INFECTION PREVENTION AND CONTROL

Standard Precautions:

Personal Protective Equipment

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PERSONAL PROTECTIVE EQUIPMENT (PPE)

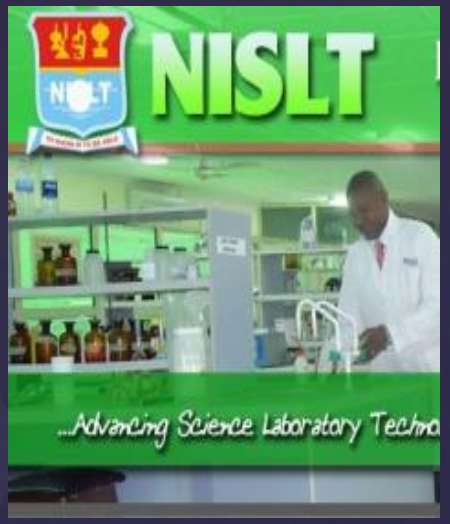
WHAT IS PERSONAL PROTECTIVE EQUIPMENT (PPE) ?

- 'PPE' is equipment that will protect the user against health or safety risks at work.

- PPE' can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses. It also includes respiratory protective equipment (RPE)

- . PPE' is specialized clothing worn by Laboratory or healthcare personnel (HCP) for protection against infectious materials.

PERSONAL PROTECTIVE EQUIPMENT (PPE)



Gloves, boots, encapsulating suits, respirators, hard hats, ear plugs, eye goggles/safety glasses, safety shoes with steel toe and/or metatarsal protection, gowns, face shields, etc.

CONTROL AND PREVENTION OF VIRUS TRANSMISSION

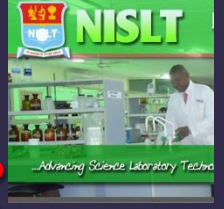
- To prevent virus transmission in laboratories, health care settings and elsewhere, procedures and protocols referred to as "**CONTROLS**" should be applied.

- The CONTROLS are (in decreasing order of IPC effectiveness):
  - administrative controls,
  - environmental and engineering controls, and
  - personal protective equipment. (**Visible control)**

CONTROL APPLICATIONS

- PPE is the most **visible control** used to prevent transmission viruses.
- PPE **must be used** in conjunction with administrative and engineering controls (such as facilities barrier and work organization, water and sanitation, hand hygiene infrastructure, waste management and ventilation).

STANDARD PRECAUTIONS:

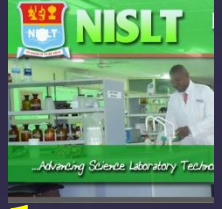


- Standard precautions are the basic IPC measures, which should be used, as a minimum, in the care of all workers and patients.

Table 1 Standard Precautions

	Standard precautions	Key components	WHO reference documents
1	Hand hygiene	Use alcohol-based hand rub Wash with soap and water	*Hand hygiene in health care in the context of filovirus disease outbreak response*
2	Personal protective equipment based on point-of-care risk assessment	Select appropriate PPE Remove PPE safely	The present document.
3	Prevention of needle-stick or sharps injuries	Never reuse syringes, needles and other similar equipment Dispose of syringes, needles and sharp objects at the point of care in appropriate, puncture resistant containers	Best practices for injections and related procedures toolkit
4	Safe waste management	Develop a management plan for health care waste Disinfect materials with 0.5% chlorine solution Incinerate or autoclave health care waste, then dispose of in pits	Ebola virus disease: key questions and answers concerning health care waste
5	Cleaning, disinfection and sterilization, where applicable, of equipment and linen used in patient care	Clean laundry and surfaces at least once a day Clean and disinfect areas contaminated with body fluids with 0.5% chlorine solution	Ebola virus disease: key questions and answers concerning water, hygiene and sanitation
6	Cleaning and disinfection of the environment		

Source: World Health Organization 2016.
https://www.ncbi.nlm.nih.gov/books/NBK401171/table/ch4.t1/?report=objectonly



- The guidelines in Table 1, recognize that Laboratory and health workers must be protected at all times, not only because they are needed to deliver accurate results, care and save lives during epidemics, but because they may unwittingly transmit pathogens if they are not properly protected.

SAFETY PRACTICES

- The practices of laboratory and health workers are equally important in preventing infections.

SAFETY AND WELL-BEING OF LABORATORY AND HEALTH WORKERS

- Safeguarding the health and well-being of Laboratory/health workers in the workplace, including providing facilities for **hand hygiene** and **appropriate PPE**, is a priority, and is the responsibility of policy-makers, employers, and managers.

SAFETY AND WELL-BEING OF LABORATORY/ HEALTH WORKERS Cont.

- A risk assessment of the workplace should be carried out by competent IPC experts appointed by the employer.
  - All Laboratory and health workers at risk should be provided with adequate, effective and sustainable protective measures commensurate with the risk.
  - Laboratory and Health workers should be informed of the risks they may face, and the mitigating effects of PPE when used consistently and correctly. Compliance with all control measures is the responsibility of the health worker.

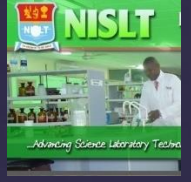
Safety and well-being of Laboratory/ health workers Cont.

- Policy-makers and managers need to consider issues such as climate conditions and cultural norms, to ensure that protection measures are adopted and to maximize compliance.
- The recommended PPE should be available and accessible to workers. Laboratory/Health workers need to be adequately trained in the use of PPE; refresher training should be available.
- All health workers with symptoms of EVD should seek rapid medical attention. They should avoid working, in order to avoid transmitting infection to colleagues. Employers are responsible for notifying the labour inspectorate of cases of occupational diseases.

Why is PPE important?

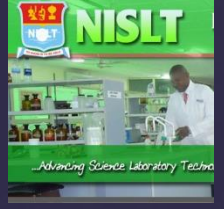
- Making the workplace safe includes;
  - providing instructions,
  - procedures,
  - training and supervision to encourage people to work safely and responsibly.

Why is PPE important?



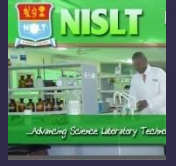
- Even where engineering controls and safe systems of work have been applied, some hazards might remain. These include injuries to:
  - THE EYES, Example: from flying particles or splashes of corrosive liquids
  - THE LUNGS, Example: from breathing in contaminated air
  - THE HEAD AND FEET, Example: from falling materials
  - THE SKIN, Example: from contact with corrosive materials
  - THE BODY, Example: from extremes of heat or cold
- PPE is needed in these cases to reduce the risk

SELECTION OF PPE



- PPE must be correctly selected and used in a safe manner; safety concerns are especially important when PPE is put on, removed or decontaminated.

SELECTION AND USE



- Choose equipment that suits the user – consider the size, fit and weight of the PPE. If the users help choose it, they will be more likely to use it
- If more than one item of PPE is worn at the same time, make sure they can be used together, Example: wearing safety glasses may disturb the seal of a respirator, causing air leaks.
- Instruct and train people how to use it, Example: train people to remove gloves without contaminating their skin. Tell them why it is needed, when to use it and what its limitations are

FACTORS TO CONSIDER IN SELECTION OF PPE

- Before choosing any **Personal Protective Equipment (PPE),** the employer (or self-employed person) must ensure that an **Assessment** is made to determine whether it is suitable.

THE ASSESSMENT IN SELECTION OF PPE

- The assessment to be made before selecting an item of PPE must include:
  - Identify the material and or physical hazards
  - Routes of entry (inhalation, absorption, ingestion and contact
  - Concentration of the material (how much)
  - Oxygen content in the atmosphere
  - What form is the material in (gases, vapors, solids or liquids)
  - Location of involved area (indoors, outdoors, enclosed, well ventilated)
  - Environmental conditions (hot, cold, windy, rainy)

Other advice on PPE

Never allow exemptions from wearing PPE for those jobs that ‘only take a few minutes'

- Check with your supplier on what PPE is appropriate – explain the job to them
- If in doubt, seek further advice from a specialist adviser

Maintenance of PPE

- PPE must be properly looked after and stored when not in use,
- Example: in a dry, clean cupboard.
  - If it is reusable it must be cleaned and kept in good condition.

Think about:

- using the right replacement parts which match the original, Example: respirator filters
- keeping replacement PPE available
- who is responsible for maintenance and how it is to be done
- having a supply of appropriate disposable suits which are useful for dirty jobs where laundry costs are high, eg for visitors who need protective clothing

- Employees must make proper use of PPE and report its loss or destruction or any fault in it.

Monitor and review

- Check regularly that PPE is used.
  - When not used, find out why not (Sanction)
- Safety signs can be a useful reminder that PPE should be worn
- Take note of any changes in equipment, materials and methods – you may need to update what you provide

Types of PPE

- Eyes Hazards
- Head and neck Hazards
- Lungs Hazards
- body Hazards
  - Hands and arms Hazards
  - Ears Hazards
  - Feet and legs Hazards
- Whole body Hazards

Eyes

- **Hazards**
  - Chemical or metal splash, dust, projectiles, gas and vapour, radiation
- **Options**
  - Safety spectacles, goggles, face screens, face shields
- **Note**
  - Make sure the eye protection chosen has the right combination of impact/dust/splash/molten metal eye protection for the task and fits the user properly

GOGGLES

Goggles

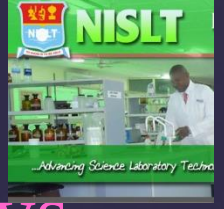
- Good seal with the skin of the face.
- Flexible frame that easily fits all face contours without too much pressure.
- Cover the eyes and surrounding areas and accommodate prescription glasses.
- Fog- and scratch-resistant
- Adjustable band that can be firmly secured and does not become loose during clinical activity.
- Indirect venting to reduce fogging.
- May be reusable (provided appropriate arrangements for decontamination are in place) or disposable.
- Quality compliant with standards:
  - EU standard directive 86/686/EEC, EN 166/2002, or
  - ANSI/ISEA Z87.1-2010
- or equivalent.

Face shield

- Made of clear plastic and provides good visibility to both the wearer and the patient.
- Adjustable band to allow good fit around the head and snug fit against the forehead.
- Fog-resistant (preferable).
- Completely covers the sides and length of the face.
- May be reusable (made of material that can be cleaned and disinfected) or disposable.
- Quality compliant with standards:
  - EU standard directive 86/686/EEC, EN 166/2002, or
  - ANSI/ISEA Z87.1-2010
- or equivalent

Use a fluid-resistant medical or surgical mask with a structured design that does not collapse against the mouth (e.g. duckbill or cup shape).

Implementation



- A medical or surgical mask should always be worn with appropriate eye protection (either with face shield or goggles).
  - If used with goggles, the mask should be fluid-resistant.
  - Fluid resistance is not essential if the mask is used together with a face shield.
- Wearing more than one mask at the same time does not provide additional protection and is not recommended.

Head and neck (Hazards)

- Impact from falling or flying objects, risk of head bumping, hair getting tangled in machinery, chemical drips or splash, climate or temperature
- **Options**
  - Industrial safety helmets, bump caps, hairnets and fire fighters' helmets

Head cover

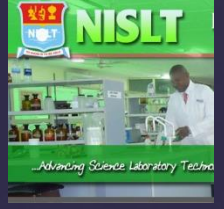
- Use a head cover that covers both head and neck.
- Single use
- Fluid-resistant
- Adjustable, and should stay securely in place once adjusted
- Facial opening constructed without elastic Cover reaches the upper part of the gown or coverall

Head cover

- The purpose of head covers is to protect the skin and hair of the head and neck from virus contamination and the possibility of subsequent virus transmission to the mucosae of the eyes, nose or mouth.

Lungs (Hazards)

- Oxygen-deficient atmospheres, dusts, gases and vapours
- **Options – respiratory protective equipment (RPE)**
- Some respirators rely on filtering contaminants from workplace air. These include simple filtering facepieces and respirators and power-assisted respirators
- Make sure it fits properly, eg for tight-fitting respirators (filtering facepieces, half and full masks)
- There are also types of breathing apparatus which give an independent supply of breathable air, eg fresh-air hose, compressed airline and self-contained breathing apparatus



Lungs (Hazards)

- Note: The right type of respirator filter must be used as each is effective for only a limited range of substances
- Filters have only a limited life. Where there is a shortage of oxygen or any danger of losing consciousness due to exposure to high levels of harmful fumes, only use breathing apparatus – never use a filtering cartridge
- You will need to use breathing apparatus in a confined space or if there is a chance of an oxygen deficiency in the work area

Duckbill or pouch

Fluid-resistant medical or surgical mask

Moulded or non-collapsible, with a half-sphere or cup shape.

Use a fluid-resistant particulate respirator during procedures that generate aerosols of body fluids.

Strong recommendation; moderate quality evidence, when evidence on protection against other pathogens during aerosol-generating procedures is also considered.

Implementation

- When a disposable particulate respirator is put on, it should be fit-tested and a seal check should be done. If used with goggles, the particulate respirator should be fluid-resistant. Fluid resistance is not required if the particulate respirator is used together with a face shield. Not all particulate respirators are fluid-resistant; for example, N95 respirators are fluid-resistant only if they are labelled as “surgical N95 respirator”.

Technical specifications

- The evidence informing the technical specifications was similar to that for face masks, i.e. breathability was important as well as a structured design that does not collapse easily.

Particulate respirator (fluid-resistant)

- Shape that will not collapse easily.
- High filtration efficiency.
- Good breathability.
- Quality compliant with standards for surgical N95 respirator:

- NIOSH N95, EN 149 FFP2,

- or equivalent
  Fluid resistance: minimum 80 mmHg pressure based on ASTM F1862, ISO 22609, or equivalent

Particulate respirator (fluid-resistant)

Duckbill or pouch

Half-sphere or cup shape

Particulate respirator (fluid-resistant)

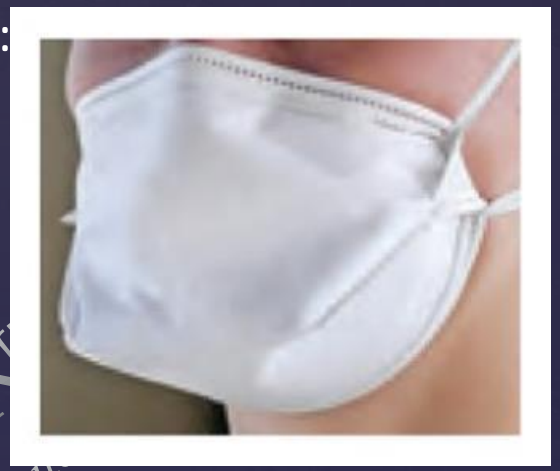
Flat-fold

Particulate respirator (non-fluid-resistant)

Only to be used together with a face shield. Quality compliant with standards for particulate respirator worn with face shield:

- NIOSH N95, EN149 FFP2,

or equivalent.



Duckbill or pouch

Half-sphere or cup shape

Body- Hazards

- Heat, chemical or metal splash, spray from pressure leaks or spray guns, contaminated dust, impact or penetration, excessive wear or entanglement of own clothing
- **Options**
  - Conventional or disposable overalls, boiler suits, aprons, chemical suits
- **Note**
  - The choice of materials includes flame-retardant, anti-static, chain mail, chemically impermeable, and high-visibility
- Don't forget other protection, like safety harnesses or life jackets

Gloves

- **Double gloves are recommended.**
  - over single gloves, to decrease the potential risk of virus transmission to the health worker as a result of glove perforations and damage to gloves from disinfectants, such as chlorine.
  - Double-gloving may also reduce risk from needle-stick injuries and contamination of hands when removing PPE. Confidence in the estimate of effectiveness was assessed as moderate, on the basis of accumulated evidence of transmission of other bloodborne pathogens, such as HIV and hepatitis B and C viruses

Using double gloves

- Consideration of the balance of benefits and harms led to a strong recommendation in favour of double gloves.
- More than two gloves on each hand has the potential to interfere with dexterity and add complexity to glove removal, and is therefore not recommended.
- Sterile gloves are not required, except when a sterile procedure is being performed, as per standard IPC recommendations.
- The gloving procedures described below also apply to specific surgical and obstetric procedures.

Implementation

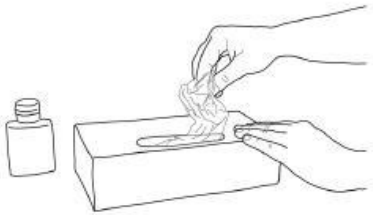
- Preferably, the outer glove should have a long cuff, reaching well above the wrist, and ideally to the mid-forearm. To protect the wrist area from contamination, the inner glove should be worn under the cuff of the gown or coverall (and under any thumb or finger loop), whereas the outer glove should be worn over the cuff of the gown or coverall.
- Gloves should not be attached to gowns or coveralls with tape, as this may interfere with safe removal of the gown or coverall and gloves, because of the need for additional manipulation and the risk of tearing of the gown or coverall, potentially resulting in contamination.
- Best IPC practice dictates that gloves should be changed between patients. However, in certain outbreak settings this may not always be feasible, for example, if clean gloves and waste disposal are not available in the patient treatment and isolation area. Because of this, the GDG did not reach agreement on whether gloves should be changed between patients inside the clinical area. Nine members were in favour of changing gloves between patients, two were against, and two members abstained. The following two-step procedure could help facilitate the safe changing of gloves while providing clinical care for many patients with filovirus disease during outbreak situations: (1) disinfect the outer gloves before removing them safely, and (2) keep the inner gloves on and disinfect them before putting on a fresh outer pair. Alcohol-based hand rubs are preferred for disinfecting hands and gloved hands. If a glove becomes compromised, it should be changed using the procedure described above. If it is not possible to change gloves between patients, the outer pair of gloves should be disinfected between patients.

Nitrile gloves are preferred over latex gloves.

- Nitrile gloves are recommended because they resist chemicals, including certain disinfectants, such as chlorine, and because nitrile is more environmentally friendly than latex. There is a high rate of allergies to latex and contact dermatitis among health workers. Estimates vary, but up to 12% of health workers experience a range of reactions to latex, including skin irritation, local itching, burning sensation and allergic symptoms .
- If nitrile gloves are not available, latex gloves may be used. Non-powdered gloves are preferred to powdered gloves.

How to don gloves

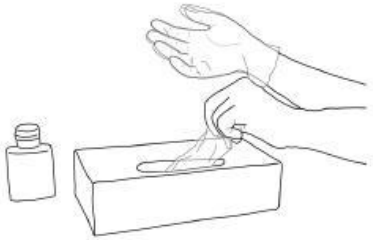
I. HOW TO DON GLOVES:



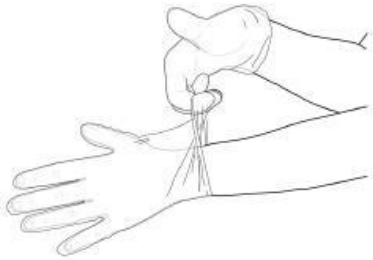
1. Take out a glove from its original box

2. Touch only a restricted surface of the glove corresponding to the wrist (at the top edge of the cuff)

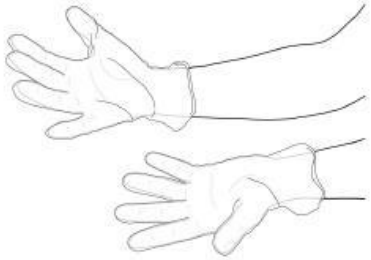
3. Don the first glove



4. Take the second glove with the bare hand and touch only a restricted surface of glove corresponding to the wrist



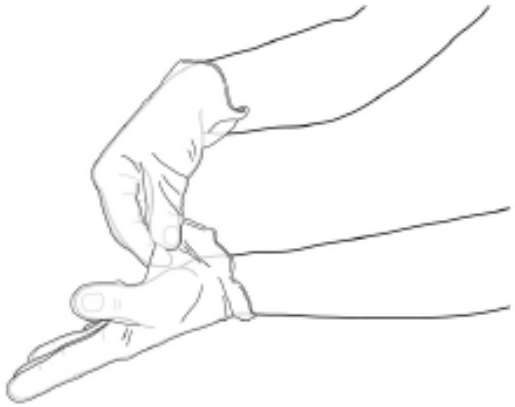
5. To avoid touching the skin of the forearm with the gloved hand, turn the external surface of the glove to be donned on the folded fingers of the gloved hand, thus permitting to glove the second hand



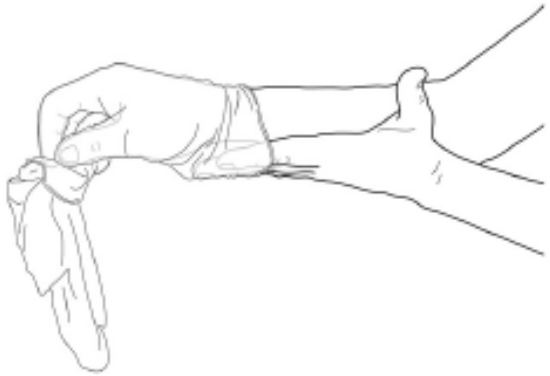
6. Once gloved, hands should not touch anything else that is not defined by indications and conditions for glove use

http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/

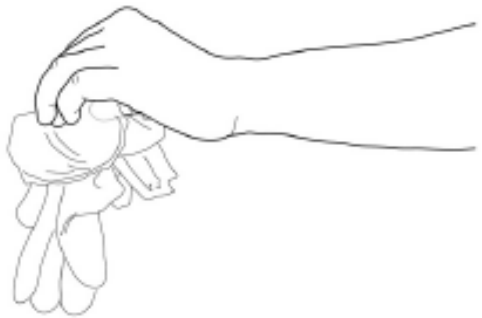
How to remove gloves



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

http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/

Gloves

- Nitrile
- Non-sterile
- Powder-free
- Outer gloves should preferably reach mid-forearm (minimum 280 mm total length)
- Different sizes
- Quality compliant with standards:
  - EU standard directive 93/42/EEC Class I, EN 455
  - EU standard directive 89/686/EEC Category III, EN 374
  - ANSI/ISEA 105-2011
  - ASTM D6319-10
- or equivalent.

Ears Hazards

- Noise – a combination of sound level and duration of exposure, very high-level sounds are a hazard even with short duration
- **Options**
  - Earplugs, earmuffs, semi-insert/canal caps
- **Note**
  - Provide the right hearing protectors for the type of work, and make sure workers know how to fit them
  - Choose protectors that reduce noise to an acceptable level, while allowing for safety and communication

Feet and legs Hazards

- Wet, hot and cold conditions, electrostatic build-up, slipping, cuts and punctures, falling objects, heavy loads, metal and chemical splash, vehicles
- **Options**
  - Safety boots and shoes with protective toecaps and penetration-resistant, mid-sole wellington boots and specific footwear, eg foundry boots and chainsaw boots
- **Note**
  - Footwear can have a variety of sole patterns and materials to help prevent slips in different conditions, including oil - or chemical-resistant soles. It can also be anti-static, electrically conductive or thermally insulating
  - Appropriate footwear should be selected for the risks identified

Footwear

- **Use waterproof boots (e.g. rubber or gum boots).**
- **For protection against contamination of floors and other surfaces with faeces, vomit and blood**
  - Solid footwear is therefore important. Waterproof boots are preferred over closed shoes, because they are easier to clean and disinfect and because they provide optimal protection when floors are wet. In addition, rubber boots can protect from sharps injuries. If boots are not available, health workers should wear closed shoes (slip-ons, without shoelaces, that fully cover the dorsum of the foot and ankle). Shoe covers, nonslip and preferably impermeable, should ideally be used over closed shoes to facilitate decontamination.

Implementation

- Boots need not be removed when the health worker leaves the PPE removal area provided that they have been cleaned and disinfected; the same pair of boots can be worn throughout the working day or shift

Waterproof boots

- Nonslip, with a PVC sole that is completely sealed
- Knee-high, to be higher than the bottom edge of the gown
- Optional light colour, for better detection of possible contamination
- A variety of sizes, to improve comfort and avoid trauma to the feet

Whole Body- Hazards

- Heat, chemical or metal splash, spray from pressure leaks or spray guns, contaminated dust, impact or penetration, excessive wear or entanglement of own clothing
- **Options**
  - Conventional or disposable overalls, boiler suits, aprons, chemical suits
- **Note**
  - The choice of materials includes flame-retardant, anti-static, chain mail, chemically impermeable, and high-visibility
  - Don't forget other protection, like safety harnesses or life jackets

Disposable gown

- Single use
- Avoid colours that are culturally unacceptable, e.g. black
  Prefer light colours to allow better detection of possible contamination
- Thumb or finger loops to anchor sleeves in place
- Different sizes available – large size especially important
- Quality compliant with either of two international standards, depending on resistance of materials:
- option 1: tested for resistance to blood and body fluid penetration: meets or exceeds ISO 16603 class 3 exposure pressure, or equivalent;
- or
- option 2: tested for resistance to bloodborne pathogen penetration: meets or exceeds ISO 16604 class 2 exposure pressure, or equivalent.

Disposable coverall

Disposable gown

- Tightly woven
- Minimum linting
- Non-sterile, reusable or single use
- Top or tunic: short sleeves
- Trousers: drawstring waist enclosure
- Different sizes

Surgical scrubs (trousers and tops)

Surgical Scrubs (Trousers and tops)

- The choice of apron should be, in order of preference:
- a disposable, waterproof apron
- if disposable aprons are not available, a heavy-duty, reusable waterproof apron, provided that it is appropriately cleaned and disinfected between patients.

Implementation

- An apron should be worn for the entire time the health worker is in the treatment area.
- If an apron is visibly soiled, it should be removed and changed.
- Feasibility issues, such as the availability of new aprons and waste disposal in isolation areas, should be addressed.
- Reusable aprons should be removed in the undressing or decontamination area for cleaning and disinfection, after the health worker has left the ward. The apron should be removed according to undressing procedures.

Technical specifications

- The apron should provide sufficient coverage of the body and should be waterproof, to protect the health worker from splashes of body fluids.

Waterproof apron

- Disposable or single use.
- Made of polyester with PVC-coating or other waterproof material
- Straight apron with bib
- Minimum basis weight: 250 g/m^2
- Covering size : approximately 70–90 cm width × 120–150 cm length, or standard adult size
- Option 1: adjustable neck strap with back fastening at the waist
  Option 2: neck strap allowing for tear-off with back fastening at the waist

Heavy-duty apron

- Heavy-duty non-woven apron
- Straight apron with bib
- Fabric: 100% polyester with PVC coating, or 100% PVC, or 100% rubber, or other fluid-resistant material
- Waterproof, sewn strap for neck and back fastening
- Minimum basis weight: 300 g/m^2
- Covering size : approximately 70–90 cm width × 120–150 cm length
- Reusable (provided that appropriate arrangements for decontamination are in place)

Waterproof apron

Conclusion

THE NIGERIAN INSTITUTE OF SCIENCE LABORATORY TECHNOLOGY

SAYS

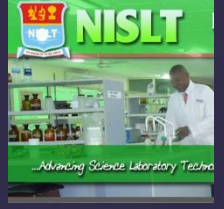
USE

Personal Protective Equipment

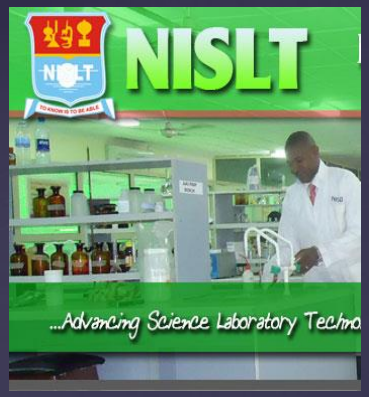
BE SAFE NOT SORRY

Use of heavy lead Apron

.



- **REFERENCES**
- World Health Organization 2016
- (http://www.who.int) .



THANK YOU ALL