



UVAIRx Plant Grow House Test Report

Written by Jerrod Keith

Last edited by: Jerrod Keith 11/14/15

Abstract:

This test was conducted to specifically address the effect UVAIRx Advanced PCO technology has on the environment of an indoor plant grow house facility, specifically that in the medical/recreational marijuana industry. Results of this testing would be expected to be the same across any type of soil-based indoor greenhouse.

Mainly molds, mildews, and other fungi were tested for in this study due to their being such a problematic pathogen in this environment. Twenty specific molds were tested for using cultured swab tests, and overall non-specific bacterial counts were also measured in this test.

Testing consisted of 'before' UVAIRx was installed and 'after' UVAIRx was installed. 'Before' swabs were taken in six different areas of the grow house identified as possible problematic areas. Six UVAIRx units were then installed in those areas, left operating for approximately two weeks, and 'after' swab tests were then taken at that time in areas immediately adjacent to those areas where the 'before' tests were taken. Ambient ion readings were taken at each area when the 'after' swab tests were taken to specifically identify the UVAIRx coverage throughout the building.

Results were encouraging for the prospects of the UVAIRx PCO technology in this application, with mold and mildew readings being dramatically reduced (from 400+ 'before' to 0 'after' in one area.) Four of the six samples returned with results at zero, and the remaining two tests were near zero (3 and 25). These two tests were close to each other in an area of the building where lower-than-desired ion levels were recorded. Continued exposure, increased ionization levels, and subsequent testing will quite likely show results of further reduced readings. Curiously, two of the 'after' results also contained minimal bacterial growth, for which possible causes are discussed in detail below.

Overall, the UVAIRx Advanced PCO technology is shown to yield promising results for the indoor plant growing industry, specifically in its ability to significantly reduce and help protect against outbreaks of mold and mildew. Further monitoring would be beneficial for continued research into this industry, but initial tests show very positive results and confirm the possibilities for the future of UVAIRx PCO technology for this application.

Purpose:

The purpose of these tests and this report was to help evaluate a commercial Plant Grow House and its various plant growing rooms, since this is a new environment for PCO technology to be tested in. The goal of this report was to address any previously unanswered questions about PCO contributions to the growing process in this, and similar environments; such as:

1. How does vegetation level affect ambient ionization levels?
2. Does our current PCO technology have the capability to address mold/mildew and bacterial/viral concerns in a vegetated area?
3. Does our technology have any impact on plant growth?
4. Does PCO technology have the ability to mitigate any smells associated with the plants?
5. What areas are of highest concern in this environment?
6. Do we have an impact on 'good' bacteria (beneficial flora) in the soil?

Setup:

Swabs were taken before installation of UVAIRx and after installation in six spots around the facility, with ion levels being monitored on the ‘after’ tests. Swabs were generally in a 1” square area for a 10 second period. All swab areas were marked with tape and annotated to ensure similar test areas. All swabs were evaluated by an independent, third-party source (EnviroScreen) to ensure unbiased results.

Results:

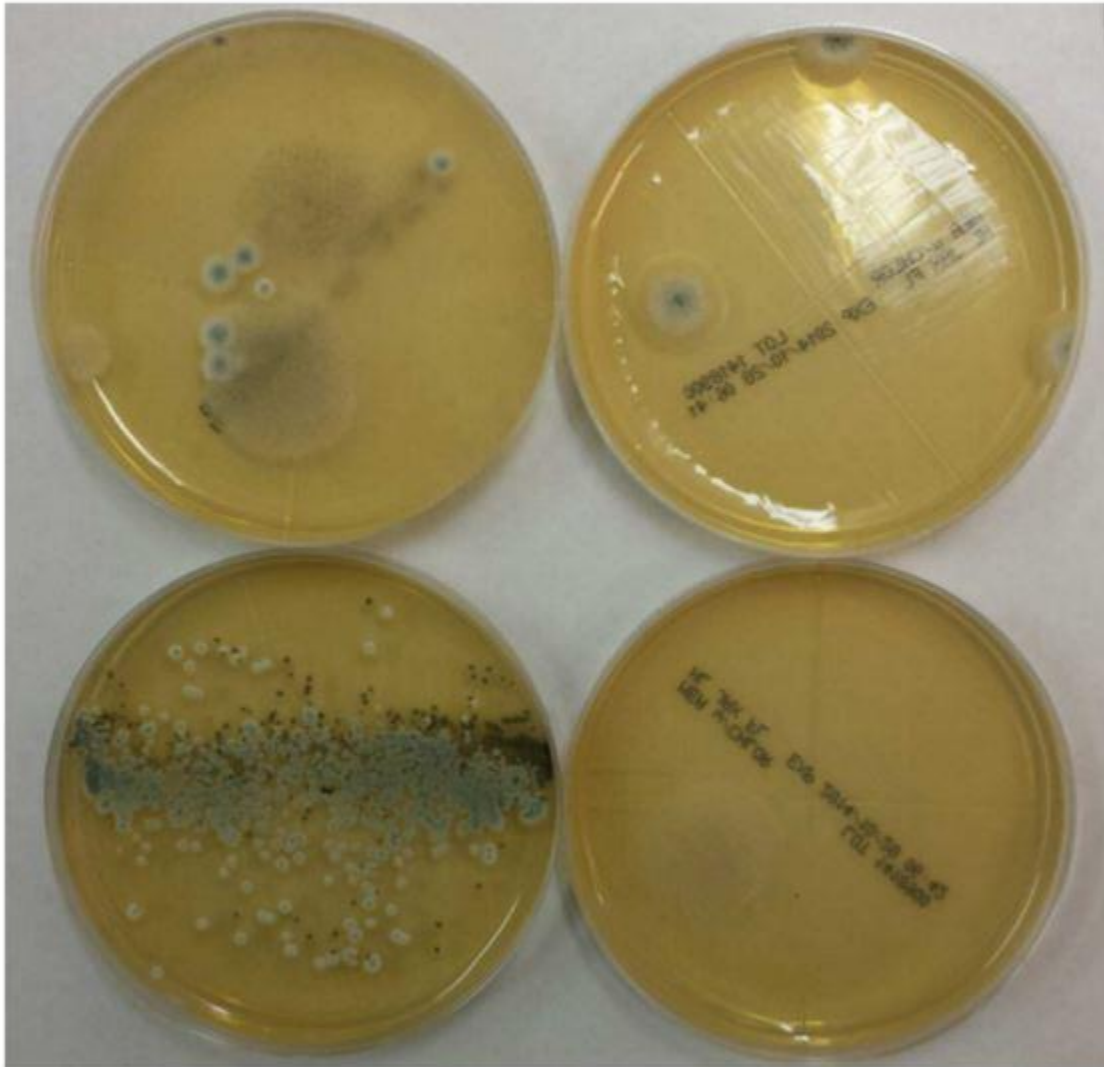
	01-Baby Veg	02-Hydroponic	03-Cure Room	04-Dark Room	05-Dark Room	06-Dark Room
‘Before’ Mold	13	3	401	1	0	44
‘After’ Mold	0	0	0	0	3	25
Difference	-13	-3	-401	-1	+3	-19
‘Before’ Bacteria	0	0	0	0	0	0
‘After’ Bacteria	100	35	0	0	0	0
Difference	+100 (See notes)	+35 (see notes)	0	0	0	0
Ion Level	580	370	1200 (see notes)	650	650	650
Notes	Noted during ‘after’ samples that there was potting soil spilled on our swab site. 73°F/55%RH	Noted during ‘after’ samples that the swab area seemed to have some sort of debris and dried liquid spilled on it.	‘Before’ swab had plants drying, and people in the room; ‘after’ swab did not. Could affect samples and ion reading. Also, swab was dropped on the ‘before’ sample, so to keep the samples standard, the ‘after’ swab intentionally dropped as well. 60°F/60%RH	Was taken on rim of plant pot to test levels at the soil. 80°F/50%RH	Was taken at floor level to test sprayed area. ‘After’ swab seemed to have some sort of liquid on the swab site. May be water or fungicide; we do not know.	Was taken approx. 5’ off of the floor to test unsprayed area.

	Entry	Entry/Hallway	Hallway	Flower Rm	Large Veg (Dark Rm)	Garage	Large Veg (Dark Rm #2)	Large Veg (Dark Rm #3)
Ion Level	880	1450	720	860	650	660	640	530
	Note: There were many people when this reading was taken, leading to lower numbers than anticipated.		Was taken at the far end of the hallway from the entry room. Opposite end from Garage.		Reading was taken between plants for more accurate reading.	Numbers started significantly higher than this (1400) but dropped to this ambient level.		

Before Swab Results

1

2



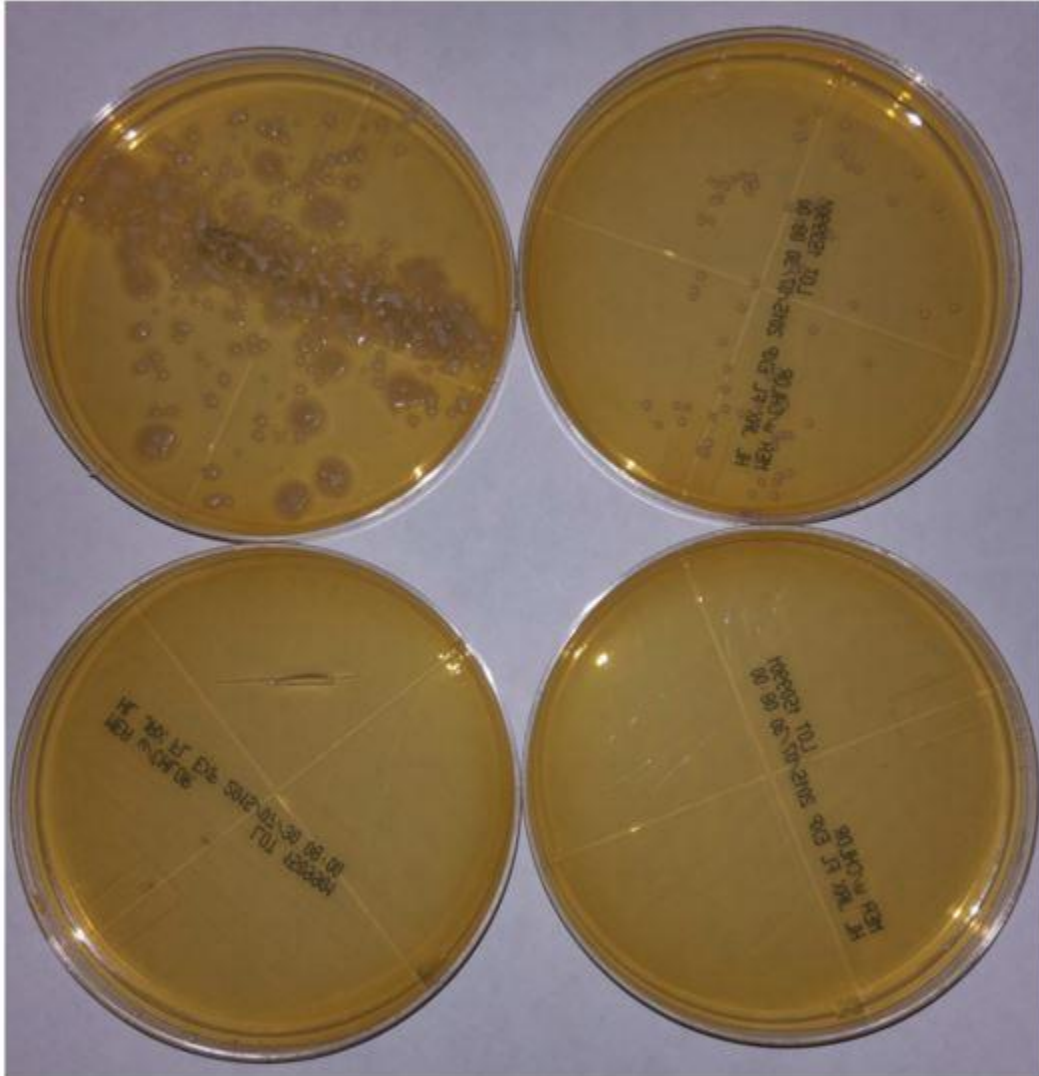
3

4

After Swab Results

1

2

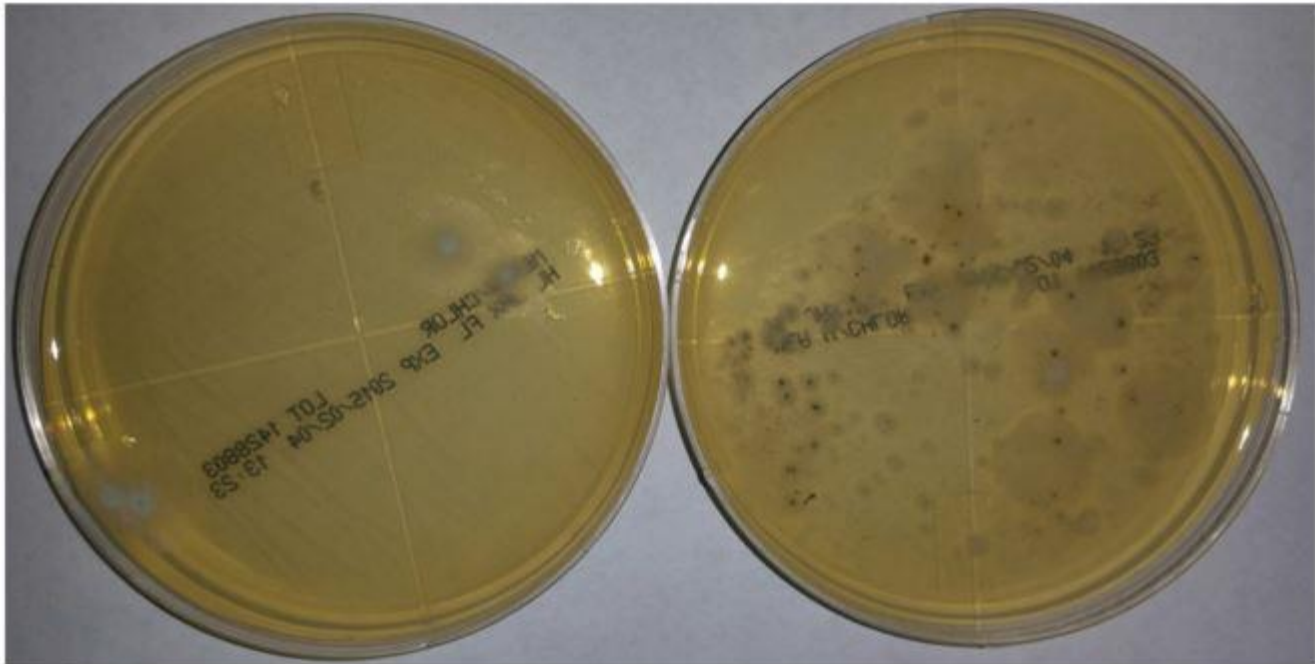


3

4

5

6



Analysis:

Six UVAIRx 14" In-Duct units were installed into the HVAC system of the building, on 10/8/15 (some units installed after this date), and evaluated on 10/28/15. All units were running for at least two weeks prior to tests.

Mold/Mildew: Results are promising, showing mold reduction on 5 of 6 samples, and the one increase was minimal (from 0 CFU to 3 CFU). Mold levels were extraordinarily high in the Cure Room (sample 3) and were completely mitigated after UVAIRx technology was installed, which is encouraging. Mold levels in the Dark Room (samples 4, 5 & 6) were not completely mitigated, but largely reduced.

Bacteria: Interestingly, bacterial levels were zero on all 'before' tests, but two were higher on the 'after tests.' Speculation is that the potting soil in the Veg Room (sample 1) shows that UVAIRx had no effect on the bacterial levels in the soil. The results with increased bacterial samples (100 CFU and 35 CFU) both show limited colonization, which is interestingly high. Verification of the speculation will need to be further tested, but it is hypothesized that we were able to test residual bacteria in the soil in our samples. This is encouraging for UVAIRx PCO technology in any area where vegetation is being grown.

Sample 1- Baby Veg Room:

As discussed earlier, this sample site had potting soil spilled on the 'after' swab location. Rather than brushing the potting soil off, we wanted to test the actual sample space. The results indicate what we hoped to see: that PCO technology does not have the capability to effect bacteria in soil. Further testing is recommended on this, but initial results are very positive for the application of PCO capabilities to plant growing.

Sample 2- Hydro Room:

Also discussed earlier, and in the notes above, this sample was taken on the powder coated railing below the Hydroponic setup. The 'after' swab site seemed to have a powdery substance (looked like foam from the hydroponic planters) and some sort of dried liquid. Rather than scrubbing or wiping the sample site, we wanted to test the space as it actually was. If the liquid was from the hydroponic process, it would be very nutrient rich, would lead to increased bacterial growth. We do know that the PCO process in the air does not make the phase change from air to liquid easily, and the liquid could harbor bacteria which the oxidative cluster ions (OCIs™) were not able to treat. Again, results were encouraging for PCO technology. Also, the "master grower" of this facility noted that a microbial (bacteria-laden) spray is used as an anti-fungal. This may account for the elevated bacterial readings as well. Further evaluation will determine this.

Sample 3-Curing Room:

These results may be the most encouraging of this sample set, seeing extremely high mold levels brought to zero. These tests are, in some regards, the most important of all of this test set, as any mold or bacteria in this environment could be ingested by the end customers and elevated levels could be potentially dangerous for the end users. Levels at 'before' results of 400 CFUs indicates full colonization of that space, and results being brought to zero shows excellent coverage of the space. This is extremely encouraging to see. One note, however, was that the 'after' tests were done with no vegetation or people entering or exiting the room, whereas the 'before' tests did include such activity. We recommend that one additional swab test be done and evaluated when vegetation is in the room drying.

Note: The "master grower" further remarked that the Curing Room was not cleaned with any sprays or cleaners between our tests.

Sample 4- Rim of planter in Dark Room:

This sample shows that there was no mold or bacterial growth at the base of the plants, which shows a healthy growing environment for the plants. This also indicates that the precautions taken before UVAIRx technology was installed are stable, and able to keep the plants healthy.

Sample 5-Baseboard in 'wet' corner of Dark Room:

Sample 6-Aproximately 5' from the floor level in the Dark Room:

Samples 5 and 6 were taken in similar locations of the Dark Room, with the difference being Sample 5 was at floor level (which is commonly sprayed by fungicides and pesticides), while Sample 6 was taken at head level (which is not commonly sprayed with fungicide or pesticide). Both samples showed promise that the environment is cleaned well, and Sample 6 indicated an improvement in 'unsprayed' space after installation of UVAIRx technology. Sample 5 showed a minor increase from 0 CFUs to 3 CFUs, and also was somewhat wet. While this result wasn't expected, it is not alarming. Both results, with ion levels below what is recommended, do show that plants absorb a certain amount of OCIs (while lesser than originally expected.) Possibly one more unit to treat that space specifically could be recommended, to bring ion levels slightly higher. Further evaluation and observation is recommended.

Conclusions:

In its entirety, the results of this set of tests is extremely encouraging, showing UVAIRx's viability to help augment treatment procedures in spaces designed to grow vegetation indoors. Ionization levels should be monitored and kept above 700 ions/cm³ within the facility with recommended levels in entry and exits at twice that to avoid pathogens entering the facility. Mold levels (which are of highest concern) were dramatically reduced, and (if hypothesis proves correct in further testing) bacteria levels in the soil (beneficial flora) are not effected, which were two of the highest concerns. Smell did not seem to be overwhelmingly reduced, and plants did not seem to be largely impacted, other than by UVAIRx adding a layer of protection against mold and mildew. The results in the Cure Room show a dramatic



improvement in the quality and safety of the end product. Further evaluation will be conducted, and updates to this document will be periodically added as the space is monitored in the future; however, initial results offer extremely promising evidence that UVAIRx Advanced PCO technology improves and protects commercial indoor growing facilities and their plants, and the use of UVAIRx should result in increased crop yields for the industry.