Purpose

3M has received a number of inquiries regarding the appropriate personal protective equipment for potential exposures to Ebola Virus Disease (EVD). Following are responses to many of the most commonly asked questions. It is important to note this FAQ is not a substitute for the guidance of the United States Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), the European Centres for Disease Prevention and Control (ECDC) and your local health authority. Please consult their websites frequently for the most current information and infection control procedures regarding EVD.

Websites for Reference

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO</td>
<td><a href="http://www.who.int/ebola/en/">http://www.who.int/ebola/en/</a></td>
</tr>
</tbody>
</table>

For further information related to PPE use, please contact your local 3M Personal Safety Division Technical Services team.

As selection of appropriate PPE should be based upon a site-specific risk assessment conducted by qualified individuals, there is no ‘3M recommended list’ of PPE. Specific scenarios and PPE selection will differ depending on many factors, including the location and type of work (e.g. caring for patients vs. laboratory tasks; hospitals outside of West Africa preparing for potential patients versus health care in W Africa). As with any use of PPE, there are no standardized solutions, and proper selection and use is critical to protection. There are a variety of options available within the different categories of PPE and associated advantages and disadvantages to the different types and models. It is the responsibility of each facility or organization to determine the appropriate level of protection by conducting a risk assessment which includes elements such as working conditions, tasks, and accessibility to decontamination facilities. As much as possible, engineering and administrative controls should be implemented. 3M cannot select PPE but can assist in helping purchasers identify the specific PPE models that meet or exceed the desired level of protection and the specifics of their situation.

What is Ebola Virus Disease (EVD)?

Ebola Virus Disease (also known as Ebola hemorrhagic fever) is a severe, often-fatal disease caused by infection with a species of Ebola virus. EVD is a severe acute viral illness often characterized by the sudden onset of fever, intense weakness, muscle pain, headache and sore throat. This is followed by vomiting, diarrhea, rash, impaired kidney and liver function, and in some cases, both internal and external bleeding.

Outbreaks of Ebola have occurred sporadically in parts of Africa, South America, the Middle East and Eastern Europe, with fatality rates ranging up to 90%.
How is it Transmitted?

Ebola is spread through direct contact with blood or body fluids (including, but not limited to urine, saliva, sweat, feces, vomit, breast milk and semen) of an infected person or animal, or through contact with objects that have been contaminated with the blood or other body fluids of an infected person, dead or alive. Transmission is believed to occur via contact with mucous membranes and non-intact skin (i.e., rashes, cuts, etc.). Risk of infection by inhalation of contaminated aerosols by healthcare workers has not been documented but is thought to be low at this time based on case history evidence.

Ebola virus is readily killed by soap, bleach, direct sunlight, or drying. Machine washing clothes that have been contaminated with fluids will destroy Ebola virus. Ebola virus survives only a short time on surfaces that are in the sun or have dried.1

WHO PPE Recommendations against Ebola Virus Disease

WHO recommendations for PPE are included in “Personal Protective Equipment for Use in a Filovirus Disease Outbreak: Rapid Advice Guideline.” (2016)

Two documents provide additional detail on PPE specification for recommendations made in the August 2014 document linked above. These documents are complementary to the 2016 document and should also be read and understood:

1) “Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Hemorrhagic Fever in Health-Care Settings, with Focus on Ebola” (August 2014)
2) “Personal Protective Equipment in the Context of Filovirus Disease Outbreak Response. Rapid advice guideline.” (October 2014)

It is important that anyone involved in infection control for Ebola Virus Disease (EVD) thoroughly read and understand these documents.

WHO emphasizes the importance of consistent use and implementation of Standard Precautions by all health care workers when providing care to all patients, regardless of their diagnoses. These precautions include a wide range measures, including the use of PPE.

The prevention of Ebola virus infection depends on avoiding contact with blood and body fluids of infected individuals and with objects contaminated with these fluids. Barrier precautions are used to prevent skin or mucous membrane exposure of the eyes, nose, and mouth with blood, other body fluids, secretions (including respiratory droplets), or excretions. For those working to control the Ebola Virus Disease (EVD) outbreak and treat patients, the WHO recommends that all health care workers have the mucous membranes of their eyes, mouth and nose completely covered by PPE. The recommended personal protective equipment for most activities includes:

- Impermeable gloves (double gloving)
- Impermeable footwear (waterproof boots)
- Eye and face protection (face shield or goggles)
- Protective clothing (gown / coverall and apron; head cover)
- Mask or respirator (fluid resistant if worn with goggles rather than face shield)

Some tasks require additional body protection. Certain tasks – including administering aerosol-generating medical procedures, certain laboratory tasks, and autopsies – require respiratory protection.

Hand hygiene is strongly emphasized. It is of the highest importance that hand hygiene be performed thoroughly and often, including before and after donning and before and after doffing PPE.
The WHO states that a risk assessment must be done by competent experts appointed by the employer. PPE should be selected based primarily on the potential exposures and need for protection against infective fluids and agents. However, work conditions, environmental conditions, tasks and accessibility to decontamination facilities should also be considered.

Health workers should be trained on the risks, mitigating effects of the PPE, and their use. Training should be mandatory and thorough and followed by mentoring before workers engage in any activities.

PPE can help provide a barrier to infectious material. However, it is very important that all local infection control protocols and manufacturer’s user instructions be followed when removing (doffing) the equipment to avoid contamination. Additionally, local infection control practices and manufacturers’ user instructions should be followed when cleaning any reusable PPE. The WHO guidance contains recommendations for donning, doffing and cleaning PPE.

A more complete summary of the WHO PPE recommendations as well as the US CDC, ECDC and United Kingdom’s PPE recommendations for EVD can be found in Appendix 4.

Eye Protection

Eye protection provides a barrier to infectious materials from entering the eye and is often used in conjunction with other personal protective equipment (PPE) such as gloves, gowns, and masks or respirators. See Appendix 1.

Goggles

Goggles are designed to fit snugly but not necessarily seal around the wearer’s eyes. NIOSH states2: “Appropriately fitted, indirectly-vented goggles* with a manufacturer’s anti-fog coating provide the most reliable practical eye protection from splashes, sprays, and respiratory droplets. However, to be efficacious, goggles must fit snugly, particularly from the corners of the eye across the brow. While highly effective as eye protection, goggles do not provide splash or spray protection for other parts of the face.

* Directly-vented goggles may allow penetration by splashes or sprays; therefore, indirectly-vented or non-vented goggles are preferred for infection control.”

Face Shields

Face shields are designed to help protect portions of the wearer’s face to certain exposures. While goggles help protect a wearer’s eyes from splashes, sprays, and droplets, a face shield can help reduce exposure to both the eyes and other facial areas.* Face shields should have crown and chin protection and wrap around the face to the point of the ear. This will help reduce the possibility of splash, sprays and droplets from going around the edges of the shield and reaching the eyes or other facial areas.

*The CDC notes that ANSI Z87.1 recommends face shields should be used in addition to goggles, not as a substitute for goggles, in a chemical exposure or industrial setting.

Safety Glasses

Safety glasses provide impact protection but do not provide the same level of splash or droplet protection as goggles and generally should not be used for infection control purposes.

For more information, consult 3M Tech Data Bulletin #192 – Eye Protection for Infection Control.
Protective Clothing

Selection of personal protection ensembles should be based on a site-specific PPE hazard assessment and consideration of recommendations made by health authorities. Performance criteria included in EN 14126:2006 - Performance Requirements and Test Methods for Protective Clothing against Infective Agents should be considered. See Appendix 2.

In general, protective clothing offering the highest level of protection from infective agents, such as the 3M™ Protective Coverall 4570, is also the least breathable and may introduce hazards related to heat stress and dehydration.

Breathable protective clothing offers less protection but may be desired for tasks in extremely hot conditions where the risk of contacting infective agents is low, where sufficient decontamination facilities are available at the completion of work tasks, and where the risk of harm from heat stress and dehydration is high.

Selection for EVD should be based primarily on the potential exposures and need for protection against infective fluids and agents. However, work conditions, environmental conditions, tasks and accessibility to decontamination facilities should be considered.

Respiratory Protection

Surgical/medical masks or respirators are another type of PPE recommended for those in contact with potential EVD cases. These products may need to be fluid resistant depending upon the eye and face protection being worn. This section discusses the use of respiratory protection.

For more information on the differences between surgical masks and respirators, please consult 3M Technical Data Bulletin #231 - Respirators and Surgical Masks: A Comparison.

A respirator is a device designed to help provide the wearer with respiratory protection against inhalation of a hazardous atmosphere.

To help reduce nose, mouth and respiratory system exposures to airborne particles, particulate-filtering respirators are often recommended. Particulate respirators are available as:

1) A filtering half facepiece respirator, where the filter is the entire respirator
2) An elastomeric (reusable) half facepiece with a particulate filter
3) An elastomeric (reusable) full facepiece with a particulate filter
4) A powered air purifying respirator (PAPR) that includes a particulate filter
5) A supplied air respirator.

Particulate respirators are designed to help reduce the wearer’s exposure to certain airborne particles. Currently, health authorities have not documented EVD as being transmitted from infected individuals via airborne Ebola virus. However, droplets containing the Ebola virus that have become aerosolized (e.g. from coughing, sneezing, vomiting, medical procedures, and surfaces etc.) may have the potential to come into contact with a person’s mucous membranes in their nose or mouth or non-intact skin. Therefore, respiratory protection may be helpful in providing a barrier to help prevent infectious materials from contacting a wearer’s mucous membranes. They may also help limit inadvertent touching of the nose, mouth and/or eyes (if a full-facepiece or powered-air respirator is used). Respiratory protection is recommended for workers who may need to perform potentially aerosol-generating procedures, such as intubation, suctioning, active resuscitation, laboratory procedures, and autopsies.

See Appendix 3 for examples of different types of respirators.

For more information consult 3M Tech Data Bulletin #174 – Respiratory Protection for Airborne Exposures to Biohazards.
Advantages and Disadvantages of Different Types of Respirators

Respiratory protection may be a component of the PPE selected based upon the risk assessment. A control banding approach has been suggested for choosing between different levels of respiratory protection based on the organism, generation rate, level of control and respirator protection factor.


Following are some general advantages and disadvantages of different types of respirators.

Disposable Filtering Facepiece Respirator

- Disposable, no maintenance or cleaning required
- Lightweight
- Less expensive
- Need separate eye and face protection
- Fit testing

Reusable Half Mask or Full Facepiece Respirator

- Often available in multiple sizes
- Facepieces can be disinfected and reused
- Full facepieces may provide eye and face protection
- Fit testing required to help ensure adequate respiratory protection
- Facepieces must be maintained

Powered Air Purifying (PAPR) Respirator

- Some elements can be disinfected and reused
- No fit testing required for systems with loose fitting head covers
- May not need separate eye and face protection depending on the head covering
- Batteries need to be charged
- Higher initial cost
- Unit needs to be maintained
- Wearer may not need to be clean-shaven, depending on the type of head cover and style of facial hair

Supplied Air Respirators

- Some systems provide cooled air to the wearer
- Some components can be disinfected and reused
- No fit testing required for systems with loose fitting head covers
- May not need separate eye and face protection depending on the head covering
- Need adequate supply and pressure of compressed breathable air (Grade D)
- Equipment needs to be maintained
- Higher initial cost

Please see 3M Technical Data Bulletin: Cleaning Reusable Respirators and Powered Air Purifying Respirator Assemblies following potential exposure to the Ebola virus.
Summary

Those who will be exposed to individuals with known or suspected cases of EVD should wear PPE that provides a barrier to help prevent infectious material from contacting mucous membranes (mouth, nose, eyes) and non-intact skin (i.e., rashes, cuts, etc.). Respiratory protection should be utilized if there is a risk of aerosolized particles (i.e. aerosol-generating procedures, certain laboratory tasks, autopsies), or according to local health authorities. Always ensure that PPE users are properly trained in the benefits and limitations of the equipment per all applicable guidance and regulations and the manufacturer’s user instructions. Please consult your occupational safety and health professional, the appropriate health authority and the PPE manufacturer with questions.

References

4) WHO http://who.int/mediacentre/factsheets/fs103/en/
5) WHO “Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Hemorrhagic Fever in Health-Care Settings, with Focus on Ebola.” http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/
10) “Health workers need optimal respiratory protection for Ebola” Lisa Brosseau, Rachael Jones.
12) “WHO Personal protective equipment (PPE) in the context of filovirus disease outbreak response.
13) Technical specifications for PPE equipment to be used by health workers providing clinical care for patients October 2014” http://apps.who.int/iris/bitstream/10665/137411/1/WHO_EVD_Guidance_SpecPPE_14.1_eng.pdf?ua=1&ua=1
16) WHO “Personal Protective Equipment for Use in a Filovirus Disease Outbreak: Rapid Advice Guideline.” (2016)
### Appendix 1 - Specifications for Examples of 3M Protective Eyewear

EN Tested, CE Approved (Marked)

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<th>Goggles</th>
<th>Face Shields</th>
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**Meeting ANSI Standards**

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## Appendix 2 - Specifications for 3M Protective Apparel

### IMPORTANT NOTE

These products will not eliminate the risk of infection. Currently there is no established guidance specifying performance criteria for protective clothing specific to EVD. This information is presented to help safety professionals make informed decisions as part of a site and task specific PPE hazard assessment.

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### General Data

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</table>

**Protection against Infective Agents**

- Synthetic blood penetration resistance
- Blood-borne pathogen penetration resistance
- Contaminated solid particle penetration resistance
- Contaminated liquid aerosol penetration resistance
- Wet bacteria penetration resistance

**Liquid Chemical Permeation**

- Chemical permeation resist. - H2SO4 98%
- Chemical permeation resist. - NaOH 40%
## Appendix 3 - Specifications for 3M Respiratory Protective Devices

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<tr>
<th></th>
<th>Half-face</th>
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* When equipped with appropriate and approved filter and/or cartridge.
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<tr>
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<th>3M™ Particulate Respirator 8810</th>
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Examples of Disposable Respirators, EN Tested, CE Approved (marked)

<table>
<thead>
<tr>
<th>Product</th>
<th>3M™ Particulate Respirator 8210</th>
<th>3M™ Particulate Respirator 8511</th>
<th>3M™ Health Care Particulate Respirator and Surgical Mask 1860</th>
<th>3M™ Aura™ Health Care Particulate Respirator and Surgical Mask 1870+</th>
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Examples of Disposable Respirators Approved by the US National Institute for Occupational Safety and Health (NIOSH)

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<thead>
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Note: Other models of 3M disposable respirators are available, but supply may be constrained if demand increases.
### Examples of Reusable Respirators: EN Tested, CE Approved (marked)

<table>
<thead>
<tr>
<th>Image</th>
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</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Half Masks</th>
<th>Full Face Masks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3M™ Half Mask 6000</td>
<td>3M™ Half Mask 7500</td>
<td>3M™ Full Face Mask 6800</td>
<td>3M™ Full Face Mask 7907S</td>
</tr>
<tr>
<td>3M™ Full Face Mask 7907S</td>
<td>3M™ 2135 P3 R</td>
<td>3M™ 6035 P3 R</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>6100 - small (light grey)</th>
<th>6200 - medium (grey)</th>
<th>6300 - large (dark grey)</th>
<th>7501 - small (grey blue)</th>
<th>7502 - medium (light blue)</th>
<th>7503 - large (dark blue)</th>
<th>6700 - small</th>
<th>6800 - medium</th>
<th>6900 - large</th>
<th>7907S - one size</th>
<th>Particulate filter</th>
<th>Encased particulate filter</th>
</tr>
</thead>
</table>

### Examples of Reusable Respirators Approved by the US National Institute for Occupational Safety and Health (NIOSH)

<table>
<thead>
<tr>
<th>Image</th>
<th>Half Facepiece Respirator</th>
<th>Full Facepiece Respirator</th>
<th>Particulate Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Half Facepiece Respirator</th>
<th>Full Facepiece Respirator</th>
<th>Particulate Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M™ Half Facepiece 6000 Series</td>
<td>3M™ Half Facepiece 6500 Series</td>
<td>3M™ Half Facepiece 7500 Series</td>
<td>3M™ Full Facepiece 6000 Series</td>
</tr>
<tr>
<td>3M™ Full Facepiece FF-400 Series</td>
<td>3M™ Full Facepiece 7800 Series</td>
<td>3M™ 2291 P100</td>
<td>3M™ 7093 P100</td>
</tr>
<tr>
<td>3M™ 2291 P100</td>
<td>3M™ 7093 P100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>6100 - small</th>
<th>6200 - medium</th>
<th>6300 - large</th>
<th>6501 - small</th>
<th>6502 - medium</th>
<th>6503 - large</th>
<th>7501 - small</th>
<th>7502 - medium</th>
<th>7503 - large</th>
<th>FF-401 - small</th>
<th>FF-402 - medium</th>
<th>FF-403 - large</th>
<th>7800S-S - small</th>
<th>7800S-M - medium</th>
<th>7800S-L - large</th>
<th>Particulate filter</th>
<th>Encased particulate filter</th>
</tr>
</thead>
</table>

Note: Chemical cartridges are available to help reduce exposures to chemical disinfectants (e.g. chlorine).
## 3M Personal Safety Division

### Examples of Powered Air Respirators: EN Tested, CE Approved

<table>
<thead>
<tr>
<th>Powered Air Turbo Unit</th>
<th>S-Series</th>
<th>M-Series</th>
<th>Breathing Tube &amp; Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M™ Versaflo™ Headcovers</td>
<td>S-133 or S-333G</td>
<td>M-206</td>
<td>S-922 or S-925</td>
</tr>
<tr>
<td>3M™ Versaflo™ Hoods</td>
<td>S-433 or S-533</td>
<td>M-306</td>
<td>3M™ Versaflo™ Breathing Tube Disposable Cover (BT-20S (735mm) or BT-20L (965mm))</td>
</tr>
<tr>
<td>3M™ Versaflo™ Faceshield</td>
<td>M-206</td>
<td>M-406</td>
<td></td>
</tr>
<tr>
<td>3M™ Versaflo™ Helmet</td>
<td></td>
<td></td>
<td>3M™ Versaflo™ Breathing Tube Disposable Cover (BT-922)</td>
</tr>
<tr>
<td>3M™ Versaflo™ Helmet</td>
<td></td>
<td></td>
<td>3M™ Versaflo™ Breathing Tube Disposable Cover (BT-922)</td>
</tr>
</tbody>
</table>

- **3M™ Versaflo™ Powered Air Turbo TR-300 with TR-3710E P Filter**
  - EN 166:2001 1:BT:3

- **3M™ Versaflo™ Powered Air Turbo TR-600 with TR-6710N Filter**
  - EN 166:2001 1:BT:3

- **3M™ Jupiter™ Turbo with 450-00-25P2X12 Filter**
  - EN 166:2001 1:BT:3
Examples of Powered Air Purifying Respirators (PAPRs) by the US National Institute for Occupational Safety and Health (NIOSH)

<table>
<thead>
<tr>
<th>Models</th>
<th>BE-Series</th>
<th>S-Series</th>
<th>M-Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assigned Protection Factor</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

Breathing Tube

3M™ Versaflo™ TR-300 PAPR with TR-3712N HEPA Filter

3M™ Versaflo™ Powered Air Turbo TR-600 with TR-6710N Filter

3M™ Versaflo™ Breathing Tube Disposable Cover BT-922

3M™ Versaflo™ Breathing Tube BT-20, BT-30, BT-40

Breathe Easy with 450-00-01R12 HEPA Filter

Note: Other PAPR's, hoods, helmets and headcovers are available.
WHO Guidance

In 2014 - 2016, WHO published three documents which provide details on the WHO’s PPE recommendations and should be read and understood:

1) “Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Hemorrhagic Fever in Health-Care Settings, with Focus on Ebola” (August 2014)
2) “Personal Protective Equipment in the Context of Filovirus Disease Outbreak Response. Rapid advice guideline.” (October 2014)
3) “Personal Protective Equipment for Use in a Filovirus Disease Outbreak: Rapid Advice Guideline.” (2016)

It is important that anyone involved in infection control for Ebola Virus Disease (EVD) thoroughly read and understand these documents. Below is a short summary of personal protective equipment recommendations both in text and table form. However, the WHO documents contain extensive information regarding PPE specifications, donning and doffing procedures, and cleaning methods.

Hand hygiene is strongly emphasized, and it is of the highest importance that hand hygiene be performed thoroughly and often, including before and after donning and before and after doffing PPE.

At a minimum, the WHO recommends a basic suite of PPE for most activities, which includes gloves, a gown, boots or closed-toe shoes with overshoes, a mask, and eye protection. Some tasks require additional body protection. Certain tasks require respiratory protection.

Everyone entering the patient isolation rooms should perform hand hygiene and wear at least gloves, gown, boots / closed-toe shoes with overshoes, and a mask and eye protection. This recommendation includes visitors. Additionally, this ensemble of PPE is recommended for those handling soiled linen from patients.

If a health care worker is undertaking any strenuous activity, such as carrying a patient, or performing any tasks in which contact with blood and body fluids is anticipated, they should also wear two sets of gloves and a waterproof apron over the gown, if the gown is non-impermeable. Disposable overshoes and leg coverings should also be used if boots are not available.

Those examining remains or handling a dead body are instructed to wear an impermeable gown, mask, eye protection, double gloves, and closed-toe shoes or boots.

When cleaning the environment or handling infectious waste, workers should wear heavy-duty rubber gloves, an impermeable gown, and closed-toe shoes (e.g. boots). If the cleaning activities have a risk of splash or contact with blood or bodily fluids, facial protection, such as a mask and goggle or face shield, should be used.

Summary of WHO PPE Recommendations by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>Recommended PPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in Patient Areas</td>
<td>• Gloves</td>
</tr>
<tr>
<td></td>
<td>• Gown: disposable impermeable</td>
</tr>
<tr>
<td></td>
<td>• Medical mask</td>
</tr>
<tr>
<td></td>
<td>• Eye protection (eye visor, goggles, or face shield)</td>
</tr>
<tr>
<td></td>
<td>• Shoes: closed, puncture and fluid resistant (e.g. rubber boots)</td>
</tr>
</tbody>
</table>
### Eye Protection

The WHO states the use of goggles or a face shield is strongly recommended, and both styles of eye protection are acceptable. Indirectly vented goggles are recommended. Goggles should form a good seal with the face, have a flexible frame to fit to the face without much pressure, cover the eyes and surrounding areas and accommodate prescription glasses, be fog- and scratch-resistant, and have an adequate band to secure to the head.

Faceshields should be clear and provide good visibility to the patient and wearer. The band should be adjustable to attach around the head and fit snugly to the forehead and completely cover the sides and length of the face. Fog resistance is preferable.

| Strenuous tasks or exposure to blood and body fluids | • Gloves, double set  
• Gown: disposable impermeable  
• Apron: waterproof (if gown is not impermeable)  
• Medical mask  
• Eye protection (eye visor, goggles, or face shield)  
• Boots: rubber. Or disposable overshoes and leg coverings with shoes. |
| --- | --- |
| Aerosol Generating Medical Procedures | • Gloves  
• Gown: disposable impermeable  
• Respirator: FFP2, NIOSH N95 or equivalent  
• Eye protection (eye visor, goggles or face shield)  
• Shoes: closed, puncture and fluid resistant (e.g. rubber boots) |
| Handling Infectious Waste | • Gloves, heavy duty/rubber  
• Gown: impermeable  
• Eye protection (eye visor, goggles, or face shield); Goggles preferred for liquid handling  
• Shoes: closed, puncture and fluid resistant (e.g. rubber boots) |
| Laboratory Personnel handling potential Ebola specimens | • Gloves  
• Gown: disposable impermeable  
• Respirator<sup>a</sup>  
• Eye protection (eye visor, goggles, or face shield)  
• Shoes: closed with overshoes or boots |
| Handling of Human Remains | • Gloves, double set  
• Gown: disposable impermeable  
• Mask  
• Eye protection (eye visor, goggles, or face shield)  
• Rubber boots or closed puncture or fluid resistant shoes and overshoes |
| Autopsies of known or suspected Ebola virus disease cases | Gloves, double set  
Gown: disposable impermeable  
Respirator: FFP2, NIOSH N95 or equivalent or a PAPR  
Eye protection (eye visor, goggles, or face shield)  
Shoes: closed or boots |

<sup>a</sup> FFP2, NIOSH N95 or equivalent for handling. PAPR for aliquoting, centrifugation or other aerosol generating procedures.
Goggles and faceshields should comply with EU standard directive 86/686/EEC, EN 166/2002 or ANSI/ISEA Z87.1-2010. Goggles and faceshields may be reused if there are adequate arrangements for decontamination. WHO recommends that goggles and faceshields not be used together.

Respiratory Protection

Respiratory protection is strongly recommended for several applications, including administering aerosol-generating procedures to a patient, performing laboratory operations, and during autopsies. If aerosol-generating procedures are necessary, the health care worker should wear a respirator, such as an EN-certified FFP2 or NIOSH N95 or equivalent. The WHO cites examples of aerosol-generating procedures as those that stimulate coughing or those that could generate aerosols, such as bronchoscopy, endotracheal intubation, airway suctioning, positive-pressure ventilation via a face mask, or administration of aerosolized or nebulised medication. FFP2 or N95 disposable filtering facepiece respirators are recommended for laboratory personnel handling potentially infected clinical specimens, as well as closed-toe shoes with overshoes or boots, gloves, a disposable impermeable gown, and eye protection or face shields. Workers aliquoting, performing centrifugation, or undertaking any other procedures that may generate aerosols should use a powered air purifying respirator (PAPR). Persons performing autopsies are instructed to wear a particulate respirator (FFP2 or equivalent or NIOSH N95) or a PAPR as well as eye protection, double gloves, disposable impermeable gowns and closed shoes or boots.

Fluid-resistant particulate respirators are recommended if goggles are utilized for eye protection. If a face shield is used, the respirators do not need to be fluid-resistant. The respirator should be of a shape that will not collapse easily and have high filtration efficiency and good breathability. Respirators should be NIOSH N95, EN 149 FFP2, or equivalent. If fluid resistance is appropriate, then a respirator also meeting the 80-mmHg minimum pressure test based upon ASTM F1862, ISO 22609, or equivalent should be selected.

In the 2007 WHO guidance document “Infection prevention and control of epidemic-and pandemic-prone acute respiratory diseases in health care,” June 2007, the WHO also recommended “particulate respirators at least as protective as a NIOSH-certified N95, EU FFP2 or equivalent” for those performing aerosol-generating procedures. They cited examples of acceptable disposable particulate respirators in use in various parts of the world:

- Australia/New Zealand: P2 (94%), P3 (99.95%)
- China: II (95%), I (99%)
- European Union: CE-certified filtering face-piece class 2 (FFP2) (95%), or class 3 (FFP3) (99.7%)
- Japan: 2nd class (95%), 3rd class (99.9%)
- Republic of Korea: 1st class (94%), special (99.95%)
- United States: NIOSH-certified N95 (95%), N99 (99%), N100 (99.7%)

Protective Clothing

A disposable gown and apron or a disposable coverall and apron are recommended. The gown or coverall should be made of fabric that is tested for resistance to penetration by blood or body fluids or to blood-borne pathogens. The technical description for gowns can be found in the document. Disposable coveralls should be single-use, of a light color, and available in different sizes. Thumb / finger loops should be available to anchor sleeves in place. The garment should either be:

- Tested for resistance to blood and body fluid penetration: meets or exceeds ISO 16603 class 3 exposure pressure or equivalent

Or

- Tested for resistance to blood-borne pathogen penetration: meets or exceeds ISO 16604 class 2 exposure pressure or equivalent.
It is noted that heat stress and breathability should be considered when selecting a garment. The second option listed above may result in higher potential for heat stress, which can reduce wear time.

It is conditionally recommended that a separate head cover be used that is single-use, fluid-resistant, and adjustable. The facial opening should be constructed without elastic. The recommendation for a separate head cover is conditional because, as the WHO stated, “there was no comparative evidence of effectiveness in preventing transmission between a separate head cover and a head cover that is integrated in the coverall. When a separate head cover is not available, a coverall with hood can be worn provided that the hood is put on after eye, nose and mouth protection so that mucosal protection is maintained after taking off the hooded coverall.”

The document also addresses technical specifications for surgical masks, rubber boots, waterproof aprons and gloves.

**U.S. CDC**

On November 17, 2015, the US CDC published “Guidance on Personal Protective Equipment (PPE) To Be Used by Healthcare Workers During Management of Patients with Confirmed Ebola or Persons Under Investigation (PUIs) for Ebola who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for Donning and Doffing PPE.”

It is important that anyone involved in infection control for Ebola Virus Disease (EVD) thoroughly read and understand this document. Below is a short summary of the revised personal protective equipment recommendations in the 2015 US CDC guidance.

Similar to the WHO, the US CDC emphasizes hand hygiene and instructs that hand hygiene be performed thoroughly and often including before and after donning and before and after doffing PPE. As of October 20, 2014, US CDC has revised their PPE recommendations for U.S. Healthcare Workers to include the following:

- “Double gloves
- Boot covers that are waterproof and go to at least mid-calf or leg covers
- Single-use impermeable gown that extends to at least mid-calf or coverall without integrated hood.
- Respirators, including either N95 respirators or powered air purifying respirator (PAPR)
- Single-use, full-face shield that is disposable
- Surgical hoods to ensure complete coverage of the head and neck
- Apron that is waterproof and covers the torso to the level of the mid-calf should be used if Ebola patients have vomiting or diarrhea.”

For more information, please see US CDC’s “Infection Prevention and Control Recommendations for Hospitalized Patients with Known or Suspected Ebola Virus Disease in U.S. Hospitals”.

**European Centre for Disease Prevention and Control**

The European Centre for Disease Prevention and Control has published "Outbreak of Ebola Virus Disease in West Africa. Third update, 1 August 2014”.

Their recommendations are very similar to those of the WHO. It is important that anyone involved in infection control for Ebola Virus Disease (EVD) thoroughly read and understand this document. The ECDC recommends that patient handling be conducted under droplet hygiene precautions; in case of invasive, potentially aerosol-generating procedures airborne transmission, precautions should be employed. The PPE, donning and doffing procedures that should be used by health care

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1. The CDC notes that ANSI Z87.1 recommends face shields should be used in addition to goggles, not as a substitute for goggles, in a chemical exposure or industrial setting.
workers treating patients infected with Ebola are described in detail in this document, published in October 2014.  

Additionally, the ECDC has published a fact sheet for health professionals.


**United Kingdom**

The United Kingdom Advisory Committee on Dangerous Pathogens has written a document “Management of Hazard Group 4 viral haemorrhagic fevers and similar human infectious diseases of high consequence”.

This document, updated in September 2014, “VIRAL HAEMORRHAGIC FEVERS RISK ASSESSMENT (Version 4: 10.09.2014),” also addresses health care worker PPE. This document is contained within the UK National Travellers’ Health Network and Centre.

Health Professional Clinical Update of June 3rd 2014 for health professionals who are advising unwell returning travelers.  
http://www.nathnac.org/pro/clinical_updates/ebola_030614.htm

It is important that any health professionals potentially dealing with unwell travellers thoroughly read and understand this document. The document recommends that “Staff at Risk,” such those caring for patients with a high possibility of a viral haemorrhagic fevers and similar human infectious diseases of high consequence (including Ebola), should wear gloves, a plastic apron, FFP3 respirator, and eye protection for potential splash or aerosol-generating procedures. “Staff at High Risk” such as those caring for a patient with positive confirmation of a viral haemorrhagic fever, should wear a fluid-repellent disposable gown, double gloves, eye protection, and an FFP3 respirator.