Johnson Controls

OpenBlue
Clean Air

Strategies to reduce risk and increase peace of mind

The power behind **your mission**

We are committed to helping facilities operate in a safe and effective way that puts owners and occupants at ease.

OpenBlue Clean Air

Overview

For over 130 years Johnson Controls has been helping customers prepare for and recover from natural disasters and other unexpected high-impact events, like COVID-19. We are here to help you take the next step towards safer schools, offices, and facilities with Johnson Controls OpenBlue Clean Air.

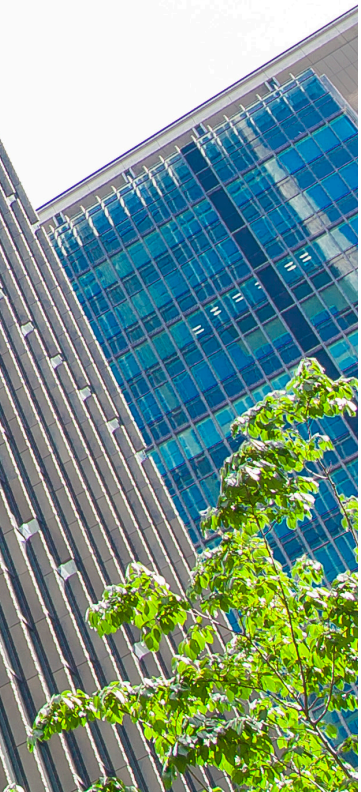
OpenBlue Clean Air is a unique solution that helps you reduce risk and increase peace of mind. It starts with a holistic consultative approach, utilizes research-based solutions, cost-effective implementation, and continues with ongoing service and support.

We can design a Clean Air strategy for your facility encompassing:

- Consultations with our HVAC experts
- Facility evaluations of mechanical and life safety systems
- Ventilation methods focused on increased outdoor air circulation
- Recommended air change rates to mitigate aerosols
- Filtration options for increased particle collection and improved indoor air quality
- Optimal temperature and humidity settings to destabilize pathogen transmission
- Ultraviolet-C (UV-C) lighting methods to inactivate viral organisms (air disinfection)
- Intuitive building automation system dashboards to help you manage your building
- Payment solutions including rental equipment and other funding sources
- Planned service agreements to provide support and maximize equipment lifespans

This document will provide guidance* to help you understand what constitutes "clean air," and the approaches you can apply to your facility to reach a higher level of safety and comfort for occupants.

We continue to follow the updated recommendations from the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), and American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).



*NOTE: This document is to be used as general guidance only. Always refer to the latest information from the CDC, WHO, and ASHRAE. Please contact your Johnson Controls representative for help planning an approach tailored for your objectives and circumstances. This document itself, and the guidance contained herein, are provided "as is," with no guarantee of any kind, and without warranty, whether expressed or implied.

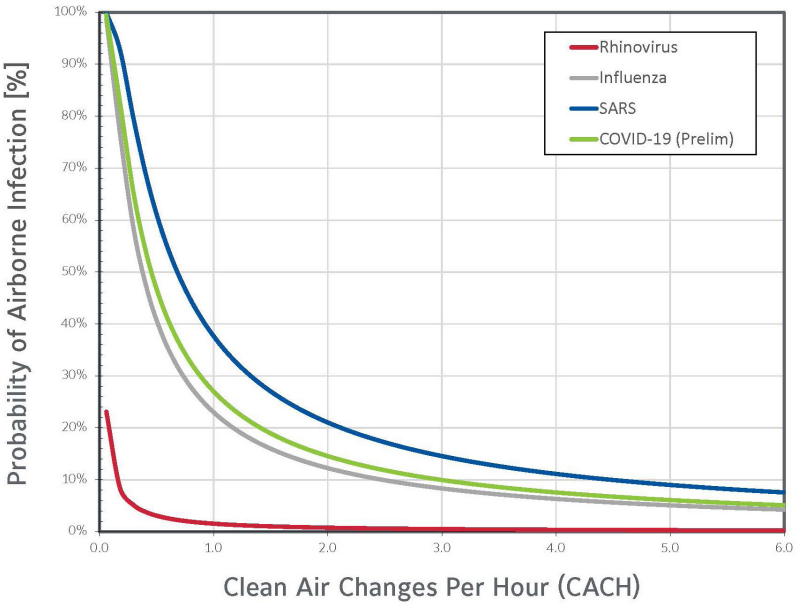
What is Clean Air?

According to ASHRAE and the CDC[1], infectious diseases like COVID-19 can be transmitted through airborne pathogens. By providing increased amounts of clean outdoor air, highly filtered air, and disinfected re-circulated air into spaces like classrooms and offices, HVAC systems can dilute and kill pathogens in the air stream and mitigate disease spread. There are several tactics you can take to reach the recommended amount of clean air for a space.[2] Our approach adheres to industry guidance and focuses on four main pillars: Ventilation, Filtration, Disinfection, and Isolation.

Methods to Increase Clean Air in Your Building:

- Use the ASHRAE and CDC[3] guidelines to meet the standards for your specific space
- Update control sequences to increase supply airflow by changing discharge air setpoints and increase clean outdoor air changes
- Further open minimum outdoor air dampers, weather permitting
- Add HEPA and MERV-13 (or higher) filters to fans and air handling units to increase the amount of filtered air
- Disable demand-controlled ventilation
- Install UV-C lighting troffers[4] to inactivate viral and bacterial microorganisms in the air
- Add UV-C disinfecting components to air handling units
- Add zone level filtration and disinfection solutions to provide multiple sources of clean air
- Keep systems running longer hours, if possible 24/7
- Consider portable room air cleaners with HEPA filters and UV-C disinfection components that can also contribute additional air changes per hour to the space
- Install Venturi air valves and room pressure controls to create protective spaces for occupants who become sick (infirmary, nursing home, flexible healthcare spaces)

Six air changes per hour greatly reduces airborne infection probability rates.



Air Change Rates and Disease Mitigation

Critical environments like operating suites have high air change rates to help prevent airborne-transmitted infections.

Applying the same technique to spaces like classrooms and offices can produce a similar effect throughout your facility.

This graph[5] illustrates how the probability of airborne infection declines for rhinovirus, tuberculosis (TB), influenza (common flu), SARS (SARS-CoV), and COVID-19 (SARS-CoV-2) as the clean air change rates per hour increase.

Probability of airborne infection calculated using the Wells-Riley equation. It assumes one infected individual in a 5,400 sq. ft. space.

1. https://www.ashrae.org/file%20library/about/position%20documents/pd_infectiousaerosols_2020.pdf
2. https://www.ashrae.org/file%20library/technical%20resources/ashrae%20journal/2020journaldocuments/72-74_ieq_schoen.pdf
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5. https://www.sciencedirect.com/science/article/pii/S0160412020312800?via%3Dihub | https://www.nafahq.org/wp-content/uploads/WellsRileyReport.pdf

OpenBlue Clean Air Solutions

Johnson Controls OpenBlue Clean Air solutions are backed by research and industry guidance, and we can offer the broadest range of products on the market today. Our team is here to help you reduce risk and ensure your facility adheres to industry requirements. We know there are various avenues to reach the optimum amount of clean air for your building, and we can help you figure out the most effective and cost-efficient path forward.

Consultation

Our consultants can meet with you to understand your goals and pain points, discover which areas of your facility are most used, and which solutions will be most effective within your air flow system and budget. Our expertise and research partnerships with leading academic institutions is unmatched in the industry.

Building Assessment

We can visit your facility to conduct a Clean Air building assessment which includes collecting data on your current air flow system (like checking damper operation and current control sequences) and analyzing what gaps need to be filled for your building to meet ASHRAE and CDC clean air requirements and recommendations.

Planned Service Agreement

We can offer ongoing service and support. Post-installation we can continue to support you with maintenance services like replacing MERV-13 filters quarterly, creating urgent space-reallocation plans (like a hurricane shelter) helping you navigate unexpected airflow conditions (like outdoor air pollution from a wildfire), and remote monitoring to keep your spaces safe and healthy and extend the life of equipment.

High Efficiency Filters

Johnson Controls offers a range of high efficiency air filters including HEPA and MERV filters for your HVAC system filter racks.

Air filters with MERV 13-16 ratings are recommended and provide a higher rate of clean air while also earning LEED® certification points. Our filters provide superior indoor air quality for applications from hospitals to commercial office buildings.

Portable HEPA Filters

Portable HEPA filters are great for smaller spaces like classrooms and waiting rooms. We have several product options available, depending on the needs of your space.

Our portable HEPA solutions can provide over 6 air changes per hour, with options to include internal UV-C light components for additional air disinfection. Units also have the ability to create flexible negative pressure isolation rooms.

UV-C Lighting Troffers

UV-C lighting troffers are a unique retrofit or new build solution.

Air is pulled into the lighting fixture and the HEPA and UV-C components disinfects the air by filtering and deactivating the viral organisms with UV-C light and then pushes the clean air back into the space.

This Clean Air solution is an easy retrofit and can be installed without breaching the plenum—keeping facility disruptions and installation costs to a minimum.

Critical Environment Controls

If you need to create a flexible protective care space (like a negative pressure patient room in a nursing home), we offer critical environment controls like touchscreen monitors and Venturi air valves to manage room pressurization, air changes, temperature, and relative humidity. These elements are essential in mitigating pathogens and preventing cross contamination.

These connected products enable you to remotely prepare rooms for occupancy and program energy-efficient setbacks during non-use hours.

Air Handling Units

To reduce airborne pathogens within a building, mixed-air HVAC systems should focus on increasing outdoor air ventilation. Our air handling units allow you to maximize outside air to displace contaminated air and increase ventilation and air change rates.

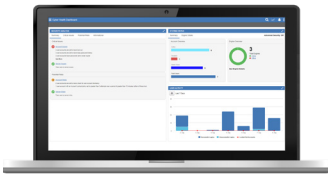
UV-C disinfecting light components are also available to sanitize the air as it leaves the air handing unit. Factory-installed humidifiers and wrap-around heat exchangers can help support effective humidity control.

Rental Equipment

We offer flexible payment solutions to help you meet your clean air goals, including rental equipment.

Rental equipment options include chillers, heaters, air conditioners, negative air pressure equipment, and HEPA filters to help ventilate both temporary and existing environments and increase the amount of clean, fresh air in your building.

These products are utilized in healthcare facilities, schools, and commercial buildings to provide adjustable clean air solutions.



Metasys Building Automation System

Metasys seamlessly integrates all your building systems to deliver the critical information you need in one place. The intuitive dashboards help you troubleshoot issues and quickly implement system changes. The new pandemic dashboard helps you swiftly respond to evolving conditions - like the ability to achieve negative pressurization in a space to set up a protective environment.

OpenBlue Clean Air Success Story: School Reopening

A school serving over 800 students and 100 teachers required a reopening strategy to resume in-person classes. Along with implementing other CDC recommendations, the school consulted with their local Johnson Controls branch, their partner for over 20 years, on how they could update their HVAC system to meet current CDC and ASHRAE guidelines.

After analyzing the school's most occupied spaces and current airflow system, Johnson Controls installed UV-C lighting troffers to replace the standard 2x4 light fixtures to filter and disinfect air. The troffers are able to capture up to 99.97% of airborne pathogens as small as 0.3 µ.

To efficiently add more air changes per hour to spaces, standalone portable HEPA units were installed. The increased amount of air changes help to dilute and mitigate the spread of airborne pathogens. Johnson Controls' portable HEPA filters also have the lowest decibel levels in the industry making it uniquely suited for the education sector, so teachers and students can feel at ease and focus on learning.

An Approachable Clean Air Strategy

To help you balance your strategy with your budget, the below recommendations start by utilizing your operational budget and progress to how you can utilize your capital expenditure budget for simple upgrades, planned upgrades, and renovations to implement clean air solutions in your building.

Operations

- Optimize current maintenance practices
- Increase outdoor air ventilation to the extent the equipment/budget can handle
- Update control system setpoints
- Maximize filtration methods by installing filters with the highest MERV rating the equipment can support

Simple Upgrades

- Changes made by maintenance staff
- Install portable HEPA filters
- Install UV-C lighting troffers to sanitize air
- Install deeper filter racks to accommodate higher efficiency filters, potentially requiring a fan motor upgrade to overcome a higher static pressure drop

Planned Upgrades

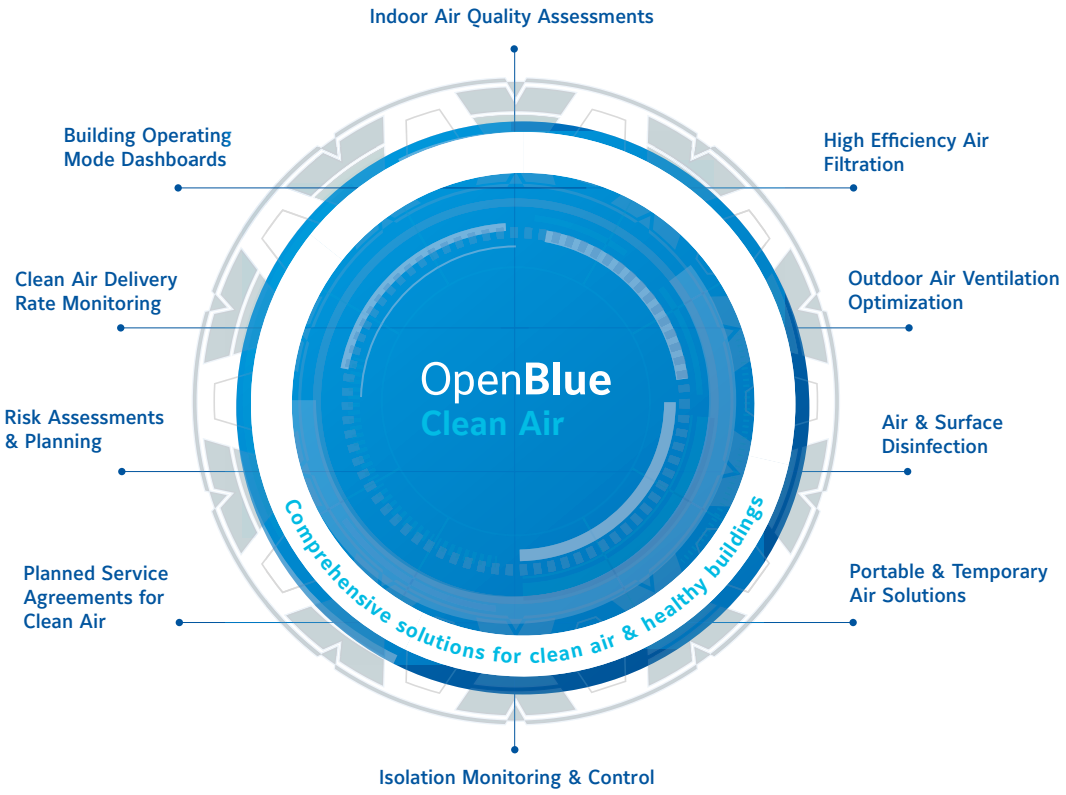
- Changes made during equipment replacement or a planned upgrade program
- HEPA filter banks
- Lower cost outdoor air supply (indirect energy recovery ventilators, dedicated outdoor air systems)
- UV-C components in air handling units

Renovations

- Changes made during renovation
- Increase outdoor air supply capacity with larger duct system
- New air handling units with HEPA filters and UV-C components
- Install Venturi valves and room pressure controls for protective spaces

To read more about OpenBlue Clean Air, visit:

johnsoncontrols.com/OpenBlue



About OpenBlue

OpenBlue is a complete suite of connected solutions that serves industries from workplaces to schools, hospitals to campuses, and many more. This platform includes tailored, AI-infused service solutions such as remote diagnostics, predictive maintenance, compliance monitoring, advanced risk assessments, and more. A dynamic new space from Johnson Controls, OpenBlue is how buildings come alive.

About Johnson Controls

At Johnson Controls, we transform the environments where people live, work, learn and play. From optimizing building performance to improving safety and enhancing comfort, we drive the outcomes that matter most. We deliver our promise in industries such as healthcare, education, data centers, and manufacturing. With a global team of over 100,000 experts in more than 150 countries and over 130 years of innovation experience, we are the power behind our customers' mission. Our leading portfolio of building technology and solutions includes some of the most trusted names in the industry, such as Tyco®, YORK®, Metasys®, Ruskin®, Titus®, Frick®, PENN®, Sabroe®, Simplex® and Grinnell®.

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