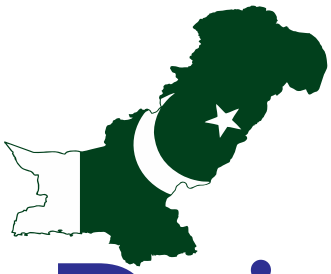

BioPrism

A Laboratory Safety Training Initiative

Program Manual 2018

Safer Behaviors
Connecting plans and outcomes

PAKISTAN BIOLOGICAL SAFETY ASSOCIATION

Let's do safety together.

BioPrism
A Laboratory Safety Training Initiative

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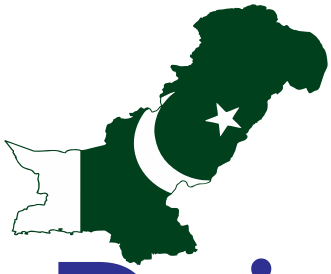

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PAKISTAN BIOLOGICAL SAFETY ASSOCIATION

HISTORY OF THE PROGRAM




This training manual was developed by the sincere contributions of the founding faculty under the auspices of the Pakistan Biological Safety Association (PBSA) and Safer Behaviors (SB). Support was provided by the Fogarty International Center, National Institutes of Health, USA.

The founding faculty was selected through a tedious process from huge number of participants attending a series of workshops held from 2014-2016. The selected faculty was then mentored by Sean G. Kaufman.

We appreciatively recognize the dedicated contributions of Sean G. Kaufman, CEO and Founding Partner, Behavioral Based Improvement Solutions, Dr. Aamer Ikram, President, Pakistan Biological Safety Association and Dr. Zeba Rasmussen, Senior Research Fellow, Fogarty International Center, National Institutes of Health, USA, in the development of this manual.

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A Laboratory Safety Training Initiative

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PAKISTAN BIOLOGICAL SAFETY ASSOCIATION

PROGRAM AGENDA – DAY 1

Time	Location	Group	Topic
9:00 - 10:00 am	Classroom	All	Welcome/Pre-Assessment
10:00 - 10:30	Tea Break		
10:30 - 01:00 pm	Classroom	1	Four Primary Controls of Biosafety
			Biological Risk Mitigation
			Risk Group Classification
			Containment Levels: Engineering and Biosafety
	Laboratory	2	Glove Removal: Beak Method Handwashing Don/Doff – Gross Contamination
1:00 - 2:00	Lunch Break		
2:00 - 4:30	Classroom	2	Four Primary Controls of Biosafety
			Biological Risk Mitigation
			Risk Group Classification
			Containment Levels: Engineering and Biosafety
	Laboratory	1	Glove Removal: Beak Method Handwashing Don/Doff – Gross Contamination
4:30- 5:00	Day 1 Quiz		



PROGRAM AGENDA – DAY 2

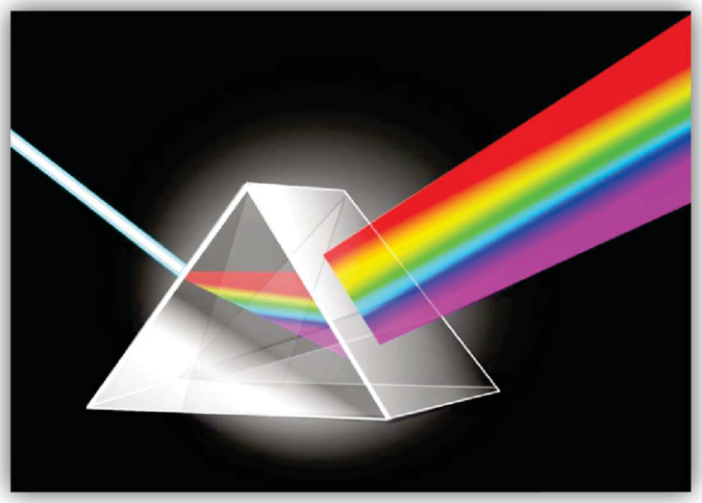
Time	Location	Group	Topic
9:00 - 10:00 am	Classroom	All	Quiz Review SOP Evaluation, Verification and Validation
10:00 - 10:30	Tea Break		
10:30 - 1:00 pm	Classroom	1	Sterilization, Disinfection, Decontamination, and Antisepsis
			Biosafety Cabinets (BSC)
			Biological Waste Management
			Medical/Incident Surveillance Programs/Occupational Health
	Laboratory	2	Shipping and Packaging Biosafety Cabinet (BSC) Techniques Spills – Inside/Outside BSC
1:00 - 2:00	Lunch Break		
2:00 - 4:30	Classroom	2	Sterilization, Disinfection, Decontamination, and Antisepsis
			Biosafety Cabinets (BSC)
			Biological Waste Management
			Medical/Incident Surveillance Programs/Occupational Health
	Laboratory	1	Shipping and Packaging Biosafety Cabinets (BSC) Techniques Spills – Inside/Outside BSC
4:30 - 5:00	Day 2 Quiz		

PROGRAM AGENDA – DAY 3

Time	Location	Group	Topic
9:00 - 10:00 am	Classroom	All	Quiz Review Cultural Expectations: Workforce, Safety Officials, Leadership
10:00 - 10:30	Tea Break		
10:30 - 1:00 pm	Classroom	1	Four Primary Controls of Biosecurity
			Emergency Response
			Written Examination
	Laboratory	2	Emergency Response Observational Evaluation
01:00 - 2:00	Lunch Break		
02:00 - 4:30	Classroom	2	Four Primary Controls of Biosecurity
			Emergency Response
			Written Examination
	Laboratory	1	Emergency Response Observational Evaluation
4:30 - 5:00	Certificate Distribution		

WELCOME SESSION AND PRE-ASSESSMENT

WELCOME SESSION



1. Welcome
2. History of Program
3. Program Agenda
4. Group Introductions
5. Unconscious Incompetence Transformation Exercise
6. Program Requirements
7. Program Materials
8. Pre-Assessment

We believe in doing biosafety with you and by you – serving you – so that you may be able to do biosafety for yourself and for your community.

Let's do safety together.

LECTURE SESSION DAY 1

FOUR PRIMARY CONTROLS OF BIOSAFTY
BIOLOGICAL RISK MITIGATION
RISK GROUP CLASSIFICATION
CONTAINMENT LEVELS

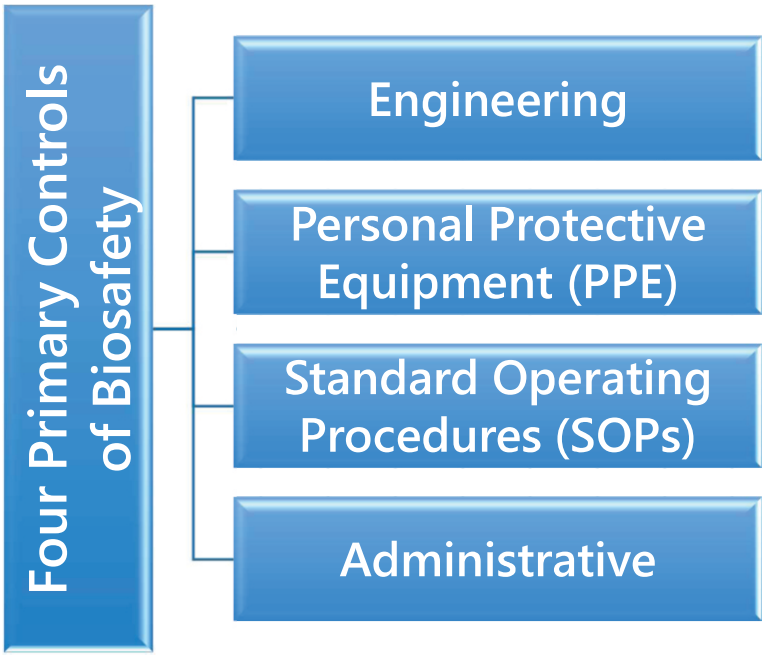
DEFINING BIOSAFETY

The World Health Organization (WHO) defines biosafety as the containment principles, technologies and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release.

DEFINING BIOSECURITY

The WHO defines biosecurity as containment principles, technologies, and practices which are implemented to prevent intentional misuse or release of pathogens.

FOUR PRIMARY CONTROLS OF BIOSAFETY



Biosafety protects the person from the agent. Biosecurity protects the agent from the person.

FOUR PRIMARY CONTROLS OF BIOSAFETY			
Engineering	Personal Protection Equipment (PPE)	Standard Operational Procedures (SOP)	Leadership
Lock on Doors	Gloves	Emergency Evacuation	Training
Directional Airflow	Eye Protection	Waste Disposal	Vaccinations
Interlocked Doors	Laboratory Coat	Spill Cleanup	SOP Compliance
Biosafety Cabinet	N95	Needle Stick	Surveillance (M/I)
Autoclaves	Booties	Lab Decon	SOP Evaluation / Validation
HEPA Filters	PAPR	Medical Emergencies	Background Checks

You could spend millions of rupees on engineering, thousands on personal protective equipment, hundreds of hours writing standard operating procedures – BUT, one misbehavior can instantly negate all of these controls.

BIOLOGICAL RISK MITIGATION

Hazard is a source or object that can cause harm.

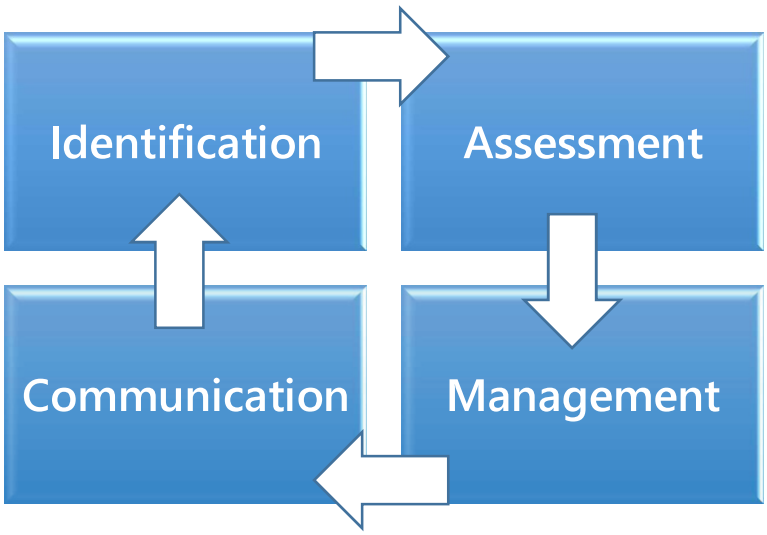
Risk is the likelihood of an event with a hazard that has consequences.

Example:

A young child is left alone in a kitchen while there is a pot of water heating on the stove.

- **What are the hazards?**
- **What is the risk of those hazards?**

THE FOUR PHASES OF BIOLOGICAL RISK MITIGATION



Risk is never static – it is always changing. Biological Risk Mitigation is a process – never ending.

HAZARD IDENTIFICATION

Identify all hazards in a laboratory environment. Some common hazards in the laboratory are:

1. Agents
2. Chemicals
3. Waste
4. Equipment
5. Animals

Are these the greatest hazards we face in the laboratory today?

RISK ASSESSMENT QUESTIONS

1. Demographic information.
2. Biosafety Level (BMBL 5th Ed).
3. Are door signs accurate and up-to-date?
4. Is this a secured laboratory?
5. What type of laboratory is being assessed?
6. List the infectious agents being researched.
7. List disinfectants used.
8. Are vaccines available?
9. Are there non-infectious or less pathogenic strains which could be used?
10. Which diagnostic tests are available in laboratory?
11. What are the routes of transmission for the infectious agents listed above?
12. Select hazards which exist in laboratory.
13. What PPE is currently in use?
14. Which of the following engineering controls are available in this laboratory?
15. Which of the following administrative controls are available in this laboratory?
16. Behavioral expectation questions (1-5).

SCIENCE QUANTIFIES RISK – BUT INDIVIDUALS DETERMINE IT. PERCEPTION MATTERS.

The greatest hazards we face today in the laboratory are the people working with the agents and the culture of the organization.

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RISK ASSESSMENT PROCESS

Step 1 Identify Agent Hazards

Step 2 Identify Laboratory Procedure Hazards

Step 3 Determine Biosafety Level and Procedures

Step 4 Evaluate Staff and Equipment

Step 5 Review Assessment with IBC, Scientists, and Safety Officers

RISK MANAGEMENT

Based on the hazard identification and risk assessment results – standard operating procedures – or strategic plans to manage risks are developed and delivered to the workforce.

Leaders don't just use a risk assessment to make risk management decisions. Budgets, policies, medical and legal consequences may force leaders to make decisions in direct contrast to risk assessment results.

RISK COMMUNICATION

"Don't cover the grill of the biosafety cabinet!" you say. OK, but when you leave, I will probably cover it again. But, if you tell me why I should not cover it and show me that what you're saying makes a difference, I will follow your directions because I understand the risk.
Risk communication explains the risk, so others can mitigate it for themselves.

That's a pretty big risk.

It would be of great benefit if you protected yourself from it.

Good Luck!

RISK GROUP CLASSIFICATIONS

HOW ARE MICROORGANISMS CLASSIFIED IN VARIOUS RISK GROUPS?

HOW MANY RISK GROUP CLASSES OF MICROORGANISMS EXIST?

DO YOU PREFER THE CATEGORIZING OF RISK GROUPS?

RISK GROUP 1

Unlikely to cause disease in healthy humans, animals, plants or fungi.

Includes: *Abiotrophia* spp., *Bacteriodes distastonis*, *Bartonella vinsonii*, *Botryosphaeria rhodian*

RISK GROUP 2

May cause disease in humans, animals, plants; unlikely to be a serious hazard to laboratory personnel. Effective treatment and preventative measures exist with respect to any infections. Limited risk of the spread of infection.

Includes: *Actinobacillus*, *Bacteroides fragilis*, *Borrelia spp.*, *Campylobacter spp.*, *Clostridium spp.*, *Corynebacterium*, *Enterococcus spp.*, *Klebsiella spp.*, *Mycobacteria*, *Aspergillus spp.*, *Candida spp.*, Dermatophytes, Subcutaneous mycosis, Hookworm, *Ascaris*, Filariases, Flukes, *Giardia spp.*, *Entamoeba spp.*, *Babesia spp.*, *Cryptosporidium spp.*, Herpes virus, Measles virus, Mumps virus, *RSV*, *Adenovirus*, *Influenza type A, B & C*, *HPV*

RISK GROUP 3

Serious human, animal, or plant disease. Serious hazard to laboratory personnel. A risk if spread in the community or the environment. Effective preventative measures or treatments are available.

Includes: *Bacillus anthracis*, *Brucella spp.*, *Coxiella burnetii*, *E.coli O157:H7*, *Francisella tularensis type A*, *Mycobacterium tuberculosis complex*, *Blastomyces spp.*, *Histoplasma spp.*, *Coccidioides spp.*, *Penicillium marneffii Echincoccus spp.*, *Taenia solium*, *Naegleria fowleri*, *Plasmodium falciparum*, Rabies virus, SARS, MERS, HIV, Dengue virus, Yellow fever virus, HCV, HBV, HDV, EEE, WEE, VEE.

Risk Groups are not static and many factors influence where specific strains are classified.

RISK GROUP 4

Causes life-threatening human or animal disease; a serious hazard to laboratory personnel. Is readily transmissible. Effective treatment and preventive measures are not usually available.

Includes: *Ebola virus, Marburg virus, Lassa fever virus, CCHF*

WHERE WOULD YOU PLACE ATTENUATED LIVE VACCINES IN RISK GROUP CLASSIFICATION?

How are Risk Groups different from Biosafety Levels?

BSL	Agents	Practices	Barriers and Safety Equipment
1	No disease in humans	Standard microbiological	None
2	Human disease; not aerosol transmitted	BSL1 & limited access, signage, medical surveillance	BSC Class I or II, lab coat, gloves
3	Aerosol transmission possible with serious or lethal consequences	BSL2 & controlled access, decontamination of waste, lab clothes, baseline serum	BSC Class II, protective lab clothing, respiratory protection
4	Dangerous/exotic high risk life threatening disease, aerosol transmission likely	BSL3 & clothing change, exit shower, all material decontaminating upon exit	BSC Class III or Class II with full-body suit

Modified from BMBL, 5th Ed. 2009

BIOCONTAINMENT EXERCISE

Let's test your knowledge! You walk into a laboratory and see the following – what level is it?

Scenario 1	Scenario 2	Scenario 3
Autoclave within the facility	Sequential passage through inner change room	No sink for hand washing
Self closing doors	Personal showers and outer change room	Lab furniture capable of supporting anticipated loads and uses
Process for sealing labs	Windows are break resistant	Benchtop impervious to water and resistant to heat
Slip resistant floor	Double door autoclave inside lab	Enough light to perform various activities
Screens on windows that open to exterior	Single HEPA filter exhaust	Chair covered with a non-porous material capable of cleaning and decontamination
Biosafety Cabinet properly installed	Single HEPA filter supply	-
Eye Wash Station in lab	Liquid decontamination process before release to sanitary	-
Directional air flow	Be completely sealed	-

WHAT IS THE BIOSAFETY LEVEL FOR THE ENGINEERING CONTROLS DESCRIBED ABOVE?

BIOCONTAINMENT LEVELS

BSL1
Agents that typically do not make healthy humans and animals sick.

BSL2
Agents which are spread via bloodborne, droplet, fecal, and/or oral routes of transmission.

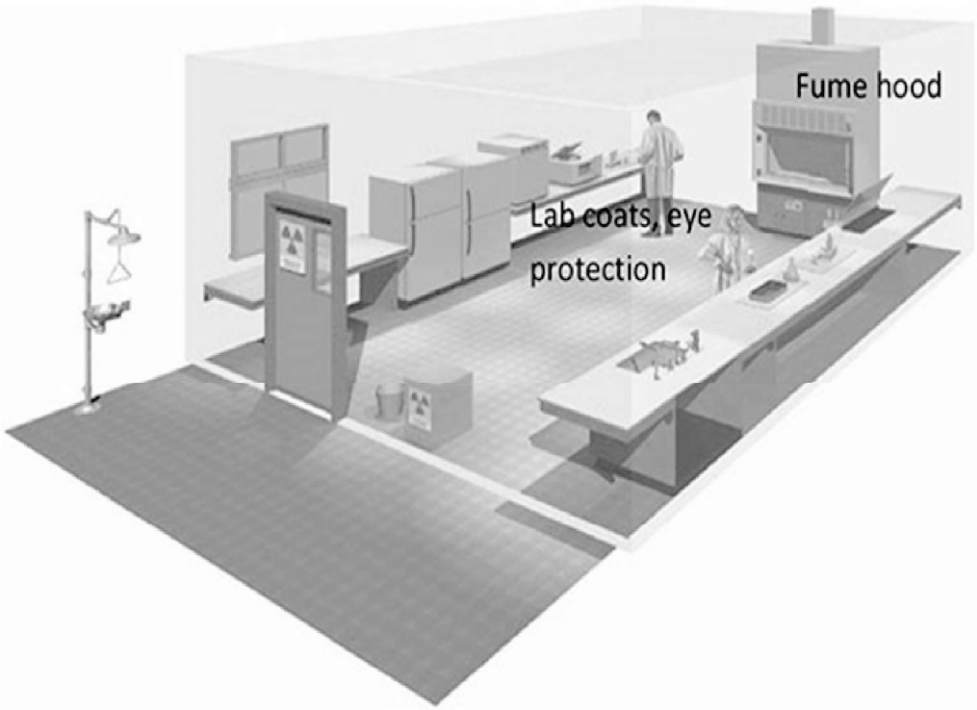
BSL3
Agents which are spread mainly via aerosol routes of transmission.

BSL4
Agents which are exotic, unknown, and typically have no treatment or prophylactic measures available.

You have Honda 50, Heavy Bike, Honda Civic, Prado – which one would you take to nearby market on sunny day?

BSL1 LABORATORY (BMBL 5TH EDITION)

1. A sink for handwashing;
2. Lab furniture capable of supporting anticipated loads and uses;
3. Benchtop impervious to water and resistant to heat;
4. Enough light to perform various activities;
5. Chair covered with a non-porous material capable of cleaning and decontamination.



What types of agents are worked with in BSL1 laboratories?

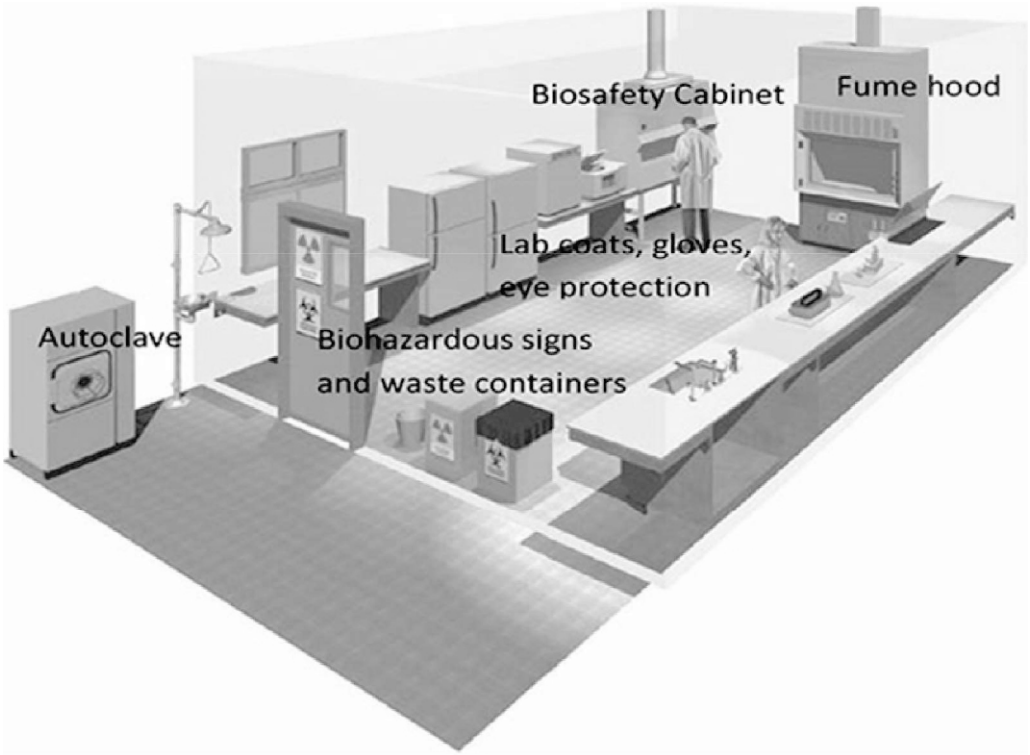
BSL2 LABORATORY (BMBL 5TH EDITION)

Must include every component from BSL1, plus:

1. Screens on windows that open to exterior;
2. Eye-wash stations readily available (can be outside lab);
3. Lockable doors.

Not required, but recommended for newly constructed BSL2 labs:

5. Directional airflows;
6. BSC used when needed;
7. Decontamination of waste available in the facility .

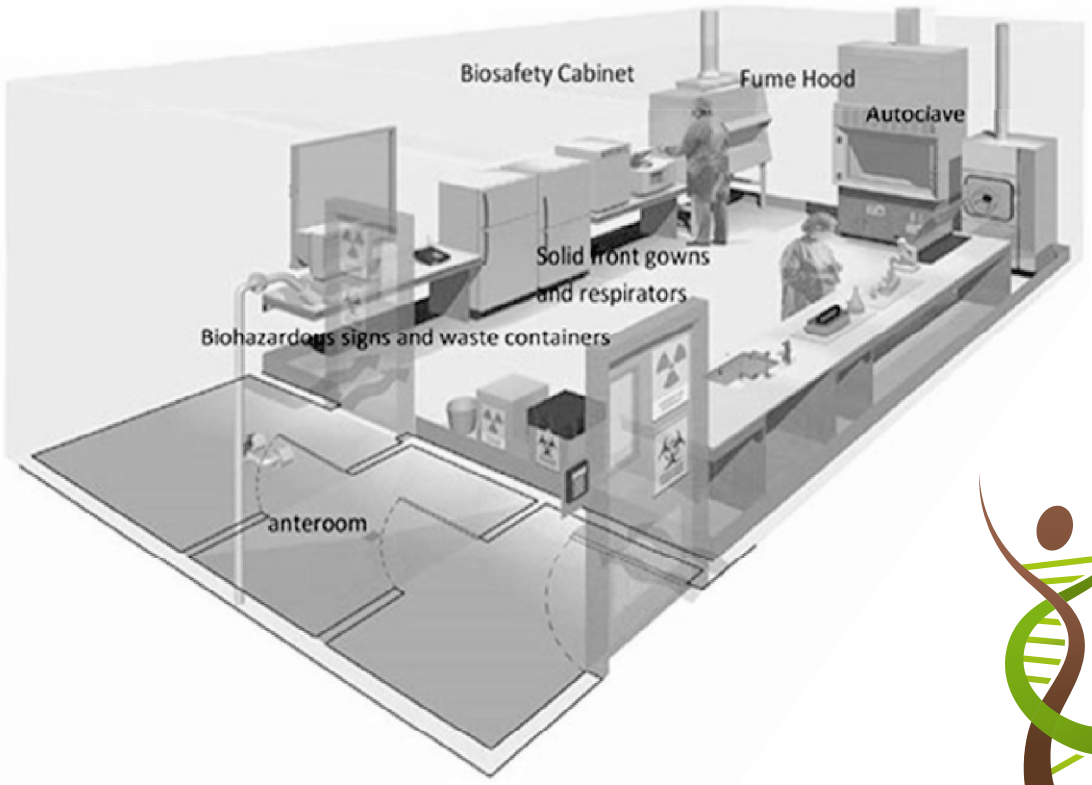


What is the difference between "must" and "should"?

BSL3 LABORATORY (BMBL 5TH EDITION)

Must include every component from BSL2, plus:

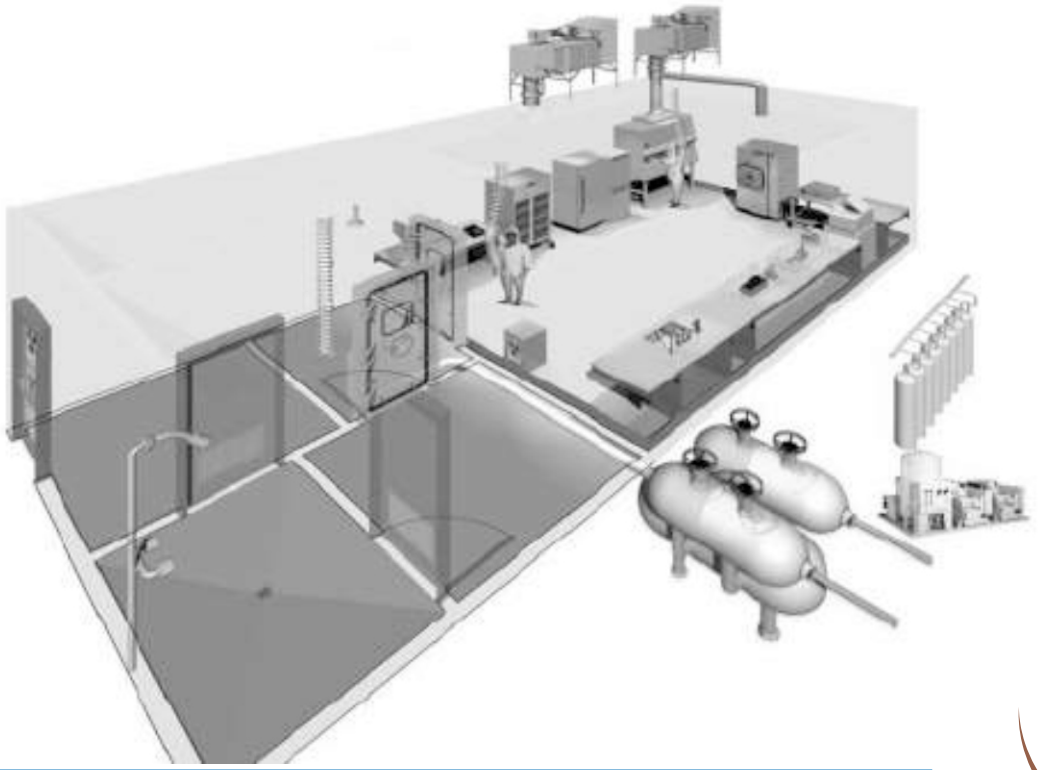
1. Hands-free sinks;
2. Self-closing doors;
3. Process for sealing labs;
4. Slip-resistant floor;
5. Sealed windows;
6. Biosafety Cabinet properly installed;
7. The laboratory exhaust air should be dispersed away from occupied areas and from building air intake locations, or the exhaust air must be HEPA filtered;
8. Eye-wash stations inside the laboratory;
9. Ducted air ventilation system;
10. Directional air flow;
11. Annual verification of the facility and documentation.



BSL4 LABORATORY (BMBL 5TH EDITION)

Must include every component from BSL3, plus:

1. Sequential passage through inner change room, personal showers, and outer change room ;
2. Be completely sealed;
3. Break-resistant windows;
4. Double-door autoclave inside lab;
5. Double HEPA filter exhaust;
6. Single HEPA filter supply;
7. Liquid decontamination process before release to sanitary system .



What is the difference between negative pressure and directional airflow?

BIOCONTAINMENT EXERCISE

Scenario 1	Scenario 2	Scenario 3
Autoclave within the facility	Sequential passage through inner change room,	No sink for hand washing
Self closing doors	Personal showers and outer change room	Labs furniture capable of supporting anticipated loads and uses
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Biosafety Cabinet properly installed	Single HEPA filter supply	-
Eye Wash Station in lab	Liquid decontamination process before release to sanitary	-
Directional air flow	Be completely sealed	-

WHAT IS THE BIOSAFETY LEVEL FOR THE ENGINEERING CONTROLS DESCRIBED ABOVE?

What is a BSL2+?

Remember all four primary controls....

LABORATORY SESSION
DAY 1

GLOVE REMOVAL – BEAK METHOD
HANDWASHING
DON/DOFF – GROSS CONTAMINATION

GLOVE REMOVAL: BEAK METHOD

https://www.youtube.com/watch?v=g1nDtVZIbEc&feature=youtu.be

PROPER HANDWASHING

World Health Organization (WHO) 2009

There is a difference between sanitizing and washing your hands!

STEPS FOR DONNING

Please write the steps for donning here.

When donning PPE, always do your best to don clean to dirty. When doffing PPE, always do your best to doff dirty to clean.

STEPS FOR DOFFING

Please write the steps for doffing here.

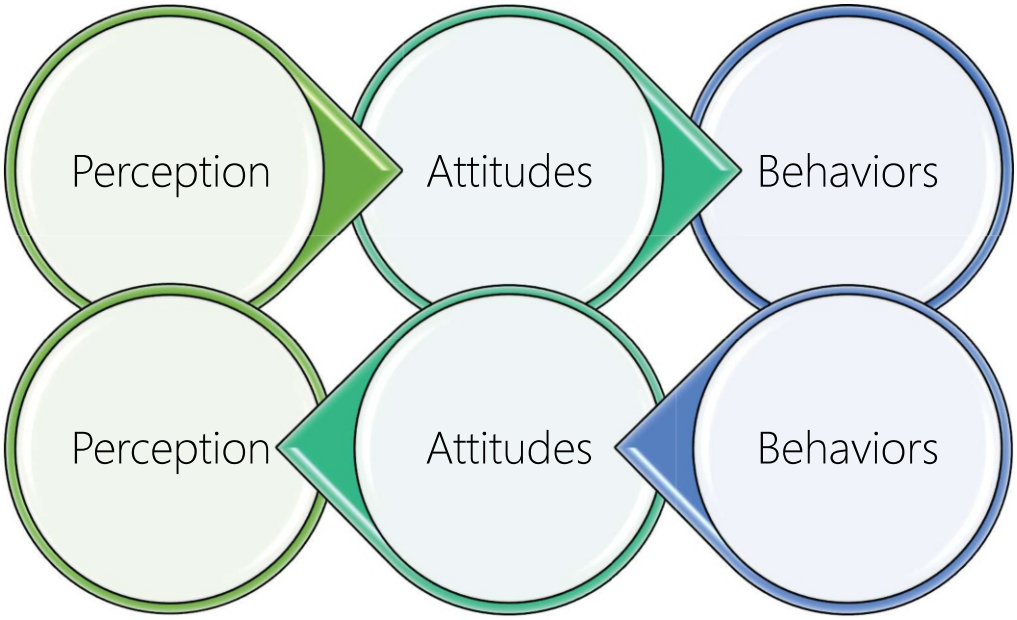
Always make sure the SOPs for doffing work correctly, otherwise you could be increasing the risk of those wearing PPE.

GROUP SESSION DAY 2

QUIZ REVIEW
SOP EVALUATION, VERIFICATION, AND VALIDATION

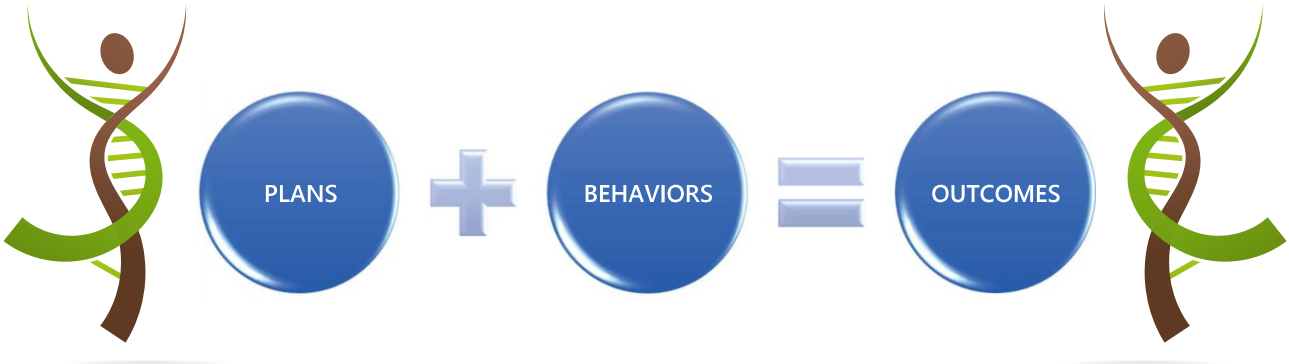
WHAT IS A STANDARD OPERATING PROCEDURE (SOP)?

An SOP is two or more people doing the same thing, the same way, to achieve the same results.



Without SOPs – perceptions drive behaviors. With SOPs – behaviors drive attitudes and perceptions.

SOP EVALUATION, VERIFICATION AND VALIDATION



Evaluation	Validation	Verification
Language	**Internal**	**Cognitive**
Can individuals understand the language of the SOP?	Are behaviors matching the author's intent?	Can the individual list the steps of the SOP? (with no SOP present)
Terminology	**External**	**Behavioral**
Can individuals understand the terminology of the SOP?	Do the behaviors lead to consistent outcomes among different individuals?	Can the individual demonstrate the steps of the SOP? (with no SOP present)
Physical Capability		
Can individuals physically do the SOP?		

Always test the SOPs for effectiveness. If the SOP doesn't work it could put people at greater risk.

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LECTURE SESSION DAY 2

STERILIZATION, DISINFECTION, AND DECONTAMINATION
BIOSAFETY CABINETS (BSC)
BIOLOGICAL WASTE MANAGEMENT
MEDICAL AND INCIDENT SURVEILLANCE
OCCUPATIONAL HEALTH PROGRAMS

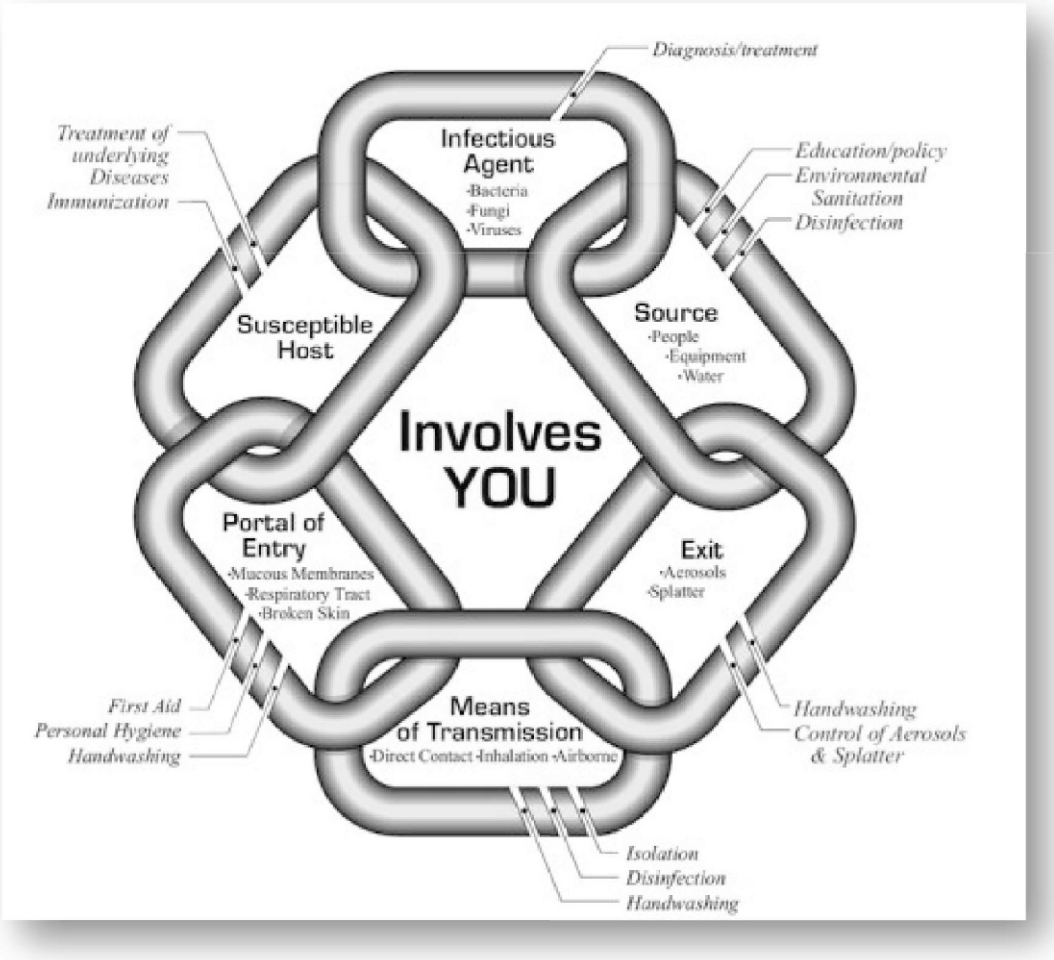
PAKISTAN BIOLOGICAL SAFETY ASSOCIATION

CONTAMINATION AND INFECTION

Contamination is any form of hazardous material that physically remains on people, animals, or objects.

Infection is the invasion and multiplication of microorganisms such as bacteria, viruses and fungi that are not normally present within the body.

CHAIN OF INFECTION



http://www.richmondinstitute.com/infection-controlnews/clinical-resources-for-infection-control-in-dentistry/attachment/chain-of-infection

Direct Contamination occurs through direct contact with the contaminant.

Cross Contamination occurs when an uncontaminated ("clean") person or thing comes into direct contact with a contaminated ("dirty") person, animal or object.

"STACK EFFECT"

DECONTAMINATION, DISINFECTION AND STERILIZATION

Decontamination is the term refer to a process which renders an item or material safe to handle. Reduction in level of microbial contamination is made to a level where it can be reasonably assumed free of risk of infection transmission.

- Physical decontamination involves physically removing the contaminant from the contaminated person or object.

- Chemical Decontamination is the process of removing or reducing the threat from a specific contaminant by rendering it less harmful through a chemical change.

Sterilization, disinfection, and antisepsis are forms of decontamination.

EXAMPLES: UV, Vaporized Hydrogen Peroxide, Chlorine Dioxide – (also may include processes under disinfection and sterilization).

Sterilization is the process of destroying all microbial forms including bacterial spores and is more thorough than disinfection.

EXAMPLES: Autoclaving – or processes which may include chemicals, heat, steam, pressure, gas and vapors for established periods of time (until complete kill is noted).

Disinfection is the process of reducing or eliminating living microorganisms so that it is no longer a health hazard. A limitation is that it does not kill spores (i.e. not sporicidal).

EXAMPLES: Use of alcohols, phenols, quaternary ammonium, chlorine species

What are the three weaknesses of using UV for decon purposes?

ANTISEPTICS

The measures to prevent an infection from entering a wound are referred to as asepsis, while those to cause the exclusion or destruction of harmful microbes over the human body are generally called "Antisepsis".

The source of infection can be either exogenous (from outside) or endogenous (from within the body).

AUTOCLAVES

Autoclaves should be tested annually. Placement of autoclaves under exhaust fans or away from fire indicators is recommended.

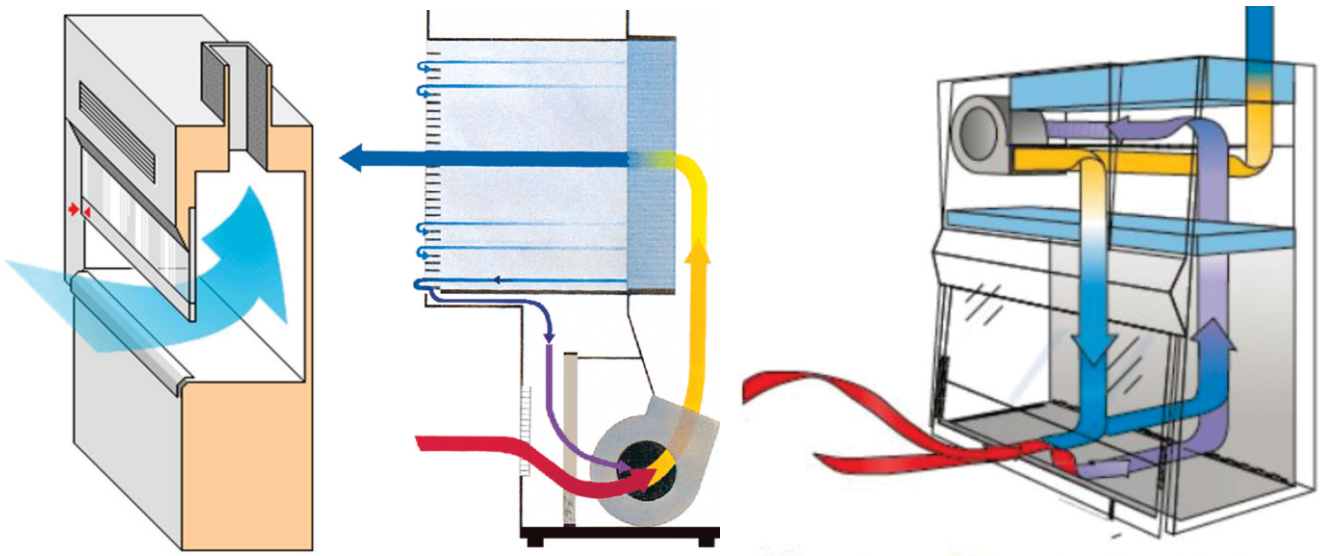
Annual testing should include:

1.Testing interlocks.
2.Confirming cycle – test load.
3.Visual Inspection of bioseal.
4.Smoke testing of bioseal.
5.Validation of sterilization temperature maintenance of 121°C for 60 minutes.

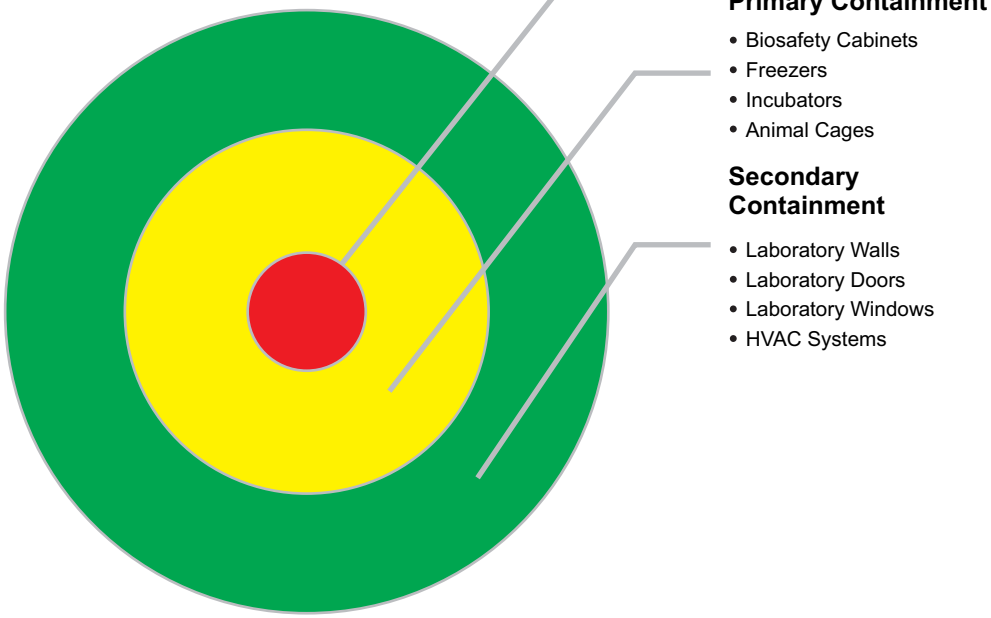
We must make sure our equipment functions properly.

Use chemical and biological indicators for in-house calibration of autoclave

CLEAN BENCHES, LAMINAR FLOW, BIOSAFETY CABINETS, AND CHEMICAL FUME HOODS



Can you identify the fume hood, BSC, and laminar flow clean bench?



BIOSAFETY CABINETS (Class I, II, III)

Three design types

1. Class I,
2. Class II (A1, A2, B1, B2)
3. Class III

Designed to provide personnel protection through directional flow of air into cabinet and environmental protection through HEPA filtered exhaust. In Class II BSCs, product protection is ensured with directional airflow into the front grill and HEPA filtered laminar airflow onto the product.

IT IS NOT ABOUT ENGINEERING CONTROLS ALONE. PEOPLE MUST BE TRAINED ON HOW TO WORK IN, USE, AND DECONTAMINATE BSC CORRECTLY.

In biosafety cabinets **ALONE** we trust.

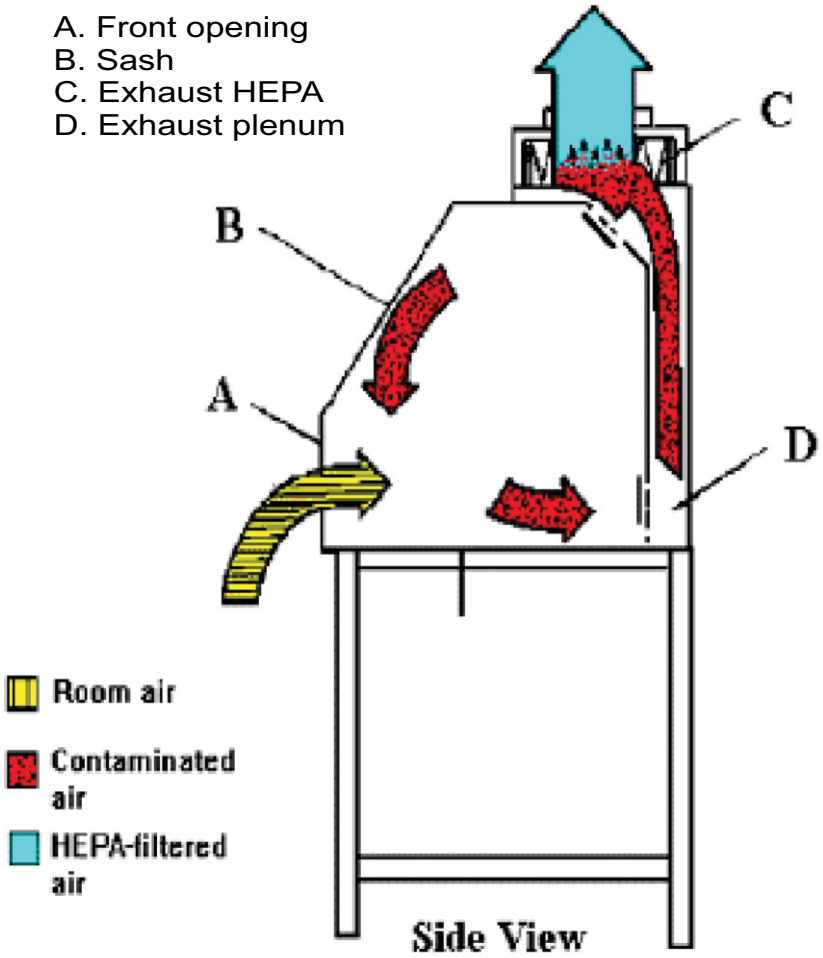
Do you agree with this statement?

CLASS I BIOSAFETY CABINET

The Class I Biosafety Cabinet protects the person. However, it does not offer protection of the product because air comes directly into the cabinet and over the surface of the product.

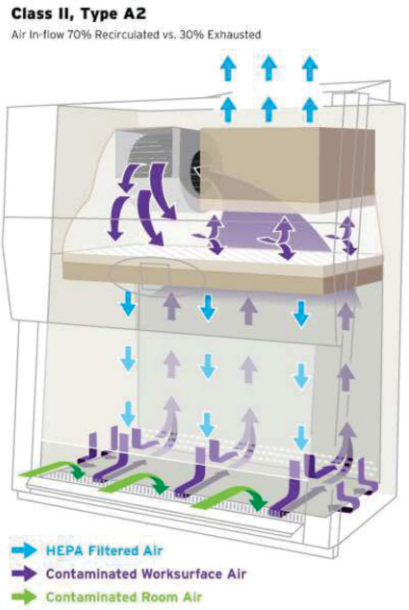
Class I Biosafety Cabinets are not hard ducted – but offer environmental protection with HEPA filtered exhaust.

Look at the picture and be prepared to discuss with the class how the Class I Biosafety Cabinet works.



Class I Biosafety Cabinet protects the person and environment. **IT DOES NOT PROTECT THE PRODUCT.**

All Class II Biosafety Cabinets protect the person, the product and the environment.



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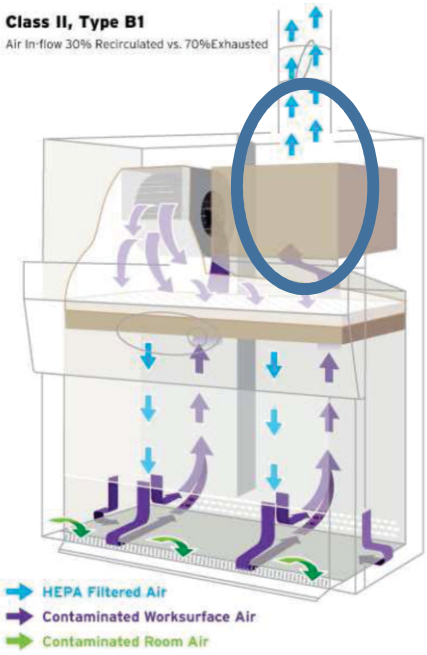

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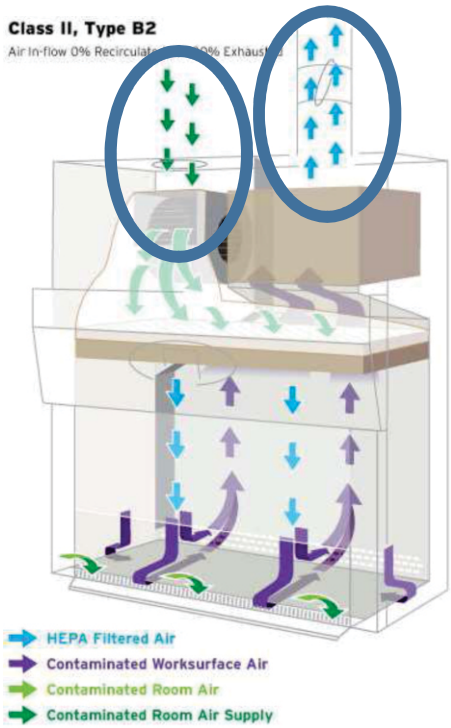


http://www.nuaire.com/media/wysiwyg/class2_b2.jpg

What is a weakness of the Class II A1 Cabinet?

HEPA filter

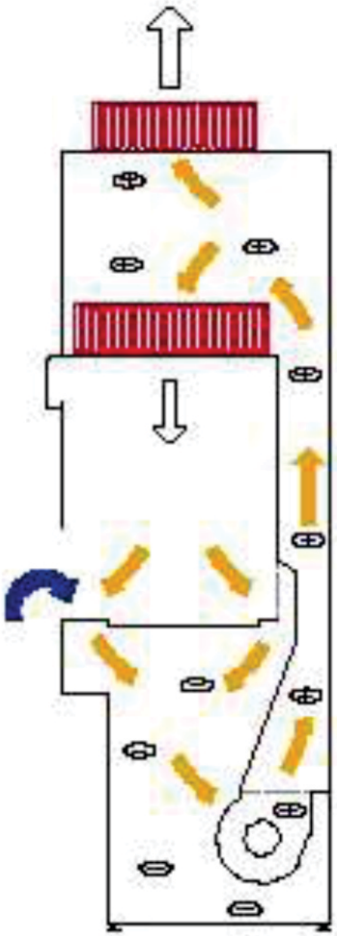
Room Air

Potentially contaminated air

HEPA Filtered air

Positive pressure

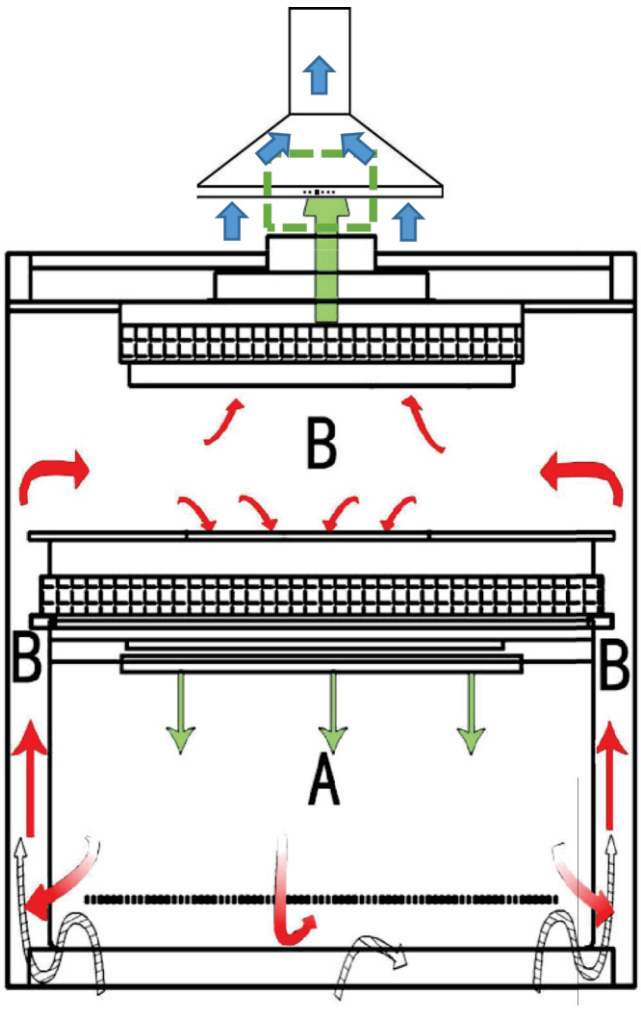
Negative pressure

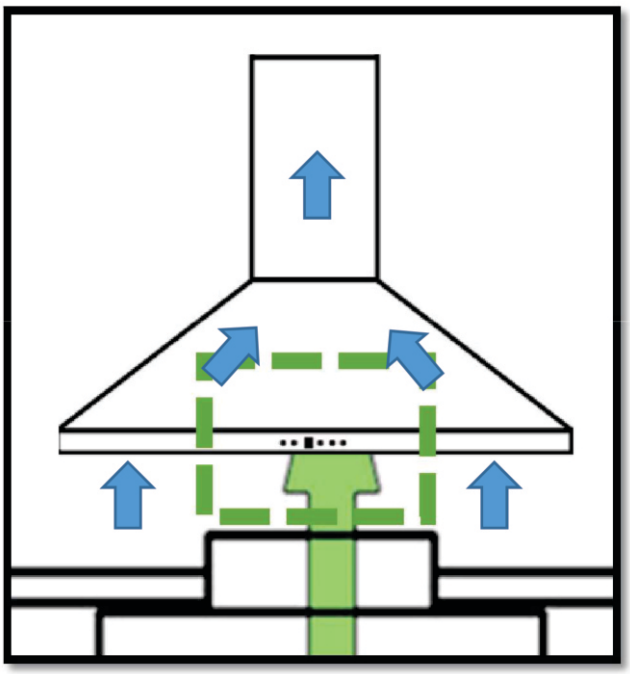


Section View

http://www.phac-aspc.gc.ca/publicat/lbg-ldmbl-04/ch9-eng.php

What is a thimble connection?





BENEFITS OF A THIMBLE CONNECTION

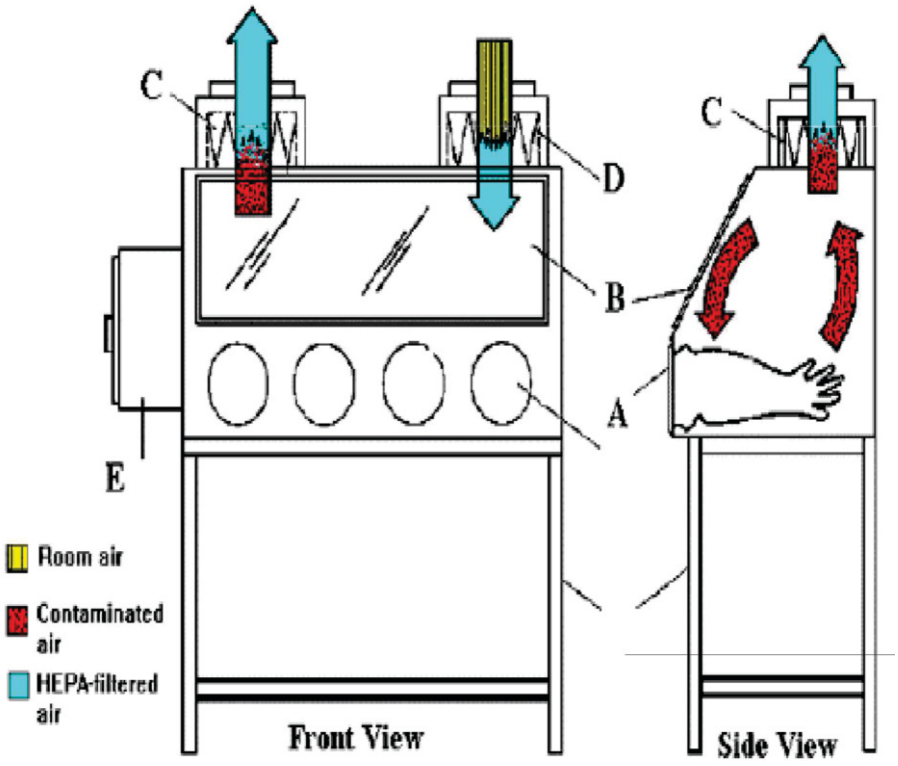
1. Saves $$ (Energy) – A2 for the benefit of a B2.
2. Minimize scents – smelly work.
3. You can shut off biosafety cabinet – and room continues to exhaust.

http://www.phac-aspc.gc.ca/publicat/lbg-ldmbl-04/ch9-eng.php

Make sure it really is a Class III Biosafety Cabinet.

IF IT DOES NOT MEET THE FOLLOWING CRITERIA, IT MAY BE A GLOVE BOX – BUT IT IS NOT A CLASS III BIOSAFETY CABINET.

- ✓ Double HEPA Filtered Exhaust.
- ✓ Single HEPA Filtered Supply.
- ✓ Must have interlocked door system.
- ✓ Must have process for decontamination.
- ✓ Must be sealed and negative pressure.



Always purchase equipment based the results of a risk assessment. Consider the space, work you do, and budget for maintenance.

Class and Type	Face Velocity/ lfm	Airflow Pattern	Nonvolatile Toxic Agents	Volatile Toxic Agents
I	75	Front -> into room/ outside	Yes	Yes when air exhausted to the outside
II, A1	75	Front -> 70% recirculated back Front -> 30% exhausted into room / outside	Yes	No
II, A2	100	Front -> 70% recirculated back Front -> 30% exhausted into room / outside *negative pressure required	Yes	Yes when air exhausted to the outside
II, B1	100	Front -> 30% recirculated Front -> 70% exhausted	Yes	Yes
II, B2	100	No Recirculation 100% exhausted	Yes	Yes
III	-	Front -> within the cabinet Exhaust Air -> 2 HEPA Filters -> Outside	Yes	Yes

THREE TYPES OF BIOLOGICAL WASTE

Physical

- Culture plates and tubes, loops, plastic ware, personal protective equipment, paper towels, animal carcasses, general waste

Liquid

- Cultures, spent culture media, blood or other bodily fluids, by-products of instrument-equipment decontamination

Sharps

- Needles, scalpels, razor blades, broken glass, pipette tips, glass slides and cover slips

Other waste may include radioactive, chemical and biological aerosols.

BEST PRACTICE

All waste generated within a biological laboratory should be treated as biological waste. This includes stationery (paper products) or any other items which could be potentially contaminated.

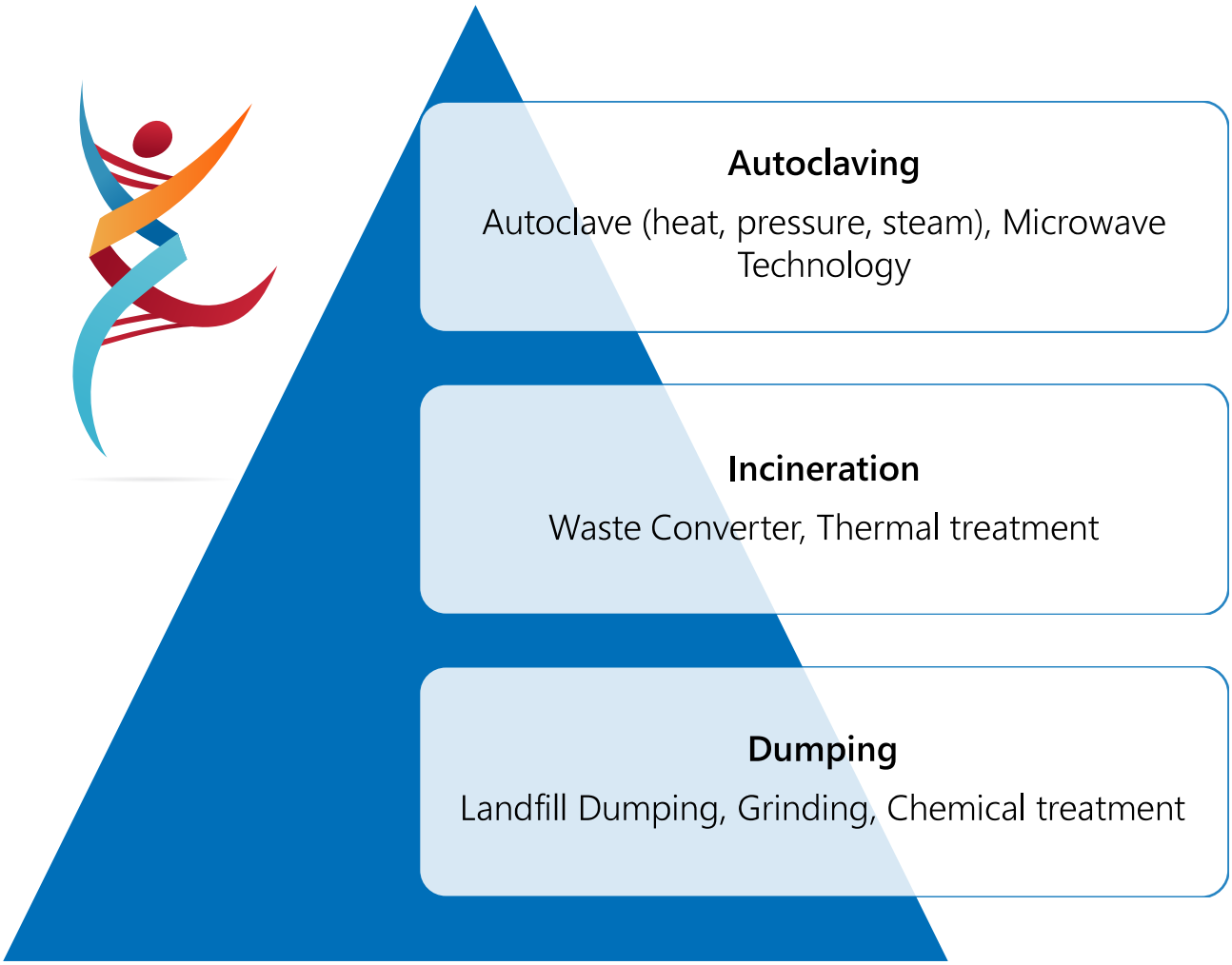
What if this is not possible?

Consider segregating waste into three categories:

1. Biological Waste (red)
2. Biological Sharps Containers (yellow)
3. Paper/Disposable Plastics* (white)

*Includes tip boxes and sterile disposable plastic bottles. This does not include any item which may be potentially contaminated.

PROCESSES FOR LABORATORY WASTE MANAGEMENT



All biological waste should be secured until it has been properly processed and inactivated. If waste is being moved from one location to another it should be secured and packaged, offering protection to the general public.

BIOLOGICAL WASTE MANAGEMENT

Waste Management Procedures

- Properly treated and bagged
- Goose-necked and taped
- Sprayed down with disinfectant
- Bagged
- Properly labeled
- Secured until autoclaved, incinerated, or taken to landfill

Always manage waste according to the local laws, organizational policies and guidelines.

Program Goals

Occupational Health Program

A program designed to screen, monitor, and provide direct medical care to laboratory staff working with biological agents with the goal of keeping the workforce healthy.

Medical Surveillance Program

A program designed to identify patterns of common source exposure of biological agents within the laboratory with the goal of quickly identifying potential containment breaches – and treating Laboratory-Acquired Infections (LAIs).

Incident Surveillance Program

A program designed to record and capture incidents, accidents, near-misses, and injuries with the goal of identifying the root cause and preventing similar events in the future.

Occupational Health Programs

- Owned by the organization
- Typically involves an Infectious Disease MBBS doctor
- Screen for "fit for duty"
- Provides annual health screenings – work/life balance
- Treats exposures
- Treats possible LAIs
- Provides vaccinations

Medical Surveillance Programs

- Owned by the laboratory
- Typically managed by Laboratory Director
- Captures day-to-day health of laboratory technicians
- Identifies staff who experience symptoms which match the clinical presentation of biological agents in the laboratory
- Reports to Occupational Health if suspected LAI

Incident Surveillance

- Owned by the organization
- Typically involves organizational leader
- Captures and shares all incidents, accidents, near misses, and injuries with members of the workforce.

CWA 15793
ISO 35001

LABORATORY SESSION
DAY 2

SHIPPING AND PACKAGING OF SUBSTANCES
BIOSAFETY CABINET TECHNIQUES
SPILLS – INSIDE/OUTSIDE BIOSAFETY CABINETS

Shipping and Packaging

Class 1. Explosives
Class 2. Gases
Class 3. Flammable Liquids
Class 4. Flammable Solids
Class 5. Oxidizing Substances
Class 6. Toxic & Infectious Substances
    Division 6.1: Toxic Substances Division
    Division 6.2: Infectious Substances
Class 7. Radioactive Material
Class 8. Corrosives
Class 9. Miscellaneous Dangerous Goods

Categories under division 6.2 (Infectious Substances)

Division 6.2 is further divided into 3 categories

Category A (Infectious Diseases) - Ebola virus, *Bacillus anthracis* (culture only)

Category B (Biological Substances) - *Bacillus anthracis* (patient specimen), highly pathogenic avian influenza virus (patient specimen)

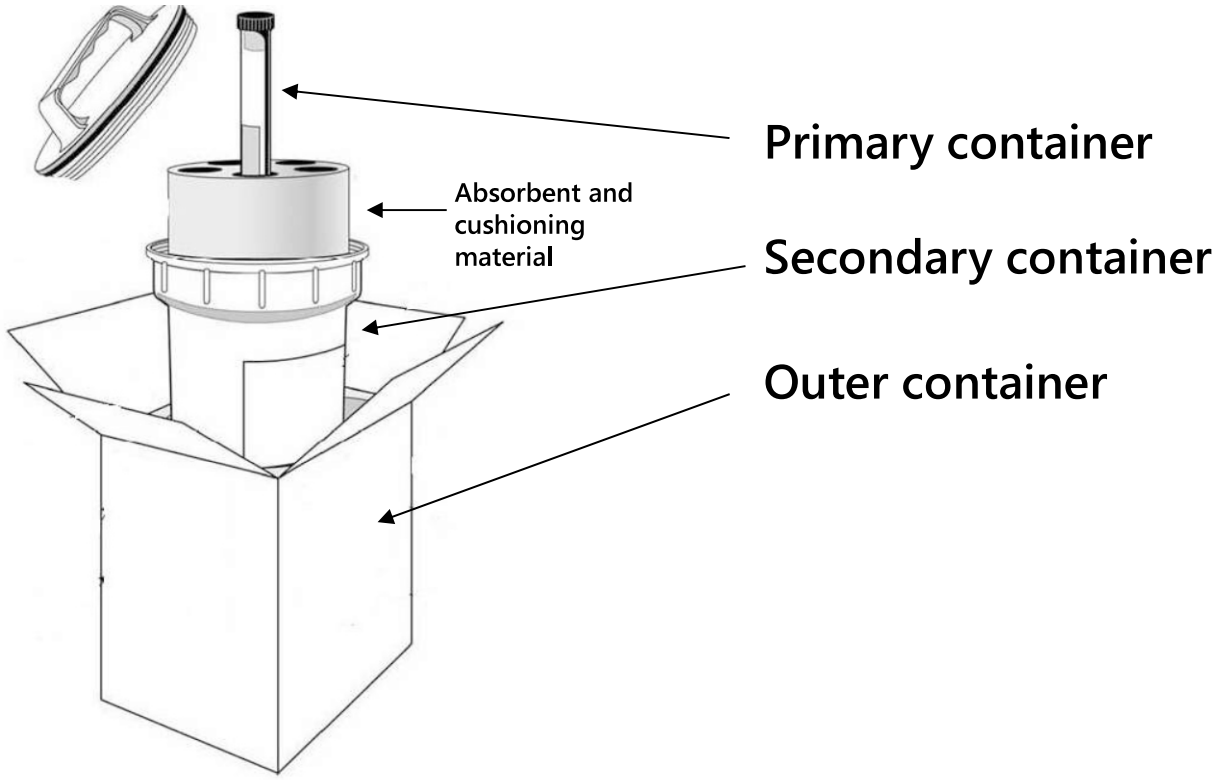
Exempt human/animal specimens - Medical assessment has determined a minimal likelihood that pathogens are present

Note:
Infectious substances are classified in Division 6.2 and assigned to UN* 2814, UN* 2900, UN* 3291 or UN 3373*, as appropriate.

*The UN numbers like UN2801, UN2900 are assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.

UN #	Proper Shipping Name	Examples
UN 2814	Infectious substance, affecting humans	*Bacillus anthracis, Brucella abortis,* Ebola virus, etc.
UN 2900	Infectious substance, affecting animals	Rinderpest virus , Avian Paramyxoviruses, FMDV (cultures only)
UN 3373	Biological substance, category-B	Infectious substances that have less likelihood of causing serious health concerns to humans and animals (ex. *E. coli, Salmonellae* suspected samples)

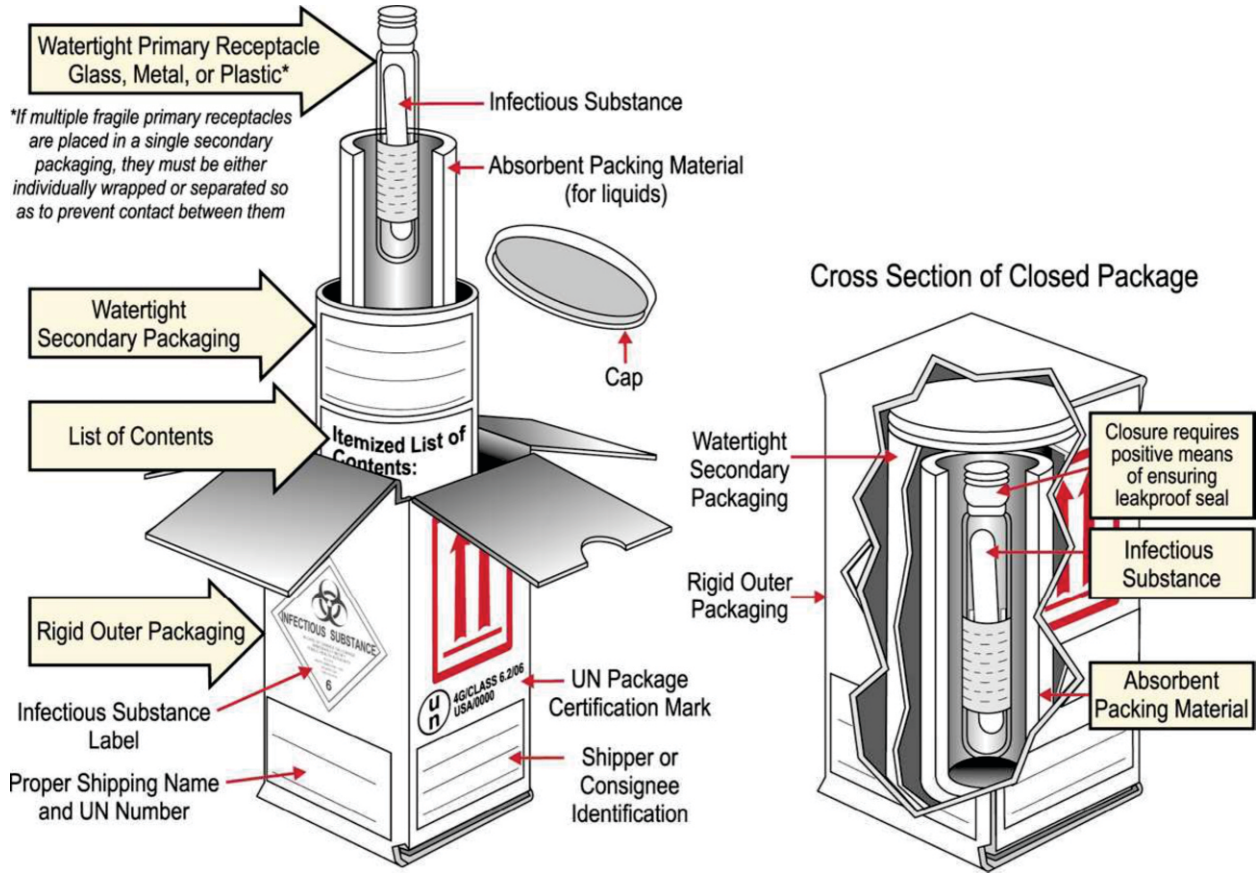
TRIPLE PACKAGING



https://ppl.app.uq.edu.au/content/2.40.11-transport-biological-materials

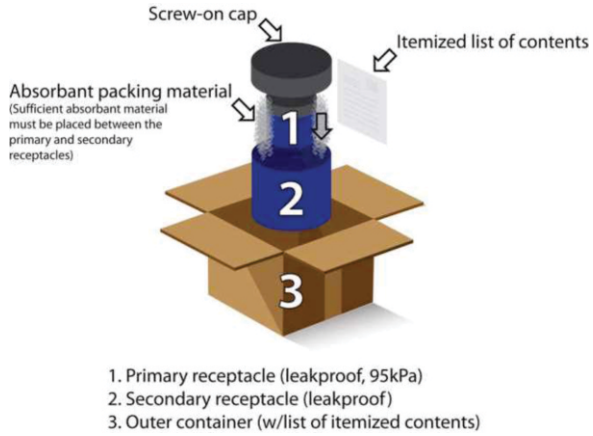
Proper packaging is a social responsibility because it protects those who handle and open the package.

TRIPLE PACKAGING (Adapted from BMBL 5th Ed)



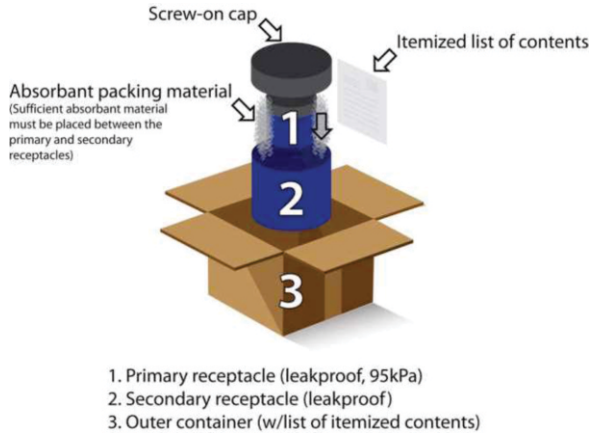
https://www.cdc.gov/vhf/ebola/healthcare-us/laboratories/specimens.html

Situation	Category	Shipping Name	UN #
Patient presents with suspected case of Hepatitis B virus and blood samples are sent.	?	?	?
A culture of *Mycobacterium tuberculosis* is sent to a reference laboratory.	?	?	?
Ebola virus has been found in bats and samples which have not been cultured are being shipped.	?	?	?
A medical professional declares that samples collected for a human drug test have only minimal likelihood of containing pathogens.	?	?	?



Put the following in order – from Step 1 to Step 13

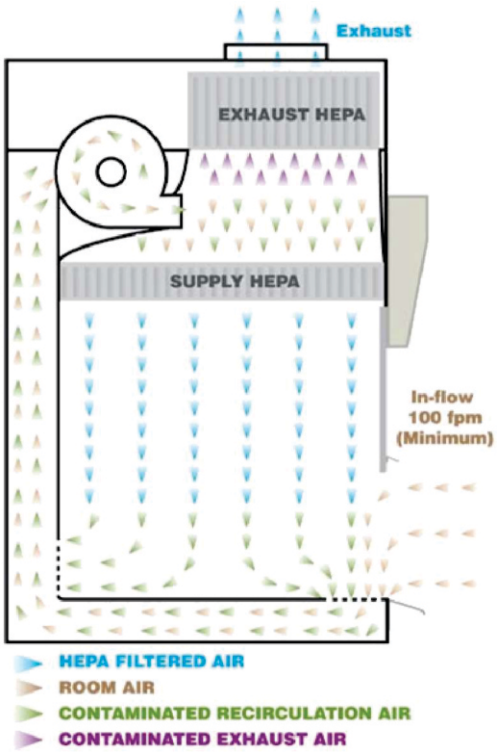
Step	Practice
	Shape outer container
	Don gloves
	Wrap cushioning material around primary container
	Close secondary container
	Place secondary container into inner lining (and outer container)
	Ensure proper labelling and marking on Category A package
	Close outer container
	Open secondary container
	Insert laboratory test instructions
	Place sample into secondary container
	Insert absorbent material
	Insert inner lining
	Doff gloves



Put the following in order – from Step 1 to Step 13.

Step	Practice
1	Shape outer container
5	Don gloves
6	Wrap cushioning material around primary container
9	Close secondary container
10	Place secondary container into inner lining (and outer container)
13	Ensure proper labelling and marking on Category A package
12	Close outer container
3	Open secondary container
11	Insert laboratory test instructions
7	Place sample into secondary container
4	Insert absorbent material
2	Insert inner lining
8	Doff gloves

PROPER BIOSAFETY CABINET TECHNIQUES



- Do not use the top of the cabinet for storage. The HEPA filter could be damaged and the airflow disrupted.
- Make sure the cabinet is level. If the cabinet base is uneven, airflow can be affected.
- Never disengage the alarm. It indicates improper airflow and reduced performance which may endanger the researcher or the experiment.
- Cabinets should be placed away from doors, windows, vents or high traffic areas to reduce air turbulence.
- Never operate a cabinet while a warning light or alarm is on.
- Perform all work using a limited number of slow movements, as quick movements disrupt the air barrier. Try to minimize entering and exiting your arms from the cabinet, but if you need to, do it directly, straight out and slowly.
- Keep all materials at least four inches inside the sash opening. The operator should be seated with shoulders level with the bottom of the sash.
- To avoid excessive movements in and out of the cabinet, discard pipettes into a tray, container or biohazard bag within the cabinet.
- All equipment which has come in contact with the biological agent should be decontaminated. The cabinet should be allowed to run for at least three minutes with no activity so that the airborne contaminants will be purged from the work area before removing equipment.
- Ensure window sash is at proper height.
- Do not use open flames inside the BSC or overcrowd or clutter the grills.

SPILL - OUSIDE AND INSIDE BIOSAFETY CABINETS (BSC)

- Don't panic. Immediately let everyone know about the spill.
- Change PPE- don't track the spill.
- Clean spill from outside in.
- Allow for appropriate contact time.
- Always log and report spill incident.

Spill Inside BSC

Leave BSC running

Use absorbent material to cover spill, pour disinfectant and allow sufficient contact time.

Remove and don new outer gloves.

Recover any sharps with forceps, collect absorbent material and discard as per SOP.

If spill has leaked beneath work tray, carefully raise tray and apply additional disinfectant.

Drain or absorb disinfectant, Be aware of sharps.

Remove and don new outer gloves.

Log and report the incident.

Spill Outside BSC

Immediately alert co-workers.

Remove booties and gloves-don new PPE.

Get spill kit.

Hang spill sign.

Establish spill parameters.

Soak towels with appropriate disinfectant.

Working outside-in, cover spill with towels.

Remove booties-don new PPE.

Allow for appropriate contact time.

Dispose of towels and waste in biohazards bag.

Mop spill area.

Remove booties and gloves-don new PPE.

Log and report the incident.

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A Laboratory Safety Training Initiative

GROUP SESSION DAY 3

QUIZ REVIEW
CULTURAL EXPECTATIONS: WORKFORCE, SAFETY OFFICERS, LEADERSHIP

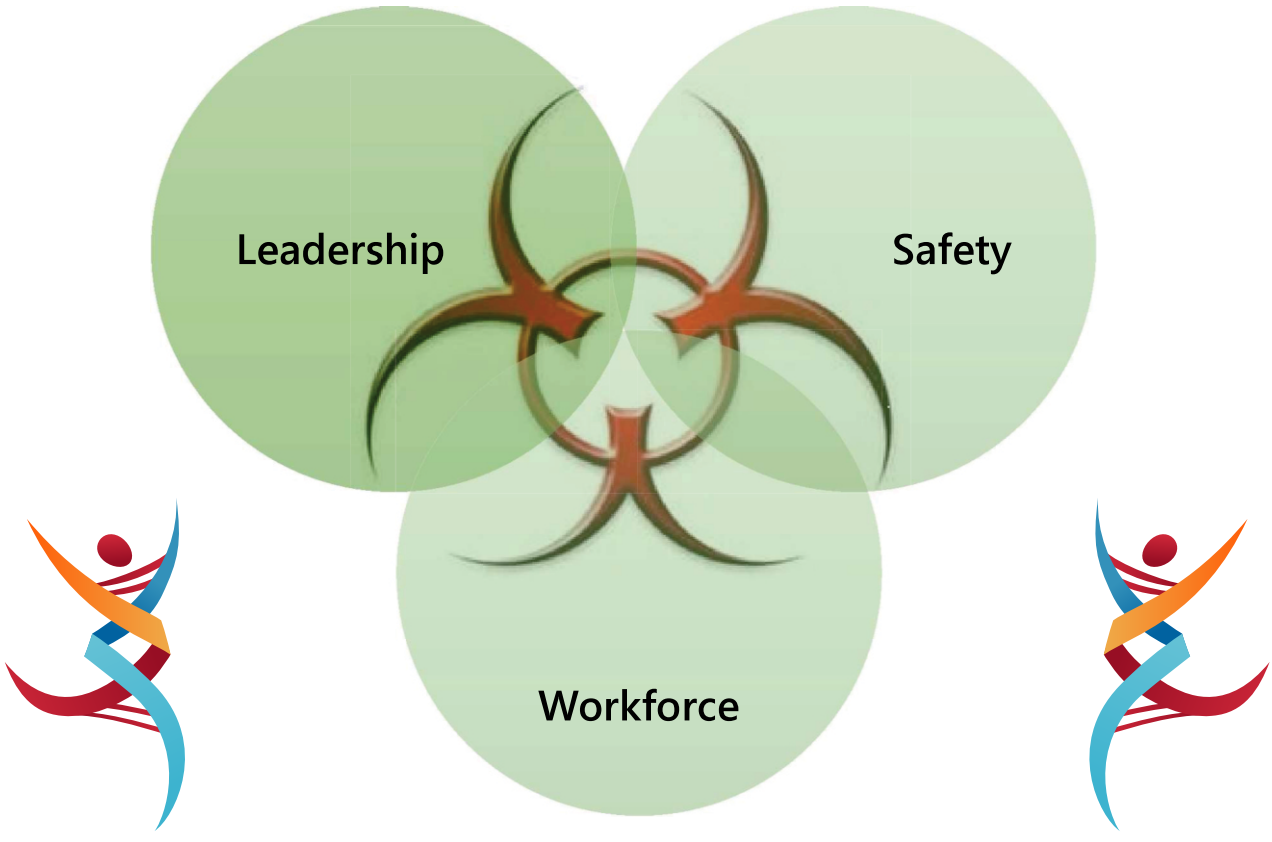
WHAT IS CULTURE?

A group of individuals, belonging to a specified unit, who share a common set of beliefs and behaviors.

A **"ONESAFE"** culture blends leadership, safety, and science.

There is never one way to do safety. Biosafety allows us to be flexible and creative-serving science rather than obstructing it.

What is the difference between a lesson learned and lesson ignored?



Laboratory Acquired Infections

Yerkes – Herpes B Virus

Boston University - *Francisella tularensis*

University of Chicago – *Yersinia pestis*

Centers for Disease Control – Rocky Moutain

Lessons in life will continue to present themselves until they are learned.

WORKFORCE EXPECTATIONS

We have to tell the workforce what we expect of them and why we expect it.

The Workforce must...

- Follow all the SOPs to the best of your ability.
- Ensure others follow all SOPs to the best of their ability.
- Report all accidents, incidents and near misses.
- Report symptoms which match the clinical presentation of agents found in the laboratory.
- Report any new medical conditions which may place you or others at increased risk.

Consider having all laboratory staff sign a behavioral expectation contract annually.

How do you define leadership?

Leadership Expectations

Prepare the workforce to the best of their ability by providing resources and training needed to work safety.

Protect the workforce from scrutiny, dismissal and abuse by recognizing issues of human error and addressing insubordinate behaviors.

Promote the workforce to the best of their ability by acknowledging the entire team for any organizational success.

Both leadership and workforce have expectations - but should the safety officer have expectations as well?

Within each organization exists individual sub-cultures: Leadership, Workforce, and Safety.

There is a difference between being together in the same organization and doing safety together.

Leadership, workforce, and safety officers must do safety together – blending efforts, supporting one another, and working together for a **"ONESAFE"** culture.

BIOSAFETY OFFICER EXPECTATIONS

The Biosafety Officer is the bridge between the organizational leaders and the workforce.

Biosafety Officers must…

- Read and understand the current biosafety guidelines (WHO).
- Accurately communicate the three levels of applied biosafety and support leadership/scientist decision.
- Facilitate safety with scientists and by scientists - not for them and toRZ([14
- Serve scientists: acknowledge there is no one way of being safe, demonstrate flexibility, and find a way to do science safely.
- Replace risky behaviors with new, alternative, safer behaviors, rather than attempting to STOP them.

There is never one way to do biosafety. Biosafety is flexible and can be based on the resources you have.

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LECTURE SESSION DAY 3

FOUR PRIMARY CONTROLS OF BIOSECURITY
LABORATORY PREPAREDNESS AND EMERGENCY RESPONSE
FINAL REVIEW
WRITTEN EXAMINATION

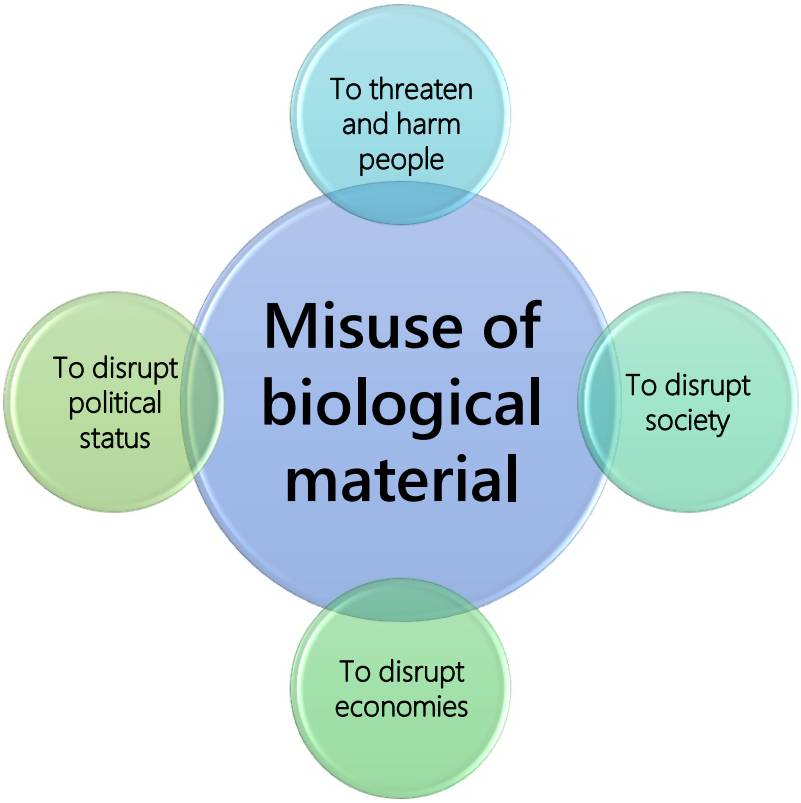
The WHO defines biosecurity as containment principles, technologies, and practices which are implemented to prevent intentional misuse or release of pathogens.

FOUR PRIMARY CONTROLS OF BIOSECURITY			
Physical	**Personnel**	**Material**	**Information**
Locks	Background Checks	Inventory	Passwords
Cameras	Reliability Programs	Transfers	Entry/Exit
PIN#s	Entry/Exit Logs	Shipping	Intellectual Property

"A collaboration involving the national security & bioscience research communities could be key to key to minimizing the challenges posed by proliferation of research findings that potential for use in bioterrorism"

DUAL USE RESEARCH OF CONCERN

1. Enhance harmful consequences of agent.
2. Disrupt immunity or effectiveness of immunization.
3. Confer resistance to useful prophylactic or therapeutic interventions.
4. Facilitate ability to invade detection.
5. Increase stability or transmissibility.
6. Alter host range.
7. Generate novel agent or reconstitute extinct agent.



A technician from the Microbiology lab requested the lab manager for an ATCC strain of *E. coli* O157, saying that her friend needed the strain for research activities. The lab manager refused to do so. The lab technician became angry and said, "What if I give the bacterial culture to my friend without permission? Then no one would be aware of this activity."

THREE LEVELS OF EMERGENCY EVACUATION

RED EVACUATION	○ Occurs immediately when life is at risk. ○ Laboratory staff are asked to immediately evacuate the laboratory using whatever means necessary. ○ **Containment is NOT maintained – risk to life is substantial.**
YELLOW EVACUATION	○ Occurs immediately when there is an unconscious or injured staff or obstructed exit preventing the staff from adhering to normal evacuation procedures. ○ Laboratory staff are asked to immediately evacuate using modified decontamination processes. ○ **Containment is maintained through modified evacuation processes.**
GREEN EVACUATION	○ Occurs immediately when a non-life threatening event happens (i.e., alarms, smoke, cabinet failure). ○ Laboratory staff are asked to secure their work (pathogens and animals), exit the laboratory using normal doffing processes, log and report incident. ○ **Containment is maintained through normal evacuation processes.**

Not every evacuation is the same – and will require laboratory staff to be prepared to evacuate the laboratory according to the threat they are directly experiencing.

There is an earthquake....

What kind of evacuation would you order?

(1)
A 10 second shake –
cracks are noticed on walls.

(2)
A 10 seconds shake –
everything seems normal.

(3)
A 10 second shake –
equipment has fallen over.

- -

Failure to prepare – is preparing to fail. If a red evacuation was needed, what would you need to be successful? Think about your laboratory staff and environment.

RESPONSE TO NEEDLE STICKS, CUTS AND ANIMAL BITES

1. • Expose the wound
2. • Express the wound
3. • Flush the wound for 5 minutes
4. • Cover the wound
5. • Doff normally
6. • Report for medical assistance
7. • Log and report the incident

Time is critical!

Make sure to immediately minimize the risk by flushing the wound – thereby reducing the exposure.

Always log and report the incident!

RESPONSE TO UNCONSCIOUS INDIVIDUAL

Unconscious Individual

- Call for Help
- Evacuate
- Decontaminate

Whenever we see someone in a laboratory who may be unconscious – the first step MUST always be to notify those outside the laboratory environment.

What would you do if you had a defibrillator inside or near the laboratory?

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LABORATORY SESSION
DAY 3

EMERGENCY RESPONSE
OBSERVATIONAL EVALUATION

Place a number by each piece of PPE – indicating which item you would <u>don</u> from the beginning (first) to the end (last).

Place a number by each piece of PPE – indicating which item you would <u>doff</u> from the beginning (first) to the end (last).

"BEAKERS" FOR LIFE

1. Pinch with index finger and thumb.
2. Give the bird.
3. Beak.
4. Remove other glove.
5. Shoot the bird.

Proper Bootie Dance

1. Left hand – right foot – behind back (butt kick).
2. Step over the line.
3. Left hand – left foot – behind back (butt kick).
4. Step over the line

14,400 illness opportunities

If you used 6 pairs of gloves a day, worked 5 days a week, for 48 weeks a year, over the next 10 years – you would remove your gloves 14,400 times.

BEHAVIORAL-BASED IMPROVEMENT SOLUTIONS
Changing behavior. One step at a time.

Remove your gloves properly.

View the Beak Method Video – developed by Sean Kaufman and taught by Emory University Healthcare. - https://youtu.be/BOAb_cy3HxM.

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BEAK METHOD
(GLOVE REMOVAL)

Excellent

Passed

Did Not Pass

Participant Name: _____

BOOTIE DANCE
(BOOTIE REMOVAL)

Excellent

Passed

Did Not Pass

Participant Name: _____

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- The concept and material of the manual is referred by Sean G. Kaufman, Safer behaviors (SB)

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Let's do safety together.

Safer Behaviors
Connecting plans and outcomes

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Connecting plans and outcomes

BioPrism
A Laboratory Safety Training Initiative

Let's do safety together.

PAKISTAN BIOLOGICAL SAFETY ASSOCIATION

A biosafety training program focusing on behavior and the nurturing of all those serving in and supporting biological laboratories. The name is based on the concept that a prism splits one ray of ight into different colors. Similarly, as you qualify this program, you will serve as a ray of light expected to impact seven others who will further spread the message of biosafety throughout Pakistan.

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