**COVID-19 N95 DECON & REUSE**

**HEAT & HUMIDITY**

See Technical Report at n95decon.org/heat

**CORONAVIRUS INACTIVATION**

- **+** 70°C dry heat for 60min inactivated* SARS-CoV-2 on N95 under lab conditions**
- **+** 50–85% humidity enhances inactivation of flu virus (non-CoV) on N95 and metal**
- **+** Real-world conditions (e.g. saliva, mucus droplets) may require higher temperature, humidity, or longer time.
- **+** SARS-CoV-2 NOT inactivated by 70°C dry heat for 30min (on N95) and 60min (on metal)†
- **-** Method does NOT inactivate all bacterial or mold spores on N95

* ≥ 3-log inactivation

**N95 MASK INTEGRITY**

- **+** Several 3M N95 models (1860, 8210, 8210+) keep fit and filtration for multiple 30min cycles at 70–85°C and >50% humidity**
- **+** Many models (e.g., 3M 8200, 3M 8511) keep fit performance for multiple 30min cycles at 75°C dry heat**
- **+** Each N95 model responds differently to heat; many have not been tested with the heating conditions above**
- **-** Repeated thermal cycles may damage N95 fit and filtration**

**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 cycles**

**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**

- **+** CDC released guidance on heat+humidity for N95 decontamination**
- **+** Many devices can maintain 70–80°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 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**


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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.
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HEAT RELATED CONCERNS

UNPROVEN METHODS

Autoclave
- Standard autoclave cycle (121°C steam, 15 min) inactivates SARS-CoV-2 on N95
- 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
- Common molded N95 models (3M 1860, 8210, 8000) known to fail after 1–2 cycles of autoclave treatment
- There are few studies on N95 filtration efficiency after autoclave treatment
- Different N95 models may respond differently to autoclave cycle

Microwave-Generated Steam
- 2 minutes above water reservoir in 1250 W microwave inactivates H1N1 and H5N1 flu (non-coronavirus) on N95
- 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 cycles
- Possibility of N95 damage beyond three cycles
- Few studies on N95 durability under more than one repeated decontamination cycle
- Some N95 models destroyed by 2-min microwave without steam
- 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

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