Respiratory Protection

- 29 CFR 1910.134
Scope

This standard applies to:

- General Industry - 29 CFR 1910
- Shipyards - 29 CFR 1915
- Marine Terminals - 29 CFR 1917
- Longshoring - 29 CFR 1918
- Construction - 29 CFR 1926
## Organization of Standard

| (a) | Permissible practice          |
| (b) | Definitions                   |
| (c) | Respirator program            |
| (d) | Selection of respirators      |
| (e) | Medical evaluation            |
| (f) | Fit testing                   |
| (g) | Use of respirators            |
| (h) | Maintenance and care          |
| (i) | Breathing air quality and use |
| (j) | Identification of filters,    |
|     | cartridges, and canisters     |
| (k) | Training and information      |
| (l) | Program evaluation            |
| (m) | Recordkeeping                 |
| (n) | Dates                         |
| (o) | Appendices (mandatory)        |

- A: Fit testing procedures
- B-1: User seal checks
- B-2: Cleaning procedures
- C: Medical questionnaire
- D: Information for employees wearing respirators when not required under the standard
Objectives

In this course, we will discuss the following:

- Written respiratory protection program
- Selection and types of respirators
- Medical evaluations and fit testing
- Use, maintenance and care of respirators
- Training employees
- Program evaluation
- Recordkeeping
What are the Ten Parts of an Effective Respirator Program?
Part Number 1

Someone in Charge
Someone in Charge

- Written program must be implemented by a trained program administrator.
  - Must be qualified.
  - Know the hazards in the workplace and if engineering controls can be applied.
  - Identify types of respirators to be used if engineering controls will not work.

- Update as necessary.
Part Number 2

Medical Evaluation
Why Have Medical Evaluations?

A physiological burden is placed on an employee when wearing a respirator:

- Type of respirator worn
- Job and workplace conditions
- Medical status of the employee
Types of Medical Effects

- Pulmonary
- Cardiovascular
- Body temperature
- Senses
- Psychological
- Irritation and allergy
Medical Evaluation

- Before the respirator is initially used.
- Must be conducted before fit testing and training.
- Establishes the medical condition of the wearer.
- Shall be performed by a physician or other licensed health care professional (PLHCP).
  - OSHA Respirator Medical Evaluation Questionnaire; Appendix C, or
  - Initial medical examination

1910.134(e)
Follow-Up Medical Examinations

A follow-up examination is required if:

- Positive response to questions 1 - 8 in Section 2, Part A of Appendix C.
- Initial medical examination indicates need for follow-up physical.

The follow-up exam shall include any medical tests, consultations or diagnostic procedures PLHCP deems necessary.
Part Number 3

Selection
Hierarchy of Controls

- **Engineering controls**
  - **Examples:** ventilation

- **Administrative/work practice controls**
  - **Examples:** rotating employees to keep exposure limits low; limit the time someone can work in an area; change the way the work process is conducted.

- **Personal protective equipment (PPE)**
  - Used when you are unable to remove or limit the hazard.
Oxygen-deficient

- Does not contain enough oxygen to sustain breathing. (<19.5 percent by volume at sea level.)
  » Examples of oxygen-deficient places: confined spaces, silos, boilers, tanks, sewers.

Immediately dangerous to life or health (IDLH) or unknown
Hazards Requiring Use of a Respirator

- **Chemical**
  - Overexposure to contaminants can result from work or environmental pollution and appear as: dust, spray, fumes, vapors, smoke, harmful gases.

- **Biological hazards**
  - Organisms that affect your health such as bacteria, viruses, fungi and other living organisms.
Hazard Determination

- Identify the chemicals and evaluate the hazards.
- Determine the physical properties of the chemical.
- Identify areas of oxygen ($O_2$) deficiency.
- Estimate or measure employee’s exposure to the hazards.
  - Assume IDLH, if not known.
Selection

- Evaluate workplace exposure.
  - Assume IDLH if not known.

- Select the appropriate respirator based on the hazard, workplace and user factors.

- Select only NIOSH-certified respirators.

- Provide sufficient number of respirator models and sizes to correctly fit user.
What is a Respirator?

- Devices that protect workers from inhaling harmful substances or where there is insufficient oxygen.

- Two major types of respirators:
  - **Supplied-air respirators**, which provide clean air from an uncontaminated source.
  - **Air-purifying respirators**, which remove contaminants from the breathing air.

- Provide protection from respiratory hazards only when they are selected and used properly.
Supplied-Air Respirators (SAR) 1910.134(d)(2)(i)

Self-Contained Breathing Apparatus (SCBA)

Air-Supplied Respirator (Airline)

Combination Respirator

These respirators provide clean air from outside the contaminated work area.
Loose-Fitting Coverings

- Hood
- Helmet
- Loose-Fitting Facepiece
- Full Body Suit
Breathing Air Quality

- **Compressed and liquid O₂**
  - Must meet United States Pharmacopoeia requirements

- **Compressed breathing air**
  - Must meet Grade D breathing air requirements
    - Oxygen: 19.5-23.5%
    - Hydrocarbon: 5 mg/m³ or less
    - Carbon monoxide: 10 ppm or less
    - Carbon dioxide: 1,000 ppm or less
    - Lack of noticeable odor
Breathing Air Use

Compressors

- If oil lubricated:
  » CO alarm, high temperature alarm or both
  » If only high temperature alarm, must monitor for CO at sufficient intervals

- If non-oil lubricated:
  » Employer shall ensure that the CO level is < 10 ppm.

- Breathing air couplings must be incompatible with those for non-respirable air or other gas systems
Interior Structural Firefighting 1910.134(g)(4)

- At least two employees enter IDLH atmosphere (two-in).
- Remain in visual or voice contact with one another at all times.
- At least two employees located outside IDLH atmosphere (two-out).
- Employees performing interior structural firefighting use SCBAs.
- Does not preclude performing emergency rescue before entire team assembles.
Air-Purifying Respirators (APR) 1910.134

Filtering Facepiece

Gas and Vapor Respirator

Combination Respirator

Powered Air-Purifying Respirator (PAPR)

Air purifying respirators remove harmful substance(s) from the air.
Filtering Facepiece (Dust Mask)

- Negative pressure particulate respirator composed of a filtering medium.

- Captures particles in the air, such as dusts, aerosols, mists, and fumes.

- Filters will be labeled with a letter N, R or P and a number representing the efficiency: 95, 99 or 100.

- Does not protect against gases or vapors.

- Filters should be replaced when user finds it difficult to breath through them.
Combination Respirator

- **Full and half facepieces**
  - Normally used in atmospheres that contain hazards of both particulates and gases.
  - Have both particulate filters and gas/vapor filters.
  - Cannot be used in oxygen-deficient atmospheres, or in atmospheres which have high concentrations of contaminants.
  - Breathing may become difficult because of the additional effort required to draw air through the purifying media.
Gas and Vapor Respirator

- **Full and half facepieces**
  - Normally used when there are only hazardous gases and vapors in the air.
  - Does not protect against airborne particles.
  - Provides protection only as long as the filter’s absorbing capacity is not depleted.
  - Uses chemical filters (called cartridges or canisters) to remove specific dangerous gases or vapors.
  - Service life of the filter depends upon many factors and can be estimated in various ways.
Powered-Air Purifying Respirator (PAPR) 1910.134

- Air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

- Can be a full and half-mask facepiece, helmet or hood.

- Use is restricted to battery life and the fan and battery pack must be carried by the wearer at all times.

- Cannot be used in atmospheres deficient in oxygen or other IDLH atmospheres.
How the Canister/Cartridge Works

- Removes contaminants before they reach your breathing zone.
Cartridge/Canister Service Life

- Exertion level
- Cartridge variability
- Temperature
- Humidity
- Multiple contaminants

1910.134(j)
Filters/Cartridges/Canister Labels 1910.134(j)

- Only NIOSH approved.

- Labeled and color coded.

- Labels shall not be removed and remains legible.
End-of-Service-Life Indicator (ESLI) 1910.134(b)

- A system that warns the user of the approach of the **end of adequate respiratory protection**; e.g., the sorbent is approaching saturation or is no longer effective.
Assigned Protection Factor (APF) 1910.134(b)

- Workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees.
  - For example, an APF of 10 for a respirator means that a user could expect to inhale no more than one tenth of the airborne contaminant present.
<table>
<thead>
<tr>
<th>Respirator Type(^1,2)</th>
<th>Quarter Mask</th>
<th>Half Mask</th>
<th>Full Face</th>
<th>Helmet/Hood</th>
<th>Loose-Fitting</th>
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<tr>
<td>Air Purifying</td>
<td>5</td>
<td>(3)10</td>
<td>50</td>
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<tr>
<td>PAPR</td>
<td>--------------</td>
<td>50</td>
<td>1,000</td>
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<td>25</td>
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<tr>
<td>• Demand</td>
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<td>10</td>
<td>50</td>
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<tr>
<td>• Continuous Flow</td>
<td>--------------</td>
<td>50</td>
<td>1,000</td>
<td>(4)25/1,000</td>
<td>25</td>
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<tr>
<td>• Pressure Demand/other (+) pressure</td>
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<td>50</td>
<td>1,000</td>
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<td>SCBA</td>
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<td>10,000</td>
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</tr>
</tbody>
</table>

\(^1\)May use respirators assigned for higher concentrations in lower concentrations or when required use is independent of concentration.

\(^2\)These APF’s are only effective when employer has a continuing, effective respirator program per 1910.134.

\(^3\)This APF category includes filtering facepieces and elastomeric facepieces.

\(^4\)Must have manufacturer test evidence to support an APF of 1,000 or else these respirators receive an APF of 25.

\(^5\)These APFs do not apply to escape-only respirators. Escape respirators must conform to 1910.134(d)(2)(ii) or OSHA’s substance specific standards, if used with those substances.
What is a MUC?

- **Maximum use concentration (MUC)**
  - Maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance.

- When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.
How to Calculate MUC

- The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit (PEL), short-term exposure limit (STEL), or ceiling limit (CL).

\[ \text{APF} \times \text{PEL} = \text{MUC} \]

\[ \text{APF} \times \text{STEL} = \text{MUC} \]

\[ \text{APF} \times \text{CL} = \text{MUC} \]
Part Number 4

Training and Information
Required:

- Prior to requiring the employee to use a respirator.
- Annually
- When changes in workplace render previous training obsolete.
- Employee use demonstrates inadequate training.
- Any other situation arises in which retraining appears necessary.
Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.

Limitations and capabilities of the respirator.

How to effectively use the respirator in emergencies.

How to inspect, don, doff, use, perform seal checks.

Maintenance and storage procedures.

How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.

General requirements of the standard.
Appendix D for voluntary use (Mandatory)

Basic advisory information on respirators shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

Training

1910.134(k)(6)
Part Number 5

Fit Testing
Fit Testing

- When is fit testing required?
  - Before initial use
  - Yearly
  - When excessive weight gain or weight loss changes your facial features
  - Facial features change

- Why conduct fit testing?
  - To ensure maximum protection
Qualitative Fit Test (QLFT)

- Means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual’s response to the test agent.

- Should not be used if a person has no sense of taste or smell.
Quantitative Fit Test (QNFT) 1910.134(f)

- Means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator, called a fit factor.

- Can be used for any type of respirator.

- The larger the number, the better the fit.
Calculating of Overall Fit Factor

\[
\frac{1}{ff_1} + \frac{1}{ff_2} + \frac{1}{ff_3} + \frac{1}{ff_4} + \frac{1}{ff_5} + \frac{1}{ff_6} + \frac{1}{ff_7} + \frac{1}{ff_8} = 8
\]

\[
\frac{1}{1200} + \frac{1}{1400} + \frac{1}{600} + \frac{1}{750} + \frac{1}{890} + \frac{1}{1} + \frac{1}{900} + \frac{1}{1200} = 8
\]

\[
.00083 + .00071 + .00166 + .00133 + .00112 + 0 + .00111 + .00083 = 8
\]

\[
8/.00762 = 1050
\]
Part Number 6

Maintenance and Care
Cleaning and Disinfecting 1910.134(h)(1)

- Respirators shall be clean, sanitary, and in good working order.

- Respirators shall be cleaned and disinfected using the procedures in Appendix B-2 or procedures recommended by the respirator manufacturer.

- Respirators cleaned and disinfected at the following intervals:
  - Exclusive use by employee
  - Shared by employees
  - Emergency use
  - Used for training and fit testing
Storage

Care:

- Respirators must be protected from:
  » Dust
  » Sunlight
  » Heat
  » Cold
  » Moisture
  » Chemicals

- Store in a sealed container or bag.
**Inspection**

Check for:

- Holes in the filters
- Loss of elasticity or tears in the head straps and hoses
- Broken or loose connectors and fittings
- Cracked or scratched face pieces
- Detergent residue
- Dirt in the valves
- General cleanliness

1910.134(h)(3)
Respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer’s recommendations, and shall be checked for proper function before and after each use.

Respirator Checklist for APR

<table>
<thead>
<tr>
<th>Employee Name:</th>
<th>Year:</th>
</tr>
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<tbody>
<tr>
<td>Month</td>
<td>Face Piece</td>
</tr>
<tr>
<td>January</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td></td>
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<tr>
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<td>November</td>
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<tr>
<td>December</td>
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</tr>
</tbody>
</table>
Repairs

- Respirators that fail an inspection or are otherwise found to be defective are removed from service and discarded or repaired/adjusted.
  - Repairs made only by appropriately trained persons
  - Use only respirator manufacturer’s NIOSH-approved parts
Part Number 7

Use
Use of Respirators

- Always don respirator in clean air environment.

- Always check the respirator seal to make sure proper fit has been achieved for tight-fitting respirators.

- Two types of user seal checks (Appendix B-1):
  - Negative pressure check
  - Positive pressure check
Negative-Pressure Check

- Place your palm over the inhalation inlet.
- Inhale gently, face piece should collapse slightly.
- Hold your breath for about ten seconds.
- If the facepiece holds the negative pressure or suction, and no leaks are felt, the respirator is considered a good seal.
Positive-Pressure Check

- Block off the exhalation valve with your palm.
- Blow outward gently.
- If the positive pressure can be maintained inside the mask and no leaks are detected, you have a good seal.
Filtering Facepiece Seal Check 1910.134(g)

- Place both hands completely over the respirator and exhale.

- If air leaks around your nose, adjust the nosepiece.

- If air leaks at respirator edges, adjust the straps back along the sides of your head.
Filtering Facepiece Seal Check

- To seal check a respirator (which must be done each time one is worn), forcefully inhale and exhale several times.

- The respirator should collapse slightly upon inhaling and expand upon exhaling.

- You should not feel any air leaking between face and the respirator.

- This is the sign of a good facial fit and a successful seal check.
Use

- Respirators are only effective when the seal around your nose and mouth is tight.
  - If you cannot achieve proper fit, do not enter the contaminated area.

- No facial hair allowed when wearing a respirator.

- Glasses cannot be worn with a full face respirator.
  - Spectacle kit required.
Use

- Remove yourself if one of the following occurs:
  - Smell or taste something out of the ordinary.
  - Feel your eyes or throat becoming irritated.
  - Observe a change in your breathing.
  - Notice the face piece is leaking or other parts of the respirator are broken.
  - Hear an alarm signaling equipment has failed.
Part Number 8

Program Evaluation
Program Evaluation

- Conduct workplace evaluations

- Consult employees concerning:
  - Respirator fit
  - Appropriate respirator selection
  - Proper respirator use
  - Proper respirator maintenance
Part Number 9

Recordkeeping

Respirator Program
Recordkeeping

- Written program
- Medical evaluations
- Fit test records
- Emergency use respirator inspection
Written Program

- Written program must contain procedures for:
  - Selecting respirators
  - Medical evaluations
  - Fit testing
  - Respirator use
  - Respirator maintenance
  - Ensuring adequate breathing air for SARs
  - Employee training
  - Program evaluation

- Program must be worksite-specific
Part Number 10

Voluntary Use
Voluntary Use

- Voluntary use of tight fitting respirators
  - Employer must determine that voluntary use is appropriate.
  - Employer must ensure that the use of a respirator will not create a hazard.

- Employees shall be provided information in Appendix D.

- Written program requirements
  - Medical evaluations
  - Employee training on respirator maintenance and care.
  - No fit testing required
Voluntary Use

1910.134(c)(2)(i) – (ii)

- Voluntary use of filtering facepieces (dust masks)
  - Employer must determine that voluntary use is appropriate.
  - Employer must ensure that the use of a respirator will not create a hazard.

- Employees must be provided information in Appendix D.

- No written program requirements.
Appendices

- **Appendix A** to § 1910.134: Fit Testing Procedures (Mandatory)

- **Appendix B-1** to § 1910.134: User Seal Check Procedures (Mandatory)

- **Appendix B-2** to § 1910.134: Respirator Cleaning Procedures (Mandatory)

- **Appendix C** to Sec. 1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

- **Appendix D** to Sec. 1910.134: Information for Employees Using Respirators When Not Required Under the Standard (Mandatory)
Summary

- Written respiratory protection program
- Selection and types of respirators
- Medical evaluations and fit testing
- Use, maintenance and care of respirators
- Training employees
- Program evaluation
- Recordkeeping
Thank You For Attending!

Final Questions?
Handouts

Place all handouts at the end of this presentation.