March 13, 2020

Decontamination procedures.

Virus-laden respirators were subjected to one of three decontamination procedures as described below. The orientation of the filter was convex panel facing the droplet or treatment source. Controls were subjected to the same decontamination procedures as the treated FFRs but were not exposed to virus.

Ultraviolet germicidal irradiation.

The best and most recent article on the subject that I could find is: J Occup Environ Hyg. 2015 ; 12(8): 509–517. "Effects of Ultraviolet Germicidal Irradiation (UVGI) on N95 Respirator Filtration Performance and Structural Integrity". The authors propose UV sterilization as an effective means for N95 reuse. Interestingly, these are the same UV sanitizers used by spas and salons to sterilize their tools. The units can be purchased for $130-200 online. The units provide reasonable sterilization in 10 minutes (or 20 minutes if you need to flip the mask over depending on the unit you buy). I ordered a unit for our main office and will have it up and running by Monday (I hope). I suspect these units will be hard to get in a week or two when people figure all of this out.

A 126- (L) × 15.2- (W) × 10.8-cm (H), dual-bulb, 15-W UV-C (254-nm wavelength) lamp (Ultraviolet Products, Upland, CA, USA) was placed in a Labgard class II, type A2, laminar flow cabinet (NuAire, Inc., Plymouth, MN, USA) set to a height 25 cm above the cabinet's working surface. Measured by a UVX digital radiometer (UVP Inc., Upland, CA, USA), the lamp's UV-C wavelength irradiance ranged between 1.6 mW cm^{-2} and 2.2 mW cm^{-2}. Virus-laden respirators were placed inside the cabinet, directly under the ultraviolet lamp with the convex panel facing the treatment, and exposed for a total of 15 min at a UV-C wavelength dose of 18 kJ m^{-2}.

Microwave-generated steam

A 1250-W (2450 MHz) commercially available microwave oven (Panasonic Corp., Secaucus, NJ, USA) with a rotating glass plate was used to irradiate a single respirator per treatment. Samples were placed above a plastic box filled with 50 ml of room temperature tap water. The top of the box was perforated with 96 holes (7 mm diameter) evenly distributed

over the entire surface to allow MGS to vent through the respirator. The virus-contaminated respirator was placed with the convex surface pointed toward the steam source and the FFR was then irradiated for 2 min at full power.

Moist heat

A 6-l sealable container (19 × 19 × 17 cm) was filled with 1 l of tap water, placed in an oven (Thermo Fisher Scientific Inc., Marietta, OH, USA), and heated to 65 ± 5°C for 3 h. This allowed the liquid to reach the desired temperature prior to any decontamination tests. For testing, the container was removed from the oven and a single virus-contaminated respirator was placed on the rack. For each decontamination procedure, the container was opened and the FFR placed onto the rack with the convex surface pointed toward the water layer. The container was then sealed and returned to the oven for the 20-min treatment.

Dilute sodium hypochlorite (bleach) and hydrogen peroxide based agents (Oxivir)

Probably the least toxic of the disinfectants would be dilute sodium hypochlorite (bleach) and hydrogen peroxide based agents (Oxivir). Each product has its own problems. Bleach is effective, but masks when soaked and dried in dilute bleach give off a chlorine-like smell due to emission of low levels of chlorine gas. Any residual sodium hypochlorite causes irritant reactions to the skin and mucous membranes. The hydrogen peroxide within Oxivir degrades and is harmless, but the MSDS sheets for this product includes phosphoric acid which would likely compromise the mask or cause skin/respiratory harm.

Brown Paper Bag

Place N95 IN A SEPARATE LABELED CLEAN BAG.

Retrieving a Reused N95:

• Perform hand hygiene and remove your N95 out of your labeled bag.

• Inspect N95, don the N95 and perform fit check.