

INITIAL FOX CHASE CANCER CENTER N95 REPROCESSING PLAN AND DATA

Below is a summary of the available data, as well as a description of phase 1 of the Fox Chase reprocessing plan for N95 respirators.

The three original ideas to sterilize PPE included:

1. Radiation
2. UV light
3. Heat

The fourth option is time. SARS CoV-2 dies on different surfaces (cardboard, metal, plastic) after several days.

1. Radiation

Radiation is intriguing because we all have access to linear accelerators. Unfortunately, the industry standard to sterilize all viruses is 25,000 Gy. Coronaviruses require lower doses, 3000-5000 Gy, although the exact dose for SARS CoV-2 is not known. Even these lower doses are not practical for a medical linear accelerator based on typical lifetime radiation dose output of a linac.

It would take 69.4 hours (at 6 Gy/minute) for our linacs to produce 25,000 Gy. This would break our machines before we could safely sterilize any N95s.

2. UV light

The second option is UV light. There is ample evidence that UV light can effectively kill viruses, including coronaviruses. Specific data regarding SARS CoV-2 is limited, but growing.

Many of us have UV irradiators in the laminar flow hoods in labs, and these can be repurposed although it might not be easy. The University of Nebraska has published their technique for using UV light to sterilize PPE

(<https://www.nebraskamed.com/sites/default/files/documents/covid-19/n-95-decon-process.pdf>). There are companies who are selling UV light machines that can treat an entire room if you can't build your own.

3. Heat

The third option is heat. There is data that supports the use of heat to kill coronaviruses including SARS CoV-2. This is the route we at Fox Chase are taking first as all the components necessary are already available on campus.

56°C for 15 minutes kills 10000 units of the SARS coronavirus. The CDC recommends 150°C for dry heat sterilization, but N95 components cannot withstand temperatures of 150°C and up. Therefore, we cannot achieve “sterilization” but we can effectively kill greater than 95% of the virus offering the possible protection for reuse.

Detailed information on the heat tolerance of the N95 respirator is below.

3M 1860 Material Composition:

- Straps – Braided Polyisoprene The typical working temperature range is -50°C to +100°C
- Staples - Steel melting point ~1370°C
- Nose Clip – Aluminum melting point 660°C
- Nose Foam – Polyurethane Foam – keep below 150-200°C
- Filter – Polypropylene melting point 160°C
- Shell – Polyester melting point 295°C
- Coverweb - Polypropylene melting point 160°C
- Not made with natural rubber latex
- Approximate weight of product: 0.40 oz.

From CDC: <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/sterilization/other-methods.html>

Dry-Heat Sterilizers

This method should be used only for materials that might be damaged by moist heat or that are impenetrable to moist heat (e.g., powders, petroleum products, sharp instruments). The advantages for dry heat include the following: it is nontoxic and does not harm the environment; a dry heat cabinet is easy to install and has relatively low operating costs; it penetrates materials; and it is noncorrosive for metal and sharp instruments. The disadvantages for dry heat are the slow rate of heat penetration and microbial killing makes this a time-consuming method. In addition, the high temperatures are not suitable for most materials⁹¹⁹. The most common time-temperature relationships for sterilization with hot air sterilizers are 170°C (340°F) for 60 minutes, 160°C (320°F) for 120 minutes, and 150°C (300°F) for 150 minutes. *B. atrophaeus* spores should be used to monitor the sterilization process for dry heat because they are more resistant to dry heat than are *G. stearothermophilus* spores. The primary lethal process is considered to be oxidation of cell constituents.



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We will be heating the N95 respirators at 70°C for 45 minutes.

Below is the Fox Chase plan, visually:



This is a brief summary of what's needed:

We need managers to identify a collection point for used masks within their departments and where they want reprocessed masks delivered.

Individual HCPs need to write name, date, and dept on mask and brown paper bag. Upon doffing mask, place it in the labeled bag, roll the top of the bag down a few times. Drop brown bag in used N95 collection location within the department.

We will collect used N95s for treatment with heat. The reprocessed N95s will be placed in clean labeled white bags. A new brown bag will be placed within the white bag. The white bag will be stapled shut and returned to the department's clean collection drop off point.

Each HCP should only wear a mask with their own name on it, do not wear a mask with someone else's name. Don reprocessed mask according to previously released instructions.

And here are even more details:

Health Care Professional (HCP)

1. HCP receives new N95 respirator and PAPER bag from supervisor
2. Using a permanent marker, label front of respirator and bag with name, date, and location
3. Properly don respirator according to the FCCC policy guidelines. [Click here](#) to find resources on the proper use of PPE, including a video on safely doffing N95 respirator.
4. Remove N95 following the proper doffing guidelines



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5. Visually inspect doffed N95 respirator:
 - a. Discard and replace respirator if it does not maintain its fit and function, becomes damaged or breathing becomes difficult.
 - b. Discard respirators that become contaminated with blood, respiratory or nasal secretions, or other bodily fluids.
 - c. Discard if used in an aerosol-generating procedure (intubation, extubation, trach exchange, bronchoscopy, upper endoscopy, PAP, BIPAP, high flow oxygen, nebulizers, open suctioning)
6. Place used N95 respirator passing visual inspection in the properly labeled PAPER bag
7. Only place one N95 respirator in a bag
8. Fold the top of the bag several times
9. Place bag in designated area for pick-up and reprocessing

HCP Instructions for Reprocessed N95 Respirators

1. At the start of shift, retrieve YOUR OWN reprocessed respirator from designated clean pickup point. Use your respirator with the oldest “first use” date first. DO NOT SHARE RESPIRATORS.
2. Obtain new paper bag and properly label with name, date, and location
3. Open reprocessed respirator bag
4. Visually inspect respirator and don according to the FCCC policy guidelines. If elastic band breaks, discard N95 respirator
5. Perform seal check,
 - Discard respirator if you are unable to achieve a proper fit
6. HCP will notice a tally mark has been added. After reprocessing respirators are marked to track the number of times a particular respirator has been reprocessed.

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