

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

See Technical Report at
[n95decon.org/heat](https://www.n95decon.org/heat)

CORONAVIRUS INACTIVATION

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- 70°C dry heat for 60min inactivated* SARS-CoV-2 on N95 under lab conditions¹

- 50–85% humidity enhances inactivation of flu virus (non-CoV) on N95 and metal^{2–4}

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- Real-world conditions (e.g. saliva, mucus droplets) may require higher temperature, humidity, or longer time.

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- SARS-CoV-2 NOT inactivated by 70°C dry heat for 30min (on N95) and 60min (on metal)¹

- Method does NOT inactivate all bacterial or mold spores on N95⁵

* ≥ 3-log inactivation

KEY CONSIDERATIONS

Temperature and humidity must be calibrated and monitored; heating devices can be highly variable

N95 must be isolated and returned to original user

User seal check must be performed before each reuse

Each don/doff can reduce N95 fit; some models fit unacceptably after 5 don/doff cycles¹²

N95 MASK INTEGRITY

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- Several 3M N95 models (1860, 8210, 8210+) keep fit and filtration for multiple 30min cycles at 70–85°C and >50% humidity^{6,7}

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- Many models (e.g., 3M 8200, 3M 8511) keep fit performance for multiple 30min cycles at 75°C dry heat^{8,9}

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- Each N95 model responds differently to heat; many have not been tested with the heating conditions above^{1,10}

- Repeated thermal cycles may damage N95 fit and filtration^{1,10,11}

RISKS

Heat inactivation is **highly sensitive** to temperature, humidity, time, surface, and co-contaminants

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

N95 will NOT be sterilized by the heat & humidity treatments listed above

IMPLEMENTATION

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- CDC released guidance on heat+humidity for N95 decontamination¹³

- Many devices can maintain 70–80°C, 50–85% humidity (warming cabinets, water baths, autoclaves, ovens)

CONCLUSION

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- Method has not been validated in an FDA-approved process

Heat and humidity for N95 decontamination requires further investigation 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 heating or multiple thermal cycles 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 ** = not peer-reviewed

[1**] Fischer et al., 2020; [2] Bergman et al., 2010; [3] Lore et al. 2012; [4] McDevitt et al., 2010; [5] Rodriguez-Palacios & LeJeune, 2011; [6**] Anderegg et al., 2020; [7**] Massey et al., 2020; [8**] Price et al., 2020; [9] Viscusi et al., 2009; [10] Viscusi et al., 2011; [11**] 3M, 2020; [12] Bergman et al., 2012; [13] CDC, 2020

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HEAT RELATED CONCERNS

UNPROVEN METHODS

? Autoclave

- Standard autoclave cycle (121°C steam, 15 min) inactivates SARS-CoV-2 on N95¹
- Autoclave is an accepted means of sterilization in hospital setting
- Many pleated N95 models (3M 1870, 1804S, 1862+, 9211; Aearo 1054S) pass quantitative fit test for 5 autoclave cycles^{1,2}
- Common molded N95 models (3M 1860, 8210, 8000) known to fail after 1-2 cycles of autoclave treatment^{1,3}
- There are few studies on N95 filtration efficiency after autoclave treatment^{2,4}
- Different N95 models may respond differently to autoclave cycle¹

? Microwave-Generated Steam

- 2 minutes above water reservoir in 1250 W microwave inactivates H1N1 and H5N1 flu (non-coronavirus) on N95^{3,5}
- No data on MGS inactivation of coronaviruses on N95
- Most common N95 models shown to withstand at least one 2-min MGS treatment, several models withstand up to 3 cycles⁶⁻⁹
- Possibility of N95 damage beyond three cycles¹⁰
- Few studies on N95 durability under more than one repeated decontamination cycle
- Some N95 models destroyed by 2-min microwave without steam¹¹
- Metal components of N95 may present sparking hazard

UNSUITABLE METHODS

✗ Home Oven

- Bringing potentially biohazardous materials home is highly dangerous and carries significant contamination risk

SUPPORTING RESEARCH ** = not peer-reviewed

[1**] Kumar et al., 2020; [2] van Straten et al., 2020; [3] Heimbuch et al., 2011; [4] Viscusi et al., 2007; [5] Lore et al., 2012; [6] Bergman et al., 2010; [7] Bergman et al., 2011; [8] Viscusi et al., 2011; [9] Fisher et al., 2011; [10**] Liao et al., 2020; [11] Viscusi et al., 2009

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