

# How long does **CORONAVIRUS** live on surfaces?

Research shows COVID-19 can remain viable on surfaces and in the air for up to 2-3 days.



**AIR**

UP TO  
**3**  
HOURS

**COPPER**

UP TO  
**4**  
HOURS

**CARDBOARD**

UP TO  
**24**  
HOURS

**PLASTIC**

UP TO  
**72**  
HOURS

**STAINLESS  
STEEL**

UP TO  
**72**  
HOURS



Best practice is to use new N95s. Decontamination does not solve the PPE shortage crisis, and is an emergency practice to be considered during the COVID-19 pandemic. Efficacy and safety of N95 decontamination has not been fully characterized.

# COVID N95 DECON & REUSE



# HEAT & HUMIDITY

## CORONAVIRUS INACTIVATION

Data not available for COVID-19 on N95s

- +** 60°C-75°C for 30min inactivates related coronaviruses in solution<sup>1-5</sup>
- +** 70°C at 85% humidity for 30min inactivates H1N1 and H5N1 flu (non-coronavirus) on N95<sup>6,7</sup>
- Method does NOT inactivate all bacterial or mold spores on N95
- ?** No data on heat inactivation of coronaviruses on N95s

## N95 MASK INTEGRITY

- +** N95 keeps filter performance at 5 cycles of 60°C heat, 80% humidity<sup>8</sup>
- +** N95 shown to keep proper seal after 1 cycle at 65°C, 85% humidity<sup>8</sup>
- Repeated thermal cycles may damage N95 fit and filtration<sup>8,9</sup>
- ?** Different N95 makes and models may respond differently to heat<sup>9</sup>

## KEY CONSIDERATIONS

Data from tests on specific N95 models may not apply to other models

N95s should be isolated and returned to original user

N95 user seal check should be performed before each reuse

## RISKS

Untested protocol - virus may survive if temperature, humidity, or duration is too low

N95 fit and filtration may be damaged if the temperature is too high or after multiple cycles

N95 will NOT be sterilized by low heat and humidity

## IMPLEMENTATION

- +** CDC has released guidance on heat and humidity for decontaminating N95s<sup>10</sup>
- +** Many devices can maintain 65-80°C, 50-85% humidity (warming cabinets, water baths, autoclaves, ovens)
- ?** Method has not been validated in an FDA-approved process

## CONCLUSION

Heat and humidity for N95 decontamination is currently unproven for inactivation of SARS-CoV-2. Its use should be evaluated by relevant authorities. This is a low-cost technique that could be easy to implement in a wide range of settings. However, excessive thermal cycling may damage N95 fit and filtration. Moreover, this approach will NOT protect against all bacterial and mold co-infection risks. If risks are mitigated, this protocol merits future FDA feasibility studies.

## SUPPORTING RESEARCH

[1] Darnell et al., 2006; [2] Darnell & Taylor, 2004; [3] Rabenau et al., 2005; [4] Duan et al., 2003; [5] Pagat et al., 2007; [6] Heimbuch et al., 2011; [7] Lore et al., 2012; [8] 3M, 2020; [9] Viscusi et al., 2009; [10] CDC, 2020

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# COVID N95 DECON & REUSE



# UV-C

Use appropriate UV-C source  
Use sensor to validate 1 J/cm<sup>2</sup> dose  
Expose both sides of N95 mask

## CORONAVIRUS INACTIVATION

Data not available for COVID-19

- +**  $\geq 1 \text{ J/cm}^2$  of UV-C inactivates viruses similar to SARS-CoV-2 on N95s<sup>1,2,3</sup>
- +**  $\geq 1 \text{ J/cm}^2$  of UV-C kills *Bacillus subtilis* spores on N95s<sup>4</sup>
- UV-C light may not reach inner N95 layers for all N95 models<sup>5</sup>
- Straps may not be fully decontaminated by UV-C alone<sup>1</sup>
- Shadowing blocks UV-C rays & can leave parts of N95 contaminated

## N95 MASK INTEGRITY

- +** N95 keeps fit and filter performance after 10-20 cycles of 1-1.2 J/cm<sup>2</sup> UV-C<sup>2</sup>
- Some damage to N95 seen at high UV-C doses ( $\geq 120 \text{ J/cm}^2$ )<sup>6</sup>
- Strap and facepiece damage seen on some N95 models after UV-C<sup>7</sup>

## KEY CONSIDERATIONS

- Ensure accurate UV-C dose on front and back of N95
- Measure dose at N95 surface with calibrated sensor
- Keep N95s separate and return to original users
- Perform user seal check before each reuse
- Be aware that data from tests on specific N95 models may not apply to other models

## RISKS

- Residual contamination may remain on N95 straps and may need to be separately wiped with disinfectant
- Consumer UV products are not recommended for N95 decontamination
- If UV-C source is underpowered, decontamination timescales may be infeasible
- UV-C may not decontaminate N95 straps or eliminate risk of bacterial co-infection
- Makeup and sunscreen on N95 may reduce decontamination efficacy

## IMPLEMENTATION

- +** Reference documents from University of Nebraska Medical Center<sup>8</sup> for implementation
- ?** Validate each UV-C source and protocol with a UV-C sensor to ensure adequate dose for decontamination at the N95 surface

## CONCLUSION

If implemented properly using sensors to ensure  $\geq 1 \text{ J/cm}^2$  UV-C dose to the N95, this method likely inactivates SARS-CoV-2; however, this has not yet been confirmed directly with SARS-CoV-2. This method may protect against some bacterial co-infection risks but not all.

### SUPPORTING RESEARCH

[1] Mills et al., 2018; [2] Heimbuch & Harnish, 2019; [3] Lore et al., 2012; [4] Lin et al., 2018; [5] Fisher and Shaffer, 2010; [6] Lindsley et al., 2015; [8] Personal Safety Division, 3M, 2020; [9] Lowe et al., 2020

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