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Commentary on the concept "Ventilation in schools" by the Federal Environment Agency

On 15.10.2020, the Federal Environment Agency (UBA) published a statement on the subject of "Ventilation in schools", which serves as a basis for far-reaching decisions in the ministries, see https://www.umweltbundesamt.de/sites/default/files/medien/2546/dokumente/umweltbundesamt_lueften_in_schulen_.pdf. The question is whether the UBA's publication is a solid basis for far-reaching decisions that serve to protect children, young people and teachers?

According to an article in *Wirtschaftswoche*, it can be assumed that the statement was supported by experts, see <https://www.wiwo.de/technologie/forschung/corona-aerosole-luftreiniger-koennten-die-loesung-sein-doch-aemter-stiften-verwirrung/26269924.html>. The involvement of experts is generally to be welcomed, as UBA's core competence does not lie in the field of fluid mechanics.

The UBA statement initially states quite correctly that the "probability of infectious particles accumulating in the room is comparatively high" because many people stay in a small classroom for a long time. It is also correct that in the "vast majority of schools in Germany no central ventilation systems" are installed. Against this background, there is undoubtedly an urgent need for action to reduce the incidence of infections in classrooms.

In order to reduce the risk of infection in classrooms, the UBA and its consultants recommend using free ventilation. It is recommended to open all windows for 3–5 minutes every 20 minutes and "after each lesson for the entire duration of the break", "even during the cold season". It is said that the temperature in the room will decrease only by "a few degrees" and the temperature will rise again rapidly after closing the windows. The ultimate goal of the measure is to achieve a "triple air exchange" per hour. Why a triple air exchange should be sufficient in the case of a potentially deadly virus is not explained. As a further protective measure the wearing of a mouth-nose-cover is recommended, but it is not said under which conditions it should be worn. It is only said that these covers are "a generally recognized protective measure to minimize the direct risk of infection" and that these masks are "no substitute for ventilation in classrooms".

Reading the UBA statement, it is first noticeable that

1. technical terms are not used correctly For example, the term "fresh air" or "fresh air" used in the UBA text does not exist according to DIN standard 1946 – the correct technical term would be "outside air". The word "air exchange" is also used incorrectly, because in mixed ventilation it does not mean that the air is completely exchanged, as claimed in the text.
2. furthermore, physical relationships are not explained correctly. The fact that the room temperature only drops by a few degrees when all windows in a classroom are opened for the "entire pause duration" at minus temperatures is physically completely wrong, as everyone knows from their own experience.
3. finally, the state of research is not taken into account. The UBA and its advisors have e.g. still not understood the function mode of mouth-nose covers, because otherwise they would know that with these covers the aerosol particles emerge laterally at the mask edge and can flow

directly to the seat neighbor (<https://www.sciencedirect.com/science/article/pii/S0021850220301063>). Even methods that have been in use for decades to combat viruses with radiation and charges are being belittled across the board without giving any technical reasons.

It is astonishing if the experts do not use the technical terms correctly, do not represent the physical connections correctly and do not consider the state of the art of research. It is also astonishing that in such a document the claims are not supported by literature references. Instead, the text is written as if the assertions were reliable knowledge. There is no getting rid of the suspicion that the UBA and its consultants are trying to spread their unfounded opinions in order to provide legitimation for other institutions to act. This is fatal, because the ones who suffer are the children, young people, teachers and parents! Countless well-informed parents, teachers, but also teachers' associations have publicly rebelled against the recommendations of the UBA. That the UBA and its advisors completely ignore this swarm intelligence is incomprehensible.

It is also fatal that the UBA in section 2, despite the small classrooms and the many people in the room, recommends only 3 air changes per hour and suggests a ventilation strategy with which even this completely insufficient recommendation cannot usually be achieved. To recommend 3 air changes per hour can be considered gross negligence. Even without dangerous viruses, significantly higher air changes per hour are recommended in many areas (DIN EN 16798 part 3, or table under <https://de.wikipedia.org/wiki/Mindestluftwechsel>). In areas with dangerous viruses, the aim is to achieve over 12 air changes per hour (DIN 1946-4). Now with potentially deadly viruses to assume that 3 air changes per hour in schools are to protect against a dangerous virus, is not comprehensible. In my opinion, the BUA was badly advised in this respect.

The Federal Ministry of Economics was also very badly advised. The current funding program (500 million euros for fixed air conditioning systems until 2024) will not prevent a single infection this winter. One might wonder why the program runs until 2024, even though we have the infection problem this winter. The explanation is simple: Since the installation of these systems requires complex approval procedures, which in the case of public buildings alone will take two years without a single system being installed, it is clear that the program must run until 2024 for the funds to flow out.

In the long 3rd section, numerous smoke candles are ignited to steer the discussion from the dangerous virus to the harmless CO₂. In section 4, the shortcoming of the room air purifiers is that they do not make a significant contribution to "removing CO₂, excess humidity and other substances from the classroom". As if this emergency situation was about removing relatively harmless substances! At this level, one could criticize the free ventilation, as it is not able to regulate the temperature in the room, introduces fine dust and pollen into the room and lowers the humidity in winter, so that the mucous membranes dry out and the risk of infection is increased. The method that has been used up to now to remove CO₂ from the room can of course still be used, even if room air cleaners are now being used. The UBA recommendation in section 4 to retrofit stationary supply and exhaust air systems installed in the windows illustrates a certain lack of reality. Why should systems be installed that are significantly more expensive and less energy-efficient than mobile room air cleaners and whose installation requires a time-consuming approval procedure, as well as specialist companies that carry out the installation? The many applications for small construction measures alone would completely overtax the authorities. The implementation of this proposal is not only expensive, but also protracted.

In section 5, mobile air purifiers are discredited long and wide with claims that are false. It is tried to present the mobile air purifiers as something complex, so that people are deterred from using them, although these devices are as easy to use as a hair dryer. Indoor air purifiers are not innovations that came up in the context of SARS-CoV-2, rather they have been used in many areas for many decades. Then it is suggested that technical competence is required for installation, although several independent studies have shown that this is not the case. In many schools and companies the devices are already being operated without problems. Finally, it is claimed that the equipment requires "regular professional maintenance", which is completely misleading but has a deterrent effect. Class H14 filters can remain in professional mobile air purifiers for years (in hospitals, the first inspection is made after 5 years to see if the filters need to be replaced) and replacing them is as easy as replacing a vacuum cleaner bag in the home.

It is interesting to follow how the air purifiers are regularly bad-mouthed in the media with the argument that it has not been proven that the mobile air purifiers can really reduce the risk of infection. Apart from

the fact that there is no such proof for free ventilation by means of windows or air conditioning systems, this claim is completely absurd. According to everything we know, the risk of infection increases with the viral load in the room and thus with the concentration of aerosol particles and the length of time spent in the room. The probability of infection is therefore reduced if the viruses are removed from the room or deposited in a place where they cannot be inhaled. To claim that this trivial fact has to be proven in the case of indoor air purifiers is unrealistic.

On the basis of weak data, it is repeatedly claimed that children and adolescents are not infected in schools, even though they sit together for many hours at a distance of 0.5 m from mouth to mouth and exchange a lot of social information. Instead, it is claimed that parties dominate the incidence of infection. The problem is certainly not parties in particular, but rather the cramped togetherness, no matter whether in the slaughterhouse, at choir rehearsals, in the nursing home or in residential accommodation. Why the cramped conditions in schools should not lead to infections is physically inexplicable. As soon as the probability of infections increases significantly, reality will immediately show that the virus spreads massively everywhere where people are cramped together and thus also in schools. Then schools will be closed in panic and there will be a lockdown in many areas because in the last few months there has been insufficient provision. The children will then have to pay off the immense costs arising from a lockdown over many decades. It is most regrettable that the children are not protected, but are expected to carry the debt burden over the next 3-4 decades, which will now be created by the upcoming lockdowns. It is high time to create conditions that will allow classes to be taught in a largely safe environment even when infected people are in the classroom! A concept that points in this direction has already been scientifically analyzed, see <https://www.unibw.de/lrt7/schulbetrieb-waehrend-der-pandemie.pdf>.

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