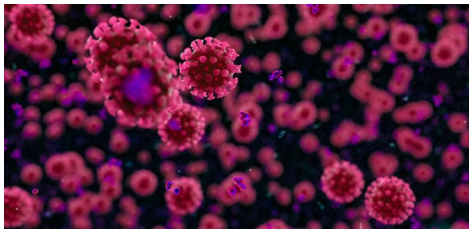
THE UNFILTERED TRUTH ABOUT RESPIRATORS



Coronavirus

The ***World Health Organization (WHO)*** has given the name "**COVID-19**" to the ***disease*** caused by the virus, while the ***virus*** itself has been assigned the name "**SARS-CoV-2**" - for *severe acute respiratory syndrome coronavirus 2*. This follows the practice of assigning a different name for the disease and virus (e.g. AIDS and HIV). To avoid confusion with the previous SARS virus, the WHO has decided to use "**COVID-19 virus**" to refer to the ***Coronavirus*** when communicating with the public.

Respirator Filter Material

The ***National Institute for Occupational Safety and Health (NIOSH)*** has established a series of standards for testing and approving the *filter material* used in respirators, whether it comprises the entire mask, or resides in a replaceable cartridge. Filters have three different levels of filter efficiency (95, 99 and 99.97%) and three levels of oil resistance (N, R

Coronavirus: Risks of Exposure

Health care workers treating patients with ***Coronavirus*** are involved in a dangerous business these days because hospitals, patients, coworkers and their own actions will inadvertently expose them to the virus. **They have a right to know the risks.** They also deserve our deep admiration and gratitude because they, like the fireman who enters a burning building, or the policeman who confronts an armed felon, have a hazardous job.

Let's look at some of those risks:

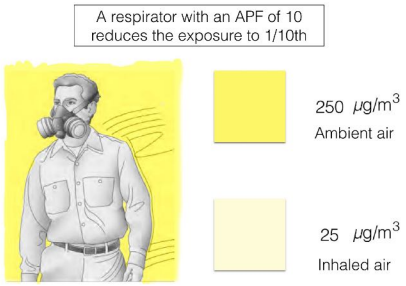
The ***Coronavirus*** is very small, ***0.05 to 0.2 microns*** in diameter (*50 to 200 nanometers*), but it does ***not*** float in the air by itself. It is transported from one person to another on droplets of liquid from sneezing and coughing, and perhaps even droplets produced when speaking. These droplets, or ***bioaerosols***, are typically ***5 microns*** (*5,000 nanometers*) or larger. (A single red blood cell is about 7 microns in length.)

If a person enters the room of a patient with known ***Coronavirus***, there will be a bioaerosol in that room that contains the virus. The concentration of virus in the air will depend on a variety of factors, including whether the patient is wearing a mask, the type and amount of ventilation, and whether there are mechanical air-filtering devices being used.

Limitations of Respirators

Bioaerosols can land on unprotected eyes, and can be inhaled through the nose and mouth. When a person wears a negative-pressure respirator, like a ***N95*** respirator, they will inhale **mostly** ***filtered*** air. They will also inhale a **small amount** of ***unfiltered*** air. Why? ***Because ambient air will inevitably leak around the edges of the respirator, where it contacts the face.*** Even a properly-fitted respirator will develop small, momentary gaps in the face seal when the user speaks, or moves their head, or smiles. To reflect this fact, each type of respirator has a different **assigned protective factor (APF)**.

Warning: All half-face respirators have an APF of 10, regardless of the filter material used. The APF reflects the limitations of a respirator's design. For example, if the airborne concentration of a contaminant known as Compound X is 250 micrograms per cubic meter (µg/m3), then a properly-fitted half-face respirator with an **APF of 10** is expected to reduce the exposure inside the mask down to 25 µg/m3. A properly-fitted full-face respirator with an **APF of 50**, would reduce the exposure inside the mask down to 5 µg/m3.



Respirator Filter Material

For example, a ***N95*** filter is rated as 95% efficient at removing particles of *0.3 microns (300 nanometers)* or larger, but should only be used in atmospheres that do not contain oils. A ***P100*** filter is 99.97% efficient at removing the same sized particles, but it can be used in atmospheres that contain oils, as well as those that do not. 42 CFR Part 84, Subpart K, § 84.181. The ***Federal Food & Drug Administration (FDA)***, in coordination with *NIOSH*, has additional approval requirements to confirm the biocompatibility of surgical masks, before they are labelled "*N95 surgical respirators*". 21 CFR 878.4040.

Common Masks

This not a respirator. It is a common surgical mask, intended to prevent the spread of infection from the **wearer's** *exhaled* breath. It can also protect the wearer from splashes of liquid reaching the wearer's nose and mouth. If it complies with ATSM F2100, it will provide substantial air filtration, but it is ***not*** to be relied upon to protect the wearer from *inhaling* all airborne particles and bioaerosols, since it is ***not*** designed to fit tightly against the user's face.

Killing the Coronavirus

The ***Coronavirus*** is encased in a lipid envelope, *basically a layer of fat*, that makes it vulnerable to desiccation, heat and detergents. It can be easily deactivated on surfaces with bleach, *Lysol,* a variety of disinfectants or UV-C light. Washing your hands with soap and water for at least 20 seconds is also sufficient.

All of these **half-face respirators** have an **APF of 10**. The APF is based on the predicted air leakage from the face seal, ***not filter efficiency***, so the APF will not increase when a more efficient filter material is used. A half-face respirator with a ***N95*** filter, and one with a ***P100*** filter, both have the same **APF of 10**.

A properly-fitted **full-face respirator** has an **APF of 50**.

PAPR
APR = 25

A **powered air purifying respirator** (PAPR) with a hood has an **APF of 25.**

SAR
APR = 1000

A **supplied air respirator** (SAR), that supplies air from an uncontaminated source, with a positive pressure in the mask - *so that when momentary gaps in the face seal develop, air will leak out of the mask rather than in* - can have an **APF of 1,000 to 10,000**, depending on other features.

The term "properly-fitted" is not to be taken lightly. It requires a person with expertise, using a specific protocol, to personally adjust and fit the respirator to the user's face and check for leakage. Otherwise, the actual leakage will be much greater.

The ***assigned protective factor*** for a respirator assumes that the environment in which it is being used has not exceeded the maximum use concentration (MUC) for the toxin. OSHA recognizes that the concentration of a toxin can reach a level where a particular respirator is no longer adequately protective - the *immediately dangerous to life or health (IDLH) level*. Neither a MUC, nor a minimum ***infectious dose***, has been established for ***Coronavirus***. *See*, discussion below.

On a positive note, studies have demonstrated that many respirators perform better than their APF would suggest. The effectiveness of a respirator is always a function of the integrity of the face seal and how well it is maintained during use, and then the efficiency of the filter material.

How Much Protection is Enough?

All N95, N99 and N100 half-face respirators (and the R- and P-variations) have an APF of 10.

Is this good enough? It depends on the toxin. Many toxins have a *no-observed adverse effect (NOAEL) level*, meaning the body seems to be capable of processing a certain amount of the toxin without sustaining any short-term or long-term injury. Either the body isolates the toxin, destroys it, or removes it in some way. In addition, the body may simply be able to absorb a degree of damage caused by the toxin without noticeably affecting any vital functions. These defenses will vary from person to person, and from day to day within the same person.

We know such defenses exist with ***Coronavirus*** to some extent, because of the variability in the response people have when they are infected by the virus. However, its not known how the initial bioaerosol concentration affects this or how it relates to the initial viral load in the body. It may also be a function of where the virus gets deposited in the lung.

More Information

Scan this QR Code with the camera on your cell phone to see the **Centers for Disease Control (CDC)** *frequently asked questions* about masks and other personal protective equipment (PPE) for use with the ***Coronavirus***.

The ***Occupational Safety and Health Administration (OSHA)*** has created a webpage to provide information to employers and workers about ***control and prevention*** of exposure to the ***Coronavirus***.

The ***National Center for Biotechnology Information (NCBI)*** offers an excellent online resource entitled "***What you need to know about infectious diseases***", that includes sections on how infection works, prevention and treatment.

The **Department of Homeland Security (DHS)** is publishing a weekly updated newsletter that outlines the progress of ongoing research into what is currently ***known*** and ***unknown*** about the ***Coronavirus***.

HEUBECK LAW, P.C.
Toxic Injury & Defective Products Litigation

John C. Heubeck, Esq.
400 Continental Blvd., 6th Floor
El Segundo, CA 90245
john@HeubeckLaw.com
(424) 218-5424

A concept exists in the study of infectious diseases known as the ***infected dose*** or the ***infectious dose***, which is the number of pathogen cells required to infect the host. Sometimes it is expressed as the ***ID50***, which is the minimum dose needed to infect 50% of the people exposed. The infectious dose varies by the specific pathogen and type of strain. Some pathogens can infect a host with only a few cells, while others require millions or billions. The **infectious dose** for the ***Coronavirus*** is currently ***unknown***, but it is presumed to be low, given the high rate of infection.

Warning: There is no known concentration of *Coronavirus* in the air that can be considered "safe". Each exposure carries a risk of infection, and the greater the exposure, the greater the risk.

If a person treating a *Coronavirus* patient is wearing anything other than a full-face, supplied-air, positive-pressure, properly-fitted, new or well-maintained respirator with a hood and disposable hazmat suit and gloves, they are at risk of infection.

If a health care worker is outside, in a parking lot, examining a prospective patient, the concentration of virus in the air will be relatively low. A properly-fitted, **full-face respirator** with an **APF of 50** should be sufficiently protective. However, safe protocols for decontamination and reuse must be in place and strictly followed.

Are N95 respirators of any use? **Certainly.** They ***substantially*** reduce the risk of infection, *but they do not eliminate it.* The amount of risk that remains is not easily quantifiable, but a significant risk does remain, given the limitations of their design. The positive news is that ***N95*** respirators are ***far superior*** to common surgical masks, scarves, and plain cloth.

Other Risks of Exposure

The number one risk of exposure is the failure to wear a respirator, when you should. But wearing an effective respirator does not end the risk. When a person leaves the room of a patient with ***Coronavirus***, if they are not decontaminated before taking off their personal protective equipment, or if they do not take it off carefully, in a clean room, and retreat to an uncontaminated environment, away from all others who may be contaminated, they may eventually get infected anyway.

Reusing respirators can be done under certain circumstances, but it will also create risks of exposure. Coworkers will inadvertently contaminate surfaces, fail to adequately sterilize equipment, and allow contaminated air to leave patients' rooms, thus exposing others to the virus.

Conclusion

Health care workers should demand the most effective protection available. In a pandemic, with supplies of effective equipment scarce, they should insist that workers involved in the activities that pose the greatest risk of exposure be provided with the most effective equipment. These activities include intubation, extubation, bronchoscopy, sputum induction, cardiopulmonary resuscitation, open suction of airways, and collecting nasopharyngeal samples.