Created by:

SVLW Schweizerischer Verein Luft- und Wasserhygiene

Translated to english by:

airoclean

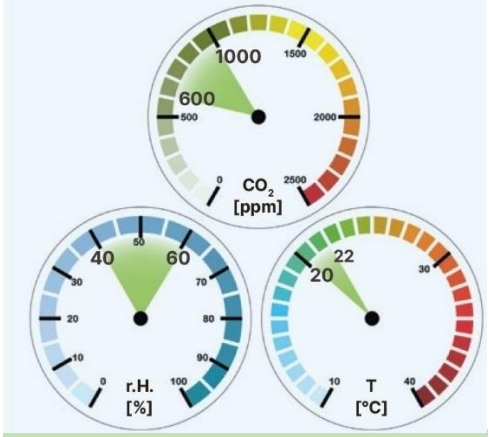
**SO WE PROTECT OURSELVES.**

# Good indoor air quality for my health care

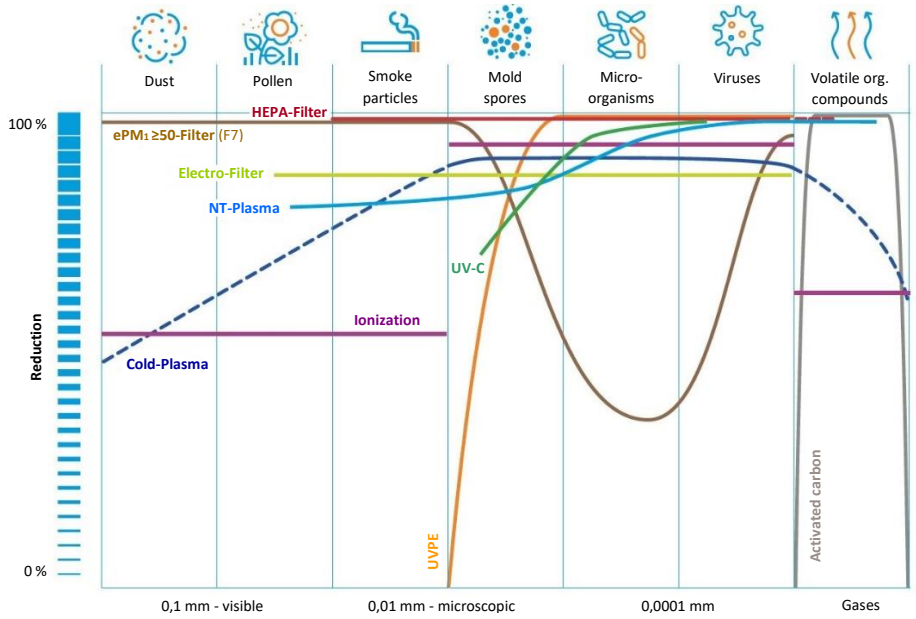
**Clean air is a necessity of life and, according to the WHO, a human right.**
**It reduces illnesses and increases our performance by up to 15%.**
**More awareness of good indoor air quality is worthwhile - as preventive health care.**

**Poor indoor air quality leads to discomfort, damage to health and is often the cause of early illness. Per day we need about 1 kg of food, 3 kg of water and 20 kg of air. For 50-100 CHF per person and year, air conditioning systems offer solutions with different refinements (air filtration, disinfection, treatment, supply/return/exhaust air), which we compare below.**

## Good indoor air




"So we protect ourselves." The SVLW recommends sufficient ventilation and adherence to the above measured values.[1] Some studies show that with good indoor air quality, the risk of virus infection is significantly reduced.[2]
Other measured variables for assessing indoor air quality[3] are fine dust, nitrogen dioxide, hydrocarbons (VOC), ozone, radon, microorganisms, viruses, etc. Depending on the outdoor air quality[4] and hazard situation (e.g. pandemic), special air treatment processes are worthwhile, such as higher-quality filters, NT/cold plasma, ionization, UV-C, ozonation, etc. These processes or their combination can achieve well over 90% protection, eliminate odors, activate air, etc., and thus make a valuable contribution to well-being and preventive health care.




## Aim, benefit

The aim is to find the most suitable process for a wide range of applications. It is intended as an orientation for building owners, operators, planners and installers.
**Health care with good indoor air does not have to be expensive.**
A Harvard study[5] found that 57% of all sick leave was due to poor ventilation. The benefit of increased ventilation is estimated at 6,500 to 7,500 U.S. dollars per person and year.

## Effectiveness for processes

Different processes have different effects. The above graphic serves as a basis for discussion. The lines show in which area the systems are effective. Some systems reduce odors or deactivate microbes and viruses, other systems eliminate them. In this context, the local situation, user concerns, size and correct use of equipment (air volume, air flow, etc.) are crucial. Expert advice for the choice and installation, especially for retrofits are strongly recommended.

**1** so we protect ourselves under https://www.svlw.ch/angebote/829 **2** REHVA-Report under https://www.svlw.ch/angebote/746-covid-19-lueften **3** Best Indoor Air Quality IDA1 after VDI 6022, DIN EN 16798-3, e.g. for Well-Certification **4** Measuring stations: www.bafu.:admin.ch/luft/luftbelastung, Environmental Federal Office under https://www.svlw.ch/838 **5** Harvard-Study: Gesunde Räume – das absolute Minimum www.svlw.ch/739

## Suitability[6]

The table briefly describes the procedures, the areas of application, as well as the expected costs for air treatment. Possible combinations of different processes should be checked by experts according to their effectiveness and the situation on site.

| Purpose-built<br>Procedure<br>Application | Filter | E-Filter | Cold-Plasma | NT-Plasma | Ionization | UV-C | UVPE |
|---|---|---|---|---|---|---|---|
| | Separation of particles and germs on fibers | With voltage positively charged particles and germs are deposited on the opposite pole grounded metal plates | Ion charge removes the hydrogen molecule from harmful pathogens | Plasma technology (reaction and oxidation process) with high voltage source | Ionized oxygen in the air inactivates microorganisms, etc. | With radiation dose to kill germs | Special UV-C modules for killing germs |
| Test methods and certifications | ISO 16890, Eurovent Energy classes and test norm EN-1822-1 | According to ISO 16890-1 or test norm EN-1822-1 | UL 867 (USA), UL 2998 (USA), VDI in test | Test report by Fraunhofer Institute for Building Physics IBP | EN 60335 + 60750, ISO16000-16,17,36 Fraunhofer Institute for Building Physics IBP | Test report by Fraunhofer Institute for Building Physics IBP | DIN FNL 8 unit module, TÜV-tested (Technical Monitoring Agency) |
| Living area | Filter $ePM_1$ >50% | Larger plants | Possible | Allergens | With prefilter $ePM_1$ 50% | Possible | Possible |
| Office | Filter $ePM_1$ >50% | Clarify prefilter and activated carbon filter | With prefilter $ePM_1$ >50% | With filter $ePM_1$ >50% | With prefilter $ePM_1$ 50% | With prefilter $ePM_1$ >50% | With prefilter $ePM_1$ >50% |
| School, Waiting room | Filter $ePM_1$ >50% | Clarify prefilter and activated carbon filter | With prefilter $ePM_1$ >50% | With filter $ePM_1$ >50% | With prefilter $ePM_1$ 50% | With prefilter $ePM_1$ >50% | With prefilter $ePM_1$ >50% |
| Restaurant | Filter $ePM_1$ >50% | Clarify prefilter and activated carbon filter | With prefilter $ePM_1$ >50% | With filter $ePM_1$ >50% | With prefilter $ePM_1$ 50% | With prefilter $ePM_1$ >50% | With prefilter $ePM_1$ >50% |
| Smoking area | EPA with prefilter | Clarify prefilter and activated carbon filter | Outside air socket smoking area | | With prefilter $ePM_1$ 50% | - | |
| Hospital, Operating room | HEPA with prefilter | Not yet established | | Waiting rooms | With prefilter $ePM_1$ 50% | | |
| Food industry | HEPA with prefilter | Not yet established | Not yet established | Not yet established | With prefilter $ePM_1$ 50% | Established | |
| Chip industry | HEPA with prefilter | | | | With prefilter $ePM_1$ 50% | | |
| HVAC-Outdoor air | | | | | | | |
| HVAC-Circulation air | | | | | | | |
| HVAC-Exhaust air | ETA only | EHA only | | | EHA only | | |
| Costs<br>Investment | $ePM_1$ >85% = Low<br>HEPA = Low-Middle | Middle-High | Middle | Middle | Middle-High | Middle-High | Middle-High |
| Operation, maintenance | Middle | Middle | Low | Low | Low | Middle | Middle |
| Benefits for controlled indoor air quality compared to window ventilation | Almost particle-free indoor air | Clean air | Reduction of infection risks for microorganisms and viruses | Reduction of infection risks for microorganisms and viruses | Increase in air quality and hygiene with additional energy savings | Minimization of infection risks for microorganisms and viruses | Minimization of infection risks for microorganisms and viruses |

**Costs** from investment and operation, maintenance should be considered via life cycle costs.
Legend: Very well suitable | Suitable | Caution (further clarifications) | No recommendation
**Activated carbon** is used to reduce odors and gases ($O_3$). Costs: 10–20 Rp./$m^3$ a
Outdoor air = ODA / Fresh | Recirculation air = RCA in HVAC | ETA = Extract air | EHA = Exhaust air
The **default** ist $ePM_1$ >50% filter (F7). In pure outside air operation, this ensures high supply air quality assured (SUP according to VDI 6022).

**Basis for the cost calculation** is an air handling unit with 10'000 $m^3$/h, whose investment for monobloc, air distribution, control and connections; maintenance and amortization over up to 20 years at 25 Rp. electricity costs, with $ePM_1$ >50% filter, without interest: 1.50-3.00 CHF/$m^3$/h a or 50-100 CHF/pers. a. In some cases, additional space requirements for the air handling unit of approx. 2'000 CHF/$m^2$ have to be included.

Costs for pure **recirculation units**, incl. electricity and maintenance, are to be obtained directly from the manufacturer. In addition, the cost of outside air exchange must be included (e.g. window ventilation, heat loss, etc.).

## Please note[7]

In general, the products in this market segment are of very different quality and also characterized by cheap mass-produced goods that do not always meet European efficacy and safety requirements.
The following questions need to be answered:

- Is there proof of effectiveness (testing, type examination, certificate, etc.) or is there at least a serious, application-specific calculation of effectiveness?
- Can the device endanger the health of users and installers?
- Is there proof that no health damage or additional health risks occur due to UV-C rays, ozone, due to the substances used or due to filtration (e.g. due to deposition of organic materials)?
- Is the general CE-compliant product safety and the EMC compatibility together with the devices given and confirmed by a release from the manufacturer?
- Is the operation of the equipment, its materials, and the intended limits of use given in the long term (performance, efficiency and acoustics, functionality and warranty)?
- Are appropriate operating and maintenance instructions available for the boosters and are they taken into account in regular services?

## Ecology[8]

The choice of products has a significant impact on the environment. The circular economy is characterized by the efficient use of raw materials for as long as possible. If material and product cycles can be closed, raw materials can be used again and again.

## Explanation of terms[9]

The term **«allergy»** refers to an excessive and undesirable reaction of the body to certain foreign substances from the environment. The triggers come mainly from the natural environment and are almost exclusively of biological origin (mostly protein compounds, such as pollen, mold spores, hair and dander from animals, from feces and bodies of mites, and from secretions of houseplants).

**Fine dust** can originate from both natural and human sources. Long-term exposure to fine dust pollution causes the greatest burden of disease, 6-10 times greater than that caused by ozone, or nitrogen oxide, or 18 times more than traffic fatalities (Federal Office for the Environment, Swiss TPH).

**Air ions** are able to attach to aerosols, fine dust, other germs as well as bacteria, promoting their deposition or, with simultaneous application of ozone, their reduction or elimination. In the mountains, by the sea and after a thunderstorm, high levels of positive and negative ions and ozone are naturally found in the air.

**Ozone** is invisible and reactive gas that occurs in our atmosphere. This triatomic oxygen ($O_3$) is a highly effective oxidant that can oxidatively reduce germs and odors. It is harmful to health in high concentrations, which is why Seco specifies the following values: 35 ppb on average over 8 hours or up to 60 ppb ozone for short periods.



**6** This information was prepared by a working group of experts under SVLW **7** Excerpts from FGK-Status Report 51 **8** Advice from experts **9** Excerpts from VDI 6022, Page 5