Grow Facility X Test Report

Test Dates: 4/6/21 to 4/7/21

Test Location: Denver, CO

Report Date: 8/26/21

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Purpose

The purpose of this test was to evaluate how effective Genesis Air equipment is at improving the indoor air quality at cannabis grow facilities. The results of this test can give an idea as to how Genesis Air equipment will affect other grow facilities. A reduction in VOCs can help reduce odor associated with growing cannabis. A reduction in fungus and bacteria can help reduce the chance of spreading airborne diseases among plants.

Test Procedure

This facility uses AHU mounted Genesis Air equipment. Each air handler is dedicated to a specific grow room. Two rooms were used for testing, room 3 and room 4. On day 1 (4/6/21), Genesis Air equipment had been turned off for an extended period of time, which had allowed airborne contaminate to climb back to original levels. On day 1, control air samples were taken in both rooms. After samples were taken, Genesis Air equipment was installed and turned ON. On day 2 (4/7/21), test air samples were taken in both rooms using the same methods as day 1. Finally, two VOC meters were placed inside the AHU to measure single pass efficiency. One meter was placed before the PCP array and the other meter was placed after the PCP array.

The biological samples were taking using two Anderson air samplers and an agar plate for each sample. Two ION Tiger meters were used to collect odor/VOC samples.

The following is the order in which the test was conducted.

Day 1

Control Samples: Without Genesis Air 4-6-21 (12pm-1pm)

- 2 Mold samples were taken in room 3. (Sample labels: M1/3 and M2/3)
- 2 Bacteria samples were taken in room 3. (Sample labels: B1/3 and M2/3)
- 2 odor samples were taken in room.
- 2 Mold samples were taken in room 4. (Sample labels: M3/4 and M4/4)
- 2 Bacteria samples were taken in room 4. (Sample labels: B3/4 and B4/4)
- 2 odor samples were taken in room 4.

Startup sample in AHU: With Genesis Air 4-6-21 (1pm-2pm)

- 2 odor samples were taken in the AHU for room 4. One meter was placed in the air stream before the PCP array and the other meter was placed in the air stream after the PCP array.

Day 2

Test Sample: With Genesis Air 4-7-21 (9am-10am)

- 2 Mold samples were taken in room 3. (Sample labels: M5/3 and M6/3)
- 2 Bacteria samples were taken in room 3. (Sample labels: B5/3 and B6/3)
- 2 odor samples were taken in room 3.
- 2 Mold samples were taken in room 4. (Sample labels: M7/4 and M8/4)
- 2 Bacteria samples were taken in room 4. (Sample labels: B7/4 and B8/4)
- 2 odor samples were taken in room 4.

Sample in AHU: With Genesis Air 4-7-21 (10am-11am)

- 2 odor samples were taken in the AHU for room 4. One meter was placed in the air stream before the PCP array and the other meter was placed in the air stream after the PCP array.

Results

Biological Data

The data in Table 1 below only shows the results of the mold samples taken.

Day	Genesis Air Equipment Status	Sample Name	Room	Location in Room	Fungal ID	Colony Count	CFU/M3
1	OFF	M1/3	3	Back	(Bad Sample)	0	0
		M2/3	3	Front	(Bad Sample)	0	0
		Subtotal	3			0	0
		M3/4	4	Back	Penicillium sp.	12	84
		M4/4	4	Front	Aspergillus sp.	4	12
					Aureobasidium	1	7
					Cladosporim sp.	1	7
					Penicillium sp.	300	2100
					Rhodotorula sp.	1	7
		Subtotal	4			319	2217
		Total				319	2217
2	ON	M5/3	3	Back	Penicillium sp.	10	70
					Sterile (white)	10	70
		M6/3	3	Front	Penicillium sp.	25	175
					Sterile (white)	14	98
		Subtotal	3			59	413
		M7/4	4	Back	Penicillium sp.	2	14
		M8/4	4	Front	Penicillium sp.	3	21
		Subtotal	4			5	35
		Total				64	448

Table 1: Mold Samples

Definitions

- **Aspergillus** is one of the most common fungal genera, worldwide, and Aspergillus fumigatus is one of the most common species found.
- **Aureobasidium** is a ubiquitous and generalistic black, yeast-like fungus that can be found in different environments (e.g. soil, water, air and limestone). It is well known as a naturally occurring epiphyte or endophyte of a wide range of plant species (e.g. apple, grape, cucumber, green beans, cabbage) without causing any symptoms of disease.

- **Cladosporium sp.** is a common mold that may affect your health. It can cause allergies and asthma in some people. In very rare cases, it can cause infections. Most species of **Cladosporium** are not dangerous to humans. **Cladosporium** can grow both indoors and outdoors.
- **Penicillium** is one of the most common fungal genera, worldwide. Microbial volatile organic compounds (MVOCs) produced: Penicillium commune produces 2-methyl-isoborneol, a heavy musty odor. (Fungus serves as a food source for storage mites). Where Found, Soil, decaying plant debris, compost piles, fruit rot. *Penicillium* is associated with bud rot (caused by *Penicillium olsonii* and *Penicillium copticola*) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6811654/
- **Rhodotorula sp**. are common environmental basidiomycetous yeasts, which can be found in soil, ocean and lake water, fruit juice and milk, and on shower curtains and toothbrushes. Today, the genus contains 46 species of which three have been described as rare human pathogens.
- **Sterile White hyphae** are simply fungal cells that do not produce reproductive structures (sexual or asexual), they do not bear spores. They make up the "body" of a fungus (mycelium).

VOC and Odor Data

Figure 1 below shows the VOC levels in the grow room on the first day, before the Genesis Air equipment was turned on. It also shows the VOC levels from the second day, after the Genesis air equipment had been turned on. The average VOC levels have been calculated for each day.

Figure 2 below shows the single pass performance of the Genesis Air equipment placed in the air handler. The average VOC levels before and after the PCP array have been calculated.

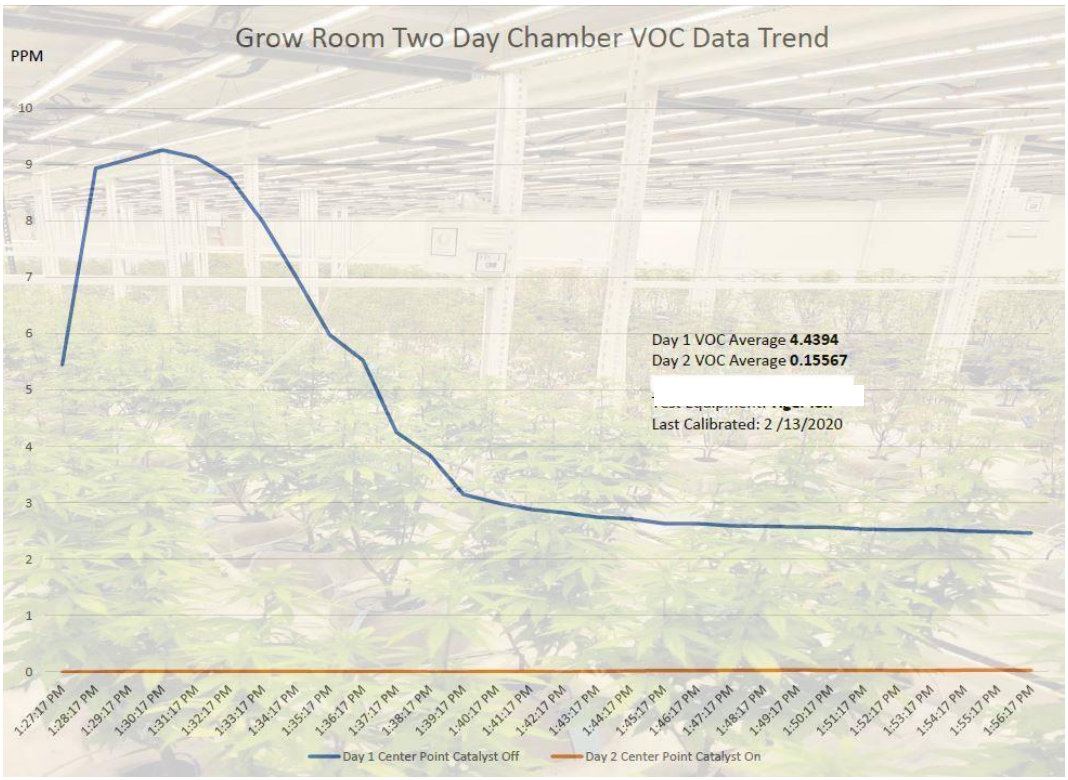

Figure 1

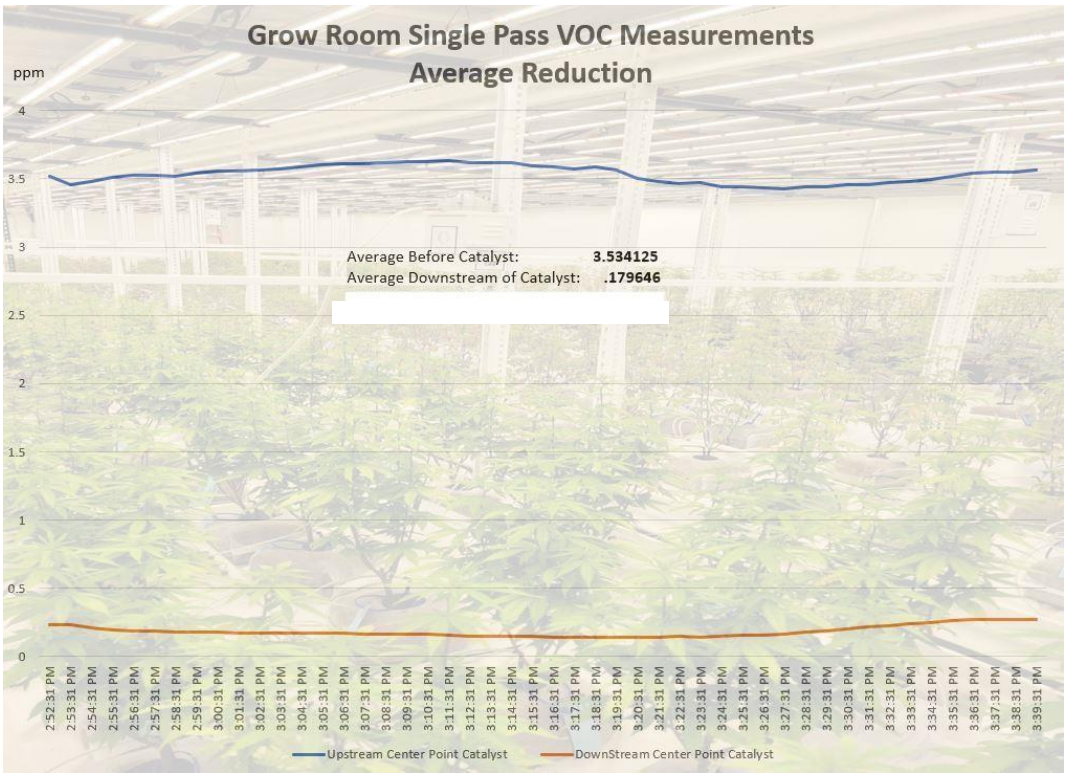

Figure 2

Calculations

Known Values

Room size: 1,900 sq. ft x 12 ft ceiling

PCP Array Size: (2) 2448 and (2) 2048 PCP panels per room

AHU Air Speed: V = 250 ft/min running continuously

AHU Volumetric Flow Rate

Cross sectional area = 2 x (24" x 48") + 2 x (20" x 48") → $A = 4224\ in^2$

$Q = V \times A \rightarrow Q = 250 * 4224 * (1ft^2 / 144in^2) \rightarrow Q = 7333\ CFM$

Air Changes Per Hour

$ACH = (Q*60) / (A*H) \rightarrow (7333*60) / (1900*12) \rightarrow ACH = 19.3$

Percent Reduction

Equation: Percent Reduction = [(Initial – Final) / Initial] * 100 %

Biological Room 4	→	[(2217 – 35) / 2217] * 100 %	→	98.4 % reduction
Biological Overall	→	[(2217 – 448) / 2217] * 100 %	→	79.8 % reduction
VOC Chamber	→	[(4.4394 – 0.15567) / 4.4394] * 100%	→	96.5 % reduction
VOC Single Pass	→	[(3.534 – 0.1796) / 3.534] * 100%	→	95.0 % reduction

Conclusion

The Genesis Air equipment can significantly improve the indoor air quality of a grow facility by reducing mold, fungus, and VOCs. In room 4, the mold samples showed a 98.4% reduction in CFUs. Cold agar plates prevented initial samples from being collected in room 3. The reduction in room 3 could not be determined. In rooms 3 and 4 combined, there was a 79.8% reduction in overall CFUs. The in-room chamber test showed a 96.5 % reduction in VOCs. The AHU single pass test showed a 94.9% reduction in VOCs.