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# CAN WE MEASURE FOR COVID-19 LIKE WE DO FOR AIR QUALITY?

## Kontrol BioCloud: A Safe Space Technology™

Reference Paper

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# Executive Summary

The COVID-19 global pandemic has impacted all facets of life including work, travel, education, and social interactions.

The science behind understanding how the virus spreads has advanced from the early days of the pandemic. Wearing masks, social distancing, more rapid testing and contact tracing have had a positive impact in mitigating the pandemic.

The scientific research referenced in this document demonstrates that the SARS-CoV-2 virus causing COVID-19 can remain in the air for prolonged periods of time, suggesting the spread of the virus through airborne transmission as well as in droplet form.

Viral detection technology which seeks to identify SARS-CoV-2 in the air can provide a new important tool in the overall fight against the global pandemic. On site viral detection can assist in more focused testing and contact tracing while providing the comfort, security and confidence for spaces and economies to re-open.

NOW MORE THAN EVER
WE WANT TO KNOW THAT THE
SPACES WE ARE IN ARE SAFE


**DISCLAIMER:** The Company is not making any express or implied claims that its product has the ability to eliminate, cure or contain the COVID-19 (or SARS-2 Coronavirus).

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# Introduction

The COVID-19 pandemic has caused unprecedented and catastrophic public health, social and economic impacts across the globe. The economic and social disruption caused by this health crisis is devastating, causing a wide range of impacts to hundreds of millions of people around the globe. To date, there have been more than forty one (41) million confirmed cases of COVID-19 in two hundred and eighteen (218) countries, including more than one (1) million deaths, as reported to World Health Organization (WHO). [1]

Economically, the COVID-19 pandemic is having an enormous impact; the World Bank reported that the baseline forecast envisions a 5.2 % contraction in global Gross Domestic Product (GDP) in 2020—the deepest global recession in eight (8) decades, despite unprecedented government policy support.[2]

# What is COVID-19?

A disease is named to enable discussion on disease prevention, spread, transmissibility, severity and treatment. A virus, on the other hand is named based on its genetic structure to facilitate the development of diagnostic tests, vaccines and medicines.

COVID-19 is the disease caused by SARS-CoV-2, a new virus that was first recognized in December 2019. Genetic sequencing of the virus suggests that it is a beta coronavirus closely linked to the SARS virus. The International Committee on Taxonomy of Viruses (ICTV), which is responsible for developing the classification of viruses and taxon nomenclature of the family Coronaviridae, recognizes this virus as forming a sister clade to the prototype human and bat severe acute respiratory syndrome coronaviruses (SARS-CoVs) of the species Severe acute respiratory syndrome-related coronavirus, and designated the new virus as "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" on 11 February 2020.[3]

To control the spread of SARS-CoV-2, scientists all over the world are investigating the possible modes of transmission. According to WHO, the possible modes of transmission include contact, droplet, airborne, fomite, fecal-oral, bloodborne, mother-to-child, and animal-to-human transmission.[4]

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# How is it transmitted?

Infections with respiratory viruses are mainly transmitted through three modes: contact, droplet, and airborne.[5]

- **Close contact transmission** is infection spread through direct contact with an infectious person (e.g., touching during a handshake) or with an article or surface that has become contaminated, then making contact with the infected article (hand or surface) and a person's noise, eye's, or mouth. The latter is sometimes referred to as "fomite transmission."
- **Droplet transmission** is infection spread through exposure to virus-containing respiratory droplets (i.e., larger and smaller droplets and particles) exhaled by an infectious person. Transmission is most likely to occur when someone is close to the infectious person, generally within about 6 feet.
- **Airborne transmission** is infection spread through exposure to those virus-containing respiratory droplets comprised of smaller droplets and particles that can remain suspended in the air over long distances (usually greater than 6 feet) and time (typically hours).

Current evidence suggests the main mode of transmission for SARS-CoV-2 is person-to-person spread through respiratory droplets.[6] Aerosol transmission can occur in specific settings particularly in indoor, crowded and inadequately ventilated spaces, where infected person(s) spend long periods of time with others such as schools, child care facilities, senior citizens' residence or long-term care facilities, health care facilities, restaurants, offices and/or places of worship.[7][8]

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NOTE: Inhalable particulate matter are particles with diameters that are 10 µm (PM10) and smaller (such as PM2.5) provide good platform to "carry" the SARS-CoV-2 (0.06-0.14 µm).

There is growing evidence that the SARS-CoV-2 virus remains airborne in indoor environments for hours, potentially increasing in concentration over time. [9] The important factor is the particle size, it can determine how long a particle can stay airborne and how deep into the lungs the particle can reach. Inhalable particulate matter are particles with diameters that are 10 micrometers (PM10) and smaller (such as PM2.5). These are microscopic particles that can remain suspended in the air and enter the body.[10] The SARS-CoV-2 virus particles have diameter of approximately 0.06-0.14 micrometers.

Scientific evidence has shown that inhalable particulate matter (PM10 and smaller PM2.5) could be both a direct and indirect transmission model for SARS-CoV-2 infection. The airborne particulate matters (PM10 and smaller PM2.5) may be associated with an increased risk of COVID-19 transmission.[11][12][13]

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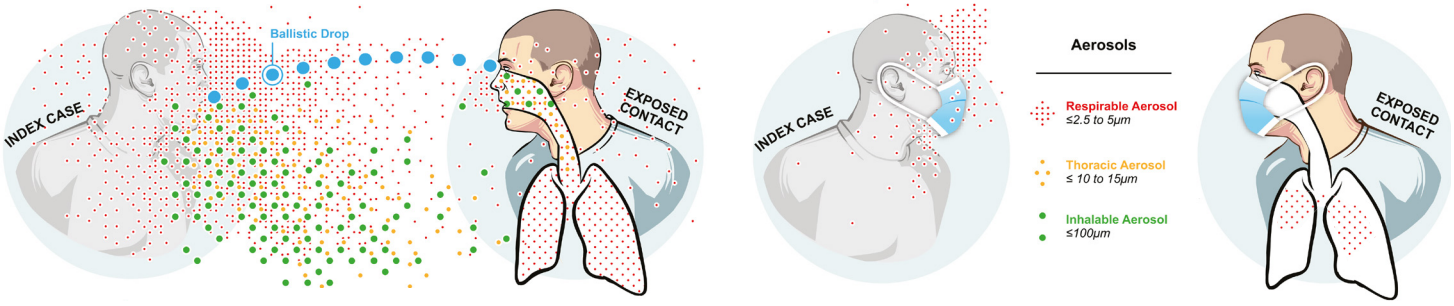
# How Much Virus is "expelled" in an Enclosed Space?

The investigations of COVID-19 outbreaks in the world have demonstrated that the gathering of crowds with asymptomatic carriers is a potential source of airborne SARS-CoV-2 in an enclosed space, such as a school classroom, a senior citizens' residence or long-term care facility and a food processing facility etc. The increasing weight of evidence supports the use of precautions against transmission of SARS-CoV-2 in indoor environments as an addition to other measures already known to limit the spread of virus. [14][15]

To identify how much virus in an enclosed space, scientists have studied how much virus is "expelled" in a breath or cough. The scientific results show that the breathing and coughing were estimated to release large numbers of viruses, ranging from thousands to millions of virus copies per cubic meter in a room with an individual with COVID-19 with a high viral load, depending on ventilation and microdroplet formation process. Based on the study, a standard 10,000 cubic feet room (classroom) could have 353, 000 viruses from a regular breathing from an individual who was a high emitter.[16]

The study results can partially explain the observed rates of air transmission and suggest that there is a need for strict respiratory monitoring and protection when people are in the same room with an individual carrying the virus with or without symptoms.




source: sciencemag.org

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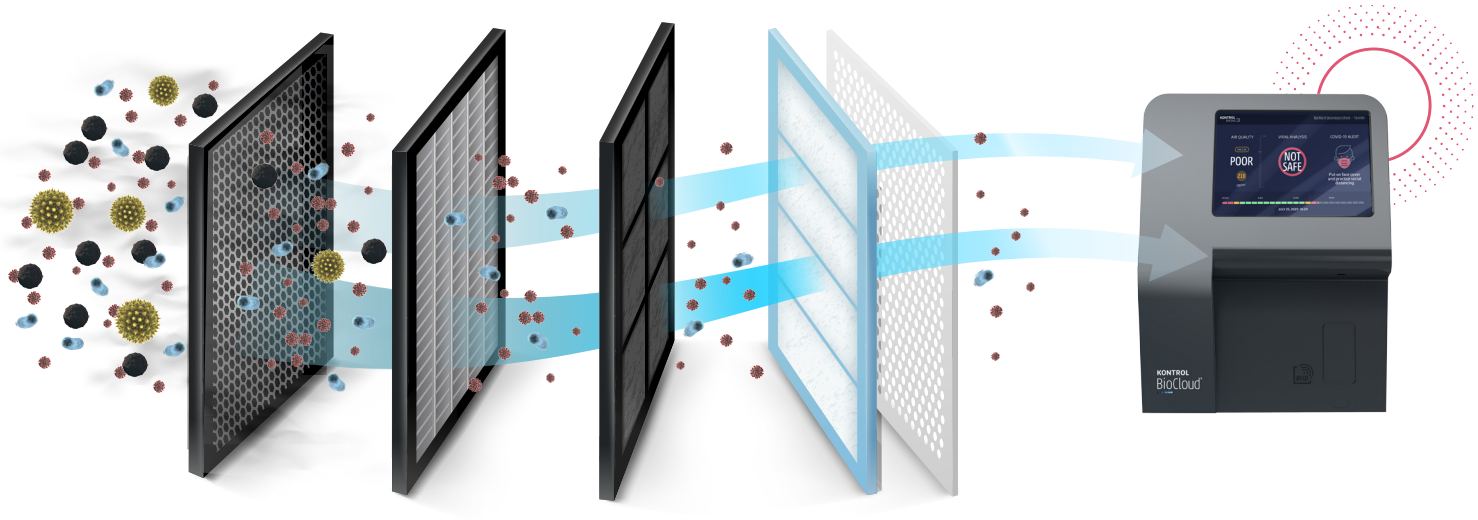
# Can we monitor for viruses like we do for air quality?

As we know, it is a normal practice that the air quality within the confined space should be tested to protect workers before they enter into the confined space. It will become the "new normal" to conduct the continuous air monitoring of virus in an enclosed workplace to effectively protect frontline workers, school staff and students from potential COVID-19 exposures.

Current practices for indoor viral air sampling include liquid and solid impactors and filters, electrostatic precipitators or swabbing various surfaces in a room.[17] Each method has its own advantages and drawbacks; however each method is only a collection method. After a sample has been collected it is sent to a laboratory to determine the presence of a virus—separating the virus-spreading event from real-time detection.

**Air filtration and testing air quality in a laboratory setting is not a solution for real-time detection of virus and the mitigation of further spreading.**



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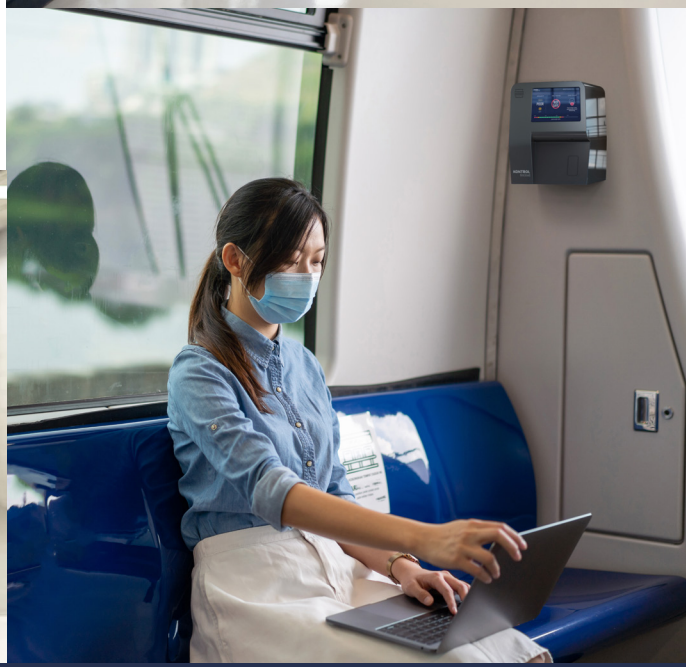
# What is BioCloud?

BioCloud is a real-time analyzer designed to detect airborne pathogens. It has been designed to operate as a safe space technology by promoting air circulation, monitoring the air quality and sampling continuously for pathogens like viruses, bacteria and fungi. The BioCloud analyzer combines a proprietary SARS-CoV-2 detection chamber with an advanced air sampling process. The air sampling system draws air in and optimizes the air for analysis. The sample flows through the detection chamber which uses both a viral collider and a chemical process to trap virus particles and identifies the SARS-CoV-2 virus with a laser sensor. When a virus of concern is detected an alert system is created in the Cloud or over local intranet.

Each BioCloud is a self-contained analyzer that requires no additional laboratory tests or movement of samples. The proprietary detection chamber and cartridges can be replaced as needed, or after a detection event.

BioCloud's applications include classrooms, retirement homes, hospitals, mass transportation, offices, break rooms, and others defined spaces.



# How does BioCloud operate as a Safe Space Technology?

AIR SAMPLING PUMP

REAL-TIME MONITORING AND COMMUNICATION

LASER BASED DETECTION


AIR CIRCULATION FAN

PROPRIETARY DETECTION CHAMBER & REAGENT

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# BioCloud has been designed as a real-time detection technology for viruses and pathogens. The current focus of the technology is SARS-CoV-2.

## AIR SAMPLING PUMP

Air is drawn in through the viral collection and viral detection systems using an air sampling pump. Depending on the size of the area, the air sampling pump volume can be increased or reduced in size to accommodate various applications.

## AIR CIRCULATION

Air circulation fans can assist in moving higher volumes of air through the BioCloud analyzer and promote air circulation within a space ensuring adequate sampling of the air in the room. For those areas and spaces where air circulation may be limited BioCloud can be modified to draw in more air for sampling (Ideal for rooms with passive ventilation systems like hot water heat).

## COMMUNICATION

BioCloud has the ability to communicate through local intranet, Wifi, Bluetooth, the front screen, and Cloud based platforms to allow silent alarms to be issued to key personnel.

## VIRAL DETECTION/CAPTURE SYSTEM

The Heart of the BioCloud device is the Viral Detection/Capture System (Patent Pending). Samples are collected through air sampling in a non-invasive proprietary inertial impact viral collider. This device utilizes a combination of three independent capture techniques that allows for intact virus sampling while also achieving a high capture ratio.

Further, the Viral Detection/Capture System utilizes a two-stage process to maximize detection of the SARS-CoV-2 virus and eliminate false positive readings. The SARS-CoV-2 virus is trapped using a virus specific collection that eliminates any other virus or pathogen from being collected. Additionally, the laser-based detection mechanism utilizes a SARS-CoV-2 specific technique that also eliminates any other virus or pathogen from interfering with the measurement. These methods combined allow for a safe reliable measurement and achieve a lower detection limit of 50vp (viral particles).

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## OPERATING EXAMPLE BASED ON LOWER DETECTION LIMIT

Many factors can affect virus dispersion and air flow in a space as it relates to air sampling including room size, heating and cooling (HVAC) system, number of people in the room, and air circulation. The table below gives an approximation of detection time in various sized rooms, with a single contagious individual breathing at a regular pace*.

| Room Size | Ceiling Height | Approximate Detection Time |
|---|---|---|
| 1,000 sq ft | 10 ft | 6 min |
| 1,500 sq ft | 10 ft | 8 min |
| 2,000 sq ft | 10 ft | 11 min |
| 2,500 sq ft | 10 ft | 15 min |

*The Approximate Detection Time calculations are based on a number of assumptions and referenced scientific research with no third-party testing at this time.

**The calculations assume the following:**

- A typical office HVAC system that produces 3 air exchanges per hour[16]
- Current research regarding virus emission from a single person classified as a high emitter of COVID-19, breathing regularly and coughing once per air exchange located across a room from the BioCloud analyzer[16]
- That humans shed virus in differing amounts[16]
- Independent lab testing received by Kontrol setting the lower detection limit as well as a set detection sequence time
- The calculations also generally assume, that virus can be airborne[5][6], that viruses can travel through distance in a room in the air[9], and that HVAC and air filters can have an impact on calculations[11]
- These calculations are limited by HVAC performance, persons location, room layout, vent and return placement, objects and furniture arrangement and their combined affect on air flow and circulation in a room or space
- This data cannot be extrapolated as more factors need to be considered for air flow and viral spread in larger spaces

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## KEY OPERATING FEATURES

- Provides continuous reassurance of a pathogen-free space
- Intended for indoor use only with temperature range of 5°C-45°C
- Can be connected to an existing HVAC system or as a standalone device
- Certified 802.11 a/b/g/n/ac for notification connectivity
- Bluetooth connectivity for notifications
- Powered by 200 watt and 80-264 VAC
- Silent alert with optional visual and audible alarm - like a smoke detector
- Lower detection set based on detection of live SARS-CoV-2 to a level of 0.005ng
- Notification can be integrated into existing software platforms, pushed to a cloud based platforms
- CSA

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# Conclusion

Detection technology can be an important addition to a holistic approach to managing the pandemic and creating safe spaces. To monitor for pathogens and prevent outbreaks and super spreader events a system is needed that can analyze ambient air and respond in a real time.

Combined with rapid testing and contact tracing, targeting airborne transmission as part of the overall arsenal of technology to combat the COVID-19 pandemic can help mitigate spread and re-open the global economy.

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