Personal Protective Equipment

Nazlina Ibrahim & Clarence Ko

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Learning Outcome

At the end of this module, participants will be able to:

- understand why PPE is one of the key controls to mitigate biorisk
- understand the use and principle of different PPE with various advantages and limitations
- Confidently select suitable PPEs determined through risk assessment, based on the tasks/activities
- demonstrate the use of PPEs (donning & doffing) correctly

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Module Outline

- PPE is one of the key controls to mitigate biorisks ("Hierarchy of Controls")
- Types/kinds of PPE with various advantages and limitations
- How to select PPE and what factors should be considered
- Selected PPEs donning and doffing

Personal Protective Equipment

Definition:

Specialized clothing or equipment, worn by an employee for protection against infectious or other hazardous materials/objects

~OSHA 1994~

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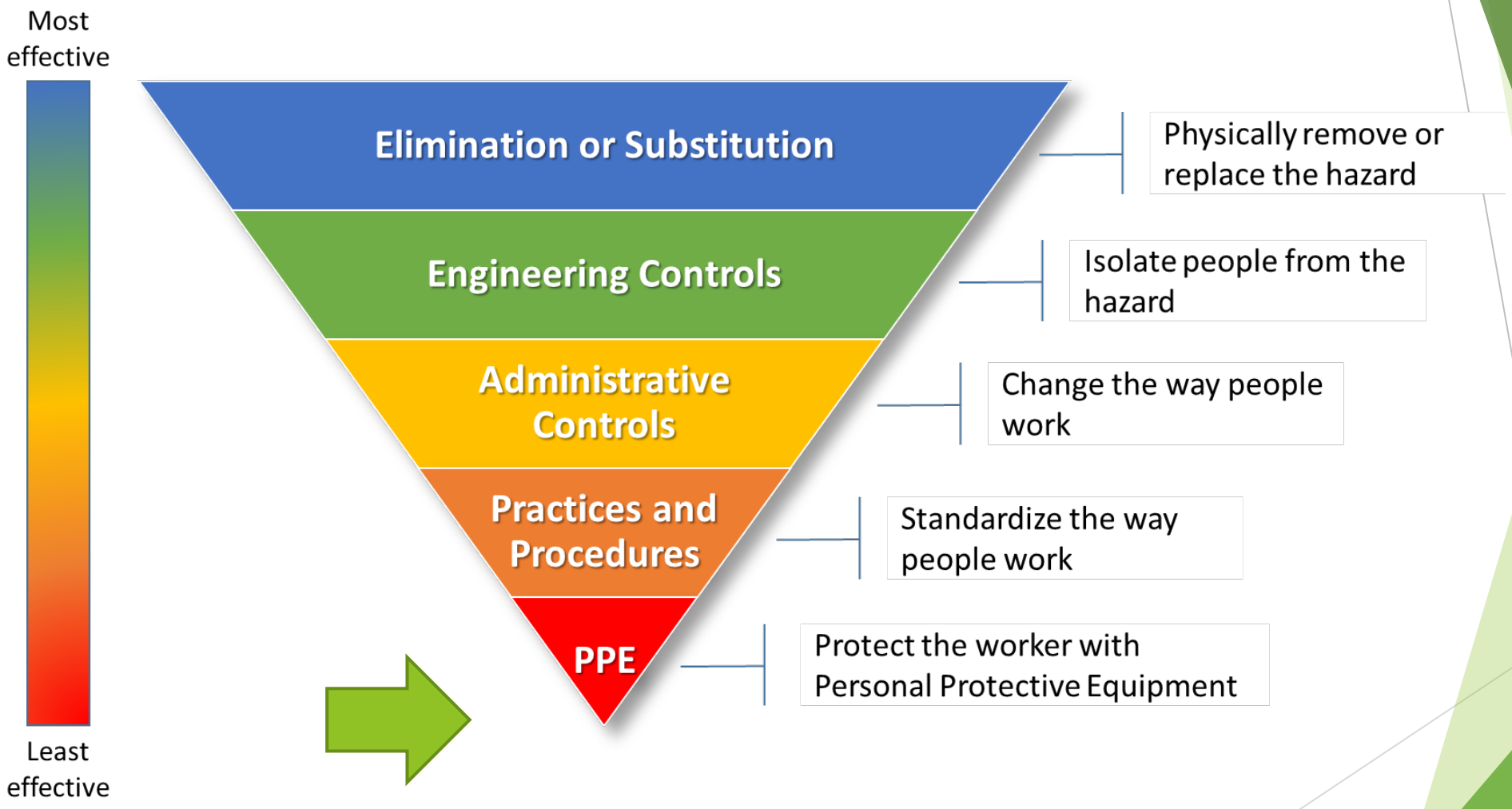
Hierarchy of Controls



PPE AS FINAL LINE OF DEFENCE AGAINST HAZARDS

- It is important that engineering and work practice controls to be in place to reduce and eliminate hazards
- PPE is the least effective method of protecting workers and is considered the last line of defense against hazards
- Appropriate PPEs will protect individuals when other controls fail or are unable to eliminate hazards
- Thus, if the PPE is damaged or fails, individuals will be exposed to the hazard

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Advantages & Disadvantages of PPEs

Advantages	Disadvantages
Low cost	Protects the user only
Easy to implement/use	Dependent on proper use
	Source of contamination (e.g. wearing a lab coat outside of the lab) Increase waste
	Single use: must be cleaned if reused
	Interferes with dexterity (gloves), vision (goggles), breathing (mask), movement (lab coat), etc.

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Importance of PPE

Answer these questions from the video:

1. How does donning on a lab coat protect the person in the video?

2. List 3 key points to be remembered in this video

3. What should you do if you do not know how to use a fire extinguisher to put out the fire on the burning lab coat?

SCAN ME

https://youtu.be/OIzFCma1KHk?list=PLjWdcP9rDY-8IJaCJKdaNB-kqbOwQpnIt

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Types of PPE

Activity: Duration - 10 minutes

- List relevant PPE when working with biological materials suitable to protect the
  - Eye
  - Face
  - Head
  - Feet
  - Hands/arms
  - Bodies

Types of PPE

- **Eyes:** goggles, safety glasses and face shields
- **Face:** shields, mask, respirator
- **Head:** hard hats, head cover
- **Feet:** safety shoes, covered shoes, shoe cover
- **Hands/Arms:** gloves and sleeves
- **Body:** lab coats, coveralls, body suites, vests, aprons

https://www.freepik.com/vectors/hand-gloves

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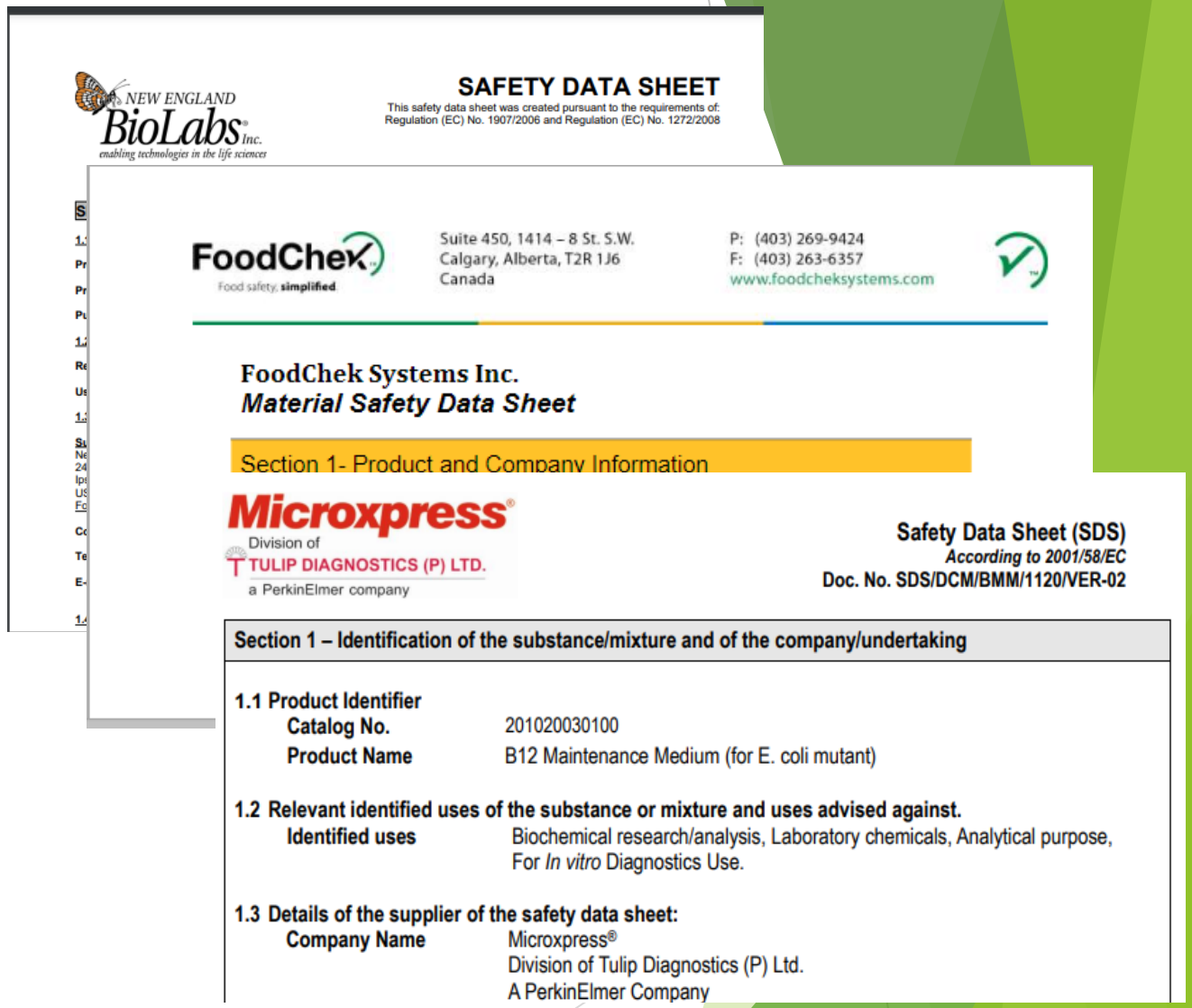
HOW TO SELECT PPE AND WHAT FACTORS SHOULD BE CONSIDERED?

- Make risk evaluations and determine which PPE to use to reduce risks
- Information on materials (biological and chemical) can be found in the **Pathogen Safety Data Sheets (PSDS)** or **Safety Data Sheet (SDS)**
- Information on proper handling and selection of suitable PPEs for the materials being handled can also be found in **SDS**



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SAFETY DATA SHEET
This safety data sheet was created pursuant to the requirements of: Regulation (EC) No. 1907/2006 and Regulation (EC) No. 1272/2008

FoodChek
Food safety, simplified

Suite 450, 1414 – 8 St. S.W.
Calgary, Alberta, T2R 1J6
Canada

P: (403) 269-9424
F: (403) 263-6357
www.foodcheksystems.com

FoodChek Systems Inc.
Material Safety Data Sheet

Section 1- Product and Company Information

Microxpress®
Division of
TULIP DIAGNOSTICS (P) LTD.
a PerkinElmer company

Safety Data Sheet (SDS)
According to 2001/58/EC
Doc. No. SDS/DCM/BMM/1120/VER-02

Section 1 – Identification of the substance/mixture and of the company/undertaking

1.1 Product Identifier
Catalog No. 201020030100
Product Name B12 Maintenance Medium (for E. coli mutant)

1.2 Relevant identified uses of the substance or mixture and uses advised against.
Identified uses Biochemical research/analysis, Laboratory chemicals, Analytical purpose, For *In vitro* Diagnostics Use.

1.3 Details of the supplier of the safety data sheet:
Company Name Microxpress®
Division of Tulip Diagnostics (P) Ltd.
A PerkinElmer Company

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Pathogen Safety Data Sheet (Template)

Section I - Infectious Agent

Name
Agent type: Bacteria, Fungi, Virus, Parasite, or Prion?
Taxonomy:

Synonym / Cross Reference
Pathogenicity / Toxicity
Epidemiology
Host Range
Natural Host(s):
Other Host(s):
Infectious Dose
Incubation Period

Section II - Hazard Identification
Pathogenicity / Toxicity
Predisposing factors:
Communicability.
Epidemiology
Host Range
Natural Host(s):Other Host(s): .
Infectious Dose
Incubation Period

Section III - Dissemination

Reservoir
Zoonosis / Reverse Zoonosis
Vectors

Section IV - Stability and Viability

Drug Susceptibility
Drug Resistance
Susceptibility to Disinfectants
Physical Inactivation,
Survival Outside Host

Section V - First Aid and Medical

Surveillance
First Aid / Treatment
Immunization
Prophylaxis

Section VI - Laboratory Hazards

Laboratory-Acquired Infections
Sources / Specimens
Primary Hazards
Special Hazards
Risk Group Classification
Containment Requirements
Protective Clothing

Section VIII - Handling and Storage
Spills
Disposal
Storage

Section IX - Regulatory and Other Information

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Pathogen Safety Data Sheet

Example：*Candida albicans* https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/candida-albicans-pathogen-safety-data-sheet.html

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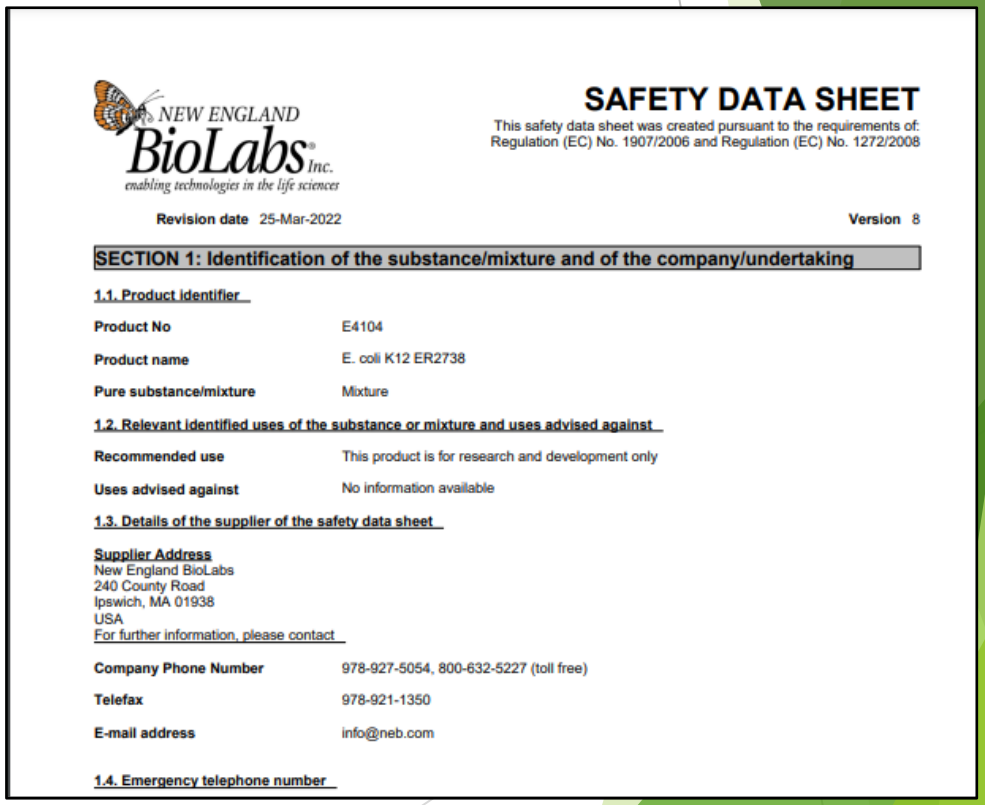
Safety Data Sheet

Example:

- https://www.neb.com/-/media/c1efe3a372d04fff98f04b304112425f.pdf

Provides Information on:

- Risk group/classification
- Hazard
- Toxicity
- Handling and Storage
- First Aid Measures
- Precaution and PPE
- Emergency release/Spills
- Containment and cleaning up
- Waste treatment methods
- Persistence and degradability



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Revision date 25-Mar-2022 **Version** 8

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product No	E4104
Product name	E. coli K12 ER2738
Pure substance/mixture	Mixture

1.2. Relevant identified uses of the substance or mixture and uses advised against

Recommended use	This product is for research and development only
Uses advised against	No information available

1.3. Details of the supplier of the safety data sheet

Supplier Address
New England BioLabs
240 County Road
Ipswich, MA 01938
USA
For further information, please contact

Company Phone Number	978-927-5054, 800-632-5227 (toll free)
Telefax	978-921-1350
E-mail address	info@neb.com

1.4. Emergency telephone number

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CLASS ACTIVITY: FINDING SDS

Individual task: 15 minutes

- List one biological material and one chemical that you will be using or know is being used regularly in the laboratory
- Find, from the internet, the PSDS/SDS for both items
- Determine the hazard(s) and risk(s)
- List the suitable PPE to be used to handle the material

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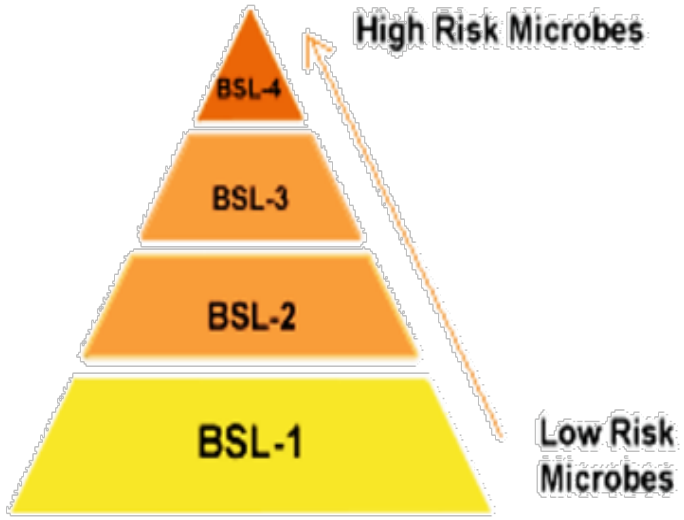
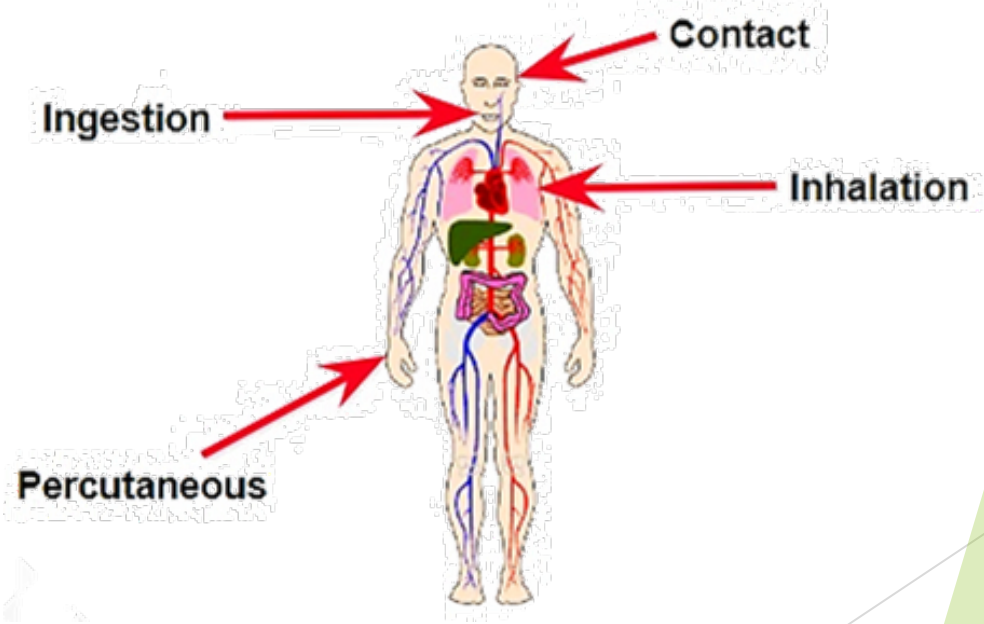
HOW TO SELECT PPE AND WHAT FACTORS SHOULD BE CONSIDERED?

- Risk of infectious material: Requires risk assessment
- Route of transmission/entry: aerosol/droplet/inhalation/ingestion/contact





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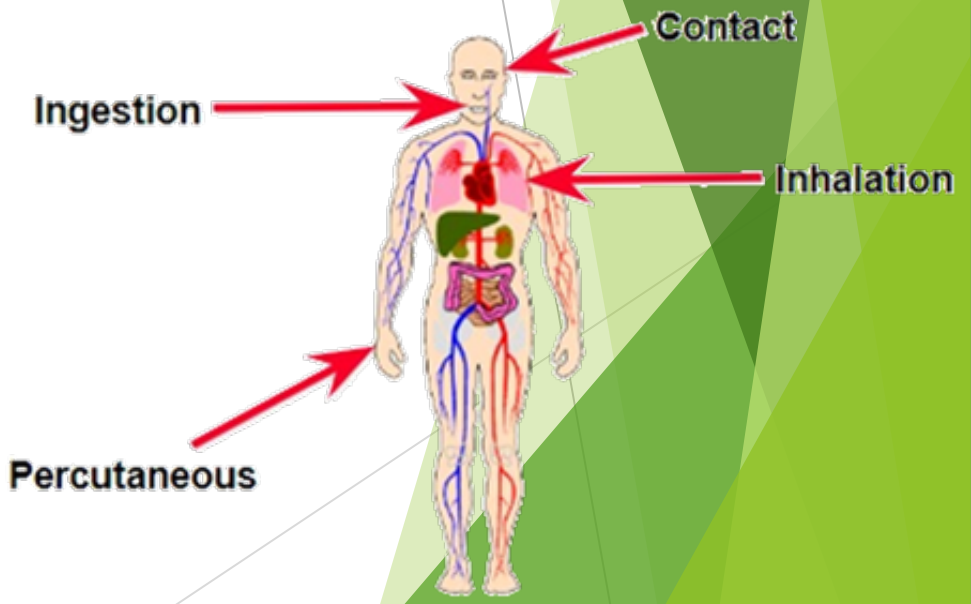
PPE HAZARD ASSESSMENT

- Assess the task, experiment, or exposure
- Exposure of hazards to specific body parts: head, face, eye, inner ear, respiratory system, hand and arms, upper and lower body, and feet
- Determine the PPE requirement(s)



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GLOVES

(PPE FOR HANDS)

TYPES OF GLOVES

Cloth gloves:

Resist freezing temperature especially when handling liquid nitrogen (-80^{o}C)

Vinyl, nitrile, and latex gloves:

Protect hands from toxic chemicals/infectious materials

Rubber gloves:

Protect from electrical shocks and infectious material. Caution – Can cause allergic reactions from the natural rubber latex or synthetic non-latex materials, such as vinyl, nitrile, and neoprene (polymers and copolymers of chloroprene)

Source: https://www.freepik.com/premium-photo/pouring-liquid-nitrogen-with-protective-glove_4801007

THE WHYS AND DOS IN USING GLOVES

- Why use gloves?
  - Protect individuals from direct contact with infectious materials
  - Reduce the risk of infectious materials from being disseminated to the environment and transmission between individuals within and outside the laboratory
- Gloves should only be worn in and not outside the laboratory or for housekeeping in healthcare facilities
- Single-use only
- Choose the most suitable type according to the purpose
- Choose the most suitable type for you (Not allergenic)
- Hand hygiene -GLWP

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WHEN TO REMOVE GLOVES

- When gloves are damaged (or non-integrity suspected)
- After in contact with blood, other body fluids, non-intact skin, and mucous membranes, and at the end of the procedure
- After being in contact with patients and their surroundings/infectious materials, or contaminated parts of their bodies
- when indications show the need for hand hygiene

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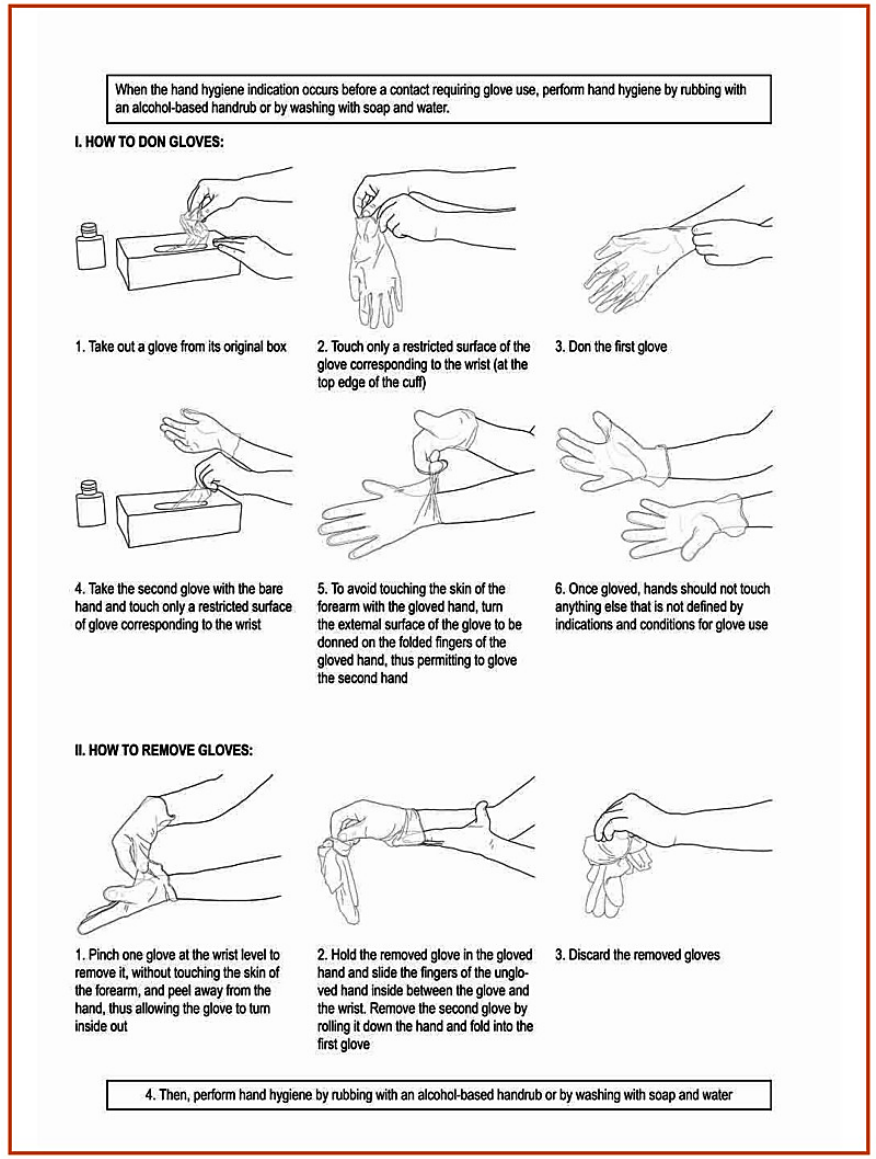
HAND HYGIENE



When the hand hygiene indication occurs before a contact requiring glove use, perform hand hygiene by rubbing with an alcohol-based handrub or by washing with soap and water.

I. HOW TO DON GLOVES:

1. Take out a glove from its original box
2. Touch only a restricted surface of the glove corresponding to the wrist (at the top edge of the cuff)
3. Don the first glove
4. Take the second glove with the bare hand and touch only a restricted surface of glove corresponding to the wrist
5. To avoid touching the skin of the forearm with the gloved hand, turn the external surface of the glove to be donned on the folded fingers of the gloved hand, thus permitting to glove the second hand
6. Once gloved, hands should not touch anything else that is not defined by indications and conditions for glove use

II. HOW TO REMOVE GLOVES:

1. Pinch one glove at the wrist level to remove it, without touching the skin of the forearm, and peel away from the hand, thus allowing the glove to turn inside out
2. Hold the removed glove in the gloved hand and slide the fingers of the unglo-ved hand inside between the glove and the wrist. Remove the second glove by rolling it down the hand and fold into the first glove
3. Discard the removed gloves

4. Then, perform hand hygiene by rubbing with an alcohol-based handrub or by washing with soap and water

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Activity:

Video: Gloves Gone Wild

Watch the video and list the do's and don_ts when wearing gloves

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Gloves Gone Wild (UCB) (1:52 min)

https://www.youtube.com/watch?v=oSUP7fIIc98

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REMOVING GLOVES (THE BEAKING METHOD)

- Gloves protect hands and skin from contact with hazardous materials
- However, exposure to hazardous materials can occur during glove removal and disposal
- **Activity:** Follow the steps in the video below to properly remove gloves used in the laboratory
- https://www.youtube.com/watch?v=dFdZxAQEx3Q (2.05 minutes)

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PPE FOR THE RESPIRATORY SYSTEM

MASKS AND RESPIRATORS

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INHALATION HAZARDS

- Inhalation is one of the principal routes for harmful materials can enter the body
- Exposure to harmful concentrations of airborne hazardous material can result in undesirable health issues

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TYPES AND SPECIFICATIONS OF PPE FOR FACIAL PROTECTION

- **FFP3** (European standard) respirators filter 99% of particles. **FFP2** respirators are specified to filter 94% of particles. All respirators need to be fitted to the wearer before use
- The **N99** (American standard) respirator is an alternative to the **FFP3** and filters 99% of particles
- An **N95** respirator is specified to filter 95% of particles and is a close equivalent of **FFP2**
- The **Type IIR** (European Standard) fluid-resistant surgical mask is the "regular" surgical mask often used in clinical settings
- The **Level 2 (American standard)** fluid-resistant surgical mask is equivalent to the Type IIR
- **Goggles or visors** can help avoid eye contamination with respiratory droplets

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MASKS VS RESPIRATORS: WHAT'S THE DIFFERENCE?

Type IIR/Level 2 Fluid Resistant Mask

Respirators (N95 non-valved & FFP3 valved)

Loose fitting, covers nose and mouth	**Tight fitting**, creates a facial seal
One-way protection – captures bodily fluid e.g. cough/sneeze leaving the wearer of the mask	**Non-valved** provides **two-way protection** – filters inflow and outflow of air
"R" denotes that the mask is fluid resistant	Respirators may have an additional letter after the number e.g. FFP3**R,** FFP3**D** **"R"** = Reusable **"NR"** = Non-reusable **"D"** = Has passed the dolomite dust clogging test, meaning that it can be used for >8 hours depending on the surrounding conditions.

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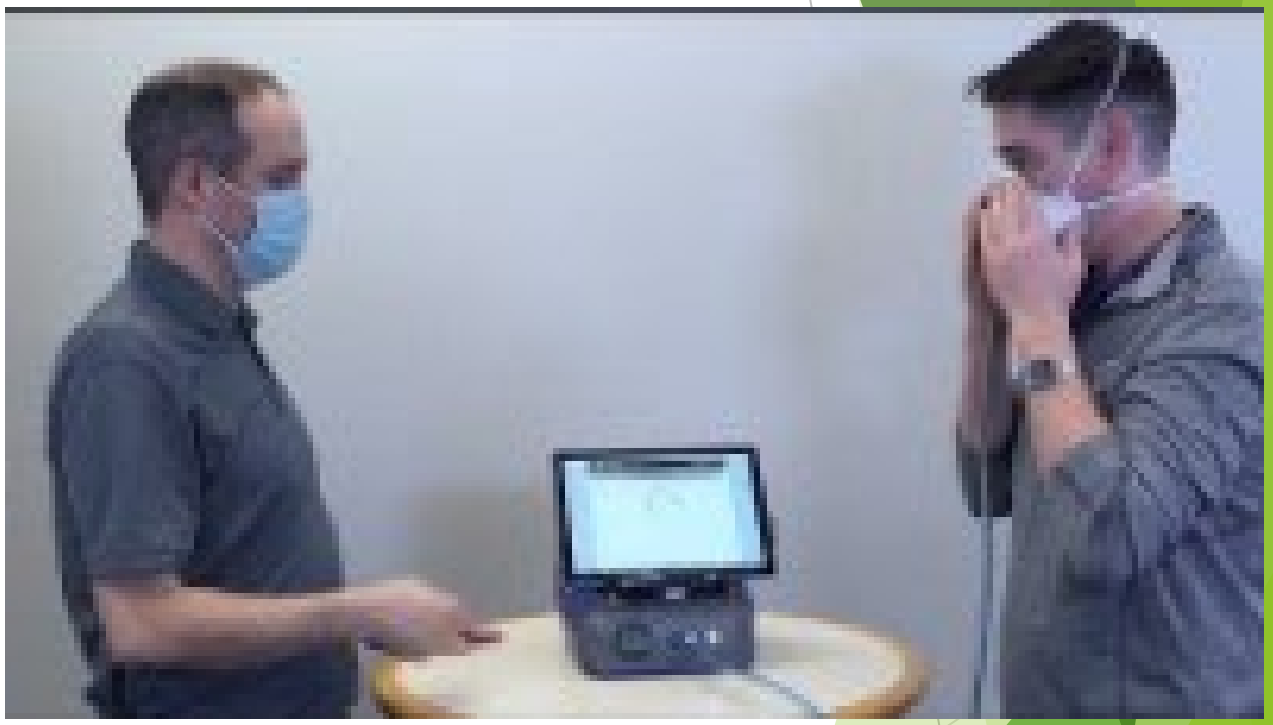
REMEMBER TO DO THE FIT TEST FOR RESPIRATOR (DEMONSTRATION)

- Must be done at least once a year or when there are:
  - changes in brand, model, or size
  - Weight gains or losses of >5kg
  - Surgeries done that changed facial features



https://www.youtube.com/watch?v=YflxRI2QDw8
(3.10 minutes)

SCAN ME

FITTING A RESPIRATOR

A medical staff performing the qualitative fit test during the COVID-19 pandemic. A bitter test agent is sprayed into the hood using a nebulizer. If the subject does not taste the nebulized test solution in each of the seven repeated tests, the fit is deemed acceptable. This test can be applied to both disposable and reusable masks.

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PROPER METHOD TO DON A RESPIRATOR

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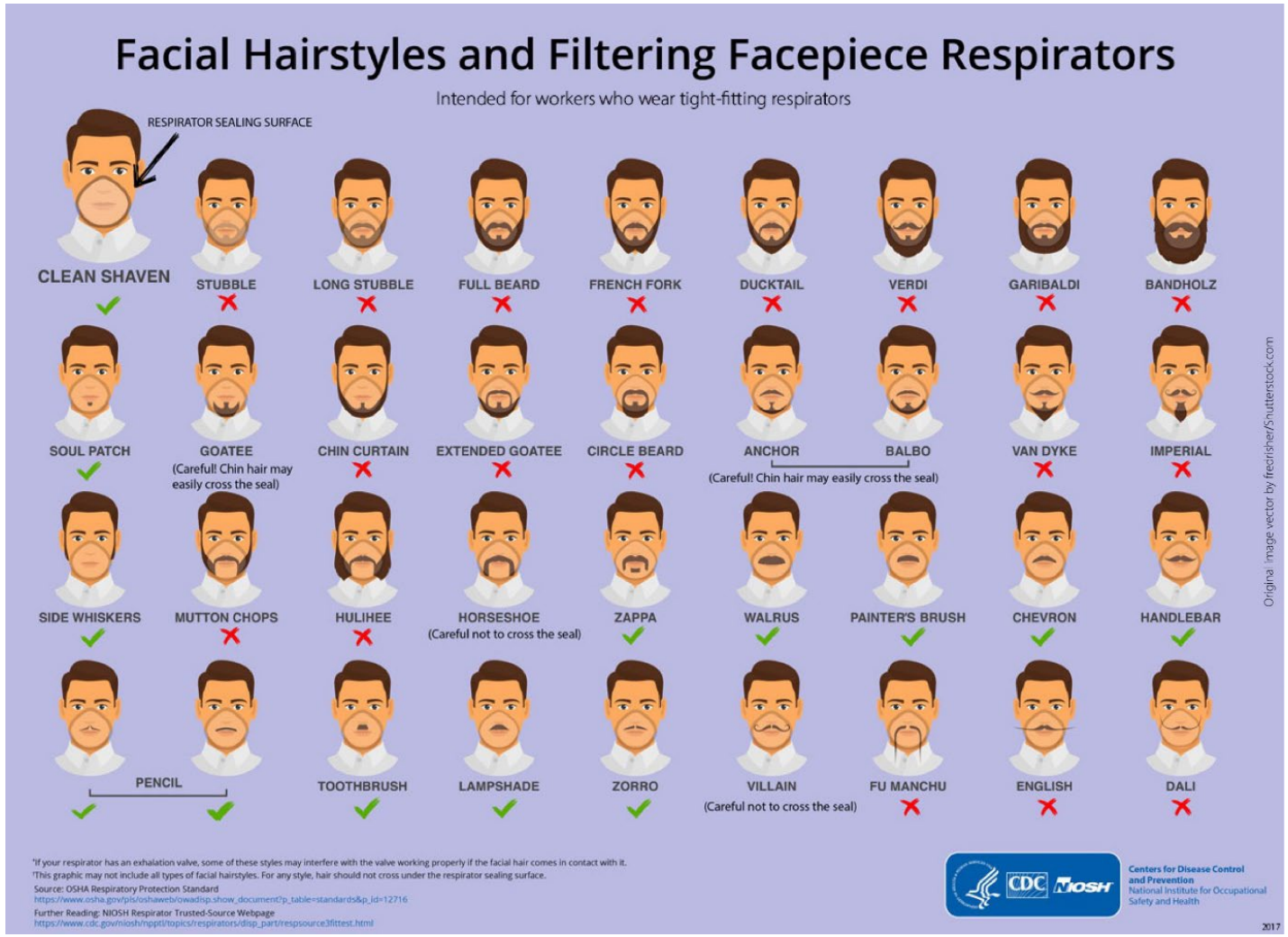
CHALLENGES WHEN USING THE RESPIRATOR



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CHALLENGES WHEN USING A RESPIRATOR

- Scarf/Tudung
- Respirator must be fitted securely on the skin of the face not on the cloth or other materials covering the skin

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Labcoats

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LAB COAT

- Used in procedures where there is potential for large splashes and spills of harmful liquid
- To protect street clothes from being contaminated with toxic solid materials
- Lab coats prevent small splashes from contacting skin and street clothes and not much more

GOWNS OR APRONS

- Purpose of use
- Material:
  - Natural or man-made
  - Reusable or disposable
  - Resistant to penetration by fluids
- Clean or sterile

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Coverall & Full Body Suits

- Laboratory coat, Tyvek suit, or scrubs must be worn, appropriately, when handling animals
- Full body protective clothing may be required when handling biosafety level 2 and level 3 organisms, to protect from exposure

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PPE IN THE FIELD (OPTIONAL)

- **Hats** – as needed
- **Boots** – Steel Toes (optional)
- **Eye Wear** – Safety Glasses as Needed
- **Prescription Glasses** – YES
- **Safety Vests** - as needed

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NOT RECOMMENDED/TO AVOID

- Sneakers
- Contact lens
- Hard Hat (Not required in most cases)

CLASS DISCUSSION

- What activities in your research or laboratories require PPEs?
- List the appropriate PPEs you need to employ in your work and/or laboratory
- Let's discuss!

KEY MESSAGES

- Understand why PPEs are one of the key controls in the mitigation of biorisks. However, it is only the last level in the “Hierarchy of Controls”
- There are many types/kinds of PPE, each with its own advantages and limitations
- The selection of PPE is based on several factors, most importantly on a thorough risk assessment
- It is important to plan the order of donning and doffing PPEs and follow the plan diligently to reduce risks

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Thank you

Any questions?