



Management of Quality, Biosafety & Biosecurity in veterinary laboratories

Mehdi EL HARRAK, DVM, PhD
Member of OIE Laboratory Commission
R&D Director MCI Sante Animale MAROC

Presentation outline

General procedures

Laboratory access

Personal protective equipment

Hands washing

Biosafety Cabinets

Common mistakes

Transport and storage



Standard Laboratory practices

A. Standard Microbiological Practices

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical,

Standard Laboratory practices

laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries.

Precautions, including those listed below, must always be taken with sharp items. These include:

- a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
 - b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
 - c. Non disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
 - d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
6. Perform all procedures to minimize the creation of splashes and/or aerosols.
 7. Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.

Standard Laboratory practices

8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport:
 - a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
 - b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. The sign may include the name of the agent(s) in use, and the name and phone number of the laboratory supervisor or other responsible personnel. Agent information should be posted in accordance with the institutional policy.

Standard Laboratory practices

10. An effective integrated pest management program is required. See Appendix G.
11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

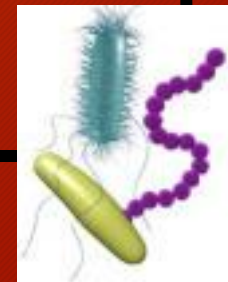
GENERAL LABORATORY SAFETY GUIDELINES

- Mostly common sense, but you must understand the hazards you face in the laboratory and be adequately trained to deal with them.
- Basic must be known for all labs.

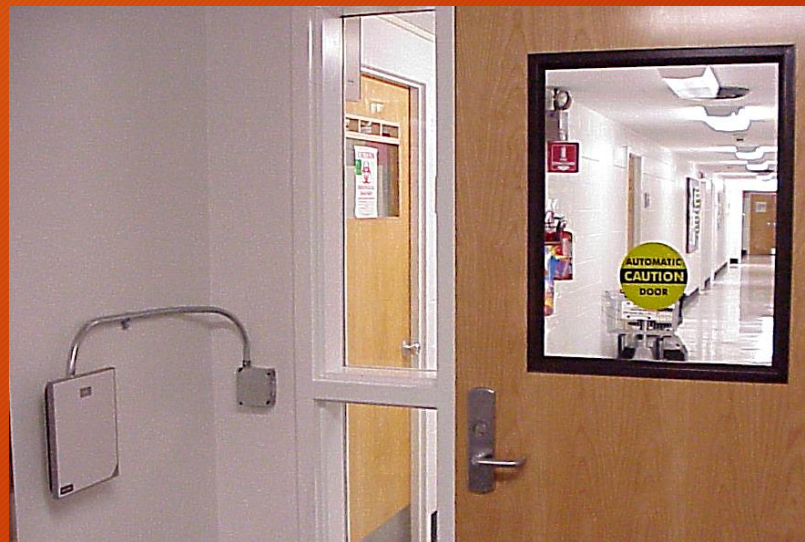


GOOD MICROBIOLOGICAL PRACTICE (GMP)

- Basic code of practice that should be applied to all types of work involving microorganisms.
- Objectives:
 - ✓ prevent contamination of laboratory workers and the environment
 - ✓ prevent contamination of the experiment/samples
- Application of aseptic technique, minimization of aerosols, contamination control, personal protection, emergency response



Controlling access



Physical barriers/ Vehicular Control



Personnel Monitoring



Access

Personnel

Clearances?

ID badges (checked?)

Visitors

open to the public?

visiting fellows, post-docs, students



Change the culture Challenge who is there

- All workers wear photo ID badges with name & expiration date.
- Use color coding to indicate clearance to enter restricted areas.
- Guests are issued Visitor ID badges & are escorted by workers.

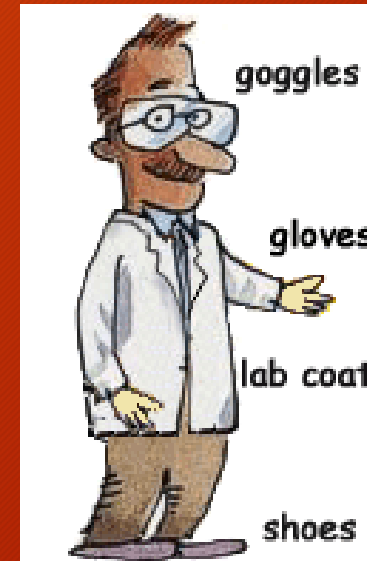


Control access to where agents are stored & used

- Labs & animal areas separated from public areas locked at all times
- Card-key or other controlled access
- Visitor entry recorded; restricted to times when staff are available for escort
- Lock storage rooms, cabinets, freezers containing agents

PERSONAL PROTECTIVE EQUIPMENT (PPE)

- PPE can become an important line of defence (last line of defense)
- Responsibility of both the user and the supervisor to ensure that PPE is worn



PERSONAL PROTECTIVE EQUIPMENT (PPE)

Lab Coats/Gowns

- Long-sleeved, knee length with snaps
- Elastic cuffs
- Back-closing gowns
- Periodic cleaning required



PERSONAL PROTECTIVE EQUIPMENT (PPE)

Gloves

- Latex, nitrile & vinyl for work with biological agents.
- Exam gloves should not be reused, change frequently. Utility gloves can be disinfected and reused if they show no sign of degradation.
- Consider tensile characteristics, length of cuff.
- Double gloving.
- Provide assistance finding an alternative for people with allergies.



PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye & Face Protection

- Goggles, safety glasses to protect the eyes
- Full face shield to protect facial skin.



Respirators

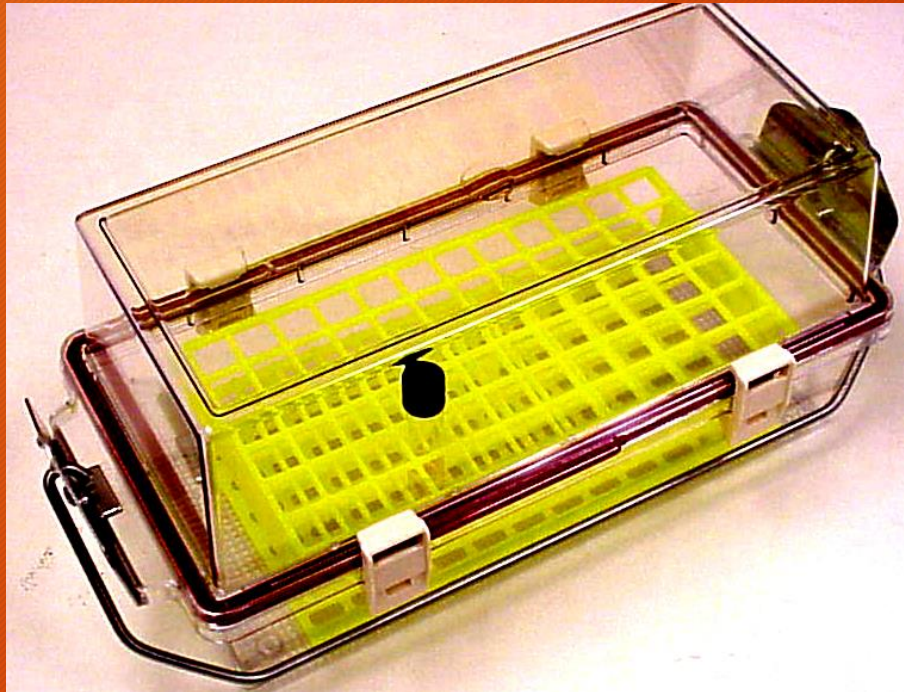
- Only personnel who have been fit-tested and trained should wear respirators.



Consider lockboxes

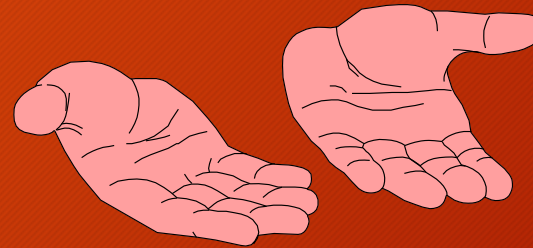


Typical transport carrier



Hand washing

- One of the single effective means of preventing infections if done properly and frequently
- When to wash?
 - ✓ Before starting any manipulations
 - ✓ Before leaving the lab
 - ✓ When hands are obviously soiled
 - ✓ Before and after completing any task in a BSC
 - ✓ Every time gloves are removed
 - ✓ Before contact with one's face or mouth
 - ✓ At the end of the day





Foot Protection

Steel toe safety shoes and boots (rubber or leather) with puncture resistant soles
from sharp objects
dropped heavy objects
heavy livestock stepping on your feet
chemical hazards (steel toe safety rubber boots)



Types of Cabinets

Fume Hood

Laminar Flow Cabinet/Hood

Biosafety Cabinet

Microbiological Safety Cabinet



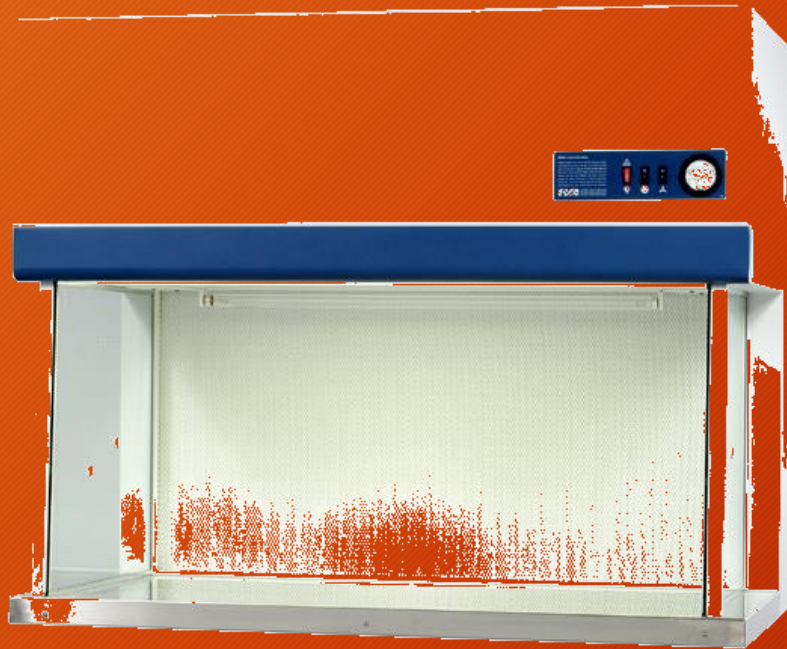
Fume Hoods

Removes toxic chemical (ducting sys./ductless)
No HEPA filter -> not for biohazard agents



Laminar Flow Cabinets

Product protection (no personnel protection)
Not for biohazard agents or chemical fumes



Biosafety Cabinets

Class I BSC: Personnel and Environment Protection

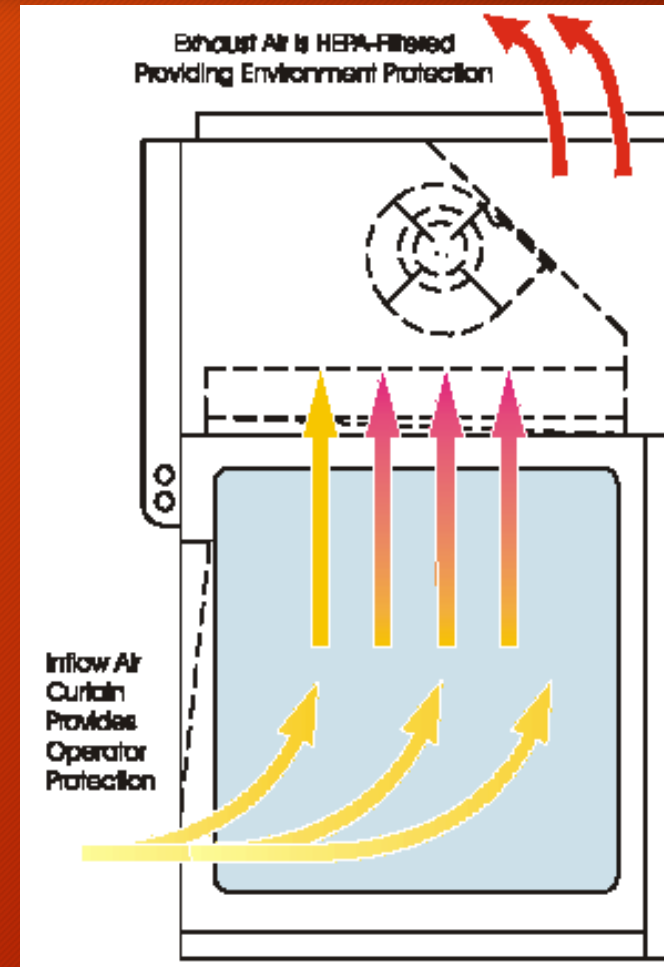
Class II & III BSC: Personnel, Product and Environment Protection

HEPA filters (not for chemical vapors)

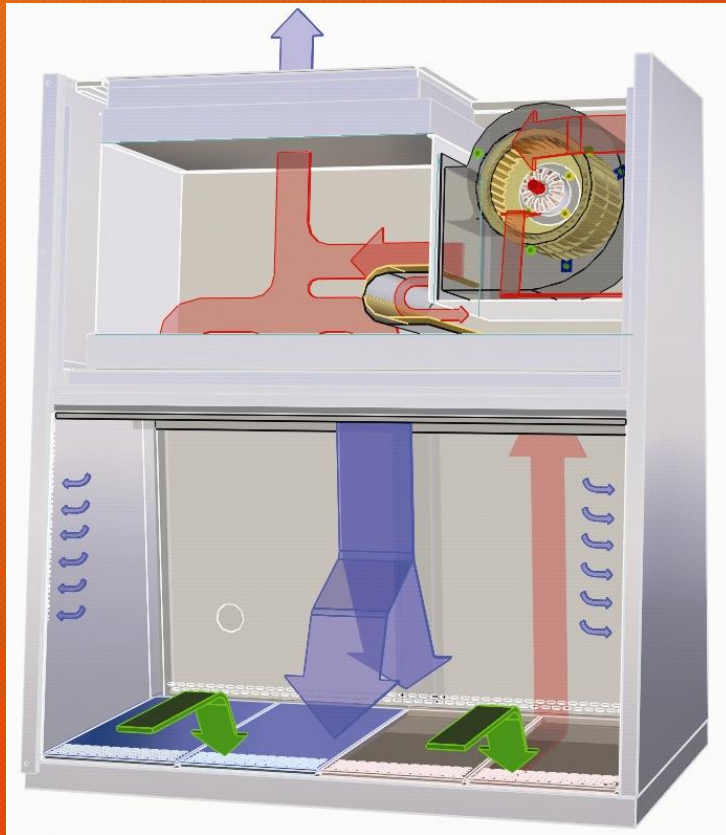


Class 1 BSC

- Only operator protection (not product).
- Same level of operator protection as Class II BSC
- Biosafety level 1, 2, 3
- Inflow away from operator
- HEPA filtered exhaust to environment
- Current trend: to Class 2



Class 2 A2 BSC



Both operator and product protection

Biosafety level 1, 2, 3

Inflow away from operator

HEPA filtered exhaust to environment

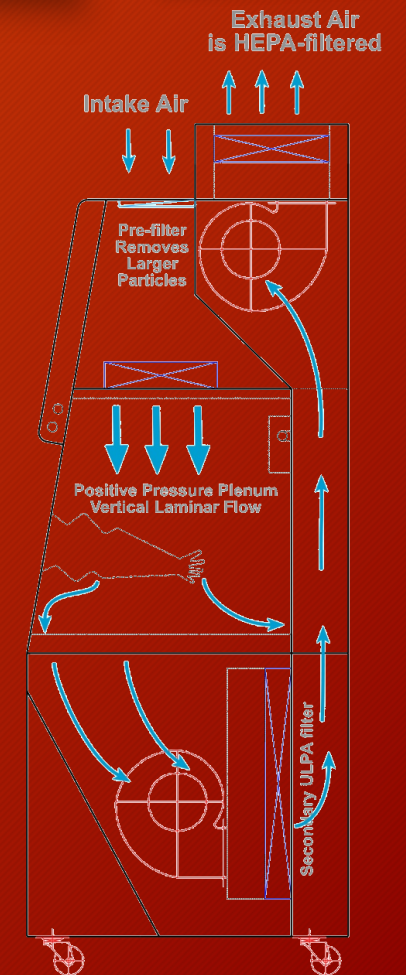
HEPA filtered laminar down flow

Carcinogen in cell culture:

biological & chemical → need ducting

Class 3 BSC

Biosafety level 1, 2, 3, 4
Product and operator protection
Gas leak tight 1×10^{-5} cc/sec leak rate
Internal operations \rightarrow attached glove
Material transfer \rightarrow 2 doors pass box
Negative air pressure > 0.5 "WC (120 Pa)
Supply is HEPA filtered
Double exhaust HEPA filter in series or:
Single exhaust HEPA and an incinerator



Common User Mistakes

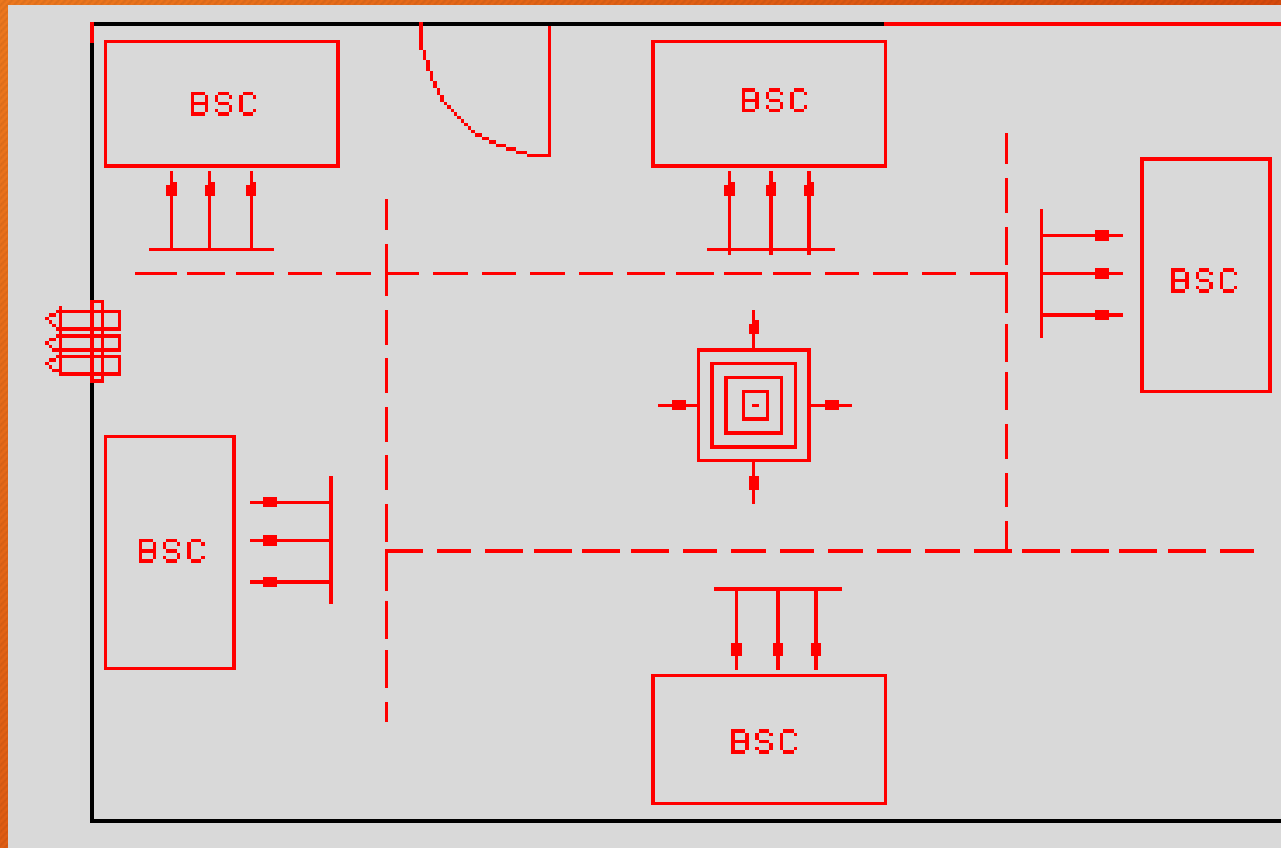
Confusing a vertical laminar flow cabinet for a Class II BSC

Failure to identify the type of BSC needed for their operations

Inappropriate choice of installation site / cabinet location

Inappropriate usage / maintenance of the BSC

Proper Installation / Location



Exhaust filter area:
Especially susceptible to disruptive air currents. Clearance of 40 cm (minimum) is recommended between the highest point of the cabinet and the ceiling.



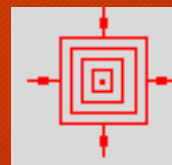
Barrier Airflow



Biosafety Cabinet



Return Air Grille



Air Inlet



Personnel Traffic

Proper Operation

- Slow deliberate movements that will not disrupt airflow, minimize arm movement
- When an alarm is activated, do NOT use the cabinet
- After usage, wipe down the cabinet with cleaning agents (UV lamp)
- Work starting from clean to “dirty” objects
- Do not block airflow perforations with objects/equipments



WORKING SAFELY IN A BSC

Before using the cabinet:

- Ensure BSC is certified
- Turn off UV lamp; turn on fluorescent lamp
- Disinfect work surfaces with appropriate disinfectant
- Place essential items inside cabinet
- Allow the blower to run for 5-10 min before work



WORKING SAFELY IN A BSC

While using the cabinet:

- Ensure material and equipment is placed near the back of the hood, especially aerosol-generating equipment. Do not block any vents
- Use techniques that reduce splatter and aerosols.
- General work flow should be from clean to contaminated areas
- Minimize movement so as not to impede air flow
- Open flame in BSC's is controversial

WORKING SAFELY IN A BSC

After using the cabinet:

- Leave blower on at least 5 minutes to purge cabinet
- Remove and decontaminate equipment and materials
- Disinfect cabinet surfaces
- Turn off blower and fluorescent lamp, turn on UV lamp



WORKING SAFELY IN A BSC

Maintenance:

- Before and after each use - Work surfaces wiped down
- Weekly - UV lamp should be wiped clean
- Monthly - All vertical surfaces wiped down
- Annually - UV lamp intensity verified
 - Decontamination with formaldehyde
 - Certification

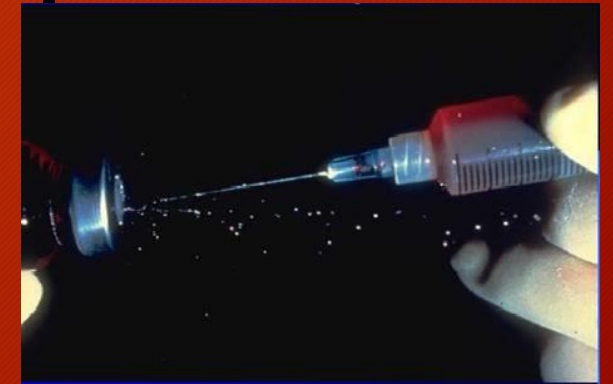
SAFE USE OF CENTRIFUGES

- Before use
 - ✓ Stress lines? Overfilled? Balanced?
 - ✓ Caps or stoppers properly in place?
 - ✓ Run conditions achieved?
- Use sealable buckets (safety cups) or sealed rotors
- After run
 - ✓ Centrifuge completely stopped?
 - ✓ Spills or leaks?
 - ✓ Allow aerosols to settle (30 min) or open in a BSC.



NEEDLES AND SYRINGES

- Avoid use whenever possible
- Use a BSC for all operations with infectious material
- Fill syringes carefully
- Shield needles when withdrawing from stoppers
- Do not bend, shear or recap needles.
- Dispose of all used needles/syringes in yellow sharps containers



PIPETTES

- Mouth pipetting is prohibited.
- Never force fluids out.
- To avoid splashes, allow discharge to run down dispense the receiving container wall.
- Never mix material by suction and expulsion.
- Reusable pipettes should be placed horizontally in a disinfectant filled pan.



INOCULATION LOOPS

- Sterilization in an open flame may create aerosols which may contain viable microorganisms.
- Use a shielded electric incinerator
- Shorter handles minimize vibrations
- Disposable plastic loops are good alternatives



Déchets à Risques Infectieux

- La durée entre la production effective des déchets et leur incinération ou prétraitement par désinfection ne doit pas excéder:
 - 72 heures lorsque la quantité de déchets d'activités de soins à risques infectieux et assimilés produite sur un même site est supérieure à 100 kilogrammes par semaine ;
 - 7 jours lorsque la quantité de déchets d'activités de soins à risques infectieux et assimilés produite sur un même site est inférieure ou égale à 100 kilogrammes par semaine et supérieure à 5 kilogrammes par mois. Par site, on entend tout lieu non traversé par une voie publique où sont installées les activités relevant d'une même personne juridique et génératrices des déchets visés à l'article 1.

Know materials brought into labs & animal facilities

- Only accept packages you expect.
- Screen all packages (visually, x-ray) before transfer into lab.
- Open all packages containing toxins &/or microbiologic agents in safety cabinets or fume hoods.

Transport, Storage & Shipping

Transport:

Closed, leakproof, primary container

Closed, leak-proof, (durable) secondary container

Storage of material:

Well-labeled

Restricted access

Personnel have knowledge of hazards

Shipping:

Saf T Pak certification for shippers of diagnostic specimens, infectious waste

First Aid

All vehicles and buildings should have a first aid kit

- get appropriate first aid training
- in your FA kit include emergency numbers
- check FA kit content every three months
- label all FA kits
- include flares and flash light in your FA kit
- emergency signals -extra help



Safety Signs

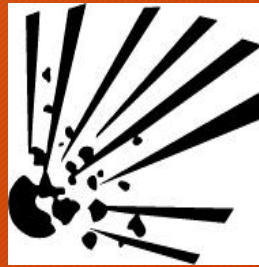
Classified according to the use hazards and risk involved

The categories of hazard are:

Toxicity / Poison



Explosive Potential



Flammability

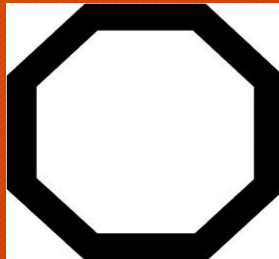


Corrosive

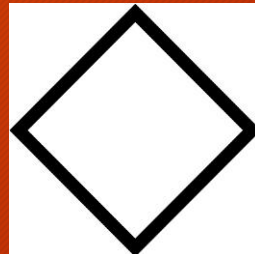


The categories of risks are:

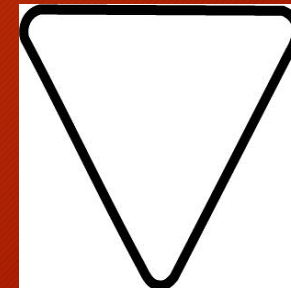
Danger



Warning



Caution



Have an emergency plan

- Controlling access to labs &/or animal facilities complicates emergency response.
 - Develop plan before the emergency
 - Involve all appropriate parties in planning
 - Inform community-based responders
 - Conduct drills & after-incident reviews



Biosafety Officer (the facilitator)

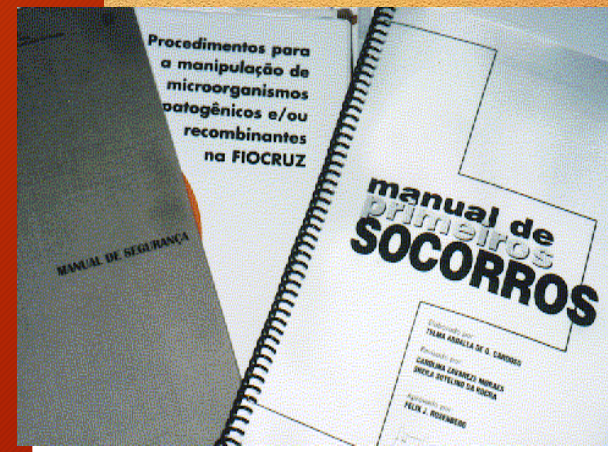
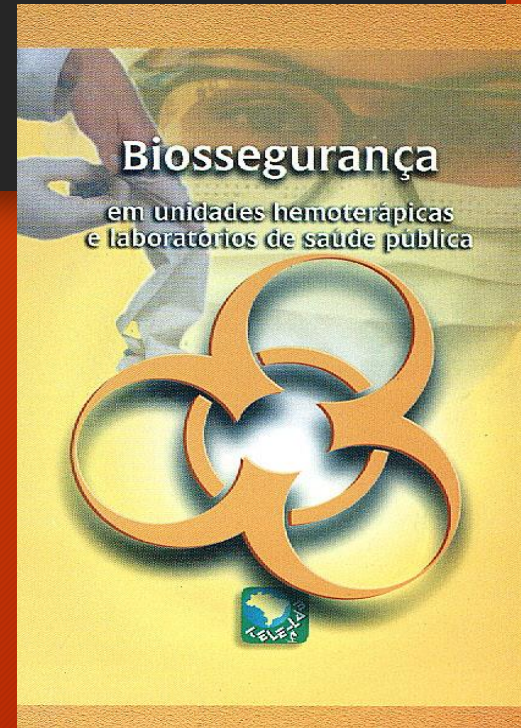
- Works with investigators to ensure the safe conduct of biological research
- Risk assessment, appropriate containment
- Provides technical advice on research safety and security procedures
- Periodic lab inspections/lab standards
- Develop emergency plans/accidental spills, investigating accidents

Biosafety Program

Principles

- General Lab Requirements

- Knowledgeable supervisor
- Knowledgeable personnel
 - Aware of potential hazards
 - Proficient in practices & techniques
- Lab specific biosafety manual
- Biosafety Levels (BSLs)
- Laboratory Practice and Technique
- Safety Equipment (Primary Barriers)
- Facility Design and Construction (Secondary Barriers)
- Biosafety cabinets (BSCs) - BSL 2/3
- Personal protective clothing
- Pipetting Devices
- Safety centrifuge cups and rotors



Conclusions

- Good laboratory biosafety practices reinforce and strengthen laboratory biosecurity systems.
- Risk assessment is essential for effective biosafety and biosecurity programs.
- The commitment to constantly improve biorisk management performance for a facility and its operation through attainable goal-setting and actual goal-achieving should be encouraged and acknowledged at all levels.

