

DOÑANA BIOLOGICAL STATION (EBD)

Occupational health and safety instructions for workers and users

Welcome Manual



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For more information about DBS' risk prevention plan: www.ebd.csic.es/prevencion/Inicio.aspx

INTRODUCTION

Doñana Biological Station has issued this "Welcome Pack" to provide as much information as possible to all people joining our Institute. This pack is in line with the CSIC's (Council for the Extension of Studies and Scientific Research) Risk Prevention Plan, whose regulatory framework and coverage is as described below:

CSIC's Risk Prevention Plan responds to the obligation introduced by the Spanish Law 54/200 on the modification of regulatory framework for occupational risk prevention contained in article 16 of Law 31/1991, and by Royal Decree 1488/1998, dated 10 July, on the adaptation of occupational risk prevention legislation to the General State Administration.

However, and considering that almost all CSIC centres and institutes practice activities which correspond to Annexe I of the Royal Decree 39/1997, dated 17 January, which approves Risk Prevention Services regulations, and the subsequent modification, Royal Decree 604/2006, dated 19 May, the legal regulations of application are extensive, given that:

Sophisticated equipment and prototypes are used.

The following raw materials are used: chemical agents, physical agents, biological agents, carcinogenic agents, toxic agents, very dangerous agents etc.

Activities and tasks are carried out in places of risk that are difficult to control

Therefore, the legal regulations that are outlined in Law 31/1995 for Occupational Risk Prevention will be applied. In addition, CSIC internal procedures will be taken into consideration.

In order to develop this Plan and in those tasks where it is deemed necessary, the standards, guides and recommendations that were to be applied will be taken as reference, such as the following:

UNE Standards.

Guides from the National Institute of Health and Safety at Work, and the Spanish Silicosis National Institute, protocols and guides from the Spanish Ministry of Health and Consumer Affairs and important institutions within the Autonomous Communities.

International standards

When the aforementioned documents are not present, guides from other renown entities on the matter will be used.

The Risk Prevention Plan develops the level of responsibility within a hierarchy: manager, deputy manager, laboratory and department managers, etc.

According to the Law 31/95 for Occupational Risk Prevention, and CSIC's Risk Prevention Plan, as well as other standards, **the head researchers** of the research projects must consider the possible risks that are associated with the project tasks that are being carried out. With regards health and safety in the workplace, they are responsible for:

- (a) Complying with and introducing the Occupational Risk Prevention Standard to the research group management, as well as the guidelines established by the Manager (in compliance with the recommendations given by the Risk Prevention Staff).
- (b) Guaranteeing that collaborators (teachers, pre- and post-doctoral researchers, workers, etc) are familiar with the Occupational Risk Prevention Standard applicable to the research being carried out.
- (c) Providing and requiring personal protective equipment (PPE) to be used when necessary.
- (d) Promoting safe practices, replacing dangerous practices for less risky alternatives.

- (e) Managing dangerous waste in line with the standard.
- (f) Defining and controlling access for authorised staff to the premises.
- (g) Making note of incidents or accidents.
- (h) Ensuring that there is a telephone or list of contact telephone numbers for emergencies

Following the previous regulations, as well as the Statute for Workers' Rights, **workers** must comply with the regulations and health and safety measures established by the company. Equipment for individual and collective use must also be used properly.

This legislation also outlines the rights and obligations for each section. Penalties associated with failure to comply with these legislations are also described.

WORK IN THE OFFICE AND DISPLAY SCREEN EQUIPMENT



Royal Decree 485/1997, of 14 April. Health and safety signs in the workplace. Spanish Official Gazette No 97, of 23 April 1997.

Royal Decree 486/1997, of 14 April. Minimum health and safety requirements in the work place. Spanish Official Gazette No 97, of 23 April 1997.

Royal Decree 488/1997, of 14 April. Transposition of **Directive 90/270/EEC**. Display Screen Equipment. Spanish Official Gazette No 97, of 23 April 1997.

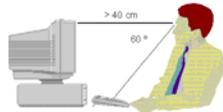
Royal Decree 1215/1997, of 18 July. Using equipment in the workplace. Spanish Official Gazette No 188, of 7 August 1997.

HEALTH RISKS: Visual fatigue, musculoskeletal disorders (tendinitis, tenosynovitis or carpal tunnel syndrome), mental fatigue. For more details, check the Spanish *National Institute of Health and Safety* at http://www.mtas.es/insht/erga_fp/efp_48.htm

As well as traditional accidents (impact, falls, fires, etc.) other types of accidents may occur during work in the office. Although these risks are not so obvious, they are no less important. Accidents may be caused due to incorrect ergonomics of work stations (furniture, lighting, noise, posture) and also general organisation (timetables, task sharing, communication, etc.). Possible injuries are muscular aches, allergies, eyesight changes, stress and physical and mental fatigue. Below, we have described a group of basic, generally applied regulations that can prevent many occupational risks in offices.

BASIC REGULATIONS

	SUITABLE CHARACTERISTICS	ENSURES	RISKS WHICH ARE AVOIDED:
FLOORING	- Non-slip flooring - Even flooring (without bumps)	Correct movement around the workplace	Trips, falls
ELECTRICAL WIRING	- Next to walls or signposted	Correct movement around the workplace	Falls, short circuits, electrocution.
ACCESS POINTS	- minimum 80 cm. - free from obstacles	Access with no obstacles in the case of an emergency	Falls
ELECTRICAL EQUIPMENT	- Electrical equipment and installations must be checked regularly - Multiple plug adapters connecting more than one device to any one plug should not be used.	Correct electrical connections	Overheating can cause the equipment to wear and provoke a fire
PRINTERS AND	- place in ventilated areas	Avoid accumulation of	Inhalation of carcinogenic

	SUITABLE CHARACTERISTICS	ENSURES	RISKS WHICH ARE AVOIDED:
PHOTOCOPIERS		substances coming from toners and inks	products, radiations
NOISE POLLUTION	- do not exceed 55 dB	Good communication and concentration	Stress, mental fatigue
TEMPERATURE	- clean the air conditioning system regularly - between 17 and 27°C in offices	Ensures that bacteria, viruses, fungus and dust mite are not present	Allergies Thermal discomfort
LIGHTING	- 300 lux in walking areas - 500 lux for reading work - fluorescent lighting should not be used without diffusers or grids - lighting in the ceiling should not be positioned above the operator.		Visual overloading
FURNITURE	- rounded edges - drawers with a blocking mechanism - low thermal transmission		Knocks
TABLE	- minimum surface measurements 80 x 120 cm - the screen and keyboard should be positioned at least 40 cm away from the user: there should be enough space to be able to support hands and arms. - matt finish - colour should not be too light or dark	Enough space to rest hands Minimises reflections	Carpal tunnel syndrome Visual fatigue
CHAIRS	- Adjustable seat and support - support until the middle part of the back - five legs with wheels that can spin around - the seat should be covered with a breathable material	that the curvature of the vertebral column in the lumbar area is protected, making it easier be able to access work elements	Musculoskeletal problems (dorso-lumbar, neck)
WORKING POSTURE	- feet flat on the floor, thighs in horizontal position - use of footrest - upright torso, straight head and neck - elbows and knees should be positioned at an angle of around 90 degrees.	Maintain a suitable posture	Musculoskeletal problems (dorso lumbar, neck)
COMPUTERS	- perpendicular to the light sources - mobile screen and keyboard - using a document holder at the same height as the upper part of the computer screen	Ensures that there is no reflection on the screen Reduces head and eye movement	Visual fatigue Neck ache
SCREEN	- upper border of the monitor at the eye level, distance 45-55 cm.		Neck ache
KEYBOARD	- flat - hand rest - wrist rest	Reduces static tension in arms and back Correct wrist alignment	Tendinitis, tenosynovitis or carpal tunnel syndrome.
MOUSE	- must be adapted to the hand's curve - must allow fingers, hand or wrist to be supported on the table	Reduces static tension in arms and back Correct wrist alignment	Carpal tunnel syndrome
ORAGNISING TASKS	The manager or supervisor should be able to explain tasks and responsibilities clearly To provide the resources needed for the job (information, time, material)	Ensures that tasks are changed regularly in jobs which require long periods of concentration and in those which are monotonous	Stress Mental fatigue

	SUITABLE CHARACTERISTICS	ENSURES	RISKS WHICH ARE AVOIDED:
WORK STATION	Taking into account the characteristics of each person (stature, age, abilities, etc.) and their activity	To ensure that the work is carried out comfortably and to allow posture changes and rests	Psycho-social problems

HEALTH

Regular eye sight tests are recommended.

Relaxation exercises are recommended (for the head, shoulders, back, waist, arms, etc.) which act against the backbone and muscle blood supply.

For tasks which are informative or monotonous, a break of 10 to 20 minutes should be taken every one and a half to two hours to prevent the negative effects of physical and mental fatigue. Not using the computer is not considered as a break: workers must go to a rest room or change the task that they are doing.

FIELD WORK

Royal Decree 487/97, of 14 April, on the Minimum Health and Safety Regulations concerning the manual handling of loads involving risks to workers, in particular dorso-lumbar risks. Spanish Official Gazette No 97, of 23 April 1997.

Royal Decree 773/1997, of 30 May on the Minimum Health and Safety Regulations concerning the use by workers of personal protection equipment. Spanish Official Gazette No 140, of 12 June 1997.

Royal Decree 486/1997, of 14 April, Minimum Health and Safety Regulations at the workplace. Spanish Official Gazette No 97, of 23 April 1997.

The nature of research work carried out at the Doñana Biological Station involves frequent field trips to make observations and collect data. The areas under study differ greatly (beach, mountain...) and are at varying distances (from Doñana to the Antártida). In addition, a diverse range of species is studied, including numerous species of flora and fauna. Therefore, the risks associated with field activities are numerous and varied, making the drafting of common guidelines and regulations essential, in order to minimise the risks to which field personnel are exposed.

Unlike office or laboratory workers, field workers find themselves in isolated situations when requiring care or assistance. In this respect, these basic regulations are essentially based on the correct location of the worker by the Centre, combined with certain individual guidelines, that is, maximum individual protection, as the number of individuals who can be helped, together with the collective available resources, are minimum.

BASIC REGULATIONS

- Individuals required to be in the field, for work-related reasons, should first request the corresponding SERVICE ORDER (with or without expenses) from the Institute's department of administration, indicating the location, date, time of departure and return so that the centre has a record of the field trip. Individuals must NEVER leave for the field without leaving prior notification.
- Two people should work together wherever possible. This is COMPULSORY in isolated zones. In extreme cases where it is necessary for an individual to go alone, they should contact an appointed person who shall be informed of the itinerary, expected departure time and their return on completion of the work.
- Before leaving, the individual should check that the vehicle, equipment and any necessary tools are all in perfect working order.
- Whenever equipment, tools, material, etc., are used, the individual should be fully trained in their correct operation, together with the safety measures required for their correct use.
- Rings should not be worn for work involving a risk of their being snared (when climbing trees, ladders, etc).
- In general, in addition to the equipment required for each activity, all workers should be equipped with the following, provided by the immediate supervisor or prevention personnel:
 - Appropriate shoes (waterproof boots, with non-slip soles, anti-perforation and reinforced toe caps, etc).
 - Protective gloves, face masks, etc.
 - Water, sun screen, hat
 - Locating system (mobile phone, GPS, etc.)
 - Containers for the disposal of sharp, biological and/or chemical material
 - Portable first aid kit.

- All waste produced in the course of work should be deposited in the appropriate containers in accordance with instructions given by authorised persons for waste management (see section 4.4. Waste Management for Laboratory Work).
- In the event of accident, the instructions given in the section, First Aid and Emergency Procedures, should be followed.

Use of vehicles

- Only personnel employed to do so are authorised to drive official vehicles.
- Prior to use, the user should check the condition of the vehicle, and complete the check sheet, designed for this purpose, at the DBS main office.
- Vehicles should be returned clean and free of waste after use, ready for the next user.
- Before using the vehicle for the first time, drivers should complete a course in driving four-wheel drive vehicles, or the supervisor, who has already completed this course, should give appropriate instructions.
- In the event of breakdown or accident on the road (roadside assistance):
 - Seguros La Estrella (for Suzuki and Citroën), telephone 902 114 868
 - Seguros AXA (for NISSAN NAVARA), telephone 900 101 681
 For further information, or in the event of query, please check the documentation provided with the vehicle.
 - * Before getting out of the vehicle, drivers should put on the reflective safety jacket, and then place the warning triangles in front and behind the vehicle to warn other drivers of a potential obstacle. Notify the corresponding roadside assistance service.
 - * If it is necessary to take the vehicle to a repair workshop, the insurance will provide transport (taxi) to take the driver home, at night time or if at long distances, the insurance should provide accommodation in a hotel.
 - * If the repair workshop is closed for whatever reason when the vehicle is being removed, it should be taken to the breakdown company for later transfer.

DESCRIPTION OF THE RISKS

The project or work managers shall give the worker a sheet listing all the different types of risk which may be encountered. These include the following:

- 1. Falls to the same or different level
- 2. Climbing trees
- 3. Roped team for lowering nests
- 4. Knocks or bumps against objects or tools
- 5. Accidents due to the presence and/or handling of machinery
- 6. Accidents due to the use of vehicles on tracks, roads, etc.
- 7. Falling of branches, rocks, etc. when climbing.
- 8. Insect and reptile stings and bites
- 9. Animal attack or bite during monitoring and/or handling
- 10. Handling of cattle
- 11. Cuts by tools or vegetation
- 12. Biological risks as a result of contact with and/or handling of animals

- 13. Collection of samples: blood, faeces, feathers, swabs, carcasses, etc.
- 14. Work in pools, lagoons and marshland
- 15. Entrance into caves
- 16. Use of cannon nets
- 17. Bad weather
- 18. Others: (please indicate).....

PREVENTIVE REGULATIONS AND CORRECTIVE MEASURES – PERSONAL PROTECTION EQUIPMENT (PPE)

All workers and volunteers are obliged to use PPE in accordance with the instructions provided, and must not take part in any task for which they are not suitably equipped with the protective equipment.

Driving vehicles: Ensure that the vehicle is fit to drive and is equipped with the compulsory safety equipment (fire extinguisher, first aid kit, warning triangles, reflective safety jacket...). Always use seat belts and observe speed limits (D 2081/97 y D 1551/98). All loose objects should be correctly secured. The speed limit in Doñana Biological Reserve and throughout Doñana National Park is 40 km/h.

Climbing trees, raising/lowering nests, entering caves: Use professional material suited to the activity. Wear appropriate shoes (to protect against knocks or crushing, non-slip, anti-perforation, reinforced toe-caps) and clothing. Use a built-in harness, safety helmet (standard EN 397), hooks, carabineers, etc. This equipment must be checked and correctly maintained each time before use. Use an approved lifting platform or ladder in combination with fastening safety systems. Have received training in climbing in the form of specialised course.

Handling machinery and tools: all machinery (chainsaws, etc...) and tools (hand ladders, etc.) must be inspected regularly and should not be used unless they are in perfect condition. Use PPE appropriate for each machine.

Handling of animals / handling of cattle: this should be handled by the fewest number of trained individuals possible. Wear suitable clothing, safety shoes (to protect against knocks or crushing, non-slip, anti-perforation, reinforced toe-caps) and the personal protection equipment required for each case. Sedatives and/or anaesthetics must be administered by qualified personnel. Large animals (horses, ruminants, etc.) should be handled in a cattle race or corridor with sufficient space for the handlers to move freely without being trapped or kicked.

Collection of samples: blood, faeces, feathers, swabs, carcasses, etc. Disposable gloves to protect against pricks and cuts (EN 374 and EN 388 standards). Dust masks (EN 149 standard). Place disposable material in sealed containers designed for this purpose and hand to authorised personnel for disposal. Never re-encapsulate needles.

Working in pools, lagoons and marshland: Always use suitable shoes (waterproof boots, etc.)

Use of cannon net Training in the use of cannon nets and the handling of explosives is compulsory. This must be carried out under supervision.

Bad weather: use appropriate shoes in accordance with recommendations and clothing suited to the weather conditions: warm, waterproof, cap or hat to protect against sun, occupational protection sun glasses (EN 172), etc.

GENERAL PPE IRRESPECTIVE OF WORK TO BE PERFORMED

Appropriate footwear (waterproof boots, non-slip soles, anti-perforation and reinforced toe-caps, etc.).

Protective gloves, face masks, etc.

Containers for the disposal of sharp, biological and/or chemical material

Water, sun screens

Locating system (mobile phone, GPS, etc.)

WORK AND USE OF LABORATORY

Royal Decree 822/1993, of 28 May establishing the principles of good laboratory practice.

Royal Decree 486/1997, of 14 April, on the minimum health and safety regulations at the workplace.

Royal Decree 374/2001, of 6 April, on the protection of workers' health and safety against chemical hazards when at work.

Royal Decree 664/1997, of 12 May on the protection of workers against the risk of exposure to biological agents when at work.

Royal Decree 485/1997, of 14 April, concerning minimum signposting requirements with respect to occupational health and safety.

Royal Decree 665/97, of 12 May, on the protection of workers against the risk of exposure to carcinogenic agents when at work.

Royal Decree 379/2001, of 6 April, approving the Regulations for the storage of chemical products and the complementary technical instructions MIE APQ-1, MIE APQ-2, MIE APQ-3, MIE APQ-4, MIE APQ-5, MIE APQ-6 and MIE APQ-7.

Royal Decree 298/2009, of 6 March, amending Royal Decree 39/1997, of 17 January, approving the Regulation of Preventive Services, on the application of measures to encourage improvements in the health and safety of pregnant workers, workers who have recently given birth and women who are breastfeeding.

Work in laboratories is characterised by inherent risks about which little is generally known. The risks are derived from the products being handled, the operations involving these products and the installations where these operations take place; the origins and consequences are, therefore, hugely varied and require assessment and control.

This manual lists a series of basic ideas concerning safety and the potential risks implied by work in a laboratory. The purpose of the list is to encourage a safe working environment, and therefore certain norms of conduct have been included, together with protocols for action in the event of accident, and how to prevent them.

Almost all the products in a laboratory are potentially dangerous, the processes followed are chemical or physical and chemical changes requiring inputs of energy, or releasing energy; the basic material used is glass, the handling of which also involves certain risks, ... These factors require the special attention of the laboratory worker, which can be defined in a series of precautions that must be observed at all times during work in the laboratory.

In the laboratory, in addition to the intrinsic risks of the chemical products and the products generated as a result of the operations performed in the laboratory, the risks inherent to the installations, laboratory material and equipment therein must also be considered.

The laboratory normally has a series of installations or mains supply of gas, water, compressed air, vacuums, electricity, etc. The centre's management must ensure that relevant national, regional and local regulations are met and that the installations are in good condition and subjected to adequate maintenance to guarantee compliance with the above regulations, and ensure that there is little or no risk of injury to personnel using the installations in the course of their work in the laboratory.

A. – Organisation of Work:

~ The organisation of the work should be thoroughly studied and suitable to ensure the maintenance of a good level of prevention. The organisation of the work in a laboratory must permit any changes such as work outside normal working hours, work at night, appliances out of order, faults in the supply of water and energy,... to be known to all and therefore allow the adoption of the appropriate safety measures.

~ Personnel joining the laboratory shall receive training in the working regulations, the laboratory safety and emergency plan, and the specific hazardous nature of products, installations and operations normally employed in the laboratory. They should not commence work until they have been duly informed by the technical and/or prevention supervisor.

~ Pregnant women or women who are breastfeeding should notify the Prevention Service immediately in order to receive specific instructions on work in certain laboratories.

~ Personnel must never work alone in the laboratory on operations involving risk or outside normal working hours.

~ During operations involving risk, even those persons not directly involved in the operation should be duly informed.

~ Work should always be carried out in the glass cabinets where possible. This is compulsory when handling toxic, volatile and/or inflammable products. The Installations and Maintenance Service (IMS) should regularly check the correct operation of the glass cabinets, their general condition, compliance with minimum intake flows, and that they are correctly used, etc.

~ Reagents stored in the laboratory must be kept away from the sunlight, they should not be stored on high shelving, care should be taken with labelling and only the absolutely essential minimum quantities stored.

~ The use of small quantities of products in all operations for which prior information regarding the potential behaviour of the substances present is not available, is a general rule to be applied in the reduction of risks in the laboratory.

~ Inflammable products must be stored in the security cabinets, always observing storage incompatibilities. Bottles containing inflammable products should not be kept on laboratory benches longer than absolutely necessary to extract the required quantity of reagent. They should be replaced in the security cabinet or cupboard immediately.

~ Waste disposal should be correctly controlled. Waste products must never be poured down the drain, even in small quantities, these include: products which react violently with water, toxic agents, carcinogenic, foul-smelling, tear-producing and non-biodegradable products. The centre has a waste management programme about which all personnel should be informed. (**Attachment**)

~ Conventional refrigerators should not be used for the storage of inflammable products unless they have been previously modified to reduce the risk of sparks, for which the IMS should disconnect the internal lighting system. In addition, the appliance should be connected to a power generation set or UPS.

B. – Work Habits:

▪ All personnel should be familiar and equipped with the personal protection equipment (PPE) required for each operation and use and maintain them correctly (lab coats, glasses, gloves, face masks...). The technical supervisor in each laboratory will provide personnel with the appropriate means.

▪ Products should not be handled in ignorance of their physical and chemical and toxicological characteristics. The safety data sheets for all products in the laboratory must be available. Special attention should be paid to phrases R and S on the labels. **Please refer to Attachments**

- Work in ordered, clean conditions, without haste and using the appropriate material for each operation.
- When performing operations involving risks, those personnel not involved in the operation, but who may be affected, should be notified.
- Never use equipment if you do not know how it works. Ask the appliance supervisor for full instructions and the appropriate safety measures.
- Before commencing an experiment, make sure that the assembly and/or equipment required for the experiment are in perfect working order.
- Smoking, eating and drinking is strictly forbidden in the laboratories.
- As part of the basic hygiene guidelines, all personnel should wash their hands on entering and leaving the laboratory, when removing their gloves, and whenever they suspect they may have been in contact with irritant, caustic, toxic or infectious material. Disposable paper should be used to dry hands.
- The lab coat and work clothes should be correctly fastened at all times, hair should be tied back, and the wearing of necklaces or wide sleeves which could get caught in laboratory assemblies or material should be avoided. Work should not be carried out away from the table or bench.
- Personal objects should not be left on the work tables or benches.
- Lab coats and gloves should be removed before entering common areas such as the library, conference rooms, rest areas, administration, etc.
- Ordinary clothes must not be kept in the laboratory, but should be stored in the lockers or offices, where provided, away from the laboratory work area.
- Safety glasses must be worn at all times when handling boiling products or when there is a risk of splashing.
- Food and drink must never be stored in the laboratory fridges or other areas. Similarly, biological material or laboratory products must not be stored in the fridges provided for the storage of food.
- The use of contact lenses is not permitted, as in the event of accidents due to the splashing of chemical products or their vapours, should these go behind the lenses, this could result in eye injuries before it is possible to remove the lenses. The use of contact lenses is permitted if safety goggles are worn.
- The use of open footwear is not recommended.
- Keep work tables clean and free of products, books, boxes or accessories not required for the job in hand.
- Use gas extractor hoods where possible.
- Do not use glass if cracked. This could increase the risk of accident.
- Do not carry test-tubes or products in the pockets of lab coats.
- Never directly force the lids of bottles, jars, stopcocks, etc, directly with your hands, if they are blocked. Use appropriate personal or collective protective equipment: gloves, glasses, trays, tube holders.
- On completion of an operation, all material, reagents and equipment should be cleared away to prevent unnecessary accumulation and to leave the work zone clean.
- Products stored inside the laboratory should be kept to the minimum possible, and preferably kept in cabinets.
- Gas extractor hoods are a means of collective protection and should not be used to store products.
- Pipettes should never be filled by mouth, the rubber pear-shaped bulb or safety pipettes should be used.

- Appropriate safety measures should be in place for reflux.
- Burners must not be left unsupervised while on. Before lighting a burner, check the absence of inflammable substances in the vicinity.
- Carry substances on trays or in containers to prevent spillage in the event of breakage.
- In the event of contamination or spillage, clean the affected area which should not be used until it has been confirmed to be decontaminated. The products used should be suited to each case, previously tested, and stored in a visible and easily accessible zone (absorbent materials). Please refer to First Aid and Emergency Procedures
- Special care should be taken when closing bottles and jars immediately after use, particularly those recipients containing waste products.
- Care should be taken when moving around the laboratory, and avoid interrupting those people working.
- Laboratory doors should be kept closed during the working day.
- On completion of the working day, check that all appliances, water, gas, etc. have been disconnected. If for any reason, it is necessary to leave any of the above connected, this should be indicated.

C. – General Safety Regulations

With respect to risks in the laboratory, please remember that the best prevention is good information. The most frequent sources of information include: labelling of products, safety data sheets, etc. Labels should be marked with the danger symbols, the R phrase indicating specific risk and the S phrase advising about precautions to be taken.

Technical safety data sheets contain information complementary to that shown on the label concerning the composition, risks, advice for handling and storage, first aid measures, toxicological measures, exposure control and personal protection. Therefore, they are an essential tool for the prevention of occupational risks and the protection of the environment. These sheets should be supplied by those firms responsible for marketing the substances, and can be viewed on the web page of the Institute of Safety and Hygiene at Work: <http://www.insht.es/portal/site/Insht/menuitem.a82abc159115c8090128ca10060961ca/?vgnextoid=4458908b51593110VgnVCM100000dc0ca8c0RCRD>

Each laboratory should have a data base of the safety data sheets for all the compounds used in the laboratory and all personnel are responsible for maintaining the data base duly updated with the introduction of all new reagents. This data base should be easily accessible for consultation as required.

Similarly, each laboratory should keep the safety data sheets supplied by the supplier for each of the products used.

Other sources of useful information are scientific and technical publications, information supplied by manufacturers and suppliers, prevention services...

Certain general guidelines for working in safety are listed below:

1. STORAGE

- Store products and materials in accordance with criteria for compatibility, level of danger, changeability and availability.

➤ Ensure that all stored components are clearly labelled. Remove old labels from reused recipients before attaching the new labels. Never stick labels on top of each other.

All solutions prepared in the laboratory should be duly labelled, specifying the name and composition of the substance, the date of preparation, the name of the person who prepared the solution, the relevant hazard symbols, and the corresponding R and S phrases. The following model of label should be used for all preparations



REAGENT LABEL

COMPOUND

CONCENTRATION

**DATE OF
PREPARATION:**

PREPARED BY

R PHRASES:

(Space for hazard symbols)

S PHRASES:

- The quantity of hazardous products in the workplace should be kept to a minimum.
- Correctly seal and label containers of hazardous products to avoid risks.
- Each laboratory manager should keep the lists of stored materials and products up-to-date and should control the stock to prevent products from expiring.

2. COLLECTIVE PROTECTION EQUIPMENT IN THE LABORATORY

The most usual collective protection equipment include gas cabinets, extractors, emergency showers and eye-baths, fire extinguishers and fire blankets, etc. These elements can help in the event of an emergency: spills, splashes, leaks, fire, etc. They should be kept in good condition and easily accessible to permit rapid use if required, and should be duly labelled.

GAS EXTRACTION CABINETS

The extraction cabinets capture, contain and expel the emissions generated by hazardous chemical substances. They protect against particle projections and splashes and facilitate the renewal of air.

The purpose of the gas extraction cabinets is to prevent the spillage of contaminants into the laboratory. This is achieved by extracting the air from the laboratory to the interior of the hood, passing via the technician.

The instructions for the use of the gas extraction cabinets should be clearly visible in each laboratory.

Recommendations for the use of extraction cabinets:

- Work should be carried out at least 15 cm from the frame of the hood and, where possible, with a maximum opening of the guillotine doors of 40 cm. The guillotine doors should be lowered completely when the cabinet is not in use.
- The gas outputs from the reactors should be directed towards the interior wall, and where possible, towards the top of the hood.
- The hood should not be used to store chemical products. The work surface should be kept clean and clear.
- The extraction cabinets should always be in good working order. The operator should not detect strong smells coming from material located inside the cabinet. If this is the case, check that the extractor is working correctly.
- A simple way to test the extraction is to lower the guillotine door to 5 cm from the base and place a piece of paper at the exit. The paper should move and even be drawn inside.
- Preventive maintenance of the glass cabinets is necessary to ensure that the speed remains inside the safety margins, and special attention should be paid to the pipes to prevent leaks.
- Each glass cabinet has a main switch which disconnects all the appliances inside the cabinet in the event of risk. All users should be familiar with the location of this switch.

However, please note:

- The cabinets suck in and extract heated or cooled air from the laboratory, implying an expenditure of energy which should be controlled. However, collective protection should prevail over the energy performance of the heating and air conditioning system.
- The cabinets do not guarantee the protection of the operator against micro-organisms and contaminants present in the laboratory. An extraction cabin for chemical agents protects the user from biological agents handled within, but does not protect the samples as the air passing over them is not sterile. Therefore, to combine user and sample protection, class II biological safety cabins should be used.

EXTRACTORS

Every laboratory should have an independent air extraction system, able to renew the air inside within a few minutes. The air should be renewed automatically via an established programme.

GAS SENSORS

There are two specific gas sensors (Laboratory of Chemical Ecology and the Laboratory of Ecophysiology) and there are two types: One detects a lack of oxygen in the air, necessary for respiration, and the other detects the presence of gases such as nitrogen, hydrogen, helium. In the event of a leak, the sensor sends a signal to the reception unit in the corridor which disconnects the gas supply and the stopcock, and issues an acoustic warning through the siren. In this instance, the instructions given in point 9, Emergency procedures in the section, First Aid and Emergency Procedures, should be observed.

EYE-BATH

This system should permit the rapid and efficient decontamination of eyes, and basically consists of two sprays or nozzles able to produce a jet of potable water for washing the eyes or face, a basin with the corresponding drainage system, and a system for fastening it to the floor or wall, together with a foot or elbow pedal. The jet of water provided by the nozzles should be low pressure to prevent damage or unnecessary pain in the eyes. The water should be potable and preferably warm, at 15 to 20°

Recommendations for use:

- If the injured person is wearing contact lenses, these should be removed as soon as possible in order to wash the eyes and eliminate any hazardous chemical substances. However, the lens may become "attached" to the eyeball, and should therefore not be touched as it requires medical attention. Therefore, laboratory personnel are not permitted to wear contact lenses.
- The water should not be applied directly to the eyeball, but to the base of the nose so that the water flows from the nose to the ears; this is a more effective method of washing eyes, removing chemical substances (powerful jets of water may lead particles to go back into the eyes).
- Eyelids should be forced open to ensure the area behind is bathed.
- The eyes and eyelids should be bathed for, at least, 15 minutes, without stopping.
- After bathing the eyes, cover both eyes with clean or sterile gauze.
- Regular maintenance checks of the equipment is required, by the IMS, at least once a month. The laboratory supervisor should establish a protocol of inspections, irrespective of that of the IMS, once a week.
- The eyebaths are located next to the safety showers, there are currently two on the first floor (one in the corridor of the LEM laboratory and the other in the corridor between the LEA, LEQ and LEF laboratories) and two in the basement -1 (one just at the entrance to the refrigeration room and the other at the entrance to preparations).

SAFETY SHOWERS

This is the most usual emergency system in the event of particle projection causing a risk of chemical burns and even if clothing catches fire (in this case, the showers should be used after using the fire blanket). The most important features of a safety shower are listed below.

The shower should provide a flow of water able to thoroughly and instantly soak the worker.

The water should be potable, preferably not cold (between 20° and 35°C) to avoid the risk of cooling a burnt person in shock. The shower should also last long enough to remove all the contaminant.

The open tap should be a quick action tap, the showers in DBS have a triangular lever which should be pulled.

All personnel must be familiar with the location of the nearest safety shower to the rooms they normally occupy. There are currently two on the first floor (one in the corridor of the LEM laboratory and the other in the corridor between the LEA, LEQ and LEF laboratories) and two in the basement -1 (one just at the entrance to the refrigeration room and the other at the entrance to preparations).

The IMS is responsible for the regular maintenance of the showers, at least once a month.

FIRE BLANKETS

These permit efficient action in the event of small fires and especially if clothing catches fire, as an alternative to safety showers. They should never be used to extinguish burning liquids, as the fire will spread rather than be extinguished.

When the blanket is unfolded, hold the blanket as a shield to protect the body if the fire gets too close.

There should be one blanket in each laboratory, next to the first aid kit.

EXTINGUISHERS

If it is not feasible to control small fires in the laboratory with fire blankets or wet cloths, due to their location, features, persistence or size, the extinguishers should be used. The extinguishers contain an extinguishing agent or substance which can be projected towards and directed at the fire due to the action of an internal pressure.

As there are different types of fire, classified according to whether they concern solids, liquids, gases or metals, the appropriate extinguishing agent should be selected for each case: a spray or a jet of water, powder, polyvalent powder, foam or CO₂.

TYPES OF FIRE	EXTINGUISHING AGENTS						
	Jet of water	Spray of water	Physical foam	Dry powder	Polyvalent powder	CO ₂ snow	
A SOLIDS	YES	YES	YES	Yes	YES	Yes	
B LIQUIDS	NO	Yes	YES	YES	YES	Yes	
C GASES	Does NOT extinguish fire Does Limit spread.			Yes	Yes	Yes	
D METALS	NO*	NO*	NO*	NO*	NO*	NO*	
KEY:	YES	Good	Yes	Acceptable	NO	Unacceptable	or hazardous
* REQUIRES SPECIAL AGENTS							

For use in the laboratory, in the event of small fires, the most practical and universal are CO₂ extinguishers, of which one of the benefits is that they create less waste. If they are not adequate, powder extinguishers should be used.

Never point a fire extinguisher directly at a person.

All personnel should be familiar with the location of the extinguishers. There are enough distributed throughout the building and they are clearly marked. Training in the use of extinguishers is of particular importance, as given their weight and the speed at which they can be emptied, an incorrect use may not only be useless but also counterproductive. In the event of doubts as to whether the fire can be controlled, the emergency plan should be activated and the laboratory evacuated.

The following table offers a summary of recommendations relating to the location of the different measures, their control and maintenance.

Table 1: Location, control and maintenance of safety measures.

SAFETY MEASURES	LOCATION	CONTROL AND MAINTENANCE
EYEBATH SHOWER	Point which can be reached in less than 15 seconds from any work position. Towards the usual exit from the room.	Flow of water, quality of water and correct operation of system.
FIRE BLANKET	Laboratory, or unit where work with inflammable products takes place. Close to work bench.	Does not require maintenance.
EXTINGUISHER	See NBE-CPI/96 Laboratory, or unit where work with inflammable products takes place. At the end of work bench and towards the usual exit from the laboratory. Storage of inflammable products.	Annual service and certification every 5 years. Should be included in the general plan for extinguishing fires in the building.
NEUTRALISERS	Central point. Close to work benches. In the product warehouse.	Stock control. Waste Management
<p>A. The laboratory manager should appoint a person responsible for monitoring the maintenance programme. B. Waste produced through spillage, once neutralised, should be collected and disposed of in accordance with the laboratory's general waste management programme.</p>		

The following table shows, by way of example, the risks associated with a series of standard activities carried out in laboratories together with the appropriate safety measures to be considered.

Table 3: Operations, hazards and necessary safety measures.

OPERATIONS	HAZARDS (*)	SAFETY MEASURES
Transfer of liquids.	Splashing / impregnation of clothing, spills.	Shower, eyebath, neutralisers, emergency ventilation.
Operations in a vacuum: evaporation, distillation, filtration, drying.	Flying particles splashing, spills, fire.	Shower, eyebaths, neutralisers, fire blanket, fire extinguisher.
Chemical reactions.	Explosion, flying particles, splashing / impregnation of clothing, spills, fire.	Shower, eyebaths, neutralisers, fire blanket, fire extinguisher, emergency ventilation.
Extractions with liquids.	Splashes, spills, fire.	Shower, eyebaths, neutralisers, fire blanket, fire extinguisher.
Distillation.	Particle projection, splashing, spills, fire.	Shower, eyebaths, neutralisers, fire blanket, fire extinguisher.
Desiccation.	Explosion, fire.	Shower, eyebaths, fire blanket, fire extinguisher.
Cleaning of glass.	Splashing.	Shower, eyebaths.
Transportation of chemical products.	Spills, splashing / impregnation of clothing.	Fire extinguisher, shower, fire blanket.
General use of chemical instrumentation.	Fire, explosion.	Neutralisers, shower
<p>(*) This table, by no means exhaustive, only lists the hazards relating to the specific laboratory techniques and operations, which is where the safety measures are most useful. Non specific hazards have not been considered, such as, for example, electrical hazards or the risk of falls, or those hazards caused by the specific installations in the laboratory.</p>		

3. PERSONAL PROTECTION EQUIPMENT (PPE)

A huge range of operations take place in the laboratory involving a large variety of products of a varied nature. This section lists the personal protection equipment which should be used in order to work in safety, always remembering that it serves to provide protection but does not reduce the risk of the operation itself.

EYE PROTECTION: GLASSES

The purpose of the glasses is to protect the worker's eyes. Eye protection is of extreme importance and suitable safety glasses should be worn at all times inside the laboratory.

Even when not working directly with the substance but only in the vicinity, safety glasses should be used to protect against indirect splashing.

When working with ultraviolet equipment, hoods, lamps, dark rooms, specific glasses designed to protect against ultraviolet rays should be worn (in accordance with standards EN 166 and EN 170).

SKIN PROTECTION

A) GLOVES

Gloves prevent contact with and penetration of toxic, corrosive or irritant substances through the skin. They should always be worn in the laboratory as the hands are the most likely part of the body to come into contact with chemical products.

Safety gloves should be selected by their ability to protect against the chemical products used.

-Nitrile: These gloves offer good resistance to chemical products in general. They are resistant to petrol, kerosene and other petroleum derivatives. However they are not recommended for use when working with ketones, strong oxidizing acids and organic chemical products containing nitrogen.

-Vinyl: These are often used in the chemical industry as they are disposable and cheap, as well as being long-lasting and resistant to cuts. They provide greater chemical resistance than other polymers against diluted inorganic oxidizing agents. They are recommended for protection against ketones, ether and aromatic or chlorinated solvents. Some concentrated acids harden and plastify PVC gloves. They do not offer good protection against infectious material and do not have the tactile sensitivity of latex.

-Latex: provides **minor** protection against irritant substances (some individuals may be allergic to latex).

-Natural rubber: protects against mild corrosive substances and electric shock.

-Neoprene: Provides excellent protection against chemical products, including alcohols, oils and dyes. They offer improved protection against acids and bases and many organic chemical products. They are also flexible and adaptable. They should not be used to protect against oxidizing agents. As for nitrile gloves, they can be used as a substitute for latex, as they protect against bloodborne pathogens and offer greater resistance against pricking.

-Zatex: when handling small very hot objects. This material is a good substitute for asbestos in gloves.

When working with highly corrosive materials, such as hydrofluoric acid, thick gloves should be used; check there are no holes, pricks or scratches in the gloves.

Take extreme care when removing the gloves, pulling from the wrist towards the fingers, turning the glove inside out and ensuring that the outer part does not touch the skin. If the gloves are to be reused, turn them the right way out and fill with air to release the fingers. Never blow air into the gloves by mouth.

Each laboratory has gloves for handling hot materials, stoves and driers, etc; gloves for protecting against splashes when handling liquid nitrogen and gloves to protect against cuts recommended when handling broken glass, on cutting plates, etc.

Normally, when working in the laboratory, gloves should comply, at minimum, with the following standards: EN 374-1-2-3, EN 455-1-2 and EN388.

They should always have the EC marking.

B) LAB COAT

The lab coat should be worn at all times when inside the laboratory but not in other areas. It should be kept in the laboratory. The lab coat not only serves to protect the worker's own clothing but also prevents any contaminating substances which fall on the coat from leaving the laboratory.

The Centre has a laundry service to wash lab coats. The laundrette company collects the coats every other Friday, and the clean coats are returned on the following Friday. Please refer to the technical personnel from the LEM for details of the collection and delivery times.

Each user at the LEM should have 4 lab coats, users of the other laboratories require 2. Lab coats should be washed at least once a month. Correctly identified coats to be washed should be placed inside the basket in the cupboard marked "LEM lab coats", and the attached log book duly completed. If a user is not registered, please refer to the LEM technical personnel. When the lab coats are returned clean, they are hung on hooks next to the doors of LEM laboratory 1, and are left there until the following Wednesday; if they are not collected by the user, they will be requisitioned by LEM technical personnel.

Indicate the protocol for washing lab coats

Indicate the use of disposable lab coats in some laboratories.

Disposable single-use lab coats when working in the LEM sterile laboratory. They should be kept in the laboratory.

C) PROTECTION OF FEET

Foot protection is designed to prevent injuries caused by corrosive substances in the event of spills or splashes, falling of heavy objects, electric shocks and to prevent slipping on wet floors. Shoes which completely cover and protect feet should be worn. The use of sandals or open shoes which leave part of the skin exposed is not allowed. Closed and ergonomic laboratory shoes are available.

PROTECTION OF THE RESPIRATORY SYSTEM

The purpose of this protection equipment is to prevent the contaminant entering the body via the respiratory system; different types are available:

Equipment which depends on the environment and uses the ambient air and purifies it, that is, retaining or transforming the contaminants in the air so that the air becomes breathable. It has two clearly differentiated parts: the face adapter and the filter. The purpose of the face adapter is to create a sealed space around the respiratory system, such that the only access to the tract is via the filter. Different filters are available according to the chemical products used, with different pore sizes depending on the particle size.

The self-filtering mask is a special type of respiratory protection which presents the facial adapter and the filter in a single body. They are not suited to protect against gases or vapours but are more suited for protection against solid particles and aerosols. The filters of the masks have a date of expiry. These usually expire after six months of continued use

Each laboratory should have masks suitable for the work in question and which complies with the relevant specific regulations.

Naturally, the masks are for personal use only and should not be shared.

ACOUSTIC PROTECTION

Hearing protection equipment are components of personal protection, used to reduce the noise perceived by an individual located in a noisy atmosphere. Acoustic protection should be worn when the level of noise is above 85 decibels (dBA).

The use of ear-muffs is recommended when working with ultrasound.

Operations/activities	Risks	PPE to be used
Handling of: <i>a.</i> Solvents and volatile products <i>b.</i> Appliances at high temperatures <i>c.</i> Syringes, glass and capillary columns <i>d.</i> Pressurised bottles <i>e.</i> Hot and cold extractions <i>f.</i> Operations in a vacuum	<i>a.</i> Inhalation of organic vapours <i>b.</i> Irritation of skin and respiratory systems <i>c.</i> Splashes and particle projection <i>d.</i> Burns <i>e.</i> Fire <i>f.</i> Cuts and prick <i>g.</i> Biological contamination	<i>a.</i> Glasses <i>b.</i> Gloves <i>c.</i> Face masks <i>d.</i> Face shields.
Handling of: <i>a.</i> Biological material <i>b.</i> Biological fluids <i>c.</i> Animals used in experiments	<i>a.</i> Cuts and prick <i>b.</i> Scratches and bites <i>c.</i> Inhalation of bioaerosol <i>d.</i> Skin contact	<i>a.</i> Gloves <i>b.</i> Face masks <i>c.</i> Face shields.
Handling products with specific risk	<i>a.</i> Exposure to carcinogenic, mutagenic and toxic products for reproduction <i>b.</i> Exposure to radionuclides <i>c.</i> Exposure to asbestos fibres and others	<i>a.</i> Glasses <i>b.</i> Gloves impermeable to biological fluids <i>c.</i> Gloves resistant to cuts and pricks <i>d.</i> Face masks <i>e.</i> Face shields.
Storage and transfers	<i>a.</i> Fire <i>b.</i> Spills <i>c.</i> Splashing	<i>a.</i> Autonomous or semi-autonomous equipment <i>b.</i> Glasses <i>c.</i> Gloves <i>d.</i> Apron <i>e.</i> Face mask

4.- PROTOCOLS OF ACTION: HANDLING MATERIALS.

Each laboratory has a technician responsible for ensuring that all the material and instruments used comply with current legislation. However, each user should take special care to ensure they are used correctly, following the instructions received from the responsible technician, and reporting any faults which may be detected.

4.1. GLASS

Glass is an essential element in laboratory work as it offers a number of benefits: transparency, easy to handle, ease of design and simple in the preparation of assemblies, thereby permitting, moreover, malleability when heated and the manufacture of made to measure parts. The risks associated with the use of glass in the laboratory include:

- Cuts or injuries:
 - caused by the breaking of glass due to its mechanical and thermal fragility, sudden changes in temperature or internal pressure.
 - as a result of opening sealed ampoules, bottles with ground glass lids, stopcocks, connectors, etc., which have blocked.
 - cooler flasks are often broken when the rubber seals for the water are removed.
- Explosion, implosion and fire due to breaking glass in operations under pressure or in a vacuum.
- Burns as a result of handling hot glass.

Appropriate measures of prevention against these risks include:

- Examining the condition of the parts prior to use and rejecting those with the slightest defect.
- Rejecting material which has been subject to hard knocks, even though there is no sign of cracks or fractures.
- Perform assemblies for the different operations (reflux, distillation, operations in a vacuum, reactions involving addition and shaking, endo- and exo-thermal reactions, etc.) with special care, preventing strain and using suitable supports and clamps and securing all the parts according to the function to be performed.
- Do not heat the glass directly over a flame; insert a material able to spread the heat between the glass and the flame (for example, a metal mesh).
- Insert glass flasks in hot baths gradually and slowly.
- Place a fine layer of high vacuum grease, silicone or Teflon tape between the ground glass surfaces to prevent pieces of glass in an assembly from blocking.
- To unblock the parts, use gloves which provide mechanical resistance and wear face protection. Perform the operation under a hood with a face shield. If the recipient to be handled contains liquid, open it over a container of compatible material. For liquids with a boiling point below the ambient temperature, the recipient should be cooled before performing the operation.
- Do not force glass, to insert stoppers or rubber tubes moisten with water or silicone to help the slide in.
- For refrigeration tubes joined to a piece of glass, when it becomes complicated to remove the rubbers, it is better to cut off a piece of rubber and remove it after separating the cooler from the assembly.
- Hot glass should be left to cool to one side on a plate or similar.
- Broken glass should be placed in the correct container (yellow bin labelled Hazardous waste GLASS). It must never be disposed of in the waste paper bins.

4.1.2.-ELECTRICAL APPLIANCES

The risks associated with the use of electrical instruments include:

- Electrocution due to direct or indirect contact, generated by any appliance with an electrical connection.
- Inflammation or explosion of inflammable vapours due to sparks or heating from the electrical appliance.

There should be an adequate number of power points suitably distributed around the laboratory to avoid the need for provisional installations. High consumption equipment should have specific power lines.

Recommendations for the prevention of these risks include:

- Each laboratory has a mains panel, with circuit breakers. All users in each laboratory must be familiar with the location and the method of disconnection where necessary.
- To avoid accidental electrical shocks, the equipment operating and handling instructions must be strictly observed.
- Avoid the use, where possible, of extension leads and multiple sockets.
- Use specific circuits for special appliances.
- Never handle equipment without it being earthed or with poor connections.
- Regular maintenance, inspections and tests must be carried out.
- Try to avoid the use of transformers as all circuit breakers are cancelled after the transformers.

Before using any appliance, make sure that personnel are familiar with the emergency disconnection procedure, particularly the extraction hoods. Familiarisation with the installation electricity panels, both for the extractor hoods and the main panel, is required in order to be able to disconnect the electricity if necessary.

4.1.3.-VACUUM PUMPS

DBS has a vacuum network and an air compressed network which supply the different laboratories, and the preparation and maintenance laboratory.

The different pumps are located on the roof of the building, and supply the vacuum and compressed air systems of all the laboratories.

Some laboratories also have membrane pumps, mainly used with rotary evaporators and for specific filtrations. These pumps do not have oil and the gaskets should be kept clean. The principal risks are sparks produced when the pump is switched on in the vicinity of inflammable solvents. Furthermore, the evaporated solvents must be correctly condensed before passing through the pump as they may progressively damage the membrane; this is achieved by adjusting the opening of the rubber connection to the pump to obtain a greater or smaller vacuum. As with all types of pump, a gas output leading to the street, to an extraction cabinet or to a cooled condensation trap is required, and this should be checked to ensure it does not block.

4.1.4.-APPLIANCES WITH FLAMES

Work with open flames, for example, using Bunsen burners, lead to a risk of fire and explosion due to the presence of oxidizing or combustible gases, or inflammable products in the vicinity of the burners. To prevent these risks, the following measures are required:

- Suppress the flame or inflammable substance, isolating it, or ensuring adequate ventilation so that it never reaches the lower limits of inflammability.
- Heat inflammable liquids using systems which operate at a temperature lower than the self-igniting temperature (e.g. Bain Marie).
- Use equipment with safety devices to permit the gas supply to be disconnected in the event of faults.
- Adequate maintenance of the gas installation.

4.1.5.-USE OF LIQUID NITROGEN

Liquid nitrogen is at a temperature of $-196\text{ }^{\circ}\text{C}$: the principal risks are of contact burns and asphyxiation due to oxygen displacement. Appropriate personal protection equipment should be used when handling liquid nitrogen.

When used as a coolant in cold baths and vacuum traps, special care is required due to the potential liquefaction of oxygen from the air, which occurs at -183°C . Condensed oxygen in the presence of a minimum quantity of organic material causes very violent explosions.

To avoid these risks, the following precautionary measures are required:

- Ground glass should be well greased to ensure there are no ores through which air may enter, the trap should also be clean.
- First, displace all the air in the system before inserting the Dewar with the liquid nitrogen.
- Similarly, on completion, first remove the Dewar and then break the vacuum by opening the air valve.
- When working with liquid nitrogen, the appropriate PPE should be used, gloves to protect against for the cold, face mask, glasses, etc.

Before emptying the trap, wait until it reaches the air temperature as there may be condensed toxic products.

- The trap is designed for maximum efficiency, preventing solvent from passing to the pump. There are two risks, depending on the nature of the solvent: that the trap is blocked because the solvent condenses too quickly, as then it would condense inside the central tube; or, that the solvent escapes towards the pump before condensing (in this case, drops may be observed on the upper part of the trap towards the pump). Therefore, when large quantities of solvents are evaporated, the trap should be emptied frequently.

4.1.6.-HOT BATHS AND OTHER HEATING DEVICES

The principal risks are thermal burns, the breaking of ordinary glass recipients with the release of vapours, overturning, spills and uncontrolled emission of smoke in oil baths. There is also a significant risk of indirect electric contact due to the ageing of the material. To prevent these risks, the following actions are required:

- Do not fill the bath right up to the edge.
- Stabilise the bath with supports.
- Do not insert ordinary glass recipients in the bath, use Pyrex type glass.
- Use a safety thermostat to limit the temperature.
- Use asbestos-free thermal insulating devices.
- When used continuously, ensure there is a method of localised extraction available.
- Carry out regular preventive maintenance. The older and more used the device, the more frequent the maintenance should be. Check the condition of the electrical connections carefully.
- Observe the maximum temperature to which the bath may be heated. The oil may burn at high temperatures. To heat at more than 150°C , special oils should be used.

4.1.7.-COLD BATHS

On the whole, occasional and minor contact with the coolant does not cause damage as evaporation is instantaneous, however prolonged contact is dangerous.

The principal risks include: release of vapours and cold burns. It should also be remembered that if used to control exothermic reactions, any incident which overrides this function may lead to fire, explosion or the emission of toxic substances to the atmosphere. In addition, evaporation of large quantities of nitrogen in small areas displaces the oxygen and may lead to asphyxiation.

General rules for the prevention of these risks include:

- Do not insert hands in cold bath without protective gloves.
- Use tongs and thermal gloves when handling carbonic snow.

- Insert recipients into the cold bath slowly to avoid sudden boiling of the coolant fluid.
- Ensure adequate ventilation in the zone.

4.1.8.-COOLANTS

Coolants normally use ordinary water circulating through a circuit of pipes, although in some cases the circuit is closed, and the water is cooled in a cold bath.

The most frequent risks when using coolants include: internal breakage with the entrance of water in the reaction media that could cause fire, explosion or the emission of toxic products, the escape of vapours due to disconnection in the water supply and flooding in the event of a disconnected pipe.

Efficient measures to prevent the above risks include the installation of a safety system which disconnects the heat supply if the water supply is disconnected, ensuring that the pipes are securely fastened, and renewing them regularly.

Refluxes should not be left unsupervised and the water flow should be checked regularly. It is also advisable to check the seal of the coil for pores, especially on the receipt of new or repaired material.

4.1.9.-OVENS

There are risks of explosion, fire and intoxication if inflammable vapours are released from the oven, and of overheating in the event of a fault in the thermostat and of indirect electrical contacts. To control these risks:

- Use ovens with a temperature control system. Current legislation requires all ovens to have a double thermostat.
- Carry out adequate maintenance, checking for the absence of leaks due to ageing material and ensure that the earth connection is in good condition.

4.1.10.-GAS BOTTLES AND INSTALLATION

Some laboratories use pressurised gas supplied by a permanent installation. Certain precautions are required together with a protocol for use. Potential leaks and fires must be considered in the laboratory emergency plan.

When using pressurised, dissolved or liquefied gases, the following are characteristic hazardous situations:

- Dropped bottle, broken valve or knocks.
- Intoxication in the event of leak of a toxic, irritant or corrosive gas from a bottle or installation.
- Leak of an explosive gas.
- Leak of an inert gas.
- Fire at the opening of a bottle of inflammable gas.

Controlling the risk:

- Keep the bottles in a fixed stable position by securing them with a chain to a solid support.
- Have a plan of action in the event of leaks or fire at the mouth of the bottle.
- Take precautions suited to the gas being handled.
- If the content of a bottle is not identified, it should be returned to the supplier without using it.
- If there is a risk of recoil from other gases or liquids, it should have a suitable valve or protection device.
- A plan for the maintenance of pipelines and accessories should be designed for each laboratory.
- Before disconnecting a bottle, the valve should be closed and the pressure reduced on the pressure reduction valve.
- If it is difficult to open the valves, ask the supplier for instructions and never use tools to try to open the valve.

- Wherever possible, the cylinders should be stored, duly anchored, in the cages outside.
- The bottle expiry date should always be checked to confirm that the bottle passes the Industry hydraulic inspection tests.
- Never transport a bottle with the gas reduction valve on the bottle.

4.1.11.-CENTRIFUGES

Risks:

- Break of rotor or of pipes.
- Injury in the event of contact with moving parts.
- Explosion due to an inflammable atmosphere.
- Formation of bio aerosols.

Controlling the risk:

- Distribute the load evenly.
- The centrifuge must be fitted with a safety mechanism to prevent it from starting if the cover is incorrectly closed or to prevent it from being opened if the rotor is still moving.
- Define a procedure for action in the event of breakage and/or the formation of bio aerosols.

4.1.12.- ANALYTICAL INSTRUMENTS

The use of analytical instruments requires specialised training. Therefore, prior to the use of any appliance, the user should request instructions on handling from the appliance supervisor.

Gas chromatographer

The gas chromatographer usually operates at high temperatures, sometimes in cycles, and may produce a certain level of environmental contamination when working with non-destructive detectors.

Risks:

- Discomfort due to heat given off by the appliance.
- Thermal burns when working with the detector, column or injector.
- Environmental contamination.
- Pricks when handling syringes.
- Leaking of inflammable gases, especially hydrogen.
- Indirect electrical contact with old appliances.

Controlling the risk:

Establish a suitable air conditioning system to dissipate the heat given off by the appliances.

- Use heat resistant gloves when handling material in hot areas.
- Connect the output of the capillary injector flow divider and the destructive and non-destructive detectors to the exterior.
- Adequate preventive maintenance.

Most of these instructions are also applicable to other equipment which operate at high temperatures.

High performance liquid chromatograph (HPLC)

Risks:

- Spillage and skin contact when preparing the eluent.
- Environmental contamination if volatile eluents are used.

Controlling the risk:

- Handle eluents correctly, wearing gloves if there is a possibility of contact with the skin when transferring the eluent.
- Use glass resistant to the eluent prior treatment, especially when working in a vacuum.
- Use rubber and paraffin corks at the input and output of the eluent to prevent it leaking.

UV-visible spectrophotometer, fluorometer, scales, pH meter, and other electroanalysis, self-analysis, microscopy, agitator equipment, etc.

The main risks associated with these instruments include electrical contact, thermal burns if there are hot zones, the formation of ozone when lamps or radiations are used at certain wavelengths, etc. The procedures for reducing the risks implied by the instrumentation are broadly based on the following:

- Adequate installation.
- Efficient preventive maintenance.
- Standardised instructions for use and work procedures with appropriate safety instructions for each specific technique.

4.2.-BASIC OPERATIONS

Any laboratory operation involving the handling of chemical products will always involve risk. To significantly eliminate or reduce these risks, before starting any operation, the procedure to be followed should be critically read, making sure the correct material is available, and always handling only the minimum quantity of the product. Suitable protective clothing and accessories must be used and there should be a plan of action defined in the event of incident or accident. Face shield must be used when working at high pressures.

A list of standard laboratory operations is given below, with the potential associated risks and the corresponding measures for reducing or eliminating these risks.

4.2.1.-TRANSFER OF LIQUIDS

Liquids may be transferred by pouring freely, using a siphon or a pump. Inflammable substances must be transferred away from sources of heat. Where possible, only pour small quantities at a time and use a specific area for the operation, if possible inside the cabinets.

- In the event of free pouring, there may be a risk of spillage or intoxication by inhalation of vapours. To prevent these risks, we recommend:
 - The use of glasses or face shields when transferring irritant or corrosive products. To transfer acids and bases we recommend the use of PVC (polyvinyl chloride) or polychloroprene gloves. Always check that the gloves are impermeable to the liquid being transferred.
 - Re-cork flasks after use.
 - Use a pump or siphon to transfer large volumes of liquid and funnels for small volumes.
- When siphoning or pumping liquids, there is a risk of explosion due to overpressure, the pumps should have safety devices to prevent this. It is also necessary to check that the pump

is compatible with the product to be transferred: Compatibility of materials, rust, contamination, risk of explosion, etc.

- When transferring significant quantities of non-conducting fluids, always assess the risk of static electricity.
- Wear suitable protective clothing to protect against the risks from the product when transferring chemical substances.

4.2.2.-WORKING WITH VACUUMS

Operations involving the use of vacuums include evaporation, distillation, filtration and drying (in desiccators). These operations involve the risk of implosion of the appliance and the projection of material, the intake of a liquid and the unforeseen combination of products which react violently together.

To control these risks, we recommend the following:

- Use special glass recipients able to withstand vacuums (thick walls, spherical in shape) and place the apparatus in an area where there is no risk of mechanical shock.
- Cover the recipient containing the vacuum with adhesive tape or a metal or plastic mesh.
- Go from vacuum to atmospheric pressure gradually and slowly.
- Remember that when using a water jet pump for the vacuum and the water tap is closed slowly, water may run back to the recipient where the vacuum is, if this recipient contains any products able to react with the water, the reaction may be violent. To avoid this, first close the tap which must be between the appliance under a vacuum and the water jet pump. A safety recipient can also be placed between the two.

Evaporation in a vacuum

This normally takes place in rotary evaporators which permit the heating and agitation by rotation of the sample in the vacuum. The following precautions should be considered:

- The flasks should not be overfilled and the mixture treated by evaporation should not be overheated. If there is a possibility of the formation of unstable products (e.g. peroxides) the mixture should not be dried.
- Wait until the flask containing the mixture has cooled before removing the vacuum. To cool gradually, remove the sample from the bath, while still agitating.
- To prevent the eliminated vapours from damaging the vacuum pump, a cooled trap may be used.
- Toxic substances (benzene, untreated alkylating agents...) or pestilents (thiols, amines...) should not be evaporated in the rotary evaporators outside the extraction hoods.

Distillation in a vacuum

When distilling in a vacuum, the boiling of the liquid should be controlled using a capillary tube which makes air or inert gas to bubble, according to the requirements for the absence of oxygen or humidity. The capillary should be checked for blockage due to the start of crystallisation during the operation, for example. If a narrow coolant passage is used, this should also be checked for blockages.

Do not start heating until the vacuum has stabilised, to prevent spontaneous boiling, with the consequent risk of a loss of product and general contamination of the system.

On completion of the distillation process, the system should be cooled before removing the vacuum, as the introduction of the air in a hot globe could lead to fire or explosion of the waste obtained during distillation. Change from vacuum to normal pressure gradually, using the capillary pipe used to control the vacuum.

Filtration in a vacuum

Flasks used for filtration in a vacuum should be made of high quality glass, be in excellent condition and should be securely fastened to prevent strain. If the filtration is defective due to the characteristics of the products handled, an increase in the vacuum may not improve either the filtering performance or time; to the contrary, it may increase the risk of implosion. The application of other measures should be considered such as the use of pressure or filtering in small quantities in order to prevent the blocking of the filter or paper filter. In the latter, always be prepared for potential breaks.

Drying in a vacuum

Desiccators should be placed in areas where they are not likely to be knocked or dropped, away from sunlight, especially when they contain unstable products. When they are in a vacuum they must never be transported. When a desiccator is used in a vacuum, it should be protected with metal mesh or with a material of proven resistance. The contact edges and keys should be suitably oiled. A flask or safety bubble device should be placed between the desiccator and the water jet pump to prevent the return of water which may affect the products in the desiccators and could react violently with the dehydratants inside.

4.2.3.-MIXING OR ADDING PRODUCTS, HAZARDOUS REACTIONS

There may be an unexpected reaction accompanied by a hazardous phenomenon (explosion, projection).

To control this risk, a protocol for action should be defined together with information on the identity and level of danger of the products handled. Furthermore, when adding a reactive, the speed of addition should be in accordance with the reaction produced. It should be particularly slow if the reaction is exothermic, produces foam, or there may be a rapid polymerization, etc.

Generally, all exothermic reactions are classified as hazardous as they may be uncontrollable in certain conditions and lead to spills, the sudden emission of vapours or toxic or inflammable gases, or cause the explosion of the recipient.

To control these risks when working at temperatures at which these substances react immediately, the reaction should be controlled by adding the reagents in small quantities. A thermostat should also be used to control the temperature and prevent the required temperature from being exceeded. If the reaction is highly dangerous, significant quantities of the product are used or very close control of the temperature is required, the thermostats are placed using a cascade connection to reinforce safety. In all cases, a protocol of action should be defined for use in the event of the loss of control of the reaction.

Other types of reactions considered hazardous include:

- Compounds products which react violently with water.
- Compounds which react violently with air or oxygen (spontaneous inflammation)
- High affinity incompatible substances.
- Hazardous reaction of acids.
- Formation of peroxides and easily peroxidable substances
- Polymerisation reactions.
- Decomposition reactions.

Generally, when hazardous reactions are carried out, all laboratory personnel should be notified, the necessary protection equipment used together with protective screens and fire extinguishers or other incident containment devices should be kept to hand.

4.2.4.-DISTILLATION

Distillation is a standard laboratory practice. It may involve the following risks:

- Breakage of recipient and inflammation.
- Stopping of cooling caused by emission of vapours and generation of an inflammable atmosphere.
- Irregular boiling with possible release of vapours, projections and splashes.

The measures to control this risk include:

- The distillation apparatus or assembly must be adapted to the quantities and nature of the products to be distilled.
- If the product to be distilled may contain sub products from decomposition of a hazardous or unknown nature, distillation should be performed with great care (in cabinet, with screen, personal protection, intervention material, etc.) and in small quantities, which can be gradually increased if no abnormalities are observed.
- Heater blankets or baths (oil, sand) placed above mobile systems (elevators) should be used for heating to permit the rapid disconnection of heat if necessary.
- The flow of water in the coolants should be controlled. To avoid the risk of a lack of water, a closed cooling system may be used or fit safety devices which disconnect the electricity supply in the event of a reduced flow of water.
- Always examine the material and the seal of the distillation assembly, especially in the case of inflammable liquids, before each operation in order to avoid possible failure or leaks.
- Control the boiling by inserting pieces of porous porcelain or glass in the liquid to be distilled or magnetic agitator prior to heating.
- Where possible work in the glass cabinets.
- Use personal protection equipment (gloves, safety glasses and other elements required according to the situation).
- Use devices to control the temperature, heat and cooling systems.
- Carefully observe the self-inflammation temperatures of the substances present in the distillation mix.
- The application of vacuum, which may bring additional problems, has been dealt with in the section regarding operations in a vacuum.

4.2.6.-EVAPORATION -DRYING

Evaporation and drying, when using solvents, involve the risk of the release of toxic or inflammable vapours. To prevent this, the following measures are recommended:

- Perform the operation inside a cabinet or use a rotary evaporator.
- If an oven must be used to provide heat, it should be well-ventilated, with a vapour intake system; always work at moderate temperatures, making sure that no point inside or outside the oven may exceed the point of self-inflammation.
- Evaporation of product soaked in a volatile liquid may be carried out cold.
- Evaporation and drying in a vacuum have been dealt with in the section concerning operations in a vacuum.

4.2.7.- TRANSPORT OF RECIPIENTS WITH CHEMICAL PRODUCTS

When transporting chemical products, there is a risk of the recipient breaking with the resultant contamination, intoxication and risk of explosion. To control these risks, we recommend the following:

- Transport glass recipients in special containers such as plastic baskets.
- Use a trolley if carrying more than one container.

4.3.- CLEANING GLASS

In order to minimise the risk of contact with or inhalation of hazardous substances, all recipients should be thoroughly drained before preparation for washing. The most frequently used substances when cleaning material which involve risk include:

Hydrogen peroxide (H₂O₂) in acid pH

Cleans and does not produce waste. It is self-destructing and is not toxic, but it is corrosive and may be explosive in contact with certain substances. The mixing process is highly exothermic and therefore preparation is an extremely delicate operation

Chromium compounds

Mixture of sulphuric acid (mainly) and chromium trioxide or potassium dichromate. This preparation is toxic, oxidizing, corrosive and hazardous for the environment. It is highly efficient in destroying organic matter but should not be used except in cases where there is not other alternative, always using the minimum concentration required. It should be noted that potassium dichromate is classified as a carcinogenic compound, category 2. The classification of the chromium compounds is: Toxic product hazardous to the environment. It may cause cancer if inhaled or hereditary genetic alterations. It causes severe burns and may cause skin sensitisation. It is highly toxic for aquatic organisms and may have long-term negative impacts on the aquatic environment.

It should be replaced by potassium permanganate, for example, which is classified as harmful if swallowed and oxidizing (risk of fire with combustible materials).

Methanol

This alcohol is toxic if inhaled or swallowed and is easily flammable. In the short-term it has a narcotic effect, typical of all alcohols. In the long term, it may cause problems to sight and could lead to total blindness. When rinsing and drying glass, it may be replaced by isopropyl alcohol which is less toxic.

Another frequently used and less dangerous compound is alcoholic potash, contained in isopropyl alcohol.

In some laboratories, recently washed material is rinsed with acetone to remove the water from the surface and speed up the drying process and with ether to eliminate the traces of acetone, these solvents should be collected and disposed of as waste.

4.4.- WASTE MANAGEMENT

To ensure the correct treatment of the waste, the regulations guaranteeing the safety of personnel and delivery of the waste to the authorised manager in optimum conditions for its final treatment must be observed.

Some general instructions are given below for handling waste:

- Always avoid direct contact with waste, using personal protection equipment suited to the level of risk supposed by the product. This is particularly important in the case of gloves and

protective respiratory equipment as there is no one piece of equipment which protects against all the products.

- All waste should be considered hazardous, assuming maximum levels of protection are required if the properties and characteristics of the product are unknown.
- For liquid waste, do not use containers with a volume of more than 25 litres in order to make handling easier and to avoid unnecessary risk.
- 25-litre containers should always be carried by fork lift truck to prevent the risk of breakage and spillage.
- Pour waste into the corresponding containers slowly and carefully. To transfer large quantities of liquid, use a pump, preferably hand-operated.
- When the transfer is complete, close the container until the next time it is used. This helps to reduce the risk of exposure of personnel to the products involved.
- Containers should not be filled to more than 90% of their capacity in order to prevent the risk of splashing, spillage and excess pressure.
- Whenever possible containers should be placed in the ground to prevent the risk of their falling to another level.
- Inside the laboratory, containers in use must not be left in passage ways or places where they may cause accidents. They must always be closed to prevent evaporation of the contents.

The waste management procedure at DBS is explained in more detail in the ATTACHMENT.

FIRST AID AND EMERGENCY PROCEDURES

The first aid and emergency procedures for action may save lives. Anyone involved in an accident should be reported to the laboratory / installation /activity manager and to the prevention officer as fast as possible.

1.-ACCIDENTS

All necessary information for action in the event of an accident should be clearly visible in the laboratory / installation: what to do, who to notify, phone numbers, interiors and exterior (emergency, prevention service, maintenance, main office, fire brigade, insurance, laboratory manager), addresses and other information which may be of use in the event of an accident, especially concerning procedures for action.

When contacting the emergency services (telephone number **112**), the following information must be supplied:

- Place of accident.
- Type of accident (intoxication, thermal or chemical burn, injury, etc.).
- Number of victims.
- Apparent condition of victims (conscious, bleeding, breathing, etc.).
- Do not hang up the phone until the speaker authorises you to do so, as they may need other complementary information.
- Have a person available to meet and accompany the emergency services to the place of accident as fast as possible.

First Aid Kit

- There are first aid kits in the DBS laboratories and vehicles. These contain a series of specially selected articles for administering emergency treatment in the event of knocks, cuts, burns, eye injuries or immediate sickness.
- The first aid kit should be regularly checked by users and any used or out-of-date articles replaced immediately. For this, the prevention officer should be contacted.
- A more fully equipped first aid kit is available at the main office.
- Oral medication from the first aid kit should never be administered in the event of accident.

2.- FIRE

The risk of fire must be defined in the emergency plan. A significant section of the general safety instructions in this manual are given to the prevention of and protection against fire.

In the event of fire, however small, personnel should be evacuated, in accordance with the emergency plan, through the main exit or through the emergency exit if necessary. Notify all colleagues without spreading panic, and remain calm at all times.

Small fires: If the fire is small and localised, it may be extinguished using the appropriate fire extinguisher, covering it with a suitably sized container to snuff out the fire or with sand or earth if outside. Remove any inflammable products in the vicinity. Never use water to extinguish a fire caused by the inflammation of a solvent. Likewise, fire blankets, located next to the first aid kits, must not be used for burning liquids, they are only suitable for use with solids.

The CO₂ extinguisher should be used in preference to the powder extinguisher as it creates less waste. It is usually adequate for small fires.

Large fires: If the fire cannot be rapidly controlled with extinguishers, raise the fire alarm, evacuate the building and notify the fire brigade. The priority is to isolate the fire. When the laboratory / installation has been evacuated, close all the doors, unless otherwise instructed by the emergency teams.

Fire on body: If a person's clothing catches fire, immediately call for help, throw them to the ground and roll them to put out the flames. It is best not to run or try to reach a shower unless it is very close to hand.

If someone is on fire, it is our duty to help them. Cover them with a fire blanket and lead them to a safety shower. Never use a fire extinguisher on a person. Once the fire has been put out, the injured person should be kept lying down, and prevented from getting cold. Never try to remove pieces of clothing attached to their skin. Seek medical assistance.

3.- ELECTROCUTION

Electrocution or electric shock occurs when a direct or indirect electrical contact occurs, a person forms part of an electrical circuit, a certain current passes through their body for a period of time. The intensity of the shock depends on the voltage and the body's resistance, which in turn, depends on the path followed and certain physiological factors. Proceed as follows if someone is receiving an electric shock:

- Disconnect the electrical supply of the appliance causing the accident before approaching the victim to prevent another accident, and move the victim. Each laboratory is disconnected via a circuit breaker switch and the offices are disconnected via the mains control panel.
- Seek help and, perform, if necessary, cardio-respiratory reanimation.
- Do not offer food, drink or any products to reactivate respiration.

4.- INJURY (minor cuts, haemorrhages and burns)

a) Minor cuts:

- Wash with soap and water for at least 5 minutes. If in the country, use saline solution to wash the wound.
- Observe and remove all fragments of glass, using a gauze and tweezers.
- Disinfect the injury, for example, with Betadine.
- When it stops bleeding, cover the wound with clean gauze. Hydrogen peroxide may be used to stop minor haemorrhages. If the wound does not stop bleeding, seek medical assistance immediately. Do not remove the bloodied dressing, but place another on top and keep pressing.

b) Major haemorrhaging:

- Call the doctor immediately.
- Keep the injured person calm.
- Lay them down to reduce the risk of fainting.
- DO NOT REMOVE ANY INCRUSTED OBJECTS.
- Apply pressure directly to the injury with a sterile bandage or clean gauze. Do not remove the bloodied dressing, but apply another dressing on top and keep pressing
- If this does not control the haemorrhage, raise the injury, where possible, above the level of the heart.
- In the event of significant haemorrhaging, raise the injured person's legs and cover with a blanket.
- Apply a tourniquet only as a last resort and only to prevent irreversible damage. It should only be applied by a suitably qualified and experienced person.

c) Thermal burns:

Minor first degree burns caused by hot material, baths, plates or blankets, are treated by washing the affected area with cold water for at least 10 minutes. A lotion may be applied to relieve the pain (the most effective is FURACIN) and the burn covered with gauze or dressing for burns.

More severe burns require immediate medical attention. Only cover the burn with a sterile dressing or clean gauze to isolate it from the air and NEVER APPLY ANY LOTIONS. SPRAYS OR CREAMS.

5.- CHEMICAL PRODUCTS ON SKIN OR IN EYES:

- Wash for at least 15 minutes. When the affected area of the body is large, use the safety showers or service showers, and remove the contaminated clothing as fast as possible. Speed is essential for reducing the severity and spread of the wound.
- Do not apply any burn creams or lotions.
- If the affected area is large, call the doctor immediately.

Acid burns: After washing, they can be neutralised with sodium bicarbonate for 15-20 minutes, remove the excess paste and cover with lime liniment or similar.

Alkaline burns: After washing, rinse with a saturated solution of boric acid or a 1% acetic solution, dry and cover with a tannic acid lotion.

- Splashes in eyes:
 - o Quickly rinse eyes and eyelids with plenty of water for at least 15 minute in the eye bath. Eyelids should be forced open to ensure the interior of the eye is bathed. Never rub eyes.
 - o Medical assistance should be sought however slight and insignificant the injury appears to be.

6.-DIGESTIVE INTOXICATION

- This should be treated according to the toxic product swallowed, information about which is available on the label and safety data sheets. Call the toxicological information service.
- Rapid medical assistance is essential; this normally implies moving the victim who should be transferred in appropriate conditions.
- Do not provoke vomiting unless expressly indicated in which case the victim should be given a glass of warm water containing bicarbonate or salt to drink. Never in the event of a corrosive or volatile product.
- Do not give the victim alcoholic products to drink, this will increase the absorption of the toxic substances.
- To prevent the absorption of the toxic substance, use active carbon or albuminous water. A list of antidotes recommended by the EU is available (Annex 111 of Resolution 90/C 329/03). In the event of minor intake of acids, drink a bicarbonate solution, while acid drinks (cola-based soft drinks) are recommended in the case of alkalis.
- If the person is conscious and able to swallow, give them water or milk
- If they feel nauseous, do not continue to administer liquids
- If the person is unconscious, place their head, or whole body, on the left side; do not allow them to choke on their tongue. Be ready to start cardio-respiratory massage.
- Never the leave the intoxicated person alone, cover them with a blanket to keep them warm.
- Take the product label to the doctor.

7.- INHALATION OF CHEMICAL PRODUCTS

- Ventilate the area and transfer the intoxicated person to the open air
- Call the Doctor

- If the intoxicated person is breathing, cover them to prevent them from getting cold:
- Lay the intoxicated person on their back.
- Place one hand below their neck and lift them up.
- With the palm of the other hand on their forehead, turn their head or tilt it as far back as possible.
- If more air is required, open the lower jaw.
- At the first sign of respiratory problem, start mouth-to-mouth artificial respiration, while waiting for the medical service to arrive. Oxygen should only be administered by trained personnel.
- Try to identify the toxic vapour.

8.- SPILLS

In the event of spills or overflow, rapid action is required, immediately clearing up the spilled product to prevent evaporation and damage to the installations. The procedure to be used will depend upon the nature of the product: inflammable, acid, alkali, mercury, etc., and commercial absorbent or neutralising products are currently available.

Each laboratory should have a container with universal absorbent, together with others for use specifically with acids and bases. All users of the laboratory should be familiar with the location of these absorbents and their method of use, being particularly aware when performing operations entailing a risk of spillage of this type of substance.

The use of personal protection equipment will depend on the characteristics of the level of danger of the spilled product (please refer to the safety data sheet). Generally the use of gloves, an apron impermeable to the product, and safety glasses should be worn.

Mercury spills should be given special attention. They should be cleared up as much as possible using an aspiration pump and joints covered with sulphur to allow the gradual formation of cinnabar.

9.- CONTAMINATED ATMOSPHERE

The Atmosphere in a laboratory may be toxic or explosive after an accident/incident: broken flask, spilled reagent, gas leak, etc. The measures to control the risk are as follows:

If the contamination is slight:

- Open all the windows.
- Start the cabinets with all the shields and general extractors fully open.

If the contamination is severe:

- Switch on the emergency system.
- Evacuate personnel from the premises.
- Notify the fire brigade.
- Close all appliances with flames if the contaminating product is volatile or inflammable.
- Open all the windows.
- If the source of the contamination is due to a spillage, mop up the spillage with the corresponding absorbent material and place in a sealed recipient, washing and rinsing it with plenty of running water. Gloves should be worn at all times. If the corresponding absorbent material is not available, use absorbent paper.
- Do not allow personnel to enter the premises until the environmental concentration of the hazardous substance in the atmosphere no longer poses a risk.
- Hyperventilate the premises for a long period of time.

If personnel are affected, the grounds should be decontaminated before you approach the individual to prevent you from becoming intoxicated also and unable to administer help.

10.- GAS LEAKS

Regular inspection of the connections of the gas installations is the most efficient method for preventing leaks which could be the cause of an emergency situation. Procedure in the event of gas leaks: As a general rule, if the gas is a toxic gas, the area should be evacuated and not re-entered until the atmosphere has been purified.

GAS LEAK FROM A BOTTLE:

1. Approach the bottle with the wind blowing on the same direction.
2. Check that the gas has not lit up.
3. Close the valve if possible.
4. Notify the fire brigade, unless the gas is an inert gas or oxygen.
5. Mark the area with the corresponding hazard warning sign and prevent unnecessary access to the area.
6. Control the bottle continuously until it is completely empty.
7. Notify the supplier.

GAS LEAK IN A PERMANENT INSTALLATION:

1. Close the valves connected to the installation.
2. Report the incident to the supervisor.
3. Decide on the most appropriate emergency measures: evacuation, notify the fire brigade, isolation of area, etc.
4. Clean the installation with an inert gas before proceeding with the repair.
5. Ensure the installation is depressurised before repairing.
6. Check that the leak has been repaired with an inert gas and correctly clean and purify before starting the installation.

FLAME AT THE MOUTH OF A BOTTLE OF INFLAMMABLE GAS

1. Close the valve if possible.
2. If this is not possible, the correct procedure will depend upon the location of the bottle:
 - if it is in a building correctly designed to contain gas bottles, the flame can be extinguished with a fire extinguisher, the zone is marked as hazardous and the valve is left to cool before closing it.
 - if the bottle is in the laboratory, assess whether the hazard resulting from the leaking of inflammable gases after the flame has been extinguished could be greater than the flame itself. If you decide not to extinguish the flame, make sure that the fire does not spread.

Notify the fire brigade, the prevention service and the gas supplier. In the case of hydrogen gas, this must be left to burn as the flame cannot be extinguished with any type of extinguisher. Make sure that there are no inflammable objects in the vicinity.

11. VEHICLES

All official vehicles are equipped with a fire extinguisher and first aid kit containing the same components as those kits kept in the institute. The prevention officers should provide and inspect the contents of the kits, but the vehicles users are responsible for notifying the officers of any abnormalities (medication about to expire, finished, etc.) detected prior to the due date of inspection.

In the event of accident, proceed as described for each case above, and in the section Field Work.

Each individual should carry the card shown below, giving details of how to proceed in the event of accident away from the institute. This card is provided by the prevention officer.



FREMAP
Mutua de Accidentes de Trabajo y Enfermedades
Profesionales de la Seguridad Social Número 61

ASISTENCIA 24h

900 61 00 61

EN CUALQUIER LUGAR DEL MUNDO +34 91 581 18 09
SEVILLA 954249100

TAMBIEN MEDIANTE SMS

**ENVIE FREMAP + MENSAJE
AL 5857**

PROCEDURE IN THE EVENT OF ACCIDENT

IN THE EVENT OF **SEVERE**

ACCIDENT

1.- Go to the nearest hospital or

FREMAP

2.- Call:

DBS 954 232340 - 24 h

Fernando Hiraldo (XXXXXX) 24h

Juan José Negro (XXXXXX)

Alicia Prieto (XXXXXXX)

Isabel M García

Raúl Sojo (XXXXXX)

DBS 959 430579 - 24h

Juan Calderón (XXXXXX) 24h

Rafael Martín Guitart (XXXXXX)

Fernando Ibáñez (XXXXXX)

Ignacio Boixo (XXXXX)

IN THE EVENT OF **MINOR** ACCIDENT

1º.- Contact: DBS / DBN

2.- Go to FREMAP:

Seville (24h, Avda. de Jerez s/n, Tel 954249100)

Huelva (M-F 8.00-20.00 h, Plaza de

América 1,

Tel 959226200)

Clínica Los Naranjos (Night / holidays Pº

los Naranjos 1,

Tel 959243078)

Ubeda (M-F 8.00-20.00 h, C/ Aznaitín s/n,

Tel 953758350)

EMERGENCIAS 112

APPENDIX 1

DBS WASTE MANAGEMENT

The laboratory of molecular ecology handles the waste from the following departments at Doñana Biological Station, and has appointed a service manager for this purpose:

- Laboratory of molecular ecology
- Laboratory of physiology
- Laboratory of chemical ecology
- Laboratory of aquatic ecology
- Collections
- Field personnel

Management of this waste is carried out according to the following:

- 1- CLASSIFICATION OF THE WASTE
- 2- CORRESPONDING CONTAINERS
- 3- LABELLING
- 4- STORAGE
- 5- USER ACTION
- 6- RESPONSIBLE PERSON ACTION
- 7- DETAILS OF WASTE MANAGEMENT FIRM

1- CLASSIFICATION OF THE WASTE

The following groups for waste classification are established based on the activities carried out in the different departments and considering the physical and chemical properties of the waste, the possible reactions of incompatibility in the event of combination and the end treatment:

LIQUID WASTE:

1. NON HALOGENATED SOLVENTS: Inflammable organic liquids containing less than 2% of halogens. These are inflammable and toxic.
 - Ethanol, formol,
 - Acetone, nitrile acetate, methanol
2. HALOGENATED SOLVENTS: Organic liquids with a halogen content of more than 2%.
 - Phenol, chloroform, isoamilic acid
3. LIQUID AQUEOUS WASTE CONTAINING HAZARDOUS SUBSTANCES
 - TBE, EDTA, TRIS-HCl, DMSO, NaOH...

SOLID WASTE:

1. INFECTIOUS WASTE
 - a. PLASTIC CONTAMINATED WITH ORGANIC WASTE
-Micro-pipette tips, Petri dishes...
 - b. SHARP OR POINTED OBJECTS
-Syringes, needles, lances, scalpel blades, small pieces of broken glass
2. CONTAINERS WITH TRACES OF HAZARDOUS SUBSTANCES
 - a. CONTAMINATED GLASS
Glass contaminated with traces of chemical products: Bottles which contained chemical products, broken laboratory material, etc.
 - b. CONTAMINATED PLASTIC
Plastic contaminated with traces of chemical products
Micro-pipette tips, PCR dishes, Eppendorf tubes, agarose gels...
3. SOLVENTS WITH ANATOMIC WASTE
- Animal waste in formol.

2- CORRESPONDING CONTAINERS

Different types of container are used for the packing and corresponding classification of the waste depending upon the type of waste and the quantity produced. The containers are certified for the transportation of hazardous goods, and are supplied by the waste disposal management company. The following types of containers are used:

Liquid waste:

- 25-litre containers are used for any liquid waste.

Solid waste:

- Disposable 60-litre containers for infectious waste.
- 60-litre containers suitable for incineration.
- Disposable 60-litre containers with arlite for chemical products from the laboratory. This container is used in the event of spillage of a chemical product.
- Special containers for sharp or pointed objects.

3- LABELLING

All containers of hazardous waste should be labelled accordingly. This label should show THE CONTENT, THE ASSOCIATED RISK, THE PRODUCER'S IDENTIFICATION AND THE INTERNAL NUMBERING OF THE CONTAINER.

The labelling corresponds to an internal model similar to the following, printed on bright paper:

 Laboratory of Molecular Ecology Doñana Biological Station Higher Council of Scientific Research		HAZARDOUS WASTE
Type of waste	Infectious waste	
Code:	Q16//D09//S01//C35//H05//H09//A861(1)B0019	
Holder Doñana Biological Station Avda. Maria Luisa s/n Pabellón de Peru Seville	16/10/2006	Handled by:
		Container No: 07/056

4- STORAGE

The full containers and bins are stored until removal by the waste disposal company in the store designed for this purpose. This store should be suitably isolated, ventilated and clearly marked. Ensure that access to the store is NEVER blocked. In addition, access is restricted to the personnel responsible for the waste. No unauthorised personnel may enter the store.

5- USER ACTION

The users of all the laboratories must dispose of the waste generated in the correct containers or bins. These containers are placed at different points in the laboratories. In addition, the laboratory supervisor should be notified when a container is full so that it may be removed to the waste store and replaced by a new container. The laboratory personnel must never remove the containers themselves. In the event of accidental spillage of a product, the waste disposal personnel should be notified immediately so that the container can be correctly removed.

The use of new products should also be notified to permit the product to be correctly listed in the established classification or to generate a new classification is applicable.

Laboratories external to the laboratory of molecular ecology should appoint a service manager for their laboratory. The responsible laboratory is responsible for providing advice, delivering, labelling and removing the waste containers, but is not responsible for the content.

As the containers for sharp waste (yellow container) are used throughout the premises and there is no appointed manager, they should be clearly labelled indicating the type of material contained inside and the name of the person responsible for each specific container. This label should be attached to the container prior to delivery to the person responsible for the waste disposal in the laboratory. These labels are supplied by the responsible laboratory.

6- ACTION OF THE PERSONNEL RESPONSIBLE in the laboratory of molecular ecology

The personnel responsible for the waste should differentiate between the management of laboratory waste and that for personnel not connected to the laboratory. The management of the laboratory waste involves the removal and renewal of the containers in each laboratory. Check that the users use the containers and dispose of the waste correctly. The supervisor should also advise on the classification of laboratory waste to prevent the risk of incompatibility and unforeseen reactions.

The management for personnel not related to the laboratory of molecular ecology involves the supply of suitable containers, duly labelled, with the corresponding certificates, and the removal of the containers to the store.

With respect to waste disposal, a database of the containers is created with the following information:

- Date on which container is opened
- Date on which container is closed
- Type of waste
- Risks and appropriate symbols
- Date on which container is delivered to supervisor

With respect to the waste disposal management company, the responsible personnel will serve as a contact to recover information regarding the waste and its management and to request the collection of the containers as necessary, completing the relevant documentation in accordance with current legislation.

When the delivery has been completed, the responsible personnel submit the documents supplied by the waste management company to the Waste Management Department of the Council for the Environment.

7- DETAILS OF WASTE MANAGEMENT FIRM

The company responsible for waste disposal management is:
CESPA located in Avda. Constitución, 22- edificio Arrayanes, local, 6
18012- Granada
Telephone number: +34 958200356, fax: +34 958270615

APPENDIX 2

Classification of chemical substances according to the level of danger due to their physical and chemical, toxicological properties, and impact on the environment.

	Category	Definitions	Symbol	Indication of danger	Symbol
Physical and chemical properties	Explosives	Solid, liquid, paste or gelatinous substances and preparations which, in the absence of oxygen, may react exothermically with the rapid formation of gas or, in specific test conditions, may deflagrate or, which after being heated up, in partially contained conditions, may explode	E	Explosive	
	Oxidizers	Substances and preparations which, on contact with inflammable or combustible substances or preparations, react exothermically	O	Oxidizing	
	Highly flammable	Liquids with an extremely low flash point and a low boiling point. Gaseous substances and preparations which ignite when they come into contact with the air, at ambient temperature and pressure.	F+	Highly flammable	
	Easily flammable	Substances and preparations which, <ul style="list-style-type: none"> • on contact with air, at ambient temperature and without the contribution of energy, may increase in temperature and ignite • when in their solid state and exposed to a source of ignition, easily catch fire and continue to burn even after the source has been removed • which have an extremely low flash point • when in contact with water or wet air, develop highly inflammable gases in dangerous amounts, 	F	Easily flammable	
	Flammable	Liquid substances and preparations with low flash point	-	-	
Toxicological properties	Highly toxic	Substances or preparations which, in the event of inhalation and/or ingestion and/or contact with the skin, even in very small amounts, cause immediate (acute) or	T+	Highly toxic	

		long term (chronic) effects which can be lethal.			
	Toxic	Substances or preparations which, in small quantities, in the event of inhalation and/or ingestion and/or contact with the skin cause immediate (acute) or long term (chronic) effects which may be lethal.	T	Toxic	
	Harmful	Substances or preparations which, in the event of inhalation and/or ingestion and/or contact with the skin cause immediate (acute) or long term (chronic) effects which may be lethal.	Xn	Harmful	
	Corrosive	Substances and preparations which, in contact with living tissue, may cause a destructive action.	C	Corrosive	
	Irritant	Substances and preparations which, despite not being corrosive, may cause an inflammatory reaction of living tissue (skin, mucous membranes, eyes) after prolonged or short-term yet repeated contact	Xi	Irritant	

APPENDIX 3

R PHRASES

These specify the nature of the specific risks attributed to the substances and hazardous preparations.

- R1 Explosive when dry.
- R2 Risk of explosion due by shock, friction, fire or other sources of ignition.
- R3 Extreme risk of explosion by shock, friction, fire or other sources of ignition.
- R4 Forms very sensitive explosive metallic compounds.
- R5 Heating may cause an explosion.
- R6 Explosive with or without contact with air.
- R7 May cause fire.
- R8 Contact with combustible material may cause fire.
- R9 Explosive when mixed with combustible material.
- R10 Flammable.
- R11 Highly inflammable.
- R12 Extremely flammable.
- R14 Reacts violently with water.
- R15 Contact with water liberates highly flammable gases.
- R16 Explosive when mixed with oxidising substances.
- R17 Spontaneously flammable in air.
- R18 In use, may form flammable/explosive air-vapour mixture.
- R19 May form explosive peroxides.
- R20 Harmful by inhalation.
- R21 Harmful in contact with skin.
- R22 Harmful if swallowed.
- R23 Toxic by inhalation.
- R24 Toxic in contact with skin.
- R25 Toxic if swallowed.
- R26 Very toxic by inhalation.
- R27 Very toxic in contact with skin.
- R28 Very toxic if swallowed.
- R29 Contact with water liberates toxic gases.
- R30 Can become highly flammable in use.
- R31 Contact with acids liberates toxic gas.
- R32 Contact with acids liberates very toxic gases.
- R33 Danger of cumulative effects.
- R34 Causes burns.

- R35 Causes severe burns.
- R36 Irritating to eyes.
- R37 Irritating to respiratory system.
- R38 Irritating to skin.
- R39 Danger of very serious irreversible effects.
- R40 Limited evidence of carcinogenic effect
- R41 Risk of serious damage to eyes.
- R42 May cause sensitization by inhalation.
- R43 May cause sensitization by skin contact.
- R44 Risk of explosion if heated under confinement.
- R45 May cause cancer.
- R46 May cause heritable genetic damage.
- R48 Danger of serious damage to health by prolonged exposure.
- R49 May cause cancer by inhalation.
- R50 Very toxic to aquatic organisms.
- R51 Toxic to aquatic organisms.
- R52 Harmful to aquatic organisms.
- R53 May cause long-term adverse effects in the aquatic environment.
- R54 Toxic to flora.
- R55 Toxic to fauna.
- R56 Toxic to soil organisms.
- R57 Toxic to bees.
- R58 May cause long-term adverse effects in the environment.
- R59 Dangerous for the ozone layer.
- R60 May impair fertility.
- R61 May cause harm to the unborn child.
- R62 Possible risk of impaired fertility.
- R63 Possible risk of harm to the unborn child.
- R64 May cause harm to breastfed babies.
- R65 Harmful. May cause ling damage if swallowed
- R66 Repeated exposure may cause skin dryness or cracking
- R67 Vapours may cause drowsiness and dizziness
- R68 Possible risk of irreversible effects

APPENDIX 4

S PHRASES

These describe cautionary recommendations relating to hazardous substances and preparations.

- S1 Keep locked up.
- S2 Keep out of the reach of children.
- S3 Keep in a cool place.
- S4 Keep away from living quarters.
- S5 Keep contents under ... (appropriate liquid to be specified by the manufacturer).
- S5 Keep under ... (inert gas to be specified by the manufacturer).
- S7 Keep container tightly closed.
- S8 Keep container dry.
- S9 Keep container in well-ventilated place.
- S12 Do not keep container sealed.
- S13 Keep away from food, drink and animal feeding stuffs.
- S14 Keep away from ... (incompatible materials to be indicated by the manufacturer).
- S15 Keep away from heat.
- S16 Keep away from sources of ignition - No smoking.
- S17 Keep away from combustible material.
- S18 Handle and open container with care.
- S20 Do not eat or drink when using.
- S21 Do not smoke When using.
- S22 Do not breathe dust.
- S23 Do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer).
- S24 Avoid contact with skin.
- S25 Avoid contact with eyes.
- S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical assistance.
- S27 Take off all contaminated clothing immediately.
- S28 After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).
- S29 Do not empty into drains.
- S30 Never add water to this product.
- S33 Take precautionary measures against static discharges.
- S35 This material and its container must be disposed of in a safe way.
- S36 Wear suitable protective clothing.
- S37 Wear suitable gloves.
- S38 In case of insufficient ventilation, wear suitable respiratory equipment.

- S39 Wear eye/face protection.
- S40 To clean the floor and all objects contaminated by this material, use ... (to be specified by the manufacturer).
- S41 In case of fire and/or explosion, do not breath fumes.
- S42 During fumigation/spraying, wear suitable respiratory equipment (appropriate wording to be specified by the manufacturer).
- S43 In case of fire, use ... (precise type of fire-fighting equipment to be specified by the manufacturer). (If water increases the risk, add: "Never use water").
- S45 In case of accident or if you feel unwell, seek medical assistance immediately (show the label where possible).
- S46 If swallowed, seek medical advice immediately and show this container or label.
- S47 Keep at temperature not exceeding ... °C (to be specified by the manufacturer).
- S48 Keep wetted with ... (appropriate material to be specified by the manufacturer).
- S49 Keep only in the original container.
- S50 Do not mix with ... (to be specified by the manufacturer).
- S51 Use only in well-ventilated areas.
- S52 Not recommended for interior use on large surface areas.
- S53 Avoid exposure – obtain special instructions before use.
- S56 Dispose of this material and it is container at hazardous or special waste collection points.
- S57 Use appropriate container to avoid environmental contamination.
- S59 Refer to manufacturer/supplier for information on recovery/recycling.
- S60 This material and its container must be disposed of as hazardous waste.
- S61 Avoid release to the environment. Refer to special instructions/safety data sheets.
- S62 If swallowed do not induce vomiting: seek medical advice immediately and show this container or label.
- S63 In the event of accident by inhalation, remove casualty to fresh air and keep at rest
- S64 If swallowed, rinse mouth with water (only if the person is conscious)