

3M Occupational Health & Environmental Safety Division



3M Occupational Health & Environmental Safety Division

3M background-Occupational Health & Environmental Safety Division (OH&ESD) - respirators, environmental sorbents, hearing protection, anti-fatigue matting, industrial hygiene monitoring equipment, Office Ergonomics, Asbestos Vacuums, Reflective tapes, First Aid Products.

Respiratory Protection

Employers that have employees wearing respirators in the workplace must come in compliance with OSHA's Respiratory Standard (new one published 1/8/98). The General Industry Standard is 29 CFR1910.134. Requirements include training on how to don/maintain/fit test respirators etc. There are also what are called "Substance Specific Standards" (e.g. lead, asbestos, cadmium, formaldehyde, vinyl chloride, benzene etc.). If an end-user has workers exposed to lead, they must ensure that they are in compliance with OSHA's respiratory standard and the lead standard.

Respirator Types

NIOSH Approval

- NIOSH tests & approves respirators
 - US Government agency
 - National Institute for Occupational Safety & Health
- Approval categories
 - Particulate filters & respirators
 - Cartridges & dual cartridge respirators
 - Powered Air Purifying Respirators (PAPR)
 - Supplied Air Respirators (SAR)

Contaminant Definitions

- **Dusts** - are created when solid materials are broken down (grinding, drilling etc)
- **Mists** - are tiny liquid droplets usually created by spraying or foaming operations. Paint spray is one of the best examples of a mist.
- **Fumes** - occur when metal is heated and then quickly cooled. This creates very fine particles (welding is an example).
- **Gases** - are substances that become air-borne at room temperature.
- **Vapors** - are substances that evaporate from a liquid or solid (usually a liquid), the way water vapor evaporates from water. (The 'funky' stuff you see coming off of gasoline)

Workplace Contaminants

Particulates

Dusts

Mists

Fumes (Welding)

Fibers (Asbestos)

Need Particulate Filters Where
Allowed

Gases/Vapors

Gases
(Helium, Nitrogen
Acetylene)

Vapors
(Solvents-Mek;
Benzene, Toluene)

Need Carbon Cartridges Where
Allowed

May need particulate filters and carbon cartridges for some combinations of contaminants.

Change In Particulate Filters (Effective July of 1998)

Old Particulate Filters/Approvals - 30 CFR 11

Examples:

- Dust/mist
- Dust/mist/fume
- HEPA (High Efficiency Particulate Air Filters)
- Paint spray and pesticide pre-filters

All of these filters are no longer manufactured for non-powered air purifying respirators. HEPA filters are still utilized and approved with Powered Air Purifying Respirators (PAPR's). End-users and distributors CAN still sell the 30 CFR filters-manufacturers, however, can no longer make these products.

42 CFR 84: New Particulate Filter Approvals

- See attachment - 42 CFR Highlights. N, R and P filters with 3 efficiency levels (95,99,100)
- There are 5 substances that require a 100 % Efficient Filter:
 - Asbestos
 - Lead
 - Cadmium
 - Arsenic
 - MDA.

Particulate Filters & Respirators

NIOSH Approvals

- Select the filter efficiency you need
- Is there an oil mist in the work area?

Minimum Filtration Efficiency	N <u>N</u>ot Resistant to Oil	R Oil <u>R</u>esistant	P Oil <u>P</u>roof
95%	N95	R95	P95
99%	N99	R99	P99
100% (99.97)	N100	R100	P100

Use “R” or “P” Filters for Oil Mist Exposure

- Oil mist is oil droplets in the air
- Applications where oil may be present
 - Spraying oil-rich wood sealants or pesticides
 - Most oil-based paints don't contain oil
 - “N” filters may be OK. Check the MSDS from paint mfr.
 - Grinding or cutting with cutting fluids or lubricants

When do I throw away Particulate filters and carbon cartridges?

Particulate Filters

- Refer to the manufacturer of these products for more information.
- For use with non-oil aerosols (all filters-N, R, P) throw away if respirator/filter becomes damaged, soiled, or when breathing becomes difficult.
- R filters used in an oil aerosol environment - Toss after 8 hrs of continuous or intermittent use (and when respirator/filter becomes damaged, soiled, or breathing becomes difficult).
- P filters used in an oil environment - Dispose after 40 hrs of use or 30 days, whichever comes first (and when respirator/filter becomes damaged, soiled, or breathing becomes difficult).

Cartridges and Dual Cartridge Respirator Approvals

- Organic Vapor (OV)
- Acid Gas (AG)
- OV/AG
- Ammonia/Methylamine
- Formaldehyde
- Mercury
- Multi-gas & vapor
- Approval may also include filters
 - OV/P95, OV/N95, etc.

When do I throw away Particulate filters and carbon cartridges?

Carbon Cartridges

- Can no longer rely on taste/smell or irritation as primary means of when to change-out. Must establish a change schedule.
- Where change schedule is established (Substance Specific Standards - benzene, vinyl chloride, formaldehyde) utilize the schedule in the standard.
- Allowed to use experience to establish schedule or refer to 3M's Service Life Software (www.3M.com/occsafety)

Types of Respirators

Two basic types of respirators:

- 1) Air Purifying Respirators
- 2) Positive Pressure Respirators

Types of Respirators

Air Purifying Respirators

- APR's are filtering devices. They may be used to trap particulates on filters or gases and vapors on activated carbon or a combination of both particulates and gases and vapors. The worker receives clean air while breathing normally through the filtering device. APR's are also often referred to as 'negative pressure' respirators because they rely on the wearer's ability to draw air through the filter or cartridge and produce a negative pressure inside the facepiece.

Types of Respirators

Positive Pressure Respirators

- Are respirators that are 'fed' with pre-filtered air either from a compressed air supply or are supplied with air taken from the contaminated air and drawn through a filter/cartridge system. Both types rely on the maintenance of a positive pressure inside the respiratory device, which ensures the wearer has a supply of clean air in excess of his requirements. The 'excess' air maintains the positive pressure and leaks away to the surrounding atmosphere and allegedly eliminates any ingress of contaminants at the headgear seal or boundary area. 3M Supplied Air Respirators are considered to be positive pressure and may take many forms. For instance they may utilize compressed air in a cylinder on the back (SCBA-Self Contained Breathing Apparatus), from an air compressor (high pressure) or air pump (low pressure) or a system of cylinders (cascade system) that provide Grade D breathing air to the user. Supplied air systems can take many forms- pressure-demand respirators, continuous-flow, pressure-demand with egress bottle etc.

Most Commonly Used Respirators

- **Half-mask** can be a disposable particulate respirator (filtering facepiece respirator-where the ‘filter’ is the facepiece), a maintenance free product for gases/vapors/particulates (3M 5000 Series) , a low-maintenance product (3M 6000 Series Respirator) ; or a traditional facepiece such as the 3M 7500 Series (replaceable valves, lenses, headstraps etc.). The half-mask may have the ability to be converted to supplied air or used with a PAPR.

Most Commonly Used Respirators

- **Fullface Respirator** (3M7800S or 6x00 Fullface) - Covers the whole face. Often used when there is an eye hazard or the contaminant irritates the eyes or mucous membranes. Available with lens kits for eyeglass wearers. May or may not be converted to positive pressure- SCBA, Continuous Flow/Pressure demand or PAPR.

Most Commonly Used Respirators

- **Powered Air Purifying Respirator** - Positive pressure device that utilizes a motor blower, battery and cartridges and/or filters to clean-up/filter the air. May be used in vehicle-mounted arrangement. Some PAPR's are designed for use with only particulates and some may be used with gases/vapors or particulates and gases/vapors simultaneously.

Most Commonly Used Respirators

- **Helmets/Hoods** - Can be used with a supplied air system with air regulating device (An air regulating valve or a device to cool (vortex) or heat the air) or with Powered air purifying respirators (PAPR's). Hoods are often utilized in paint booths or where there may be a splash hazard to the head or torso. Helmets are used in welding, grinding, painting etc. and may have ANSI approvals for impact. With helmets and hoods, fit testing is NOT required and facial hair is allowed to be worn by the worker.

Most Commonly Used Respirators

- **Loose-fitting facepiece** - Is a respiratory inlet covering that is designed to form a **partial seal** with the face, does not cover the neck and shoulders, and may or may not offer head protection (examples- L-500 Series/L-700 Series; Headcovers (H-200 Series); Airhat and Airstream). Fit testing is **NOT** required and facial hair may be worn with some devices.

Definitions

- **ACGIH** - American Conference of Governmental Industrial Hygienists. Write and review the Threshold Limit Values.
- **NIOSH** - The National Institute of Occupational Safety and Health. Tests and certifies respirators in the US. They do not enforce OSHA standards but often publish documents where they make recommendations.
- **OSHA** - Occupational Safety and Health Administration. Part of the Department of Labor-enforces regulations - for instance Hazard Communication and Lock-Out Tag Out.

Definitions

- PEL - Permissible Exposure Limit-Exposure limit for respiratory protection set by OSHA. The 8 hour average concentration of a contaminant which may not be exceeded in any 8 hour workshift of a 40 hr week. Gases and vapors generally reported in ppm (parts per million) and particulates in milligrams per cubic meter of air (mg/m³).
- TLV - Threshold Limit Value- Established by ACGIH. An exposure limit for respiratory protection (based on a Time Weighted Average) for a normal 8-hour workday and 40 hour week. Nearly all workers can be repeatedly exposed to this concentration, day after day and not suffer any adverse effects. Often the TLV may be below (or lower) than the PEL.

Definitions

- Assigned Protection Factor (APF) - Used in reference to the assigned performance index for a particular type or class of respirator. Protection factors have been created by both NIOSH and ANSI (American National Standards Institute) although neither sets of these APFs are legally binding. OSHA, however, does have some APFs in their Substance Specific Standards such as benzene, formaldehyde and lead.

Examples of ANSI Protection Factors

ANSI Z88.2-1992 ANSI Standard for Respiratory Protection

Type of Respirator

APF

- Half Mask - Air Purifying	10
- Full Facepiece – Air Purifying	100 (50 is most commonly used by OSHA)
- Half Mask - PAPR	50
- Full facepiece - PAPR	1000
- Hood or Helmet - PAPR	1000
- Loose Fitting Facepiece - PAPR	25

Examples of ANSI Protection Factors

ANSI Z88.2-1992 ANSI Standard for Respiratory Protection

<u>Type of Respirator</u>	<u>APF</u>
- Half mask - continuous flow (airline)	50
- Full facepiece - continuous flow/pressure demand	1000
- Hood or helmet (continuous flow)	1000
- Loose Fitting Facepiece (continuous flow)	25
- SCBA - pressure demand	No more than 10,000

What the heck do I do with these protection factors and TLVs/PELs?

- When selecting a respirator-the device must have a APF adequate for the workplace exposure. Divide the air contaminant concentration by the TLV or PEL (whichever is lowest) to obtain a hazard ratio. Then select a respirator with an APF greater than or equal to the hazard ratio.

What the heck do I do with these protection factors and TLVs/PELs?

Example:

- Substance A has a PEL and TLV of 100 ppm. (We will say it is a vapor). The concentration of Substance A in the work environment is 225 ppm on an 8 hr Time-weighted average.
- Divide 225 by 100 = 2.25. The work environment exceeds the PEL of 100 ppm and hence, a respirator is required. A device that has a protection factor of at least 2.25 is appropriate. At a minimum-a half-mask with the appropriate cartridge for this vapor should be chosen assuming no other governmental limits apply.

IDLH

- **IDLH** - Immediately Dangerous to Life or Health. An IDLH concentration of a contaminant poses an immediate threat of loss of life, immediate or delayed irreversible adverse effects on health or safety. Must wear a SCBA or Fullface Pressure demand with egress bottle for escape.