

UNDERSTANDING WHEN TO SELECT PAPR FOR YOUR WORKERS

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WHY RESPIRATORY PROTECTION MATTERS

Risks of inhaling harmful substances, airborne contaminants and working in environments with depleted oxygen levels can be life-threatening. In fact, 1 in 10 people worldwide have experienced respiratory hazards in the workplace that are linked to disease.¹ That's why five million workers in 1.3 million U.S. workplaces are required to wear respirators.²

With so many workers' lives at stake, safety managers should provide quality and comfortable respiratory protection to help ensure safety and compliance. Workers need the correct respirators and filters or cartridges depending on their workplace applications and the Permissible Exposure Limit (PEL) of contaminants in the air.

Understanding the difference between Disposable Respirators, reusable Air-Purifying Respirators (APR), Powered Air-Purifying Respirators (PAPR), Supplied Air Respirators (SAR), Self-Contained Breathing Respirators (SCBA) and the variety of different configurations can help ensure your workers have access to the appropriate level of protection – especially when engineering and administrative controls aren't enough.

This whitepaper aims to provide an overview of when to use PAPR, how to determine the level of protection needed, how to choose different configurations and a summary of the safety standards set by OSHA to help ensure your workers are protected when and where they need it most.

WHAT IS A PAPR?

OSHA defines a Powered Air-Purifying Respirator (PAPR) as an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements such as a filter or cartridge to the inlet covering.³ The respiratory protection solution helps protect workers from some of the most dangerous substances such as gases, vapors, dust, mists, fumes, smoke, sprays and fog.

Typically, a PAPR ecosystem consists of an air-purifying filter, cartridge or canister that removes specific air contaminants as well as a motor/blower, battery, belt, headpiece or hood and breathing tube. A PAPR unit also offers face and eye protection and even head protection depending on the headpiece, making it an all-in-one integrated PPE system.

WHEN TO USE A PAPR?

A PAPR should be used in work environments with an Assigned Protection Factor (APF) requirement of 25 or above and atmospheres that are not Immediately Dangerous to Life and Health (IDLH).

The type of air-purifying respirator required for your workplace depends on several factors, including:

- Applications in your workplace
- Type of contaminants exposed to your workers
- Length of time workers are exposed to contaminants
- The concentration of contaminants in your work environment
- The Permissible Exposure Limit (PEL)
- Accommodates most types of facial hair when used with hoods and helmets

A PAPR shouldn't be used in the following work conditions:⁴

- Atmospheres containing less than 19.5 percent oxygen
- IDLH environments

Common industries where PAPR respirators may be necessary:

- Chemical
- Manufacturing
- Pharmaceuticals
- Food and beverage
- Agriculture
- Oil and gas

Common applications where PAPR respirators may be necessary:

- Welding
- Sanding, cutting and drilling
- Remediation
- Construction finishing and grinding
- Adhesive and removal
- Painting removal and cleaning
- Construction road work
- Soldering
- Utilities, semiconductor
- Paper and pulp galvanizing
- Chemical handling



HOW TO DETERMINE THE LEVEL OF RESPIRATORY PROTECTION NEEDED?

When it comes to respiratory selection, understanding the contaminants in your environment through air sampling is the first step toward figuring out what level of protection your workers need.

Each contaminant has a Permissible Exposure Limit (PEL) specified by OSHA during a typical eight-hour workday. Any worker in an environment that has concentrations over the PEL should wear a suitable respirator. Every respirator is given an Assigned Protection Factor (APF) by NIOSH, which represents the workplace level of protection a respirator is expected to provide workers.

Typically, workers need a PAPR when working in environments with an APF between 25 times and 1,000 times over the quantifiable limit of concentration. The Maximum Use Concentration (MUC) is the highest concentration allowed and is determined by multiplying the PEL by the APF.⁵ However, if the MUC exceeds the IDLH limit, an SCBA or PD-SAR with escape must be used.



OSHA PEL STANDARD BY SUBSTANCE ^{6,7,8}

SUBSTANCE	OSHA PEL		
	ppm	mg/m ³	Other Measurements
Acrylamide		0.3	
Acrylonitrile	1		
Ammonia	50	35	
Antimony		0.5	
Asbestos			0.1 f/cc
Arsenic		0.5	
Benzene	1		
Beryllium			0.2 µg/m ³
Cadmium	5 µg/m ³		
Carbon Disulfide	20 ppm		
Carbon Monoxide	50	55	
Chlorine	(C)1	(C)3	
Chromium			5 µg/m ³
Cobalt metal, dust and fume		0.1	
Dimethylformamide	10	30	
Ethylene Glycol Dinitrate	(C)0.2	(C)1	
Ethylene Oxide	1		
Formaldehyde	0.75		
Hydrazine	1	1.3	
Hydrogen Chloride	(C)5	(C)7	
Hydrogen Cyanide	10	11	
Hydrogen Peroxide	1	1.4	
Hydroquinone		2	
Iron oxide fume		10	
Manganese		(C)5	
Mercury			1 mg/10m ³
Methylene Chloride (dichloromethane)	25		
Nickel carbonyl	0.001	0.007	
Nickel, metal, insoluble and soluble compounds		1	
Nitric Acid	2	5	
Osmium Tetroxide		0.002	
Ozone	0.1	0.2	
Phenol	5	19	
Phosgene	0.1	0.4	
Phosphine	0.3	0.4	
Silica			50 µg/m ³
Sodium Hydroxide		2	
Styrene	100		
Sulfur Dioxide	5	13	
Sulfuric Acid		1	
Tetraethyl Lead		0.075	

*The PELs listed above are based on an 8-hour Time-Weighted Average (TWA). A (C) designation represents a ceiling limit. They are to be determined from breathing-zone air samples.

The information in the chart above was pulled from the most recent OSHA and NIOSH guidance as of January 1, 2022.

DETERMINING THE APF NEEDED FOR YOUR WORK ENVIRONMENT

An industrial hygienist should conduct air sampling at your site to determine the concentration of contaminants in the air. The chart shows industry standards released by OSHA for common hazardous substances.

WHY CHOOSE PAPR FOR YOUR RESPIRATORY SOLUTION?

With a full range of respiratory protection to choose from, it can be difficult to decide which solution is right for your workplace. PAPRs can be a reliable, cost-effective and sustainable alternative to disposable and other reusable respirators with many benefits.



ALL-IN-ONE INTEGRATED SOLUTION

Depending on the configuration, PAPR systems often include integrated eye, face and even head protection. Some headgear options also offer a wider field of vision to help workers more easily view their surroundings.



INCREASED COMFORT & BREATHABILITY

PAPRs are designed to make breathing easier. As a positive pressure respirator, it delivers filtered air for long periods using a blower instead of lung power. Workers who wear a PAPR can breathe more comfortably and with less resistance because the airflow comes directly into the headgear.



MULTI-CONTAMINANT PROTECTION

When combined with the appropriate filters or cartridges, a PAPR can be utilized for both particulate, gas and vapor protection.



FULLY REUSABLE

A PAPR consists of reusable components and replaceable filters and/or cartridges based on change-out schedules.



POTENTIALLY HIGHER APF

A PAPR can provide up to 1,000 APF depending on the headgear or facepiece used, compared to select other respiratory solutions.



NO FIT TESTING REQUIRED WITH LOOSE FITTING HEADPIECE

A fit test isn't required when wearing loose-fitting head, hood or helmet PAPR configurations, allowing workers the option to keep limited facial hair while wearing respiratory protection.

WHAT ARE THE DIFFERENT PAPR CONFIGURATIONS TO CONSIDER?

PAPRs come in a variety of different configurations based on the preferences of the wearer and the protection level needed. A mask-mounted PAPR is mounted on a full facepiece, while a belt-mounted PAPR is attached to a belt and worn around the waist. Both PAPR configurations are comprised of a rechargeable battery, belt, blower and filter or cartridge. A headgear/facepiece and breathing tube are also needed for belt-mounted PAPR.

WHEN TO CHOOSE MASK-MOUNTED PAPR

Mask-mounted PAPRs are primarily used for abatement and remediation of asbestos and mold as well as lead reclamation. They are used in markets that require particulate protection only. The mask-mounted full facepiece PAPR provides an APF of 1,000.

WHEN TO CHOOSE BELT-MOUNTED PAPR

Belt-mounted PAPRs are primarily used in heavy manufacturing industries including food and beverage and chemical manufacturing. They are also commonly used in hospital labs during chemotherapy drug mixing and exposure to infectious disease and pharmaceutical development.

Below is a breakdown of the different APF levels based on belt-mounted PAPR configurations:

- Half mask (APF 50)
- Full facepieces (APF 1,000)
- Loose-fitting facepieces (APF 25)
- Hoods (APF 1,000)
- Helmets without a shroud (APF 25)
- Helmets with a shroud (APF 1,000)

WHEN TO CHOOSE HALF MASK

A half mask covers the nose and mouth, allowing workers to wear the PAPR with any face shield they may already be using. The half mask is very low profile and can be used in work environments that require a lower APF level.

WHEN TO CHOOSE FULL FACEPIECE

Full facepieces offer protection against impact injuries, liquid splash exposures, and other eye irritants. The wearer must be clean-shaven in all areas that come in contact with the seal. It provides a higher APF level and requires a fit test. The results of the test should indicate that the facepiece of the respirator fits properly.

WHEN TO CHOOSE HOODS, HEADPIECES AND SHROUDS

Loose-fitting hoods and headpieces don't require fit testing and the user can have most styles of facial hair. Hoods and helmets with a shroud generally provide a higher APF level and often provide more comfort and ease of use. Additionally, workers can more easily wear their prescription eyeglasses while wearing hoods and helmets.

ANATOMY OF A PAPR



Belt



Blower



Filter/Cartridge



Headgear/Facepiece
(Belt-mounted only)



Breathing Tube
(Belt-mounted only)

HOW TO CHOOSE THE RIGHT PAPR FILTER OR CARTRIDGE

Filters help protect workers in dangerous environments against dust/particulates while cartridges help protect against certain gases and vapors. However, combination cartridges protect against both particulates and gases. The type of filter or cartridge necessary depends on your work environment PEL and applications. A filter cover, which is easy to wipe clean, can also be used on top of filters or cartridges for added protection.

The filter service life depends on the particulate concentration. As filters and cartridges fill up, it's harder for air to pass through, putting a strain on the battery and blower and eventually restricting the flow of air to the facepiece. OSHA states filters and cartridges should be changed as recommended by your organization's change-out schedule, which should be part of the written Respiratory Protection Program.⁹

ESTABLISHING AN EFFECTIVE RESPIRATORY PROTECTION PROGRAM

Incorporating respiratory protection into your workplace goes beyond selecting the most suitable respirator and wearing it properly – it's about building a holistic culture of safety. Implementing a Hierarchy of Controls recommended by NIOSH¹⁰ and an effective Respiratory Protection Program recommended by OSHA¹¹ can help prevent fatalities, illnesses and accidents before they happen through proper training and fit testing when required.

The first step in establishing a Respiratory Protection Program is to understand all the respiratory hazards and potential hazards at your worksite. This includes knowing the contaminants and their concentrations and whether there is an IDLH or potential IDLH environment. The Program Administrator must have a thorough understanding of OSHA or CSA Regulations, State or Provincial regulations, plus any industry and contaminant-specific regulations that apply to the worksite.

A written Respiratory Protection Program is required whenever there is a respiratory hazard or potential for a respiratory hazard at a worksite. The following is a very brief overview of the minimum requirements set forth by the U.S. Occupational Safety and Health Administration (OSHA) regulation 29 CFR 191.134 and Canadian Standards Association (CSA) standard Z94.4-11.

For a more thorough review of Program requirements, visit sps.honeywell.com, the OSHA website for U.S., or the CSA and local Work safe websites for Canada. In addition to a thorough understanding of OSHA and CSA Regulations, you must also understand and comply with any additional State or Provincial regulations, plus any industry and contaminant-specific regulations that apply to your worksite.

OSHA 29CFR 1910.134

CSA Z94.4-11

PROGRAM REQUIREMENTS

1. The program must be written, with worksite-specific procedures, and updated as necessary.
2. The program must be managed by a trained Program Administrator.
3. When contaminants are below the PEL, employers may still allow workers to wear respirators on a voluntary basis.*
4. Respirator training must be provided at no cost to the employee and must be performed annually.
5. The employer shall provide a medical evaluation to determine the employee's ability to use a respirator before the employee is fit tested or required to use the respirator in the workplace.
6. A respirator shall be provided to each employee at no cost to the employee and is applicable and suitable for the purpose intended.
7. Fit Testing is required prior to initial use, whenever a different respirator facepiece is used and at least annually thereafter by OSHA and every two years by CSA. OSHA and CSA require quantitative fit testing for air-purifying full facepieces that will be worn in environments where a contaminant's concentration is between 10 times and 50 times the PEL; CSA also requires quantitative fit testing for self-contained breathing apparatus.
8. The Respirator Program must include procedures for proper use during an emergency.
9. Establish your worksite procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding and maintaining respirators.
10. If air-purifying or powered air-purifying respirators are used for protection from gases or vapors, the cartridges must be equipped with an End-of-Service Life Indicator (ESLI), or there must be a cartridge change schedule established; refer to the Honeywell esLife at sps.honeywell.com for cartridge service life calculations.
11. If an atmosphere-supplying respirator is used, such as a continuous flow or pressure demand airline, there must be procedures in place to assure that the breathing air is grade D or better (US) or meets requirements of Z180.1 (CSA).

*Voluntary Use of Respirator requirements only applies to the OSHA Regulations; CSA does not address voluntary respirator use.

RESOURCES

- CSA Z94.4-11
- NIOSH Decision Logic
- OSHA 29 CFR 1910.134
- OSHA "Small Entity Compliance Guide for the Respiratory Protection Standard"
- OSHA MedCert
- ANSI Z88.2 "American National Standard for Respiratory Protection"

NOT ALL RESPIRATORY SOLUTIONS ARE CREATED EQUAL

It's important to equip your workers with the right solutions that provide a proper and comfortable fit when working around toxic containments. With so many options on the market, let Honeywell be your guide to helping provide all workers with the safety they need.

At Honeywell, safety is in our DNA. For decades, we've helped protect more than 500 million workers every day. We take a consultative approach that goes beyond recommending the right respiratory protection. We can work with you to build a comprehensive respiratory program for your workforce. We offer in-person and online training programs to teach workers how to properly don and doff their equipment, change filters and cartridges and properly clean their respirators.

With our legacy as an expert in respiratory protection and our continued innovation in safety solutions, our passion lies in helping protect more workers in more environments with innovative products that meet changing worker needs. Built with a high level of comfort, durability and protection, our PAPR solutions help protect workers when and where they need it most.

¹AJMC, <https://www.ajmc.com/view/respiratory-hazards-at-work-linked-to-disease-for-1-in-10-people-worldwide>

²ISHN, <https://www.ishn.com/articles/110051-osh-respiratory-protection-standard>

³OSHA, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134>

⁴CDC, <https://wwwn.cdc.gov/NIOSH-CEL/Limitations/Papr>

⁵OSHA, <https://www.osha.gov/sites/default/files/publications/3352-APF-respirators.pdf>

⁶OSHA, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ1>

⁷OSHA, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ2>

⁸NIOSH, <https://www.cdc.gov/niosh/docs/2005-149/pdfs/2005-149.pdf>

⁹OSHA, <https://www.osha.gov/etools/respiratory-protection/change-schedules>

¹⁰NIOSH, <https://www.cdc.gov/niosh/topics/hierarchy/default.html>

¹¹OSHA, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134>

For more information

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