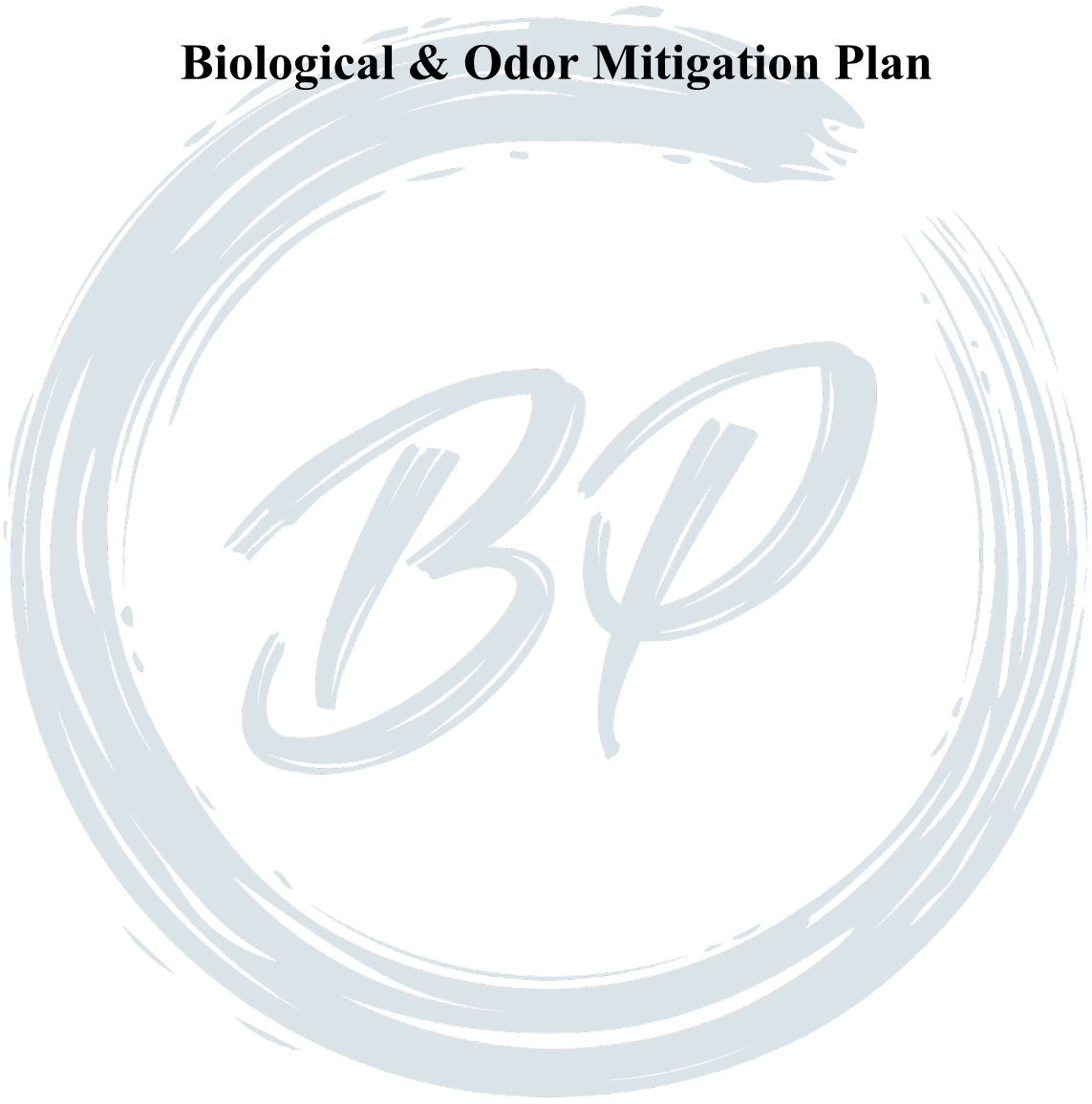
FullTilt Labs

Biological & Odor Mitigation Plan



By Bract & Pistil

Table of Contents

Biological & Odor Mitigation Plan

FullTilt Labs has taken extreme measures to eliminate all odor emitting from the facility during operations. The multiple layers of odor control that FullTilt Labs will install will be more than sufficient to mitigate all odors produced by the facility. These include redundant carbon filtration located throughout the facility, negative air pressure in cultivation rooms, odor technology, and Employee standard operating procedures.

These procedures will be applied to the following odor-emitting areas of activity:
• Mother/ Clone Rooms
• Vegetative Room
• Cultivation Rooms
• Drying Rooms
• Trimming Rooms
• Package Rooms
• And all other ancillary spaces in the facility

I. **Staff training procedures** FullTilt Labs has an extensive training program that includes training specifically for odor mitigation. The consistent practice of keeping doors shut, changing carbon filters, HEPA filters, and monitoring odor daily will ensure proper odor mitigation. FullTilt Labs will conduct monthly staff meetings and at these meetings, we will

discuss odor mitigation with all departments and the importance of keeping up with the processes we have in place.

II. **Record keeping** Carbon Filter Report Card, this card is maintained and filled out after every change by our manager on duty. FullTilt Labs will have a supply of Carbon Filters on site that will be re-ordered by the manager to keep aligned with the facility maintenance program. If a filter needs to be changed sooner, filters will be on-premises to do so. If maintenance is needed it will be done immediately to not affect the surrounding areas.

III. **Monitoring & inspection**: Every odor-emitting room will be continuously monitored with daily inspections for odor. If a high volume of odor is detected by an employee, they will directly inform the manager. If a filter needs to be changed it will be done so at this time. If doors are not closing by themselves, doors will be fixed as soon as the problem is detected.

Biological & Odor Mitigation Design & Equipment

1. ProGuard Air Purification
    a. ProGuard uses a proprietary photocatalytic oxidation (PCO) technology. This technology uses UV light energy to activate a proprietary catalyst, turning moisture into dry hydrogen peroxide and other sanitizing elements that continuously clean indoor rooms 24X7. This process will clean mold, mildew, bacteria, viruses, and voc's.
        i. Defender DXB 100 with BPI *(page 9)*
        ii. Defender DXB Mini with BPI *(page 10)*

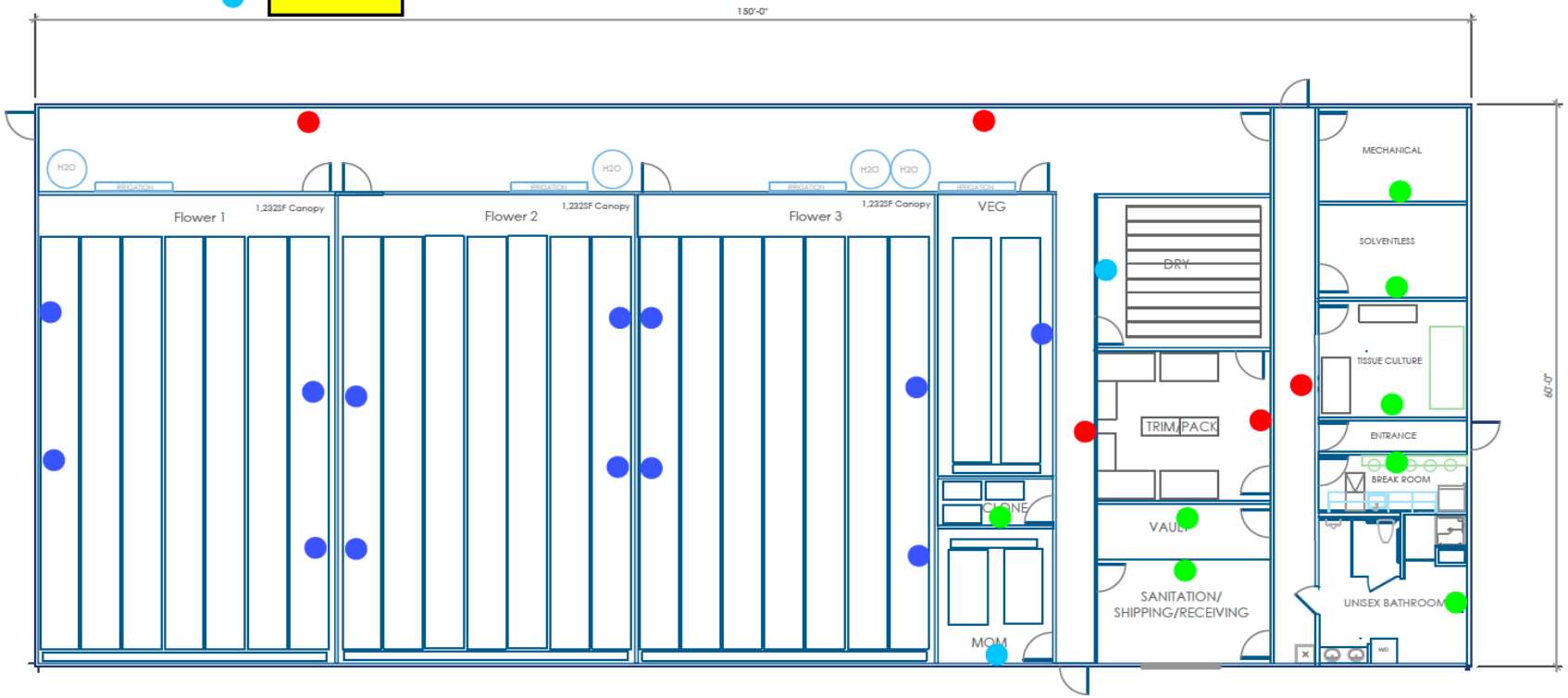
ProGuard Layout *(See Page 5)*

DXB 100

DXB 50

DXB Mini CA

DXB Mini



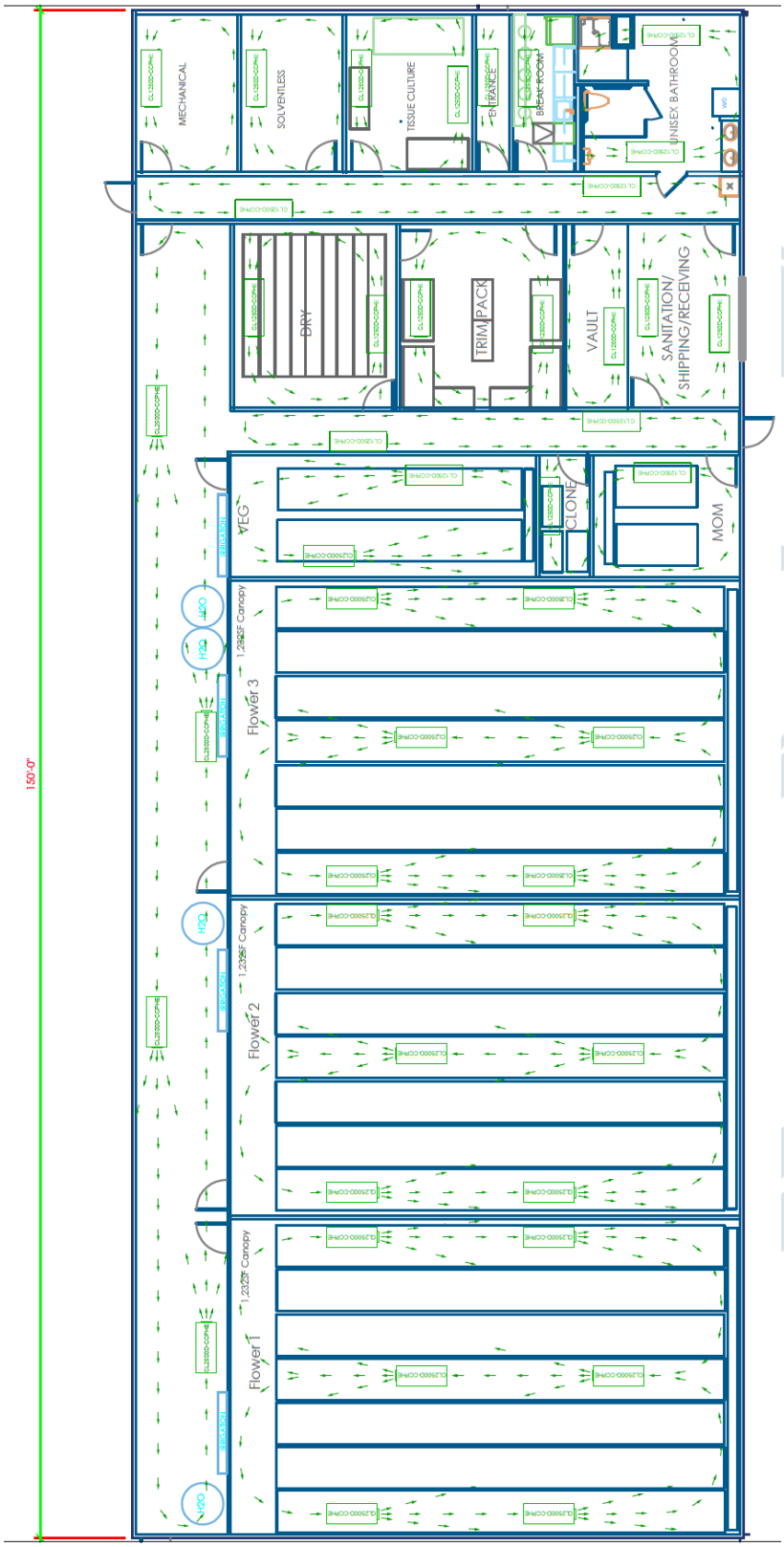
2. Clean Leaf Carbon & HEPA Filtration
    a. Active Carbon Filters absorbs its molecular weight of contaminants it encounters. Adsorption is a distinct process where organic compounds in the air react chemically with the activated carbon, which causes them to stick to the filter. The more porous the activated carbon is, the more contaminants it will capture.
    b. HEPA Filters
        i. HEPA filters are high efficiency filters that typically capture over 99.5% of all particulate pollution. They're made from either plastic (PP+PET) or fiberglass, and can capture things like pollen, viruses, bacteria, mold and PM2.5. Diffusion also means they are highly effective at capturing nanoparticles.
            1. Specification Sheet CL1250D-CCPHE *(page 30)*
            2. Specification Sheet CL2500D-CCPHE *(page 31)*

Clean Leaf Layout *(Page 7)*

Design Parameters:

Building Size: 9000 square feet (sqft)
Building Volume: 106,000 cubic feet (cft)
4000 sqft will be 14' tall = 56K cft
5000 sqft will be 10' tall = 50K cft
Air Exchange for entire building will happen every 90 seconds.

We will be exchanging 68,000 cubic feet per minute (cfm) of air in the room. This will give us an air exchange for the entire building approximately every 90 seconds. The industry standard is exchanging the air every 3 minutes. This will allow the carbon filters to have max longevity.


150'-0"
MECHANICAL
SOLVENTLESS
TISSUE CULTURE
ENTRANCE
BREAK ROOM
UNISEX BATHROOM
DRY
TRIM/PACK
VAULT
SANITATION/
SHIPPING/RECEIVING
VEG
CLONE
MOM
Flower 3
1,292SF Canopy
Flower 2
1,295SF Canopy
Flower 1
1,232SF Canopy
HPD
H2O
HPD
H2O

3. HVAC systems installed at this facility will be considered "closed-loop" systems. The HVAC equipment will recirculate 100% of the supply being distributed to the various applications areas throughout the facility. Ionization and active carbon filtering will be installed to mitigate odors within the facility. To the extent possible, the odor mitigation will be intended to mitigate odor migration to the outside of the building and surrounding areas. Each grow room will be designed to create negative air pressure within the growing environment. This essential component to our odor control system isolates odors and doesn't allow them to escape from their respective grow areas.

Ongoing Monitoring & Assessment

1. Odor Assessment Plan
    a. SOP for equipment inspection and filter changes
    b. Odor Inspection Calendar, Locations & Tracking System
    c. ***Public Outreach***
        1. We will have a monitored email account for the public to report any concern, comment, or complaint and staff will immediately review the concern and take appropriate measures to address the issue.
            a. Staff will document they received a Community Concern Form *(page 36)* which will include key information about the time, location, and the nature of the concern and then document their response and plan of action to fix the concern.
            b. All documents will be filed and kept for reference.

We are dedicated to addressing all serious odor concerns in connection with our operations and will utilize all available and feasible technology and operational adjustments to abate such concerns.

Innovative Solutions

Proactive Air and Surface Sanitization

Defender DXB 100 with BPI

Defender DXB 100 has been designed and engineered to deliver sanitization that is proven to reduce & eradicate surface and airborne pathogens for high load environments in Cannabis Cultivation Centers using the **ProGuard Sanitization Technology.**

Defender DXB 100 is easy to install and maintain as it operates 24/7 in Cannabis facilities.

ProGuard Sanitization has been tested and validated by reputable labs across the world to ensure safety and effectiveness in reducing mold, mildew, bacteria, viruses, voc's and other dangerous pathogens.

Applications Include: Indoor Grow Rooms, Greenhouses, Dry Rooms, and More.

Specifications

- Weight of Unit: 6.5 lbs.
- Dimensions (H x L x D): 11.69" x 13.44" x 3.5"
- Electrical Input: 100-240V – 50/60Hz
- Electrical Output: 12VDC 3A
- Power Consumption: Running 14W - 21W
- Warranty: 2 Years

Gary Mancini
858.382.1933

Mike D'Ambra
858.231.8484

www.Innovative-Solutions.org
innovativesolutions4mmj

Innovative Solutions

Proactive Air and Surface Sanitization

Defender DXB Mini with BPI

Defender DXB Mini has been designed and engineered to deliver sanitization that is proven to reduce & eradicate surface and airborne pathogens for high load environments in Cannabis Cultivation Centers using the **ProGuard Sanitization Technology.**

Defender DXB Mini is easy to install and maintain as it operates 24/7 in Cannabis facilities.

ProGuard Sanitization has been tested and validated by reputable labs across the world to ensure safety and effectiveness in reducing mold, mildew, bacteria, viruses, voc's and other dangerous pathogens.

Applications Include: indoor grow rooms, greenhouses, dry rooms, and more.

Specifications

- Weight of Unit: 3.3 lbs.
- Dimensions (H x L x D): 11.92" x 9.72" x 3.64"
- Supply Voltage/Watts: 100-240VAC / 17W
- Operating Voltage/Amps 24VDC / .67A
- Warranty: 2 Years

Gary Mancini
858.382.1933

Mike D'Ambra
858.231.8484

www.Innovative-Solutions.org
innovativesolutions4mmj

Advanced Oxidation Technology for

Control of Selected Bacteria, Mold and Yeast on Stainless Steel Surfaces

James L. Marsden, Ph.D. Distinguished Professor – Food Safety & Security

Kansas State University

Objective

The objective of this study was to evaluate the efficacy of the Sanitization Technology Advanced Oxidation Cell for the inactivation of selected bacteria, mold and yeasts on stainless steel surfaces. The microorganisms tested were chosen to represent important food safety and health care related hazards.

Materials and Methods

The following microorganisms were chosen for this study:

Bacillus globigii (ATCC # 31028, 49822, 49760), Staphylococcus aureus (ATCC # 10832D, 25178, 11987), Candida albicans (ATCC # 96108, 96114, 96351), Stachybotrys chartarum

(ATCC # 18843, 26303, 9182), Pseudomonas aeruginosa (ATCC# 12121, 23315, 260),

Escherichia coli (ATCC# 27214, 19110, 67053), Escherichia coli O157:H7: ATCC # 43890

and ATCC # 43889, Streptococcus pneumoniae (ATCC# 27945, 29514, 10782), Staphylococcus aureus - Methicilin resistant (ATCC# 33591) and Listeria monocytogenes (KSU # 56 and 70).

Cultures were revived using ATCC recommended instructions

The Bacterial, yeast and mold species were independently grown in Tripticase Soy Broth (TSB; Difco Laboratories, Detroit, MI) and YM broth (Difco Laboratories, Detroit, MI), respectively to mid-exponential phase followed by a wash and re-suspension in 0.1% peptone water. The microbial cultures were combined by specie type to ca. 108 CFU/ml.

The microbial species used to validate the Advanced Oxidation Cell were tested as microbial cocktails inoculated onto 6.3 x 1.8 cm on #8 finish stainless-steel

coupons (17.64 cm2 double sided area). Four stainless steel coupons were dipped per microbial inoculum and vortex 15 sec optimizing microbial dispersion. Sterile binder clips were used to hang each stainless steel coupon from a cooling rack for 1 h until dryness in a laminar flow biohazard air hood. The initial microbial population attached to the stainless steel coupons was in the range of 106 to 107 CFU/cm2. The inoculated stainless steel coupons were transferred to a controlled airflow test cabinet (Mini- Environmental Enclosure, Terra Universal, Anaheim, CA) at 26°C, 45 % relative humidity (ambient conditions), and exposed to the Advanced Oxidation Cell for periods of 0, 2, 6, and 24 h. Levels of Hydrogen Peroxide was measured using Draeger Hydrogen Peroxide 0.1/a Tubes (Range 0.1 – 3.0 ppm). Ozone levels were measured using Draeger 0.01/b Ozone Tubes (Range 0.01 – 1.4ppm).

Sampling

At the end of the each treatment time, the coupons were placed into 30 ml of 0.1% peptone water and vortexed for 30 sec; the samples were serially diluted and plated on Tripticase Soy Agar (TSA; Difco Laboratories, Detroit, MI) for bacteria recovery, additionally, yeast and mold cultures were plated on Potato Dextrose Agar (PDA; Difco Laboratories, Detroit, MI) and Cornmeal plates, respectively. The colony-forming units per square centimeter (CFU/cm2) were estimated after 24h (35oC) or 5 (30oC) days of incubation for bacteria or yeast and mold, respectively.

Results and Discussion

Reductions in microbial counts on #8 finish stainless steel coupons produced by the Advanced Oxidation Cell after 0, 2, 6, and 24 h exposure are presented in table 1. Exposure to oxidative gases and ionization produced by the cell reduced all microbial populations tested after just 2 hours. Longer exposure times resulted in greater reductions with the greatest reductions found after 24 hr exposure. The microbial reduction means after 24 h exposure were; Staphylococcus aureus (2.07 log CFU/cm2), Escherichia coli (2.23 log CFU/cm2), Escherichia coli O.57:H7 (2.34 log CFU/cm2) Bacilus spp. (2.71 log CFU/cm2), Methicilin Resistant Staphylococcus aureus (2.12 log CFU/cm2), Streptococcus spp. (1.93 log CFU/cm2), Pseudonomas aeruginosa (2.34 log CFU/cm2), Listeria monocytogenes (2.90 log CFU/cm2), Candida albicans (3.87 log CFU/cm2), and S. chartarum (4.12 log CFU/cm2).

The Advanced Oxidation Cell reduced microbial populations on stainless steel surfaces within 2 h under ambient conditions, with greater reductions associated with longer exposure times. This study demonstrated that the low levels of vapor

Hydrogen Peroxide combined with the ionization effect produced by the system has the potential to be an effective surface disinfectant tool. This technology has applications in health care, food processing and home environmental decontamination.

Table 1. Microbial Populations on Stainless Steel Surfaces associated with treatment using Advanced Oxidation Cell

	S. aureus	MRSA	E. coli	E. coli O157: H7	B. globigii	L. Mono	P. aeruginosa	S. pneumonia	C. albicans	S. chartarum
O Hours	6.71	6.48	6.93	6.77	6.39	6.81	6.26	6.51	5.97	6.18
2 Hours	5.19	5.36	5.82	5.39	5.51	5.72	5.11	6.10	4.96	4.81
6 Hours	5.02	5.15	5.33	5.07	4.45	4.93	4.74	5.31	3.30	3.21
24 Hours	4.64	4.36	4.70	4.43	3.68	3.91	3.92	4.58	2.10	2.06

Table 2. Microbial Reductions on Stainless Steel Associated with 24 Hour Treatment using Advanced Oxidation Cell and Average Ozone and Hydrogen Peroxide Measurements

	S. aureus	MRSA	E. coli	E. coli O157: H7	B. globigii	L. Mono	P. aeruginosa	S. pneumonia	C. albicans	S. chartarum
24 Hrs	2.07	2.12	2.23	2.39	2.71	2.90	2.34	1.93	3.87	4.12
Ozone ppm	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.01	0.03	0.02
H2O2 ppm	0.40	0.40	0.40	0.50	0.40	0.40	0.45	0.50	0.45	0.55

Innovative Solutions
ProGuard Sanitization Technology Test

MCR Group
Research Scientist Dr. Darryl Hudson PHD.
Kelowna, B.C., Canada

September 9, 2017

Objective:
Attached are some recent tests, which were conducted for the ProGuard Sanitization Technology by a third party research lab. The objectives of this study were to determine the efficacy of the ProGuard Sanitization Technology in dealing with some of the common problems cannabis cultivators deal with when growing medical marijuana.

1. Testing was done to measure the efficacy of the ProGuard Sanitization Technology in cleaning Cannabis growth rooms, while measuring impact on Terpenes, THC & CBD of the finished product.

2. Testing was also done to determine if the ProGuard Sanitization Technology can help producers meet government regulations regarding the allowable microbial CFU limits in the finished product.

Many producers have trouble meeting these requirements without some post-processing treatment such as irradiation. While irradiation sterilization processes are very effective in reducing CFUs, they have been reported to degrade the medicine by destroying important terpenes in the plant; which can negatively affect the product's fragrance, flavor, and cannabinoids.

Results:
The results for these tests are attached. A summary of the results is shown below.

1. **Air Quality Test in Grow Rooms**

Bio aerosols air samples were taken in order to assess the room contamination prior to implementation of the ProGuard Sanitization Technology. We found significant colony formation in each side rooms at all three sample locations and no considerable differences were found between samples locations of the two rooms.

All 3 samples in each room showed a significant reduction in bacterial colonies. Sample location 1 showed the most significant with a 61.2% reduction in colonies. Sample 2 showed a 49.3% and sample location 3 showed a 39.2% reduction. This is not surprising considering that location 1 is closest to the ProGuard Sanitization Technology and sample 3 is below the canopy of plants and therefore does not get as much airflow.

Unfortunately, one species of fungi present in the rooms had a tendency to overgrow the agar plates within one night; it would take over in a short period of time making colony counts not possible. Still, there appeared to be a drastic difference as observed with the bacteria. In the treated rooms, almost NO fungi grew. In contrast all the samples from the untreated rooms were covered in fungal growth.

Methods

Room Set Up
Small rooms - 28 x 18 x 11.5 = 504ft^2 / 5796ft^3
Central Ventilation in room 1 ProGuard Sanitization unit installed
Humidity - 45-55% in room. <65% outside during experiments

Large Room – 24 x 25 x 15 = 1080ft^2/16400ft^3
Ventilation along both walls 2 ProGuard Sanitization units in opposite corners.
Humidity - 40% in room. <40% outside during experiments

The layout of the smaller rooms is such that the intake air enters from in the ducting along the ceiling and blows toward the back of the room exiting out holes along the ducting (as shown in the image/diagram below).

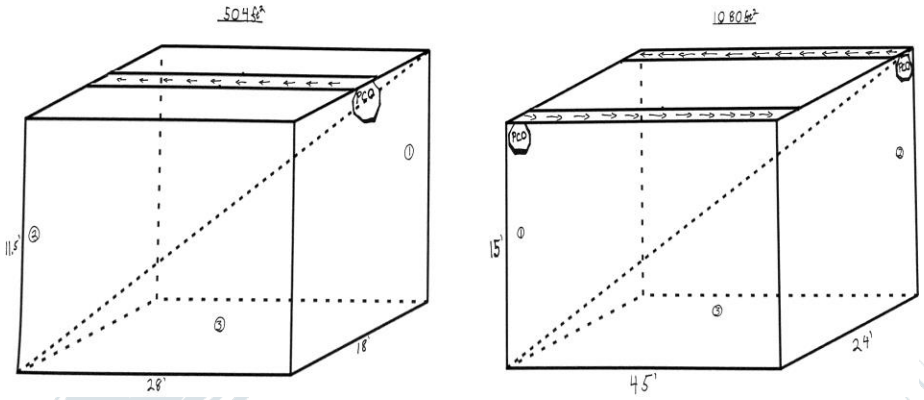
All ducting and negative room pressures were assessed prior to experimentation. The indoor temperature was typically 70- 73°F (23°C), with 45-55% relative humidity and air-flow velocity of ~500 ft/min (0.94m3/sec).

The ProGuard Sanitization unit was placed at the entrance of this ducting to the room. Fans are placed throughout the room to achieve good air circulation throughout. The larger rooms were set up in a similar fashion; however the ventilation ran along both sides of the ceiling in opposite directions. ProGuard Sanitization units were installed on opposite sides of the room blowing into the ducting. There were 24 lights in the small flowering rooms and 40 lights in each of the larger ones.

Example of Smaller Flowering Room

Sample location 1 is at the plant height (top),
~6 ft. closest to the ProGuard Sanitization unit.

The second location is to opposite corner, also at the height of the plant. The third sampling location was the center of the room and placed at the height of the pot, approximately 1 ft. off the floor.



Diagrams are showing room layouts with arrows showing direction of the airflow in the HVAC ventilation system. Circled numbers show the sampling locations for bio aerosols in the rooms.

2. **Microbial Measurements in Dry Cannabis**

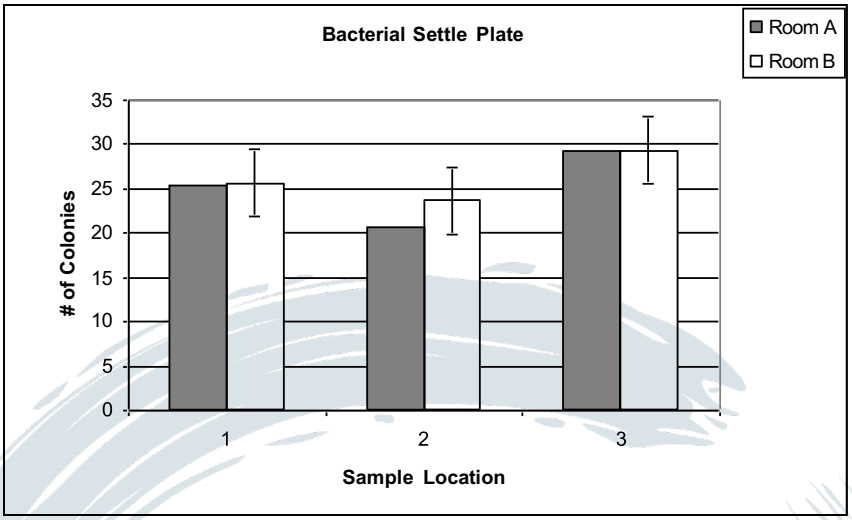
Finished product results showed that most of the flowers harvested from the growth rooms looked very good. As such, these results are representative of what might be produced from a typical grow.

The reductions in bio aerosols present in the grow rooms were predicted to significantly improve the quality of the finished product. The results verified this assumption was true. The flowers forming in a “clean room” with the ProGuard technology attacking the CFUs did result in cleaner product; in fact the harvested flowers did meet the Canadian medical marijuana requirements.

We also did not observe a reduction in terpene content of the dried flowers exposed to the ProGuard Sanitization Technology. As such, it can be concluded that the ProGuard Sanitization Technology has no negative side effects when used as to treat dried Cannabis flowers, and does not affect the flavor, fragrance of cannabinoids in any significant amount.

<u>Bioaerosols</u>

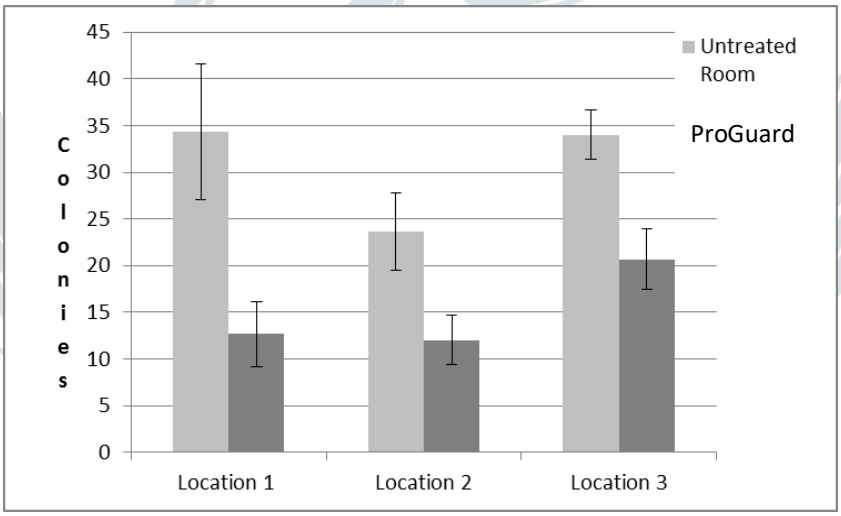
Samples were taken in order to assess room contamination prior to implementation of the ProGuard Sanitization Technology. For the smaller rooms, we found significant colony formation in each side rooms at all three sample locations and no considerable differences were found between samples locations of the two rooms. As such, it did not matter which room the ProGuard Sanitization unit was installed in at the beginning of the experiment.
The larger rooms also showed some colony formation, though much less (average 5.5) and were not as consistent between samples (some plates did not show any growth). This initial sampling performed at week 4 of flowering whereas the final tests were performed at week 8 (4 weeks following the installation of the ProGuard Sanitization unit).



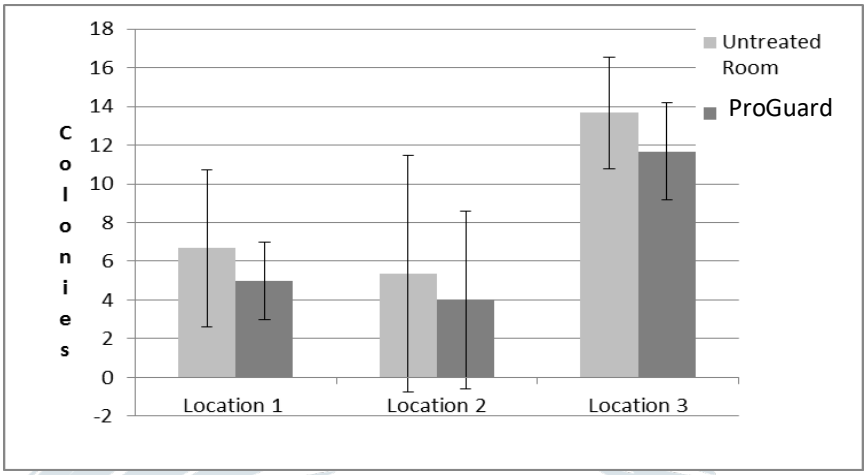
Example of colonies formed in the smaller room
prior to installation of ProGuard Sanitization Technology.

For the smaller room, all 3 locations showed a significant reduction in bacterial colonies. Sample location 1 showed the most significant with a 61.2% reduction in colonies. Sample 2 showed a 49.3% and sample location 3 showed a 39.2% reduction. Is not surprising considering that location 1 is closest to the ProGuard Sanitization unit and sample 3 is below the canopy of plants and therefore does not get as much airflow.

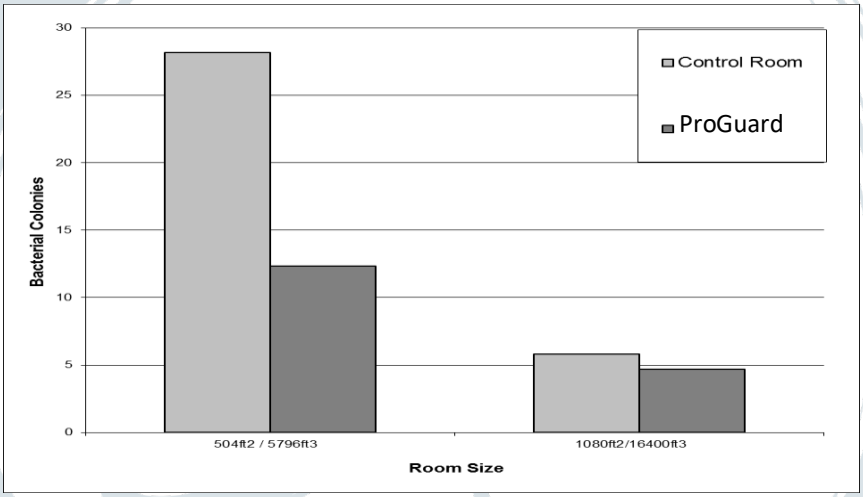
These reductions in bioaerosols were predicted to significantly improve the quality of the finished product.



Bacterial Settle Plates from Small Room.



Bacterial Settle Plates from Large Room.



Bioaerosols at Plant Height

When only taking into account the 2 samples taken at plant height from opposite corners of the room into account, only the small room showed a significant reduction in bacteria. Despite this, there was still a reduction in the larger rooms. However decreased initial contamination of the rooms combined with the relatively small sample size makes this insignificant. Regardless, any reduction of potential contaminants in the growing environment is beneficial for production of medical Cannabis.

Fungi

Unfortunately, one species of fungi present in the rooms had a tendency to overgrow the agar plates within one night. Once it began sporulation on the plate, it would take over in a short period of time making colony counts not possible. Still, there appeared to be a drastic difference as observed with the bacteria. In the treated rooms using ProGuard, almost NO fungi grew. In contrast all the samples from the untreated rooms were covered in fungal growth.

Colonies

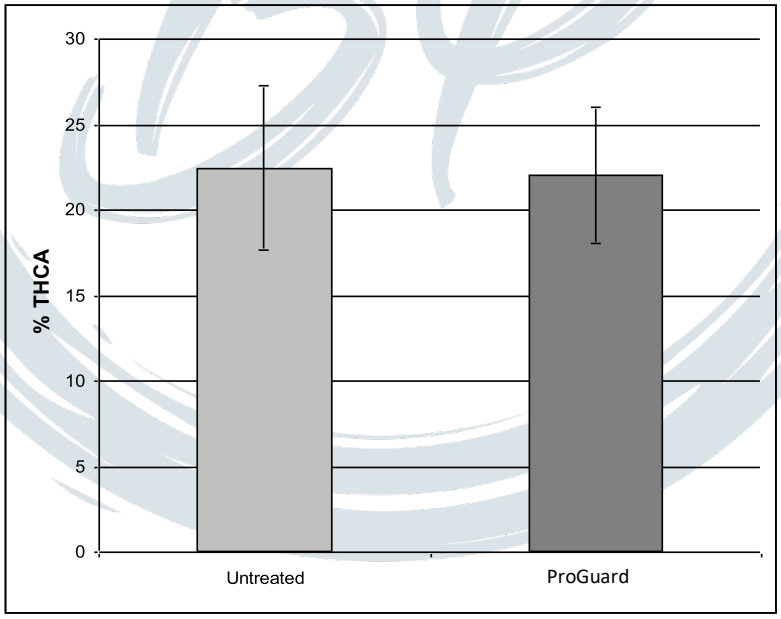
$504ft^2$ / $5796ft^3$ 1 unit	Untreated	ProGuard
Sample 1	Overgrown	None Detected
Sample 2	Overgrown	None Detected
Sample 3	Overgrown	None Detected
$1080ft^2$/$16400ft^3$ 2 units		
Sample 1	Overgrown	None Detected
Sample 2	203	None Detected
Sample 3	Overgrown	16

Cannabis Flowers

Visually, most of the flowers harvested from the growth rooms looked very good. Only one variety showed any sign of 'bud-rot' having what appeared to be some mild bud rot in the large upper flowers. There was no evidence of mold growing on most of the varieties samples. No pest issues (i.e. Insects or infection) were reported during the growth cycles from any room. As such, these results are representative of what might be produced from a typical grow.

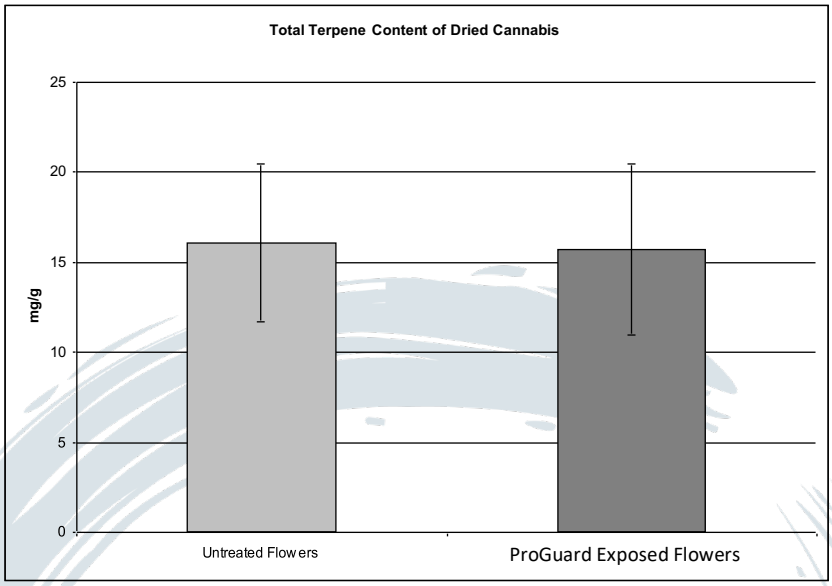
Moisture contents ranges from 8.13% to 10.7% in the dried flowers.

Cannabinoids were not significantly affected with variations falling within the typical range seen from one flower to the next.



Presence of THCA in flowers exposed to ProGuard Sanitization Technology prior to storage

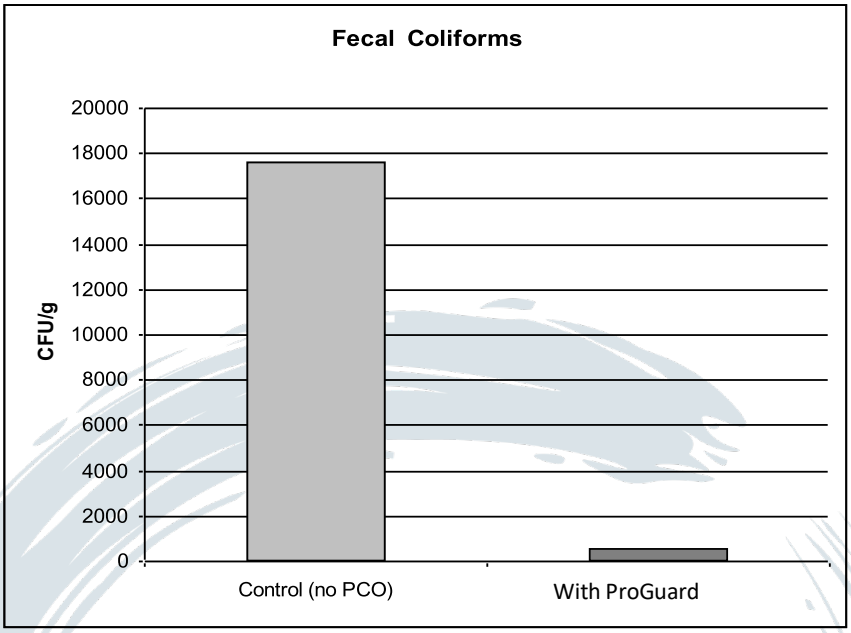
We did not observe a reduction in terpene content of the dried flowers exposed to the ProGuard Sanitization Technology. As such, it can be concluded that the ProGuard Sanitization Technology has no negative side effects when used as to treat dried Cannabis flowers.

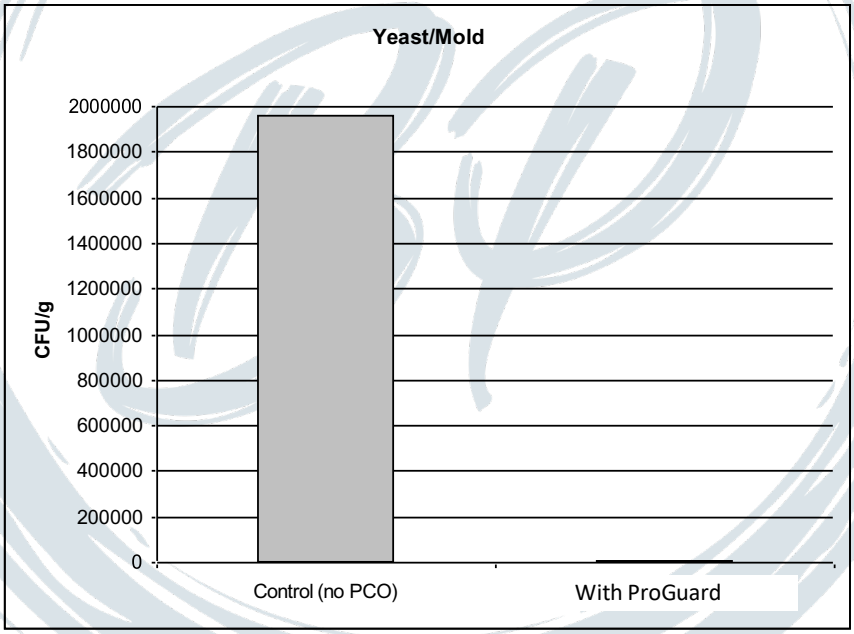


Terpene content of dried cannabis flowers treated with ProGuard Sanitization Technology compared to untreated controls. No significant variance was found in terpene levels after treated with ProGuard technology.

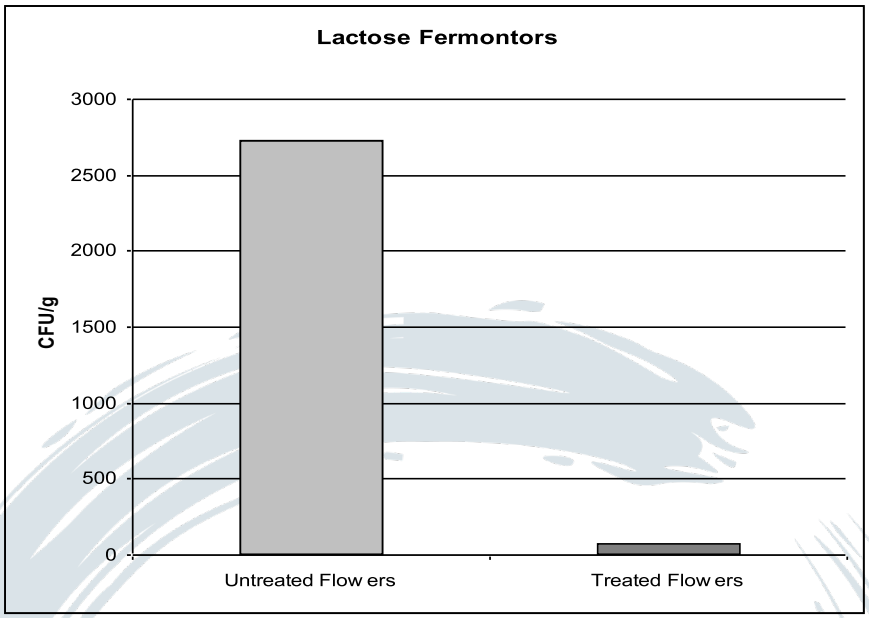
Microbial Load

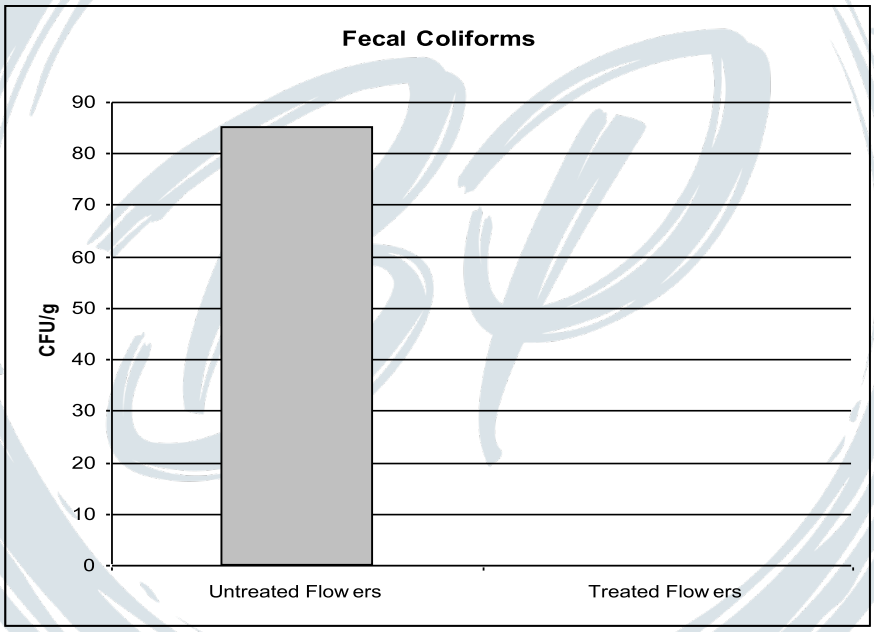
There was a large reduction between harvests of the control room (not treated) and the flowers collected from rooms with the ProGuard Sanitization unit installed. Product went from being significantly contaminated with both bacteria and fungi to having relatively little presence of any microbial activity. These levels would be considered acceptable by the strict guidelines set out in the Canadian MMPR regulations and the product could be directly approved for sale.

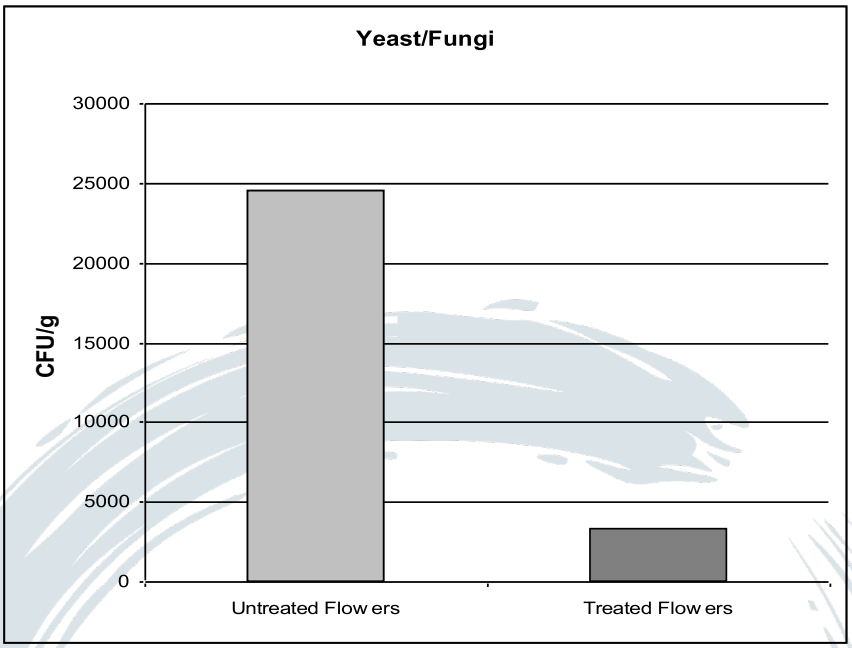




Dried flowers were also treated product to assess if any further reduction in microbial activity could be achieved at the final stages of processing. Product was directly exposed to the ProGuard Sanitization Technology in a bag for 2 minutes and then immediately sealed for 2 weeks of final curing prior to analysis. Due to variation between samples, these differences were not found to be statistically significant. Regardless, the overall averages in colony forming units per gram of sample (CFU/g) suggest reductions in all forms of microorganisms analyzed.


Lactose Fermontors
3000
2500
2000
1500
1000
500
0
CFU/g
Untreated Flow ers
Treated Flow ers


Fecal Coliforms
90
80
70
60
50
40
30
20
10
0
CFU/g
Untreated Flow ers
Treated Flow ers



.

Conclusions:

The ProGuard Sanitization Technology demonstrated the ability to clean Cannabis growth roomsof both odors and potential biological contaminants. No negative effects were observed on plant growth or the finished product quality. There was no negative impact found on the product Terpenes.

Flowers from rooms with the ProGuard technology installed were found to be acceptable by QA standards set out in the US pharmacopeia for dried herbal products. This is extremely important,as many commercial growers have had trouble consistently meeting these standards without post-production sterilization techniques such as irradiation.

The addition of the ProGuard Sanitization Technology to growth rooms, drying/curing rooms and processing areas will reduce the potential for contaminations and is a preventative measurethat should be considered for any company producing medical grade Cannabis.

Based on our results, I am convinced that the Technology should be used by every Indoor Grower as part of a complete QA program. I have not encountered another technology that canreduce microbial levels as effectively while maintaining the integrity of the product.

MCR Group Lab Tests – Using ProGuard to Reduce CFUs

MMPR - Lab Tests - March 2015

Analytes	Unit	*Control - UNTREATED** *w/o technology* **Bacteria Count**	*TREATED*** ***With Technology*** **Bacteria Count**	**Reduction**
Total Bacteria Count / # 1	cfu/g	36,180	184	99.49
Total Bacteria Count / # 2	cfu/g	72,285	7	99.99

This report relates only to the sample(s) and information that the MCR Group provided to the laboratory

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods

Tests were conducted independently by the MCR Group

MCR Group Lab Tests – Using ProGuard to Reduce CFUs

MMPR - Lab Tests - January 2015

Analytes	Unit	*Control - UNTREATED** *w/o technology* **Bacteria Count**	*TREATED*** ***With Technology*** **Bacteria Count**	**Reduction**
Bile Tolerance Gram Neg.	MPN/g	>10,000	<10	99.9
Total Bacteria Count	cfu/g	290,000	<10	99.99

This report relates only to the sample(s) and information that the MMPR LP provided to the laboratory

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods

Tests were conducted for a Licensed Indoor Grower that was experiencing high CFU's.

MCR Group Lab Tests – Using ProGuard to Reduce CFUs

MMPR - Lab Tests - September 2014

Analytes	Unit	*Control - UNTREATED** *w/o technology* **Bacteria Count**	***TREATED***** ***With Technology*** **Bacteria Count**	**Reduction**
Bile Tolerance Gram Neg.	MPN/g	>100 - <1,000	<10	99.9
Total Bacteria Count	cfu/g	160,000	20	99.99

This report relates only to the sample(s) and information that the MMPR LP provided to the laboratory

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods

Tests were conducted for a Licensed Indoor Grower that was experiencing high CFU's.

MCR Group Lab Tests – Using ProGuard to Reduce CFUs

MMPR - Lab Tests - August 2014

Analytes	Unit	*Control - UNTREATED** *w/o technology* **Bacteria Count**	***TREATED***** ***With Technology*** **Bacteria Count**	**Reduction**
Bile Tolerance Gram Neg.	MPN/g	>10 - <100	<10	95.9
Total Bacteria Count	cfu/g	24,000	40	97.9
Coliforms	MPN/g	93	<3	97.9

This report relates only to the sample(s) and information that the MMPR LP provided to the laboratory

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods

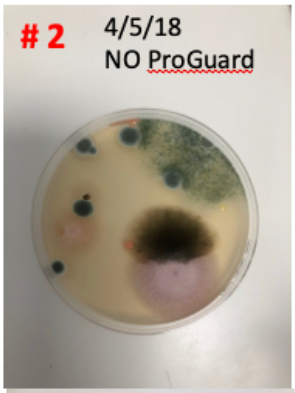
Tests were conducted for a Licensed Indoor Grower that was experiencing high CFU's.

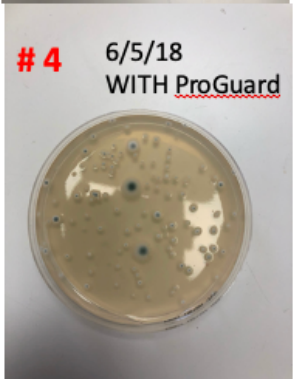
Innovative Solutions

ProGuard Proactive Air & Surface Sanitization

ProGuard Test Results
June 5, 2018

Trim Room





Pete Martin - CPHIC (Certified Public Health Inspector Canada)

Photo # 1 - The green circles are "active" Penicillium & Aspergillus Niger Mold. Both very harmful. *Very HIGH Contamination*

Photo # 2 - High levels of Penicillium & Aspergillus Niger Mold. Pink Mold/Bacteria as well as several types of Yeast. *Very HIGH contamination.*

Pete: The microbial levels would be unacceptable and a very high safety concern and not meet Quality Control standards

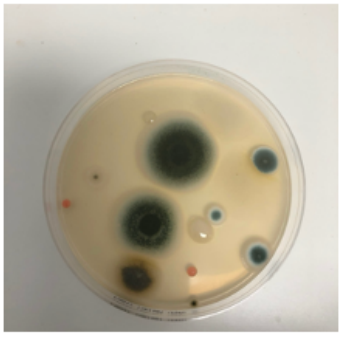
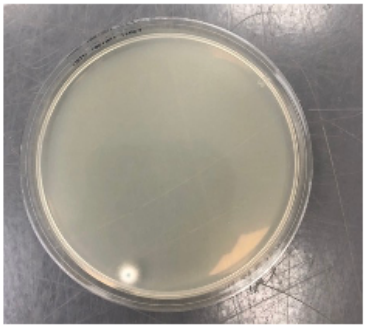
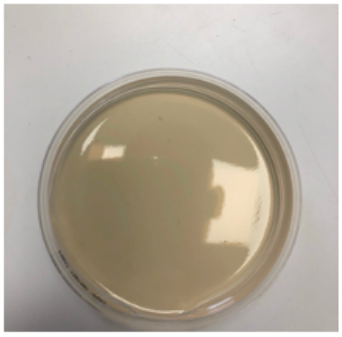
Photo # 3 - CLEAN - NO contamination

Photo # 4 - The green circles are "active" mold spores. The white circles are "inactive" mold spores that have been killed by the technology and would not show up on a lab test. - LOW contamination

Pete: The sanitization units dramatically reduced the amount of pathogens. The microbial levels are very low and would be acceptable for Quality Control standards

Cure Room

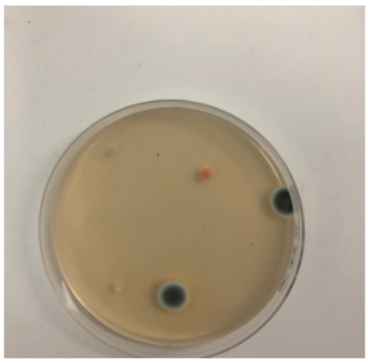
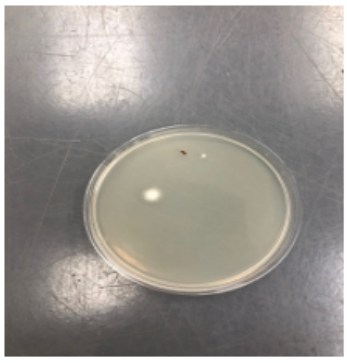
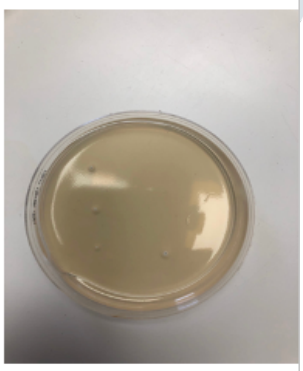
4/5/18 - NO ProGuard **4/24/18 - WITH ProGuard** **6/5/18 - WITH ProGuard**

The test result WITHOUT the sanitization technology has very HIGH levels of Penicillium and Aspergillus Niger Mold as well as Pink Mold/Bacteria. The test results WITH the sanitization technology have significantly reduced pathogens and have very LOW levels of contamination

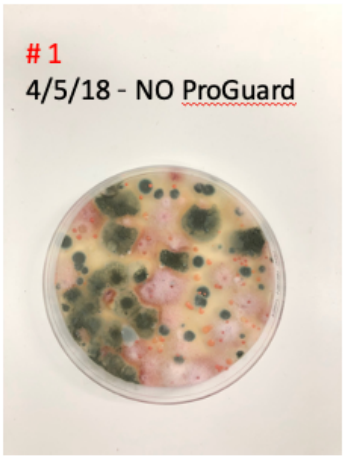
Dry Room

4/5/18 - NO ProGuard **4/24/18 - WITH ProGuard** **6/5/18 - WITH ProGuard**

The test result without the technology has a MODERATE level of contamination with some large colonies of Penicillium and Aspergillus Niger Mold as well as some Pink Mold/Bacteria. The test results with the technology show very LOW levels of Contaminants.

Hallway



Pete Martin:

Photo # 1 *- High levels of Penicillium & Aspergillus Niger Mold. Both very harmful. Numerous Pink Mold as well as several types of Yeast. Very HIGH contamination*

Photo # 2 *- Significantly reduced mold, and no bacteria & yeast. LOW contamination*

Photo # 3 *- Without the sanitization unit running it appears that re-contamination has begun causing an substantial Increase in Mold spores and bacteria. MEDIUM contamination*

Innovative Solutions

ProGuard Test Results
June 5, 2018

Test Results Overview:

The test results WITHOUT the sanitization technology in Trim Room, Hallway, Dry Room and Cure Room showed very HIGH levels of microbial contamination. From a Quality Control perspective these microbial levels would be a very high concern and not meet the standards set out by most regulatory standards.

The test results WITH the sanitization technology showed significant microbial reductions and had LOW levels of microbial contamination. From a Quality Control perspective these results would meet the standards set our by most regulatory standards.

ODOR SERIES

CLEANLEAF
Air Filtration Systems

Comply With Odor Regulations & Protect Your Plants

Controlling odor in and around your facility is a constant challenge. Make the CL1250D-CCPHE part of your **Odor Mitigation Plan**. Packed with 56 lbs. of activated carbon and a 95% efficient HEPA filter, the CL1250D-CCPHE eliminates the odor of even the most potent plants while protecting them from mold and mildew growth. Focus on your grow without worry of odor complaints or mold outbreaks.

SKU: CL1250D-CCPHE

Unit Specifications

Sound Level*	73 dBA @ 5'
Cabinet Size	25"W x 16.5"T x 59"L
Cabinet Material	16 Ga. Cold Rolled Steel
Cabinet Finish	White
Motor	48V DC Brushless Axial Flow Fan
Input Power	115V/60Hz/1PH/12A
Hanging Weight	333 lbs.
Shipping Weight	437 lbs.
Warranty	2 Years
Options	Silencer* (Reduces to 63 dBA @ 5')
	Ducting Package
	Alternative Voltage Options
	WiFi/Modbus Smart Controls
	7 lb. Carbon After-filter

**Noise level measured at typical operating speed*

AIRFLOW LEVELS

CFM	Conditions	W.G.
1500	Max Speed, No Filters	0" w.g.
1420	Max Speed, Clean Filters	1.33" w.g.
900-1000	Suggested Operating Range for Max Filter Effectiveness	Variable

Filter Stages

35% Efficient Pleated Pre-Filter, 15" x 25" x 2"

95% Efficient D.O.P. HEPA Filter, 15" x 25" x 4"

(8) 7lb. Activated Carbon Canisters, **56 lbs. Total**

35% Efficient Pleated After-Filter, 15" x 25" x 2"

Features & Benefits

- ✓ Easy Installation (Pre-Installed Eye Bolts/115V Wall Plug, 5-15p)
- ✓ Minimal Maintenance (Long Filter Life, Hinged Door Filter Access, Filter Change Indicator)
- ✓ Adaptable: Can Be Stand-Alone Or Ducted, Flexible Filter Configuration Options
- ✓ High Static (4" w.g.) Continuously Variable Speed Motor (Maintains Airflow as Filters Load)
- ✓ Industry-Leading Carbon Weight (56 lbs per unit)
- ✓ Combines Clean Room HEPA Filtration + Odor Control

info@cleanleaf.com | 1-866-455-2135 | cleanleaf.com

ODOR SERIES

CLEANLEAF
Air Filtration Systems

Avoid odor complaints while eliminating mold & mildew with 112 lbs of industry proven activated carbon filtration.

Controlling odor in and around your facility is a constant challenge. The CleanLeaf Odor Series was specifically engineered for cultivators to help eliminate the odor of even the most potent flowers while protecting them from contaminants like mold and mildew. CleanLeaf units provide a safe, effective, and efficient solution using a powerful 2500 CFM blower to pull air through layers of 95% efficient D.O.P. HEPA filter media and 16 carbon canisters, ensuring maximum adsorption.

SKU: CL2500D-CCPHE

Unit Specifications

ACFM	2000 CFM
Airflow	Straight Through
Sound Level	65 dBA @ 5' (on high)
Cabinet Size	26"W x 28"T x 64"L
Cabinet Material	16 gauge Cold Rolled Steel
Cabinet Finish	White, Light Reflective Polyurethane
Motor	PSC Type 1/3 HP Direct Drive
Input Power	115V 60Hz 1PH
FLA	9A
Running Amps	7.5A
Grille/Louver	4-Way Adjustable Blades/Fins
Hang Weight	516 lbs.
Warranty	2 Years
Options	Smart Controls
	99.97% True Medical HEPA Filter
	12 lb. Carbon Afterfilter

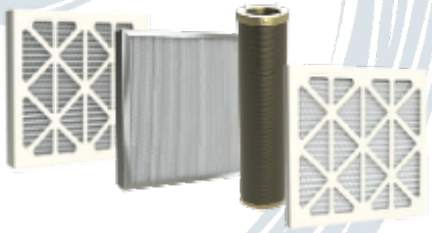
Filter Stages

35% Efficient Pleated Pre-Filter, 26" x 26" x 4"

95% Efficient D.O.P. HEPA Filter, 26" x 26" x 4"

(16) 7lb. Activated Carbon Canisters

35% Efficient Pleated After-Filter, 26" x 26" x 2"



Features

- ✓ Pre-Installed Eyebolts
- ✓ Filter Change Gauge
- ✓ Multiple Motor Voltages Available
- ✓ Hinged Door For Easy Filter Access
- ✓ Ambient or Ducted Configuration
- ✓ Pre-Drilled Duct Holes

info@cleanleaf.com | 1-866-455-2135 | cleanleaf.com

A Division of Air Cleaning Specialists
PROOF OF EFFICACY

OVERVIEW

The following is the statement of efficacy regarding carbon air filtration and the CleanLeaf Air Filtration System for use in cannabis cultivation facilities.

Controlling odor in and around cannabis facilities can be a challenge. Terpenes are generally considered to be the major contributor to odor issues, but other compounds may be present in the exhaust from other indoor sources, for example fertilizer and extraction processes (butane, propane). Different fertilizer types will produce different combinations of gas emissions and require targeted **carbons** due to the small size of the gas compounds that may be present. [1] These other odor sources are also commonly associated with more mainstream plant cultivation.

To address the odor and environmental concerns associated with cannabis cultivation, the CleanLeaf Odor Series was specifically engineered to eliminate odor from even the most potent flowers, while protecting the health of the plants and people from other airborne threats such as mold and mildew.

We will examine the efficacy of carbon itself, important things to consider and how CleanLeaf has applied this leading air-filtration technology with other proven methods to produce an effective solution.

WHY CARBON?

Carbon is the most effective and efficient odor eliminator because of its organic structure. Activated carbon, in particular, is porous. It is designed to capture contaminants such as VOC's (volatile organic compounds) that are responsible for odors of all kinds. As the carbon pores become saturated, the VOC's are neutralized - eliminating odor at the source.

From the Colorado Department of Public Health and Environment - Air Pollution Control Division:
"Carbon filtration is currently the best control technology for reducing VOC emissions from cannabis cultivation facilities." [2]

From Caitlin D. Naske, Lead Chemical Engineer, Dynamic Air Quality Solutions:
"The majority of grow facilities working to control odors use activated carbon filters." [1]

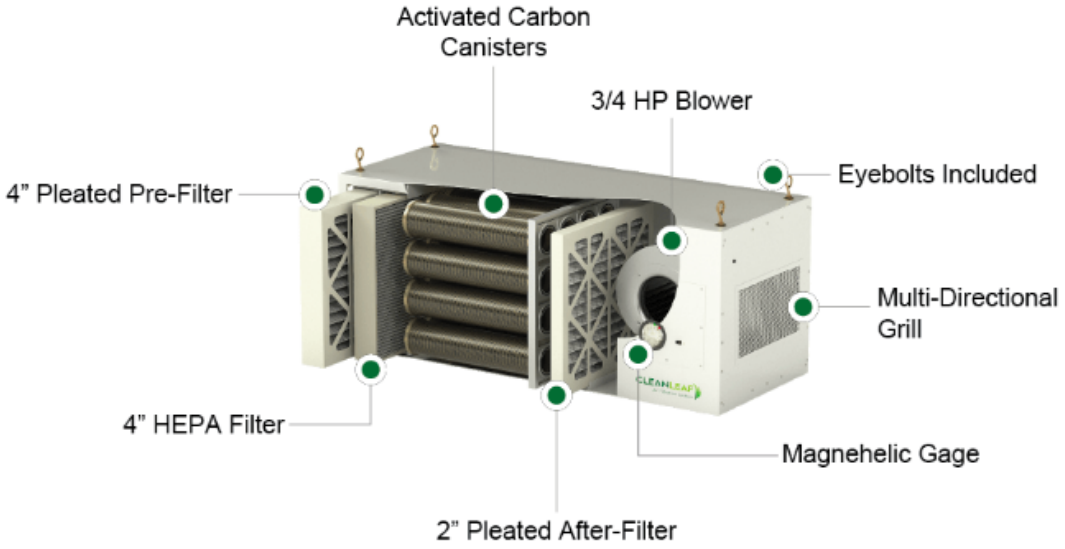
From Robovent:
"Activated carbon is the most commonly used adsorbent material. This is a form of carbon that has been specially treated (activated) to increase the internal surface area of the material. Activated carbon contains millions of internal "micropores" that result in a structure that provides ~1,000 or more square meters of surface area per gram of material.
Activated carbon is widely available, affordable, biologically inert and safe to handle and use. It is often called the "universal adsorbent" because it can adsorb virtually any vapor or gaseous contaminant and can adsorb and retain many different chemicals at the same time. It is especially effective for organic molecules and solvents. Unlike some adsorbent materials, it does not retain moisture. These properties have made activated carbon the material of choice for a wide range of adsorption applications, including gas masks, space capsules, nuclear submarines and radioactive iodine removal for nuclear plants". [3]

From growweedeasy.com:
[Regarding carbon] "These are hands-down the best option for controlling marijuana grow room odors. Carbon filters (also called 'carbon scrubbers') will actually pull the smells out of the air, neutralizing any odors that pass through.
Carbon filters are what you need if it's important to neutralize the air coming out of your exhaust. A good carbon filter will make sure you never accidentally leak the smell of cannabis out through a window into your neighborhood.
These devices use activated carbon to chemically absorb smells and other impurities from any air that is pushed through the filter." [4]

IMPORTANT CONSIDERATIONS

MTZ
From Caitlin D. Naske, Lead Chemical Engineer, Dynamic Air Quality Solutions:
“A critical activated carbon design factor that is often overlooked is mass transfer zone (MTZ). MTZ is the section of carbon
where active adsorption is occurring, or more specifically, the depth of carbon needed for complete capture of the gas, at a
given airflow and concentration.
The MTZ is not only influenced by the type, concentration and number of contaminants, but also other design factors
including the area of media and airflow through the media. The higher the concentration and/or air velocity, the longer the
MTZ and the more depth that is required to prevent contaminant breakthrough and downstream odors.” [1]
In short, the surface area of the filtration media must be big enough to adsorb the particulate as it is circulated through.
HVAC & AIRFLOW
The ability for the filtration system to change the air in a room is critically important. The motor and fan in the air filtration
unit must be powerful enough to change the air a particular amount of times in one hour (referred to as ACH = air changes
per hour), depending on the size of the room. Some cultivators will attempt to rely on their HVAC system to accomplish
proper air filtration, but the truth is they' re not powerful enough to filter cannabis odor molecules or contaminated air.
HVAC systems are built for heating and cooling the air and aren't equipped with the proper filter media, technology, or
power to control grow-room odors. HVAC filters are simply designed to keep large particulates from affecting the internal
mechanisms. Responsible cultivators understand that more attention to detail is needed for proper air filtration and odor
control.
When appropriately placed, air filtration systems should work in tandem to create vortex-like patterns that maximize
airflow and more effectively capture odors and particulate. The air pattern is often called a “racetrack”.
This prevents particulate from having the chance to settle in the grow room.
ADDITIONAL FILTRATION
Additional layers of filtration are needed to achieve optimal air quality and to protect the carbon.
From Caitlin D. Naske, Lead Chemical Engineer, Dynamic Air Quality Solutions:
“Another simple and often forgotten way to maintain carbon performance is to install adequate pre-filtration
to protect and prevent damage to the activated carbon. Debris can build up on the surface of the activated
carbon over time reducing the carbon availability, inhibiting the adsorption of gasses and restricting air flow.” [1]
WHY CLEANLEAF AIR FILTRATION SYSTEMS?

With a thorough understanding of cannabis cultivation and more than 40 years of experience in air filtration, Air Cleaning
Specialists created CleanLeaf to solve the unique and ever-growing challenges faced by cultivators and the individuals that
are charged with the difficult task of regulating the industry.
Here's how:
There are a few options available to combat odor and contaminants in cannabis cultivation facilities, but many are designed
to simply mask the issue, and worse, some actually emit byproducts that are harmful to humans and plants. CleanLeaf units
provide the safer, more effective and efficient solution using a powerful 2000 CFM blower to force air through a 4" pleated
MERV 10 pre-filter, a 4" HEPA filter, 16 large carbon canisters & a 2" pleated after-filter to ensure maximum adsorption.
The completely self-contained units hang from the ceiling and are designed to work in teams to continuously circulate air,
creating the "racetrack" airflow pattern to constantly adsorb odors and capture contaminants.



12 lb. Carbon After-Filter Option Available

CLEANLEAF FILTER STAGES & FUNCTIONS

STAGE 1: HEPA SAVING PRE-FILTER
FIBER MEDIA | MERV 10
This pre-filter protects the HEPA filter from getting clogged with larger particulate. Should be changed every 6 months to 1 year.

STAGE 2: HEPA FILTER TO PROTECT CARBON
HEPA MEDIA | 95% D.O.P. @ 0.3 microns
This true medical grade HEPA filter captures mold and mildew and other contaminants, protecting your garden from powdery mildew, cross-pollination, and more. Should be changed every 6 months to 1 year.

STAGE 3: ODOR ABSORBING CARBON CANISTER
7 lbs. OF ACTIVATED CARBON PER CANISTER
Each carbon canister is filled with 7lbs. of activated carbon. Made to capture and absorb even the most stubborn odors from your garden. Should be changed every year.

STAGE 4: PLEATED AFTER-FILTER
FIBER MEDIA | MERV 10
This after-filter gives the air one last step of filtration before circulating it back into your garden. Should be changed every 6 months to 1 year.

Community Concern Form

COMMUNITY CONCERN FORM

Full Name:

Phone Number:

Email:

Date:

Time of Day:

What is the location of the smell?

How severe is the smell?

Is there any other concern you would like our team to address?

Thank you for taking the time to communicate your concerns with our team, we will investigate this immediately.

Bract & Pistil