



**Northern Illinois
University**

Respiratory Protection

**Everything You Wanted to Know About Respiratory Protection
– and Probably a Bit More.**

Purpose of this training



- OSHA requires that workers be provided with respirators by the employer when such equipment is necessary to protect the health of the employee.
- The employer shall provide training in the proper use of respirators including donning and removing them, maintenance, limitations and respiratory hazards to which the workers may potentially be exposed during routine and emergency situations.

Respirators are **NOT** the first line of defense



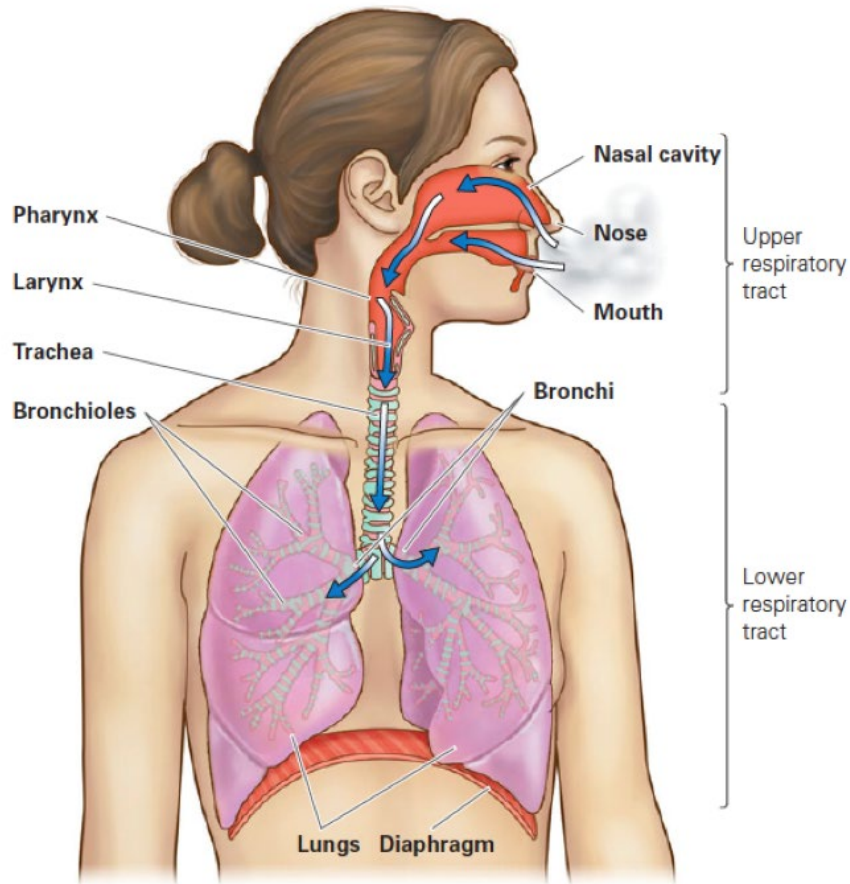
- Engineering controls, administrative measures and good work practices are the first line of defense. It is best to design the work so that hazardous contaminants don't get to the worker in the first place, or if they do, to minimize the amount.
- Respirators are used as necessary additional protection to workers' respiratory systems.
- Even if needed for only a short time, use the respirator. With some materials it does not take long to damage the lungs.

What You're Protecting



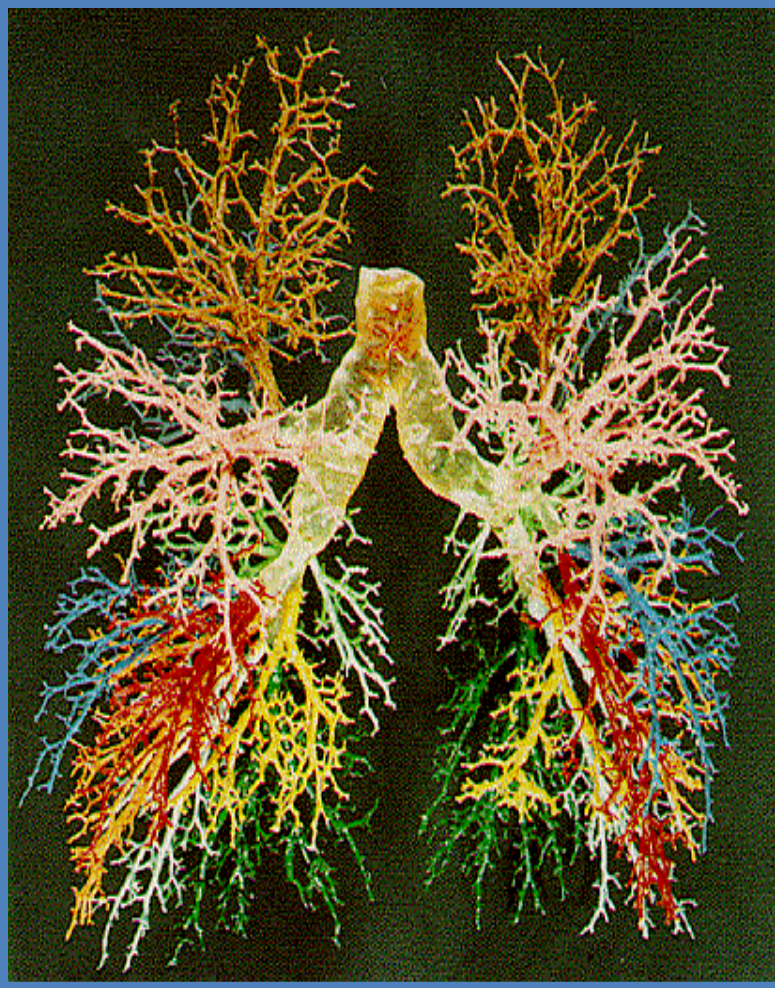
- The respiratory system draws air through the nose and mouth down through airways to the lungs, where the alveoli of the lungs allow inhaled oxygen to enter the blood and carbon dioxide to leave it to be exhaled.
- CO₂– oxygen exchange is vital. If you can't breathe you won't survive long.
- Lungs & airways are delicate tissues.
- Chemicals and particulates in the air in sufficient quantities can damage them.
- Engineering controls and respirators are used to protect the lungs by keeping damaging materials away from them.

Respiratory System

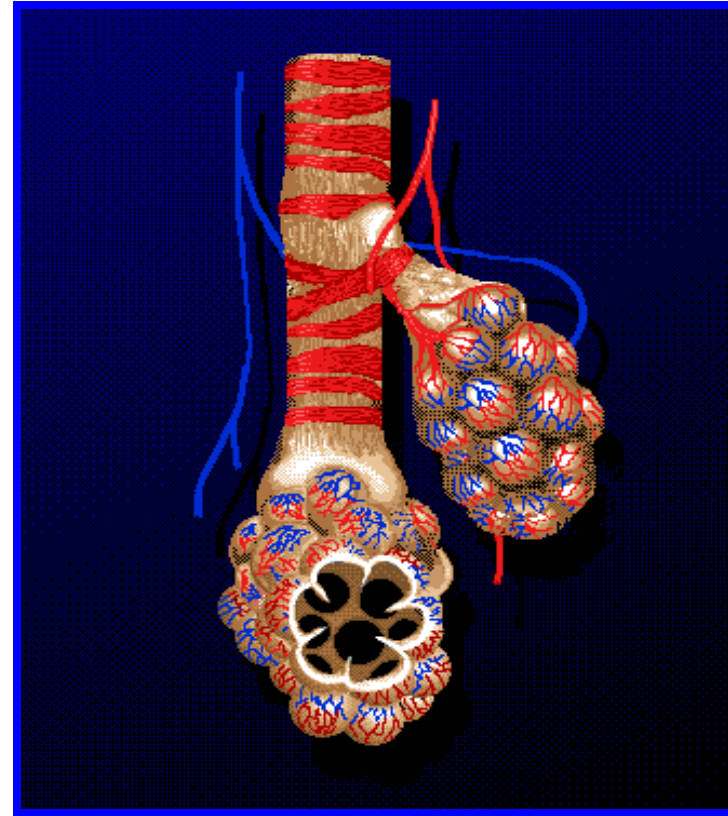


The main parts of the system are

- Nose and Mouth
- Throat (including larynx)
- Trachea (windpipe)
- Bronchi
- Lungs



Bronchi
(branches from trachea)



Alveoli
(air sacs in the lungs)

What you're protecting against when you wear a respirator



Respiratory Hazards

There are three main categories of respiratory hazard:

- Oxygen Deficiency
- Toxic Contaminants
- Biological Agents

Oxygen Deficiency



- Oxygen Deficiency occurs where other gases have displaced the oxygen (such as in low spots in confined spaces) or consumed it (fires).
- If used in sufficient quantity, certain fire-fighting materials such as carbon dioxide or halon from fire extinguishers can displace oxygen. Exit a fire area immediately.

Toxic Contaminants



There are three categories of toxic contaminants

- Gases and Vapors (carbon monoxide, gasoline)
- Particulates (asbestos, dust from pool chlorination tablets)
- Combinations of gases/vapors and particulates

Biological Agents



- Respirators are also used to protect against inhalation of certain contagious biological agents such as bacteria and viruses.

N95 respirators have been used to protect medical personnel from biological agents such as tuberculosis (TB) and SARS.



Control of Respiratory Hazards

To control respiratory hazards

- Assess the hazard (identify the contaminant & its concentration)
- Reduce or eliminate the hazard (use good work practices and engineering controls.)
- Provide respiratory protection equipment based on work activities, environmental conditions and needs of the workers.

Types of Respirators

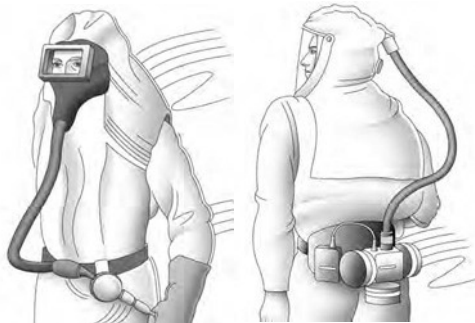


There are four categories of respirators

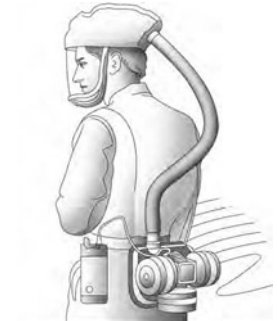
- Air-purifying respirators (APR)
- Supplied-air respirators (SAR)
- Self-contained breathing apparatus (SCBA)
- Combination respirators



Air Purifying Respirators (APR)



Powered Air Purifying Respirators (PAPR)



Self Contained Breathing Apparatus (SCBA)



Air-Purifying Respirators



- Removes contaminant from air before it is inhaled.
- Made of a filter facepiece, or a facepiece and disposable filter cartridges.
- Depends on the lung power of the wearer to draw air through the filter (negative pressure.)



Air Purifying Respirators



APRs remove limited amounts of contaminants from the worker's breathing zone, but do nothing to change the oxygen content or affect conditions where the contaminant concentrations exceed the limits of the respirator and filter cartridges.

Do not depend on an APR in an oxygen-deficient environment!

Air-Purifying Respirators



There are two types of APR filters:

- Particulate-removing or mechanical (includes HEPA filters)
- Gas and vapor-removing or chemical (includes organic vapor and acid gas absorbents)



N 95 Respirators



N 95 Respirators



N 95 respirators:

- The facepieces are made of filtering material
- Are more restrictive and efficient than a "dust mask"
- The N means the filter material is "Not oil resistant"
- The 95 means "95% efficiency"
- Filter out particulates (bacteria are particles) but not gases or vapors
- Are not HEPA filters (HEPA stands for "high efficiency particulate air")
- Cannot be cleaned
- Can be used until they are difficult to breathe through
- Are disposable.



Half mask respirators with P100 (HEPA) filter cartridges



Half Mask Respirators



Half Mask respirators:

- Have an elastomeric face piece and disposable filter cartridges
- Are more restrictive and efficient than an N 95
- Filter cartridges may be changed to suit the particular protection needed, such as from fine particulates (P100), acid gases, volatile organic compounds, mercury, etc.
- The P100 cartridges (which are pink, magenta or purple) filter out to 99.97% of particulates down to 0.3 microns. These are HEPA filters
- The filters themselves cannot be cleaned but the filter cartridge can be wiped clean with a damp cloth. Do not get the filter material wet.
- The P100 filter cartridges can be used until they are difficult to breathe through.
- Filter cartridges are disposable.
- The half mask is washable and can be used until it can no longer form a proper seal on the face.

Full face respirator with HEPA and acid gas filter cartridges



Full Face Respirators



Full face respirators:

- Have an elastomeric face piece that protects the eyes, nose and mouth.
- Uses disposable filter cartridges
- Are more restrictive and efficient than an N 95
- Like half mask respirators, the filter cartridges may be changed to suit the particular protection needed, such as from fine particulates (P100), acid gases, volatile organic compounds, mercury, etc.
- The pink, magenta or purple P100 cartridges are HEPA filters
- The P100 filter material cannot be cleaned but the filter cartridge can be wiped clean with a damp cloth. Do not get the filter material wet. These filter cartridges can be used until they are difficult to breathe through.
- Once the charcoal based filters (used for volatile organic chemicals) are opened they continually absorb these gases. If the cartridge has not been used for a long time, dispose of it and get a new one. Don't trust your lungs to a used-up filter cartridge.
- Filter cartridges are disposable.
- The full face respirator is washable and can be used until it can no longer form a proper seal on the face.

Powered Air-Purifying Respirators



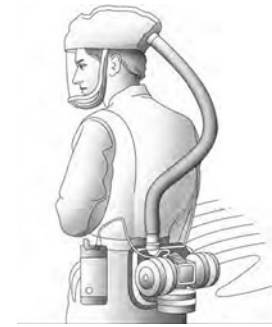
A special category of APR

- Uses a blower and portable battery pack to force air through filter cartridge (positive pressure)
- Leakage helps push contaminants out of breathing zone.

Is no protection in oxygen-deficient atmospheres.

Do not depend on an APR in an oxygen-deficient environment!

Powered air purifying respirator (PAPR) with HEPA filter cartridge



Powered Air Purifying Respirators



Powered air purifying respirators (PAPR):

- Do not depend on lung power. The filtered air is forced through the hood or mask (positive pressure) by the blower.
- May have a face-shield with an elasticized Tyvek™ throat guard or a loose-fitting hood that protects the whole head.
- Use a disposable filter cartridge that screws in to the respirator blower unit.
- Have filter cartridges selected to suit the particular type of protection needed.
- Filter cartridges are disposable.
- Are a good alternative for those with pulmonary problems or whose facial hair interferes with the seal of half mask or full face respirators. (Employers would be required to provide PAPR for the former but not the latter.)

Supplied Air Respirators



- Supplies uncontaminated air from a source independent of surrounding atmosphere.
- Air line feeds air to face-piece.
- Safe to use in oxygen-deficient atmospheres.
- Complex, needs monitoring, involves more regulations.
- Mobility limited to length of air hose.
- (Not used on campus.)



Self-contained breathing apparatus (SCBA)



Self-Contained Breathing Apparatus (SCBA)



- User carries source of breathable, uncontaminated air.
- Provides highest level of protection.
- Tanks hold up to 30 or 60 minutes of air.
- **Safe to use in oxygen-deficient atmospheres.**

Combination Respirators



- “Escape Bottles” (5 minute SCBAs)
- Supplied air respirators with emergency HEPA filters
- (not used on campus)

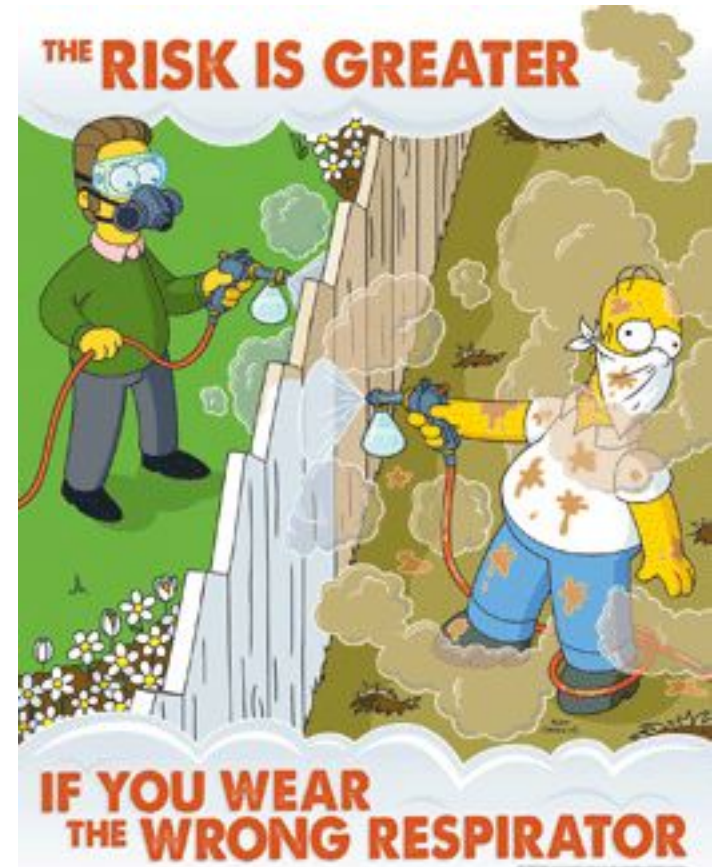


How is it determined which type to use?



Respirator type is decided by exposure level to contaminants in the work area. Toxic materials have a known Permissible Exposure Limit (PEL). The goal is to choose a respirator that will prevent more than that level from reaching your lungs.

This is done using **protection factors**.



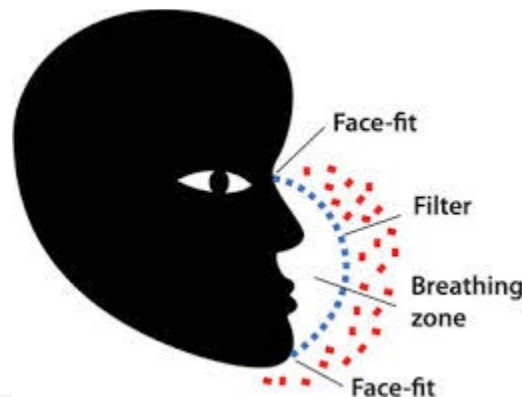
Protection Factor



The **protection factor (PF)** of a particular type of respirator is the difference between wearing that type of respirator and wearing no respirator at all.

Concentration of substance outside

Concentration of substance inside the mask



Protection Factors of Respirators with Filter Cartridges



<u>Respirator Type Factor</u>	<u>Protection</u>
Half face APR	10
Full face APR	50
Powered APR (PAPR)	50
Supplied Air	1,000
SCBA	10,000

How to wear a respirator



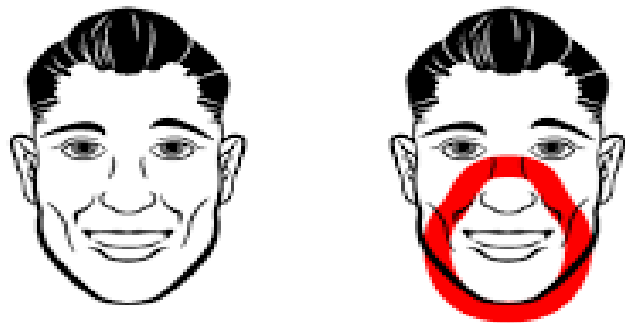
Respirator must fit tight to the face. This seals the contaminant out of the breathing zone.

- Try on different sized respirators to get the right fit.
- Excess facial movement can break the seal. Do not chew gum or tobacco, and especially do not smoke while wearing a respirator!
- Facial hair prevents the mask from sealing to the face.

How to wear a respirator—Facial Hair

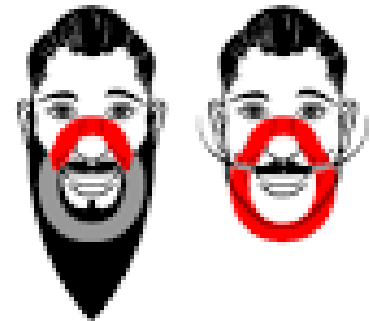


Red Area is the Masking Seal Surface
No hair should be in the Masking Seal Surface Area!



Acceptable

Unacceptable



How to wear a respirator—Facial Hair



It is important to remember **the respirator face-piece cannot properly seal over facial hair.** Even a long stubble is enough to break the seal and let contaminants inside the mask. This is why OSHA has stated a person with facial hair shall not be fit tested as it causes an automatic fail.

Do not use a respirator that has not been fit tested.

To all affected, it is important to be clean shaven **EVERY** time you use a respirator. It is not enough to be clean shaven the day your respirator is fit tested. Don't put your lungs at risk just to sport a beard.

How to wear a respirator



Inspecting the Respirator

Check face-piece and valves for

- Excessive dirt
- Distortion from poor storage
- Anything cracked, torn or missing

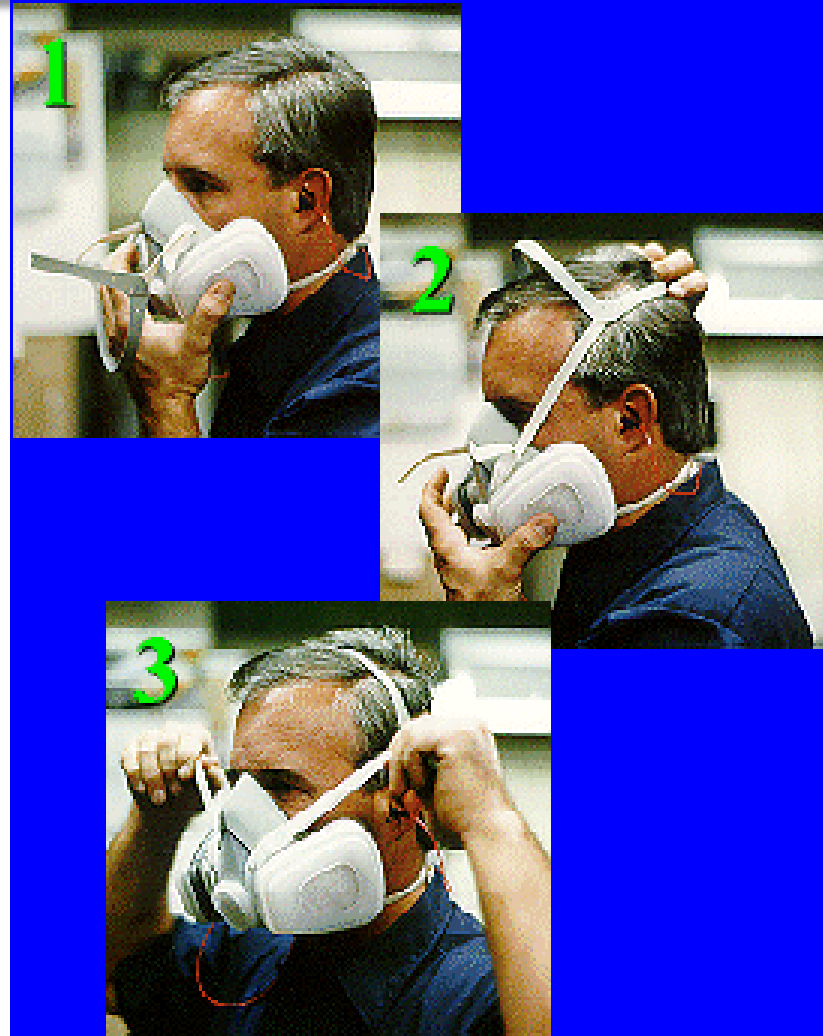
Check straps for

- Loss of elasticity
- Anything cracked, torn, broken or missing

Donning the respirator



1. With one hand, hold the respirator to your face.
2. While holding the respirator in place, slip the head harness over your head.
3. Adjust and tighten the head harness straps until the respirator fits snugly to your face. The best way to tighten a respirator is to tighten the straps from the bottom up.



Fit Checks for Respirators with Filter Cartridges



The wearer needs to perform a fit check **every time** he or she dons the respirator. It consists of two tests:

- Negative Pressure Check
- Positive Pressure Check

Respirator Pressure Checks



**Cover inhalation valves and breathe in.
This creates a small vacuum.**



**Cover exhalation valves and breathe
out.
This pressurizes the mask.**

Respirator Fit Checks



If the respirator fails either fit check, adjust the straps and try again. If that fails, try a respirator of a different size and fit check it.

It is important the respirator fits comfortably. If it becomes irritating the wearer may not be able to tolerate it over any length of time.

Respirator Fit Testing



Respirators must be fit tested to ensure proper protection of the user.

Once fit checks are passed, the respirator is fit tested. An appropriate test material is puffed around the intakes and seals.

If the respirator wearer can detect the test substance, there is a gap or leak somewhere. Another size or model of respirator must be chosen and the checks and test repeated.



Fit Testing



Different materials are used to test the fit.

- N95 respirators are tested using a nebulized mist of saccharin or a bitter substance known as Bitrex.
- HEPA filtered respirators are tested using an irritating smoke (stannic chloride or titanium tetrachloride).
- Filters for organic compounds are tested using banana oil.



Fit Testing



The wearer will be asked to

- Breathe normally
- Breathe deeply
- Turn head side to side
- Move head up and down
- Talk

--all while the test substance is blown in and around the mask.



Fit Testing



If the user detects the substance inside the respirator, the respirator fails this test.

(It is very difficult to pretend to pass when irritant smoke is used because it causes involuntary coughing and sneezing.)

Maintaining your respirator



It is best that respirators are not shared.

- Used N95s are disposable.
- Other respirators should be cleaned and disinfected by:

wiping with an alcohol or a respirator cleaning wipe, first the inside, the outside and let air dry.

or

rinsing with clean water, then wash it with detergent, then rinse with clean water again and let air dry.

Respirator Storage



Keep your respirator clean. Store it clean and dry in a closed, resealable bag.

Respirators must be protected from extremes of heat and cold, sunlight, dust, excessive moisture and damaging chemicals so keep it in a clean, sanitary place.

Questions?



Contact
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at

NIU Environmental Health & Safety Dept.
Phone 815-753-0404

One More Thing...

QUIZ !



Thank you for your attention! Be safe out there.

**Please click on the link below and take the
Respiratory Protection quiz now.**

[respiratory protection quiz](#)