

## Elastomeric Respirators: Strategies During Conventional and Surge Demand Situations

Conventional, Contingency, and Crisis Strategies

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**Who this guidance is for:** Federal, state, and local public health officials, respiratory protection program managers, occupational health service leaders, infection prevention and control program leaders, and other leaders in healthcare settings who are responsible for developing and implementing policies and procedures for preventing pathogen transmission in healthcare settings.

**Purpose:** This webpage offers guidance for the use of reusable elastomeric particulate respirators to provide respiratory protection to healthcare practitioners (HCP) against pathogens as a component of a formally developed and implemented written respiratory protection program.

This guidance is based on what is currently known about the transmission and severity of coronavirus disease 2019 (COVID-19).

The US Centers for Disease Control and Prevention (CDC) will update this guidance as needed and as additional information becomes available. Please check the [CDC COVID-19 website](#) periodically for updated guidance.



Conventional guidance is not applicable during the COVID-19 response when supplies are short. HCP should follow the contingency and crisis strategies.

## Conventional Strategies During Non-Surge Demand Situations

### Elastomeric 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.



**Filtering 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).



Example of an open-circuit SCBA

**Self-Contained Breathing Apparatus (SCBAs)** 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.



Example of an SAR/SCBA

**Combination Respirators** can be either a supplied-air/SCBA respirator or supplied-air/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.



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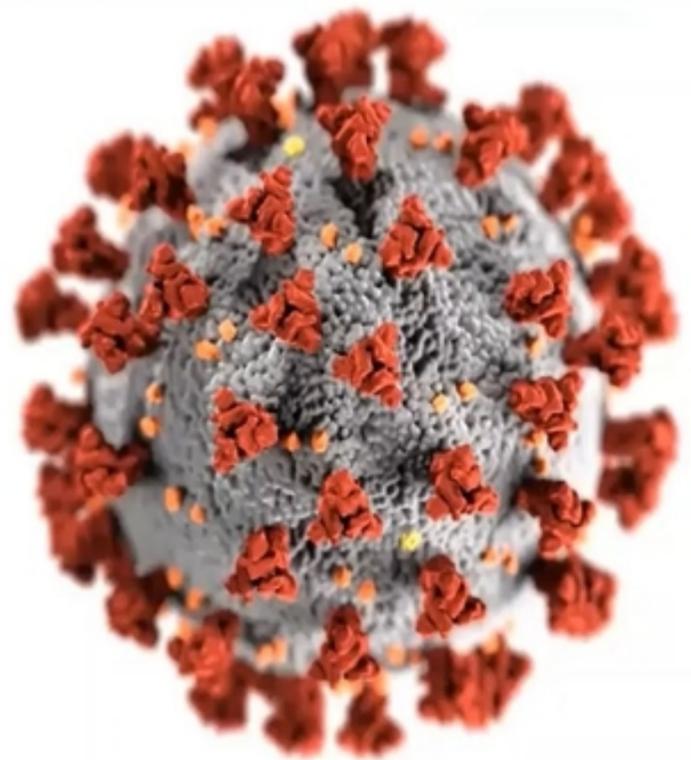
[Alternative Format](#)

Elastomeric respirators, such as half facepiece or full facepiece tight-fitting respirators where the facepieces are made of synthetic or natural rubber material, can be repeatedly used, cleaned, disinfected, stored, and re-used. They are available as alternatives to disposable half mask filtering facepiece respirators (FFRs), such as N95 FFRs, for augmenting the total supply of respirators available for use by HCP. While elastomeric respirators are not cleared by FDA for fluid resistance, based on their NIOSH approval, they can provide at least equivalent protection to N95 FFRs. Some types of elastomeric respirators can offer higher assigned protection factors (APFs) than N95 FFRs. They are equipped with replaceable filter cartridges or flexible, disc or pancake-style filters, which are not housed in a cartridge body. All elastomeric respirators equipped with the proper air-purification filters, cartridges, or canisters would also have utility in this application. Elastomerics may also have sealing surfaces and adjustable straps that accommodate a better fit.

Because they can be re-used, elastomeric particulate respirators provide an alternative respiratory protection option to FFRs for protection against pathogens. While this document focuses on respiratory protection for exposure to pathogens, these respirators may also serve as protection against other airborne hazards in healthcare settings. However, they require maintenance and a supply of replaceable components including straps, inhalation and exhalation valves, valve covers, and filters, cartridges, or canisters.

# Elastomeric Respirators for U.S. Healthcare Delivery

## Key Considerations



For more information: [www.cdc.gov/COVID19](http://www.cdc.gov/COVID19)

This webinar provides an overview of respiratory protection and guidance surrounding supply shortages. This webinar also provides information on infection prevention measures, strategies for optimizing the supply of N95 respirators, and a broad overview of the use of elastomeric respirators in healthcare. Guidance on elastomeric respirators is currently in development.

Elastomeric respirators have the same basic requirements for an OSHA-approved respiratory protection program as filtering facepiece respirators, including medical evaluation, training, and fit testing. However, they have additional maintenance requirements which also include cleaning and disinfection of the facepiece components such as straps, valves, and valve covers. While it is often possible to decontaminate the hard outer casing of filters, the filter material itself typically cannot be cleaned or disinfected for reuse. Instead, filter components should be discarded when they become damaged, soiled, or clogged.

There are several types of elastomeric respirators, half-facepiece or half mask (APF = 10)<sup>1</sup> and full facepiece (APF = 50). The specific cautions, limitations, and restrictions of use should be understood when determining whether to use these respirators in healthcare facilities. Respirators with full facepieces have the same filter considerations but provide greater protection because of better sealing characteristics and less face seal leakage and also provide protection to more of the face and very importantly, the eyes. Elastomeric respirators with exhalation valves should not be used in surgical settings due to concerns that unfiltered air coming out of the exhalation valve may contaminate the surgical field.

## OSHA-Compliant Written Respiratory Protection Program Requirements

When respirators are used to protect against hazardous airborne exposures in the workplace, OSHA requires employers to develop and implement a written respiratory protection program that conforms to OSHA 29CFR1910.134 including initial and annual fit testing.<sup>1</sup> The use of a NIOSH-approved respirator is required by OSHA. OSHA also requires that respirators be used in conformance with the conditions of their NIOSH certification. Hence, a NIOSH-approved respirator assembly cannot be modified, and only those replacement parts specified and provided by the manufacturer must be used. The manufacturer's instructions are specific to its respirator materials and specifications. Manufacturer instructions are generally provided with the respirator facepiece packaging.

Appendix B-2 to OSHA's Respiratory Protection standard ([29CFR1910.134](https://www.federalregister.gov/documents/2013/07/16/2013-14176) [↗](#)) provides general procedures for employers to use when cleaning respirators. OSHA also permits employers to use the cleaning recommendations provided by the respirator manufacturer, if such procedures are as effective as those listed in Appendix B-2, meaning that the respirator is

properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm such as skin irritation to the user.

## Cleaning, Disinfection, and Use

Generally, it is recommended that respirators be cleaned and disinfected immediately after doffing (i.e., removing). To avoid contact transmission, precautions should be taken during doffing and use. Training on appropriate donning and doffing procedures should be provided to all employees expected to wear respirators. Both CDC and OSHA have videos illustrating proper donning and doffing of the respirator.<sup>16</sup> Elastomeric components vary among manufacturers and react differently to cleaning and disinfection solutions and procedures. The respirator facepiece components such as facepiece, valves, and straps require maintenance including cleaning, disinfection and inspection prior to reuse. OSHA only requires replacing filters “where necessary,” for example, when soiled, contaminated, or clogged.

Viruses and bacteria that cause acute respiratory infections can survive on respirator components for variable periods of time, from hours to weeks. Consequently, contaminated respirators must be handled, cleaned, and disinfected carefully and properly to reduce the possibility of the device carrying infection and contributing to disease transmission.<sup>2</sup> Manufacturers recommend cleaning and disinfection procedures for their elastomeric respirator components such as facepiece, valve covers, valves, and straps. The materials that comprise the elastomeric components of NIOSH-approved respirators vary among manufacturers; consequently, cleaning and disinfection solutions and procedures recommended by manufacturers may also vary. Manufacturers typically recommend that filter cartridges be discarded after each use when cleaning an elastomeric respirator. Following manufacturer recommendations may be possible for some employers, but others may find discarding the filter component with each cleaning of an elastomeric respirator to be a cost factor when selecting between FFRs and elastomeric respirators, but especially in times of shortage, users may find it difficult to replace the filter cartridges due to supply difficulties. OSHA only requires replacing filters “where necessary,” for example, when soiled, contaminated, or clogged. Additionally, cleaning and disinfecting respirators can damage or deteriorate respirator facepiece component materials and adversely affect their performance when re-using after disinfection.

## Filter Types

Three types or series of filters are available for use with reusable elastomeric respirators. Filters are classified by their resistance to degradation by oil-based aerosols.

- N-Series filters are not oil-resistant.
- R-Series are somewhat oil-resistant, and, in industrial use, typically have an 8-hour time-use limitation.
- P-Series are oil-resistant and rarely have use-time limitations.

Manufacturers provide use-time limitations and other limitations or restrictions depending on the respirator’s intended use. If the healthcare setting does not have any oil-based aerosols present, any filter series can be used. Filters are available in three efficiency levels – 95, 99, 100. Thus, a wide selection is potentially available for use to augment the overall supply of respirators in healthcare settings. The half mask or facepiece type respirator with N-Series 95% efficiency level filters (N-95) has been determined to provide adequate protection in combination with other healthcare practice interventions such as hand washing, isolation, and spatial distance for the risks associated with the transmission of tuberculosis, influenza, and novel coronaviruses.<sup>3 4</sup>

Generally, in industrial settings, filters are replaced when soiled or contaminated, damaged, and when breathing resistance increases. However, in healthcare settings breathing resistance will unlikely be a reason for filter replacement since filters should seldom if ever become loaded with heavy concentrations of dust. Depending on use, one manufacturer recommends the filter be discarded after each use, while another recommends the filter cartridge be disposed no later than 30 days after the first use if no oil mists are present.<sup>5 6</sup> The respirator’s other elastomeric components should not be cleaned with solvents (e.g., acetone, ethanol) or exposed to temperatures greater than 50°C (122°F).

## Disinfection Procedures

Cleaning and disinfection must be done using either the procedures in OSHA’s Respiratory Protection Standard or the procedures recommended by the respirator manufacturer, provided they are at least as effective as OSHA’s procedures. The employer must consult with the manufacturer for the proper disinfectants/procedures and their potential impact upon its respirator facepiece components.

If it is determined that the disinfection solution and procedures do not degrade the facepiece components, it is possible the components can be re-used, subject to inspection by a qualified individual to determine whether the components need to be repaired or replaced.

Filter cartridges should be removed from the facepiece prior to cleaning and disinfecting the elastomeric facepiece components. Generally, the facepiece components are removed from the facepiece to be cleaned and disinfected. There are several basic steps to clean and disinfect a respirator – remove, clean, disinfect, rinse and dry, inspect and repair or replace, and store. The order and details of each step are important. And it is very important that respirators are *thoroughly* air dried prior to storage.

Some disinfectants are powerful germicides and their use requires special precautions such as adequate ventilation, use of clean non-sterile gloves, gowns, and/or face shields. Therefore, cleaning and disinfection must be done by competent, trained individuals. Centralizing this activity might help ensure that it is being properly executed.

Maintenance must be performed only by those individuals who have been trained in the task and are knowledgeable of the models being serviced. Specially trained individuals (ideally the same people who clean and disinfect respirators) should also be employed to carefully inspect respirators after cleaning with attention to valves and straps. Inspections should follow the manufacturer's recommendations. Only the original respirator manufacturer's component parts should be stocked and available to replace damaged components when necessary.

## Contingency Capacity Strategies During Surge Demand Situations

**Who this guidance is for:** Those responsible for developing and implementing policies and procedures for preventing pathogen transmission in healthcare settings. This includes federal, state, and local public health officials, respiratory protection program managers, occupational health service leaders, and infection prevention and control program leaders.

**Purpose:** This webpage describes options for deploying air-purifying reusable elastomeric particulate respirators to provide respiratory protection to healthcare practitioners (HCP) when supplies of N95 filtering facepiece respirators (FFRs), including surgical N95s, are limited or not available.

Strategies for reusable elastomeric respirator use in healthcare settings in conventional, non-surge demand situations, are discussed in [Conventional Strategies](#). Conventional use should adhere to OSHA requirements and manufacturer-specific recommended instructions.

**Contingency capacity strategies** are for emergency situations in which each elastomeric respirator is issued for the exclusive use of an individual employee. The respirators are cleaned and disinfected as often as necessary to remain unsoiled and sanitary. Their description and use should be part of a written OSHA respiratory protection program (RPP). If there is deviation from the standard RPP, it should be authorized and documented by the program's administrator.

**Crisis capacity strategies** are for emergency use, limited respirator and/or respirator component supplies such as filters, cartridges, or canisters, and valves, and situations in which it is impossible for individual HCP to have a dedicated elastomeric respirator, for example when the same respirator must be used by multiple HCP. When used by more than one HCP, respirators must be cleaned and disinfected before being worn by different individuals. The use of elastomeric respirators should be part of a written OSHA RPP. If there is any deviation from the conventional RPP, it should be authorized and documented by the program's administrator.

## Elastomeric Respirators as an alternative to NIOSH-approved N95 respirators

NIOSH-certified reusable elastomeric particulate respirators provide at least the same level of protection as N95 FFRs, and some types of elastomeric respirators can offer higher assigned protection factors than N95 FFRs.

The most significant difference between reusable elastomeric respirators and disposable FFRs is that reusable respirators must be maintained and inspected after each use, including cleaning and disinfection of the elastomeric components such as facepiece valves, valve covers, and straps. When used in conventional workplace conditions, the filter, cartridge, or canister of a reusable elastomeric respirator is not cleaned or disinfected; it is discarded once damaged, soiled, or clogged. Elastomeric respirators are equipped with replaceable filters. Some replaceable filters are cartridge style in which the filtration media is housed inside of a cartridge. Others consist of flexible, disc or pancake-style filters, in which the filter media are not housed within a cartridge body.

This document provides considerations for disinfecting the outside of a filter cartridge during contingency and crisis scenarios to increase the supply of respirators for protection during the Coronavirus Disease 2019 (COVID-19) pandemic. However, there is an increased risk of contact transmission or damage to the filter cartridge that must be considered.

## General Reusable Elastomeric Respirator Considerations

Reusable respirators described in this document include tight-fitting half-facepiece or full-facepiece elastomeric respirators that use replaceable filters, cartridges, or canisters and have facepieces made of synthetic or natural rubber material permitting repeated cleaning, disinfection, storage, and reuse. They contain an exhalation valve and should not be used in surgical settings when there is concern that unfiltered air coming out of the exhalation valve may contaminate the surgical field. As with N95 FFRs, reusable respirators require an RPP including, but not limited to, initial and annual fit testing, and a user seal check each time the respirator is used. However, on March 14, 2020 OSHA issued [Temporary Enforcement Guidance](#)  permitting OSHA field offices to exercise enforcement discretion regarding the annual fit testing requirements until further notice.<sup>7</sup>

NIOSH-approved, elastomeric respirators provide an alternative respiratory protection option capable of decreasing the total number of respirators required because they may be cleaned, disinfected, and reused numerous times, which should reduce the number of respirators needed when supplies are limited.<sup>8</sup> However, a supply of elastomeric respirator facepiece components should be held in reserve to replace damaged or deteriorated parts, and supplies of replacement filters, cartridges, or canisters are also needed. The filters of these respirators are at least as protective as the N95 FFRs and surgical N95 FFRs typically used in healthcare settings. They are not cleared by FDA for fluid resistance and require maintenance including cleaning, disinfection, and inspection.

There are several types of filter media for use with NIOSH-approved reusable, half -facepiece elastomeric respirators. All are sufficient at removing droplet and viral size particles when worn correctly for the duration of the exposure. Filters are available in three efficiency levels – 95, 99, 100. Thus, a wide selection is potentially available for use to augment the overall supply of respirators in healthcare settings.

- **On an emergency basis during contingency and crisis emergency use,**
  - **Filters (except for unprotected disc type, i.e., pancake style) may be used for an extended period, if the filter housing of cartridge types is disinfected after each patient interaction provided the disinfectant or cleaning agent does not come in contact with the filter media.**
  - **Filters, even cartridge types, must not be dipped or immersed in a cleaning or disinfection solution because this may damage or render the filter material ineffective. When using a cleaning or disinfectant wipe on the external surface of a filter cartridge, users should avoid contact with the filter media on the inside of the cartridge.**
- The specific cautions, limitations, and restrictions of use should be understood when determining whether to use these respirators in healthcare facilities.
  - Respirators with full facepieces have the same filter considerations but provide greater protection because of better sealing characteristics and less face seal leakage and also provide protection to more of the face and very importantly, the eyes.
  - Elastomeric respirators with exhalation valves should not be used in surgical settings due to concerns that unfiltered air coming out of the exhalation valve may contaminate the surgical field.

Half-facepiece or half mask (APF = 10)<sup>1</sup> and full facepiece (APF = 50) elastomeric respirators have specific cautions, limitations, and restrictions of use that need to be understood when determining whether to use these respirators in a healthcare facility. Respirators with full facepieces have the same filter considerations but provide greater protection because of better sealing characteristics and less face seal leakage and also provide protection to more of the face and very importantly, the eyes.

## Effective Elastomeric Respirator Use

During contingency and crisis capacity strategies, when shortages are predicted, but supplies are still available, each elastomeric respirator is issued for the exclusive use of an individual employee. Elastomeric respirators must be cleaned as often as necessary to remain unsoiled and sanitary.

- As with N95 FFRs, achieving an adequate seal to the face is essential. OSHA regulations require a written respiratory protection program requiring workers to undergo an initial and annual fit test and conduct a user seal check each time the respirator is donned (put on). Workers must pass an initial and annual fit test to confirm a proper seal before using a tight-fitting respirator in the workplace. Any exception to the program during emergency use should be authorized and documented by the program administrator. On March 14, 2020 OSHA issued [Temporary Enforcement Guidance](#) [↗](#) permitting OSHA field offices to exercise enforcement discretion regarding the annual fit testing requirements until further notice.<sup>7</sup>
- When properly fitted and worn, minimal leakage occurs around the edges of the tight-fitting respirator where it seals to the user's face when the user inhales. This means almost all the air is directed through the filter media.
- A respirator with an exhalation valve provides the same level of protection to the wearer as one that does not have a valve. The presence of an exhalation valve reduces exhalation resistance, which makes it easier to breathe (exhale). Some users feel that a respirator with an exhalation valve keeps the face cooler and reduces moisture build up inside the facepiece. However, respirators with exhalation valves are generally not be used in situations when a sterile field must be maintained, such as during an invasive procedure in a surgical or procedural setting, because the exhalation valve allows unfiltered air exhaled by the wearer, potentially contaminated with microbes, to escape and possibly contaminate the sterile field. There may be other healthcare activities where respirators with exhalation valves are appropriate.
- During contingency or crisis scenarios, HCPs may receive elastomeric respirators they are not accustomed to using. The JETFIT Study provides information about how quickly the healthcare workers can be trained on using elastomeric respirators when switching from N95 FFRs to elastomerics.<sup>9</sup>
- The Bessesen et al. protocol describes a simple approach to cleaning and disinfecting elastomeric respirators in healthcare settings.<sup>10</sup> The CDC webinar on *Elastomeric Respirators for U.S. Healthcare Delivery* describes the Bessesen protocol and additional information about the use of elastomeric respirators in healthcare settings.<sup>11</sup>

## General Cleaning and Disinfection Information

Viruses and bacteria that cause acute respiratory infections can survive on respirator components for variable periods of time, from hours to weeks. Consequently, contaminated elastomeric respirators must be handled, cleaned, and disinfected properly to reduce the possibility of the device carrying infectious particles and contributing to disease transmission.<sup>2</sup>

Each respirator manufacturer identifies the appropriate cleaning procedures, which typically involves 1) using soap and warm water or chemical disinfectants authorized for use with their specific elastomeric facepiece components and 2) discarding the filter cartridge.

**For conventional use:** Employers must consult with the manufacturer concerning the effectiveness and uncertainties of alternative cleaning and disinfectant solutions and procedures used for reuse of the facepiece, straps, and filter components.

- The solutions and procedures must be effective for disinfection but 1) not damage the respirator, including causing damage to the filter media, which conventionally is discarded and 2) not cause harm such as skin irritation to the wearer.
- Prolonged or repeated use of disinfectants may damage or degrade respirator elastomeric components (facepiece, valves, valve covers, straps), causing components to discolor, swell, harden, and crack.

**For contingency and crisis use:** Because of necessity, elastomeric facepiece components and filter cartridges may be treated differently for their cleaning and disinfection. Whereas conventional practice is to discard the filter component, contingency practices may necessitate cleaning and disinfecting the filter housing, but care must be taken to not expose the filter media to any cleaning solutions. The performance of filter media can be degraded by contact with the disinfectant.

- During surge situations, when manufacturer instructions are not available, and supply shortages exist, interim cleaning and disinfection procedures may be necessary and effective to reuse scarce or unavailable replacement components. However, interim procedures could increase the risk of contact transmission or damage to the filter media if not done properly. Alternate procedures and risks must be considered to protect HCP and meet healthcare needs.

- First clean the surface of each component except for the filter media after each use. Removing organic and inorganic materials from the component surfaces will help achieve maximally effective disinfection.<sup>12</sup>
- Some disinfectants are powerful germicides, so their use requires special precautions such as adequate ventilation, use of clean non-sterile gloves, gowns, and face shields. As such, cleaning and disinfection must be done by competent, trained individuals.
- Additional guidelines for cleaning and disinfecting elastomeric respirators are available from the CDC/NIOSH-sponsored JETFIT study, conducted in 2019-2020 at two academic medical centers to better understand the feasibility of rapidly fit testing and training HCP to use elastomeric respirators.<sup>9</sup>
- Care needs to be taken during cleaning and disinfection to ensure the trained respirator cleaning staff does not contaminate or injure themselves. Centralizing this activity might be helpful for ensuring that it is being properly executed. Recent studies demonstrate that some elastomeric respirators continue to function and perform as expected after 150 cleaning and disinfection cycles.<sup>13</sup>

## Basic Steps to Clean and Disinfect an Elastomeric Respirator

There are several basic steps to clean and disinfect an elastomeric respirator – remove, clean, disinfect, rinse and dry, inspect and repair or replace, and store. Bessesen et al. provide useful guidelines for cleaning and disinfecting elastomeric respirators in healthcare environments.<sup>10</sup> These methods have been used successfully in several healthcare settings in the United States. The order and details of each step are important.

If available and appropriate, the respirator facepiece components should be cleaned using OSHA or manufacturer protocols.<sup>7</sup> <sup>14–15</sup> Filter cartridge components would conventionally be discarded. However, during periods of surge capacity, a careful wipe of the filter cartridge, avoiding contact with the filter media, and using a common hospital disinfectant wipe has low risk of damaging the filter. The filter cartridge should never be dipped or submerged in disinfectant or excessively wetted with disinfectant.

Generally, it is recommended that respirators be cleaned and disinfected immediately after doffing (i.e., removing). To avoid contact transmission, precautions should be taken during doffing and use. Training on appropriate donning and doffing procedures should be provided to all employees expected to wear respirators. Both CDC and OSHA have videos illustrating proper donning and doffing of the respirator.<sup>16</sup> Elastomeric components vary among manufacturers and react differently to cleaning and disinfection solutions and procedures. The respirator facepiece components such as facepiece, valves, and straps require maintenance including cleaning, disinfection and inspection prior to reuse. OSHA only requires replacing filters “where necessary,” for example, when soiled, contaminated, or clogged. The alternate cleaning and disinfection method, described by Bessesen et al. for use in healthcare when conventional practices are not practical, has been used successfully.<sup>10</sup>

## Cleaning

- When removing organic and inorganic matter from the respirator, trained personnel should wear nitrile gloves to protect their hands and limit the potential for self-infection. Additional protective equipment such as gowns and face shields, as well as ventilation, may be required during cleaning and disinfection procedures. Cleaning solution contact with the filter media must be avoided.
- A detergent or soap and warm water could be used to clean the surface of the filter cartridge prior to disinfection. Carefully avoid contact with the filter media. Cleaning can be done using a clean, soft cloth dampened with warm water approximately 49°C (120°F) containing a mild pH neutral (pH 6-8) detergent and using a mechanical wiping action. Other elastomeric facepiece components may be cleaned using the manufacturer’s recommended procedures.

## Disinfecting

The effectiveness of an alternate filter cartridge disinfection solution and procedure may be uncertain:

- All crevices of many filter cartridge housings may not be reached with sufficient disinfection solution or be contacted for the period of time required to be effective.
- The filter media may be degraded from contact with the disinfectant.

Some elastomeric respirators have filter cartridges that prevent disinfectant contact with the filter media. If available, these filter cartridges should be used in the contingency capacity strategies approach. These filter cartridges provide added assurance that the filter media will not be contacted with the cleaning and disinfectant solutions. These cartridges may be

assurance that the filter media will not be contacted with the cleaning and disinfectant solutions. These cartridges may be wiped down repeatedly.

**NOTE: P-series filters can generally be re-used until they are soiled, damaged, or difficult to breathe through. Caution should be used when using the filter for a live virus, and thorough disinfection of the filter cartridge should be completed.**

Practices not approved by the manufacturer can increase the risk and uncertainty of re-using damaged or degraded components. This must be balanced against other available HCP protection options to sustain effective HCP protection and patient care.

Modified procedures used during emergencies should be assessed and documented in the written RPP, including alternate cleaning and disinfection practices.

For disinfection, diluted household bleach solutions, alcohol solutions with at least 70% ethyl alcohol, and EPA-registered household disinfectants should be effective against coronaviruses.

For use of diluted household bleach solutions, follow disinfectant manufacturer's instructions for proper disinfectant application, PPE, and ventilation.

- Check to ensure the bleach is not past its expiration date.
- Never mix household bleach with ammonia or any other cleanser. Unexpired household bleach will be effective against coronaviruses when properly diluted.
- Most Household bleach solutions vary in concentration from 5.25% sodium hypochlorite (~50,000 ppm available chlorine) to up to 12.5% sodium hypochlorite (~125,000 ppm). It is important to check the product label and follow the disinfection directions for use, dilution, and contact time. Adjust the ratio of bleach to water as needed to achieve appropriate concentration of sodium hypochlorite.
  - Based on the EPA List N: Disinfectants for Use Against SARS-CoV-2 products, 2500 ppm (0.25%) for 5 minutes is effective. Most readily available bleach is approximately 6% so 2/3 cup of bleach per gallon of cold tap water (1:24 dilution) for 5 minutes is appropriate.
  - For bleach preparations containing 5.25% sodium hypochlorite, use ¾ cup of bleach per 1 gallon of cold tap water for 5 minutes.
  - If a lower concentration of bleach is desired, the EPA standard disinfection rate for hypochlorite products is 600 ppm for 10 minutes. That is, use 3 tablespoons of bleach per 1 gallon of cold tap water for 10 minutes.
- Prepare a fresh bleach solution each day in a well-ventilated area. Always add bleach to cold water, not water to bleach.

**CAUTION: The following may degrade or damage the respirator components.**

- Strong solutions such as hypochlorite, iodine, and high concentrations of alcohol may degrade, deteriorate or extract chemical additives from certain respirator materials.
- Healthcare sterilization processes including ethylene oxide should not be used unless authorized by the respirator manufacturer, as they may degrade and alter the shape of the facepiece.
- Steam sterilization equipment should not be used unless authorized by the respirator manufacturer.

Some EPA-approved disinfectants are also available as ready to use at 2700 ppm for 1 minute; however, these strong solutions could impact the integrity of the respirator components. [Products with EPA-approved emerging viral pathogens claims](#)  are expected to be effective against SARS-CoV-2. Follow the manufacturer's instructions for all cleaning and disinfection products (e.g., concentration, application method and contact time, etc.).

Disinfectants listed on the EPA's Registered Antimicrobial Products for Use Against Novel Coronavirus SARS-CoV-2, the virus that causes COVID-19, could be used to inactivate the virus.<sup>18</sup> Those intended for use with soft surfaces may be preferred.

## Inspection

All respirators used in routine situations must be inspected by properly trained individuals before each use and during cleaning. This includes a check of respirator function, tightness of connections, and the condition of the various parts, such as the facepiece, head straps, valves, cartridges, and canisters or filters.

Inspect elastomeric parts for pliability and signs of deterioration. Respirators that fail an inspection or are otherwise found to be defective should be removed from service and discarded, repaired, or adjusted in accordance with the following procedures:

- Repairs or adjustments to respirators must be made only by persons appropriately trained to perform such operations, and only using the respirator manufacturer's NIOSH-approved parts designed for the respirator.
- Repairs must be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed.
- Reducing and admission valves, regulators, and alarms must be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

## Particulate Filter Replacement

Discard filter cartridges if they become visibly soiled or wet, if they are visibly damaged, or if the respirator becomes notably harder to breathe through. Otherwise, change out the filters periodically. Provided the cartridge integrity and filter have not been compromised, current practice shows that conservatively, the filters could be used for at least one year.<sup>18</sup>

## Training

Workers must be educated and trained on how to safely use their elastomeric respirator. Employers should follow the respirator manufacturer's instructions and OSHA guidance to the greatest extent possible; and consider training recommendations described in the Bessesen protocol. The NIOSH JETFIT study provides excellent training for contingency situations.

To ensure respirator maintenance is conducted properly, employers should establish disinfection and cleaning procedures and train staff to perform the required maintenance including storage, inspection, distribution, repair or replacement, cleaning, disinfection, and disposal. Employers may identify a central location for disinfection or train individual users to clean and disinfect their respirators. Initial surface cleaning should be done at point of use before moving to a central location for disinfection.<sup>19, 20, 21</sup>

## Respirator storage

Respirators must be stored in a clean, non-contaminated location in a manner that does not distort the facepiece or straps. Respirators need to be thoroughly air dried prior to storage.

# Crisis Capacity Strategies During Surge Demand Situations

During periods of crisis surge capacity, several strategies in addition to the contingency strategies may be followed.

## Sharing elastomeric respirators

If it is impossible for individual HCP to have dedicated elastomeric respirators, the same elastomeric respirator may be used by multiple HCP. Elastomeric respirators issued to more than one employee should be cleaned, disinfected, and inspected before being worn by different individuals. One option is to label the respirator, conduct surface cleaning at the point of use, and return to a central location to be disinfected by central staff before reissuing the respirator to a different user.

Machines may be used to expedite the cleaning, sanitizing, rinsing, and drying of large numbers of elastomeric respirators. In general, the respirator's elastomeric components should not be cleaned with solvents (e.g., acetone, ethanol) or exposed to temperatures greater than 50°C (122°F). Post-cleaning inspection by personnel trained in the necessary maintenance tasks should still be conducted to assure respirator functionality has not been degraded.

Extreme care should be taken to limit tumbling, agitation, or exposure to temperatures above those recommended by the manufacturer, as these conditions may result in damage to the respirators.

Ultrasonic cleaners, clothes washing machines, dishwashers, and clothes dryers have been specially adapted and successfully used for cleaning and drying elastomeric respirators.<sup>22</sup>

# Waiving the fit testing requirements

OSHA has issued temporary enforcement guidance about switching from quantitative to qualitative fit testing, and OSHA is waiving the annual fit testing requirements as described above.<sup>7</sup> If fit testing is not possible, leakage at the face seal could occur and the protection provided to the wearer may be significantly reduced. For any tight-fitting respirator, such as FFRs and elastomeric respirators, a successful user seal check must be performed with each donning.

Under serious outbreak conditions in which respirator supplies are severely limited, HCP may not have the opportunity to ever be fit tested on a respirator before needing to use it. While this is not ideal, in this scenario, HCP should work with their employers to choose the respirator that fits them best, as, even without fit testing, a respirator will provide better protection than using no respirator at all or using a surgical mask.

If possible, the HCP should start with the size used previously for fit testing, but as size can vary by manufacturer and model, a different size may be needed to achieve a good fit.

If fit testing has never been done, the following recommendations are still useful.

- If using a half facepiece respirator, it should fit over the nose and under the chin. If a good face seal cannot be achieved when performing a user seal check, try a different model or size.
- OSHA has developed videos in English and Spanish to assist users with donning, doffing, and user seal checks.<sup>23,24</sup>
- If respirators are received during a crisis, and they need to be used right away without fit testing, ask the employer for additional product training videos and literature on proper donning (putting on) and doffing (taking off), and content on how to conduct a [user seal check](#) .<sup>25</sup>
- Practice putting on the respirator and doing a [user seal check](#) at least several times.
- Check the fit in a mirror or ask a colleague to look to be sure the respirator is touching your face and appears to be on properly.

Fit testing is necessary to confirm if a respirator does or does not fit. During a crisis, however, when conventional requirements cannot be implemented, healthcare professionals should be able to determine if they have obtained a reasonable fit if they have had training and they perform a successful user seal check prior to each use of the respirator.

## Considerations for Users of Corrective Lenses

- Conventionally, workers who wear a full facepiece respirator and need corrective lenses would have prescription inserts. In a surge situation, where multiple employees share respirators, the use of prescription inserts might not be feasible.
- Employees who use glasses could wear half facepiece respirators, with glasses worn over the respirator to avoid a situation where the arms of the glasses interfere with the respirator seal.
- The risks of contamination by solvent vapors do not apply in most healthcare settings. Therefore, individuals who wear contact lenses should be able to wear either full facepiece or half facepiece respirators. However, the use of contact lenses in general could present additional risks where SARS-CoV-2 exposures are known or suspected.

## Footnotes

<sup>1</sup> An Assigned Protection Factor (APF) is the workplace level of respiratory protection that a respirator is expected to provide to employees when used in conjunction with an effective RPP.

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