

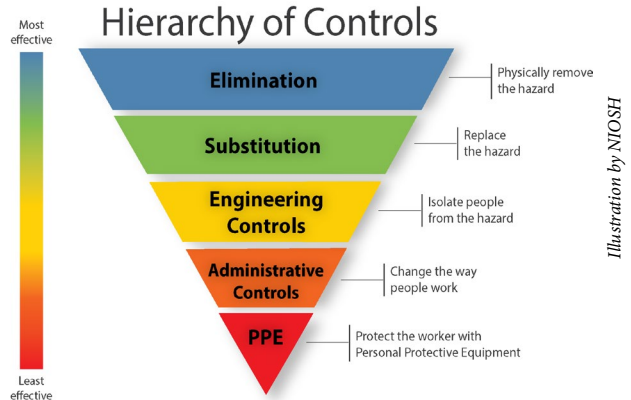
Respirator Selection Guide for the Healthcare Industry

Assisting Healthcare Facilities in Selecting Appropriate Respirators During Conventional Operations

Healthcare personnel (HCP) are exposed to a variety of respiratory hazards on the job such as infectious agents, surgical smoke, and anesthetic waste gases. Depending on the hazard, different types of respiratory protection may be appropriate. Employers and respiratory protection program (RPP) managers play an essential role in selecting the correct respirator to protect HCP from these hazards.

Before selecting a respirator, employers must first identify the hazards to which HCP are exposed. To do this, employers should conduct a [hazard assessment](#). This assessment identifies important information such as the chemical state, physical form, and concentration level of contaminants and the exposure potential.

Once a hazard assessment is completed, employers and RPP managers should follow the hierarchy of controls to reduce, or even eliminate, exposure to the hazard. Engineering and administrative controls should be in place before HCP use a respirator.



Engineering controls are methods to reduce or remove the hazard at the source or place a barrier between the worker and the hazard (e.g., redirecting air flow through ventilation).

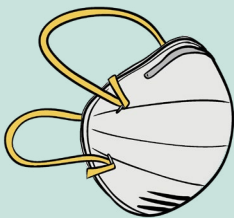
Administrative controls are changes to, or new, policies and work practices that reduce workers' exposure to hazards (e.g., limiting exposure time by responding to call button clicks outside the patient's room; training on relevant equipment and procedures).

When these controls are not available, feasible, in working order, or are insufficient at reducing exposure to harmful contaminants, respiratory protection is required. If respirators are required, they must be used within an Occupational Safety and Health Administration (OSHA) compliant RPP (see [29 CFR 1910.134](#)). These respirators must be approved by the National Institute for Occupational Safety and Health (NIOSH).

NIOSH Approved® Respirators Used in Healthcare

Respirators can protect workers by either purifying the air breathed in by the worker (air-purifying respirators) or by supplying clean breathing air (atmosphere-supplying respirators). HCP commonly use air-purifying respirators to protect them from respiratory hazards including particles (e.g., surgical smoke, infectious particles), gases (e.g., nitrous oxide, isoflurane), and vapors (e.g., hydrogen peroxide, acetic acid). While N95® filtering facepiece respirators (FFRs) are the most commonly used in healthcare, other air-purifying respirators such as those described below can provide equal or greater protection.¹

Illustration by NIOSH



FFRs, such as N95 and P100® FFRs, are disposable respirators. They are made of a filter material that removes particles from the air as the wearer breathes. Some FFRs, known as Surgical N95 FFRs, also provide HCP protection from airborne and fluid hazards (e.g., splashes and sprays). FFRs do not protect against gases or vapors.

¹ Wizner K, et al. [2016]. Prevalence of respiratory protective devices in U.S. health care facilities: implications for emergency preparedness. *Workplace Health Saf* 64(8):369-68.



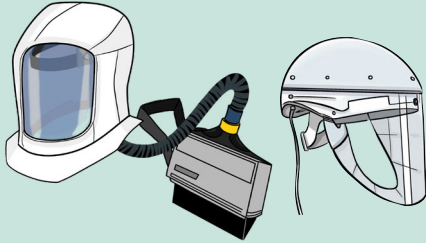
U.S. Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Illustration by NIOSH



Elastomeric half mask respirators (EHMRs) are reusable respirators. They typically have exhalation valves, but some are designed without an exhalation valve or with an exhalation valve filter. EHMRs with an exhalation valve or an exhalation valve filter can protect against gases, vapors, or particles when equipped with the proper filter or cartridge.² EHMRs without an exhalation valve are only approved for use with particulate filters.³ They cannot be equipped with gas or vapor cartridges.

Illustrations by NIOSH



Powered air-purifying respirators (PAPRs) are reusable respirators. They protect against gases, vapors, or particles when equipped with the appropriate filter, cartridge, or canister. These include loose-fitting, tight-fitting, or helmet-style designs, and the blower and motor unit can either be at the belt or in the headgear itself.

Selecting the Appropriate Respirator and Level of Protection

When selecting a respirator, employers and RPP managers should consider the hazards present and understand the different protections each air-purifying respirator type can provide to make a proper selection.

Protection Factors

OSHA provides an [assigned protection factor \(APF\)](#) for each respirator class. APFs indicate the level of protection the wearer can expect to receive from a respirator when the wearer is properly fitted and trained. The higher the APF, the greater amount of protection the respirator can provide to HCP.

- FFRs and EHMRs have an APF of 10, meaning only 1/10th, or 10%, of the hazardous particles enter the respirator facepiece, thereby reducing the wearer's exposure to contaminants by 90%.
- PAPRs have an APF of at least 25, meaning only 1/25th, or 4%, of the hazardous particles enter the respirator facepiece, thereby reducing the wearer's exposure by at least 96%.
 - Loose-fitting PAPRs have an APF of 25. Loose-fitting PAPRs with a helmet or hood can receive an APF of 1000 if the employer has evidence from the respirator manufacturer that the PAPR performed at this level, or greater, during testing.
 - Half facepiece PAPRs have an APF of at least 50 and full facepiece PAPRs have an APF of 1000.

Particulate Protection

FFRs, EHMRs, and PAPRs can all be used to protect HCP from hazardous particles. While N95 FFRs are the most commonly used for particulate hazards in healthcare settings, employers and RPP managers always have the option to choose a respirator with a higher level of protection.

There are nine filter classes for FFRs. Each class identifies how oil resistant the filter is (N-, R-, or P-series) and its filtration efficiency (95%, 99%, or 99.97%). EHMRs can also be equipped with these filter classes.

The [nine filter classes](#) for particulate protection can be made up of a combination of the following filter series and filter efficiencies:



N Not resistant to oil



R Resistant to oil



P Oil Proof



95 Filters at least 95% of particles



99 Filters at least 99% of particles



100 Filters at least 99.97% of particles

² Currently, there are no NIOSH Approved EHMRs with an exhalation valve filter on the market that are approved for use with gas or vapor cartridges.

³ NIOSH's standard [42 CFR Part 84](#) requires all EHMRs used with chemical cartridges to have functional inhalation and exhalation valves. This is to protect the cartridge from excessive exhaled air.

There are two different filter classes that PAPRs can be equipped with: HE[®] and PAPR100

The PAPR100 class includes two series, PAPR100-P[®] and PAPR100-N[®]. Both series provide the same level of protection as a high-efficiency (HE) filter, filtering 99.97% of airborne particles.

Selecting the appropriate filter class depends on the hazards HCP are exposed to.

Examples of selecting a respirator for particulate protection:

- A respiratory therapist will be present during a surgery in a hospital where they will be required to intubate a patient – an aerosol generating procedure. The patient has tested positive for seasonal influenza. Performing an aerosol generating procedure on a patient with confirmed influenza can increase HCP's risk of influenza exposure. NIOSH recommends a respirator with at least an APF of 10 and an N95 particulate filter or better for aerosol generating procedures.⁴ To protect the respiratory therapist, the employer selects an N95 FFR.
- A nurse is required to go into a room to care for a patient with tuberculosis, which is known to be transmitted through exhaled aerosols. There is no occupational exposure limit for this exposure, but the Centers for Disease Control and Prevention recommends a respirator with at least an APF of 10 and an N95 particulate filter or better.⁵ The employer selects a PAPR with PAPR100-P filters to protect the nurse entering this patient's room.

Gas or Vapor Protection

If HCP need protection from gases or vapors (e.g., hazardous drugs, anesthetic waste gases), a respirator such as an EHMR or PAPR equipped with a chemical or combination cartridge should be used. Chemical cartridges only remove gases or vapors, while combination cartridges can remove particles as well. The [NIOSH Certified Equipment List](#) can help in selecting the appropriate cartridge or canister needed for specific gases or vapors.

Example of selecting a respirator for gas or vapor protection:

A hospital environmental services employee is exposed to high concentrations of hydrogen peroxide while cleaning hospital rooms between patients. The employer conducted a hazard assessment and found the concentration of hydrogen peroxide in the bathroom is 2 parts per million (ppm) while the worker is cleaning.

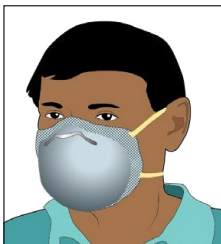
The NIOSH recommended exposure limit for hydrogen peroxide is 1 ppm. The hazard ratio, the concentration of the hazard divided by the exposure limit, is 2 (2 ppm/1 ppm). The selected respirator's APF must be greater than or equal to the hazard ratio.

Given this concentration and the hydrogen peroxide vapors, the employer selects an EHMR with organic vapor cartridges to protect the worker.

Considerations for Using FFRs, EHMRs, and PAPRs

When selecting the appropriate air-purifying respirator, it is important to understand the advantages and limitations of each type.

FFR



Advantage

- Does not require maintenance because it should be discarded after each use.

Limitations

- Cannot be used when splashes or sprays are anticipated unless it is a Surgical N95 FFR.
- Requires fit testing.
- Cannot be used for protection against gases or vapors.

⁴ NIOSH [2015]. Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication Number 2015-117 (revised 04/2022), <https://www.cdc.gov/niosh/docs/2015-117/pdfs/2015-117revised042022.pdf?id=10.26616/NIOSH-PUB2015117>.

⁵ Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, <https://www.cdc.gov/infection-control/hcp/isolation/isolation-precautions/index.html>.

EHMR (with cartridges)



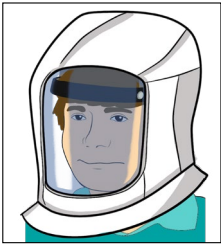
Advantages

- Reusable
- Provides the same level of protection as an FFR as they both have an APF of 10.
- Can be used in place of a disposable FFR, especially when disposable FFRs are in short supply.

Limitations

- Requires maintenance as it must be cleaned, disinfected, and stored properly, and its filter or cartridge elements must be replaced when needed.
- Requires fit testing.
- Cannot be used for protection against gases or vapors if it does not have an exhalation valve.

PAPR (loose-fitting)



Advantages

- Reusable
- Provides greater protection than an FFR and EHMR.
- Can be used in place of a disposable FFR, especially when disposable FFRs are in short supply.
- Does not require fit testing if it is loose-fitting.

Limitations

- Requires maintenance as it must be cleaned, disinfected, and stored properly, and its filter, cartridge, or canister elements must be replaced when needed.
- Prolonged use is limited by battery life.
- Must be kept charged.

Illustrations by NIOSH

Implementing a Respiratory Protection Program

Employers who require workers to use a respirator must implement an RPP. Employers and RPP managers can use NIOSH's [Hospital Respiratory Protection Program Toolkit](#) for assistance with developing and implementing an effective RPP. Additionally, as part of a NIOSH-funded effort, the University of Maryland created [implementation guidance](#) for EHMR use.

Medical evaluations, fit testing, and training are essential components of RPPs.

Medical Clearance: Before HCP can wear any type of respirator on the job, including loose-fitting PAPRs, a medical evaluation must be completed. This evaluation ensures HCP can wear a respirator without health complications.

Fit Testing: Fit tests ensure that tight-fitting respirators, such as FFRs or EHMRs, form a complete seal to the face, which is important for providing the expected level of protection. HCP should undergo fit testing annually and anytime a different model, style, or size respirator is used. Employers must provide various respirator models and sizes to determine which respirator fits and is acceptable to the worker. Loose-fitting PAPRs can be a good alternative if HCP are unable to pass a fit test with a tight-fitting respirator or have facial hair. For additional information about fit testing and the qualifications needed to perform fit tests, see NIOSH's [trusted source web page](#).

Training: Employers must train HCP on how to properly use, clean, and maintain their respirator. Training should occur annually or when the need arises. This includes if exposure conditions change, or if HCP use a new type or model of respirator. OSHA's standard 1910.134 provides requirements for proper use, cleaning and disinfection, and storage of respirators. Respirator manufacturers also often provide this information in their user instructions.

Get More Information

Find NIOSH products and get answers to workplace safety and health questions:
1-800-CDC-INFO (1-800-232-4636) | TTY: 1-888-232-6348
cdc.gov/info | cdc.gov/niosh
Monthly NIOSH eNews: cdc.gov/niosh/eNews