



Personal Protective Equipment (PPE)

2020

Objectives



- Selection
- Use & Limitations
- Donning / Doffing
- Common Applications

Why Use Personal Protective Equipment?



- To provide barriers against skin, mucous membrane, and respiratory exposure to infectious agents
- To prevent the spread of contamination

Introduction



Why Use PPE ?

Controlling exposure to hazards

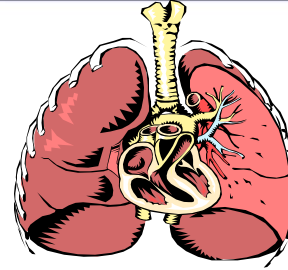
- Elimination or substitution
- Engineering controls
- Work practice controls

Personal protective equipment last resort (PPE)

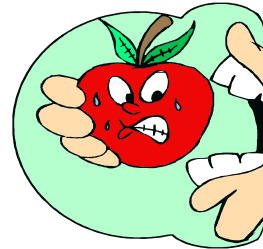
Routes of Exposure



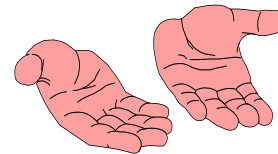
Inhalation



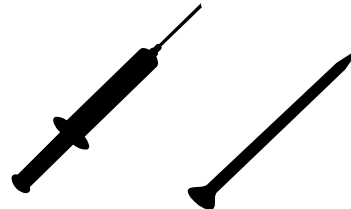
Ingestion



Absorption



Puncture



Forms Of Contaminants



PARTICULATES



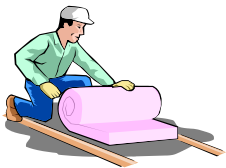
Dust



Mist



Fume



Fibre

GAS / VAPOUR

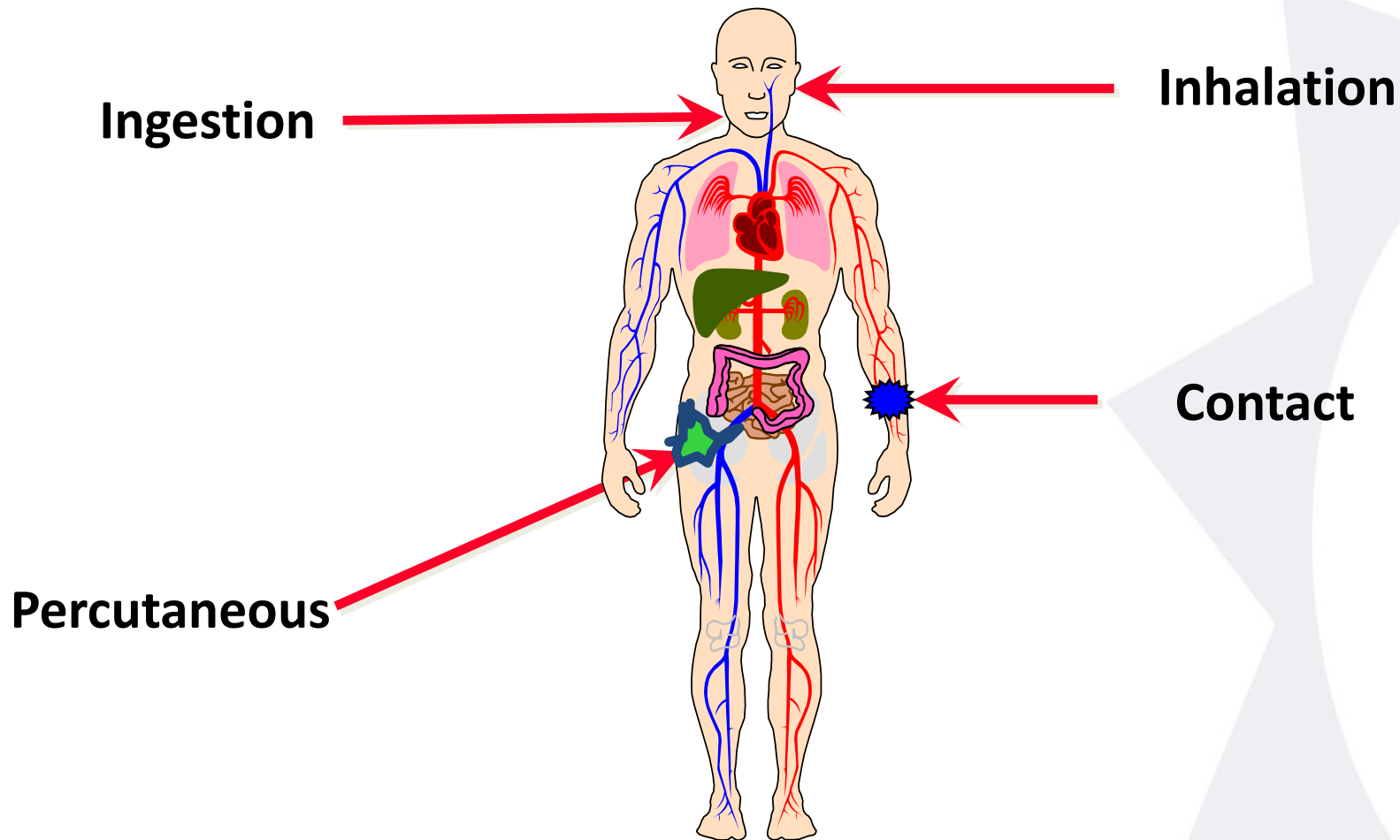


Gas



Vapour

Class Activity: Identifying Types of PPE to Protect Against Exposure by Different Routes



Requirements for PPE Program



- Selecting the PPE
- Hazard identification
- Risk assessment
- Training Employees in Proper Use of PPE



Example of a risk matrix for Biological Hazard

| Type of Biohazard | Form of Biohazard | Known Routes of Exposure | Known Infective Dose of Biohazard | How is the Biohazard Handled in the Lab | How frequently is the Biohazard Handled | Quantity of Biohazard Handled at One Time |
|--|---|--|-----------------------------------|---|---|--|
| <input type="checkbox"/> Bacteria <input type="checkbox"/> Virus <input type="checkbox"/> Prion <input type="checkbox"/> Human Pathogen <input type="checkbox"/> Animal Pathogen-Non-Zoonotic <input type="checkbox"/> Animal Pathogen-Zoonotic <input type="checkbox"/> Other | <input type="checkbox"/> Culture, live <input type="checkbox"/> Frozen <input type="checkbox"/> Lyophilized <input type="checkbox"/> Fixed <input type="checkbox"/> DNA <input type="checkbox"/> RNA <input type="checkbox"/> Recombinant DNA <input type="checkbox"/> Recombinant RNA <input type="checkbox"/> Diagnostic Samples <input type="checkbox"/> Blood <input type="checkbox"/> Serum <input type="checkbox"/> Sputum <input type="checkbox"/> Feces <input type="checkbox"/> CFS <input type="checkbox"/> Tissue(type) <input type="checkbox"/> Environmental Source <input type="checkbox"/> Other | <input type="checkbox"/> Contact with Mucous Members/Eyes <input type="checkbox"/> Inhalation of Aerosols <input type="checkbox"/> Ingestion <input type="checkbox"/> Contact with non-intact skin <input type="checkbox"/> Parenteral Inoculation <input type="checkbox"/> Other | | <input type="checkbox"/> Pipetted <input type="checkbox"/> Handled with Sharps <input type="checkbox"/> Centrifuged <input type="checkbox"/> Poured <input type="checkbox"/> Inoculated with Loop <input type="checkbox"/> Used to prepare slides <input type="checkbox"/> Cultures Grown <input type="checkbox"/> Infected Animal <input type="checkbox"/> Other | >5 times/day 2-4 times/day once daily up to 4 times/week 1 time/week 2-3 times/month monthly 2-4 times/year 5-11 times/year less than once a year other | ul/g quantities >1ml/g 1ml/g-100ml/g 100ml/g-1000ml/g <1 litre/kilogram unknown |

How to select your PPE



- Familiarise with potential hazards and types of PPE available
 1. Anticipate exposure
 2. Durability and appropriateness of PPE to the task
- Consider the hazard association with Environment

How to select your PPE



- Select PPE that ensures greater level of protection than minimum requirement.
- Fit the worker with PPE and give instructions on use and care.
- Make workers aware of limitation of PPE.
- If several different type of PPE are worn together, make sure they are compatible

Training Employees



- In proper use of PPE
 - Why PPE is necessary?
 - When PPE is necessary?
 - What PPE is necessary?
 - How to properly put on, take off, adjust and wear the PPE.
 - The limitations of the PPE.
 - Proper care, maintenance, useful life and disposal of PPE.

Personal Protective Equipment Policies and Procedures



- Policy and Procedure should include:
 1. Selection
 2. Training
 3. Fit testing
 4. Use and Maintenance

Gloves



- Gloves help protect you when directly handling potentially infectious materials or contaminated surfaces.
- Wear gloves when directly handling potentially infectious materials or in contact with contaminated surfaces.
- Vinyl, latex, or nitrile gloves may be worn. (there are many other types of gloves other than the ones listed here)
- Change gloves when visibly soiled, torn or punctured.
- Wash hands upon removing gloves. Gloves do not replace the need for excellent hand washing!
 - <http://www.bestglove.com>



Gloves



- Purpose is to protect from infectious agents/chemicals being transmitted/absorbed via hands
 - Body fluids, mucous membranes non-intact skin
 - Contaminated equipment and surfaces
 - Considerations
 - Fit (tight fitting or loose fitting)
 - Material
 - Sterile, non sterile
 - Use and reuse, disposable versus reusable

Types of Protective Gloves



- Type of chemicals handled.
- Nature of contact (total immersion, splash, etc.).
- Duration of contact.
- Area requiring protection (hand only, forearm, arm).
- Grip requirements (dry, wet, oily).
- Thermal protection.
- Size and comfort.
- Abrasion/resistance requirements.



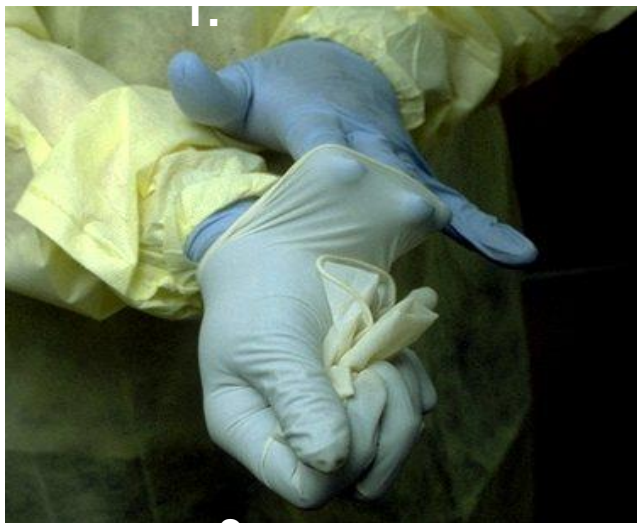
Types of Protective Gloves



- Gloves made from a wide variety of materials are designed for many types of workplace hazards. In general, gloves fall into four groups:
 - Insulating rubber gloves (See 29 CFR 1910.137 and the following section on electrical protective equipment for detailed requirements on the selection, use and care of insulating rubber gloves).
 - Gloves made of leather, canvas or metal mesh;
 - Fabric and coated fabric gloves;
 - Chemical- and liquid-resistant gloves;



Example: Doffing Gloves



1.

2.

3.

Gowns



- Gowns help protect you from the contamination of clothing with potentially infectious material.
- Wear a gown when contamination of clothing with potentially infectious material is possible.
- Your gown should fully cover the torso, fit close to the body and cover the arms to the wrists.
- Choose a gown appropriate to the situation:
 - Disposable vs re-useable (requires laundering).
 - Fluid-resistant vs non fluid-resistant.
 - Sterile vs clean.



O.R. Gown Full Barrier Front



- Raised neckband, colour coded to identify size
- GORE® LP Surgical Fabric protection on gown front and on sleeves from 4" above elbow to knitted cuff and yolk to hem
- three sets of inside centre back tape ties
- overlap back for better coverage
- outside tie closure at waist
- seam sealed sleeves



■ Scrubs

Tyvek Suits, Coveralls



- Protect your skin and clothing when working with dirt, paint, solvents, chemicals, oil, grease. These multipurpose suits are durable and can be worn over and over.
- Head and body protection in a disposable coverall with elasticized cuffs to protect arms and legs.
- The durable Tyvek® fabric is hard to tear or puncture, yet it functions as a breathable membrane that allows body heat and sweat to escape while preventing chemicals, paints and particles from getting in.

There are many other types of coveralls made of cloth, heavy PVC/Poly, etc.....)

Shoe and Head Covers



- **Shoe covers**

- Wear shoe covers to provide a barrier against possible exposure to airborne organisms or contact with a contaminated environment.



- **Head covers**

- Wear head covers to protect the hair and scalp from possible contamination when sprays or airborne exposure is anticipated.



Masks and Respirators



- Surgical masks help protect your nose and mouth from splattered body fluids (such as blood, respiratory secretions, vomit, urine or feces).

(a surgical mask is not a respirator)



- Respirators filter the air before you inhale it.

Respirators



- Respirators filter the air you breathe to help protect you from microorganisms including bacteria and many viruses.
- Types of respirators include:
 - Disposable Respirators (includes N95, N100)
 - Powered Air Purifying Respirator (PAPR)
 - Self-Contained Breathing Apparatus (SCBA) Respirators



Air Purifying Respirators



- Non-powered (Negative Pressure)



- Powered (Positive Pressure or PAPR)



**Air-Mate™ HEPA
PAPR System**



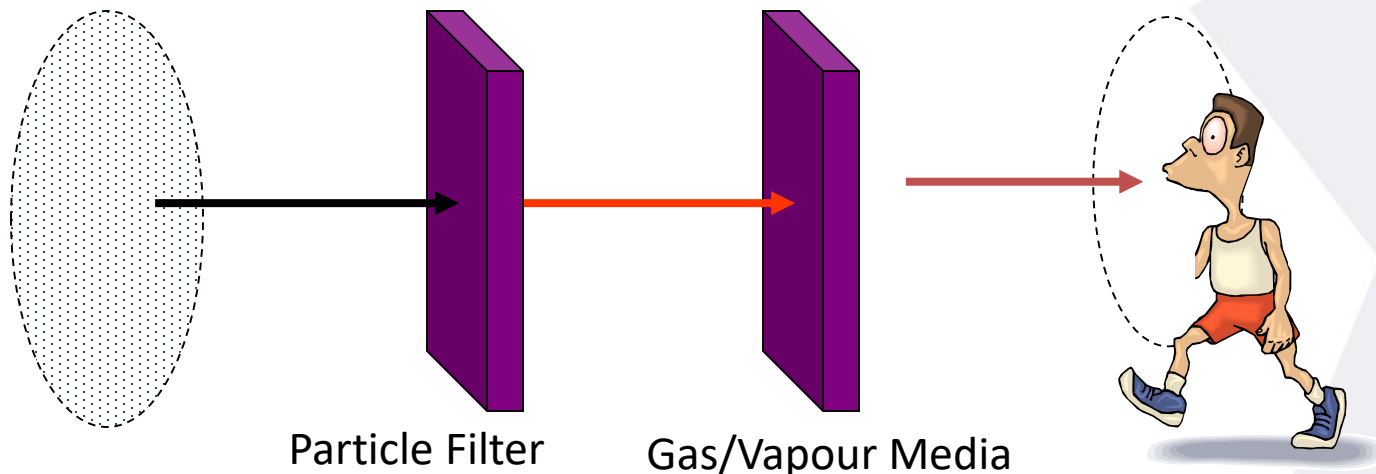
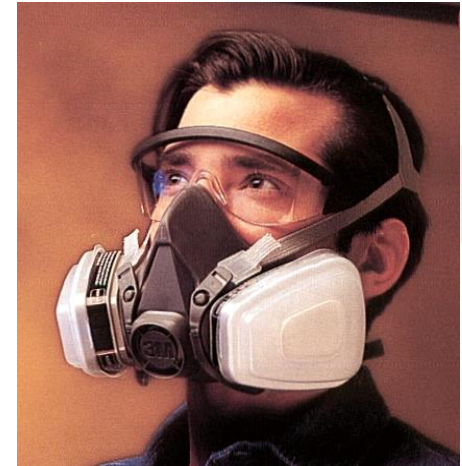
**R-Series™
PAPR System**

Negative Pressure Air Purifying Respirator



HOW IT WORKS

By inhaling, a negative pressure is created in the respirator. Ambient air flows through a filter or cartridge, which removes the contaminants. The clean air continues into the respirator and then the lungs.

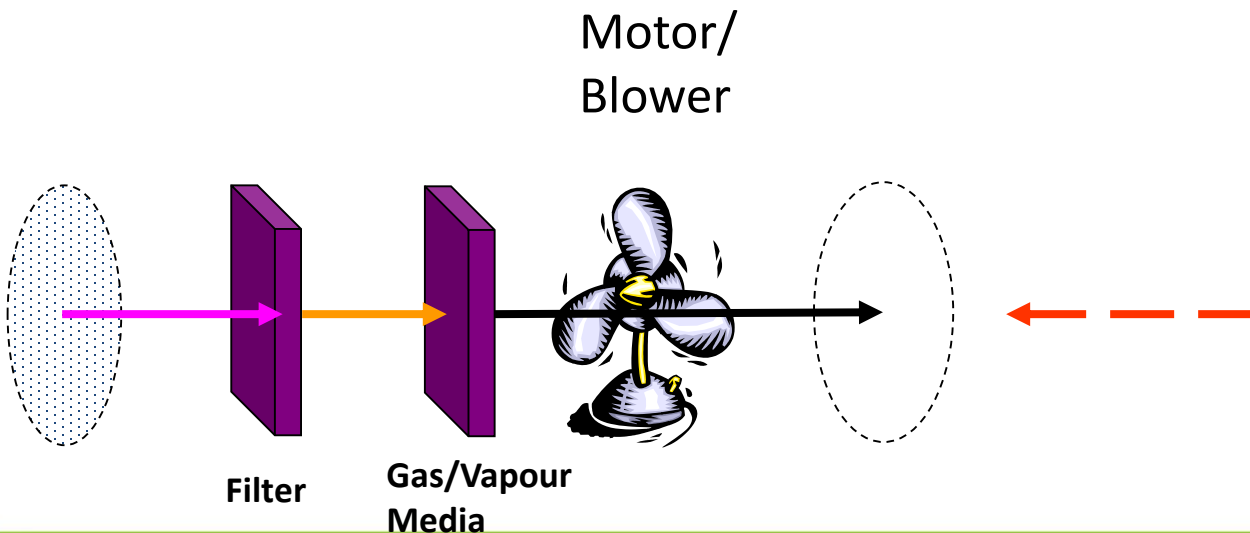
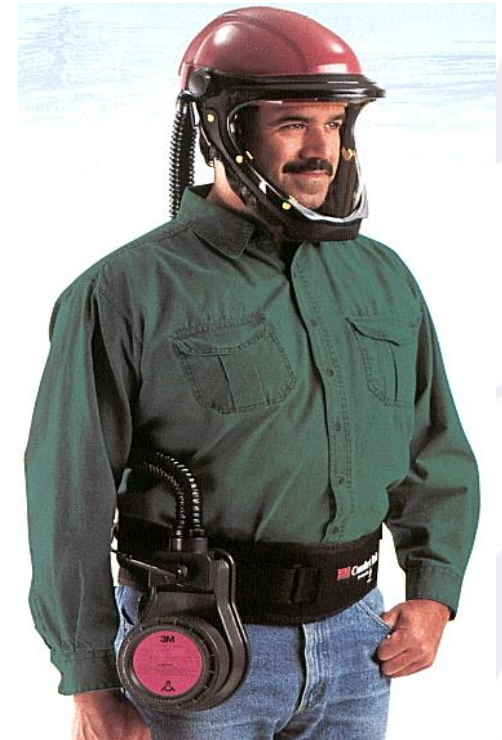


Positive Pressure Air Purifying Respirator

(A.K.A. Powered Air Purifying Respirators (PAPRs))



The motor/blower unit pulls the ambient air through a filter or cartridge, which removes the contaminants, and then forces the purified air into the breathing zone.



Fit Testing Methods



QUALITATIVE:

Subjective pass/fail method.
Sensory response of the test subject to a test agent.



QUANTITATIVE:

Objective test.
Number generated.

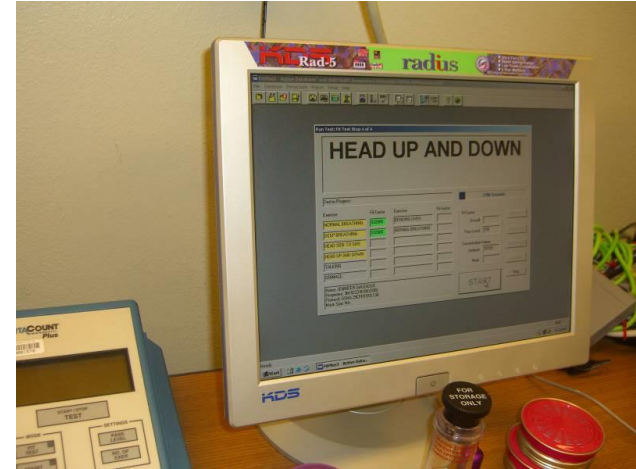


Scenes from a Respirator Fit Test



FIT TEST SUBJECT AID

1. SELECT/ASSESS AND INSPECT RESPIRATOR
2. REMOVE INTERFERENCES (e.g., **HAIR**)
3. INSTALL CORRECTIVE LENSES INSERT (IF REQUIRED)
4. DON & WEAR RESPIRATOR FOR COMFORT ASSESSMENT PERIOD (**AT LEAST 5 MINUTES**)
5. MOVE HEAD SIDE-TO-SIDE, UP AND DOWN, AND BREATHE DEEP SLOWLY TO SEAT THE MASK
6. PERFORM POSITIVE & NEGATIVE (**HOLD FOR 10 SECONDS**) PRESSURE **USER SEAL** CHECK
7. PERFORM FIT TEST EXERCISES IN STANDING POSITION
8. REMOVE RESPIRATOR WHEN FIT TEST IS COMPLETE
9. SIGN/DATE RECORDS
10. REVIEW RESPIRATOR AUTHORIZATION CARD FOR CORRECTNESS



Factors Affecting Face Seal



- Facial hair
- Weight loss/gain
- Wrinkles, scars, acne, make-up
- Facial structure
- Dentures



NIOSH Particulate Filter Classifications



- ❑ N-Series: Not for oil
 - ❑ Approved for non-oil particulate contaminants
 - ❑ Use until increased breathing resistance or damaged (In Health Care settings, the infection control practices take precedence)
- ❑ R-Series: Resistant to oil
 - ❑ Approved for all particulate contaminants
 - ❑ Time restriction of 8 hours when oils are present
- ❑ P-Series: Oil Proof
 - ❑ Approved for all particulate contaminants
 - ❑ Manufacturer's time use restrictions apply

NIOSH Particulate Filter Classifications



42 CFR 84 Filter Classifications

| Minimum Efficiency | N Class No Oil | R Class Oil Resistant | P Class Oil Proof |
|--------------------|-------------------|--------------------------|----------------------|
| 95% | N95 | R95 | P95 |
| 99% | N99 | R99 | P99 |
| 100% | N100 | R100 | P100 |

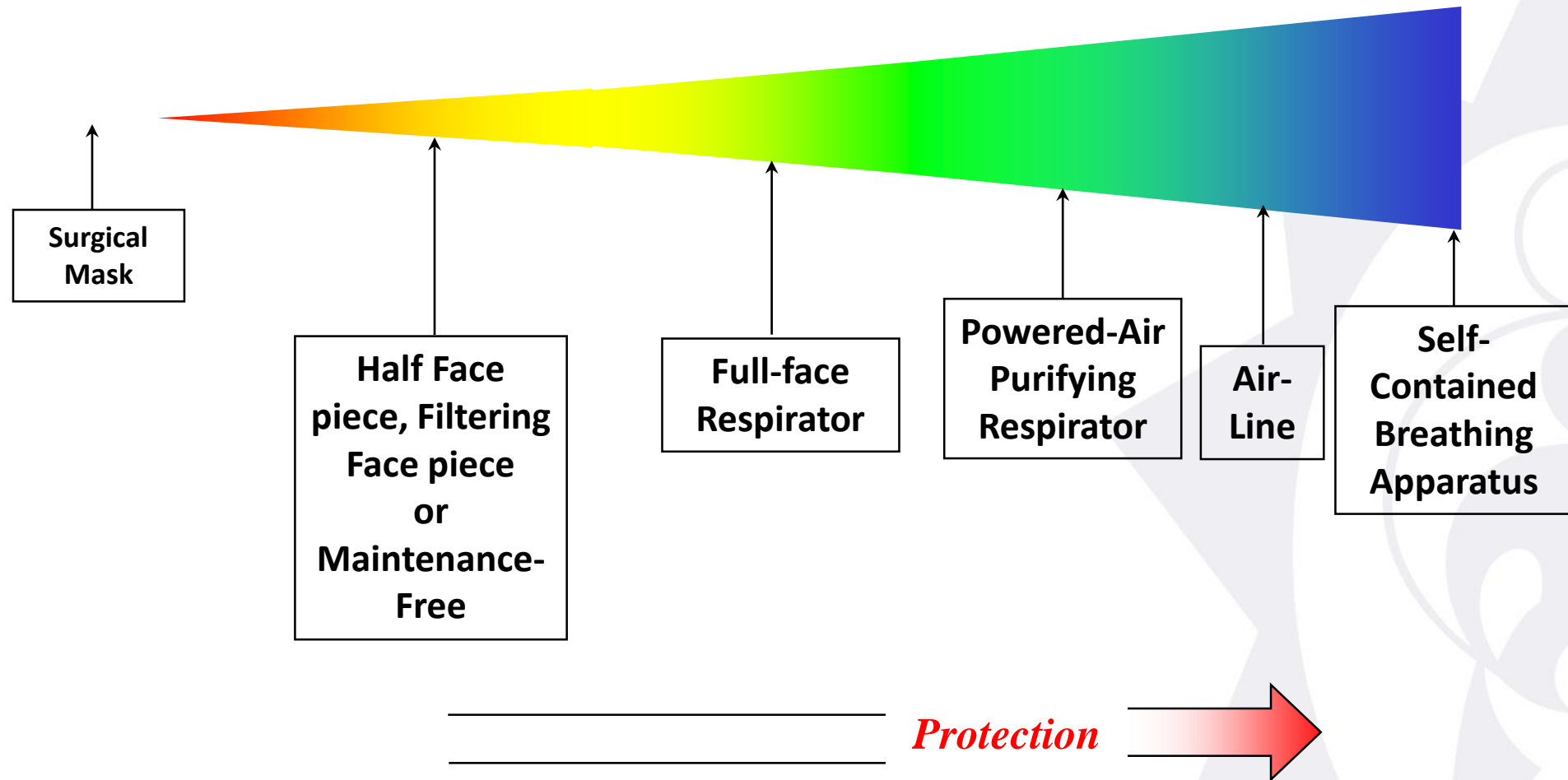


Limitations of Air Purifying Respirators



- Not for use in atmospheres containing less than 19.5% oxygen
- Not for use in Immediately Dangerous to Life and Health (IDLH) atmospheres
- Do not use with facial hair, or other conditions that interfere with the seal between the face and the respirator (N100, $\frac{1}{2}$ or full face tight fitting respirator)
- Do not alter, abuse, or misuse the respirator

Respiratory Protective Equipment Spectrum



Key Messages



- PPE is the last control in the Hierarchy of exposure Control

Drill



1. Donning & Doffing of disposable PPE
2. Donning & Doffing of reusable PPE

Any Questions?

