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Respiratory Protection

- A respirator is one type of control often selected when ventilation controls such as local exhaust or enclosure are not feasible or sufficient.
- Respirators are designed to protect the respiratory system from inhalation of atmospheric hazards by either:
 - removing contaminants from the air before they are inhaled, or
 - supplying an independent source of "clean" air.


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Respiratory Protection

- Properties of hazardous substances:
 - Gases
 - Vapors
 - Particles




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Respiratory Protection

- Gases
 - One of the three basic phases of matter (along with liquids and solids)
 - Gases (like liquids) are fluids
 - Ability to flow
 - Viscosity, but does not resist deformation
 - Unconstrained gases (unlike liquids) do not occupy a fixed volume, but expand to fill their space




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Respiratory Protection

Tight-Fitting Facepieces

 Half-mask APR with twin cartridges

 Full facepiece APR

 The rarely-seen quarter-mask APR, which seals above the chin and below the mouth and has a single cartridge

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Respiratory Protection

Half mask APRs

- Protection against gases, vapors, or particulates
- Cartridges contain a filtering and / or adsorbing media that removes contaminants from the air. The type of cartridge selected is based on anticipated contaminant(s) in the work environment.
- Cartridges attach to the respirator inlets, so air entering the facepiece is purified before it is inhaled by the respirator wearer.
- On the front of the mask is an exhalation outlet with a one-way valve that allows air to leave the facepiece.



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Respiratory Protection

Full Facepiece APRs

- Full facepiece respirators are used when a higher level of respiratory protection is needed, or when protection of the eyes and face is important.
- Examples:
 - Hazardous waste bulking, in which there may be high atmospheric concentrations of vapors
 - Jobs involving chemicals that are irritating to the eyes
 - Pesticide or herbicide spraying, where overspray may contact the eyes
 - Research animal care, where allergens can affect the eyes as well as the respiratory system.
- Like the simpler half-face respirator, full facepieces have interchangeable cartridges that are selected on the basis of the anticipated respiratory hazard(s).



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Respiratory Protection

"Canister" Respirators

- Canisters are sometimes used instead of cartridges for gas and vapor respirators, because more sorbent material can fit in a canister
- These tend to be heavier than cartridge-using APRs, and are not widely used at UK.



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Respiratory Protection

Disposable Filtering Facepiece Respirators

- This is another type of APR, which is used once and discarded. These are popular in healthcare settings and research laboratories.
- Filtering facepiece respirators are intended to protect against particles, although some models may contain an activated charcoal media to control odors or vapors. However, this type of respirator is not recommended if you have potential exposure to gases or vapors.



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Respiratory Protection


Disposable Filtering Facepiece Respirators

- These respirators are described based on their resistance to oil, and their collection efficiency with 0.3 micron test particles
- Oil resistance is indicated by N, R, or P:
 - "N" means that the respirator is not resistant to oil
 - "R" is more resistant to oil
 - "P" is most resistant, and is often considered "oil-proof"



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Respiratory Protection


Disposable Filtering Facepiece Respirators

- Filtration efficiency is listed by the numerical percent of test particles (0.3µm) that are filtered
 - This number is listed after the N, R, or P
- N-95 is the minimum level of efficiency that is acceptable for protection against hazardous particulates.
 - Respirators with greater filtration efficiency are available (e.g. N-97 and N-100, R-97 and R-100, P-97 and P-100).
 - An N -, R-, or P-100 filter is also called a High Efficiency Particulate Air (HEPA) filter because it is nearly 100% effective at filtering test particles.



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Respiratory Protection


Disposable Filtering Facepiece Respirators

- N-95 or higher disposable respirators are effective for hazard reduction when working with infectious agents.
 - Greater levels of protection might be required for specific agents or protocols.
- Eye and face protection can be worn with disposable filtering facepiece respirators.
 - E.g. goggles and/or face shield worn with disposable respirator in Biosafety Level 3 facilities



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Respiratory Protection

NIOSH Certified Respirators

- All respirators used in the workplace must bear the certification of the National Institute for Occupational Safety and Health (NIOSH).
 - Ref: 29 CFR 1910.134(d)(1)(ii)
- NIOSH certification is for the intact respirator unit, with all parts in place, operational, and from the same manufacturer
 - "Mixing and matching" parts from different brands of respirators invalidates the NIOSH certification.
 - Homemade and shop-made respirators or alterations are NOT approved.



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Respiratory Protection

NIOSH-Certified Respirators

- Some disposable masks are not "respirators" at all, since they are not NIOSH certified.
 - These are often recognizable by their use of thin paper rather than a rated filtering material, or a single strap. NIOSH-certified filtering facepiece respirators will always have two straps.
 - Paper masks and "surgical" masks have their uses, but they are not respirators!
 - Do not use these for tasks where a real respirator is needed, and do not expect these to provide any level of respiratory protection.



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Respiratory Protection

Powered Air-Purifying Respirator (PAPR)

- PAPRs are useful for work environments where traditional full facepiece respirators are not acceptable.
 - Example: if the work environment is hot with high humidity, then the face shield on a traditional full facepiece respirator may fog up rapidly, causing discomfort and obstructed vision.
- PAPRs utilize a battery powered blower motor to pull air through a purifying element (cartridge or canister), then push the air into the full facepiece.



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Respiratory Protection

Powered Air-Purifying Respirator (PAPR)

- Air is circulated through the facepiece producing a cooling effect that improves comfort and reduces fogging.
 - Additionally the blower motor does the work of pulling air through the filtering media, resulting in less physical stress on the user.
- When maximum comfort and communication ability is needed, a loose-fitting covering or hood can be used with a PAPR blower motor and air purifying element.



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Respiratory Protection

Do I have to know about all respirator types, even if I will only use one certain type in my job?

- This is necessary only to the extent that knowledge of other respirator types helps you or your supervisor make the correct choice regarding the best type of respirator for your work environment.



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Respiratory Protection

Do I have to know about all respirator types, even if I will only use one certain type in my job?

- **Example:**
 - You initially select a half-mask respirator and then a new contaminant is introduced to the work environment, one that causes a need to protect the eyes and face
 - At that point, a general awareness of the protective capacity and general uses of full facepiece respirators will help you to realize that there is a better, more protective choice in respirators for your work environment.



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Respiratory Protection

I have asthma. Will this cause a problem when I am wearing a respirator?

- Possibly. In fact, there are a number of conditions that could cause potential adverse health effects for respirator wearers, including:
 - respiratory diseases
 - history of heart attack or stroke
 - claustrophobia
 - high blood pressure
- Each of these conditions may adversely affect the health of some employees who wear respirators.

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Respiratory Protection

I have asthma. Will this cause a problem when I am wearing a respirator?

- A physician or other licensed health care professional operating within the scope of his/her practice needs to medically evaluate employees to determine under what conditions they can safely wear respirators.
- Thus, it is necessary to ensure that you are physically capable of wearing a respirator.

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Respiratory Protection

How will I know if my respirator is fitting properly?

- Fit testing is an OSHA requirement, and is conducted to determine proper respirator fitting.
- Even the best designed and manufactured respirator will not protect the wearer if there is an improper match between facepiece and wearer or improper wearing practices by the user.



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Respiratory Protection


How will I know if my respirator is fitting properly?

- With different brands of a particular type of facepiece available, it is important to determine which one fits best.
- It is also important to know how to correctly wear your respirator.
- Choosing the correct respirator and knowing how to wear it are accomplished by fit testing.



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 **Respiratory Protection**

How will I know if my respirator is fitting properly?

- It is important to remember that no single respirator type / model will fit everyone.
- Therefore, more than one brand of a given type of respirator should be purchased to take advantage of the different characteristics of each type, and to ensure a correct fit for everyone.
- Also, having more than one facepiece to choose from gives a better chance to find a respirator that is comfortable while providing good protection.


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 **Respiratory Protection**


Quantitative Fit Testing (QNFT): the preferred method for determining proper fit

- QNFT is conducted using sophisticated equipment by trained personnel, in order to detect facepiece leakage.
- QNFT does not rely on subjective responses, and is highly sensitive and assures correct fit. This is especially important when working in highly hazardous atmospheres which can be immediately dangerous to life or health.




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 **Respiratory Protection**

After the initial fit test, how do I know if my respirator continues to function correctly?

- To ensure that your respirator is functioning correctly and is safe to use, meticulous respirator MAINTENANCE is vital, and includes the following:
 - Inspection
 - Cleaning
 - Proper Storage



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Respiratory Protection

Respirator Maintenance

- Manufacturers' instructions for caring for your respirator should be followed to ensure correct function.
- Poorly maintained or malfunctioning respirators do not protect the wearer and can be more dangerous than not wearing a respirator at all.
- Maintenance guidelines may change due to the needs of your facility and how often you are using respirators and for what purpose.

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Respiratory Protection

Respirator Maintenance: Tailoring

- In a large respirator program in which respirators are used routinely, they should be exchanged daily for cleaning and inspection.
- However, in a small program involving only occasional respirator use, this period could be weekly or monthly.
- It is important to evaluate your specific needs regarding respirator use to determine the best maintenance program.

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Respiratory Protection

Respirator Maintenance: Inspection

- The *facepiece* of a routinely used respirator should be checked before and after each use for
 - Excessive dirt
 - Cracks, tears, holes, or distortion from improper storage
 - Inflexibility (stretch and massage to restore flexibility)
 - Cracked or badly scratched lenses in full facepieces



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Respiratory Protection

Respirator Maintenance: Inspection

- The *facepiece* of a routinely used respirator should be checked before and after each use for:
 - Incorrectly mounted full-facepiece lens or broken or missing mounting clips, and
 - Cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s) (if required).

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Respiratory Protection

Respirator Maintenance: Inspection

- The *head straps* or head harness of a routinely used respirator should be checked before & after each use for:
 - Breaks
 - Loss of elasticity
 - Broken/malfunctioning buckles and attachments, and
 - Excessively worn serrations on the head harness, which might permit slippage (full facepieces only)



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Respiratory Protection

Respirator Maintenance: Inspection

- The *air-purifying elements* of a routinely used respirator should be checked before and after each use for:
 - Incorrect cartridge, canister, or filter for the hazard
 - Incorrect installation, loose connections, missing or worn gaskets, or cross-threading in holder.
 - Expired shelf-life date on cartridge or canister
 - Cracks or dents in outside case of filter, cartridge, or canister, and
 - Evidence of prior use of adsorbent cartridge or canister, indicated by absence of sealing material, tape, foil, etc., over inlet.



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Respiratory Protection

Respirator Maintenance: Cleaning

- OSHA states that "routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided." and that emergency use respirators "shall be cleaned and disinfected after each use."



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Respiratory Protection

Respirator Maintenance: Cleaning

- If the respirator is dirty, it should be washed with detergent in warm water using a brush.
- If the respirator is not visibly soiled, it may still need to be disinfected using a solution of one part bleach to 10 parts water.



Place respirator in bleach solution for no less than 10 minutes, then rinse thoroughly in clean water (140°F maximum) to remove all traces of detergent or bleach. This is very important to prevent exposure that could lead to dermatitis.

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Respiratory Protection

Respirator Maintenance: Cleaning

- Alcohol-free cleaning pads can be used for cleaning non-disposable respirators that are not visibly soiled
- The use of rubbing alcohol should be avoided because alcohols will cause the rubber components of the facepiece to degrade.



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Respiratory Protection

Respirator Maintenance: Cleaning

- Drying of your respirator should be on a clean surface.
- Respirators may also be hung to dry, but care must be taken not to damage the facepiece or stretch/distort the head straps.
- Do not place the respirator back into an airtight container or storage bag until it is completely dry or mold growth could result.



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Respiratory Protection

Respirator Maintenance: Storage

- Storage of your respirator should be done in a clean, dry place free of hazards.
- The respirator should be able to dry where it is stored and respirator storage must protect against:
 - Dust
 - Sunlight
 - Heat
 - Extreme cold
 - Excessive moisture, and
 - Damaging chemicals.



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Respiratory Protection

Respirator Maintenance: Storage

- Clean, dry respirators should be placed in reusable plastic bags or other clean, sealable containers.
- They should be stored in a clean, dry location away from direct sunlight.
- They should be stored in a single layer with the facepiece and exhalation valve in a more or less normal position to prevent the rubber or plastic from taking a permanent distorted "set".

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Respiratory Protection

Can I wear a respirator if I have facial hair?

- A tight-fitting respirator must have a good seal around the face to ensure maximum protection. Facial hair that lies along the sealing area of the respirator, such as beards, sideburns, moustaches, or even a few days of stubble are **NOT permitted** when wearing a respirator.
- Facial hair between the wearer's skin and the sealing surfaces of the respirator will prevent a good seal. The wearer should be cleanly shaven when wearing a tight-fitting respirator.
- The only exception would be a small moustache that does not lie beneath the sealing surface of the respirator.

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Respiratory Protection

Can I wear a respirator if I have facial hair?

- Respirators with loose-fitting facepieces (such as the PAPR pictured below) are an option for personnel who cannot shave or maintain a tight face-facepiece seal.
- Consult UK OHS if you are interested in a loose-fitting respirator for a reason related to fit or comfort.



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Respiratory Protection

Can I wear a respirator if I wear eye glasses?

- Ordinary eye glasses should not be used with tight-fitting full facepiece respirators. They can be worn under loose fitting PAPRs (see previous slide).
- Eye glasses with bars or straps that pass through the seal of the respirator will prevent a good seal.
- Special corrective lenses can be mounted inside a tight-fitting full facepiece respirator and are available from all manufacturers of full facepiece respirators.
- When wearing a half-mask respirator, glasses MAY be permitted because they do not pass through the seal.

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Respiratory Protection

Can I wear a respirator if I wear contact lenses?

- There are several factors that limit the use of contact lenses while wearing any type of respiratory device, especially air-supplying respirators.
- With full facepiece respirators, incoming air directed toward the eye can cause discomfort from dirt, lint, or other debris lodging between the contact lens and the pupil.
- It is not recommended that contact lenses be worn while using a respirator and that other means be used such as special corrective lenses that are mounted inside a full facepiece respirator.



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SAFETY RESOURCES



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