ESH&Q at Fermilab

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Respiratory Protection

Intro

Respiratory Protection

Start Training

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To navigate through this course use the arrows located at the bottom of the screen. Click the button to move forward to the next slide. Click the button to go back and review a slide.

You will see information icons . Be sure to place the mouse on the icon to read additional useful information.

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Learning Objectives

- ✓ Hazard Identification
- ✓ Methods of preventing exposure to the hazards
- ✓ Limitations of respirator protection
- ✓ Respirator types and cartridge/filter types
- ✓ Assigned protection factors
- ✓ Three requirements before using a respirator
- ✓ Maintenance (Storage, Cleaning and Inspection)
- ✓ Donning (put on) and inspecting the respirator properly and effectively performing respirator fit-checks

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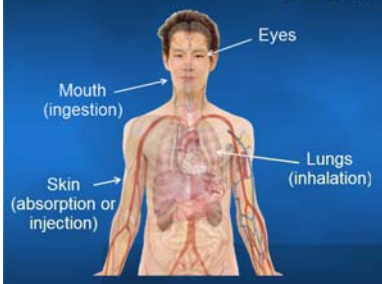
Routes of Entry



Possible routes of entry include the mouth, eyes, lungs and skin.

Do you know the two most common types of exposures?

Click the answer button to find out.

Answer

Inhalation and absorption are the two most common types of exposures.

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A respirator is a type of personal protective equipment (PPE) used when no other means of controls can protect the worker from an exposure.

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Air Contaminants

Air contaminants come in two different forms. They are either an **aerosol** or in a **gaseous** phase.

Examples of air contaminants in a **gaseous** phase include gas and vapor.

Examples of **aerosol** air contaminants include dust, fumes and mist.

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Dust

Dust is tiny particles produced by the mechanical breakdown of a solid such as crushing, grinding, or sanding.

Examples of activities that create dust at Fermilab are sanding and sawing operations.

Mist

Mist is fine droplets of liquid in the air. Examples include fog or liquids sprayed into the air.

Fume

A **fume** is a solid that has been raised to a temperature where it becomes a vapor and then condenses as it cools.

Particle Diameters

Gases and Vapors

Vapors are liquid at room temperature.

Gases are gases at room temperature.

Fermilab has an abundance of gases present such as nitrogen, propane, helium, oxygen and acetylene.

Drag the physical property listed below to the correct air contaminant on the right. Then click the button below to check your answer.

- Becomes a vapor when heated and condenses when cooled
- Fine droplets in the air
- Tiny particles from mechanical breakdown
- Airlike fluid substance at room temperature

Check Answer

Respiratory Protection Practice

The major elements of an OSHA required Respiratory Protection Program include:

- ✓ Program administration
- ✓ Program evaluation
- ✓ Worksite-specific procedures
- ✓ Medical evaluation
- ✓ Respirator selection
- ✓ Fit-testing
- ✓ Training
- ✓ Maintenance

To stay current in the Respiratory Program you will need to be medically qualified biennially, and trained and fit-tested annually.

Respiratory Protection Practice

The ESH&Q Industrial Hygiene Group oversees the administration of the respirator program

Worksite specific procedures can be found within our FESHM Chapter 4150.

Fermilab divisions, sections and projects are evaluated biennially for adherence to the Fermilab program.

Respirator selection will be based on:

The form of the hazard, such as aerosols, gases and vapors.

Workplace and user factors such as:

- how often and how long the respirator is worn
- other personal protective equipment that must be worn in conjunction with the respirator

NIOSH certification.
(National Institute of Occupational Safety and Health)

All respirators must be NIOSH approved.

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All filters, cartridges and canisters must be labeled and color coded with the NIOSH approval label. The NIOSH label must not be removed and must remain legible.

Atmospheric Contaminants	Colors Assigned
Organic Vapor	Black
Acid Gases	White
Ammonia Gas	Green
Acid Gases/Organic Vapors	Yellow
P-100	Purple
Organic Vapors/P-100	Purple & Black

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Particulate respirators are classified into the categories as follows:

Filter	Filter Type	Efficiency
N (No Oil)	N100	99.97
	N99	99
	N95	95
R (Oil Resistant)	R100	99.97
	R99	99
	R95	95
P (Oil Proof)	P100	99.97
	P99	99
	P95	95

NIOSH developed a filter category scheme to help in clarifying filter effectiveness. High Efficiency Particulate Air (HEPA) is equivalent to N100, P100 and R100.

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Respirator Types

Air Purifying Respirator (APR)

- ✓ Filtering Facepiece (dust mask)
- ✓ Half-Mask
- ✓ Full-Face
- ✓ Powered Air Purifying Respirator (PAPR)

Place your mouse over each type of respirator listed to see what it looks like.

Supplied Air Respirator (SAR)

- ✓ Self-Contained Breathing Apparatus (SCBA)
- ✓ Air Line

Respirator types differ in the level of protection they offer. Full-face respirators may be appropriate for materials that are irritating to the eyes (e.g., acids, etc.)

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Assigned Protection Factors (APFs)

The APF is the number of times above the exposure limit for which a given respirator provides protection. See the chart on the right for APFs.

Type of respirator	Quarter mask	Half mask	Full facepiece	Helmet/ hood	Loose-fitting facepiece
1. Air-Purifying Respirator	5	10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	50	1,000	.....	.....
4. Self-Contained Breathing Apparatus (SCBA)					
• Demand mode	.....	10	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	.....	10,000	10,000	.....

APF Calculations

To calculate the maximum concentration for a respirator multiply the Permissable Exposure Limit (PEL) by the Assigned Protection Factor (APF).

Example:

- Lead PEL = 0.05mg/m3
- APF = 10

0.05mg/m3 x 10 APG = 0.5mg/m3

The respirator may be used up to concentrations of **0.5mg/m3.**

APF Calculations

Use the following information to answer the questions on the right.

Lead PEL*=0.05mg/m3

For a loose-fitting PAPR with P-100 filters the APF is 25.

The respirator can be used up to which concentration?

- 25 mg/m3
- 0.125 mg/m3
- 1.25 mg/m3
- 0.5 mg/m3

Filtering Facepiece

A voluntarily worn filtering facepiece (dust mask) does not require the implementation of a written program. However, the voluntary use of a tight-fitting respirator does have medical evaluation and respirator care requirements.

See appendix D below for voluntary respirator users

Information for Employees Using Respirators When Not Required Under the Standard

There are limitations for Air Purifying Respirators (APR) such as:

- Cannot be used in oxygen deficient atmospheres
- Cannot be used for concentrations beyond its rated protection factor
- Cannot be used for unknown concentrations
- Cannot be used for chemicals with poor warning properties

Problems can arise when using respirators

- Facial hair interferes with the face-to-facepiece seal
- Eye glasses can also affect respirator fit
- Facial deformities such as dentures, scars, can affect respirator fit
- Communications are affected due to muffled speech

Medical Evaluation

A medical evaluation must be completed prior to fit-testing or respirator use.

It must be performed biennially by a physician or other licensed health care professional (PLHCP).

Dial x3232 to contact the Medical Office.

Fit-testing

Fit-testing is done following medical evaluation. Fermilab requires annual quantitative fit-testing for all employees within the Respirator Program.

Training

Training must be conducted in a manner that is understandable.

Training must be conducted prior to a person's assignment of the respirator.

Training

Training must be conducted annually or when:

- ✓ changes in the workplace or type of respirator occur
- ✓ inadequacies in the employee's knowledge are noted
- ✓ any other situation arises in which retraining appears necessary to ensure safe respirator use

Maintenance - Storage

Respirators should be stored in protective plastic bags.

Do not place any objects on top of the respirator to avoid crushing or deforming it.

Avoid using alcohol or other solvents to clean the respirator. This will only lead to the degradation of the rubber or silicon.

Do not hang respirator by its straps. This may stretch the elastic and effect the user's ability to maintain an adequate face to facepiece seal.

Place your mouse on each camera icon to view a photo related to the topic.

Maintenance - Cleaning

See the Respirator Cleaning Procedures in Appendix B-2 of the OSHA Respiratory Protection Standard 29 CFR Parts 1910 and 926.

Non-alcoholic wipes are fine, but for gross contamination it is necessary to perform a much more thorough cleaning as outlined in Appendix B-2.

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Maintenance - Inspection

There are four major steps on the Respiration Inspection Checklist.

Hover your mouse over each box for details on each step.

1. Examine the facepiece
2. Examine the harness straps
3. Examine the inhalation and exhalation valve
4. Examine the air-purifying element

This checklist is available online here.

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Employee Responsibilities Include:

- Using respirators in accordance with the instructions received in training class (including User Seal Check Procedures).
- Maintaining, cleaning, inspecting, and storing respirators as instructed in class.
- Reporting any malfunction of his/her respirator to his/her supervisor.
- Immediately discontinuing use of a respirator malfunctions and immediately going to an area with fresh air.

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Supervisor Responsibilities Include:

- Ensuring personnel use respirators in accordance with instructions received in training class.
- Ensuring respirators are cleaned, disinfected and stored in a clean, sanitary condition.
- Ensuring respirators are in good working condition.

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You can seek help from the sources listed below:

The Hazard Analysis Form for your job

Division Safety Officer (DSO)

The ESH&Q Section Webpage

Industrial Hygiene Group

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This concludes *Respiratory Protection* training. You must take and pass a test in order to receive TRAIN credit.

Click here to request the test.

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