

WIZARD



Germicidal capacity WIZARD SCARECROW

Models: 15, 18 and 18 Turbo



Index

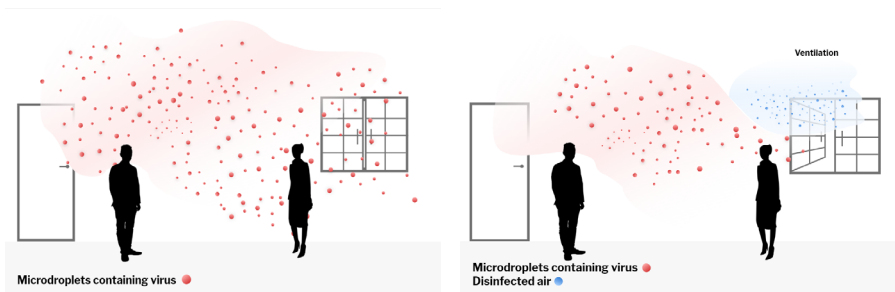
1. Air renewal, filtering, and disinfection	3
Air renewal	3
Deodorization	3
Filtration	3
Disinfection	4
2. UVC radiation: important concepts	6
Wavelength and power	6
Dose	7
3. Scientific studies on UV-C	9
4. Standards and regulations	10

1. Air renewal, filtering, and disinfection

All these actions can be useful to maintain cleaner environments and to combat the spread of Covid-19 and other pathogens, but it is important to know the difference between them.

Air renewal

Air renewal can be achieved with traditional ventilation, for example by opening windows, air conditioning is only effective if there is a minimal renewal with outside air, on the contrary, it is harmful, if it is recirculated in the same interior environment since it disperses viruses within the same room.



Deodorization

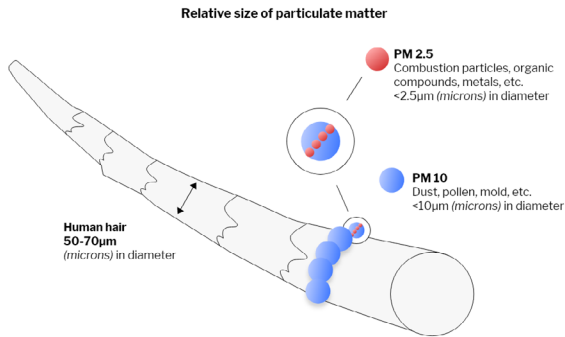
It consists on the neutralization of part of toxic gases and odors through the use of carbon filters, it is usually used in most filtration equipment as a complement to filtration.

Filtration

A more effective step is particle filtration with HEPA filters. HEPA 13 filters can filter particles down to 0.3 microns (μm). Viruses and specifically Sars-CoV-2 have a smaller size (in the order of 0.06 to 0.14 μm) and recent studies have shown that SARS-CoV-2 type viruses can remain adhered in suspension for

hours to other particles in aerosols (size of these particles between 0.002 to 100 μm), emitted simply when speaking. (Source: CSIC Emission, exposure and leakage of SARS-CoV-2, report v3 of April 15, 2020).

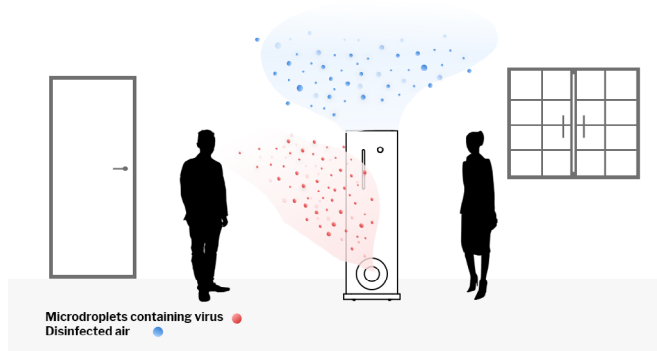
Therefore, these filters alone, while improving simple ventilation, are not a definitive solution.

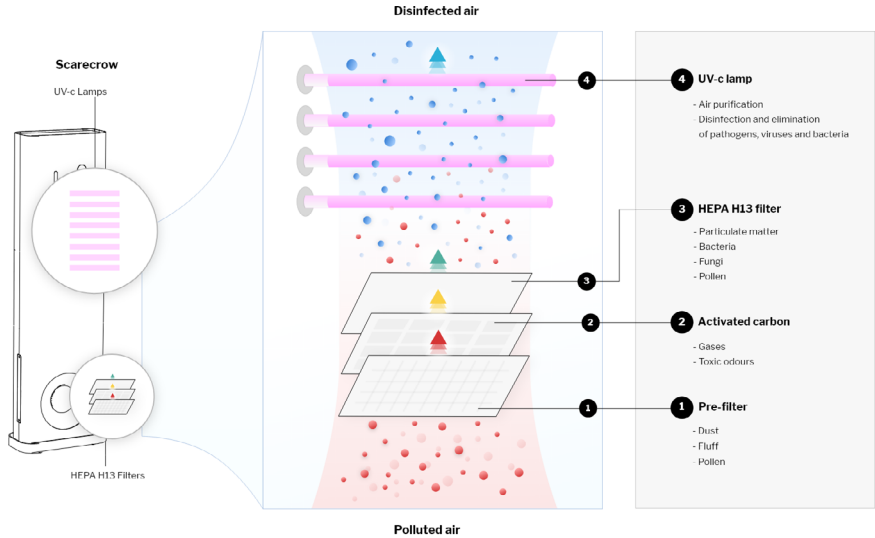


Disinfection

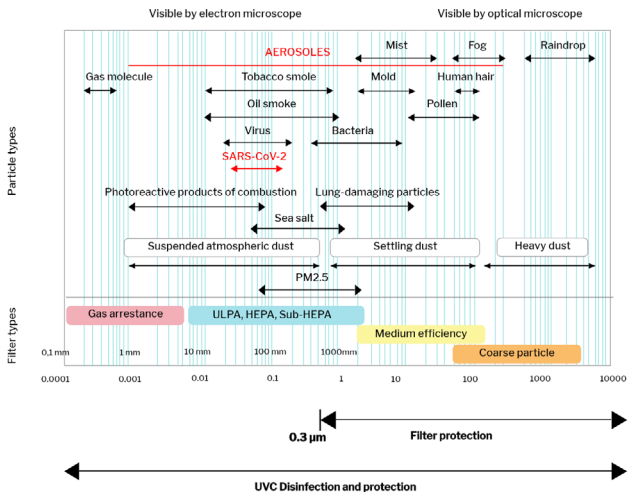
Last but not least, disinfection consists of attacking the microorganism (virus, bacteria, etc.), achieving their deactivation, so it is the optimal solution.

SCARECROW equipment combines a first stage of ventilation, deodorization-filtration with a second stage of disinfection.



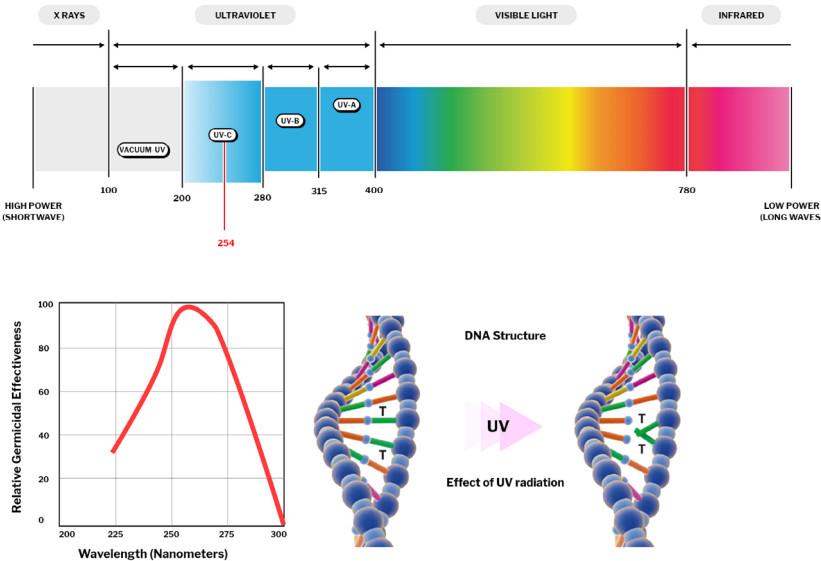


In the first stage, a deodorization is carried out with carbon filters and a mechanical filtration of particles by means of a HEPA 13 filter. This filtering is able to eliminate a large part of mites, spores, molds and other pathogens, as well as the neutralization of part of smells. Viruses and bacteria may still be present in the air that enters the equipment after going through the first mechanical stage, so it will undergo a second stage, this time disinfection. The disinfection process is carried out using UVC radiation. **This ensures that SCARECROW equipment is the most effective solution to combat microorganisms present in the air.**



2. UVC radiation: important concepts

UVC radiation is that which has a wavelength between 200 and 280 nm. Various scientific studies have proven that radiation of around 260nm, (which coincides with that corresponding to UVC), is capable of inhibiting the replication capacity of microorganisms (SARS-CoV-2 and others) by causing photochemical changes in the strands of your DNA and RNA. The theoretical point of maximum germicidal efficiency coincides with a wavelength of 260 nm. (Source: Ultraviolet germicidal irradiation handbook. Wladyslaw Kowalski).



Disinfection: Breakage of DNA and RNA chains by action of UV C. Inactivation of the virus; inability to reproduce.

Wavelength and power

SCARECROW equipment uses lamps that produce UVC radiation with a wavelength of 254 nm, thus ensuring their germicidal capacity. The total generating power of UVC radiation is 28W for MODEL 15 and 56W for MODEL 18. It is important to know that the nominal electrical power of the lamp has nothing to do with the power of UV-C radiation it offers. Some manufacturers use the misleading concept of total power to make it appear that their equipment has more germicidal power than it actually does.

Dose

—

The concept of radiation dose is important because it is what will really tell us if our equipment can deactivate the corresponding microorganism (virus, bacteria, etc.).

Dose is the energy (in Joules) absorbed per unit area by an irradiated object during a given exposure time, that is, the amount of radiation that the virus to be inactivated will absorb in a given time.

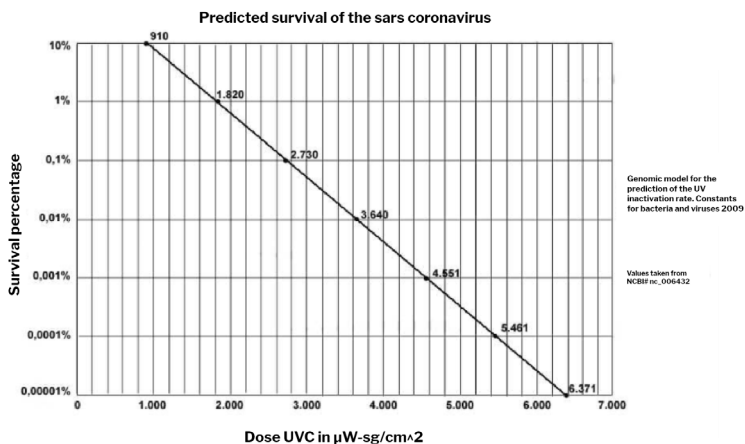
UV dose = UV intensity (I) x Exposure time (t) in seconds.

In other words, UV dose = I x T, where:

- UV dose is measured in joules per square meter (J / m²) or milli joules per square centimeter (mJ / cm²)
- UV intensity (also called UV irradiance) is measured in milli watts per square centimeter (mW / cm²)

Different scientific studies have already established the necessary dose to apply to specific microorganisms to deactivate them. In the case of coronaviruses, we can find, among others:

- According to the NCBI (National Center for Biotechnology Information), part of the US National Library of Medicine, it was established in 2009 that the dose to eliminate SARS-CoV-1 with an effectiveness of 99.99% is **3,640 μW • sec / cm²**. Taking into account that 1 Joule (J) is equivalent to 1 Watt (W) for 1 second (sec), we can express the dose value as **36.4 J / m²**. (Source: <https://www.ncbi.nlm.nih.gov/>)



• According to more recent studies, such as the one carried out by the University of Milan, the dose to eliminate SARS-CoV-2 (COVID-19) with an effectiveness of 99.9% is **37 J/m²** and a complete inhibition would be achieved with a dose of **169 J/ m²**. (Source: <https://www.medrxiv.org/content/10.1101/2020.06.05.20123463v2>)

• For other types of viruses and bacteria, the maximum necessary dose values, with 90% effectiveness, are around **180-190 J / m²**. Most need lower doses.
(Source: <https://www.assets.signify.com/is/content/PhilipsLighting/Assets/philips-lighting/global/20200504-philips-uv-purification-application-information.pdf>)

To calculate the dose values in the SCARECROW equipment, the generated UVC power and the working speed (exposure time in seconds) are taken into account, since the lower the speed the longer the virus will be irradiated, so there will be a greater inhibition effectiveness. The results obtained are the following:

	SCARECROW 15 (28W)	SCARECROW 18 (42W)	SCARECROW 18 TURBO (42W)
Dose Max Speed (J/m ²)	105	219	123
Dose Mid Speed (J/m ²)	210	438	246
Dose Min Speed (J/m ²)	419	875	491

In conclusion, these values ensure the effectiveness of SCARECROW equipment. Furthermore, this equipment is completely safe as UVC radiation is inside the device, thus preventing radiation exposure to people.

Regarding the necessary time to completely disinfect the air in a room with SCARECROW equipment, the results obtained are the following:

Disinfection time (minutes)				
Surface(m ²)	Volume (m ³)	Max. speed	Med. speed	Min. speed
100	230	38	77	153
150	345	58	115	230
200	460	77	153	307
250	575	96	192	383

Notes:

1. Volumes calculated with height of 2.3m.
2. Scarecrow Model 15 calculated with 99.99% disinfection for SARS-CoV-2, due to its 28W UVC power.
3. Scarecrow Model 18 calculated with 100% disinfection for SARS-CoV-2, due to its 56W UVC power. It has the same speed as the Model 15 but with a greater disinfectant power.

3. Scientific studies on UV-C

UV-C light disinfection systems have been used since the 1940s for disinfection in operating rooms and hospitals where there was a risk of airborne infectious diseases, achieving a significant reduction in human-to-human infections [1]. It was later used in other places such as schools [2] and is still used today in hospitals and operating rooms.

Studies are currently being carried out for all types of viruses, bacteria, fungi and different microorganisms in which the deactivation of these is demonstrated and the necessary dose of radiation to be applied to achieve this is calculated. The International Commission on Illumination (CIE) compiles 60 of these studies [3].

Other more recent studies, already focused on COVID-19, have been cited in the previous section.

[1] Goldner JL, Moggio M, Beissinger SF, McCollum DE. Ultraviolet light for the control of airborne bacteria in the operating room. *Ann NY Acad Sci* 1980;353:271-84.

[2] Wells WF, Wells MW, Wilder TS. *The environmental control of epidemic contagion I: an epidemiologic study of radiant disinfection of air in day schools.* *Am J Hyg* 1942;35:97-121 & Wells WF. *Airborne contagion and air hygiene: an ecological study of droplet infections.* Cambridge (MA): Harvard University Press 1955

[3] CIE 155:2003 Ultraviolet Air Disinfection

4. Standards and regulations

SCARECROW equipment complies with the mandatory Directives:

- *2014/35/UE of the European Parliament and of the Council, of February 26, 2014, on the harmonization of the laws of the Member States regarding the marketing of electrical equipment intended for use within certain voltage limits.*
- *2014/30/UE of the European Parliament and of the Council, of February 26, 2014, on the harmonization of the laws of the Member States on electromagnetic compatibility.*
- *2011/65/UE of the European Parliament and of the Council, of June 8, 2011 on restrictions on the use of certain dangerous substances in electrical and electronic equipment.*
- *2006/25/CE of the European Parliament and of the Council of April 5, 2006 on the minimum safety and health provisions relating to the exposure of workers to risks derived from physical agents (artificial optical radiation).*

Other regulations:

- *EN 0068:2020 – Safety requirements for UV-C devices used for air disinfection of premises and surfaces.*
- *15858:2017 – UV-C devices. Safety information. Permissible limits for human exposure.*