

Protocol: Ultraviolet-based disinfection of respirator masks using the UVP Crosslinker CL-3000

Disclaimer: This protocol is intended only for the UVP Crosslinker CL-3000 equipped with 254 nm bulbs. If you have any model other than what is listed here, then this protocol will not work.

This protocol is intended to fit within the context of an institution-approved UV germicidal irradiation (UVGI) mask disinfection procedure^{1,2}. For example, it is expected that an operator is wearing appropriate PPE while handling contaminated masks and placing them into the CL-3000; users should keep contaminated and disinfected masks separate. It is expected that each operator consults their organization for proper infection/isolation control procedures prior to operating the CL-3000.

It is also important to note that UVC irradiation with the CL-3000 does not provide a “sterile” environment. While the CL-3000 can provide up to 10J/cm² UV doses, bacterial spores and types of UV resistant microorganisms may not be inactivated after running a full disinfection cycle. In addition, other factors, such as shadows, do affect the germicidal efficacy of the UV light³⁻⁶. Therefore, improperly placing a mask or having masks overlap to where shadows are created will affect the performance of the UVC irradiation.

Prior to use, it is advised that operators contact the manufacturer of their particular mask because UVC is known to damage or degrade materials over time³⁻⁶. For example, some mask/N95 respirator manufacturers do not recommend using UVC disinfection with their mask. Therefore, operators should consult with their organization on the material compatibility of their masks with UVC irradiation.

Indications for use: This protocol is only intended for the disinfection of N95 respirators and should not be used to disinfect other medical equipment. It is up to each operator to determine how this protocol fits in with their organization’s decontamination process.

Operating the CL-3000 as part of an approved UVGI workflow

Note: The CL-3000 should be set-up and used in a soiled utility room and is considered contaminated. The operator should be wearing proper PPE when using the CL-3000.

- 1) Following local organization protocol, label each mask (if not done already) so they may be tracked. Our recommendation is to write directly on the mask using a marker. Stickers are not advised, as the area beneath the sticker won’t be properly disinfected due to little or no UV exposure.
- 2) Take each mask and unfold all creases until all the mask material is completely exposed. UV light will not be effective in shadowed areas, so it is up to the operator to ensure masks are not folded, creased or bent in a way that creates a shadow on the mask.
- 3) Place masks into the chamber.
- 4) Set the dosage on the instrument by selecting **ENERGY**, then pressing **1-0-0-0-0** for **1000.0 mJ/cm² (1J/cm²)** and then press **ENTER**. When ready to start the cycle, press **START**.
- 5) Wait approximately **2-3 minutes** for the decontamination cycle to run. The CL-3000 counts downward until the desired UV dosage is delivered. The number onscreen indicates the dosage to be delivered before the cycle is complete.
- 6) Open the CL-3000 door and flip the masks over, once again ensuring there is no overlapping material that can create shadows. Since the UVC light comes from a single direction, irradiating both sides are advised to ensure proper UVC exposure.
- 7) Repeat **step 5** above and run the second cycle.
- 8) Wait approximately **2-3 minutes** for the second decontamination cycle to run.
- 9) Change PPE and remove the disinfected masks from the chamber.
- 10) Using a marker, indicate the UV cycle number on the mask to track how many UV cycles the mask has undergone. One cycle indicates ~2J/cm² of total mask UV exposure (1J/cm² per side). Follow your organization’s procedure for separating disinfected and contaminated masks.

References

1. Lowe, J. *et al.* N95 Filtering Facemask Respirator Ultraviolet Germicidal Irradiation (UVGI) Process for Decontamination and Reuse. <https://www.nebraskamed.com/sites/default/files/documents/covid-19/n-95-decon-process.pdf> (2020).
2. Price, A. & Chu, L. COVID-19 Evidence Service - Addressing COVID-19 Face Mask Shortages [v1.2]. <https://aim.stanford.edu/covid-19-evidence-service/> (2020).
3. Fisher, E. M. & Shaffer, R. E. A method to determine the available UV-C dose for the decontamination of filtering facepiece respirators. *Journal of Applied Microbiology* **110**, 287–295 (2011).
4. Lindsley, W. G. *et al.* Effects of Ultraviolet Germicidal Irradiation (UVGI) on N95 Respirator Filtration Performance and Structural Integrity. *Journal of Occupational and Environmental Hygiene* **12**, 509–517 (2015).
5. N95Decon. N95Decon - UV-C Fact Sheet. *N95DECON - A scientific consortium for data-driven study of N95 FFR decontamination* <https://www.n95decon.org/publications>.
6. Heimbuch, B. & Harnish, D. *Research to mitigate a shortage of respiratory protection devices during public health emergencies.* (2019).