

Elastomeric Respirators Effectiveness and Use

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Advocacy

- <https://twitter.com/ppetoheros>
- <https://correcttheoversight.com/success-stories-news>
- <https://www.northernontariobusiness.com/regional-news/sudbury/sudbury-engineer-urging-mining-industry-to-donate-respirators-2273156>
- https://www.ola.org/en/legislative-business/committees/finance-economic-affairs/parliament-42/transcripts/committee-transcript-2020-jul-13#P547_134915
- <https://www.sudbury.com/local-news/with-ongoing-n95-shortage-sudburian-advocating-for-donations-of-elastomeric-respirators-2910127>

What are elastomeric respirators?

- They are tight fitting respirators made of synthetic or natural rubber material, can be repeatedly used, disinfected, stored, and re-used.
- They are equipped with replaceable filter cartridges or flexible, disc or pancake-style filters, which are not housed in a cartridge body.
- They may also have sealing surfaces and adjustable straps that accommodate a better fit.
- Elastomeric respirators have the same basic requirements for an OSHA-approved respiratory protection program as filtering facepiece respirators such as N95s, including medical evaluation, training, and fit testing. However, they have additional maintenance requirements which also include cleaning and disinfection of the face piece components such as straps, valves, and valve covers.

Hierarchy of Controls for COVID-19 Prevention



[https://www.ccohs.ca/bestpractice/resources/1089-COVID-19---Hierarchy-of-Controls-\(1\).pdf](https://www.ccohs.ca/bestpractice/resources/1089-COVID-19---Hierarchy-of-Controls-(1).pdf)

N95 vs Half Face vs Full Face

Respirator Types



Disposable Half Face Full Face

Different filters available

- While P100 filters provide the most protection against infection, there are other options available.

Minimum Filter Efficiency	N series – not resistant to oil	R series – somewhat resistant to oil	P series – oil Proof
95%	N95	R95	P95
99%	N99	R99	P96
100% (99.997%)	N100	R100	P100

History of use among health care workers

- Elastomeric respirators were first used by health care workers in 1996 when the CDC started using them to protect health care workers from Tuberculosis at the Texas Center for Infectious Diseases (TCID).
- They were used to protect health care workers during SARS in 2003. The Canadian Medical Association Journal and the CDC explained how elastomeric respirators should be used along with N95s to protect health care workers.
- Some hospitals that used elastomeric respirators in 2009 for H1N1 ended up storing their respirators for 10 years and then took them back out in 2020 for the current pandemic.
- In February 2020, health care workers used elastomeric respirators from TCID when they helped care for sick Covid patients on the docked cruise ships in San Antonio.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC191266/>

<https://www.cdc.gov/sars/clinical/respirators.html>

<https://hcarefacilities.com/newsletter/article.asp?id=1955>

What agencies recommend elastomeric respirators as a safe N95 alternative?

- Elastomeric respirators have been recommended for health care workers by the top health agencies in Canada and the US including Health Canada, Ontario Health, IPAC, CDC, FDA, HHS, FDA and FEMA.
- These agencies are recommending health care workers use elastomeric respirators since these respirators can offer the same or higher levels of protection than a disposable N95 depending on the filter used and can be safely used for years. These respirators are also readily available while N95s are not which make them a more suitable option for places that need a constant supply of PPE such as hospitals and long term care homes.

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/elastomeric-respirators-strategy/index.html>

[https://www.ontariohealth.ca/sites/ontariohealth/files/2020-](https://www.ontariohealth.ca/sites/ontariohealth/files/2020-05/Ontario%20Health%20Recommendations%20on%20Optimizing%20Personal%20Protective%20Equipment%20During%20the%20COVID-19%20pandemic_rev10May20%20PDF_v2.pdf)

[05/Ontario%20Health%20Recommendations%20on%20Optimizing%20Personal%20Protective%20Equipment%20During%20the%20COVID-19%20pandemic_rev10May20%20PDF_v2.pdf](https://www.ontariohealth.ca/sites/ontariohealth/files/2020-05/Ontario%20Health%20Recommendations%20on%20Optimizing%20Personal%20Protective%20Equipment%20During%20the%20COVID-19%20pandemic_rev10May20%20PDF_v2.pdf)

<https://www.canada.ca/en/health-canada/services/drugs-health-products/covid19-industry/medical-devices/personal-protective-equipment/medical-masks-respirators/safety-performance-specifications.html>

<https://www.osha.gov/memos/2020-04-03/enforcement-guidance-respiratory-protection-and-n95-shortage-due-coronavirus>

N95 vs Elastomeric Respirator

	N95	Elastomeric Respirator
Recommended length of use	hours	months to years
Advantages	disposable, common, well known	reusable, better protection, available, can be used in more work environments, long term cost savings
Disadvantages	less protection, supply shortage, cost more in the long run, higher risk of infection with reuse	additional training needed, not well known or understood by the public
Year first used by health care workers	1995	1996
Minimum % of air filtered	95	95 - 99.997
% that pass fit-testing *	57	98

https://asapublicaccess.s3-ap-southeast-2.amazonaws.com/AustralianAnaesthetist/Feature_Fittesting.pdf

Who can benefit from using elastomeric respirators during a pandemic

- Any workplace where infection could be spread is a great place for elastomeric respirators to be used.
- Anywhere outbreaks occur are ideal users because widespread use of elastomeric respirators can prevent outbreaks and the community spread that tend to follow outbreaks. These places include but are not limited too hospitals, long term care homes, prisons, food plants, among migrant workers on farms, and at airports.
- Anywhere large amounts of employees work closely together such as factories could greatly benefit from using N95s or elastomeric respirators.

Benefits of using elastomeric respirators for employers

- If employers provide elastomeric respirators to all their employees who could be exposed to the virus at work, not only will there be less outbreaks and infections but there will be less employees needing to use sick days.
- Advertising that the workplace is protected with proper PPE to prevent infections can also be a promotional tool to get more customers to come to their businesses and feel safe while going there.
- It would decrease mental health issues that are common because employees are scared they could become infected at any time and bring the infection home to their families. It would help increase productivity since employees would be less distracted or needing to care for the issues they may face.
- The respirators are very sustainable and once a workplace has elastomeric respirators, they can keep them for years and not have to worry about PPE shortages affecting their business operations. They can also store the respirators after the pandemic is over and take them back out and retrain employees when a future pandemic comes around again.

Secondary Benefits to using elastomeric respirators

- By using elastomeric respirators to prevent outbreaks at places like food plants, there would be less need to shutdown these locations to deal with the spread or to disinfect the entire operation and this would reduce economic losses.
- By putting elastomeric respirators into widespread use, we can help minimize the spread and reduce the need for city wide shutdowns as an alternative way to slow the spread.
- By effectively protecting employees across a broad range of industries where they could potentially be infected, we can stabilize and prevent business disruptions and slow down hospitalizations to a manageable amount.
- Reducing the spread of the virus in regular workplace settings would also reduce the spread at schools since less parents would be infecting their children and less children would therefore be spreading it to other students and teachers

Studies on elastomeric respirators in health care settings

- The American College of Surgeons study.
 - <https://www.facs.org/media/press-releases/2020/reusable-masks-061220>
 - <https://www.youtube.com/watch?v=RV31PWYhe-M>
- Reusable Elastomeric Respirators in Health Care: Considerations for Routine and Surge Use
 - https://www.ncbi.nlm.nih.gov/books/NBK540070/pdf/Bookshelf_NBK540070.pdf
- American Journal of Infection Control - Elastomeric respirators for all healthcare workers
 - <https://www.ajicjournal.org/action/showPdf?pii=S0196-6553%2820%2930888-9>

Important News Articles on Elastomeric Respirators

- <https://www.cnn.com/2020/02/25/health/coronavirus-pandemic-frieden/index.html>
- <https://www.usatoday.com/story/news/nation/2020/04/03/coronavirus-national-stockpile-disposable-n-95-face-masks-reusable-respirator/5118669002/>
- <https://www.nytimes.com/2020/05/27/us/coronavirus-masks-elastomeric-respirators.html>
- <https://ici.radio-canada.ca/nouvelle/1706817/masque-cartouche-filtre-p100-covid-19-solution-rechange-n95-coronavirus>
- <https://www.nydailynews.com/new-york/ny-fdny-new-covid-mask-protection-20201110-7ehwdcduwffcn3qigd2vp6dla-story.html>
- <https://www.thesudburystar.com/news/local-news/sudbury-engineer-raising-awareness-about-n95-mask-alternative>

Misconceptions – Exhalation Valves

- The most common misconception is that since some elastomeric respirators have an exhalation valve, they cannot be used at all because they could potentially infect a patient if the health care worker wearing them was infected.
- Due to the lack of awareness and communication most people do not realize the CDC, FEMA, Ontario Health and other agencies have recommended that the exhalation valve be covered with a cloth, procedural or surgical mask to offer source control.
- Elastomeric respirators could also be safely used by health care workers in a Covid ward or while caring for Covid positive patients or residents without a cover on the valve since the health care worker would be the one at risk and not the patient.
- There are several manufacturers including MSA Safety, Dorma, and Trebor Rx which have elastomeric respirators without an exhalation valve. The Dorma 99 was the first elastomeric respirator approved by Health Canada and the MSA Advantage 290 was the first elastomeric respirator without an exhalation valve approved by NIOSH.

<https://files.asprtracie.hhs.gov/documents/elastomeric-half-mask-respirators-and-powered-air-purifying-respirators-in-healthcare-and-ems-settings-fact-sheet.pdf>

<https://sharedhealthmb.ca/files/covid-19-reuse-of-elastomeric-respirators.pdf>

First NIOSH approved elastomeric respirator without an exhalation valve



<https://us.msasafety.com/advantage290>

First Health Canada approved elastomeric respirator without an exhalation valve



<https://dormafiltration.com/dorma-99-respirator/>

Misconceptions - Availability

- A lot of people assume elastomeric respirators cannot be used because they are in short supply. In early April, the White House put elastomeric respirators on a list of banned exports along with N95s citing low supply yet they were quickly taken off that list when demand became very low and supply became much higher.
- A lot of new elastomeric respirator manufacturers have entered the market including Dorma, Trebor Rx, Husco (MaskForce), Enny, United Safety Technology, GVS and others. Other manufacturers like MSA Safety have not only increased their regular supply of elastomeric respirators but have also come out with new types of elastomeric respirators that do not have exhalation valves.
- Several manufacturers including MSA Safety, Dorma, Trebor Rx and GVS each have enough elastomeric respirators to provide every health care worker in Canada with their own. Some manufacturers like Trebor Rx, can produce 50,000 elastomeric respirators per day and have kid sizes available as well. Other Canadian manufacturers such as Dorma can produce over 1 million of these respirators per month.

<https://www.whitehouse.gov/presidential-actions/memorandum-allocating-certain-scarce-threatened-health-medical-resources-domestic-use/>

Misconceptions – Costs are too high compared to an N95

- A common misconception is thinking the cost of elastomeric respirators are too high compared to the costs of N95s. Studies like the one by the American College of Surgeons performed at the Allegheny Health Network (AHN) showed that switching to reusable elastomeric respirators vs disposable N95s reduced long term costs by over 90%.
- Elastomeric respirators start at \$16 and P100 filters start at \$6. Buying in bulk would reduce those costs even further especially if buying directly from the manufacturer. Typically, filters should be changed once a year or immediately if they become damaged or too soiled to use.

<https://www.facs.org/media/press-releases/2020/reusable-masks-061220>

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/elastomeric-respirators-strategy/index.html>

Cost Savings Calculator

N95 FILTERING FACEPIECE RESPIRATOR

Number of users at the facility

N95 used per day per user

Average work days per month

Cost per single N95

ELASTOMERIC RESPIRATOR

Price for Elastomeric Respirator

Quoted price for filter set

Filter changes per year

1 3 4 12 24 52

COST COMPARISON

N95 VS ELASTOMERIC RESPIRATOR

N95 FFPs used / disposed

5,000 Units / mo
\$13,750 / mo

60,000 Units / yr
\$165,000 / yr

Elastomeric Year One Cost

250 Respirators w/ 1 Filter Set
\$6,562.50

Annual Filter Replacement Cost
\$7,500 / yr

Annual Savings over N95

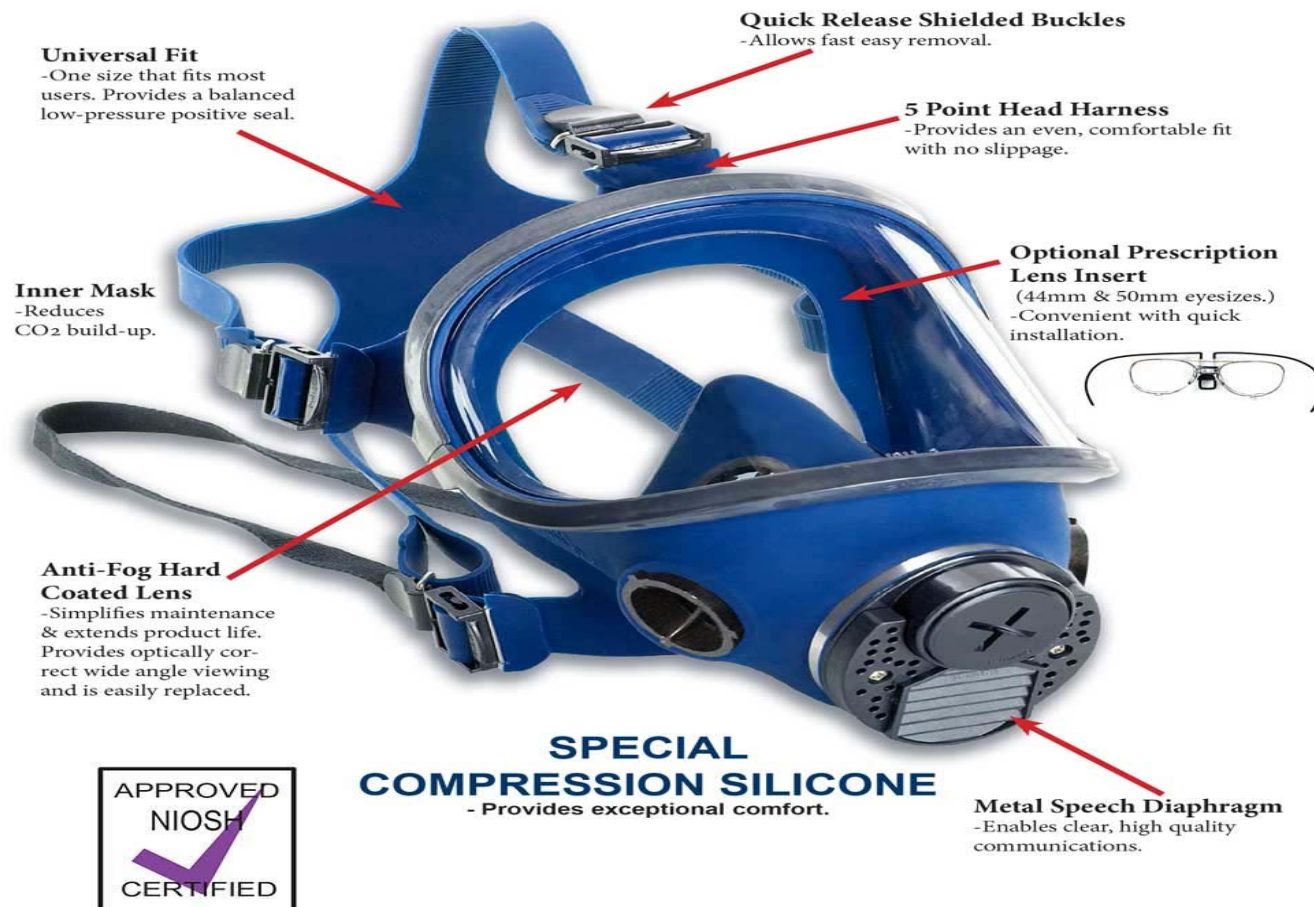
First year
\$150,937.50

Following years
\$157,500 / yr

<https://webapps.msasafety.com/apr-calculator/>

Misconception – Communication Issues

- A lot of people believe that elastomeric respirators cannot be used because the voice could get muffled making it harder to communicate.
- Like N95s, some elastomeric respirators can muffle sounds although some manufacturers offer elastomeric respirators with speech diaphragms to improve communication.
- Some manufacturers have built acoustic improvements into the design of their respirator so that the acoustics sound better than an N95 or regular elastomeric respirator.



Are we just learning about elastomeric respirators in health care?

- Elastomeric respirators in health care settings have been discussed and recommended by Canadian experts for almost 20 years. While Ontario Health and Health Canada have created PPE guidelines recommending their use as a safe N95 alternative, these recommendations are not well known and often overlooked so a lot of employers might not know about the recommendations to use these respirators.

Past Canadian recommendations to use elastomeric respirators for infection control

- 2003-**Canadian Medical Association Journal** : SARS Respiratory Protection
 - <https://www.cmaj.ca/content/169/6/541.3>
- 2004-**OSHA for Health Care in BC** : Protecting the Faces of Health Care Workers
 - <https://www.linkedin.com/feed/update/urn:li:activity:6691792157529001984/>
- 2012-**Region of Peel** : Reducing the Risk for Front-Line Staff
 - <https://www.peelregion.ca/health/infectioncontrol/pdf/ROP-2012-Designated-Officer-Manual.pdf>
- 2013-**WorkSafeBC** : Assessment and Determination of Practical Considerations for Widescale Utilization of Elastomeric Half-facepiece Respirators during a Pandemic or Outbreak Situation
 - <https://www.worksafebc.com/en/resources/about-us/research/assessment-and-determination-of-practical-considerations-for-wide-scale-utilization-of-elastomeric-half-facepiece-respirators-during-a-pandemic-or-outbreak-situation?lang=en&direct>

New manufacturers of elastomeric respirators CANADA

Dorma



Trebor Rx



<https://dormafiltration.com/>

<https://treborrx.com/>

New manufacturers of elastomeric respirators USA

MaskForce



<https://www.maskforce1.com/>

<https://ennywhere.com/>

<https://unitedsafetytech.com/>

Enny



UST



Manufacturers

- Dorma
- Trebor Rx
- MSA Safety
- MaskForce
- United Safety Technology
- GVS
- Design Reality
- Enny
- Dentec
- 3M
- Honeywell
- Moldex

https://www.cdc.gov/niosh/nppt/topics/respirators/disp_part/respsource1quest3.html

Ways to disinfect elastomeric respirators

- I am not an expert and I do not know what chemicals might interact with each respirator so I cannot make any recommendations on which method works best for each situation or every respirator. Please reach out to experts like occupational hygienists if you need help determining the appropriate methods of disinfection or infection control. You could also speak directly with the manufacturer to find out what they recommend be used with their respirator.

Ontario Health recommendations

Daily Cleaning

Cleaning and Disinfecting 3M Half and Full Facepieces³

- 1) Cleaning is recommended after each use. Nitrile or vinyl gloves should be worn during cleaning as well as other personal protective equipment (PPE) as indicated.
- 2) Remove any filters or cartridges and set them aside so they do not get wet. Please note that the filters and cartridges are reusable and should not be disposed of during cleaning. The facepiece may be further disassembled as necessary.
- 3) Inspect the facepiece per the *User Instructions* to identify any damage or excessive wear. Replace components or the entire facepiece as necessary.
- 4) Manually clean the facepiece by immersing it in warm water not to exceed 120°F (49°C), and scrub with soft brush until clean. Add neutral detergent. Do not use cleaners containing lanolin or other oils. **NOTE:** Solvents and strong detergents may damage 3M facepieces and should not be used for cleaning.
- 5) Rinse thoroughly with fresh warm water.
- 6) Disinfect by soaking, wiping or spraying the facepiece according to the user instructions for the selected disinfectant, including application and contact time.
- 7) Rinse, wipe or spray the facepiece thoroughly with fresh warm water.
- 8) Air dry in a non-contaminated area.
- 9) Inspect and reassemble the respirator as described in the *User Instructions*.
- 10) The respirator should be stored in a non-contaminated area when not in use.

Ontario Health recommendations

Interim Wipe Cleaning and Disinfection of 3M Half Facepieces⁴

Wipe cleaning and disinfection of the facepiece can be considered as an interim method. This method is not to be the only method of cleaning.

- 1) If gross contamination or facial oil is present, a cleaning step should be performed before disinfection. Wipe all components with cleaning solution, including the interior and exterior of the facepiece and head harness.
- 2) Wipe the interior and exterior of the facepiece and head harness with the selected disinfectant, following the disinfectant user instructions including application and contact time.
- 3) Wipe all components with clean water to remove residual chemical.
- 4) Air dry or hand dry prior to next use in a non-contaminated area.
- 5) Inspect prior to use as described in the *User Instructions*.
- 6) The respirator should be stored in a non-contaminated area when not in use.

Health Canada recommendations

Cleaning and disinfection

Elastomeric respirators should be cleaned and disinfected according to the manufacturer's validated cleaning and disinfection instructions. Reusable respirators are to be cleaned and disinfected after each use, according to the Occupational Health and Safety Administration (OSHA) hospital and respiratory toolkit.

A validation protocol should be created to provide evidence that the process chosen adequately cleans and disinfects the reusable parts of the respirator. The microbial challenge organism should reflect a worst-case scenario organism for the chosen technology or method of disinfection. Also, the cleaning and disinfection procedure should demonstrate that the most difficult areas of the respirator can handle a significant or worst-case microbial load (for example, 6 log reduction of bacterial spores).

<https://www.canada.ca/en/health-canada/services/drugs-health-products/covid19-industry/medical-devices/personal-protective-equipment/medical-masks-respirators/safety-performance-specifications.html>

CDC recommendations

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- 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.

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/elastomeric-respirators-strategy/index.html>

<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134AppB2>

OSHA recommendations

- These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here. Equivalent effectiveness simply means that the procedures used must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.
- I. Procedures for Cleaning Respirators
 - A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure- demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.
 - B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
 - C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.

<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134AppB2>

OSHA recommendations (continued)

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- D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:
 - 1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,
 - 2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,
 - 3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

OSHA recommendations (continued)

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- E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.
 - F. Components should be hand-dried with a clean lint-free cloth or air-dried.
 - G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
 - H. Test the respirator to ensure that all components work properly.

IRRSST recommendations

- Remove the filters and set them aside on a disposable alcohol wipe.
- Wash the respirator by immersing it in lukewarm water (maximum 43 °C) with a gentle detergent or any cleanser recommended by the manufacturer. Rub with a soft brush for 1 minute. **Do not use cleansers containing lanolin or other oils and do not use a brush with metal bristles.**
- Rinse the parts in lukewarm running water.
- The respirator must then be immersed for a minimum of 1 minute in a solution of sodium hypochlorite (5,000 ppm) to be disinfected. Place the respirator facedown to avoid the formation of air bubbles in the mask. Swish it around to remove any residual bubbles. The hypochlorite solution (approximately 5,000 ppm of available chlorine) can be made by adding 100 ml of bleach (5%) to 900 ml of lukewarm water. Since the concentration levels of commercial and industrial bleach vary, it is advisable to use the following calculator, developed in Ontario, to validate the necessary volumes to make your solution : <https://www.publichealthontario.ca/en/health-topics/environmental-occupational-health/water-quality/chlorine-dilution-calculator>

<https://www.irsst.qc.ca/en/covid-19/irsst-notice/id/2648/disinfection-of-reusable-elastomeric-respiratory-protection-equipment>

IRRST recommendations (continued)

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- Rinse the respirator firmly with lukewarm running water for a minimum of 2 minutes. Drain. It is important to rinse well, since soap and disinfectant that dry on parts of the respirator can irritate the skin and cause dermatitis. In addition, some can degrade the rubber or corrode the metal parts.
 - The RPE must be dried with a clean cloth, paper towel or simply air-dried in a clean location.
 - Keep it in a clean container that is not hermetically sealed to avoid retaining moisture.

Note: Although bleach can cause premature wear of the elastics, the procedure does not recommend removing them to facilitate its application in case of a pandemic.

Additional resources on disinfecting elastomeric respirators

- <https://www.medschool.umaryland.edu/fpi/Novel-Coronavirus-COVID-19/Information-for-FPI-Clinical-Practices/Personal-Protective-Equipment-PPE/Respirators/>
- <https://pubmed.ncbi.nlm.nih.gov/25816692/>
- <https://www.sciencedirect.com/science/article/pii/S0196655315000899>
- <https://med.uth.edu/orl/wp-content/uploads/sites/68/2020/04/UTHealth-Elastomeric-Respirator-Disinfection-SOP.pdf>
- <https://intjem.biomedcentral.com/articles/10.1186/s12245-020-00296-8>

Questions?

- There will be a question and answer session at the end of all the presentations.
- If you would like to ask me more questions or would like additional resources, you can reach me at:
 - Email: smitnicolas@hotmail.com
 - LinkedIn: <https://www.linkedin.com/in/nicolas-smit-b8836b5b/>
 - Twitter: @PPEtoheros

