

Respiratory Protection 1910.134



Learning Objectives

- Requirements of a respiratory protection program
- Types of respirators and their uses
- Respirator selection based on the hazards and protection factor
- Respirator medical evaluation and fit testing requirements
- Proper use and cleaning of respirators



Course Outline

1. Introduction
2. The Respirator Program
3. Air-Purifying Respirators
4. Atmosphere-Supplying Respirators
5. Filters and Cartridges
6. Protection Factors
7. Fit Testing
8. Use and Maintenance
9. Summary



Introduction

- Respirators are the last line of defense against airborne contaminants.
- Respirators are only effective if:
 - They are available.
 - The employees know which ones to use and how to use them.
 - The employees are medically approved for various types of respirators.
 - The respirator fits well and has an adequate seal.
 - Employees properly maintain and store them.



Introduction

When to wear respirators:

- They are required when feasible engineering controls do not adequately remove or control the hazards for employees.
- They may be worn while engineering controls are being evaluated or implemented.





Respiratory hazards:

- Mists
- Gases
- Biological hazards
- Fumes
- Dusts and fibers
- Vapors

*Contaminants come in either a
particulate or chemical form.*

Respirator Program

Respiratory protection program creation:

- Conduct a hazard assessment.
- If respirators are necessary, a written program is required.
- Keep the program up-to-date to reflect changes.
- Provide respirators, training, and medical evaluations at no cost.

A program is not required if the only respirators that are used are filtering facepiece respirators on a voluntary basis.

Respirator Program

Elements of the program:

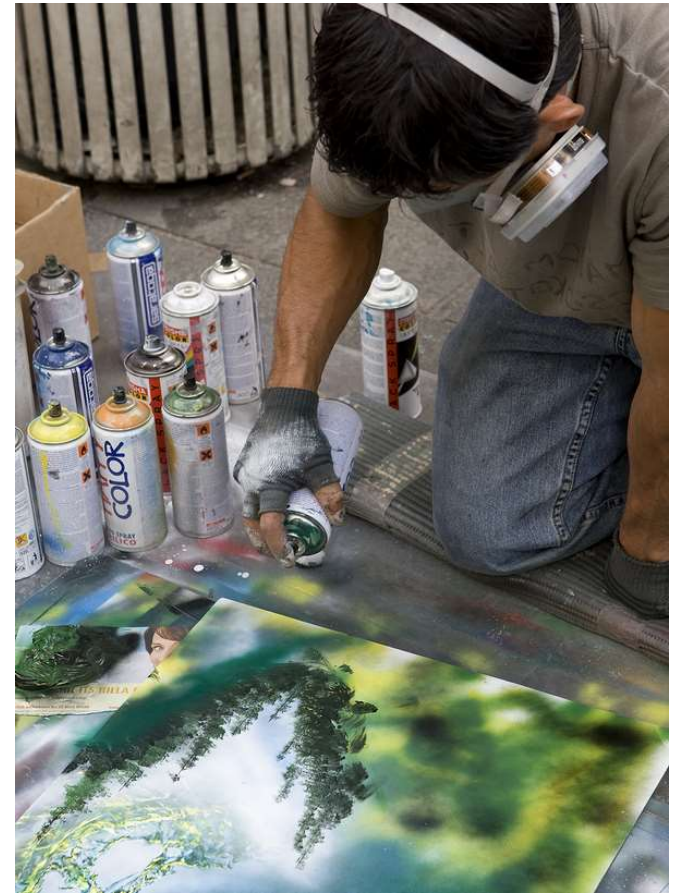
- Program administration
- Standard operating procedures
- Proper respirator selection
- Hazard assessments
- Employee training
- Medical evaluations
- Fit testing
- Program evaluation
- Recordkeeping
- Availability of the written program



Respirator Program

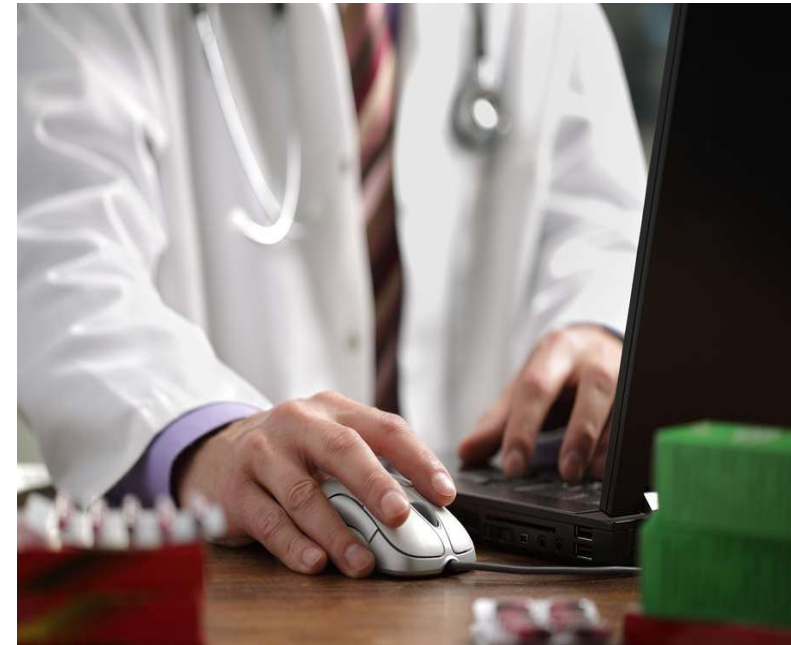
Selection of respirators:

- Identify and evaluate:
 - Hazards.
 - Contaminant properties.
 - User factors.
- Select sufficient models and sizes.
- Select a NIOSH-certified respirator.
- Exposure that cannot be identified or estimated is considered IDLH.



Medical evaluations:

- Respirator usage has a medical risk.
- Records must be maintained for duration of employment plus 30 years.
- Evaluations must be performed by a PLHCP.
- Medical evaluation possible results:
 - Approval for all use
 - Approval for limited use
 - Recommendation for a particular type
 - Request for further medical evaluation
 - No approval



Respirator Program

Employee training:

- General topics:
 - The components of the program
 - Types and limitations
- In-depth training for each type:
 - Limitations
 - Types of contaminants
 - How to put on and take off
 - When to wear it
 - When to change cartridges
 - How to clean it for storage
- Frequency:
 - Prior to use
 - If there are any changes



Respirator Program

Voluntary respirator use:

- Filtering facepiece respirators are the only respirators allowed to be used on a strictly voluntary basis.
- A written program, medical evaluations, and fit testing are not required.
 - Appendix D
- They may be supplied by the employer or employee.
- Employees must receive additional information:
 - Manufacturer's instructions
 - Storage instructions
 - Information about certification and labels
 - The correct and incorrect environments to wear the respirators in

Respirator Program

Program evaluation:

- Hazard assessments
- The selection of respirators
- Respirator appropriateness
- Fit testing
- Employee interviews
- Proper maintenance
- Employee observations
- Written program accessibility



Respirator Program

Recordkeeping:

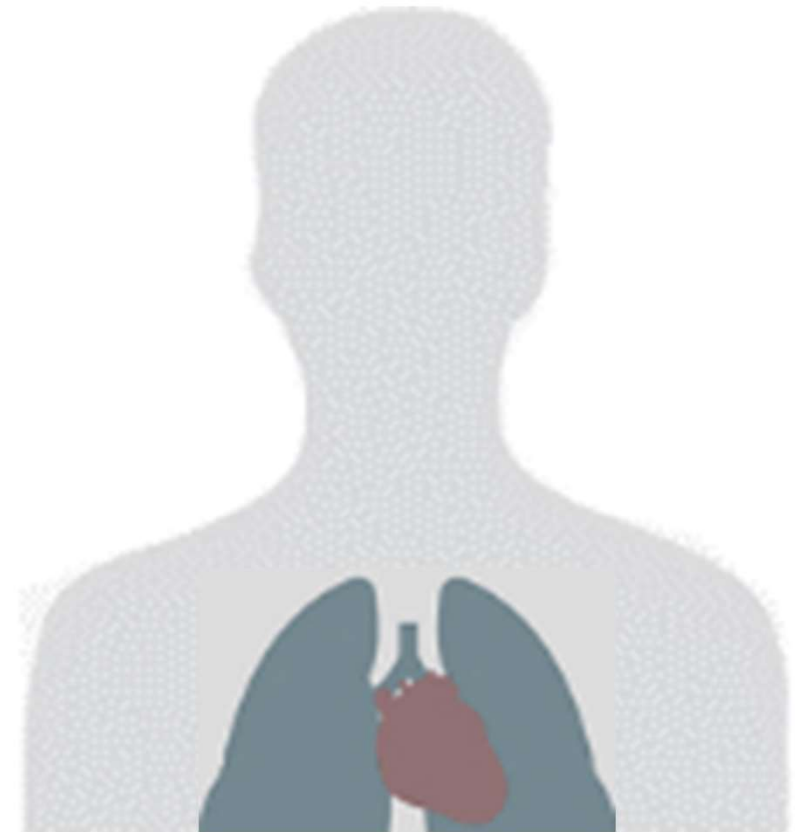
- Medical evaluation records
- Fit testing records:
 - Employee information
 - Date of testing
 - Fit test type
 - Specifics of the respirator
 - Outcomes



Air-Purifying Respirators

Air-purifying respirators (APRs):

- Filter contaminants from the ambient air.
- Use a filter, cartridge, or canister.
- Must be chosen based on the hazards.
- May be full face or half mask.
- Seal against the wearer's face.
- Require fit-testing.



Air-Purifying Respirators

Do not use APRs in the following conditions:

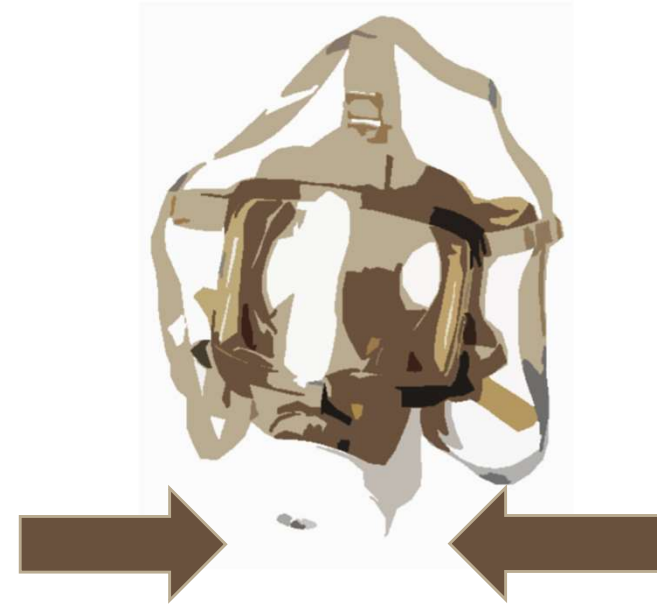
- When contaminants or their concentrations are unknown
- If concentrations exceed maximum use
- Around gases or vapors with low sensory warning properties
- In high humidity
- In oxygen-deficient environments
- In IDLH environments

**Immediately
Dangerous to
Life and
Health**

Air-Purifying Respirators

Negative pressure respirator:

The air pressure outside exceeds the air pressure inside.



Positive pressure respirator:

The air pressure inside exceeds the air pressure outside



Air-Purifying Respirators

Filtering facepiece:

- Negative pressure particulate respirator
- Largely made of the filtering medium



Air-Purifying Respirators

Powered air-purifying respirators (PAPRs):

- They are mostly positively pressurized.
- They require an external air source for minimum air flow.
- They can be sometimes negatively pressurized.
- They do not require a fit test or the user to be clean shaven.



Atmosphere-Supplying Respirators

Types of Respirators Overview:

- The air source is independent of the ambient atmosphere.
- The categories are:
 - SARs.
 - SCBAs.
 - Emergency escape respirators.
- The main operating types are:
 - Continuous flow.
 - Demand pressure.
 - Negative pressure.
 - Pressure demand.



Atmosphere-Supplying Respirators

Typical system components:

- Compressor or cylinders
- Air delivery lines
- Air purification system
- Reserve air supply
- Carbon monoxide filter or alarm



Atmosphere-Supplying Respirators

Supplied-air respirators (SARs):

- They deliver clean breathing air from outside the work area.
- The source of breathing air is not designed to be carried by the user.
- They are used in IDLH environments and emergency response situations.



Atmosphere-Supplying Respirators

Self-contained breathing apparatus (SCBA):

- The breathing air source is carried by the user.
- They are used for:
 - Firefighting.
 - General industry.
 - Hazmat projects.



Atmosphere-Supplying Respirators

Grade D Breathing Air Requirements:

Gases	Allowable concentrations
Carbon Monoxide (CO)	< 10 parts per million
Carbon Dioxide (CO ₂)	< 1000 parts per million
Condensed Hydrocarbons	< 5 milligrams per cubic meter
Noticeable Odors	None

Filters and Cartridges

Particulate air filters:

- These are the most common type.
- They have ratings based on efficiency of filtering.
 - 95 = 95%
 - 99 = 99%
 - 100 = 99.97% (HEPA filters)
- There are additional ratings for oil.
 - N = not recommended for oil mist
 - R = oil mist-resistant
 - P = oil-proof



Filters and Cartridges

Canisters and filter cartridges:

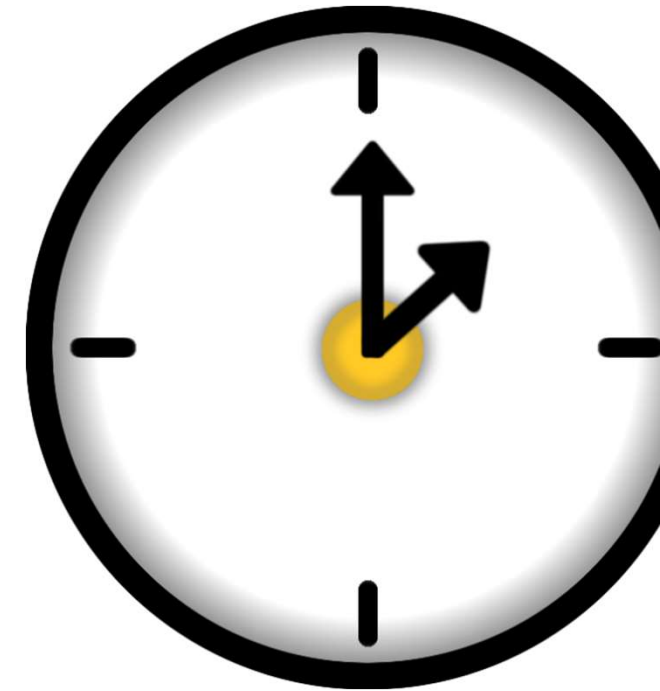
- Have a filter, sorbent, catalyst, or a combination.
- Are selected based on the hazards.
- Remove specific contaminants from the air.
- Must match the respirator brand.
- Must be labeled and color-coded.



Filters and Cartridges

Service life:

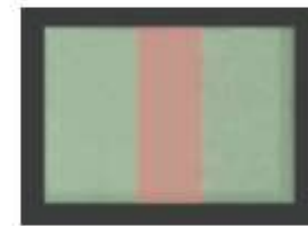
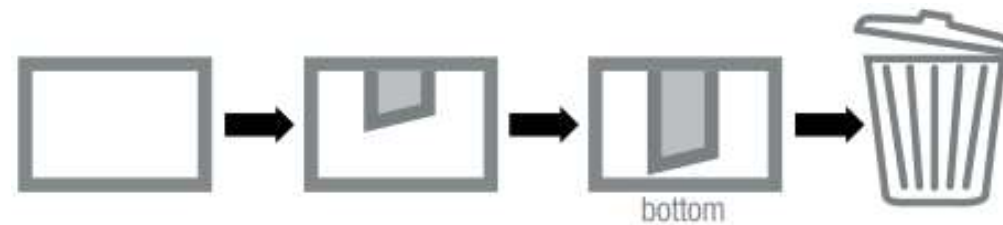
- Service life is the length of adequate protection.
- Particulate filters remain serviceable until breathing becomes restricted.
- Single-use filter facepieces must be disposed of after each use.
- Factors for determining useful life include:
 - Chemical warning properties.
 - Chemical concentrations.
 - Identity of the chemical.
 - Temperature and humidity.



Filters and Cartridges

Cartridge replacement:

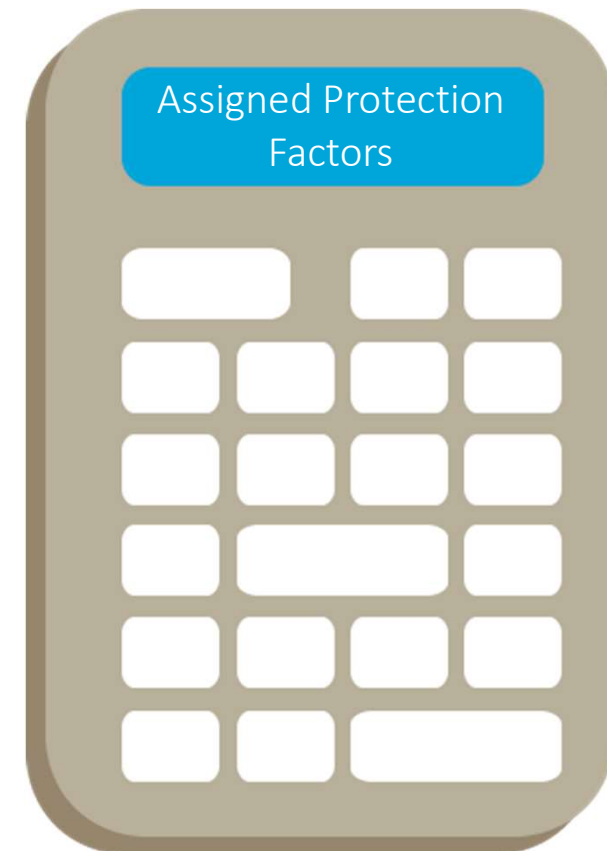
- Chemical cartridges become saturated.
- End-of-service life indicators (ESLI) are required for organic vapor and chemical cartridges.
- If no ESLI is available, establish a replacement schedule.
- Replacement schedules are developed using:
 - Mathematical models.
 - Manufacturer's software.
 - Calculations.
 - Rules of thumb.



Protection Factors

Assigned protection factors (APFs):

- APFs reflect the degree of protection.
- They range from 10 – 10,000.
 - 10,000 is the highest protection.
 - The most effective respirator is a SCBA with a protection factor of 10,000.
- APFs are assigned to generic types.
- They are used to determine the type needed.
- The APF is only valid if the fit test is passed.



Protection Factors

Maximum use concentration (MUC):

- The MUC is the maximum use concentration of a specific contaminant for which a respirator may be used.
- $MUC = \text{permissible exposure limit (PEL)} \times \text{assigned protection factor (APF)}$.

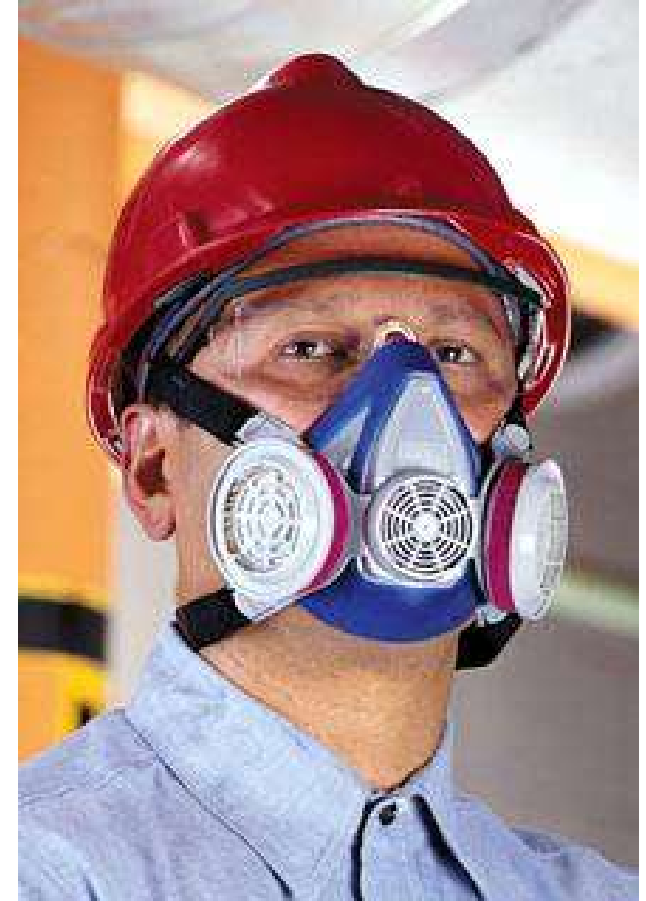
PEL for benzene = 1 ppm

Respirator	Protection Factor	Equation	Maximum Use Concentration
Half face	10	1×10	10 ppm
Full face	50	1×50	50 ppm
PAPR	100	1×100	100 ppm

Respirator Fit Test

Respirator fit:

- Proper respirator fit depends on the face-to-facepiece seal.
- Proper fit assures that the respirator is the most protective.
- This can be affected by the following:
 - Overall fit
 - Facial hair
 - Facial scars
 - Eyeglass temple bars



Respirator Fit Test

Fit testing:

- Before using respirators, employees must be fit tested.
- The two types are:
 - Qualitative.
 - Quantitative.
- Fit testing must be completed:
 - Prior to initial use.
 - Annually.
 - When a different respirator is used.
 - If facial features change.

Fit testing must be conducted by a competent and trained individual.

Respirator Fit Test

Qualitative fit testing (QLFT):

- This tests the face-to-facepiece seal.
- Test agents can be sensed at low concentrations.
- Testing agents include:
 - Irritant smoke.
 - Isoamyl acetate (banana oil).
 - Saccharine mist.
 - Bitrex.
- Use this testing only when Assigned protection factors (APF) are below 100.



Quantitative fit test (QNFT):

- It measures the fit rather than the seal.
- It compares particle concentration.
- An instrument numerically measures the amount of leakage.
- The results are expressed as fit factors.



Use of Respirators

Respirator inspection:

- Intact and functional straps
- No cracks in the facepiece
- Proper cartridge assembly
- Intact, clean, and functioning valves
- Proper assembly of all parts
- Cleanliness
- Pliability of the facepiece



Use of Respirators

Positive pressure check:

1. Cover the exhalation valve.
2. Lightly exhale.
3. Check for leaks.



Negative pressure check:

1. Cover the cartridge intakes.
2. Lightly inhale.
3. Check for leaks.

For both checks, if any leaks are detected, adjust the mask and try again. If leaks continue, do not use the respirator.

Use of Respirators

Respirators cannot be used:

- While using tobacco products.
- While using chewing gum.
- While eating or drinking.
- With facial hair.



Use of Respirators

Employees must leave the respirator use area if:

- They need to wash their face or respirator facepiece.
- They detect contaminants, changes in breathing resistance, or leakage of the facepiece.
- They need to replace the respirator, filter, cartridge, or canister.
- They experience dizziness, disorientation, or any other unusual symptoms.

Maintain an appropriate surveillance of work area conditions and the degree of employee exposure.



Use of Respirators

Cleaning and storage:

- Respirators must be cleaned before storage.
- Upon removal:
 - Remove and discard cartridges.
 - Wash your hands and face.
 - Disassemble and wash parts.
 - Reassemble and store.
- Respirators must be stored:
 - In a sealed container.
 - In a clean and dry location.
 - Away from chemicals.



Use of Respirators

Preventative maintenance:

- Replace worn and deteriorated parts.
- Only use parts and cartridges approved for the brand and type.
- Re-evaluate effectiveness when there are changes in the work area or exposure.

Preventative Maintenance

- Respirators are a key element in protection from airborne hazards.
- Various types are available and must be matched to the hazards.
- Before using respirators, employees must be medically evaluated and fit tested.
- Training must be provided for the care, use, and limitations of respirators.



Any Questions?

