

Summary of information available on life extension/sterilization of N95's

Thanks to Dr. Eva Dickson, Defence Scientist, DRDC Suffield Research Centre

(A) Parameters for a disinfection method to be considered successful for an N95 filtering facepiece [<https://consteril.com/covid-19-pandemic-disinfection-and-sterilization-of-face-masks-for-viruses/>]:

1. Retain filtration efficiency of >95% (i.e. capture at least 95% of test particles greater than 0.3 microns)
2. Maintain breathability as the filter element may be damaged. Breathability must not be substantially reduced as determined by measuring the pressure drop across the mask.
3. Not have visible damage or deformation to the filter, straps or sealing members. The mask must retain shape, fit and seal integrity. Straps must retain elasticity.
4. Be successfully decontaminated of the desired organism(s), for example the virus SARS-CoV-2 that causes COVID-19. An ideal process would eliminate all organisms and pathogens rendering the mask sterile.
5. Be safe to use for the wearer (no harmful chemical residues or toxic off-gassing)."

(B) Parameters to be considered in applying a disinfection process are:

1. Throughput (time, number)
2. Footprint (sterilization, drying, offgassing, storage)
3. Tracking of items (clean/dirty, return to original wearer, number of uses)
4. Quality assurance (continued assurance of process control and sterilization success)
5. Transportation of contaminated and clean items

Life extension/ re-use approach	Pros	Cons	Unknowns	Summary
Extended wear (up to one day)	Extends life of item simply and with minimum training. Can be combined with other approaches.	Limited capability to extend supply, and largely already in use. May require doffing and donning contaminated items if breaks are involved.	Effect of extended and reuse wear on workplace protection	Already in use. Can be combined with other approaches to extend further.
Warm moist heat	Virtually any scientific institution or hospital has the technology easily available CDC has released guidance	Less well validated method Will not sterilize bacteria	Effectiveness against related coronaviruses on surfaces . All data on limited models only	May be suitable for small scale use if masks are returned to same wearers
Hydrogen peroxide Vapour	HPV has been FDA approved, studies done, implemented at Duke QNFT and other performance checks indicate minimal degradation in performance	Delivery systems not routinely available Requires a centralized facility and transport of items	All data on limited models only	Has successfully been implemented as a large-scale centralized facility approach, and is FDA approved. Is suitable to produce a pool of masks that need not be returned to the same wearer.
Hydrogen peroxide gas plasma	HPGP is a proven technology for sterilization	HPGP can degrade media	All data on limited models only	Seems likely to be very model specific and offer less re-use
UV-C (germicidal)	Accepted sterilization method commonly available in technical institutions	Very dose dependent by model for efficacy vs performance degradation Shadowing means not all surfaces will necessarily be reached Straps may degrade and might need shielding May not sterilize all bacteria	All data on limited models only	May be suitable for small scale use when combined with other surface decontamination methods such as sterilizing wipes for straps, and if masks are returned to same wearers
Autoclaving	Easily available equipment Total sterilization Fast	Only works on some styles (pleated)	All data on limited models only	May be suitable for small scale use on certain models

All methods:

In most cases, data are very limited and it cannot be assumed that it will work for every model of N95 FFP.

Careful control of conditions is required to assure sterilization while not causing performance degradation of FFP's.

Dose monitoring is essential (time, temperature, concentration, flux as relevant).

Use of biological indicators as QA process will provide continual validation, while keeping masks out of use until QA results returned.

Every re-used mask has to be inspected for defects, and a seal check performed when wearing, and discarded if degradation is observed.

Many methods are best to return the same mask to the same wearer because full sterilization is not guaranteed, and therefore likely are only suitable for small-scale use; further, in case of co-infection with other organisms e.g. bacterial pneumonia, will not be sterilized, and therefore high risk use areas should be identified and items used in these areas treated differently.

In all cases there is limited data on how many re-uses can be safely performed without degradation of performance in use below an acceptable threshold and in some cases the limited available data are on few reuses; there is more extensive QNFT data from the Duke HPV study, but performance in use has not been determined in any case.