VITESY

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REOPEN SAFELY WITH ETERIA

“AIR BUBBLE” ANALYSIS

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The context

A safe return to the office

Return to the office Post Covid-19

The COVID-19 pandemic that hit us has forced many employees around the world to work from home.

For companies, understanding and applying the best policies for returning their employees to the workplace will ensure improved employee confidence and thus productivity, ensuring business success.

For entrepreneurs, the crucial factor for success in bringing people back to the workplace is to instill trust in their employees and gain their acceptance.

In a survey conducted in late 2020 by ***WeWork***, in collaboration with ***Brightspot strategy***, it was found that after spending many months in *smart working* during the COVID-19 pandemic, the **majority of employees want to return to the office.**

Working in the office can be enjoyable and fun, but not only that: it improves **personal well-being and enhances the experience of corporate culture**

The study shows that returning to the office provides net benefits:

+3,1%

INDIVIDUAL PRODUCTIVITY

Increase in individual productivity

+6,1%

COLLABORATIVE PRODUCTIVITY

Increase in collaborative productivity / team work efficiency

+4,2%

WELLNESS

Increase of personal well-being

+8,0%

EXPERIENCE

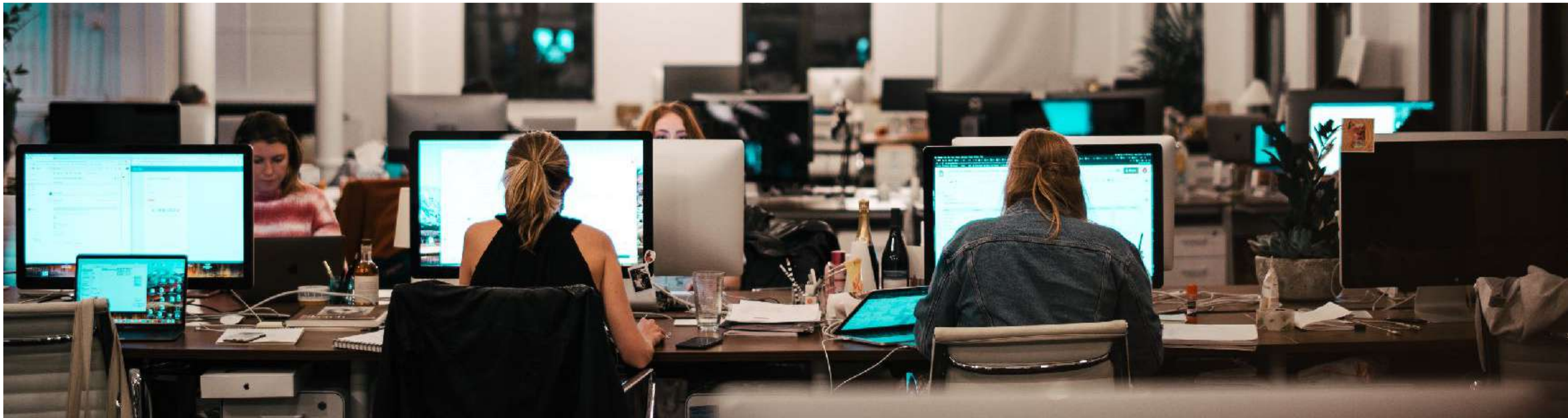
Increased experience of corporate culture

Indoor Air Pollution

WHO has defined indoor air quality as up to 5 times more polluted than that found outdoors.

Multiple pollutants are dispersed in indoor environments, which can make the quality of the air you breathe at home or at the office very low. Air quality strongly affects the well-being of people within the work space. Many studies show how **improving indoor air quality improves people's cognitive abilities and productivity and reduces absenteeism due to illness** *(see article 1 and article 2 on our blog about this topic).*

Clean air also **prevents** the onset of **symptoms** such as: drowsiness, headaches, exhaustion, poor concentration, burning eyes, breathing difficulties such as throat and nose discomfort, asthma and allergies, which are **typical of the *Sick Building Syndrome*.**



Pollutants in the office

The workplace is ranked as one of the most unhealthy places people probably live in on a daily basis.*

Today's workspaces have changed, with companies increasingly preferring shared spaces over isolated workstations.

Research by *Initial Washroom Hygiene* suggests that in shared environments–where workers share desk space or work on a different workstation each **day-desks contain one-fifth more germs than desks used by a single person.** This greatly increases the risk of disease and infection transmission.

**Dr Lisa Ackerley, hygiene expert and visiting professor at the University of Salford.*

It’s not only Covid-19

INDOOR AIR.

The COVID-19 pandemic has raised public awareness of air quality and health risks.

There are many sources of pollution in enclosed spaces, which greatly affect the quality of life of employees.
The pollutants most commonly detected in the office are categorized as follows:

- **Chemical:** mainly Volatile Organic Compounds (VOCs);
- **Particulate:** mainly airborne solid particulate matter (PM2.5);
- **Biological:** bioareosols mainly emitted by humans (droplets).

One of the reasons indoor air is dangerous in spaces occupied by multiple people is the presence of **microorganisms**, typically brought in by people spending time in the facility, and this is greatly amplified when **coworking** spaces are used.

Viruses and bacteria emitted or diffused by ill people can be spread by ***three mechanisms**** :

1. **Direct or indirect contact**;
2. **Respiratory droplets** (including larger droplets that fall rapidly near the source and large aerosols with aerodynamic diameters > 5 μm);
3. **Aerosol of fine particles** (droplets with aerodynamic diameter ≤ 5 μm).

**nature.com*

Eteria for personal protection

Airborne droplets can settle on any surface, even on the furthest desks, making them contaminated.

To evaluate the effectiveness of Eteria in this situation, one of our offices was taken as a reference room. The space measures (5.35 x 5.10 x 3) m, totaling about 82 m^3 and three people were assumed to be inside it working spaced according to **anti-Covid standards.**

Eteria's optimal location is on every desk, one per person.

The Test was conducted in collaboration with Iefluids, a spin-off of the University of Trieste.

In this way, **its purifying effect acts as a protective bubble for desk occupants,** as a defense against people coughing and inevitably emitting droplets, which are potentially unhealthy and rich in microorganisms.

Analysis 1 - Prevention of droplets' diffusion

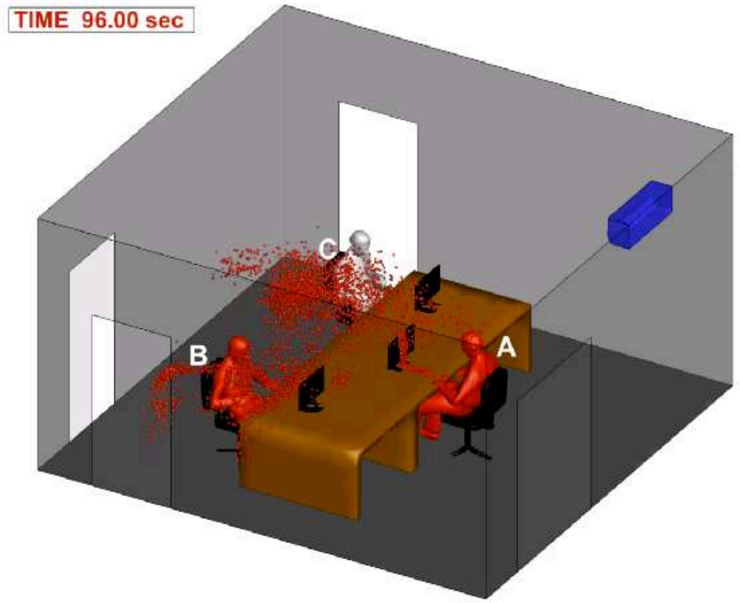
After a thorough review of the scientific literature, **a CFD** (*Computational Fluid Dynamics*) **analysis** was performed in the situation identified as having the **highest risk** and **most frequent** in terms of particle diffusion, which is when the ill person (**A**) produces a **coughing fit.**

When **A** emits a cough, the particles spread throughout the room according to the physical laws that govern their motion. Without Eteria the two people **B** and **C** are hit by the particles emitted by the ill person and can become infected; the remaining particles spread throughout the room, settling on surfaces.

By repeating the simulation **with the Eteria system, the % of particles that come into contact with the two people is reduced to 0:**

Eteria captured 98 percent of the total **particles** emitted by the sick person that could infect others, protecting the people in the room.

WATCH THE VIDEO



With Eteria

Without Eteria

Effective against SARS-CoV-2 Virus

Eteria not only captures pollutants but also **destroys** them, as is the case with **SARS-CoV-2**, the virus responsible for **covid-19 disease**.

Vitesy's WO_3 Photocatalytic Technology can produce an average viral titer reduction of **97.18% in just 20 minutes** of contact with the inoculated viral suspension on the filter itself, and **over 99% in 4 hours.**

Referring to the CFD analysis just discussed, if person **A** had **covid-19 and coughed, thanks to Eteria the probability that the emitted aerosol particles had come into contact with other people inside the room would be greatly reduced.**

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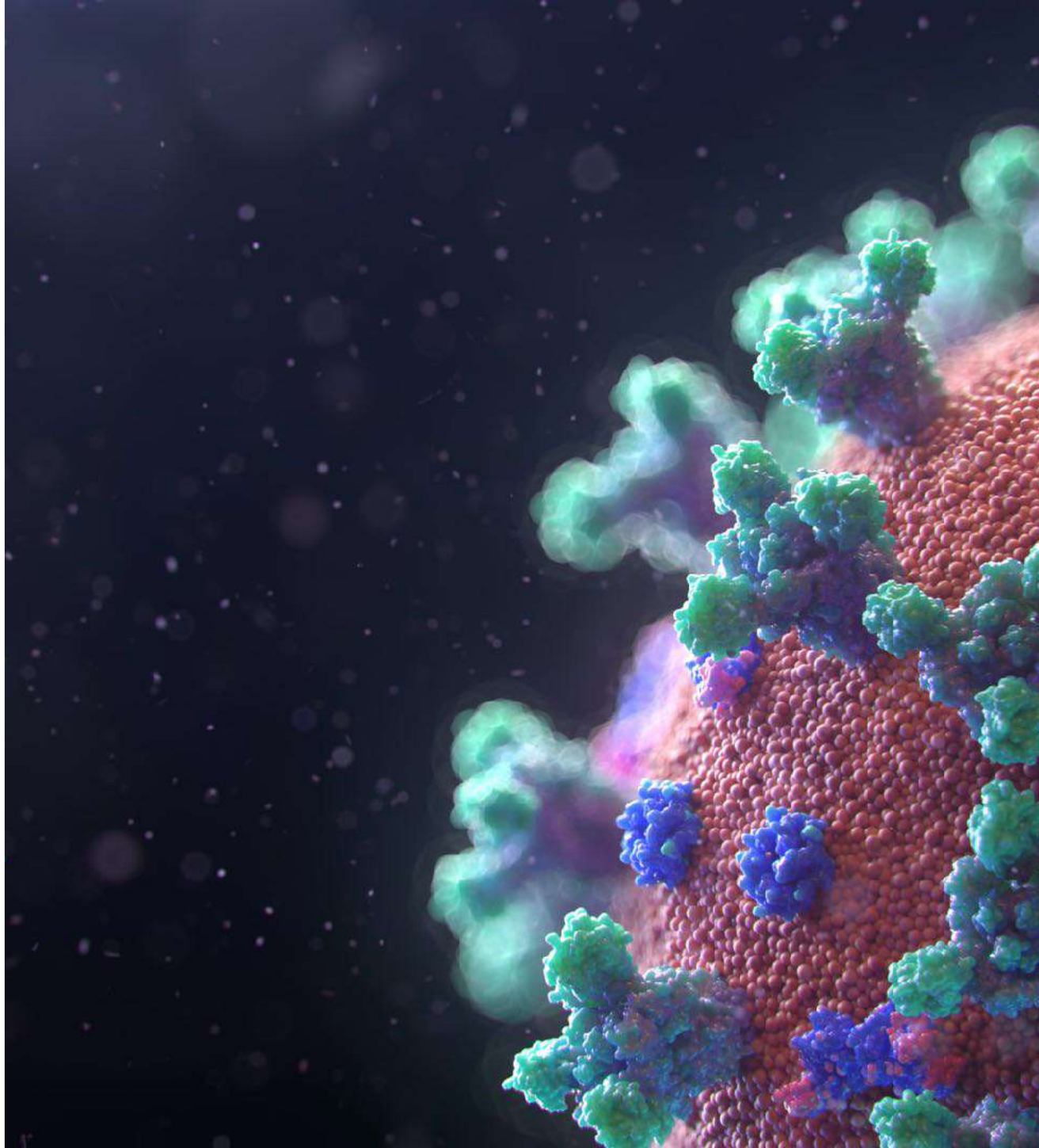

Pollutant abatement performance of Eteria

Eteria is able to remove microorganisms, gaseous compounds, and fine particulate matter, which are the indoor pollutants that can form in both home and work spaces, from the air we breathe, creating a clean air bubble in which to breathe peacefully.

Specifically, it **was tested on the following pollutants and showed the following performance**

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Pollutant		Abatement	Time
Microbiological agents	Bacteria	95,76%	24 hours
	Molds and Yeasts	99,95%	24 hours
	SARS-CoV-2 Virus	97,18%	20 minutes
Nitrogen-based compounds	NOx	97,8%	1.5 hours
Smells	Benzyl mercaptan	97,76%	1.5 hours
COV	Pyrazine	80%	1 hour
	Limonene	70%	1 hour
	BTEX	86%	1 hour
	Formaldehyde	85%	1 hour
Particulate	PM2.5	72,0%	3 hours
	PM10	52,4%	1 hour

Analysis 2 - Reduction of a homogeneously dispersed pollutant

SIMULATION OF A BORDERLINE SCENARIO

We performed a **CFD** (*Computational Fluid Dynamics)* virtual fluid dynamic analysis in collaboration with Iefluids, a spin-off of the University of Trieste, to evaluate the fluid dynamic performance of Eteria. We analyzed 2 scenarios:

1. **Eteria** used **as a personal purifier**: a single unit placed on the desk near a single user;
2. **Eteria** used **as a system for capillary air purification**, in which an Eteria is associated with each user (for a total of 3 devices), evaluating the synergy of operation

In the simulations, we considered a **homogeneously dispersed pollutant** whose **concentration**, throughout the room, is **100%**.

This is an **extreme situation**, since with these values there would be no space for the molecules that make up the air,

such as oxygen (21%) or nitrogen (78%): however, it is a useful situation to realize the Air Purification effectiveness of Eteria.

When particles are treated with Eteria they mix with the rest of the air, decreasing the concentration of pollutant present.

Eteria as a personal purifier

The clean air bubble generated by 1 Eteria (**personal purifier**) in a single hour was analyzed. At the initial instant of the simulation, the air bubble is completely red, meaning that the % of pollutant is 100%.

In 1 hour, we can see how the concentration changes from red to dark green values, that become then lighter and lighter, symbolizing **a reduced and contained concentration of the pollutant.**

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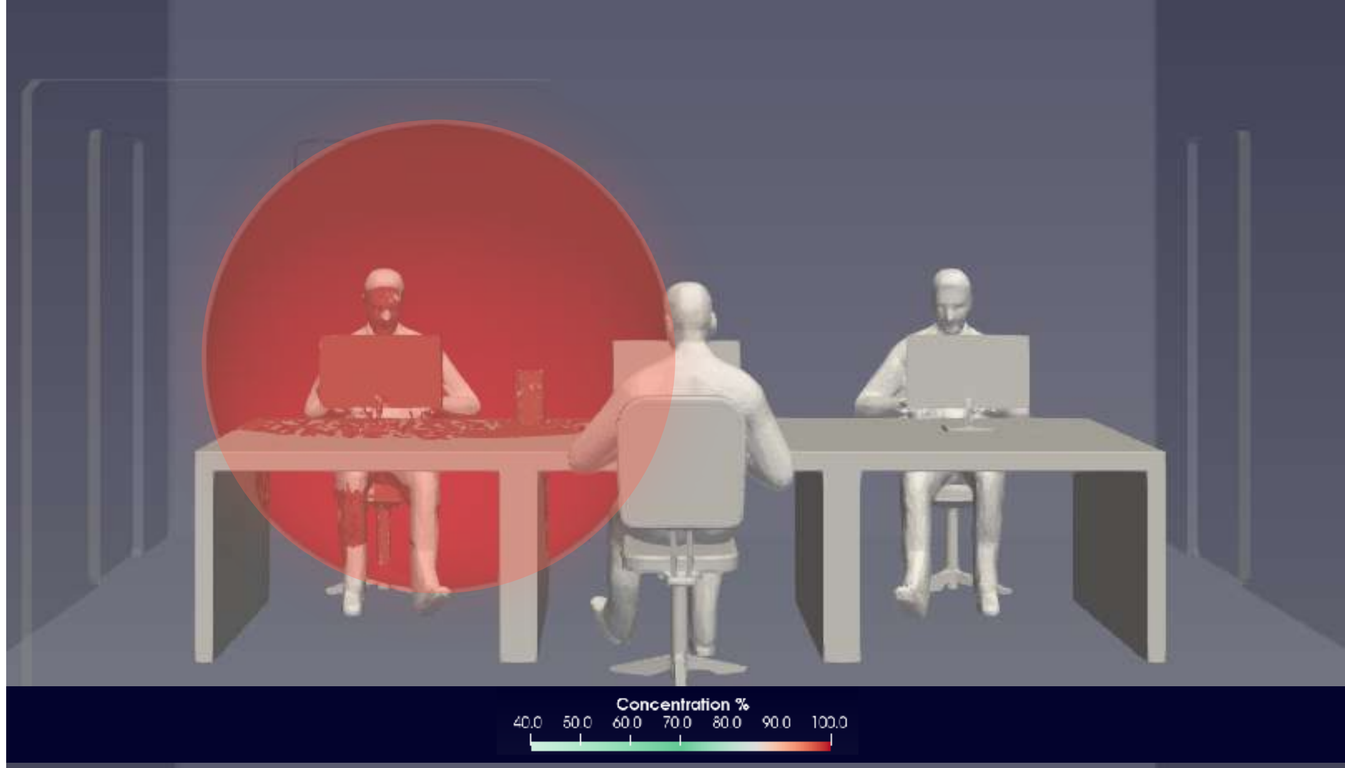
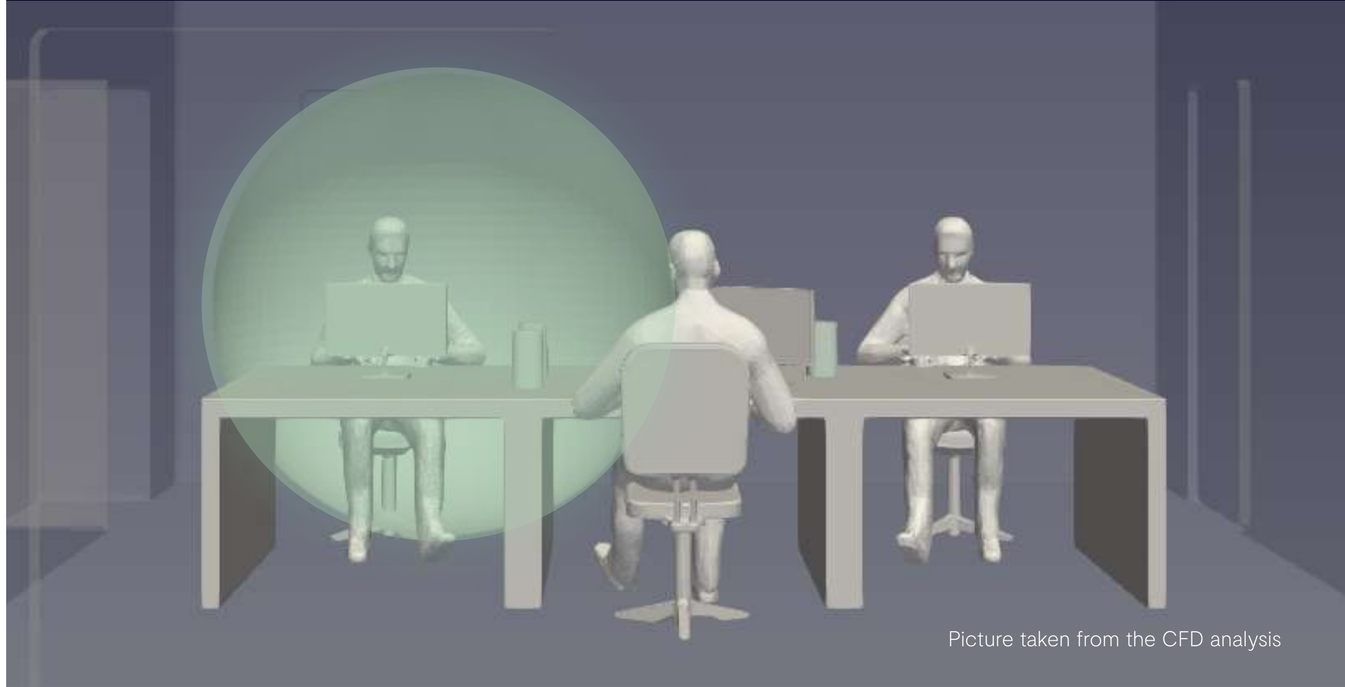
INITIAL CONCENTRATION



CONCENTRATION AFTER 1 HOUR



Picture taken from the CFD analysis

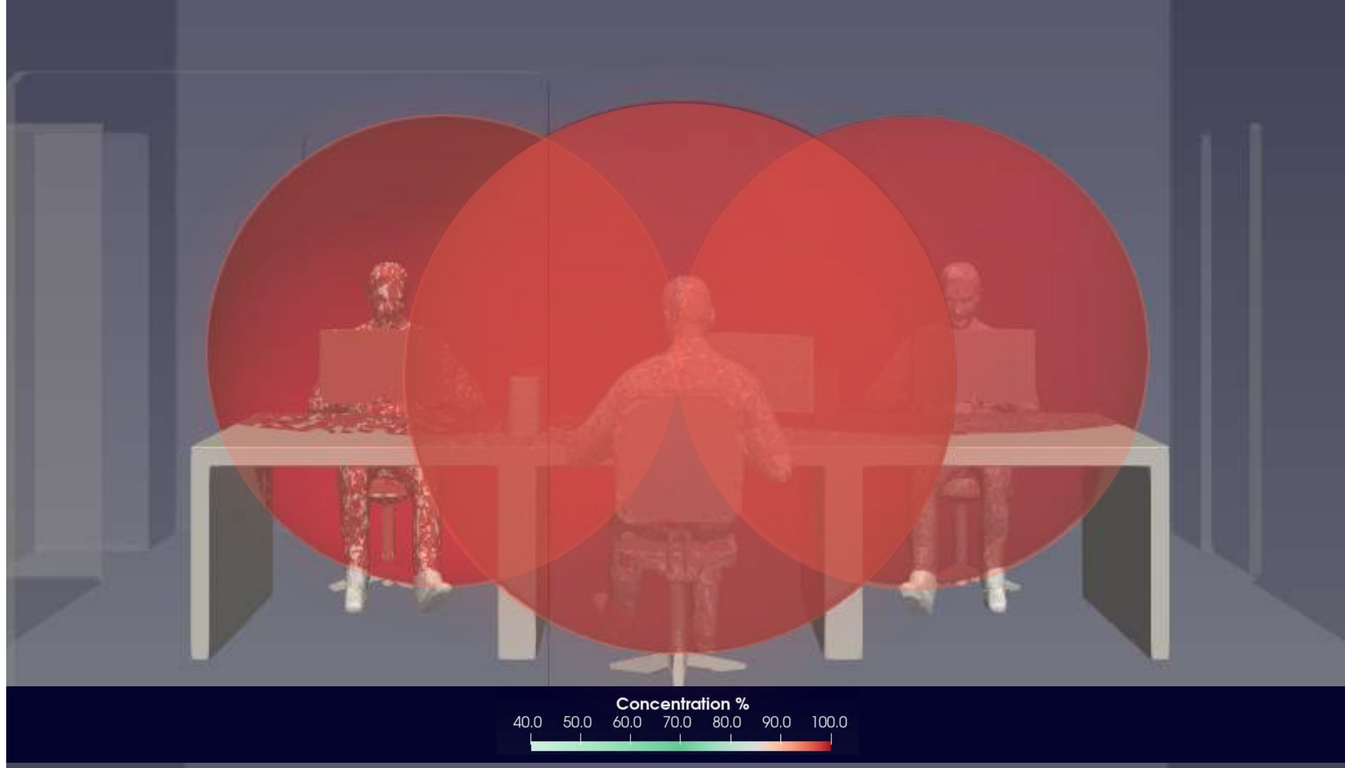
Eteria as a capillary purification system

The clean air bubble generated by 3 Eteria (**capillary air purification**) in a single hour was analyzed. At the initial instant of the simulation, the air bubbles are completely red, meaning that the % of pollutant is 100%.

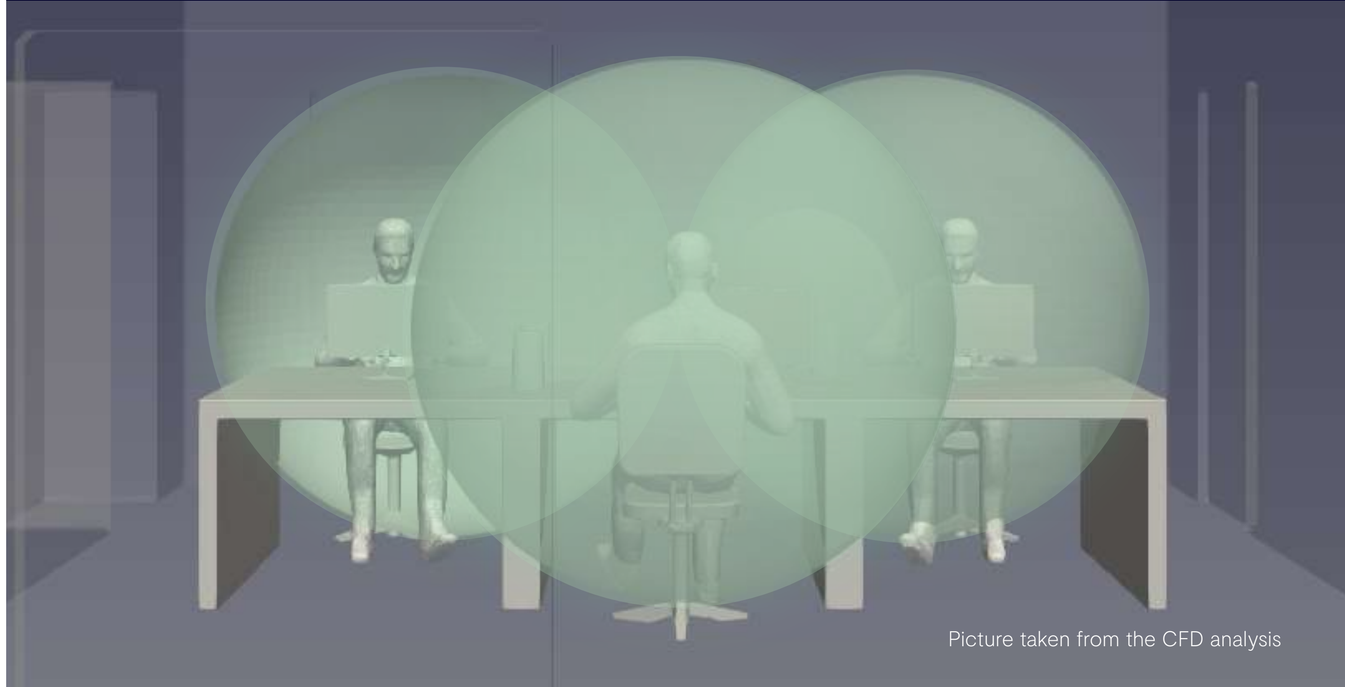
The capillary purification results show how the synergy of multiple systems are able to act even faster against the pollutant, processing **as much as 60 percent of all the pollutant in the room in as little as one hour.**

WATCH THE VIDEO

INITIAL CONCENTRATION



CONCENTRATION AFTER 1 HOUR



Picture taken from the CFD analysis

Effective against microbiological pollution

When particles are processed by Eteria's photocatalytic filter, they are **not simply blocked**, as is the case with air purifiers that rely on disposable technologies such as HEPA filters and activated carbon. In fact, Eteria is able to **break down pollutants into harmless molecules** and eliminate or inhibit microorganisms that are present in the air. As evidenced by laboratory tests *(see previous slide)*, Eteria is capable of very high abatement performances against microbiological pollutants (viruses, bacteria, molds and yeasts).

BACTERIA: Over a 24h period, Eteria **kills an average of 95% of bacteria in the air**, with significant reductions already in the first 5 hours. In the specific case of **Gram negative (-) bacteria**, which are typically the **culprits of the most serious diseases**, the performance is **even greater (99.9%)**. Belonging to the Gram negative bacteria family are, among others, *Escherichia coli*, bacteria belonging to the genus *Salmonella*, *Klebsiella pneumoniae*, *Helicobacter pylori*, and bacteria belonging to the genus *Shigella*.

Gram-negative bacteria, in addition to having a thicker cell wall, consist of highly adaptive pathogens and are the cause of the most common intra-abdominal infections, tract infections high adaptive capacity and are the cause of the most common intra-abdominal infections, urinary tract infections, and nosocomial (i.e., hospital-acquired) pneumonias. According to data from the 2015 Antimicrobial resistance surveillance in Europe project, *Klebsiella Pneumoniae*, *Escherichia coli*, and *Pseudomonas aeruginosa* apportion 70% of all Gram-negative pathogens causing intra-hospital infections.

BACTERIOLOGICAL RISK REDUCTION: Analyzing the guidelines about microbiological pollution by CONTARP ("Technical Consultancy Risk Assessment and Prevention" - unit of Italian governmental body INAIL "National Institute for Insurance against Work-related Injuries") *(see side table)*, it can be seen that Eteria with this performance is able to **bring the category of bacterial microbiological pollution** (specifically, Gram negative) from a category tending toward intermediate to one where the **bacterial load is very low** in home and office environments.

MOLDS AND YEASTS: Eteria also performs extremely well on molds and yeasts, **eliminating 99.95%** of them within 24 hours.

CONTARP GUIDELINES

Microbiological pollution category (bacterial)	Homes (CFU/m3)	Non-industrial environments (CFU/m3)
Very low	< 100	< 50
Low	< 500	< 100
Intermedia	< 2500	< 500
High	< 10000	< 2000
Very high	> 10000	> 2000

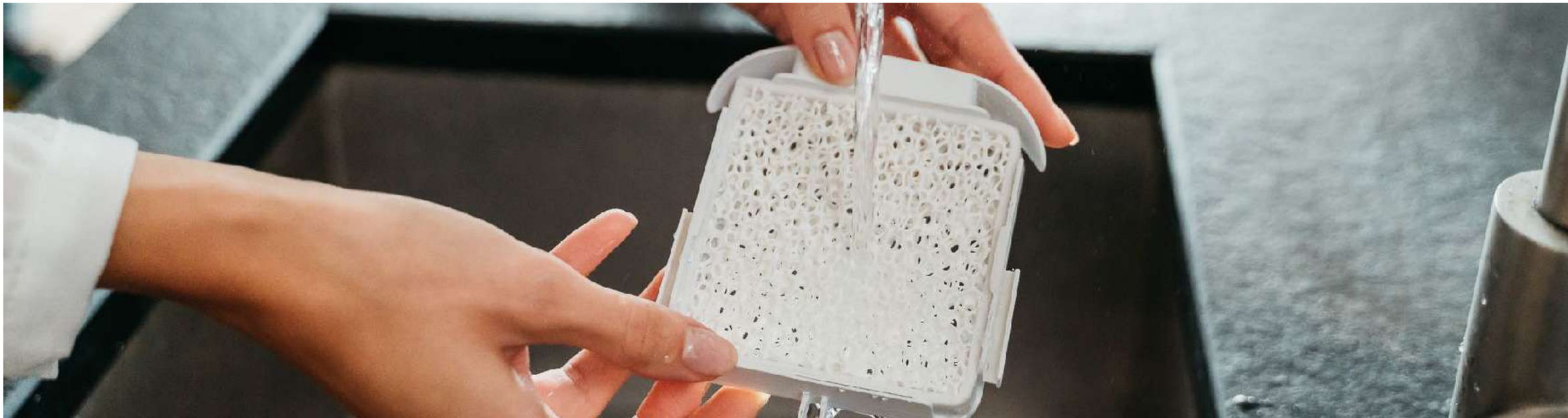
Washable filters: sustainability and saving

Eteria's photocatalytic filter is eternal, which is an interesting fact from the point of view of **environmental sustainability.** Through simple periodic maintenance, in fact, the user can **regenerate the filter** and use it for a long time.

The **fabric pre-filter too** is **machine washable**, easily and without the need of any specialized detergent.

The **benefit** is not only **environmental** but also **economic**. In fact, purifiers with **HEPA filters require periodic filter replacements** (1 to 4 times a year) with costs ranging from 20-25% to 35-40% of the purchase cost of the purifier itself.

Opting for a solution with washable filters such as **Eteria provides significant savings, quantifiable in hundreds of euros per year** already in small offices.



Environmental Comfort

Due to the possibility of being positioned close to the user, Eteria can move little air while maintaining a high pollutant abatement performance. In this way, it is possible to ensure:

1) Better environmental comfort
* for people spending time in the room (the suitable velocity of air moved in a room should not exceed 0.2 m/s at any point in the room);

2) Lower energy consumption of the product *(about 50 percent less than an ordinary air purifier)*, which translates into economic savings for the user but also greater environmental sustainability.

Source: *Ministry of Health of Italy*

Operational Tips

Based on the considerations made following the CFD analysis and pollutant abatement tests, **we suggest the following guidelines for installing Eteria systems in your offices:**

1. Providing **1 Eteria for each employee** is the optimal situation, however, should the arrangement of desks allow, one can consider placing one Eteria for every two workers, trying to place it equidistant between the two people.

2. During **meetings** where there are several people sitting around the same table, it is advisable to place **at least 2 Eteria systems** placed 1.5 meters apart.

3. It is important that **Eteria's Air Purification unit is always on**, preferably in STANDARD mode but, if the noise level is excessive, **also in SILENT mode**.

4. In any case, we recommend that you **operate the STANDARD or PERFORMANCE mode** when you step away from your desk for at least 5 minutes to **maximize the purification effectiveness.**

5. Eteria **performs best** when placed at least **40-50 cm from the workstation.**

6. We recommend periodic **maintenance** on filters, specifically:
   - The **pre-filter** should be machine washed at least **1 time every 3 months;**
   - the **photocatalytic filter** should be washed under running water at least **1 time every 6 months.**

By following these quick and simple tips, the **effectiveness of technology will always be maximized and protect employees to the fullest.**

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