency personnel.
 - Raise the alarm immediately.
- Fire in an **area with pressurized gas bottles** (compressed, liquefied or dissolved). The actions to follow are:
 - The bottles must be removed with maximum speed. If they cannot be removed, they must be chilled and covered with water, activating the Self-Protection Plan.
 - Cylinders containing gases capable of worsening the fire should never be opened, those that are in service should be closed.
 - If firefighters are working in a laboratory in which you have gas bottles, warn them of their existence, location and number, as well as the gas they contain.
 - After the fire, the bottles that have not been removed should be carefully reviewed to check for clear marks of fire exposure.