Hazard Communication

PERSONAL PROTECTIVE EQUIPMENT
Objectives

- Inform about types of personal protective equipment available.
- Describe conditions for PPE use.
- Show resources available for PPE selection.
PPE Types

- Respiratory protection
  - Two types
- Chemical protective clothing (CPC)
  - Body protection
    - Gloves, booties,
      eye protection
Respiratory Protection

- Air-purifying respirators
- Air-supplied respirators
TYPES OF RESPIRATORY PROTECTION

**Elastomeric Half Facepiece Respirators** are reusable and have replaceable cartridges or filters. They cover the nose and mouth and provide protection against gases, vapors, or particles when equipped with the appropriate cartridge or filter.

**Elastomeric Full Facepiece Respirators** are reusable and have replaceable canisters, cartridges, or filters. The facepiece covers the face and eyes, which offers eye protection.

**Filtration Facepiece Respirators** are disposable half facepiece respirators that filter out particles such as dusts, mists, and fumes. They do NOT provide protection against gases and vapors.

**Powered Air-Purifying Respirators (PAPRs)** have a battery-powered blower that pulls air through attached filters, canisters, or cartridges. They provide protection against gases, vapors, or particles, when equipped with the appropriate cartridge, canister, or filter. Loose-fitting PAPRs do not require fit testing and can be used with facial hair.

**Supplied-Air Respirators** are connected to a separate source that supplies clean compressed air through a hose. They can be lightweight and used while working for long hours in environments not immediately dangerous to life and health (IDLH).

**Self-Contained Breathing Apparatus (SCBA)** are used for entry into or escape from environments considered to be IDLH. They contain their own breathing air supply and can be either open circuit or closed circuit.

**Combination Respirators** can be either a supplied-air SCBA respirator or supplied-air-purifying respirator. The SCBA type has a self-contained air supply if primary airline fails and can be used in IDLH environments. The air-purifying type offers protection using both a supplied-air hose & an air-purifying component and cannot be used for entry into IDLH environments.

*September 2016*
Respiratory Hazards

- Respiratory hazards are one of the most common industrial contamination problems.
- They can be grouped into three broad categories.
- These categories are:
  - Particulates
  - Gaseous contaminants
  - Oxygen deficiency
Respiratory Hazards

- Particulates
- They are fine liquid or solid particles suspended in air.
  - The smallest particle the eye can see is about 50 microns or 0.002 inches in diameter.
Respiratory Hazards

- Most visible dust particles and other large contaminants are deposited in the nasal and throat passages during inhalation and do not enter the lungs.
- Generally, only the smallest particulates will travel all the way to the alveoli.
Respiratory Hazards

- Gaseous Contaminants
  - Gases and vapors are filtered to some degree on their trip through the respiratory tract.
  - The conducting tubes absorb soluble gases and vapors before they reach the alveoli.
  - Insoluble gases travel into the alveoli and can be directly absorbed into the bloodstream.

Organs of the Respiratory System
Respiratory Hazards

- Oxygen Deficiency
- The third category of respiratory hazards is oxygen deficiency.
- The body requires oxygen to live.
Respiratory Hazards

Normal breathing are consists of:

- 78% Nitrogen
- 21% Oxygen
- 0.9% Inert gases
- 0.04% Carbon Dioxide
Respiratory Hazards

- If the oxygen concentration decreases, the body reacts in various ways.
- Physiological effects of oxygen deficiency are not apparent until the oxygen concentration decreases to 16%.
Respiratory Hazards

- Death occurs rapidly when the concentration decreases to 6%.
- Concentrations of oxygen in the air below 19.5% are considered to be oxygen deficient.
- 19.5% oxygen in the air is the lowest “safe” working condition.
- 6% oxygen in the air results in difficult breathing and death in minutes.
OSHA Respirator Safety Program

- Engineering controls first choice to prevent respiratory hazards:
  - Operation enclosure/ventilation
  - Substitution of less toxic chemicals

- Where respirators are used, minimum requirements are set forth in 1910.134.
OSHA Respirator Safety Program

- Employers must develop and implement a written respiratory protection program with work site specific procedures.
  - Updates made when needed.
  - Trained program administrator required.
Respirator Selection

Respiratory Protection Standard covers:
- The nature of the hazard
- That the atmosphere shall be considered IDLH if the hazard cannot be identified or reasonably estimated.
Respirator Selection

- Workplace and user factors that may affect performance and reliability.
- The review of sufficient number of respiratory models and sizes to determine correct fit.
OSHA APR Use Requirements

- Identify contaminant and concentration
- Concentration within Maximum Use Concentration of the respirator (but not an IDLH atmosphere)
- Respirator approved for contaminant
OSHA APR Use Requirements

► Oxygen levels between >19.5% and <23.5%
► Work area periodically monitored
► Successful fit test
► ESLI/Change schedule
Conditions to Leave Use Area

► Wash hands/face/respirator facepieces to prevent eye/skin irritation from respirator use.

► If vapor/gas breakthrough detected.
  ▶ Change in breathing resistance
  ▶ Facepiece leakage

► To replace respirator, filter, cartridge, or canister elements.
National Institute for Occupational Health and Safety (NIOSH) recommends using SCBA/SAR in an immediately dangerous to life and health (IDLH) atmosphere.

OSHA requires it.

NIOSH also recommends not using an APR with a material that has “poor warning properties”.

Means you can’t physically detect material above the permissible exposure limit (PEL).
Powered Air Purifying Respirators

- PAPRs are designed to be a positive pressure respirator.
- A powered blower intakes air, filters it, and delivers it to either a tight or loose fitting hood.
- Subject to same limitations of other APRs.
APR Major Components

- Face piece
- Air purifying element
Facepieces

- Quarter face
- Half face
- Full face
# Air Purifying Elements

<table>
<thead>
<tr>
<th>Colour</th>
<th>Type</th>
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</thead>
<tbody>
<tr>
<td>White</td>
<td>Acid Gas</td>
</tr>
<tr>
<td>Black</td>
<td>Organic Vapours</td>
</tr>
<tr>
<td>Green</td>
<td>Ammonia Gas</td>
</tr>
<tr>
<td>Yellow</td>
<td>Organic Gas &amp; Vapour</td>
</tr>
<tr>
<td>Olive</td>
<td>Multi-Gas</td>
</tr>
<tr>
<td>Magenta</td>
<td>P100 Particulate Filter Cartridge (HEPA)</td>
</tr>
</tbody>
</table>
Air Supplying Respirators

- **Airline**
  - 300’ maximum
  - Escape bottle (5 min.) for IDLH atmospheres
    - 10 minute for sewer work

- **Self Contained**
  - Breathing Apparatus (SCBA)
    - Closed circuit
    - Open circuit
    - Exhaled air out
SCBA

- Air tanks rated at 5-60 minutes.
  - 5-15 units are for emergency escape.
- Actual usage time depends on many factors

(partial list):

- Users physical activity
- Users physical condition
- Users experience with the unit
- Other PPE worn by the user
Any time entry into an IDLH atmosphere is made, at least one additional (persons, if necessary) also equipped with an SCBA and retrieval equipment must be outside the area and in direct communication (visual, voice, signal line) with the person inside the IDLH area.
Stand-by Personnel [1910.134 (q)(3)]

The purpose of this outside person (or stand-by personnel) is to “provide effective emergency rescue” of the person from the IDLH area if necessary.
SCBA Components

- Compressed air cylinder
- Carrier and harness assembly
- Low air alarm
- Mainline and by-pass valve
- Facepiece

Diagram:

- Harness shoulder straps
- Motion sensor alarm
- Cylinder
- Cylinder support clamp
- Buddy breathing hose inside bag
- Cylinder valve handwheel
- Harness assembly
- Regulator emergency air valve
- Harness waist straps
- High pressure hose
- Facepiece
- Speaking diaphragm
- Regulator
Fit Tests

- Performed before respirator use (tight fitting face pieces).
  - Annually and more often if needed.

- Types:
  - Quantitative
    - Outside/inside comparison
  - Qualitative
    - Odor threshold
Pre-Use Fitting Instructions

► Positive seal check
  ► Cover exhalation valve
    ► May have to remove cover
  ► Exhale into face piece
  ► If no leaks detected around seal, mask is seated correctly.
Pre-Use Fitting Instructions

- Negative seal check
  - Cover filters/air intake
  - Pull breath in
  - Face piece should collapse in on face if mask is seated correctly.
Ultimately, it is up to the employer to determine what atmosphere they will require you to work in and match the respirator to the hazard(s). You may need to be medically cleared to wear a respirator, trained, and fit tested (for tight fitting respirators) prior to respirator use.

Note: Suitable respiratory protection is indicated by a ✓ in the appropriate box.

If oil mist is present, use R or P filters.

<table>
<thead>
<tr>
<th>Filter Efficiency and Type</th>
<th>95</th>
<th>100</th>
<th>95</th>
<th>100</th>
<th>Organic vapour</th>
<th>95 + Organic vapour</th>
<th>100 + Organic vapour</th>
<th>HEPA</th>
<th>HEPA</th>
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<td>Assigned Protection Factor* (NIOSH 1987)</td>
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<td>10</td>
<td>10</td>
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<td>10</td>
<td>10</td>
<td>10</td>
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<td>Dust Exposures</td>
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<tr>
<td>Asbestos removal using wet methods (chrysotile)</td>
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<td>Asbestos removal dry (all types)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Asbestos encapsulation</td>
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<tr>
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<tr>
<td>Lead paint abrasive blasting (workers in area)</td>
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<tr>
<td>Refractory lining and removal (no asbestos present)</td>
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<td>✓</td>
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</tr>
</tbody>
</table>

Supplied Air

- Hood or Helmet
- SCBA or SCBA+Airline

Pressure demand:
- Loose fitting
- Tight fitting

Full face piece + pressure:
- 100
- 10,000
Chemical Protective Clothing

- **Level D**
  - Work clothes

- **Level C**
  - APR/splash

- **Level B**
  - Supplied air/splash

- **Level A**
  - Supplied air/gas tight
Chemical Protective Clothing

- Level D used when no respiratory/chemical hazard exists.
- Level C used when contaminant is known, able to be filtered out by an air purifying respirator and only skin splash protection is necessary.
Chemical Protective Clothing

- Level B is used when the highest level of respiratory protection is needed; however skin splash protection is also required.
- Level A is used for unknown or immediately dangerous to life and health atmospheres where chemicals can be absorbed through the skin.
  - It is a gas-tight barrier.
PPE Failure

Knowing how to recognize PPE failure is very important because PPE is the last line of defense between you and the chemical.

Therefore, you must limit contact time with chemical hazards and inspect PPE frequently.

PPE must be able to resist three types of failure.
PPE Failure

- Permeation
- Permeation occurs when the chemical passes through the intact PPE barrier.
- Permeation is perhaps the most insidious manner in which chemical protective clothing can be compromised.
PPE Failure

- **Penetration**: Occurs when the chemical passes through seams, rips, and zippers.

  Simply put, it is a leak.

*Penetration* is the movement of chemicals through an opening such as zippers or seams.
Degradation occurs when a chemical reaction takes place between a chemical and the PPE.

- The PPE may shrink or crack.
- Degradation indicates that the chemical is incompatible with the PPE material.

Degradation is an observable or measurable change in material caused by contact with another agent.
Additional PPE

- Hardhat
- Gloves
- Booties/Chemical resistant boots
- Eye protection
In order to be properly protected while performing cleaning/disinfecting, the employer has to assess the hazard(s) and the working conditions.

They then have to match the PPE to that set of circumstances.
Where applicable, the OSHA PPE standard requires employers to:

- Conduct an assessment for PPE
- Provide PPE at no cost, appropriate to the hazard
- Train employees on how to don (put on) and doff (take off) PPE
- Train workers to maintain, store, and replace PPE
- Provide medical evaluation and fit testing
PPE Selection

- If an SDS available, use that reference for determining protection needs.
- 500+ chemicals in List N
- Some materials regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) may not have SDSs.

About 1 in 3* adults used chemicals or disinfectants unsafely while trying to protect against COVID-19

Stay safe while using household cleaning and disinfectant products

- Always read instructions
- Wear protective gear
- Do not mix chemicals

*According to a nationally representative survey of 902 U.S. adults—May 4, 2020
**Glove Selection**

Ansell Guide:


**ChemScan® labels – quick, accurate and only from Kappler.**

Scan the label with your phone’s QR reader for a complete list of chemicals tested against your garment’s protective fabric.
Summary

- PPE is divided into two major components:
  - Respiratory protection and body protection.
- It is up the employer to determine levels of protection needed, and to train and equip any employee who has to use any type of PPE in their job.