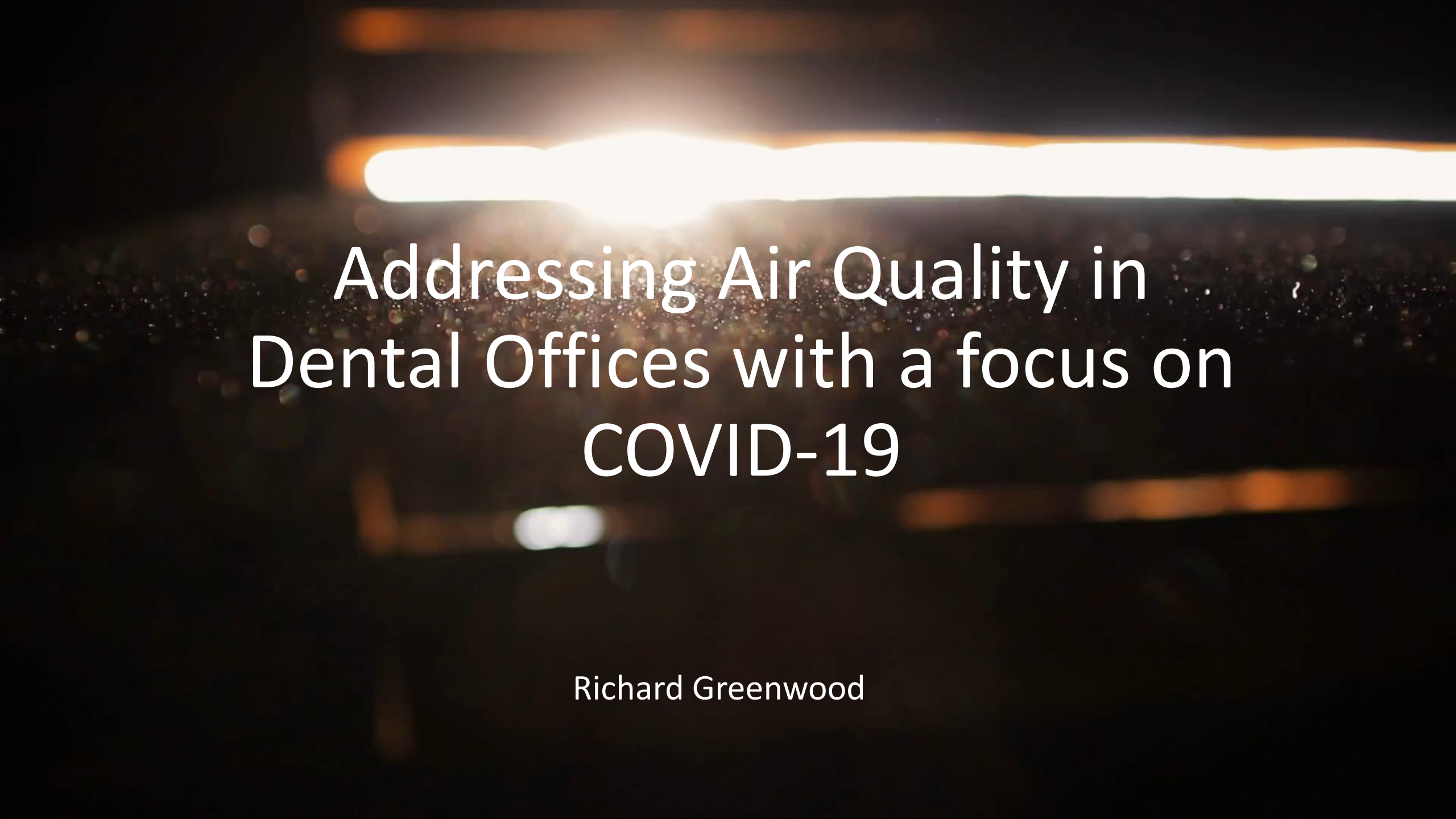


Addressing Air Quality in Dental Offices with a focus on COVID-19

Richard Greenwood

There are four disease transmission routes

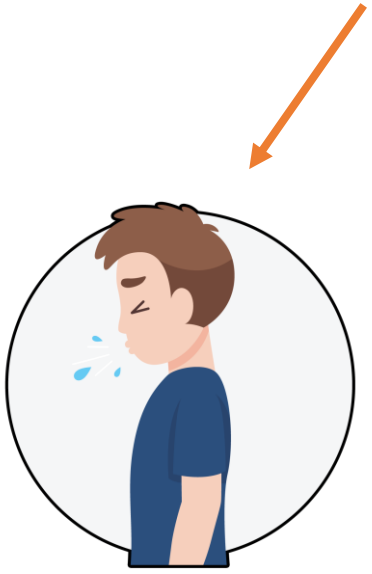
In the West, not enough is being done against these two:

1. Direct contact

Coming in contact directly with an infected person. (i.e. handshake)

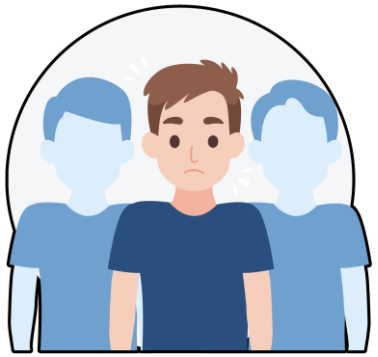
2. Indirect contact

Coming in contact with an infected object. (i.e. door handle after an infected person has interacted with it)



3. Droplet

Coming in contact with droplets from an infected person. (i.e. saliva droplets from a sneeze)



4. Airborne

Coming in contact with airborne, microscopical particles coming from an infected person. (i.e. sharing a room and breathing the same air.)

Its not all about COVID-19

We will never go back to ‘normality’ again.

But we seal ourselves up in energy efficient boxes and have growing amounts of air indoor pollution to deal with, including viruses.

Spending money on an ‘air pollution solution’ should deal with as much of the problem as possible.

What is the problem?

- Particulate matter
- Dust
- Pollen
- Dander

- Viruses
- Bacteria
- Mold
- Fungus

- Extremely small particles
- Gases

AIR PURIFICATION

Are filters effective on trapping the viruses?

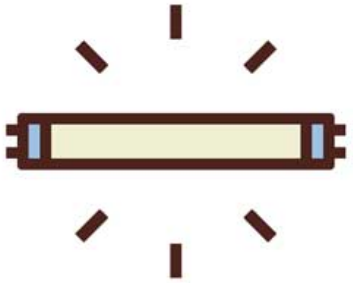
Here is a table of MERV filter model filtration efficiency, see on Coronavirus that the higher the grade, the more effective the filter is, a MERV 15 has a 68% efficiency on SARS (i.e., SARS-CoV-1), which is similar to SARS-CoV-2 (the virus that causes COVID-19).

Airborne Nosocomial Pathogen Removal Rates

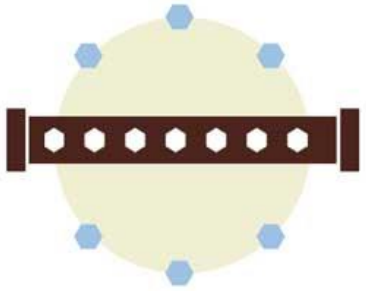
Microbe	Size (µm)	MERV Filter Model Filtration Efficiency (%)								
		6	8	9	10	11	12	13	14	15
Parvovirus B19	0.022	21	32	35	40	52	72	89	97	98
Rhinovirus	0.023	21	31	34	39	51	70	88	97	98
Coxsackievirus	0.027	19	29	31	36	47	66	85	96	97
Norwalk virus	0.029	18	27	30	35	45	64	84	95	97
Rubella virus	0.061	11	16	18	21	28	43	62	82	84
Rotavirus	0.073	9	14	15	18	24	38	57	77	79
Reovirus	0.075	9	14	15	17	24	37	56	77	79
Adenovirus	0.079	9	13	14	17	23	36	54	75	77
Influenza A virus	0.098	7	11	12	14	19	31	48	69	71
Coronavirus (SARS)	0.11	6	10	11	13	18	28	45	66	68
Measles virus	0.158	5	8	9	10	15	24	38	59	63
Mumps virus	0.164	5	8	9	10	14	23	38	58	63
VZV	0.173	5	8	8	10	14	23	37	58	63
Mycoplasma pneumoniae	0.177	5	7	8	10	14	23	37	58	63
RSV	0.19	5	7	8	9	14	23	37	58	64
Parainfluenza virus	0.194	4	7	8	9	14	23	37	58	64
Bordetella pertussis	0.245	4	7	8	9	14	23	38	61	68

Independent studies show aerosolised viral penetration of HEPA filters. (Long et al., Biosafety 2012 & Joseph D. Wander, Air Force Research Laboratory, 2007)

Common Technologies to inactive particles in air

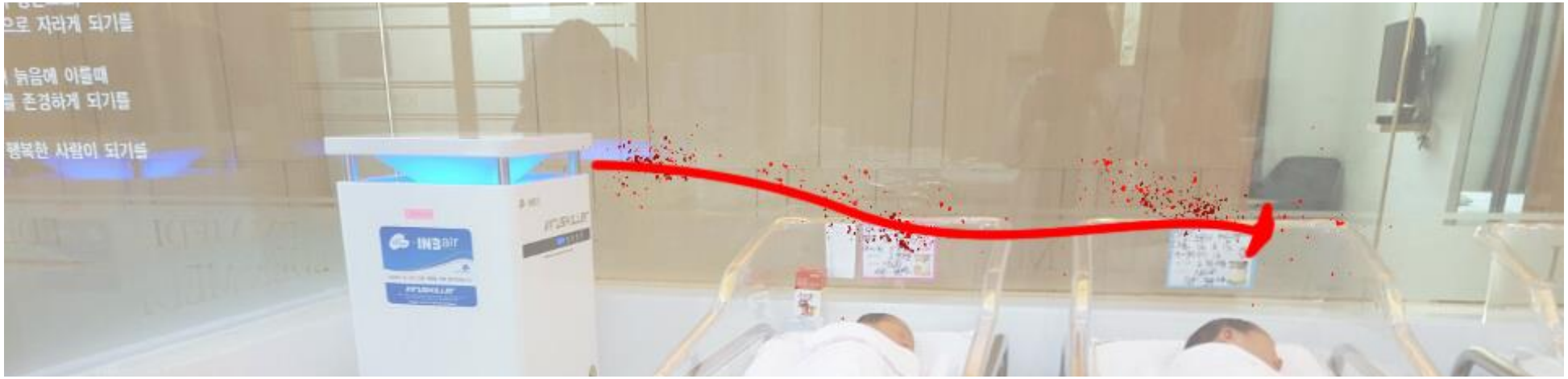


UV Radiation,
Photocatalytic Oxidation
Heat
Plasma
Ionization

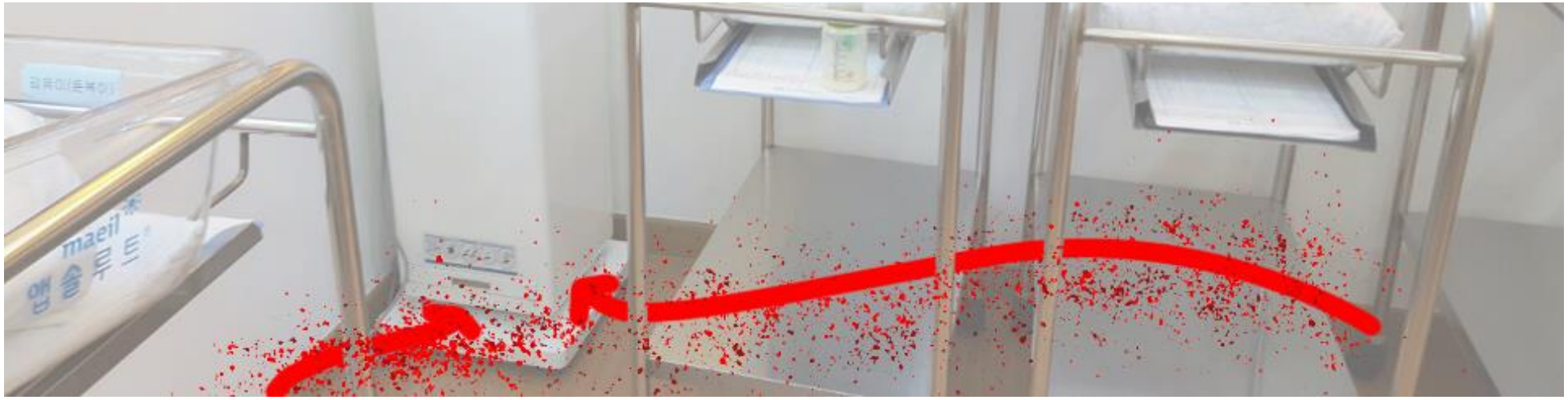


One of the common downfalls of air inactivation technologies is dwell time with forced airflow.
It is common practice for air inactivation to be tested over a period of time within a test chamber but if we go back to the comment about viruses:

If we are pulling a virus out of the breathing zone and processing it through clean air technology, is it acceptable for some of that virus to be distributed back into the breathing zone?



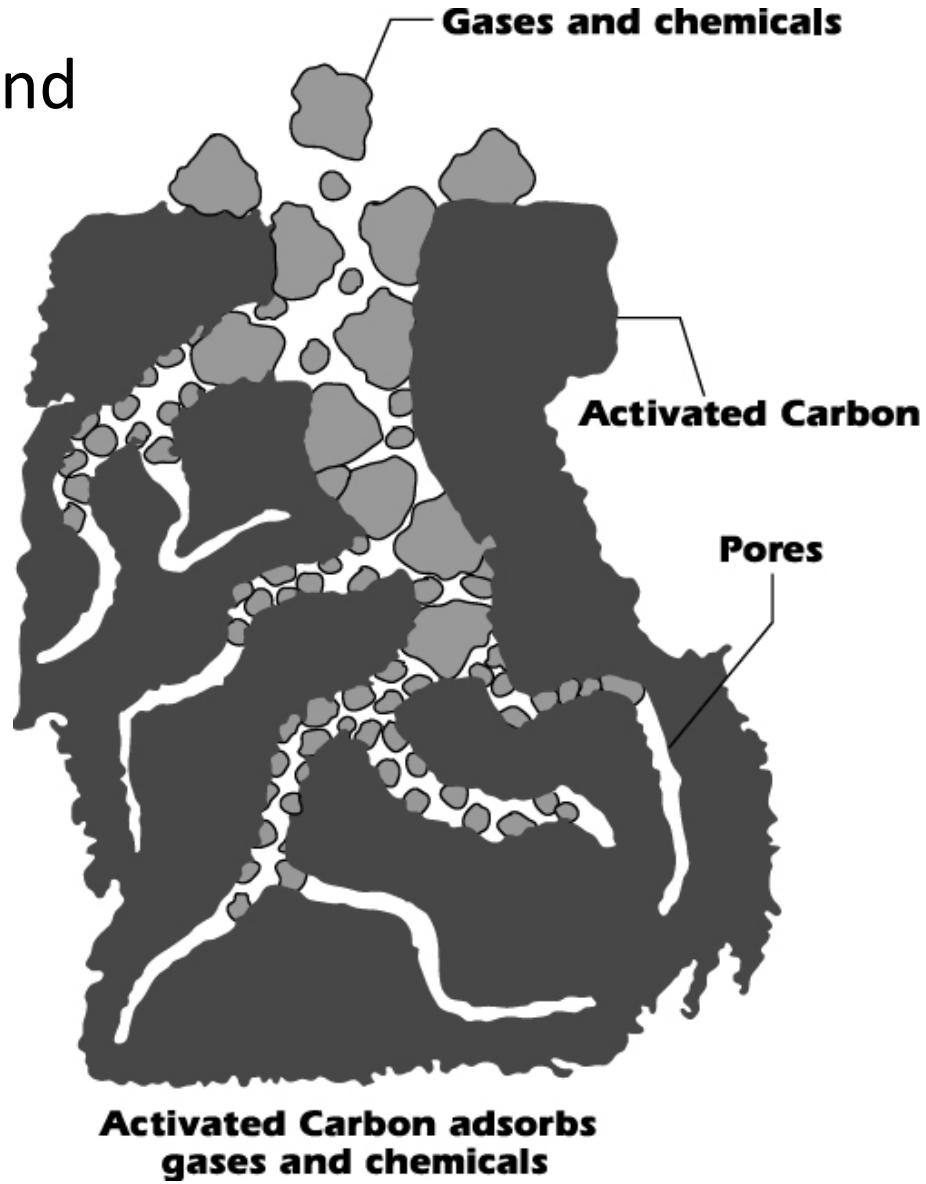
For this reason, I believe that single air pass test results should be used to give virus kill rates, not chamber test results that can be confusing at the best of times.



Gases and VOC’s

The most common way of dealing with gases and volatile organic compounds is to use activated carbon filters.

Activated carbon works via a process called adsorption, whereby pollutant molecules in the fluid to be treated are trapped inside the pore structure of the carbon substrate.



Airflow

The starting point to any clean air technology implementation should be the airflow that it creates.

The objective is to pull polluted air out of the breathing zone, process the pollution and disburse clean air back into the breathing zone.

Note: airflow and air exchanges are two very different things and creating the wrong airflow can cause further infection risk

Generally: The tighter the building envelope, the worse the indoor air is.

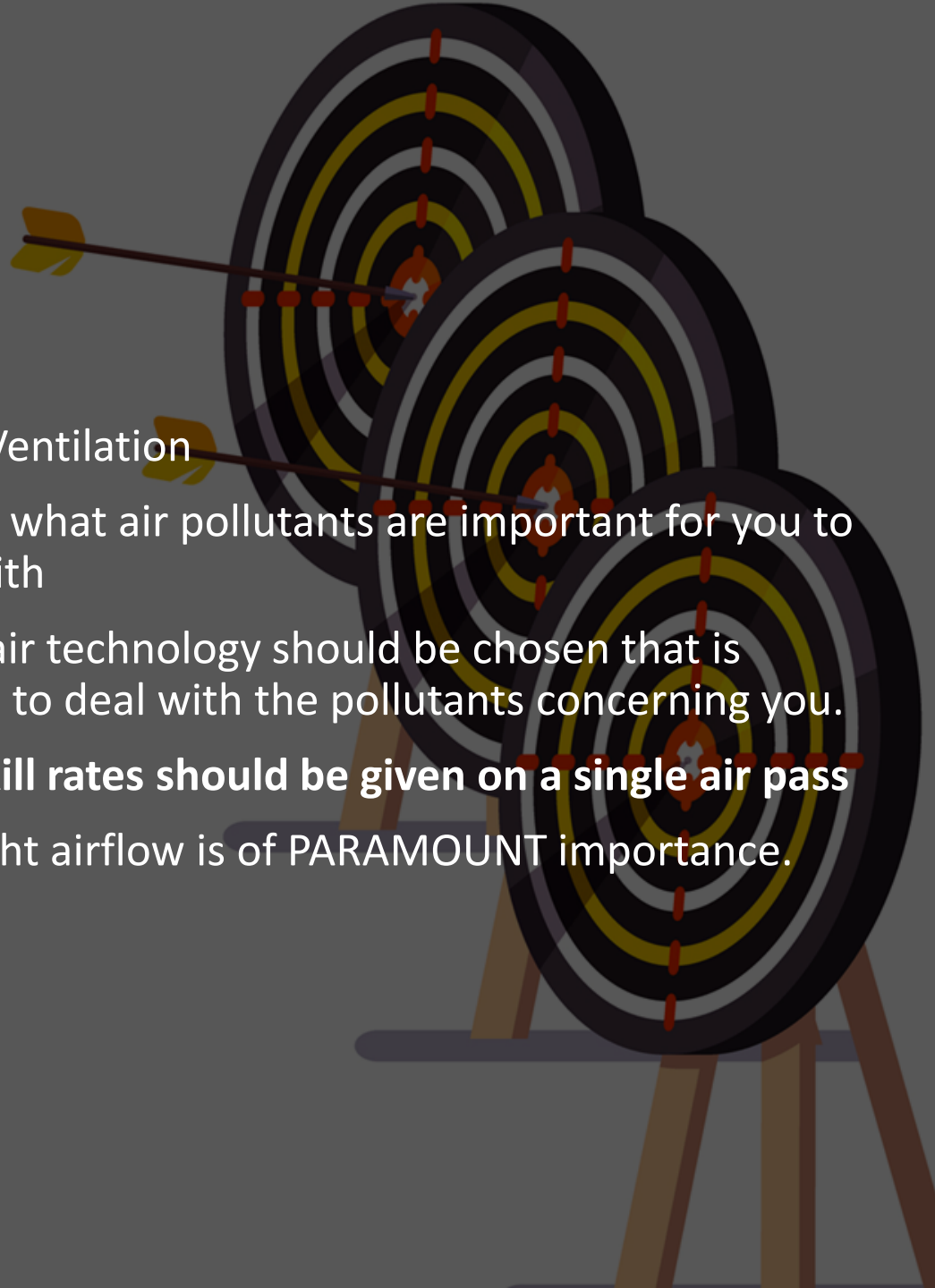
Most people think that if they seal themselves indoors and turn on an air purifier, they will be safe.

Clean air technology is something that should be a standard part of modern day life, we are the indoor generation.

You take an average of 20,000 breaths per day and release on average 500 litres of CO2 per day

CO2 is the elephant in the room and the reason that good ventilation should form a major part of your clean air strategy

Recommended Solutions.



- Good Ventilation
- Decide what air pollutants are important for you to deal with
- Clean air technology should be chosen that is proven to deal with the pollutants concerning you.
- **Virus kill rates should be given on a single air pass**
- The right airflow is of PARAMOUNT importance.

Viruskiller™

Viruskiller™ is a clean air technology that was funded by the South Korean Government as an emergency response to the 2003 SARS outbreak (i.e., SARS-CoV-1).

It was developed by a consortium on universities and Government bodies.

Its main strengths are:

- **SINGLE AIR EXCHANGE KILL RATES**

The technology is able to help kill viruses in a *single air pass through the unit.*

- **AIRFLOW CONTROL**

Designed in partnership with the Korean Aerospace University, the units have unparalleled airflow control in just about any indoor environment. They draw contaminated air out of the breathing zone and into the unit, help to purify it in a single air pass and release safe air back into the breathing zone

- **PROVIDES EXTRA LAYER OF PROTECTION IN ADDITION TO PPE**

Although it is impossible to eliminate risk, when used in addition to PPE, Viruskiller™ can help reduce exposure