Aircuity case study

Ivy League University

Aircuity Measures and Manages Critical Parameters Verifying a Healthy Building for Occupants

WITH CORONAVIRUS CIRCULATING THE COUNTRY healthy air quality is critical to safely bring students and staff back to campus. Recognizing this, an Ivy League university client is using Aircuity to verify that it is safe for people to occupy the buildings.

There are four key categories to consider when creating a space that effectively reduces viral spread: dilution (air), filtration, humidification and sanitization. Air quality data can be used to verify these parameters:

Healthy Building Recommendation	Measured Parameter
1 **Dilution:** Increased Outdoor Air	CO2
2 **Filtration:** Increase filter MERV rating	Particles
3 **Humidification:** Maintain 30–60% RH	Dewpoint & Temp
4 **Sanitization:** Enhanced Cleaning	TVOCs

In this instance each of the buildings with Aircuity installed were examined to verify the measures taken by the university to curb the spread of COVID-19 were effective and that they had healthy air quality. Data from their library building will be used as an example to examine each category.

DILUTION AIR/CO2

In order to verify that enough dilution air is being brought into the building the university is using the MyAircuity analytics platform to look at the CO2 levels of the outside air, supply air and room air.

These readings were then used in an equation to ensure CO2 levels were meeting science-based air quality standards.

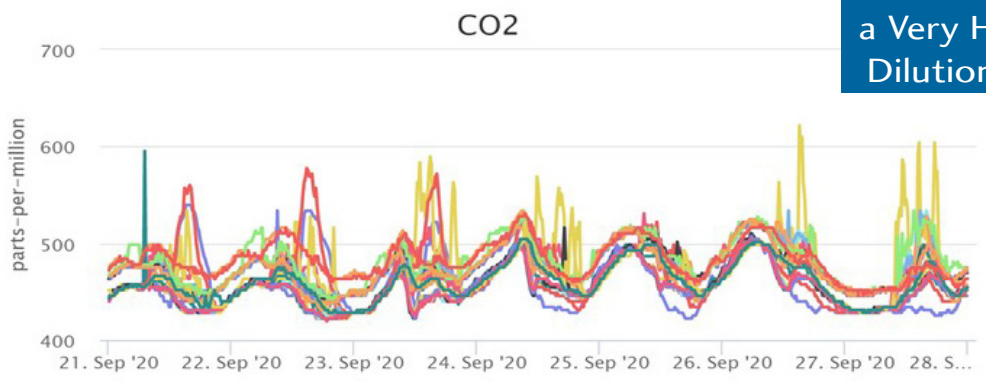
The university was targeting 30 CFM per person, following recent guidance by ASHRAE to maximize OA. The CO2 data showed that they had 5–10x that amount and does not need to further increase OA in the building.

$$V_o = N/(C_s - C_o) \qquad \text{(D-1)}$$

where

V_o = outdoor airflow rate per person
V_e = breathing rate
N = CO_2 generation rate per person
C_e = CO_2 concentration in exhaled breath
C_s = CO_2 concentration in the space
C_o = CO_2 concentration in outdoor air

Figure 2 - ASHRAE 62.1 Equation



Data Indicates a Very High Level of Dilution Ventilaton

Figure 1 - Room Air was Tracking Ambient Outside Air (OA) of 450 ppm

AIRCUITY

Room	AVG	MAX	OA AVG	AVG CFM/Person	Min OA CFM/Person	Meet University Standard?
Annex	482.86	533.61	461.33	300+	138.37	✓
RM L01	460.26	536.54	461.33	300+	132.97	✓
RM L02	459.60	504.29	461.33	300+	232.81	✓
RM 11	458.53	539.47	461.33	300+	127.98	✓
RM 16	467.84	577.58	461.33	300+	86.02	✓
RM L37	482.40	530.67	461.33	300+	144.22	✓
RM 60	453.29	504.29	461.33	300+	232.81	✓
RM 61	454.29	516.01	461.33	300+	182.88	✓
RM 69	476.23	533.61	461.33	300+	138.37	✓
RM 110	468.08	530.67	461.33	300+	144.22	✓
RM 110A	472.58	621.56	461.33	300+	62.41	✓
RM 112A	458.20	595.18	461.33	300+	74.71	✓
RM 176	476.23	533.61	461.33	300+	138.37	✓
RM 177	477.45	533.61	461.33	300+	138.37	✓
RM 180	474.95	521.88	461.33	300+	165.17	✓
RM 184	472.83	524.81	461.33	300+	157.54	✓
RM C203	472.99	524.81	461.33	300+	157.54	✓
RM C214	453.91	507.22	461.33	300+	217.94	✓
RM 261	460.47	527.74	461.33	300+	150.58	✓
RM 262	472.99	521.88	461.33	300+	165.17	✓
RM 274	472.53	524.81	461.33	300+	157.54	✓
RM 276	454.07	504.29	461.33	300+	232.81	✓
RM 277	453.59	504.29	461.33	300+	232.81	✓
RM C312	453.32	504.29	461.33	300+	232.81	✓
RM 370	452.99	501.35	461.33	300+	249.87	✓
RM 371	453.56	504.29	461.33	300+	232.81	✓

Figure 3 - Data for Each of the Rooms

FILTRATION/PARTICLES

Particles are a critical parameter for COVID-19 as there is near universal scientific consensus the virus can spread via aerosols, i.e. particles less than 5 microns in size. Having recently upgraded the filter to MERV 14 per ASHRAE guidance, the university was looking to quantify the impact by measuring particle levels pre and post filter.

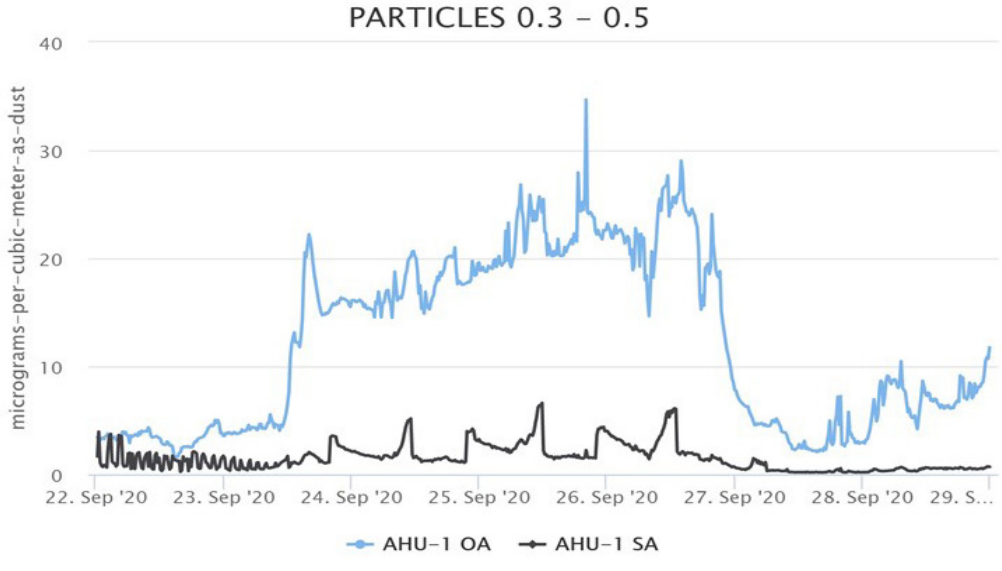


Figure 4 - Particles 0.3–0.5µm at the Air Handling Unit Level

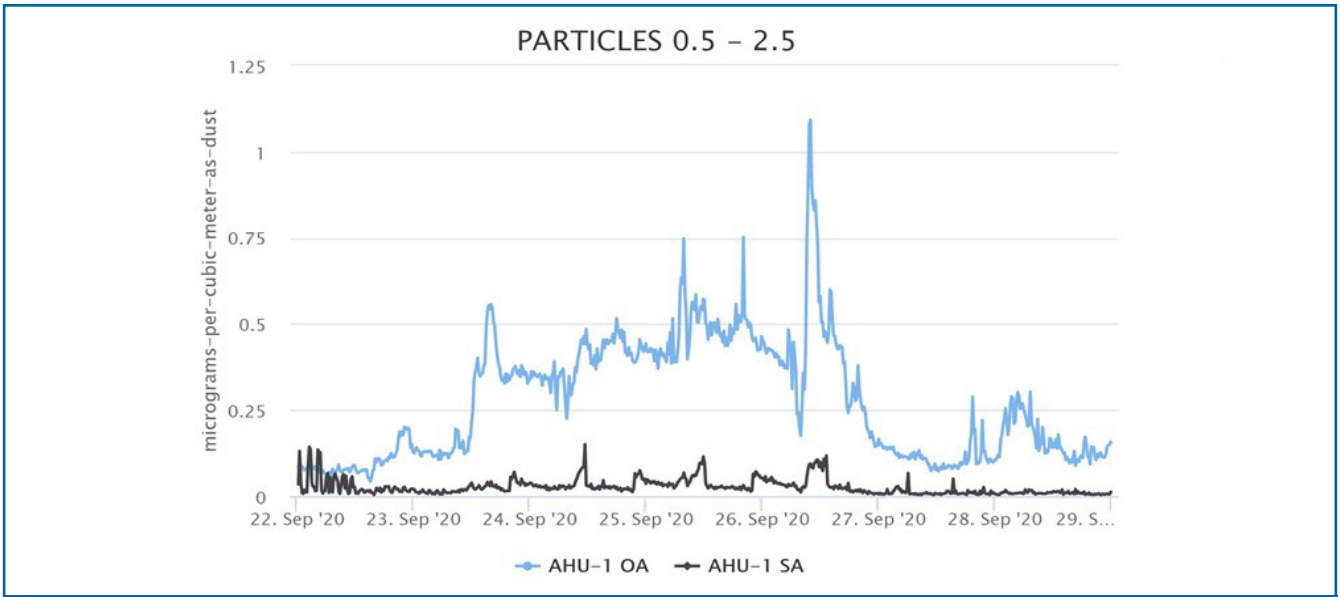


Figure 5 - Particles 0.5–2.5µm at the Air Handling Unit Level

Further, not all particles are the same: larger particles of 10µm stay airborne for a few minutes while smaller particles of 0.3 microns stay airborne for hours. Filter performance is also substantially reduced for smaller particles: A MERV 13 filter is only 40% efficient at 0.3µm while it is 99%+ efficient at 2.5µm! It is not uncommon for 90%+ of all measured particles to be less than 0.5µm.

For these reasons, the university employs Aircuity's clean room grade dual channel particle counter, which measures particles from 0.3–0.5µm and 0.5–2.5µm. Results showed that in the 0.3–0.5 range filters were 87% effective and in the 0.5–2.5 range they were 92% effective. 98% of all particles were 0.5 microns and smaller.

HUMIDIFICATION/DEWPOINT AND TEMPERATURE

There has been much research showing that when relative humidity (RH) is lowered to the 0–40% range respiratory immune defenses are impaired. Within this range, airborne droplets containing viruses evaporate and lighten allowing the droplets to float longer thereby allowing the virus to survive for a longer period of time. Due to these issues the university wanted to make sure that the relative humidity is within the ideal range of 40–60%RH.

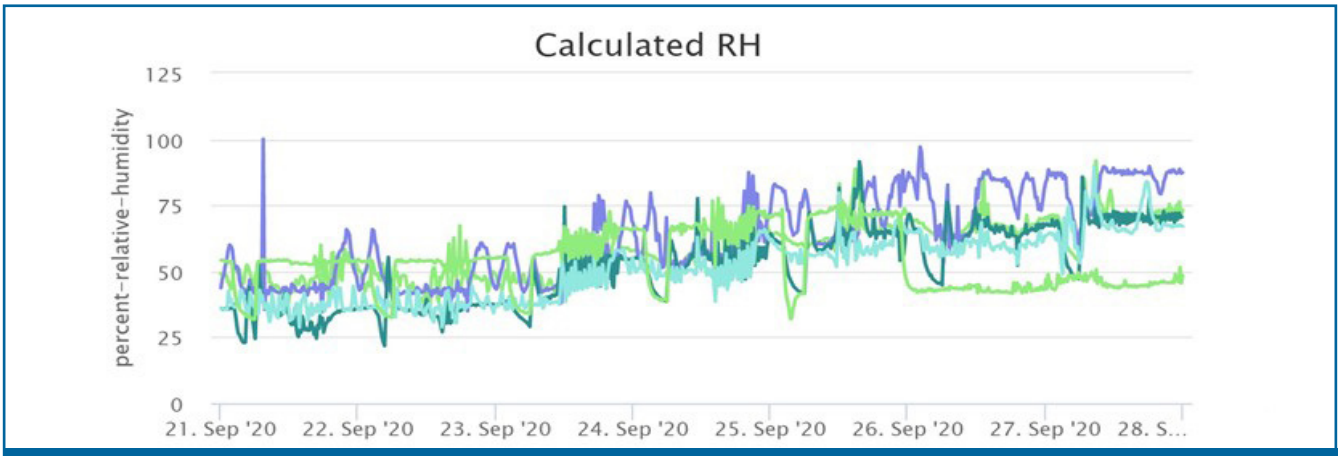


Figure 6 - Data Shows Average RH at Each Air Handling Unit

The data showed that the average calculated RH stayed within the targeted range. The readings on the lower side of the target threshold on Sept 21st–23rd reflected the cool, dry weather which increased in temperature and humidity as the week went on.

SANITIZATION/TVOCs

Enhanced cleaning protocols are another key part of a safe return to campus. However, this increased cleaning using stronger chemicals comes with a sharp increase of total volatile organic compounds (TVOCs) in the air. The Aircuity system senses increased TVOCs from cleaning and sends a signal for more outside air until TVOC levels drop again. Data from MyAircuity can be reviewed for added assurance that TVOCs are in an acceptable range.

For the life of the building Aircuity continually tests for CO2, particles, RH and TVOCs and brings in more air when and where needed.

With all four of these categories in acceptable ranges the university had tangible validation that the building was as safe as possible for students and staff. For the life of the building Aircuity continually tests for CO2, particles, RH and TVOCs and brings in more air when and where needed. Meanwhile the Aircuity data is available 24/7 for the university to view and validate that the building is consistently providing the best air quality possible.

ABOUT AIRCUITY

Aircuity is the 20-year leader optimizing ventilation through its patented indoor environmental quality (IEQ) platform, significantly reducing energy costs and improving the indoor environmental quality for occupants. As a result, commercial, institutional and lab building owners can lower operating costs, protect occupants and verifiably reduce energy use by as much as 60 percent. Headquartered in Newton, MA, Aircuity's solutions have benefited organizations such as Google, Amazon, SUNY, Eli Lilly, The Durst Organization, the University of Pennsylvania, and the University of California-Irvine. For additional information on the company and its solutions, please visit: www.aircuity.com.

AIRCUITY®