UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE

Hospital Elastomeric Respirator Use Pre- and During COVID-19

Cal/OSHA
August 26, 2020

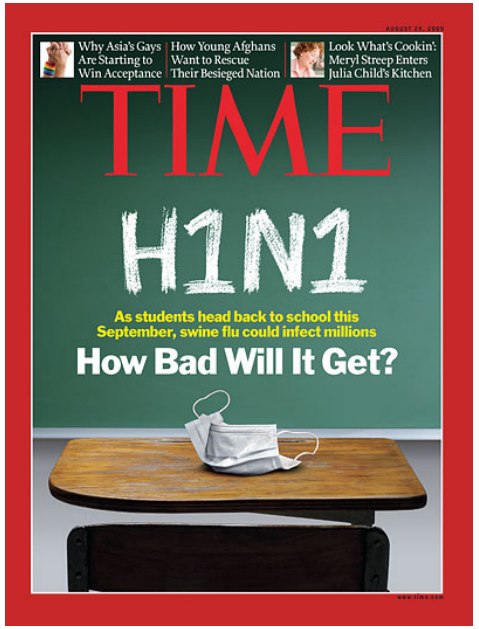
Stella E Hines, MD, MSPH
Divisions of Occupational & Environmental Medicine
and Pulmonary & Critical Care Medicine
shines@som.umaryland.edu

Disclosure/Disclaimer

- I receive research funding to my institution to study elastomeric respirator use in healthcare by:
  - CDC NIOSH (1R211OH010868-01, completed; contract 75D30118C02646, active)
  - CleanSpace Technology (active)
- The findings and conclusions in this report are those of the author and do not necessarily represent the views of the University of Maryland Medical Center or School of Medicine. Mention of specific products does not imply endorsement.

Elastomeric respirators in use at Univ of Maryland-Baltimore since 2009

- 2009 H1N1 caused N95 shortages
  - Safety Director familiar with elastomerics from general industry
- Workers in Hospital and Ambulatory Practices
  - Inpatient units: i.e. Medicine, MICU, ED, Peds, Radiology
- Duration
  - Practice continued after 2009, transitioned away from late 2016
    - ~25% wanted to remain (NASEM 2017)



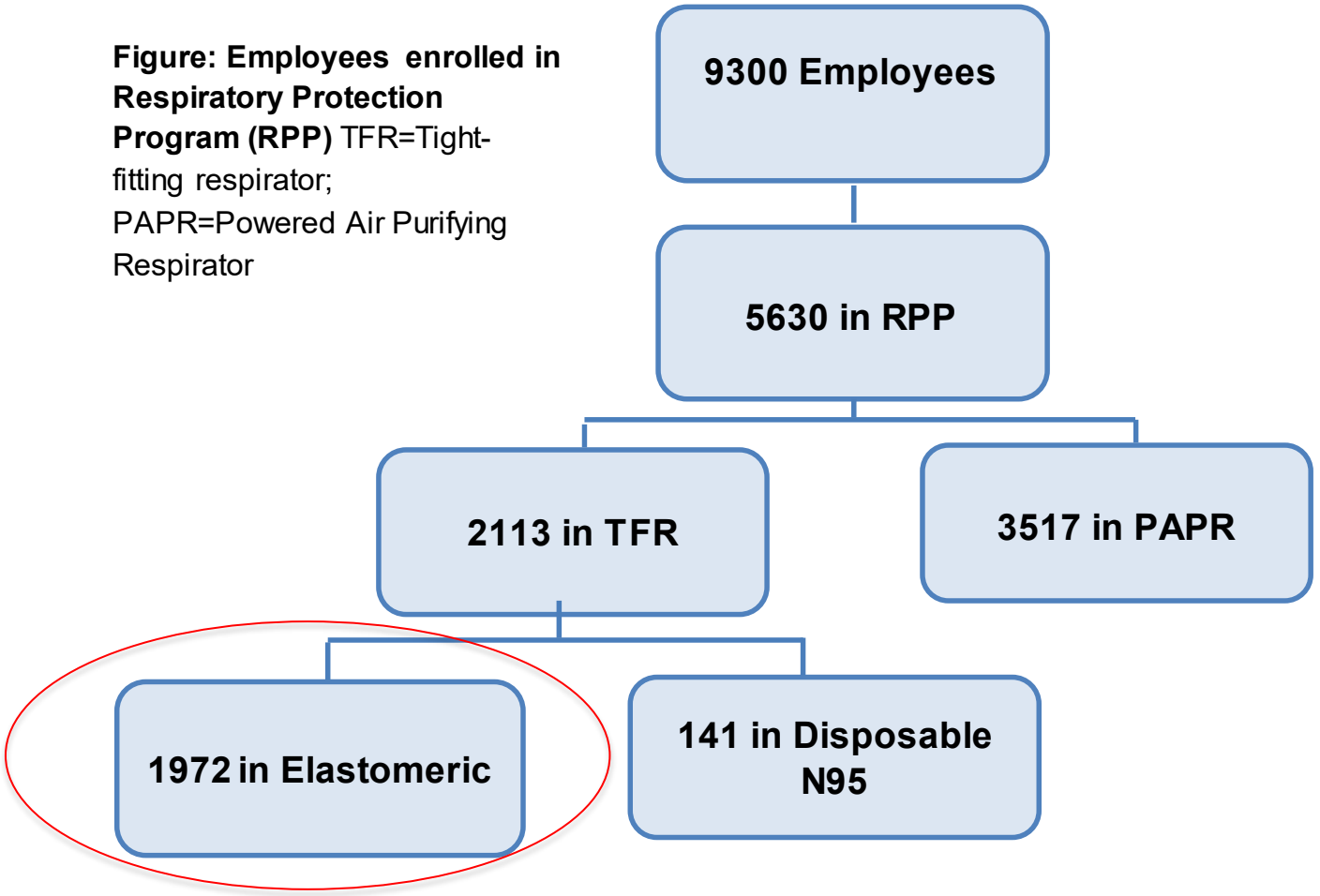
Hines et al. J Int Soc Respir Prot 2017.

Devices

- 3M 7500 Series Elastomeric Respirators
  - Small, medium, large face masks
- 3M 7093 P100 particulate cartridge filters
  - Covered, cleanable

Large, urban US academic medical center, hospital & ambulatory – 6/2014

Figure: Employees enrolled in Respiratory Protection Program (RPP) TFR=Tight-fitting respirator; PAPR=Powered Air Purifying Respirator



2015-2016 Study using

Key Informant interviews, Focus Groups and Electronic Surveys

Are elastomeric respirators an

- Acceptable (i.e. user acceptability)
- Feasible (logistics – storage, cleaning, supply)

alternative to N95s in healthcare?

- 1152 respondents
- 432 elastomeric respirator users

2016 UMMC respirator study of 1152 participants – User Acceptance

- **Elastomerics** scored highest in **sense of protection** from disease & **confidence** that the respirator will protect.
- *Despite* lower comfort & communication ratings, elastomeric users still **PREFERED** to use them in certain risk scenarios

Hines et al, AJIC 2019

Availability

Is the respirator model and size you were assigned to use available when you need it?	
	%
Never	2
Sometimes	0
About half the time	2
Usually	19
Always	75

94%

Hines et al., Health Security, 2019

Storage location

When my reusable elastomeric respirator is not in use, I store it:	
	%
In a drawer near the patient's room	5
Somewhere in the patient care area nearby (like a locker)	60
Somewhere on campus	9
In my car/at home/don't know	6
Other	19

Inconvenient storage location more often reported in non-compliant elastomeric users

Hines et al. , Health Security, 2019.

Logistics - Decontamination

I wipe my respirator with an alcohol pad or disinfectant wipe after each use.	
	%
Never	4
Sometimes	11
Half the time	6
Usually	21
Always	58

I remove the filters and wash inside of my respirator with soap and water	
	%
Rarely/never	69
Yearly	11
Monthly	9
Weekly	3
After each shift	8

No difference in reporting btwn compliant v non-compliant elastomeric users.

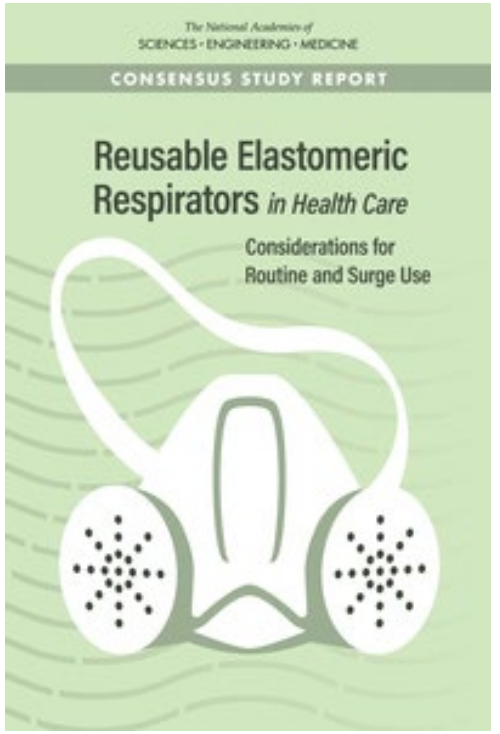
Hines et al, Workplace Health & Safety 2020

2016 Study Findings

- User acceptance is **not** a critical barrier *(Hines et al, AJIC 2019)*
- Storage & assuring availability are barriers to expected use *(Hines et al., Health Security 2019)*
- Disinfection NOT a barrier to expected use, but inadequate compliance with expected cleaning practice when left to the individual (*Hines et al., Workplace Health and Safety 2020*)
  - Probably can be taught
  - Strategies to centralize would bypass this

Storage & Availability Options

- Central Cache vs. individual-based
  - TCID – backpacks (NASEM 2018)
  - WorkSafe BC (Ciconte & Danyluk, 2013)
  - Allegheny Health (Chalikonda 2020)
- Take home:
  - Central cache: identify staff in advance, assure job duties
  - Individual maintenance: Provide means of readiness (bag)



WORK SAFE BC
WORKING TO MAKE A DIFFERENCE

Cleaning & Disinfection Options

- Cleaning = removal of soiling agents (dirt)
- Disinfection = removal of microbial agents (virus)
- Strategies
  - Individually based
  - Centrally based

Effectiveness of Common Healthcare Disinfectants against H1N1 Influenza Virus on Reusable Elastomeric Respirators

Shobha S. Subhash, MS, MPH;[1] Maria Cavaiuolo;[2] Lewis J. Radonovich Jr, MD;[1,3] Aaron Eagan, RN, BSN;[1] Martin L. Lee, PhD;[4] Sheldon Campbell, MD, PhD;[2,5] Richard A. Martinello, MD[6,7]

Disinfection of reusable elastomeric respirators by health care workers: A feasibility study and development of standard operating procedures

Mary T. Bessesen MD [a,b,*], Jill C. Adams BSN [a], Lewis Radonovich MD [c,d], Judith Anderson MD [a]

Assessment of half-mask elastomeric respirator and powered air-purifying respirator reprocessing for an influenza pandemic

Caryn Lawrence BS [a], Delbert A. Harnish MS [a,*], Megan Sandoval-Powers BS [a], Devin Mills BS [a], Michael Bergman MS [b], Brian K. Heimbuch MS [a]

APPLIED RESEARCH ASSOCIATES, INC.

Published protocols for manual elastomeric respirator reprocessing

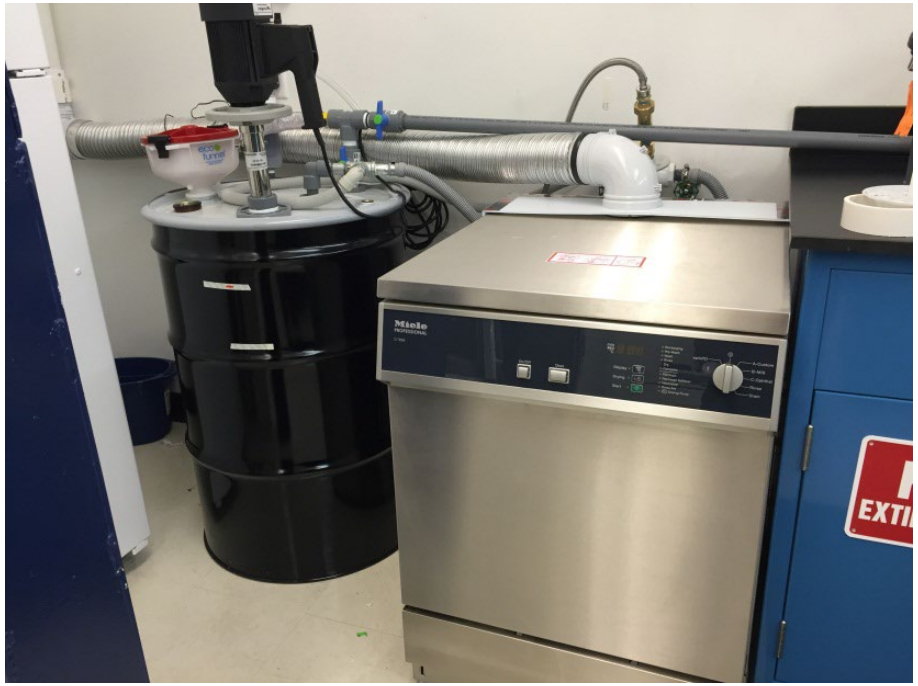
- Protocols described in:
  - Bessesen et al, AJIC 2015, Lawrence et al., AJIC 2017, Heimbuch & Harnish, 2019.
- Cleaning
  - Remove filters
  - Use neutral detergent (dish soap) & warm water, sponge/soft brush
- Disinfection
  - Dilute bleach (<0.1%)
  - Rinse
- TIme: 16-23 minutes; Up to 6 hours for drying (straps)

Photo: Bessesen et al, 2015.

Photo #2

Automated Reprocessing

- Limits on upper temperature limits for elastomerics
- ARA 2019 Report: 5 elastomeric models contaminated with influenza
- Hospital Washer-Disinfectors
  - Performed at **50 C** (122 F) – *normally these machines operate at >90 C*
  - Used Miele® G7899 washer-disinfector



ARA 2019: Mitigate a Shortage of Respiratory Protection Devices HHSF223201400158C

Evidence of Effect

- Virus Removal (influenza)
  - Manual
    - Virus eliminated from all surfaces
      - Fabric surfaces harder to test
  - Automated
    - No detectable viable virus
  - No difference between

    cleaning alone vs.

    cleaning + disinfection

- Durability
  - Manual
    - Passed all tests (**150 cycles)**
  - Automated
    - Passed all durability tests in 4 of 5 models (**100 cycles)**

Lawrence et al, AJIC 2017; Heimbuch & Harnish, 2019.

Do you have to wash in soap & water or just disinfect with a wipe?

- Halo ARC Study (Hines et al., JISRP 2020)
  - Facial contaminants – yes
  - Need to also get disinfectant residue off
  - Viral contaminants – yes, at some interval

Filter cartridges

- Cleaning/Disinfection
  - Cleaning alone equivalent to Cleaning + Disinfection
    - Neutral detergent
    - SaniCloth Wipe
  - Removed all virus
  - Passed all tests afterwards
- Change the filters…….if they become wet or damaged

Lawrence et al, AJIC 2019; Heimbuch & Harnish, 2019.

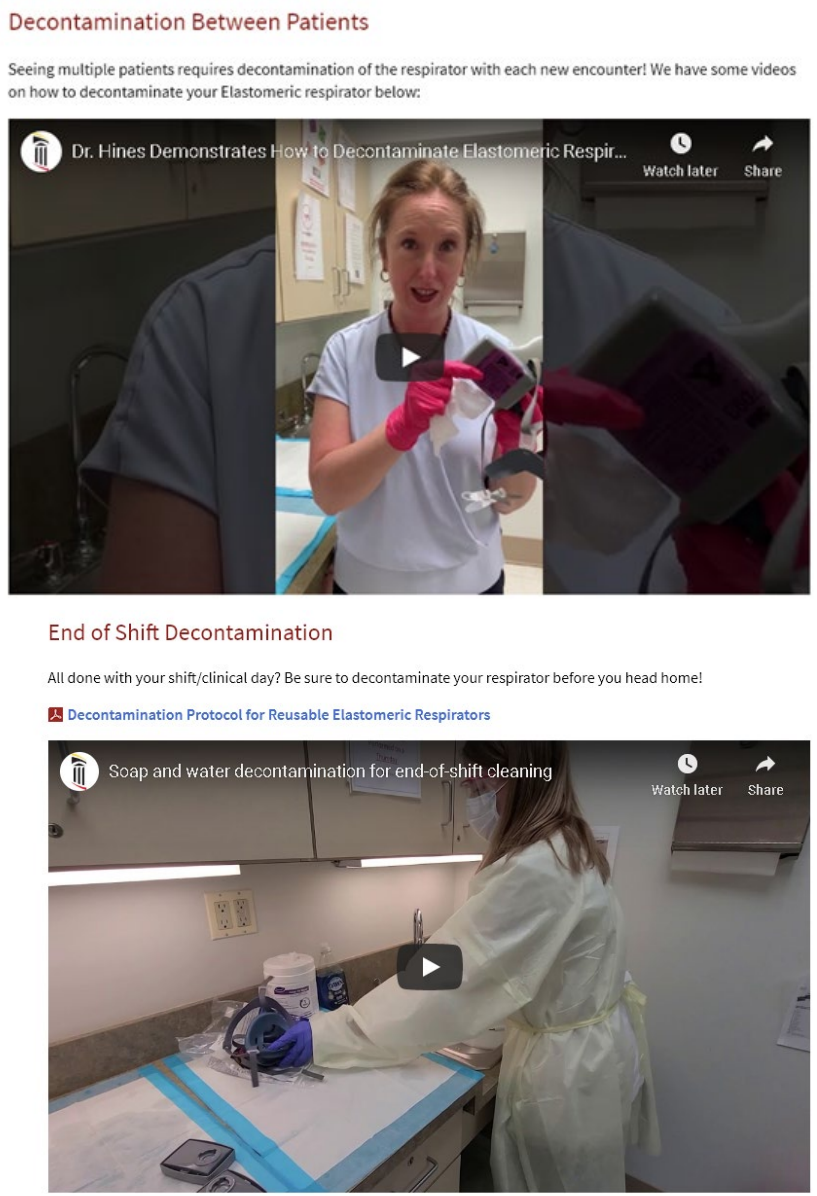
Current CoVID19 Respirator Program at University of Maryland

- Ambulatory practices

  (Run by Employee Health)

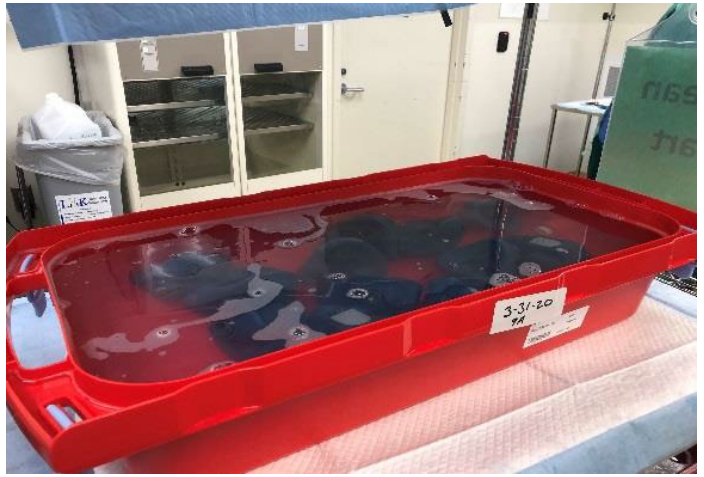
  – Elastomerics main form of respiratory protection
    - Individually-assigned
    - Practices expected to clean & maintain
    - Policies, protocols and videos available to public on website

https://www.medschool.umaryland.edu/fpi/Novel-Coronavirus-COVID-19/Information-for-FPI-Clinical-Practices/Personal-Protective-Equipment-PPE/Respirators/



Current CoVID19 Respirator Program at University of Maryland

- Hospital *(run by Safety)*
  - Elastomerics part of pandemic plan
  - Disinfect with wipes after each use
  - End of Shift Cleaning in Central Sterile Processing
    - Bessesen/Lawrence protocol
  - Shared supply



https://www.n95decon.org/implementation#other-ppe

PPE Distribution Center

Summary

- Elastomeric respirators have been used in healthcare, prior to COVID19.
- Facilities must have plans for assuring storage, availability, cleaning & disinfection.
- Cleaning & Disinfecting protocols exist & can be adapted for local use
- Elastomeric respirators can alleviate some N95 shortage burden

Questions? shines@som.umaryland.edu

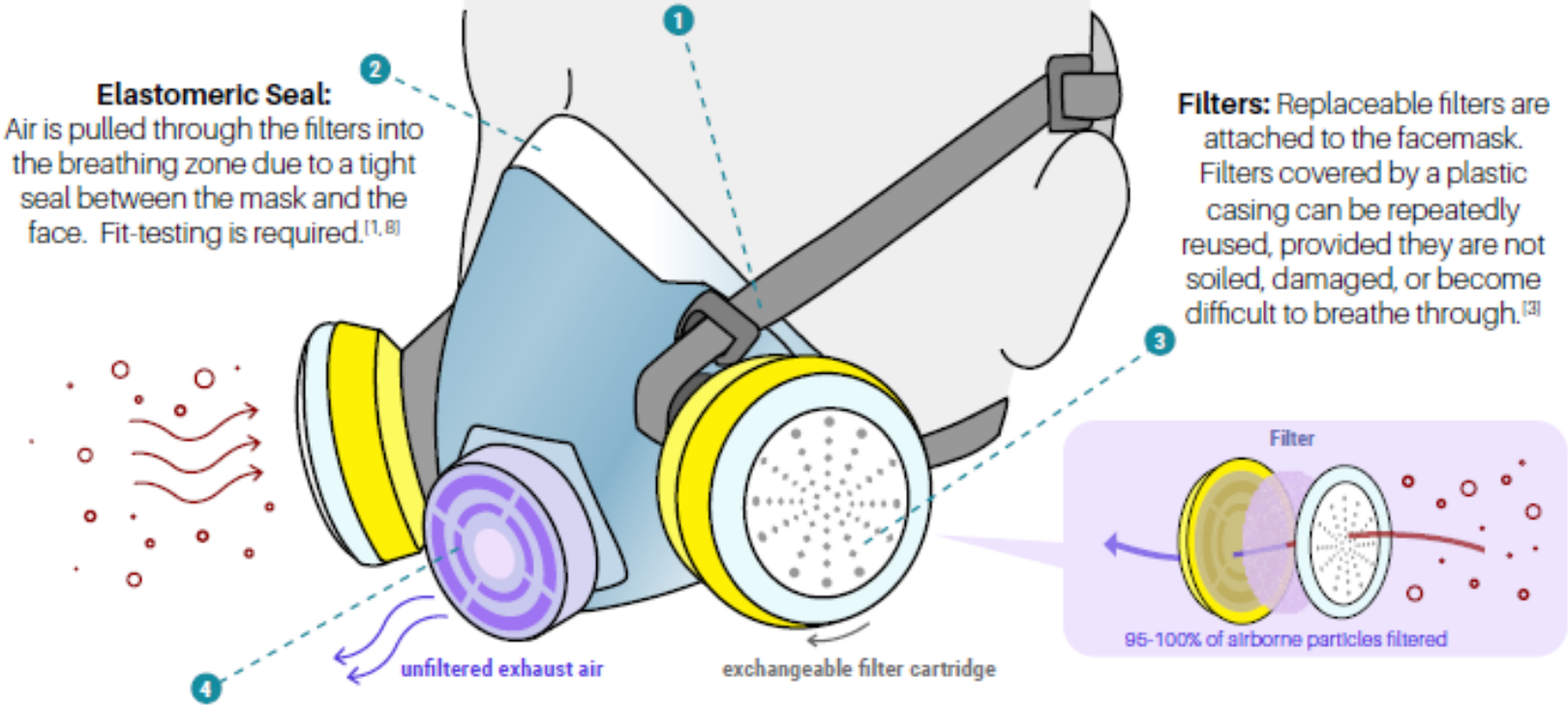
What is an Elastomeric Respirator?

Elastomeric respirators are **reusable air purifying respirators with replaceable filters** that filter 95-100% of airborne particles, depending on filter type.[1] They can cover the nose and mouth (half face respirators) or the entire face (full face respirators). Many elastomeric respirators allow **unfiltered exhaust of the user's exhaled breath.**

Facemask: A conformable face mask is held in place by adjustable straps.

Elastomeric Seal: Air is pulled through the filters into the breathing zone due to a tight seal between the mask and the face. Fit-testing is required.[1, 8]

Filters: Replaceable filters are attached to the facemask. Filters covered by a plastic casing can be repeatedly reused, provided they are not soiled, damaged, or become difficult to breathe through.[3]



Exhalation port: Most elastomerics have an unfiltered exhalation port for easier breathing. Those with unfiltered exhalation ports **are not recommended for use in sterile procedures** where barrier face masks are required, such as surgery.[3] The presence of infectious particles in exhaust breath has not been studied. It may be possible to filter exhausted air.

https://www.n95decon.org/publications