BioZone Air Purification

Validation Report

BIOZONE®
SCIENTIFIC INTERNATIONAL

Validations

Europe

France :	The National Scientific Research Centre
	Clean Concepts Measurements
Ireland :	Dublin University
Finland：	Tervisekaitseinspektsioon
	Health Protection Inspectorate
	Mikrobioloogia Kesklabor
	Central Laboratory of Microbiology

North America

USA ：	USDA—Vallid Labs
	US FDA—Tri-Tech Analytical Lab
	Department of Biology，Penn State University
	Environmental Industries International, Inc.
	Envirogen International Testing Lab

Asia

Australia：	Engineered Environments (IEQ) Pty Ltd
	Healthy Buildings International Pty Ltd.
Korea：	Korea Apparel Testing & Research Institute
Singapore：	Pure Science International Pte Ltd
China：	國家空調設備質量監督檢驗中心
	國家環境分析測試中心
	中國疾病預防控制中心環境與健康相關產品安全所
	軍事醫學科學院微生物流行病研究所
	深圳福田區疾病預防控制中心
	深圳市計量質量檢測研究院
	(國家質量監督檢驗檢疫總局深圳計量檢定站)
	深圳維中檢測技術有線公司
	醫科大學公共衛生與熱帶醫學學院微生物學系
	廣東省疾病預防控制中心(廣東省衛生檢驗中心)
Hong Kong:	SGS
	Lawn Environmental Protection Limited

UV DOSAGE FOR DESTRUCTION

Ultraviolet energy levels at 254 nanometer unit wavelength required for 99.9% destruction of various microorganisms:

BACTERIA	Common Name	µW/cm2/sec.
Bacillus anthracia	Anthrax Virus (not spores)	8,700
Agrobacterium tumefaciens	Crown Gall Disease (plants)	8,500
Bacillus Megatherium	Wet wood Disease	2,500
Bacillus subtilis	(vegetative)	11,000
Clostridium Tetany	Tetanus/Lockjaw	23,000
Corynebacterium diphtheria	Diphtheria	6,500
Escherichia coli	E-Coli	7,000
Legionella bozemanii	Pontiac Fever	3,500
Legionella dumoffii	Pontiac/Legionnaires	5,500
Legionella gormanii	Pontiac/Legionnaires	4,900
Legionella micdadei	Pontiac/Legionnaires	3,100
Legionella longbeachae	Pontiac/Legionnaires	2,900
Legionella pneumophila	Legionnaires Disease	2,760
Leptospira interrogans	Infectious Jaundice/Leptospirosis	6,000
Mycobacterium tuberculosis	Pulmonary Tuberculosis	10,000
Neisseria catarrhalis	Meningitis, Endocarditis, Pneumonia, Bronchitis, Otitis Media, Sinusitis	8,500
Proteus vulgaris	Urinary Tract Infection, Bacteremia, Pneumonia and Focal Lesions	3,900
Pseudomonas aeruginosa	Laboratory Strain	3,900
Pseudomonas aeruginosa	Enviormental Strain	6,900
Rhodospirillum rubrum	Bacterium	6,200
Salmonella enteritidis	Gastroenteritis, Enteric Fever, Osteomyelitis	7,200
Salmonella paratyphi	Para-Typhoid Fever, Enlargement of Spleen	6100
Salmonella typhimurium	Gastroenteritis	15,200
Salmonella typhose	Typhoid fever, Enteric fever, Typhus Abdominales	6,000
Serratia marcescent	Septicaemia, Abscesses, Burn Infections, Osteomyelitis	6,200
Shigella dysenteriae	Dysentery - Enteric Infection	4,200
Shigella flexneri	Dysentery	3,400
Shigella sonnei	Enteric Infection	7,000
Staphylococcus epidermidis	Bacteraemia, Wound Infection, Endocarditis, Catheter-Related Sepsis,UT I, Toxic Shock Syndrome, Eye Infection, Osteomyelitis	5,800
Staphylococcus aureus	Staphylococcal Diseases, Impetigo, Toxic Shock Syndrome, Food Poisoning	7,000
Streptococcus faecalis	Urinary Tract Infection and Bacterial Endocarditis	10,000
Streptococcus hemolyticus	Various Infections	5,500
Streptococcus lactic	Various Infections	8,000
Viridans streptococci	Invasive Infections	3,800
Vibrio cholera	Cholera	6,500

Report

UV DOSAGE FOR DESTRUCTION

MOLD SPORES

Mucor ramosissimus	Sinuses, Brain, Eyes, Lungs, & Skin Infections	35,200
Penicillium expensum		22,000
Penicillium roquetorti	Green	26,400

ALGAE

Chlorella vulgaris	Green Algae	22,000

VIRUSES

Bacteriophage	E. Coli / Bloody Diarrhea / Hemorrhagic Colitis	6,600
Hepatitis Virus	Hepatitis	8,000
Influenza Virus	Influenza	3,400
Poliovirus	Polio	21,000
Rotavirus	Rota Virus	24,000
Small Pox Virus	Small Pox	9,000

CYST

Giardia Lamblia	Giardiasis	5,000 - 10,000
Chryptosporidium	Diarrheal Disease	5,000 - 10,000

YEAST

Bakers yeast	Trichosporon	8,800
Brewers yeast	Brewers Yeast	6,600
Common yeast cake	Yeast Cake	13,200
Saccharomyces ellipsoideus	Saccharomyces	13,200

Europe

France :	The National Scientific Research Centre
	Clean Concepts Measurements
Ireland :	Dublin University
Finland :	Tervisekaitseinspektsioon
	Health Protection Inspectorate
	Mikrobioloogia Kesklabor
	Central Laboratory of Microbiology

BioZone™ Destroys H5N1 Viruses

- A reduction of 5.7 logs (99.9998%) in less than 0.44 seconds

The effectiveness of BioZone™ technology in destroying H5N1 virus

Introduction: This is a summary of the tests performed to measure the effectiveness of BioZone™ technology in destroying airborne H5N1 avian influenza virus. The complete report is available upon request.

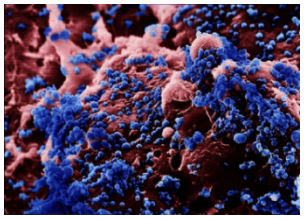
Laboratory: The tests were performed by The Centre National de la Recherche Scientifique (CNRS, The National Scientific Research Centre under the authority of France's Ministry of Research) in bio safety level 3 laboratory in Lyon, France - one of the World Health Organization (WHO) collaborative center for Avian and human influenza viruses.

Method: Influenza strain A/Finch/England/2051/91 H5N2 (316.000.000 viruses/ml) was sprayed as an aerosol into an inlet leading into a purification chamber. The first samples were collected from the inlet before the aerosol entered the purification chamber. In the chamber the virus aerosol was subjected to UV light and photo plasma-based BioZone™ technology for 0.44 seconds, after which the second samples were collected from the outlet. The concentration was then calculated using the "Reed and Muench" statistical method.

Destroys **99.9998%** of H5N1

Results: The tests show that BioZone™ technology destroys the strain of H5N1 virus, reaching 5.7 logs (99.9998%) reduction rate in less than 0.44 seconds.

About BioZone Scientific International



Company: With over a decade of experience in its field, BioZone Scientific International (BSI) researches, develops and manufactures technology-based solutions for microbial contaminant and VOC originated hygiene and odor problems in human environments. BSI develops best-in-class solutions for specific applications in close collaboration with its customers and distributors.

BioZone solutions, based on multi-faceted technology, are extremely efficient in eradication airborne and surface micro organisms such as viruses and bacteria, mold spores, yeasts and algae as well as volatile organic compounds (VOC). Solutions range from general use products to application specific products, for uses such as public restrooms and ice machines.

Communiqué de presse *Grippe H1N1*

99,9998 %**

****C'est le taux d'efficacité de la technologie BioZone dans la destruction des virus grippes de type influenza porcine / aviaire / humaine.**

La technologie BioZone : certifiée anti-grippe !

L'efficacité est prouvée pour les virus à transmission aérienne. La technologie Biozone permet de détruire les pathogènes environnementaux.

La protection de la population contre les virus respiratoires devient possible avec l'utilisation en continu des appareils Biozone en présence humaine.

Nouvelle arme pour faire face à cette menace : la technologie BioZone.

Testée et certifiée par le CNRS de Lyon, Biozone **détruit 99,9998% du virus de la grippe influenza présent dans l'air** en moins de 0,44 seconde sans passage dans le générateur de plasma. Ce rapport CNRS unité de Virologie porte la référence DE084-2007.

Le procédé de photodissociation de l'oxygène de l'air, mis au point dans les années 90 pour la Nasa, permet la création de zone biologiquement maitrisée. La dissémination virale par voie aérienne est bloquée.

Cette technologie de plasma froid d'oxygène permet de sécuriser les lieux de vie tels que les hôpitaux, aéroports, crèches, protection civile, SDIS, véhicules de transports, préfectures et tous sites sensibles pour lesquels une présence humaine est indispensable en temps de crise sanitaire.

BioZone Europe assure déjà la sécurité sanitaire de nombreux établissements de santé (ex. hôpitaux de Paris), SDIS – Pompiers (technologie agrée protection civile), Cliniques privées, aéroports (Ajaccio, Clermont Ferrand,…). L'utilisation de notre technologie n'est pas strictement destinée aux pandémies. En effet, les domaines d'applications sont très larges et permettent avec une implantation importante de diminuer les risques de transmissions de virus

Pour toute information complémentaire, merci de prendre contact avec M. Dubreuil au 06 85 54 53 85 et via **Laurent.Dubreuil@Biozone-Europe.eu**
www.BioZone-Europe.eu

UNIVERSITÉ
CLAUDE BERNARD LYON – 1

INSTITUT FEDERATIF de RECHERCHES
LAENNEC

CENTRE NATIONAL DE LA RECHERCHE
SCIENTIFIQUE

29 Octobre 2007

Laboratoire de Virologie et Pathologie Humaine – **FRE CNRS 3011**
Faculté de Médecine RTH Laennec
Ref. : DE084-2007

Résultats : les tests réalisés montrent que la technologie BioZone est efficace dans la destruction du virus de la grippe aviaire H5 utilisé jusqu'à 5,7 Logs de réduction en moins de 0.44 seconde.

Professeur Bruno LINA **Docteur Vincent MOULES**

L'efficacité de la technologie BioZone dans la destruction du virus humain parainfluenza type 3 (hPIV-3)

Résultats : les tests réalisés montrent que la technologie BioZone est efficace dans la destruction du virus parainfluenza humaine type 3 utilisé jusqu'à 5 Logs de réduction en moins de 0.44 seconde.

L'efficacité de la technologie BioZone dans la destruction du virus VRS Humain Virus Respiratoire Syncitial Humain – Agent de la Bronchiolite

Résultats : les tests réalisés montrent que la technologie BioZone est efficace dans la destruction du virus VRS jusqu'à 3,8 Logs de réduction en moins de 0.44 seconde et ce sans passage dans l'air contaminé dans le dispositif.

Professeur Bruno LINA **Docteur Vincent MOULES**

BioZone Europe
1 rue Notre Dame, 59300 Valenciennes, France
www.Biozone-Europe.eu

Press communication – H1N1 influenza

99.9998%**

**The efficiency rate of Biozone technology in the destruction of the swine / bird / human influenza virus types

Biozone Technology: certified to fight the flu virus!

Biozone's efficiency is proven for viruses transmitted through the air. Its technology destroys environmental pathogens.
The protection of the population against respiratory viruses has become possible through a continuous use of Biozone products in human presence.

New weapon against the threat: Biozone technology

Tested and certified by the CNRS (National Centre of Scientific Research) of Lyon in France, Biozone destroys 99.9998% of the influenza virus present in the air in less than 0.44 seconds without passing through a plasma generator. The CNRS Virology unit reference is DE084-2007.

The procedure of photo-dissociation of oxygen in the air, developed by NASA in the 1990s, allows the creation of biologically mastered zone. The viral dissemination in the air is blocked.

This oxygen cold plasma technology secures every-day places such as hospitals, airports, crèches, civil protection, SDIS (Documentation and Specialised Information Service), transport vehicles, prefectures and all sensitive places where human presence is indispensible during times of sanitary crisis.

Biozone Europe already ensures the sanitary security of numerous health establishments (for example hospitals in Paris), Fire Brigade SDIS (it is the authorised civil protection technology), private clinics, airports (Ajaccion, Clermont Ferrand…). The use of our technology is not strictly only for use during pandemics. In fact, the applications are extremely numerous and installation reduces the risk of transmitting the virus.

For any further information please contact Mr. Dubreuil on +33 0685545385 or via Laurent.Dubreuil@Biozone-Europe.eu.
www.BioZone-Europe.eu

Claude Bernard University, Lyon
Laennec Federal Research Institute
CNRS - National Centre of Scientific Research

29 October 2007
Laboratory of Human Virology and Pathology – **FRE CNRS 3011**
Faculty of Medicine RTH Laennec Federal Research Institute

Results:
The tests carried out show that Biozone technology is effective in the destruction of the bird influenza virus H5, up to 5.7 Logs of reduction in less than 0.44 seconds.

Professor Bruno LINA **Doctor Vincent MOULES**

The effectiveness of Biozone technology in the destruction of the parainfluenza human virus type 3 (hPIV-3).

Results:
The tests carried out show that Biozone technology is effective in the destruction of the parainfluenza human virus type 3, up to 5 Logs of reduction in less than 0.44 seconds.

The effectiveness of Biozone technology in the destruction of VRS, the Human Respiratory Syncitial Virus, human agent of Bronchiolite.

Results:
The tests carried out show that Biozone technology is effective in the destruction of the VRS virus, up to 3.8 Logs of reduction in less than 0.44 seconds, without passing through contaminated air in the device.

Professor Bruno LINA **Doctor Vincent MOULES**

BioZone™ Tests in Hospital Environment

In May 2007 BioZone Scientific International Inc carried out institutional tests in a private hospital (Val d'Or surgery hospital in Saint Cloud) and a residential care home (EHPAD Du Bourg Joly in Saint Mathurin sur Loire) in France, EU. These tests were directed and conducted by a 3rd party research agency SARL AFR and the samples were analyzed by an independent laboratory Clean Concepts Measurements.

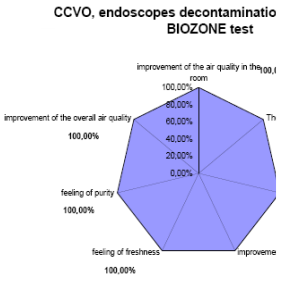
The tests were planned and conducted so, that the results would capture and describe both the perceived improvements in the room air quality, as well as quantify and verify the factual changes in the levels of airborne bacteria, mold and dust particles. The airborne microbe contamination was measured both before and after the installation of the BioZone unit. Also the room temperature and humidity was monitored throughout the test. The units were placed in chosen faclities including patient room, restroom, small surgery ward, endoscopy ward and operating theatre.

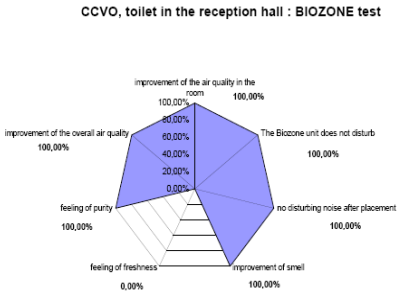
Test equipment used:
• *Portable airborne particle counter*: Met-One 3313 SN 030401025 – flow rate : 28,3 litres per minute - 6 particle size channels : ≥ 0,3 µm, ≥ 0,5 µm, ≥1,0 µm, ≥3,0 µm, ≥5,0 µm and ≥10,0 µm, sensitivity 0.3 µm,
• *Air sampler*: Sieve air sampler SAMPL'AIR MK2 n° 41671588 of AES Laboratoire with two sampling heads, n° 41671613d and 41671588d using 90 mm Petri dish.
• Airborne microbe incubation medium, temperature and time according to the table below

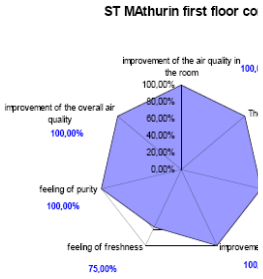
Sought flora	Culture medium	Temperature	Incubation time
Aerobic mesophiliac flora	Tryptic Soy Agar (TSA)	30 +/- 1°C	72 hours
Yeast and mold	Yeast Extract Glucose Chloramphenicol Agar	25 °C +/- 1°C	5 days

RESULTS OF THE OVERALL AIR QUALITY IMPROVEMENTS AND ODOR REDUCTION

The Biozone units were placed in cooperation with the technical staff of the hospital and of the care home. The first week was spent for users to get used to the presence and use of the units. On the second and the third week the qualitative interview audits were conducted to assess the perceived efficiency of the placed units. The interview results were presented using radar diagrams as displayed on the right. Summary of the results is listed below:







VAL D' OR SURGERY, PRIVATE HOSPITAL, ST. CLOUD

ENDOSCOPY WARD
Improvement of air quality: 100%
Feeling of purity: 100%
Feeling of freshness: 100%
Improvement of odor: 100%

SMALL SURGERY WARD
Improvement of air quality : 100%
Feeling of purity: 25%
Feeling of freshness: 100%
Improvement of odor: 100%

TOILET IN THE RECEPTION HALL
Improvement of air quality : 100%
Feeling of purity: 100%
Improvement of odor: 100%

INTENSIVE CARE UNIT
Improvement of air quality: 100%
Feeling of purity: 50%
Improvement of odor: 100%

THE RESIDENTIAL HOME

FIRST FLOOR CORRIDOR
Improvement of air quality: 100%
Feeling of purity: 100%
Feeling of freshness: 75%
Improvement of odor: 100%

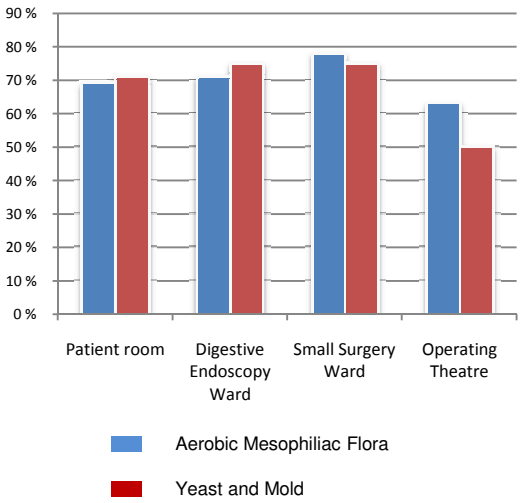
PATIENT'S ROOM
Improvement of air quality : 100%
Feeling of purity: 100%
Feeling of freshness: 100%
Improvement of odor: 100%

BioZone Scientific International Inc.
Linnoitustie 4 b, 02600 Espoo, Finland, T +358 (0)20 743 6620, F +358 (0)20 743 6639

BioZone™ Tests continued…

REDUCTION OF THE AIRBORNE MICROBES IN THE HOSPITAL

The test measured the reduction of the general airborne bacteria (aerobic mesophiliac flora), yeast and mold. In practice a standard amount of air was sucked through the air sampler to the soy agar and glucose plates. The plates were then placed into an incubator for 72 hours (bacteria) or 5 days (yeast), after which the results were calculated. In all tests BioZone units reduced dramatically the amount of airborne microbes.



INTENSIVE CARE UNIT PATIENT ROOM
Aerobic mesophiliac flora: *a reduction of over 69%*
Yeast and mold: *a reduction of over 71%*

DIGESTIVE ENDOSCOPY WARD
Aerobic mesophiliac flora: *a reduction of over 71%*
Yeast and Mold: *a reduction of 75%*

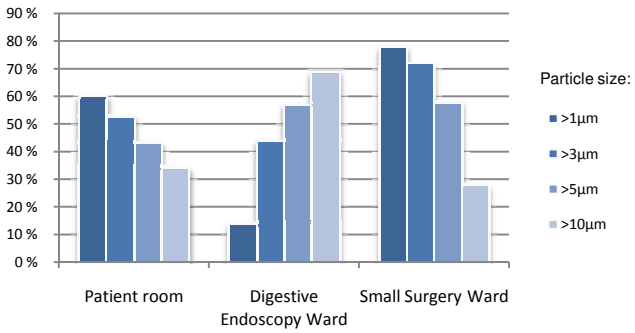
SMALL SURGERY WARD
Aerobic mesophiliac flora: *a reduction of 78%*
Yeast and Mold: *a reduction of 75%*

OPERATING THEATER SUITES
Aerobic mesophiliac flora: *a reduction of 63%*
Yeast and Mold: *a reduction of 50%*

REDUCTION OF THE AIRBORNE PARTICLES IN THE HOSPITAL

Due to the ionization technology of the BioZone units, the airborne particles become negatively charged. This electric charge attaches the particles to the positively charged walls and floors removing them from the room air. The particles can then be easily removed as part of the normal cleaning.

As the diagrams displays, the test results show a significant reduction of airborne particles in the measured size categories.



BIOZONE PRODUCTS USED IN THE TEST:

AirCare®
Bullet- proof solution for any restrooms' odor controlling
- Reliable, automatic purification 24/7
- Easy and fast installation

PowerZone®
Portable and efficient sanitizing tool
- Quick and complete deconta-mination even in the most challenging sites and facilities

BioZone®
Effective and silent general solution purifier for odor and microorganism control

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Ireland Validation
Comments on the UCD Investigation

The investigations carried out at the University College Dublin showed that Biozone air purifiers operated safely and effectively within the operating conditions specified by the Suppliers.

Safety

The principal safety concern was that the ozone generated by the air purifiers should not cause the room ozone concentrations to exceed the level set by Irish air-quality regulations (IRL SI 53/2004). Operated in appropriately-sized rooms, where the background ozone levels (before use of the air purifiers) were not greater than 0.025 ppm, the ozone produced by the Biozone 1000 and AC20 did not exceed the regulatory level (the 'Target' level, 0.060 ppm).

The Powerzone-II was tested also, but it is designed particularly for purifying heavily-contaminated rooms, and it generates relatively large amounts of ozone. Personnel would not be present in a room if decontamination was in process.

Effectiveness

The focus here was to confirm that the air purifiers improved the microbial air-quality in rooms where they operated.

Firstly, the Powerzone-II was extremely effective in reducing even heavy air contamination to a very low level. Without a doubt, the vigorous ultraviolet and ozone action performed by the device killed microorganisms. This is proof of the principal; the Biozone air purifiers in general, then, have the capability to reduce the microbial 'burden' of the air in a room.

The test results for Biozone 1000 showed a reduction in the region of 70% (about a half log reduction) in the number of microorganisms in air samples taken from a seminar room after a lecture had been held there. The reduction was maintained during long continued use of the device (41 hours) in the unoccupied room.

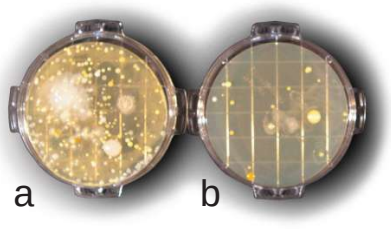
With this outcome for the Biozone 1000 air purifier, it was judged unnecessary to conduct the microbial tests with the AC20 which has essentially the same design capacity.

With the entry of personnel into a 'purified' room, with the introduction of air from outside the room (opening and closing doors and windows, or by an active ventilation system), and with particulate re-suspension (including by movement of personnel about the room), microbial contamination would tend to increase. The air purifier would act against such increase, by sterilizing the air it treats. The microbial room air quality resulting from this contamination/sterilisation combination, while not easily predictable, should nevertheless be improved.

The health benefits will depend, among other things, on whether pathogenic air-borne microorganisms are present, on the state of health and immune competence of the personnel exposed, and the effectiveness of the air purification process. There is insufficient epidemiological evidence available in these matters to enable accurate prediction; sufficient studies haven't been published. Intuitively though, when the number of microorganisms of human origin is reduced in room air, human health benefit may well result.

oOo

B. Masterson PhD,
Scientific Advisor AHSS,
6th November 2006.



Agar plates incubated at 37 °C for 48 hours for air samples taken in asealed room (Series 1): sample taken (a) prior to an 18-hour PowerZone-II run;
(b) after a further one-hour operation of an air circulation fan.

THE MOLD TEST, FINLAND

The mold test was performed at a location damaged by water. A warm water line had leaked causing water to run down a particle board/painted brick wall damaging both surfaces. The size of the damaged area was about 500 square feet. It was located in the middle of a building and didn't have a window. The accident caused serious odor problems affecting practically the entire building. The odors were removed with Biozone assuring an uninterrupted use of the building by the rest of the tenants.

The mold test wes performed about three weeks after the area had been dryed. The test samples were taken from concrete (painted brick?) and particle board surfaces. Using a normal swipe method, a 4 by 4 inch area of each surface was swiped with a cotton swap and a liquid developed for testing purposes. Test certificate 2004-4814 was taken before using Biozone Powerzone II unit. The Powerzone II was in use for about 12 hours with mechanical ventilation system running the whole time.

The swipe test was repeated the next day; its' results can be read in test certificate 2004-4982. Mold spore counts were reduced very dramatically making the seriously damaged area mold free in a matter of hours. The results were analysed by Kokkola Area Food Stuff and Environmental Laboratory. The analyses was performed by microbiologist Kirsi Vedenpää. In discussions, after the analysis, Ms. Vedenpää explained mold to be a problem if the mold spore counts exceeds 100,000 units. As can be seen from tets certificate 2004-4982 mold was no longer a problem.

We are convinced that Biozone units are very effective at dealing with mold damage.

In Kokkola September 15th. 2004.

Suomen Valinehuolto
Tero Kiviaho
Allinkatu 9
67200 Kokkola
Finland
358 500 561 085

Kiviaho Tero

Allinkatu 9
67200 Kokkola

Sample information

Sample Surface cleanliness, swipe
Sample Collected 09.08.2004 Sample Collected by Customer
Arrival 09.08.2004
Test began 10.08.2004
Test Completed 26.08.2004

Analysis Unit of Measure Method Sample	Actinomycetes pmy/100cm2 Sis.menet.	Molds pmy/100cm2 Sis.menet.
4814-1, Surface cleanliness, swipe, test 1		22 000
4814-2, Surface cleanliness, swipe, test 2		120 000
4814-3, Surface cleanliness, swipe, test 3		>1 300 000 Est.
4814-4, Surface cleanliness, swipe, test 4		450 Est.
4814-5, Surface cleanliness, swipe, test 5	<10 Est.	150 Est.

Statement

The interpretation of test results is based on Dwelling Health Guideline (Finland's Ministy of Health guide booklet: 2003:1). Surface sample test result interpretation must always be based on the comparison of microbial counts on the test sample and the control sample. Fungi-spore counts, or in other words, the mold and yeast amounts on dry, damage free surfaces are usually under 1000 pmy/100 cm². If the fungi-spore count on a surface test sample exceeds 100 000 pmy/100 cm², and the surface test sample fungi-spore count is at least 100 times greater than on the surface control sample, it is safe to say that the surface test sample has fungi growth. If the surface test sample actinomycetes count is at least 10 times greater than on the control sample, it is safe to say that the test sample contains actinomycetes growth.

Sample 1 did not contain an elevated mold-spore count. However, the presense of Penicillium- ja Coelomycetes-mold families were found.

Sample 2 did contain an elevated mold-spore count. Acremonium- , Penicillium- ja Aspergillus-mold families were present. The sample also contained an unidentified mold family.

Sample 3 did contain an elevated mold-spore count. Acremonium-mold family was dominant. Cladosporium- ja Penicillium-mold families were also found. The sample also contained an unidentified mold family.

Sample 4 did not contain an elevated mold-spore count. However, the presense of Acremonium- ja Aspergillus-mold families were found.

Sample 5 did not contain an elevated mold-spore count. No actinomycetes were found. The presense of Penicillium-mold family was found. The sample also contained an unidentified family of mold.

_____

Kirsi Vedenpää
Microbiologist

Kiviaho Tero

Allinkatu 9
67200 Kokkola

Näytetiedot

Sample	Surface cleanliness, swipe		
Sample Collected	13.08.2004	Sample collected by	Customer
Arrival	13.08.2004	Reason for sample	Moisture damage
Test began	16.08.2004		
Test Completed	30.08.2004		

Analysis Unit of Measure Method Sample	Actinomycetes pmy/100cm2 Sis.menet.	Molds pmy/100cm2 Sis.menet.
4982-1, Surface cleanliness, swipe , concrete I		6 000
4982-2, Surface cleanliness, swipe , concrete II		700 Est.
4982-3, Surface cleanliness, swipe , concrete III		17 000
4982-4, Surface cleanliness, swipe , concrete IV	<10 Est.	
4982-5, Surface cleanliness, swipe, concrete V		<10 Est.

Statement

The interpretation of test results is based on Dwelling Health Guideline (Finland's Ministy of Health guide booklet: 2003:1). Surface sample test result interpretation must always be based on the comparison of microbial counts on the test sample and the control sample. Fungi-spore counts, or in other words, the mold and yeast amounts on dry, damage free surfaces are usually under 1000 pmy/100 cm². If the fungi-spore count on a surface test sample exceeds 100 000 pmy/100 cm², and the surface test sample fungi-spore count is at least 100 times greater than on the surface control sample, it is safe to say that the surface test sample has fungi growth. If the surface test sample actinomycetes count is at least 10 times greater than on the control sample, it is safe to say that the test sample contains actinomycetes growth.

Sample 1 did not contain an elevated mold-spore count. However, the presense of Penicillium- ja Phoma-mold families were found.

Sample 2 did not contain an elevated mold-spore count. However, the presense of Penicillium- , Aspergillus- ja Phoma-mold families were found

Sample 3 did not contain an elavated mold-spore count. However, the presense of Acremonium- , Penicillium- ja Cladosporium-mold families were found.

Sample 4 did not contain an actinomycetes growth.

Sample 5 did not contain mold growth.

_____
Kirsi Vedenpää
Microbiologist

Requested by Infosto International Oy
P.O. Box 39
FI-33541 TAMPERE

Order Matti Rantaniemi 17.3.2004

Contact person at VTT **VTT TECHNICAL RESEARCH CENTRE OF FINLAND**
VTT BUILDING AND TRANSPORT
Senior Research Scientist Tiina Tirkkonen
P.O. Box 1806, FIN-02044 VTT, Finland
Tel. + 358 9 456 5287
Fax + 358 9 456 7027
E-mail: tiina.tirkkonen@vtt.fi

Task **Biozone 500 and Biozone 3000 Air Purifier VOC-reduction test in test chamber**

Test arrangements The capability of Biozone Air Purifiers to reduce the concentration of volatile organic compounds (VOC) was tested using a 5-m^3 stainless steel test chamber, Figure 1. Building materials and permeation vials were used as VOC sources in the chamber.

Figure 1. Biozone 500 Air Purifier in the 5-m^3 test chamber.

During the tests temperature, relative humidity and air exchange in the chamber was set as follows:

	Biozone 500	Biozone 3000
Temperature	23 ± 2°C	23 ± 2°C
Relative humidify	50 ± 5 %	50 ± 5 %
Air exchange	0,5 h^{-1}	0,25 h^{-1}

The reference concentration of VOCs in the chamber air was measured before turning on the air purifier. After the air purifier was turned on, air samples from the chamber were collected after 2 - 24 hours operating time. VOCs were collected using Tenax TA and Tenax GR adsorbents /1/. In Biozone 3000 tests

air samples were also collected on charcoal. Tenax samples were analyzed with gas chromatography after thermal desorption /2/. From charcoal VOCs were desorbed using carbon disulphide and analysed with gas chromatography.

Ozone concentration in the chamber air during the tests was not measured.

Results

The concentration of VOCs emitted from building materials before (0 h) and after (2 - 24 h) starting the Biozone 500 Air Purifier, output low, are shown in Figure 2. Within 24 hours the concentration of different VOCs was reduced by 25 - 100 %.

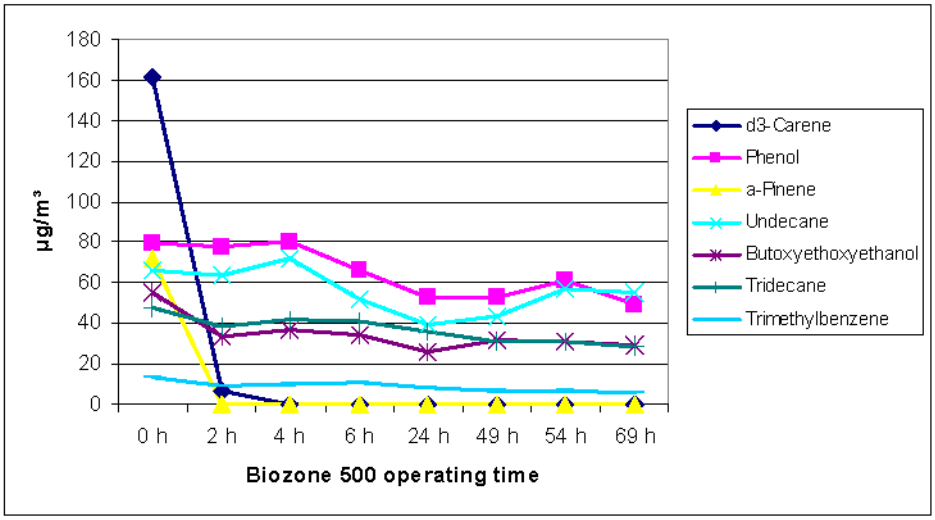


Figure 2. The concentration of different VOCs in the test chamber air as function of Biozone 500 operating time (output low).

Biozone 3000 was tested for toluene, xylene and butyl acetate. As source for these compounds permeation vials were used. The concentration of these compounds in the chamber air before starting the air purifier and after 18 - 24 hour operating time are shown in Table 1 (sampling media: Tenax TA).

Table 1. The Concentration of toluene, xylene and butyl acetate in the test chamber air before and after 18 - 24 hour operating time of Biozone 3000 air purifier (output low).

Compound	**Concentration in chamber air, µg/m³ Biozone 3000, output low**		
	before	**after 18 - 24 h operating time**	**Reduction**
Toluene	test 1: 360 test 2: 1000	test 1: 240 test 2: 550	test 1: 34 % test 2: 45 %
Xylene	320	120	63 %
Butyl acetate	100	54	46 %

Observations

Results shown in Figure 2 and Table 1 apply only to conditions used in these tests. By request of the customer the tests were performed in a test chamber

with a volume of 5 m³, i.e. too small compared to the design values of the tested air purifiers. Due to the test conditions the ozone concentration in the chamber during the tests may have increased over the levels occurring in normal operating conditions with proper design capacity. As an indication of increased ozone level in the chamber slightly increased aldehyde levels (hexanal and nonanal) were measured during the tests. Aldehydes are typical oxidation products of unsaturated organic compounds /3/. Ozone level in the chamber during the tests was confirmed with measurements.

References

1. VTT Building and Transport Method description RTESIS495. Material emissions. Emission measurement of volatile organic compounds (VOC) using small test chambers. In Finnish.

2. VTT Building and Transport Method description RTESIS995. Analysis of volatile organic compounds from Tenax TA adsorbent tubes using GC-FID/MDC. In Finnish

3. Dunston, N.C. & Spivak, M.S. A preliminary investigation of the effects of ozone on post-fire volatile organic compounds. J. Applied Fire Science 1996-97, Vol. 6, p. 231-242.

Espoo, 26.5.2004

Eva Häkkä-Rönnholm
Group Manager

Tiina Tirkkonen
Senior Research Scientist

DISTRIBUTION

Customer	Original
VTT	Original

North America

USA ： USDA－Vallid Labs

US FDA－Tri-Tech Analytical Lab

Department of Biology，

Penn State University

Environmental Industries International, Inc.

Envirogen International Testing Lab

USDA Certified Laboratory - Vallid Labs Summaries

Test #2

Description: Measure the reduction of bacteria in an airstream passing through a Biozone Model 2000 Air Purifier
Results: 99% reduction of airborne bacteria

Test #4

Description: Measure the amount of normal flora on surfaces before and after use of a Biozone Model 2000 Air Purifier
Results: 99.4% reduction in Standard Plate Count and 85% of yeast and mold count after 3 hours of device operation

Test #5

Description: Measure the reduction of surface bacteria on surfaces before and after use of a Biozone Model 2000 Air Purifier
Results: 96% reduction of surface bacteria

Complete Test Results on Following Pages

Vallid Labs, Inc.

608 Thompsonville Rd
Suffield, CT 06078
Phone: 860 668-4330
Fax: 860 668-5595
Email: vallid.lab@snet.net

BioZone Scientific
1190 18th Street
Vero Beach, FL 32960

March 27, 2000

Reporting on samples taken at Vallid Labs using the BioZone air filter on Tuesday, March 21, 2000 for analysis. The following are the procedures and the results of the tests. Lab # VL-31300 Test 2

Test 2

Purpose

Measure the amount introduced Enterobacter aerogenes coming into the air purifier compared to the amount of introduced Enterobacter aerogenes exiting the BioZone air purification.

Method

Using a Biotest air sampler, the introduced Enterobacter aerogenes coming into the air purifier was collected directly from the air afetr introduction using a spray bottle with a suspension of Enterobacter aerogenes . Samples were taken again at the outlet vene with the UV/O_3 lamp on. All testing was run in triplicate. Numbers reported are averages of triplicate results.

Results

Sample	Enterobacter aerogenes/ft3 of air
Enterobacter aerogenes in air before fan	**>1,100**
Enterobacter aerogenes in air directly after treatment	**10.85**

Sincerely,

Debra Vallides
Vallid Lab, Inc.
PH#-0542, EPA-CT00077
USDA-0978,3734

Vallid Labs, Inc.

608 Thompsonville Rd
Suffield, CT 06078
Phone: 860 668-4330
Fax: 860 668-5595
Email: vallid.lab@snet.net

BioZone Scientific
1190 18th Street
Vero Beach, FL 32960

March 27, 2000

Reporting on samples taken at Vallid Labs using the BioZone air filter on Tuesday, March 21, 2000 for analysis. The following are the procedures and the results of the tests. Lab # VL-31400 Test 4

Test 4

Purpose

Measure the amount normal surface flora before air purification compared to the amount of normal surface flora after 3 hours of BioZone air purification.

Method

Using a swabbing method , the normal surface flora was collected before air purifier was run. The O_3 and UV were then turned on for 3 hours with an average O_3 concentration of 0.04 PPM, and Swab samples were taken again. Standard Plate Count (SPC) and Yeast & Mold (Y&M) counts were done. All testing was run in triplicate. Numbers reported are averages of triplicate results.

Results

Sample	SPC/in^2	Y&M/in^2
Normal surface flora of untreated surface	46	2
Normal surface flora after 1/2 hr O_3 exposure	42	0.7
after 2 hr O_3 exposure	1.7	1.7
after 3 hr O_3 exposure	0.3	0.3

Sincerely,

Debra Vallides
Vallid Lab, Inc.
PH#-0542, EPA-CT00077
USDA-0978,3734

Vallid Labs, Inc.

608 Thompsonville Rd
Suffield, CT 06078
Phone: 860 668-4330
Fax: 860 668-5595
Email: vallid.lab@snet.net

BioZone Scientific
1190 18th Street
Vero Beach, FL 32960

March 27, 2000

Reporting on samples taken at Vallid Labs using the BioZone air filter on Tuesday, March 21, 2000 for analysis. The following are the procedures and the results of the tests. Lab # VL-31400 Test 5

Test 5

Purpose

Measure the introduced Enterobacter aerogenes on a surface before air purification compared to the amount of introduced Enterobacter aerogenes on the same surface after 3 hours of BioZone air purification.

Method

Using a swabbing method , the introduced Enterobacter aerogenes was collected before air purifier was run. The O_3 and UV were then turned on for 3 hours with an average O_3 concentration of 0.04 PPM, and Swab samples were taken again. Standard Plate Count (SPC) was done. All testing was run in triplicate. Numbers reported are averages of triplicate results.

Results

Sample	Enterobacter aerogenes /in^2
Enterobacter aerogenes of untreated surface	>120,000*
Enterobacter aerogenes after 1/2 hr O_3 exposure	>120,000*
after 2 hr O_3 exposure	3,000*
after 3 hr O_3 exposure	4,800*

Sincerely,

Debra Vallides
Vallid Lab, Inc.
PH#-0542, EPA-CT00077
USDA-0978,3734

FDA Certified Laboratory - Tri-Tech Analytical Laboratories Summaries

Test #3

Description: Measure the reduction of bacteria (Listeria monocytogenes) on surfaces after use of a Biozone Powerzone I Model

Results: 3 log reduction (99.9%) after 1 minute of treatment
5 log reduction (99.999%) after 2 minutes of treatment

Test #4

Description: Measure the reduction of bacteria (E. coli 0157) on surfaces after use of a Biozone Powerzone I Model

Results: 4 log reduction (99.99%) after 1 minute of treatment
5 log reduction (99.999%) after 2 minutes of treatment

Test - Biozone Photoplasma Experiment

Description: Measure the reduction of surface bacteria (E. coli, Salmonella, Listeria) on surfaces before and after use of a Biozone Air Purifier

Results: After 24 hours of use, there was no remaining bacteria

Complete Test Results on Following Pages

Tri-Tech Analytical
Laboratories, Inc.

P.O. Box 140966 • Orlando, FL 32814-0966 • (407) 275-8463
See us on the web at : http://www.tri-techlabs.com

DISINFECTION VALIDATION PROCESS

TEST RESULTS:

3. REDUCTION Listeria monocytogenes CONTAMINATION – NOT TREATED (NT) VERSUS TREATED (T)

AVERAGE OF 7 SAMPLES	RESULTS	UNITS
ONE (1) MINUTE TIME, EXPOSURE LEVEL A		
#1 - #7 Listeria monocytogenes/NT	$5\ 10^{(7)}$	CFU's
#1 - #7 Listeria monocytogenes/T	$2\ 10^{(4)}$	CFU's
	% Reduction	**3 LOG**
TWO (2) MINUTE TIME, EXPOSURE LEVEL B		
#1 - #7 Listeria monocytogenes/NT	$5\ 10^{(7)}$	CFU'S
#1 - #7 Listeria monocytogenes/T	$2\ 10^{(2)}$	CFU'S
	% Reduction	**5 LOG**

4. REDUCTION E. coli (0157) CONTAMINATION – NOT TREATED (NT) VERSUS TREATED (T)

ONE (1) MINUTE TIME, EXPOSURE LEVEL A		
#1 - #7 E. coli (0157)/NT	$3\ 10^{(7)}$	CFU's
#1 - #7 E. coli (0157)/T	$7\ 10^{(3)}$	CFU's
	% Reduction	**4 LOG**
TWO (2) MINUTE TIME, EXPOSURE LEVEL B		
#1 - #7 E. coli (0157)/NT	$3\ 10^{(7)}$	CFU's
#1 - #7 E. coli (0157)/T	$7\ 10^{(2)}$	CFU's
	% Reduction	**5 LOG**

Tri-Tech Analytical
Laboratories, Inc.

P.O. Box 140966 • Orlando, FL 32814-0966 • (407) 275-8463
See us on the web at : http://www.tri-techlabs.com

DISINFECTION VALIDATION PROCESS

OVERALL CONCLUSION DATA

The concentration of bacteria recovered from all inoculated treated samples analyzed show at least a 3 to 5 log reduction. This factor proves that the disinfectant process utilized in this study is effective in inhibiting the most common bacterial problems in producing a high quality product.

The concentration of E. coli (0157) bacteria recovered from only a one minute exposure treated samples, show a 5 log reduction. This factor proves that the disinfectant process utilized in this study is effective in inhibiting the most common bacterial problem in producing a high quality product

TRI-TECH LABS, INC.
"HELP SAFEGUARD YOUR FUTURE AND YOUR HEALTH"
P.0. BOX 140966
ORLANDO, FLORIDA 32814-0966
(407) 275-8463 FAX (407) 281-9187

02-06-1078

To:

Biozone Scientific
1180 19th Street
Vero Beach, Florida 32960
Attention: Mr Bryan Cecchi

Project:

Biozone Plasma Experiment

Test Protocol:
Infect E. Coli, Salmonella, and Listeria; all at 10^2, on to a cutting board and stainless steel utensils.
Placé them in a controlled photoplasma environment.

Summary:
After 24 hours there was no remaining bacteria.

Test Specifics:

Biozone PhotoPlasma Experiment
Tri-tech Lab ID 02-06-1078A

Start time: June 28 10:00
Temperature: 21.5C
Setup: SB

Temperature at 15:50 23.5C
Temperature at 18:20 21.0C

End time: June 29 10:00
Temperature: 22.0C
End: LT

Sample ID	Exposure time 24 hours Test at 10:00	Comments
Cutting Board/Utensils W/E.c S.t. L.m. 10^2	Negative No Growth	Effective in this experiment

Penn State University Biology Department Test at Applied Research Laboratory
Summary

Test - Surface Disinfection of E. coli with Low Levels of Airborne Ozone from a Biozone Powerzone I

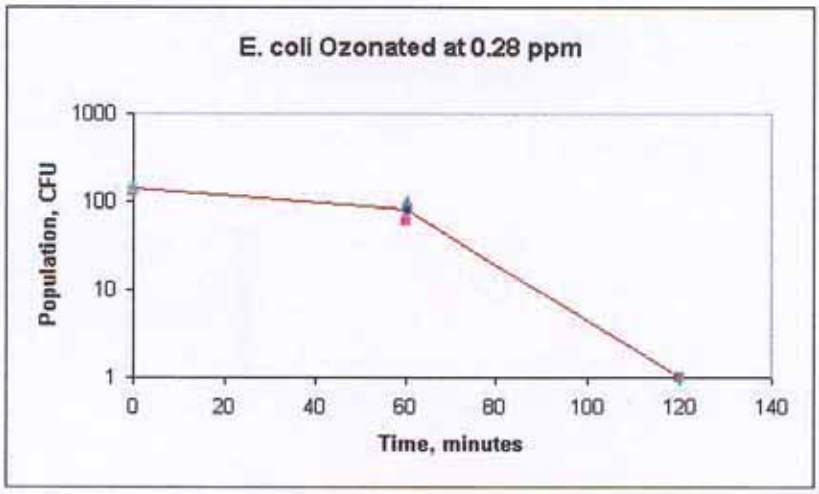
Description: Measure the reduction of surface bacteria (E. coli) over time
Results: 100% reduction after 3 hours of exposure.

Complete Test Results on Following Page

Results of Experiment on 3-24-00.

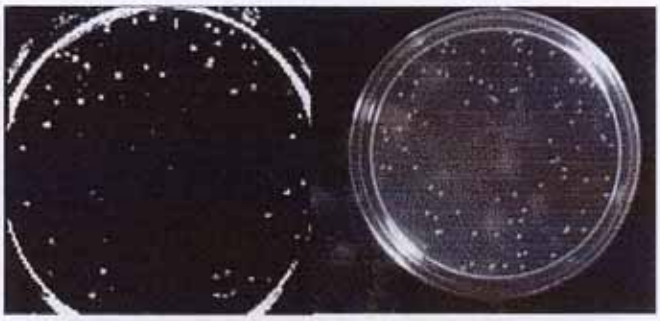
Exposure of E. coli to low levels of ozone (0.1-0.5 ppm).
Average ozone level 0.28 ppm.
Temperature 75 degrees, 22% RH,
Penn State Biology Dept test at ARL, W. Kowalski, Brad Striebig, T. Whittam, W. Bahnfleth.

Output graph:

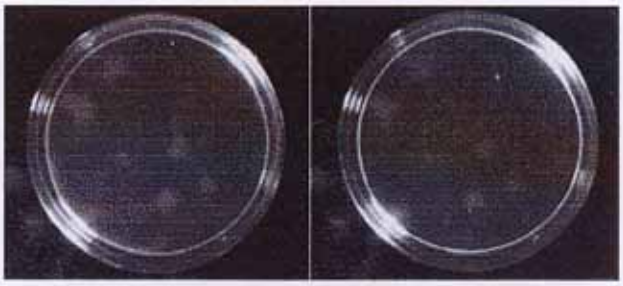


Three Controls: no exposure

Two plates exposed for 1 hour.



Two plates exposed for 2 hours.



Two plates exposed for 3 hours had no survivors.

(not imaged)

Environmental Industries

Summaries

Test - House

Description: Demonstrate the reduction of airborne biological contaminants in actual residential setting utilizing a Biozone Air Purifier Model #2000

Results: Demonstrated positive reduction in airborne microorganisms

Test - Condominium

Description: Demonstrate the reduction of airborne biological contaminants in actual residential setting utilizing a Biozone Air Purifier Model #1000

Results: Demonstrated positive reduction in airborne microorganisms

Complete Test Results on Following Pages

Environmental Industries International, Inc.
1180 19th Street
Vero Beach, Florida 32960
Phone (561) 778-4886 • Fax (561) 778-8391

INTRODUCTION

This report details the results of a singular Air Quality Study utilizing the Biozone 1000 model air purifier.

The purpose of the study was to determine the in-situ results of the Biozone 1000 in a domestic location and its effect in the reduction (if any) of airborne bacteria flowing through a dwelling's ventilating system.

METHODOLOGY

A residential condominium and its independent ventilating system was selected for the Study. The air quality, re. bacterial content, was measured with Micrology Laboratories Easygel petri dish system which is a pectin-gel method. The formulation used was the Standard Plate Count formulation. The air in the ventilating system was tested before utilization of the Biozone 1000 and again after 24 hours of use of the device.

The condominium was a 700 sq. ft., single floor dwelling inhabited by two working adults. The condo appeared clean with no noticeable organic odors. A petri dish was placed inside an outlet vent in the living area. For the initial air test, the prepared petri dish was uncovered and left exposed to the circulating air for 1 hour then recovered and allowed to incubate for 48 hours. The ventilating system fan was switched for continuous operation.

The Biozone 1000 was placed on a waist high stereo speaker in the living room approximately 7 feet away from the return air vent. The Biozone unit was turned to "High Fan" and allowed to run for 24 hours. Biozone's photoplasma output contains small amounts of ozone and ozone levels were tested in several areas of the condominium at 8 hour intervals using two monitors, an Ecosensor A-21Z ozone monitor and an Enmet Ozone Monitor 0800 model. At no time did the ozone levels anywhere in the living area exceed .04 ppm.

After 24 hours of continuous operation of the Biozone 1000, another air quality test was performed following the same methodology as previously described.

SUMMARY OF RESULTS

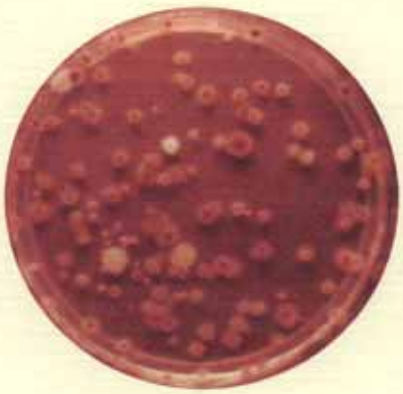
Based on our experience of indoor environments, the bacteria count exhibited in the ventilating system of the dwelling was typical of the air quality found in such testing. However, microbiological analysis of the specific types of bacteria and mold/fungus colonies where not performed.

Visual examination of the petri dishes' bacterial and mold/fungus colonies indicate a significant reduction in counts after the use of the Biozone 1000. There did not appear to be other environmental events or circumstances that would contribute to the result.

CONCLUSION

Analysis of the results would indicate that very low levels of ozone used in the Biozone 1000 had a very positive effect on reducing the presence of airborne microorganisms in the ventilating system. It has been well established that photoplasma is biocidal in nature. Exposure to photoplasma even for short time periods, such as the 24 hours in this study, further support its effectiveness. It can be further suggested that if the ventilating system had been subjected to these purification methods for longer than 24 hours, further reductions in bacteria and mold counts could be obtained.

Air Sample
Beginning



Air Sample
After Biozone

Envirogen International Testing Laboratory Summaries

Test - Condominium

Description: Demonstrate the reduction of airborne biological contaminants in actual residential setting utilizing a Biozone Air Purifier Model #InDuct 1500

Results: Demonstrated positive reduction in airborne microorganisms

Test - Vehicle

Description: Demonstrate the reduction of selected airborne contaminants inside an automobile utilizing a Biozone Air Purifier Model #50V

Results: Demonstrated positive reduction in airborne particles, VOC's and microorganisms

Test - Food Shelf Life Extension

Description: Demonstrate the extension of shelf life of various produce products when stored in a refrigerated environment by removing food spoilage organisms through the use of a Biozone unit

Results: Demonstrated significant improvement in produce quality and shelf life extension

Complete Test Results on Following Pages

INDOOR AIR QUALITY TEST UTILIZING A BIOZONE AIR PURIFIER

INTRODUCTION

This report details the results of a singular Air Quality Study utilizing the Biozone 1500 InDuct model air purifier.

The purpose of the study was to determine the in-situ results of the Biozone 1500 in a domestic location and its effect in the reduction (if any) of airborne bacteria flowing through a dwelling's ventilating system.

METHODOLOGY

A residential condominium and its independent ventilating system was selected for the Study. The air quality, re. bacterial content, was measured with Micrology Laboratories Easygel petri dish system which is a pectin-gel method. The formulation used was the Standard Plate Count formulation. The air in the ventilating system was tested before utilization of the Biozone 1500 and again after 24 hours of use of the device.

The condominium was a 2300 sq. ft., ocean front, single floor dwelling inhabited by two retired adults. A petri dish was placed inside an outlet vent in the master bedroom. For the initial air test, the prepared petri dish was uncovered and left exposed to the circulating air for 1 hour then recovered and allowed to incubate for 48 hours. The ventilating system fan was switched for continuous operation.

The condominium had two-zone heating/cooling (two air handlers). A Biozone 1500 was installed (per instructions) just past each air handler. The Biozone units are designed to operate when the ventilating fan is activated. Biozone's photoplasma output contains small amounts of ozone and ozone levels were tested in several areas of the condominium at 8 hour intervals using two monitors, an Ecosensor A-21Z ozone monitor and an AFX model N-2000. At no time did the ozone levels anywhere in the living area exceed .02 ppm.

After 24 hours of continuous operation of the Biozone 1500, another air quality test was performed following the same methodology as previously described.

SUMMARY OF RESULTS

Based on our experience of indoor environments, the bacteria count exhibited in the ventilating system of the dwelling was typical of the air quality found in such testing. However, microbiological analysis of the specific types of bacteria and mold/fungus colonies where not performed.

Visual examination of the petri dishes' bacterial and mold/fungus colonies indicate a significant reduction in counts after the use of the Biozone 1500. There did not appear to be other environmental events or circumstances that would contribute to the result.

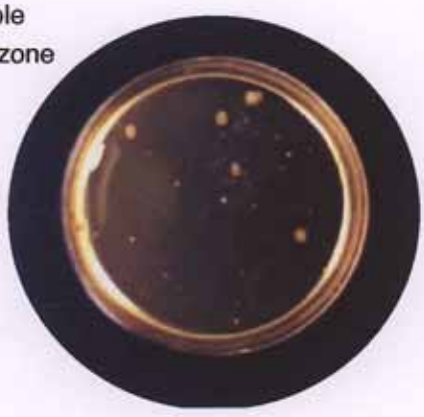
CONCLUSION

Analysis of the results would indicate that very low levels of ozone used in the Biozone 1500 had a very positive effect on reducing the presence of airborne microorganisms in the ventilating system. It has been well established that photoplasma is biocidal in nature. Exposure to photoplasma even for short time periods, such as the 24 hours in this study, further support its effectiveness. In can be further suggested that if the ventilating system had been subjected to these purification methods for longer than 24 hours, further reductions in bacteria and mold counts could be obtained.

EITL
ENVIROGEN
International Testing Lab

Air Sample
Beginning

Air Sample
After Biozone



Air Quality in Automobiles - The Health Risk
Air Resources Board Study and Product Report

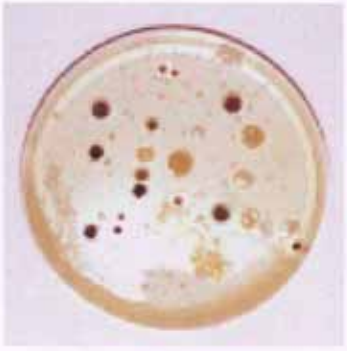
AIR RESOURCES BOARD STUDY - There has been strong scientific evidence that air contaminants inside automobiles pose a serious health risk to drivers and passengers. University studies confirm that the air inside vehicles is more hazardous than the air outside. Once polluted air from the outside is sucked into a car, it remains inside for long periods of time and builds up. Common vehicle contaminants include gaseous pollutants, diesel soot and other fine particles. Levels of hydrocarbons and carbon monoxide are often 2 to 10 times higher inside vehicles. Other contaminants found inside vehicles include ethyl benzene, benzene, butadiene, formaldehyde, toulene, xylene, and MTBE, all considered toxic. New cars are even worse. That "new" car smell is actually created by toxic off-gassing of different materials inside the car.These volatile organic compounds (VOC's) can cause serious health problems ranging from nausea, headaches, eye irritation, dizziness, and central nervous system problems. In addition, a vehicle's air conditioner (AC) can also be hazardous to your health. Fungi (mold) can grow in a car's AC system and trigger nausea, headaches, allergies and asthma attacks. And finally, the risk of airborne disease transmission is very high in a small, confined space. Any infectious person who coughs, sneezes, or laughs will emit infectious droplet nuclei that will circulate throughout a vehicle.

PRODUCT REPORT - It has been determined that a high quality air purification system is the most effective solution to vehicle air contamination. The Biozone Vehicle Air Purifier #50V was tested as to its ability to reduce the concentration of selected contaminants inside an automobile in typical "city traffic" conditions. Specifically, the level of biological contaminants was determined (bacteria and fungi), VOC's, and respirable particulates. Standard scientific testing protocols and methodology were followed to ensure validity of conclusions.

CONCLUSIONS - Tests and measurements were taken during 3 separate commutes with and without the Biozone Vehicle Air Purifier. The mean results indicated reductions in the levels of bacteria and mold by as much as 99%. Levels of VOC's were reduced from 25 mg/cm^3 to 4 mg/cm^3. Particles of .015 - 2.5 μm size were reduced from 2200/cm^3 to 40/cm^3.

EITL
ENVIROGEN
International Testing Lab

Tests were performed in several vehicles during several commutes using the Biozone Vehicle Air Purifier. This device utilizes high energy plasma and photochemestry for air purification. The air was tested using Micrology Laboratories Easygel petri dish system with the Standard Plate Count formulation. The air was tested before use of the Biozone and again after 2 hours of use. The petri dishes below were typical of the results.



Beginning
Air Sample

After 2 hrs.
Biozone #50V

Extended Shelf Life for Produce

by Bryan Cecchi, John Garrett, B.V. Rajmane, Ph.D.

INTRODUCTION

The preservation of food quality and reduction of spoilage organisms are of paramount importance to the food industry. Economic benefits through extended shelf life can be meaningful at every step along the food process. Figures as high as 30% or more have been used to assess the amount of produce lost to microbial activity between the time of harvest and consumption. Losses occur at every step of handling, including transient time, processing, and storage. The USDA says the effective extension of produce requires an understanding that spoilage can be reduced at numerous points along the food chain. Therefore, it is important to apply risk reduction strategies at each step and process.

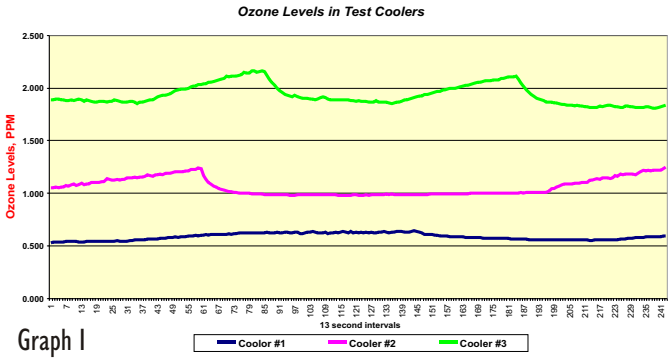
One strategy to reduce various spoilage organisms, such as bacteria and mold, as well as the losses from accelerated ripening is through the introduction of gas phase ozone. Hundreds of scientific papers have been published proving ozone kills spoilage organisms and neutralizes the off-gasses that accelerate ripening and spoilage. The FDA has approved the use of ozone for all food storage and preparation, and the USDA has acknowledged ozone's role for improved food production.

While there has been significant research on the use of ozone for extending the shelf life of a variety of foodstuffs, the purpose of Biozone Scientific's research is to define more closely the parameters necessary to maximize the reduction of spoilage, and to apply them to common, everyday food processing and storage applications. Specifically, laboratory testing was performed to quantify the life extension of produce in cold storage, combining variant ozone levels and ultraviolet light. Testing protocol was written by Dr. B.V. Rajmane and followed Good Laboratory Procedures in Biozone Scientific's Analytical Testing Laboratory.

MATERIALS AND METHODS

Produce products were stored in 4matching coolers. A Biozone Scientific 100FS model UV/ozone unit was placed inside each cooler. The ozone generation rate was adjusted to maintain a relatively constant, predetermined ozone level over the duration of the testing (see graph 1). A recently calibrated INUSA-2000-1 gaseous ozone analyzer measured ozone levels. A monitoring probe was installed in each cooler and connected to the analyzer with ozone levels sampled every 13 seconds. Results were fed directly from the monitor to a Dell computer via serial port download using Windows Hyperterminal and importing the data into Excel. In addition, temperature conditions were monitored in each cooler with professional-grade refrigerator thermometers to ensure proper and homogeneous storage conditions in each cooler of 42F. See Figure 1 below. The ozone levels selected for testing were based on previously published research, as well as previously conducted in-house testing.

Cooler "C" control, no ozone
Cooler #1 - 0.6 ppm
Cooler #2 1.0 ppm
Cooler #3 2.0 ppm



Graph I

The produce selected for testing was purchased at a local produce stand, and all five of the following produce items were consistent in freshness and appearance.

Strawberries Raspberries
Blueberries Asparagus
White grapes

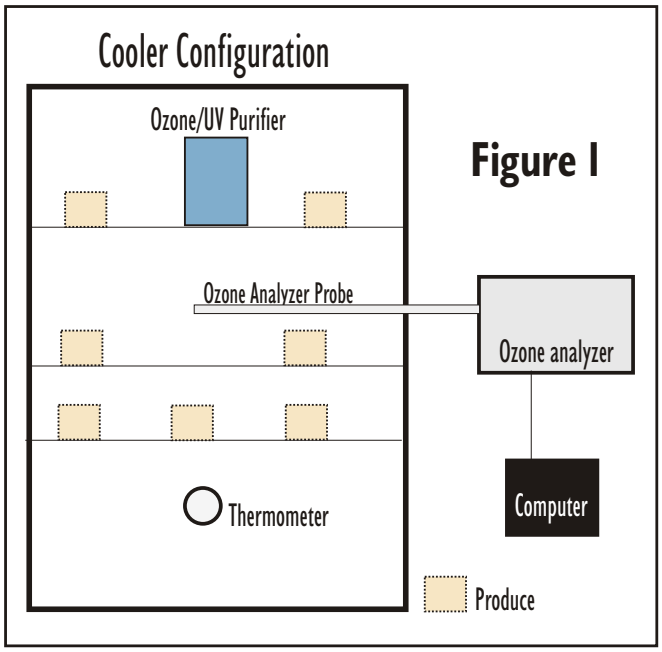


Figure I

The produce was inspected each day for mold, color, ripeness and firmness. All coolers were opened for the same time intervals each day, and to assume "real world" commercial applications, many days the doors were opened numerous times.

RESULTS

The results of produce exposure to variant ozone levels in a refrigerated environment compare well to results from other investigators and further support ozone's effectiveness in extending produce shelf life. In addition, testing variant levels simultaneously provided indications of optimum ozone levels for maximum effectiveness (see Graph II, III, IV,, and Table I).

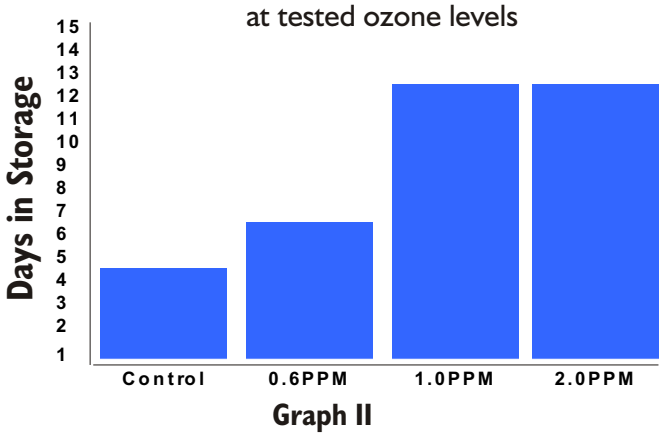
Delaying the formation of mold on produce was easily accomplished in an ozone environment. Strawberries in the control cooler began forming mold after 2 days (this was on a bruised section), but no mold ever formed (even on bruised berries) in any of the coolers containing ozone for the duration of the 15-day test (see figures II & III). Highly sensitive raspberries experienced mold growth on the 3rd day in the control cooler but showed no mold growth until the 5th day in the 0.6 ppm cooler with no mold growth for the duration of the test at the higher ozone levels of 1.0 ppm and 2.0 ppm. Blueberries, white grapes and asparagus showed no mold growth in the control or ozonated coolers.

Indications as to produce quality and freshness are displayed in the color and firmness of the product. Dramatic improvements in the color retention of all produce stored in ozone environments were observed. Asparagus color remained good throughout. Strawberries held their color 5 days longer than the control group while raspberry color remained 3 days longer and blueberries 3 to 9 days longer. Asparagus firmness lasted as long as 17 days longer depending on the ozone level. The color and firmness of white grapes lasted 7 days longer at the 2.0ppm level.

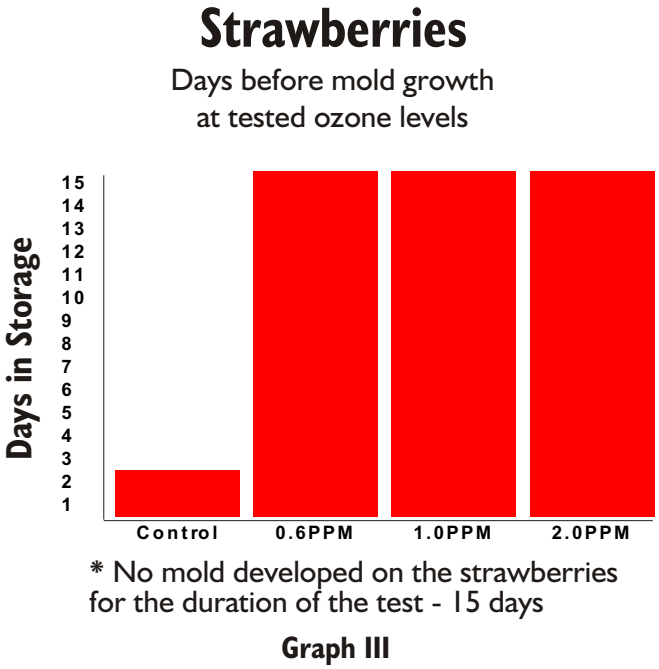
CONCLUSIONS

The results presented here demonstrate that a high degree of improved shelf life of produce products can be achieved with airborne ozone. The shelf life improvements in this study compare well with the best results obtained in numerous studies on the effects of ozone in prolonging the life of foodstuffs through inactivation of spoilage organisms and reduction of produce-generated gases that enhance ripening. The use of ozone for inactivation of spoilage organisms to extend the useful life of produce also strongly parallels other studies performed on the reduction of pathogenic and non-pathogenic organisms with ozone. The results would suggest that worthwhile product life extension could easily be accomplished by introducing appropriate amounts of ozone into refrigerated environments.

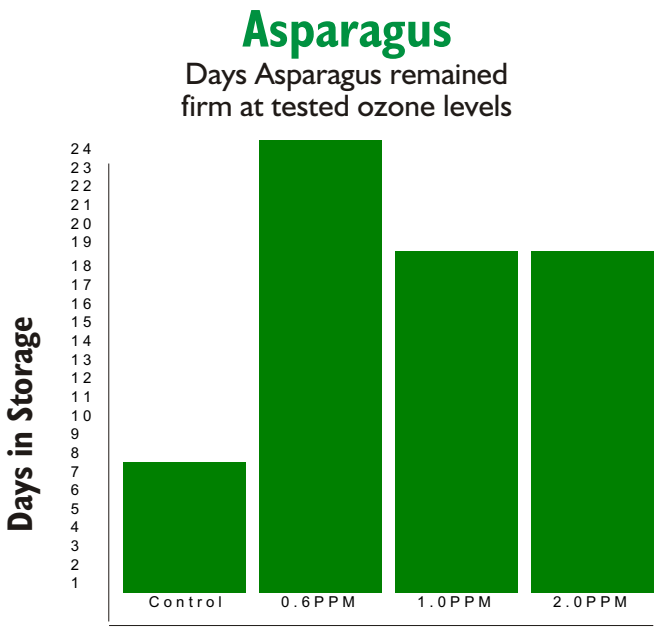
While this research examined the results of three levels



Graph II



Graph III



Graph IV

of ozone, precise ozone levels necessary for optimum results have not been determined. However, if exact levels were established, their practicality would be suspect in actual application due to the nature of produce processing and storage. As a result, an optimum or preferred ozone range could be determined that would achieve desirable results for each produce product or for a "mix" of stored produce. This research indicates the following levels were most effective for achieving overall improved quality (mold, color, firmness):

Strawberries	1.0 ppm
Raspberries	1.0 ppm
Blueberries	1.0 ppm
Asparagus	0.6 ppm
White Grapes	2.0 ppm

A recommendation as to a level for storing a mixture of produce in an environment that would indicate significant improvements in shelf life would be 1 & 2ppm. It should be noted that previous studies have indicated life extension benefits from levels as low as .3 -.5 ppm, and such levels, while perhaps not optimal, should be considered when integrating storage with worker exposure times. In addition, this study did not directly determine the microbial reduction benefits of the

Produce	Ozone Level	Days Before Mold Growth	Days Before Color/ Appearance/Firmness Change
Strawberries	0.0	2	3
	0.6	none	8
	1.0	none	8
	2.0	none	10
Blueberries	0.0	none	2
	0.6	none	5
	1.0	none	7
	2.0	none	11
Raspberries	0.0	3	1
	0.6	5	4
	1.0	none	4
	2.0	none	4
White Grapes	0.0	none	3
	0.6	none	5
	1.0	none	7
	2.0	none	15
Asparagus	0.0	none	7
	0.6	none	none - 24 days
	1.0	none	18
	2.0	none	18

Table I

use of ultraviolet light as the ozone generation source. In spite of this unknown, the results, as well as previous studies on the subject, would indicate that ultraviolet light would encourage the reduction of organic contaminants and further enhance an environment for extended product shelf life.

The results presented here continue to support the

Figure II

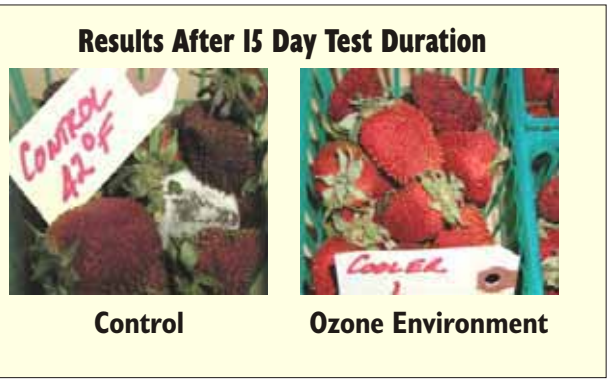


Figure III

benefits of ozone in cold storage and the obvious economic benefits to everyday food storage and processing applications. Additionally, the tests confirm the effectiveness of Biozone Scientific's products to substantially extend the shelf life of the tested produce.

ADDITIONAL BENEFITS

While the primary purpose of this research was investigation of shelf life extension, tests were also conducted to ascertain the reduction of odors, and, in particular, odor contamination between products. It is well documented that ozone neutralizes most odors. The application of gas phase ozone into refrigerated containers substantially reduced foodstuff odors. Specifically, it eliminated "cross-odor" contamination, i.e., the absorption of one product's odor by another product. For example, strawberries stored next to onions did not absorb the onion smell (or taste) as they did in the control cooler (no ozone).

CASE STUDY - APPLICATION OF RESEARCH RESULTS

A commercial retailer of produce was selected as a test site to demonstrate the effectiveness of ozone in prolonging shelf life in a real world environment. A Biozone Scientific ozone/UV unit was placed in his 713 cubic ft. Cooler.

During a 30-day test, the owner compared shelf life with previous experiences. His records verified a reduction in product waste of 66%. Examples from his data included:

- Strawberries remain in saleable condition 12 to 14 days longer
- Raspberries that normally last only a few days now last as long as 13 days
- Lettuce life was extended 4 to 5 extra days
- Absolutely no mold growth on any produce product

The reduction in spoilage was significant and resulted in favorable economic benefits and dramatic improvement in product quality.

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BIOZONE SCIENTIFIC

1180 19th Street, Vero Beach, FL 32960
772-564-2414 Fax: 772-564-0709
www.biozonescientific.com

Asia

Australia：	Engineered Environments (IEQ) Pty Ltd
	Healthy Buildings International Pty Ltd.
Korea：	Korea Apparel Testing & Research Institute
Singapore：	Pure Science International Pte Ltd
China：	國家空調設備質量監督檢驗中心
	國家環境分析測試中心
	中國疾病預防控制中心環境與健康相關產品安全所
	軍事醫學科學院微生物流行病研究所
	深圳福田區疾病預防控制中心
	深圳市計量質量檢測研究院
	(國家質量監督檢驗檢疫總局深圳計量檢定站)
	深圳維中檢測技術有線公司
	醫科大學公共衛生與熱帶醫學學院微生物學系
	廣東省疾病預防控制中心(廣東省衛生檢驗中心)
Hong Kong:	SGS
	Lawn Environmental Protection Limited

Engineered Environments (IEQ) Pty Ltd
Summaries

Objective: Evaluate the performance of the Biozone Air purification devices installed into the club's air-conditioning systems with the aim of reducing the concentrations of airborne nicotine without increased levels of residual ozone.

Test #1

Description: Measure the reduction Airborne Nicotine
Results: **Average reduction in 5 places - 50%**

Test #2

Description: Measure the ozone concentration to ensure levels remained at recommended safe limits
Results: **before -** .01 ppm **during use** - .02 ppm

Description of Testing on the Following Page

Engineered Environments (IEQ) Pty Ltd

Suite 2, 6 Faraday Road, Padstow NSW 2211
Postal Address: PO Box 648, Padstow NSW 2211
Phone: 9792 8855 Fax: 9792 6744
ACN: 101 704 269 ABN: 27 101 704 269
www.environments.com.au/ieq

Indoor Air Quality Testing Report

of

Cabra-Vale Diggers Club
1 Bartley Avenue
Canley Vale NSW

for

Biozone Australia Pty Ltd

January 2004

Ozone

Ozone is a molecule composed of three oxygen atoms. The third oxygen atom can detach from the molecule and reattach to molecules of other substances, altering their chemical composition. It can have adverse health effects on people and when breathed in may damage the lungs. Relatively low amounts can cause chest pain, coughing, shortness of breath and throat irritation.

The Biozone system is known to produce a small amount of ozone, therefore this substance was monitored to ensure that it remained within the recommended safe limits.

Table 1: Ozone Concentrations

Location	Approximate Time	Ozone (ppm)	
		16 January	*23 January*
Outdoors	20:30	< 0.01	0.01
	21:25	< 0.01	0.01
	22:30	0.01	0.01
	23:45	0.01	0.02
Shipwreck Lounge	20:32	0.01	0.02
	21:27	0.01	0.02
	22:32	0.01	0.02
	23:32	0.01	0.02
Poker machines – Centre	20:34	0.01	0.02
	21:29	0.01	0.02
	22:34	0.01	0.03
	23:34	0.01	0.02
Poker machines – East	20:35	0.01	0.02
	21:30	< 0.01	0.02
	22:35	0.01	0.03
	23:35	0.01	0.02
Bowlers Lounge	20:37	0.01	0.02
	21:32	0.01	0.02
	22:37	0.01	0.02
	23:37	0.01	0.02
Sports Lounge	20:40	0.01	0.01
	21:35	0.01	0.02
	22:40	< 0.01	0.02
	23:40	0.01	0.02
NHMRC recommended limit		0.08 ppm (4-hour average)	

Comments

The concentrations of ozone were well below the NHMRC recommended limit at all times.

Although there was a slight increase overall when the Biozone system was operating, this was not enough to present any real problems. The outdoor level was also slightly higher on the second night, so this contributed to the indoor increase as well.

Environmental Tobacco Smoke Measurements

The tests were conducted during a busy 4-hour period from 6 pm to 10 pm on Friday 28 November and Friday 5 December. As such they are representative of the worst conditions present in the building. Long term average values would almost certainly be lower.

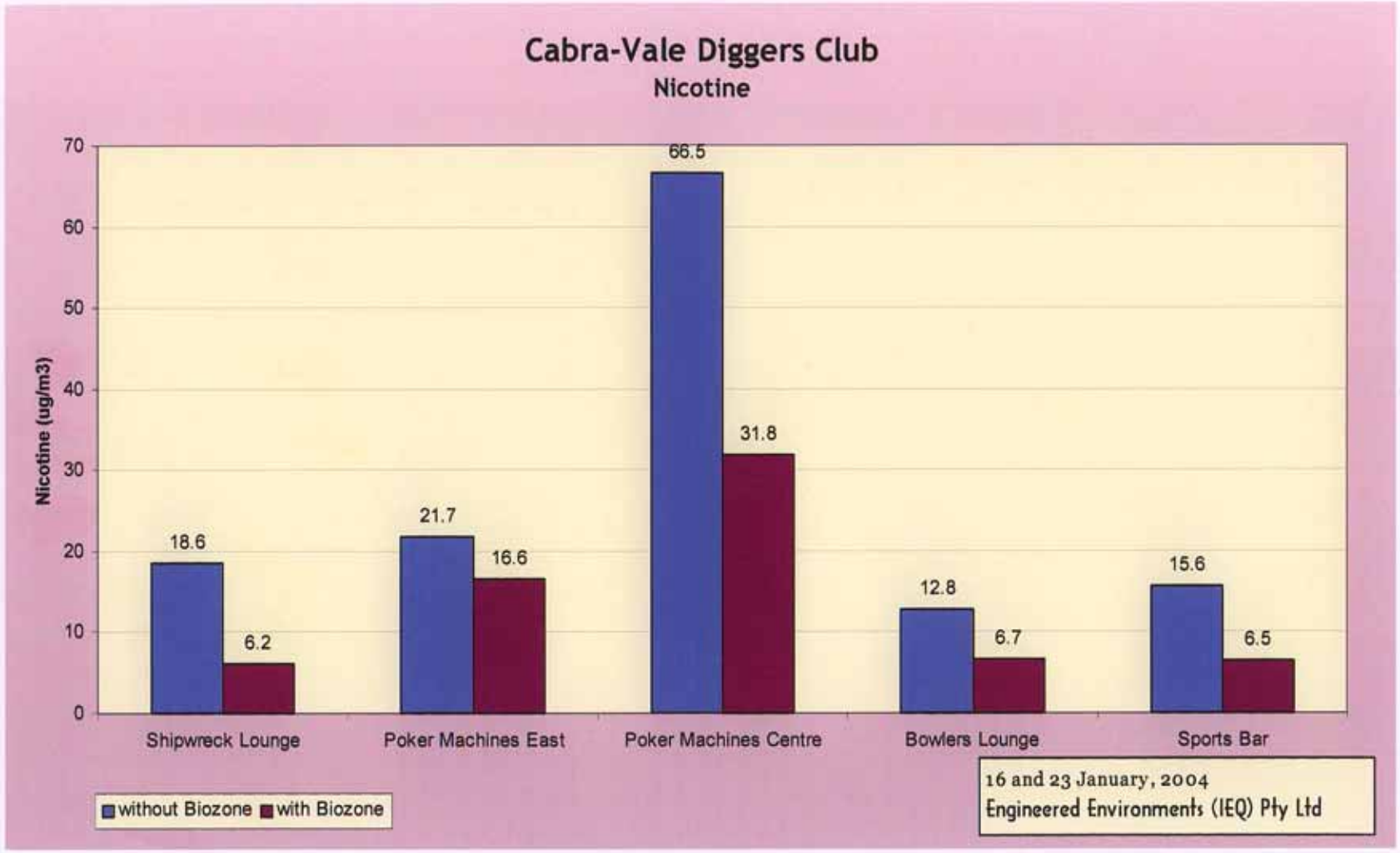
Table 2: Results of Environmental Tobacco Smoke Testing

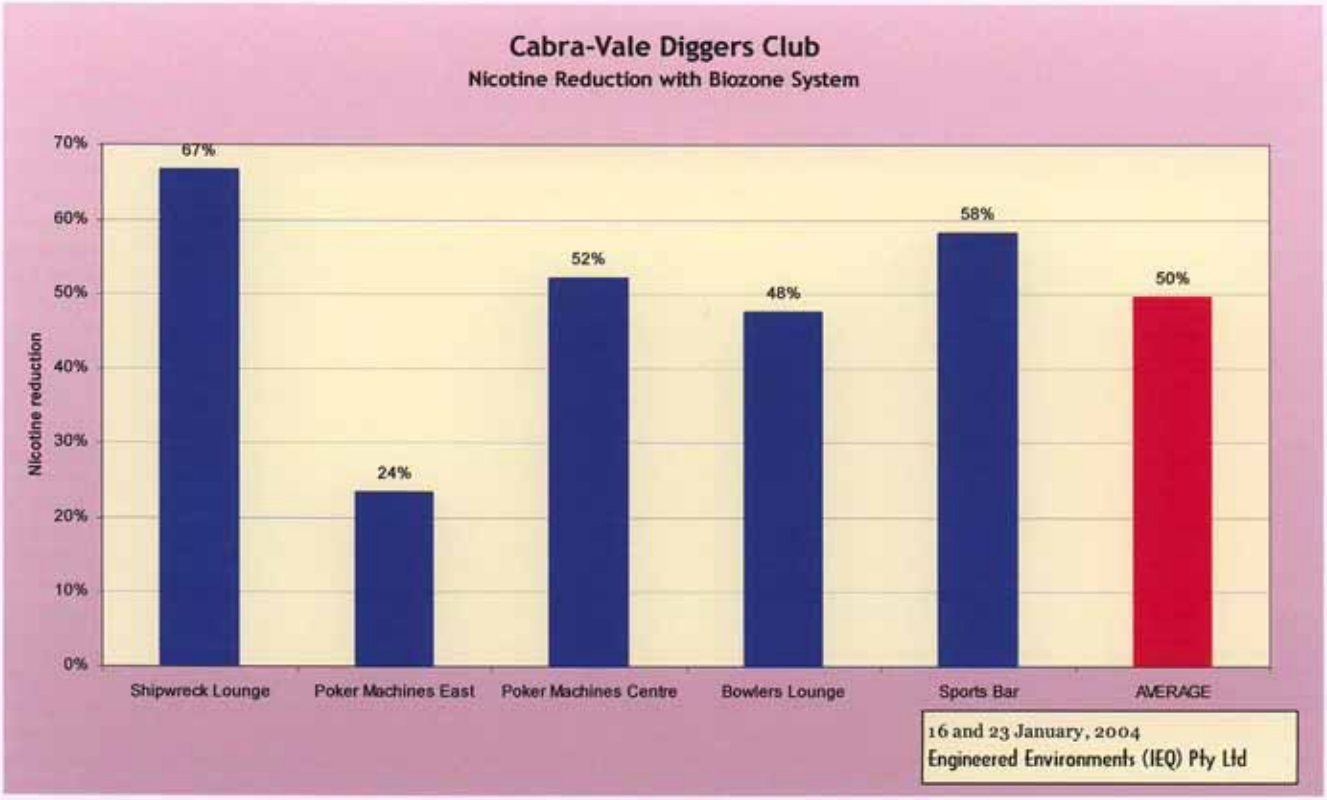
Location		RSP $\mu g/m^3$	CO_2 ppm	CO ppm	Airborne Nicotine $\mu g/m^3$
No.	Description				
Without Biozone					
1	Shipwreck Lounge	61 - 149 Avg: 94	430 - 460 Avg: 440	1 - 2	18.6
2	Poker machines East	56 - 210 Avg: 128	470 - 520 Avg: 490	1 - 2	21.7
3	Poker machines Centre	149 - 346 Avg: 250	-	-	66.5
4	Bowlers Lounge	73 - 137 Avg: 106	-	-	12.8
5	Sports Bar	89 - 256 Avg: 156	-	-	15.6
With Biozone					
1	Shipwreck Lounge	48 - 168 Avg: 113	400 - 440 Avg: 420	1 - 2	6.2
2	Poker machines East	84 - 317 Avg: 185	500 - 550 Avg: 520	1 - 2	16.6
3	Poker machines Centre	180 - 443 Avg: 342	-	-	31.8
4	Bowlers Lounge	72 - 161 Avg: 111	-	-	6.7
5	Sports Bar	130 - 379 Avg: 225	-	-	6.5
Recommended Standard		*	800 *Maximum*	9 *Maximum*	*

Detailed results are included in the Graphs section at the end of this report.

Key:

RSP = Respirable suspended particulate
CO_2 = Carbon dioxide
CO = Carbon monoxide
$\mu g/m^3$ = micrograms per cubic metre
ppm = parts per million
* = see Tables 3 and 4 below


Cabra-Vale Diggers Club
Nicotine
Nicotine (ug/m3)
70
60
50
40
30
20
10
0
18.6
6.2
21.7
16.6
66.5
31.8
12.8
6.7
15.6
6.5
Shipwreck Lounge
Poker Machines East
Poker Machines Centre
Bowlers Lounge
Sports Bar
without Biozone
with Biozone
16 and 23 January, 2004
Engineered Environments (IEQ) Pty Ltd


Cabra-Vale Diggers Club
Nicotine Reduction with Biozone System
Nicotine reduction
70%
60%
50%
40%
30%
20%
10%
0%
67%
24%
52%
48%
58%
50%
Shipwreck Lounge
Poker Machines East
Poker Machines Centre
Bowlers Lounge
Sports Bar
AVERAGE
16 and 23 January, 2004
Engineered Environments (IEQ) Pty Ltd

Healthy Buildings International Pty Ltd
Summaries

Objective: Determine the effects of Biozone unit trials on environmental tobacco smoke.

Test

Description: Measure the reduction Airborne Nicotine in 2 locations

Results: **before** - 27.5 µg/m3 **after** - 5.8 µg/m3 (84% reduction)
before - 18.5 µg/m3 **after** - 7.2 µg/m3 (61% reduction)

Test Results on the Following Page

HBI Healthy Buildings International Pty Ltd
A.C.N. 003 270 693 A.B.N. 39 003 270 693

7 / 33 Ryde Road
Pymble NSW 2073

Mailing: PO Box 1047
Pymble Business Centre
NSW 2073 Australia

Tel: 61 (02) 9880-2744
Fax: 61 (02) 9880-2766
e-mail: *hbi@hbi.com.au*
Web: www.hbi.com.au

NORTH SYDNEY LEAGUES CLUB
12 ABBOTT STREET
CAMMERAY NSW

NORTH SYDNEY LEAGUES CLUB LIMITED

HBI'S REPORT ON THE EFFECTS OF BIOZONE UNIT TRIALS

NOVEMBER 2003

5.1.8 *Environmental Tobacco Smoke (ETS) Measurements*

OBJECTIVE To establish average levels of constituents of tobacco smoke in indoor air.

METHOD Sampling of airborne nicotine in occupied areas as a surrogate indicator of the gaseous components of ETS. The detection limit of this method is 0.08 $\mu g/m^3$ for the 4 hour sample period used here.

Sampling for airborne nicotine by XAD-4 tubes was carried out in two fixed locations, one in the Eureka room and one in the poker machine area. The test period was from 8:00 pm to midnight Friday, 14 November. Testing was again performed in the same locations from 8:00 pm to midnight Friday, 28 November. Testing was performed on both evenings to test for ETS before and after the installation of ozone generators.

PRECAUTIONARY NOTE

HBI has expressed its reservations on the results of this type of indoor air quality testing done, absent controlled conditions. Thus testing for ETS levels on any given evening can only reflect what happened on the evening in question. The tests are very useful in order to record events at any given time and useful in attempting to assess changes over time. They rely on an understanding that if the conditions change between test periods, any changes measured during the test period will not necessarily reflect an overall improvement or deterioration in the indoor air quality.

During this exercise we tested at the same locations and times and on both occasions, on Friday evenings. We did not however have any control on any of the nights in question over, population numbers, the numbers of smokers/non smokers present, the rate at which smokers present actually smoked, or the type of cigarettes smoked. We are of the view that these were approximately the same but we caution readers as to the limitations in this type of testing.

RESULTS

Sample		**Nicotine ($\mu g/m^3$)**	
No.	Location	14.11.03	28.11.03
1	Eureka Room atop Roulette Machine	27.5	5.8
2	Poker Machine area Centre atop machine 401	18.5	7.2

Key: $\mu g/m^3$ = micrograms per cubic metre of air
ND = Not detected. Detection limit is 0.08 $\mu g/m^3$.

KATRI Korea Apparel Testing & Research Institute

232-22, Yongdu-dong, Dongdaemun-gu, Seoul, Korea
Tel : +82-2-925-2451 Fax : +82-2-925-2462 http://www.katri.re.kr

TEST REPORT

COPY

KATRI NO. : SS4 - 00009959 DATE : Sep. 25, 2004.
APPLICANT : BIOZONE KOREA PAGE (S) : 1 OF 1

SAMPLE DESCRIPTION : ONE(1) PIECE OF AIR PURIFIER

RECEIVED DATE : Aug. 27, 2004 ***

TEST ITEM	TEST RESULT
	#1 (BIOZONE-100)
Assessment of bactericidal Activity (Reduction Rate of surface bacteria, %)	
30mins	6.4
60mins	25.4
120mins	94.6
180mins	99.0

Remark) Test condition

1. Test Bacteria : *Klebsiella pneumoniae* ATCC 4352
2. Chamber size : 2m× 1m× 1m(W× D× H)
3. Exposure time & condition : 30mins~180mins, Room temp.

#1

CHUNG SEOK YOO
Director General

The results on this sheet are offered in good faith and are derived from the samples submitted. They represent the testing carried out by our competent staff in our up to date laboratory.

KATRI
http://www.katri.re.kr

한국의류시험연구원
산업자재연구센터

서울특별시 동대문구 용두동 232-22, 서울 02-925-2451(FAX 02-925-2462), 강남 02-561-0845
구로 02-2633-8444, 부산 051-469-0525, 대구 053-255-0933, 대전 042-533-6689, 전주 063-214-2282

시 험 성 적 서

신 청 자 : 바이오존코리아
주 소 : 경기 안양시 동안동 관양2동 1505-4 타워빌딩 802호
제 출 처 :
시 료 명 : 공기정화기(바이오존-102)

KATRI NO : SS04-00009960
발급일자 : 2004. 09. 25
PAGE(S) : 1 / 1

2004. 08. 27일자로 의뢰하신 시료에 대한 시험결과는 아래와 같습니다.

시 험 항 목	시 험 결 과	
살균력(표면살균율, %) : 살균효과 판정 방법(의뢰자 제시방법)		
	공시균1	공시균2
30분	11.3	24.0
60분	37.7	40.0
120분	96.5	98.8
180분	99.3	99.9

주)시험방법 및 조건
1.시 험 균 종 : 1)공시균1 - *Staphylococcus aureus* ATCC 6538 (황색포도상구균)
2)공시균2 - *Escherichia coli* ATCC 25922 (대장균)
2.시험챔버크기 : 2m×1m×1m(W×D×H)
3.작동시간 및 조건 : 30분~180분, Room temp.
4.살균율(%) = {(초기균수-접촉후균수)}×100

시 료

한국의류시험연구원장

KATRI
http://www.katri.re.kr

한국의류시험연구원
산 업 자 재 연 구 센 터

서울특별시 동대문구 용두동 232-22, 서울 02-925-2451(FAX 02-925-2462), 강남 02-561-0845
구로 02-2633-8444, 부산 051-469-0525, 대구 053-255-0933, 대전 042-533-6689, 전주 063-214-2282

시 험 성 적 서

신 청 자 : 바이오존코리아
주 소 : 경기 안양시 동안동 관양2동 1505-4 타워빌딩 802호
제 출 처 :
시 료 명 : 공기정화기(바이오존-100)

KATRI NO : SS04-00009959
발급일자 : 2004. 09. 25
PAGE(S) : 1 / 1

2004. 08. 27일자로 의뢰하신 시료에 대한 시험결과는 아래와 같습니다.

시 험 항 목	시 험 결 과
살균력(표면살균율,%) : 살균효과 판정 방법(의뢰자 제시방법)	
30분	6.4
60분	25.4
120분	94.6
180분	99.0

주)시험방법 및 조건

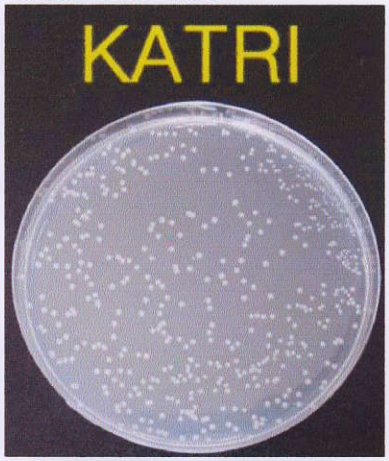
1.시 험 균 종 : *Klebsiella pneumoniae* ATCC 4352 (폐렴간균)
2.시험챔버크기 : 2m×1m×1m(W×D×H)
3.작동시간 및 조건 : 30분~180분, Room temp.
4.살균율(%) = {(초기균수-접촉후균수)}×100

시 료

한국의류시험연구원장

PHOTO)

▣ 시험균 - *Klebsiella pneumoniae* ATCC 4352



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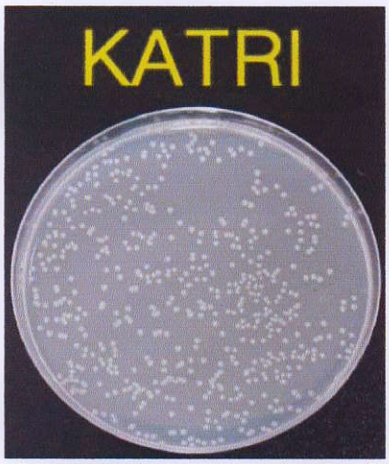

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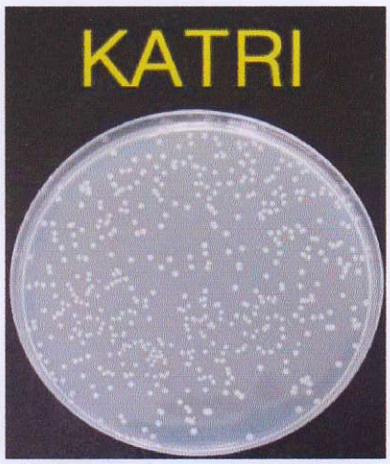

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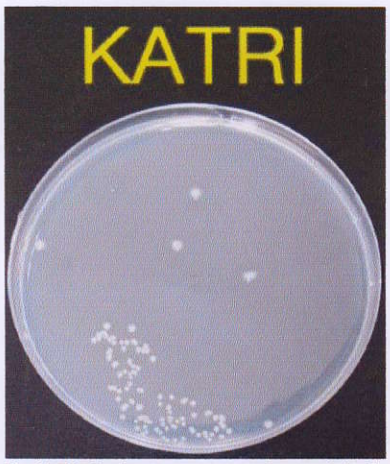

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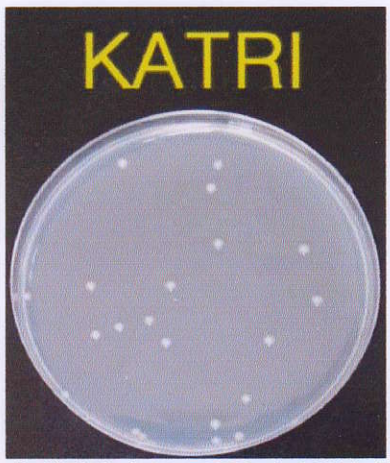


[시험편 / SS4-9959 / 180분]

KATRI Korea Apparel Testing & Research Institute

232-22, Yongdu-dong, Dongdaemun-gu, Seoul, Korea
Tel : +82-2-925-2451 Fax : +82-2-925-2462 http://www.katri.re.kr

COPY

TEST REPORT

KATRI NO. : SS4 - 00009960 DATE : Sep. 25, 2004.
APPLICANT : BIOZONE KOREA PAGE (S) : 1 OF 1

SAMPLE DESCRIPTION : ONE(1) PIECE OF AIR PURIFIER

RECEIVED DATE : Aug. 27, 2004 ***

TEST ITEM	TEST RESULT
	#1 (BIOZONE-102)

Assessment of bactericidal Activity (Reduction Rate of surface bacteria, %)

	Test Bacteria 1	Test Bacteria 2
30mins	11.3	24.0
60mins	37.7	40.0
120mins	96.5	98.8
180mins	99.3	99.9

Remark) Test condition

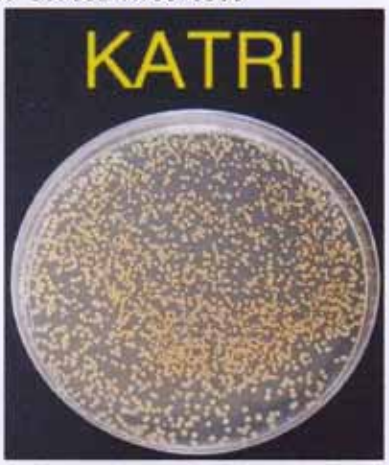
1. Test Bacteria 1 : *Staphylococcus aureus* ATCC 6538
   Test Bacteria 2 : *Escherichia coli* ATCC 25922
2. Chamber size : 2m× 1m× 1m(W× D× H)
3. Exposure time & condition : 30mins~180mins, Room temp.

#1

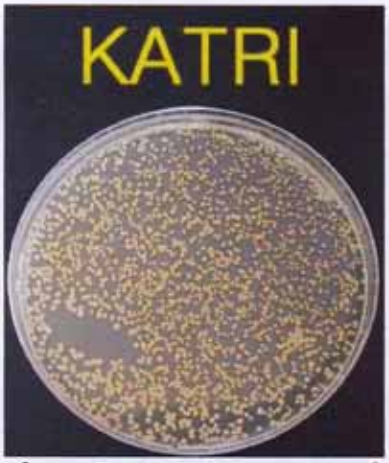
CHUNG SEOK YOO
Director General

PHOTO)

▣ 공시균 1 - *Staphylococcus aureus* ATCC 6538



[대조편 / 초기]



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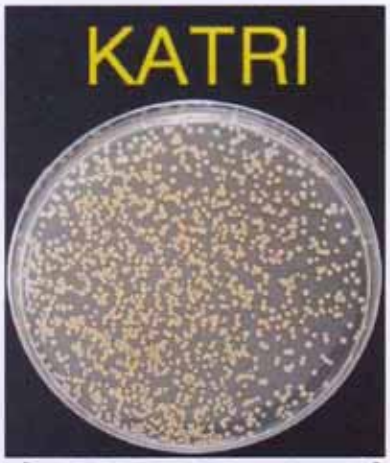


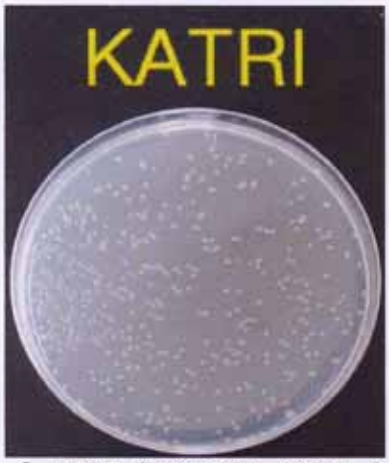
[시험편 / SS4-9960 / 60분]

[시험편 / SS4-9960 / 120분]

[시험편 / SS4-9960 / 180분]

▣ 공시균 2 - *Escherichia coli* ATCC 25922

[대조편 / 초기]



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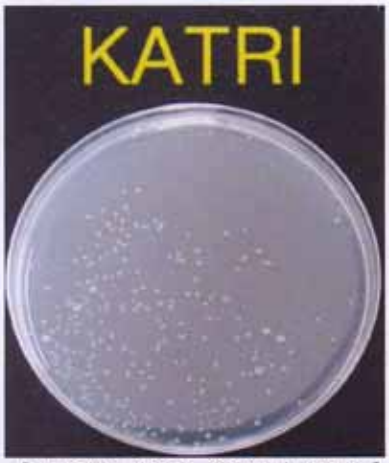

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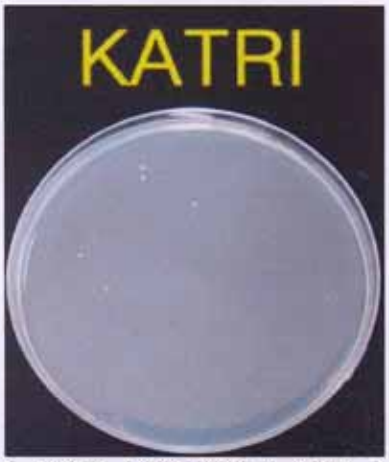

[시험편 / SS4-9960 / 120분]

[시험편 / SS4-9960 / 180분]

Pure Science International Pte Ltd
7500A Beach Road, #05-318 The Plaza. Singapore 199591.
t: +65 6396 7889; f: +65 6456 7396; e: sales@puresciencelnt.com

Nosocomial Infections and Biozone Air Purifiers

By Lenz Wong

Introduction

Nosocomial infections refer to "hospital acquired" infections arise as complications of the primary reason for being in hospital in the first place (e.g. burn victims acquiring a *pseudomonas sp.* infection). The main features of these infections are:

- **Infectious agents** – the disease causing agents (pathogens) may be part of the normal flora found on perfectly healthy persons and emerge as opportunistic pathogens. Some infectious agents display outright pathogenicity in humans.
- **Sufferers** – these people normally comprise the very young, very old or immuno-compromised where the condition of their body's own defense systems or normal flora allows colonization and proliferation necessary for these infections. Systemic infections may arise and lead to focal infections.
- **Sources and transmission** – The infectious agents are most commonly introduced by people, and occasionally by vectors. Once introduced into the hospital environment these agents are commonly directly or indirectly spread through contact with infected individuals and formites or through the air-borne route. Reservoirs or secondary sources may form where conditions conducive for sustenance or proliferation are available.
- **Environment** – The hospital environment is an indoor environment that houses a community comprising regular healthcare workers and patients. It is also a concentration point of persons requiring healthcare and any associated pathogens

Significance of Nosocomial Infections

An important feature of many nosocomial infections is their resistance to antibiotics. Drug resistance is encoded on specific genes that may traverse between species via plasmids, viruses or other molecular vehicles.

The emergence of multi-drug resistance raises the threat of "super bugs" that are resistant to all currently known antibiotics. Strains of specific organisms have already been isolated that are resistant to antibiotics regarded as the last line of defense in antimicrobial therapies. An extension of the threat of the "super bug" is the chance of escape from hospitals and epidemics that follow.

Pragmatically, these infections raise costs directly in additional medicines or indirectly in resources associated with additional resources such as lengthened hospital stay or course of treatment, and control measures. Depending on a hospital's capacity, this may result in lower productivity, work morale and overall efficiency. Costs for resistance alone are estimated to be in the hundreds of millions of US dollars annually in the USA.

The hospital environment requires special attention focused at controlling the spread of disease between individuals through adequate cleaning and maintenance programs. Besides controlling the administration of antibiotic drugs, adopting strategies to reduce the number of microorganisms at different areas involved in its transmission without the use of antibiotics may have positive short and long-term effect against nosocomial infections.

Reducing Microbial Counts in Indoor Environments

One new method of reducing total microbial counts in indoor environments is the use of gas plasmas, also known as energized gas. Although gas plasmas include ozone as one of its components and by itself is known to possess antimicrobial properties, they include a wider range of antimicrobial reactive oxygen species referred to as reactive oxygen species (ROS) translating to higher potency per ozone output when compared to ozone-only systems.

This gas plasma technology is utilized by Biozone air purification units. These units are used in many different industries such as the food and beverage, indoor air quality and healthcare industries to reduce microbial counts since gas plasmas offer several outstanding features:

- Active antimicrobial effect
- Does not use chemicals, avoiding problems arising from chemical accumulation
- Reduces air-borne microbial counts as well as on surfaces
- Anti-microbial effect reaches spaces that gas plasmas can penetrate

Pure Science International Pte Ltd
7500A Beach Road, #05-318 The Plaza Singapore 199591.
t: +65 6396 7889; f: +65 6456 7396; e: sales@puresciencelnt.com

- Provides microbial count reductions 24 hrs a day and to improve many aspects of indoor air quality
- May be configured for regular decontamination cycles
- May be used in crisis management / bioremediation scenarios
- Low maintenance
- Compliments existing cleaning and maintenance programs

Biozone air purification units have been tested by numerous agencies including FDA and USDA accredited laboratories. The results of these tests have several important indications regarding their application of these units in hospitals and other healthcare facilities.

Significance of Test Organisms used in the Context of Hospitals

In tests conducted by Biozone Scientific, Inc., five different species of bacteria, each of separate genera were used as test organisms (See Biozone Test Reference List at last page). These organisms are identified as nosocomial pathogens. The table below summarizes the significance of these organisms in the hospital context.

Organism Name	Nosocomial Background
Enterobacter aerogenes	Significant hospital pathogen (nosocomial) (1) Infectious diseases caused by *E.aerogenes* (2) include: • nosocomial respiratory tract infections (third leading cause) (3) • wound infections • bacteremia Multidrug resistance on the rise (4) References: 1. Sanders and Sanders. Clin. Microbiol Rev., 1997, 10: 220-241 2. Population and Public Health Branch (Canada) – MSDS for *E.aerogenes*. 3. Chollet, R., et al. Antimicrobial agents and Chemotherapy, April 2002, pp 1093-1097. 4. Van Belkum, et al. CDC Research, Sep-Oct 2001, Vol. 7, No. 5
Escherichia coli	Significant hospital pathogen (nosocomial) (1) Infectious diseases caused by *E. coli* (2) include: • urinary tract infection (leading cause) • travelers' diarrhea • neonatal meningitis • wound infections • peritonitis (inflammation of abdominal wall) • nosocomial pneumonia (up to 50% of all cases) • bacteremia Multidrug resistant strains on the rise (3,4) Some strains produce toxins such as Shiga toxins (5), enterotoxins (6), verotoxins (7). References: 1. Poster# P1398 - Selected poster presentation from the 12th European Congress of Clinical Microbiology and Infectious Diseases, April 2002, Italy, Milan. 2. Population and Public Health Branch (Canada) – MSDS for *E.coli*. 3. Kaye, K.S., et al., Antimicrobial Agents and Chemotherapy, April 2000, pp 1004-1009, Vol 44, No.4. 4. Lautenbach, E., et al. Internal Medicine, Nov 2002, Vol. 162, No.21. 5. Population and Public Health Branch (Canada) – MSDS for *E.coli*, Entoerhemorrhagic 6. Population and Public Health Branch (Canada) – MSDS for *E.coli*, Enterotoxigenic 7. Commun Dis Rep, CDR Weekly, May 1997, 7(19): 165.
Listeria monocytogenes	Selected hospital pathogen (nosocomial) (1) Infectious diseases caused by *L.monocytogenes* (1,2) include: • meningoencephalitis • septicemia • endocarditis Common hospital areas associated with infection include nurseries (1) Multidrug resistant strains exist (3) References: 1. Population and Public Health Branch (Canada) – MSDS for *L.monocytogenes*. 2. Manitoba Health CDC Unit – Communicable Disease Management Protocol, Listeriosis (Nov 2001) 3. Safdar, A. and Armstrong, D. Journal of Clinical Microbiology, Jan 2003, Vol. 41, No.1, p 483-485.

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7500A Beach Road, #05-318 The Plaza. Singapore 199591.
t: +65 6396 7889; f: +65 6456 7396; e: sales@puresciencelnt.com

Organism Name	Nosocomial Background
Salmonella sp.	Hospital pathogen (nosocomial) (1) Infectious diseases caused by *Salmonella spp.* (1) include: • Salmonellosis (acute gastroenteritis and acute infectious disease, headache, abdominal pain, diarrhea, vomiting, nausea) • septicemia • endocarditis • pneumonia • meningitis • osteomyelitis • other focal infections • Reiter's syndrome Multidrug resistant strains prevalent and on the rise (1, 2, 3) References: 1. Population and Public Health Branch (Canada) – MSDS for *Salmonella spp.*. 2. Olsen, S.J., et al - New England Journal of Medicine, May 2001, Vol.344, No.21, p.1572-1579 3. Rissing, J.P. et al –The Certified Medical Representatives Institute, Inc. Continuing Education Article DR-3.
Serratia marcescens	Hospital pathogen (nosocomial) (1) Infectious diseases caused by *S.marcescens* (1,2) include: • meningoencephalitis • osteomyelitis • septic arthritis • otitis media • bacteremia • endocarditis • urinary tract infections • lower respiratory infections • surgical wound • cutaneous infections Common hospital areas associated with infection include nurseries, ICUs and renal dialysis units (1) Multi-drug resistant strains common and on the rise (1,3) References: 1. Population and Public Health Branch (Canada) – MSDS for *S.marcescens*. 2. Johns Hopkins Microbiology Newsletter Vol 16, No.28 3. Champion, H.M., et al. Journal of Antimicrobial Therapy (1988), Vol 22, 587-596

The viable count reduction tests performed on surfaces involving the microorganisms above is summarized in the following table:

Organism Name	Control (CFUs)	Biozone (CFUs)	% Reduction
Enterobacter aerogenes (surface)	>120,000	3900	>96.8%
Escherichia coli	100, 3x10e7	0, 7x10e3	99.9%, 99.9%
Listeria monocytogenes	100, 5x10e7	0, 2x10e4	99.9%, 99.9%
Salmonella sp.	100	0	99.9%
Serratia marcescens	(n/a)	(n/a)	98.4%

Discussion and Summary

Nosocomial infections pose a threat to all people in the widest perspective due to related issues such as resistance. Awareness of the modes of transmission between patients and healthcare workers should be addressed appropriately.

Biozone air purifiers utilize photoplasma which has been lab and field proved for effectiveness in reducing indoor biological contaminants in the form of total microbial counts and specific bacteria. All of these bacteria are known nosocomial pathogens.

Pure Science International Pte Ltd
7500A Beach Road, #05-318 The Plaza. Singapore 199591.
t: +65 6396 7889; f: +65 6456 7396; e: sales@puresciencelnt.com

The effectiveness testing of gas plasma technology demonstrates the ability to reduce the number of pathogens in the high nineties percentile both in the air and on surfaces. This indicates the effective use of these gas plasmas in risk reduction strategies against pathogenic and opportunistic organisms, especially for the majority that rely on contact for their transmission.

Of particular significance is *L.monocytogenes* since this is the only Gram positive organism in the panel, bearing notable cell wall resemblance to the most prevalent nosocomial pathogen, *Staphylococcus aureus* and its associated drug-resistant strains such as MRSA and VRSA.

New gas-plasma technologies used in Biozone air purifiers offer many benefits and good potential to users who are interested for the main purposes of improving and maintaining microbial cleanliness and indoor air quality.

These benefits may be realized by a quick retrofit or as plug-and-play modules, complementing any cleaning regime or infrastructure already in place (e.g. HEPA filtration systems, cleaning programs). Hospitals, their staff and patients are good candidates to benefit from these capabilities. □

Biozone Test Report References:

1. For organism *E.aerogenes* : Vallid Labs, Inc. Test ID: Test 5 (27 March 2000)
2. For organism *E.coli* : Tri-Tech Analytical Labs, Inc. Test ID: 02-061078A (29 June 2002),
   : Tri-Tech Analytical Labs, Inc. Test ID: (not available).
3. For organism *L.monocytogenes* : Tri-Tech Analytical Labs, Inc. Test ID: (not available).
4. For organism *S.marcescens* : Academy of Military Medical Sciences, IME, China. Test ID: 29 May 03
5. For organism *Salmonella sp.* : Tri-Tech Analytical Labs, Inc. Test ID: 02-061078A (29 June 2002)

SGS Job No. : 1993479

1. Introduction

Report on laboratory testing of BIOZONE air purifier (Model V2 Serial No.: 6208) in controlled room of SGS HK Ltd on 14 - 15 March 2006.

2. Sample Identification and Test Requested

SGS Sample No.	Sampling Status	Date of Sampling	Test Requested
A0603052	Before	14 March 2006	TBC
A0603056	After 24 hour operation	15 March 2006	TBC

TBC - Total Bacteria Count

Sampling : Conducted by SGS
Sampling address : Controlled room, SGS HK Ltd.
Reported by client
Sample receiving : The agar plates were received by SGS on the day of sampling. All agar plates were kept cool in an icebox.
Testing Period : 14 - 21 March 2006

3. Sampling and Analysis Methodology / 4. Results

Please refer to the following page(s)

****

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG
SECTION MANAGER

3. Sampling and Analysis Methodology

3.1 Sampling

Sampling was conducted by using SAS air sampler whereas other equipment for sampling was as follows:

(a) Agar medium (55mm petri dish)
APHA plate count agar for total bacteria count
(b) Alcohol for sterilizing purpose
(c) An ice box

3.2 Analytical Method

The agar was incubated at 37 degree Celsius for 48 hours for total bacteria count

4. Results

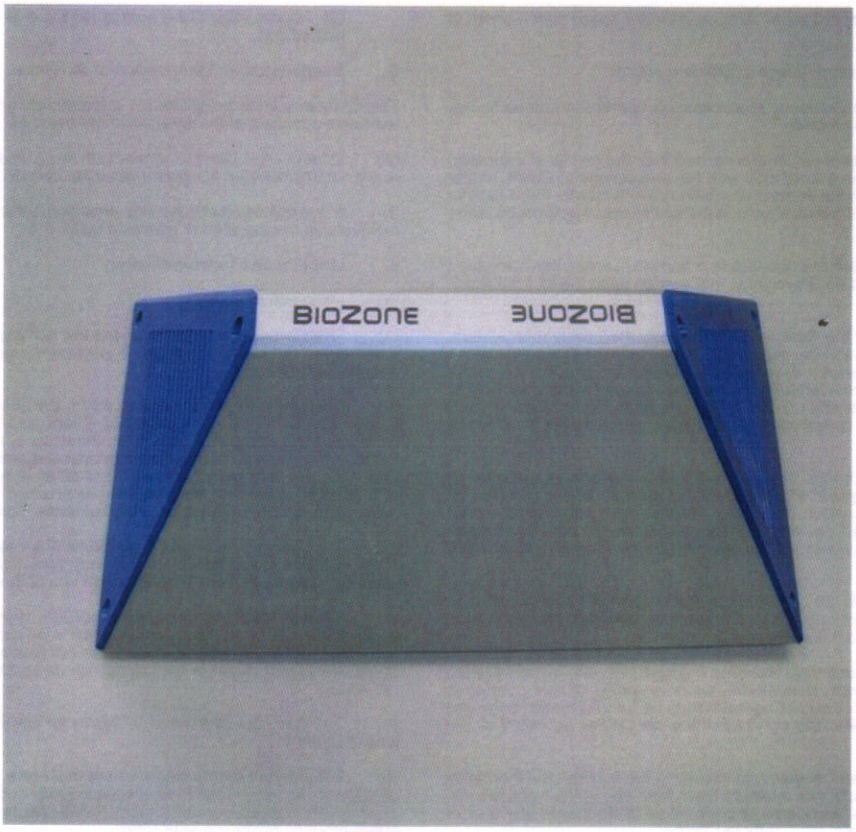
Parameter	A0603052	A0603056
Total Bacteria Count (cfu/m^3)	180	33

Note : 1. cfu - colony forming unit.
2. Volume of air sampled for each sample of TBC analysis was 300 L.

*** End of Report ***

Test Report No. : 2001187/IEQ

PHOTO APPENDIX



SGS authenticate the photo on original report only

Authorized Signature

SGS Hong Kong Ltd. | 5/F - 8/F & 28/F - 29/F., Metropole Square, 2 On Yiu Street, Siu Lek Yuen, Shatin, N.T., Hong Kong. t (852) 2334 4481 f (852) 2764 3126 www.hk.sgs.com

SGS Job No. : 1922869

1. Introduction

Report on laboratory testing of air samples collected from 20/F, The Hong Kong & China Gas Co. Ltd with BIOZONE LE-250 installed, on 10 - 11 January 2006.

2. Sample Identification and Test Requested

SGS Sample No.	Sampling Location as Reported by Client	Date of Sampling as Reported by Client	Test Requested
A0601033	20/F Meeting Room 1 (Before)	10 January 2006	TBC
A0601034	20/F Meeting Room 1 (After)	11 January 2006	TBC

TBC - Total Bacteria Count

Sampling : Conducted by SGS
Sampling address Reported by client : 20/F, The Hong Kong & China Gas Co. Ltd., 363 Java Road, North Point, Hong Kong
Sample receiving : The agar plates were received by SGS on the day of sampling. All agar plates were kept cool in an icebox.
Testing Period : 10 - 19 January 2006

3. Sampling and Analysis Methodology / 4. Results

Please refer to the following page(s)

****

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG
SECTION MANAGER

3. Sampling and Analysis Methodology

3.1 Sampling

Sampling was conducted by using Anderson air sampler whereas other equipment for sampling was as follows:

(a) Agar medium (55mm petri dish)
APHA plate count agar for total bacteria count
(b) Alcohol for sterilizing purpose
(c) An ice box

3.2 Analytical Method

The agar was incubated at 37 degree Celsius for 48 hours for total bacteria count

4. Results

Parameter	A0601033	A0601034
Total Bacteria Count (cfu/m^3)	60	10

Note : 1. cfu - colony forming unit.
2. Volume of air sampled for each sample of TBC analysis was 200 L.

*** End of Report ***

SGS

Test Report

No. 2001075/IEQ Date : Jan 26 2006

SGS Job No. : 1922869

1. Introduction

Report on laboratory testing of BIOZONE air purifier (Model BI-205 Serial No.: K22095) in controlled room of SGS HK Ltd on 6 January 2006.

2. Sample Identification and Test Requested

SGS Sample No.	Sampling Location as Reported by Client	Date of Sampling as Reported by Client	Test Requested
A0601021	Before	6 January 2006	O_3
A0601022	After: 4 hours operation	6 January 2006	O_3

O_3 - Ozone

Sampling : Conducted by SGS
Sampling address : Controlled room, SGS HK Ltd.
Reported by client
Sample receiving : The passive samples were received on the day of sampling.
Testing Period : 6 - 16 January 2006

3. Sampling and Analysis Methodology / 4. Results

Ozone (O_3)
The sample "Before" was the background measurement of the controlled room.
The sample "After" was the measurement of Ozone in air after 4 hours operation.
The sampling last for 2 hours.
The concentration of Ozone were analyzed by USEPA B-1011 by an outside laboratory assessed as competent.

4. Results

Parameter	A0601021	A0601022
O_3 ($\mu g/m^3$)	< 50	< 50

*** End of Report ***

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG
SECTION MANAGER

SGS Hong Kong Ltd. | 5/F - 8/F & 28/F - 29/F., Metropole Square, 2 On Yiu Street, Siu Lek Yuen, Shatin, N.T., Hong Kong. t (852) 2334 4481 f (852) 2764 3126 www.hk.sgs.com

SGS Job No. : 1607586

Report on laboratory testing of Total Plate Count (TPC) product BIOZONE-200FS from Green Point International Ltd. at Control Room of SGS on 14 December 2004.

1. Introduction

Total Plate Count (TPC)

The sampling for Total Plate Count (TPC) were performed by the SGS whereas other equipment for sampling and the laboratory testing were conducted by SGS. The details were described in the following sections.
A Control Room was locked and no external ventilation provided during testing period (24hr) after setting up the BIOZONE inside the room. Two plates of grind meat were prepared. One of it placed into Control Room in which the BIOZONE would be operated. After 6 hrs the plate would be taken TPC analysis as "BIOZONE Treated" Sample, while the other plate would be taken for analysis directly as untreated sample.

2. Sample Identification and Test Requested

SGS Sample No.	Sampling Location	Date & Time of Commencing Sampling	Test Requested
S0412001	BIOZONE-200FS Before - Control Room 701	14 December 2004 1000	TPC
S0412002	BIOZONE-200FS After - Control Room 701	14 December 2004 1600	TPC

Sampling : Conducted by SGS
Sampling address reported by SGS : SGS Control Room 701 for TPC
Sample receiving : For TPC analysis, all agar plates were received by SGS on 14 December 2004 under ambient temperatare.

3. Sample and Analysis Methodology / 4. Results

Please refer to the following page(s).

****

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG

SECTION MANAGER

3. Sampling and Analysis Methodology

Total Plate Count

Sampling
Sampling was conducted by SGS whereas other equipment for sampling was provided by SGS. The equipment provided was as follows :
Sterile plastic dish

Analytical Method
TPC determination was conducted with reference to AOAC official Method, 17th edition, 2000, Method no.990.12 (3M Petri film Plate), which would be incubated at 35 ±1°C for 48 ±3hr.

Testing periods for laboratory analysis
14 - 16 December 2004 for samples submitted on 14 December 2004

4. Results

Total Plate Count

SGS Sample No.	Sampling Location	Date & Time of Commencing Sampling	TPC (col/g)
S0412001	BIOZONE-200FS Before - Control Room 701	14 December 2004 1000	1.9×10^7
S0412002	BIOZONE-200FS After - Control Room 701	14 December 2004 1600	7.5×10^6

Note : col - colony

*** End of Report ***

SGS Hong Kong Ltd. | 5/F - 8/F & 28/F - 29/F, Metropole Square, 2 On Yiu Street, Siu Lek Yuen, Shatin, N.T., Hong Kong t (852) 2334 4481 f (852) 2754 3128 www.hk.sgs.com

Appendix

Test Report No. 2000392/IEQ Date: Jan 04 2005

SGS Job No. : 1607586

Calculation of Disinfect Efficiency:

$$\frac{\text{TPC After Treatment} - \text{TPC Before Treatment}}{\text{TPC Before Treatment}} \times 100 = \text{Disinfect Efficiency}$$

$$\frac{1.9 \times 10^7 - 7.5 \times 10^6}{1.9 \times 10^7} \times 100 = 60.53\ \%$$

The disinfect efficiency in the food sample for the submitted product: BIOZONE – 200FS reach 60.53% referring to the result of this report.

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Test Report

BIOZONE SCIENTIFIC (HK) LIMITED

SGS Job No. : 1993479

1. Introduction

Report on laboratory testing of air samples collected from Chicken Stall, King Lam Estate, Tseung Kwan O using BIOZONE (Model ATC Serial No.: A3-1583) on 13 & 17 March 2006.

2. Sample Identification and Test Requested

SGS Sample No.	Sampling Location as Reported by Client	Date of Sampling as Reported by Client	Test Requested
A0603048	Chicken Stall (Before)	13 March 2006	TBC
A0603075	Chicken Stall (After)	17 March 2006	TBC

TBC - Total Bacteria Count

Sampling : Conducted by SGS
Sampling address : Chicken Stall, King Lam Estate, Tseung Kwan O
Reported by client
Sample receiving : The agar plates were received by SGS on the day of sampling. All agar plates were kept cool in an icebox.
Testing Period : 13 - 26 March 2006

3. Sampling and Analysis Methodology / 4. Results

Please refer to the following page(s)

****

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG
SECTION MANAGER

3. Sampling and Analysis Methodology

3.1 Sampling

Sampling was conducted by using SAS air sampler whereas other equipment for sampling was as follows:

(a) Agar medium (55mm petri dish)
APHA plate count agar for total bacteria count
(b) Alcohol for sterilizing purpose
(c) An ice box

3.2 Analytical Method

The agar was incubated at 37 degree Celsius for 48 hours for total bacteria count

4. Results

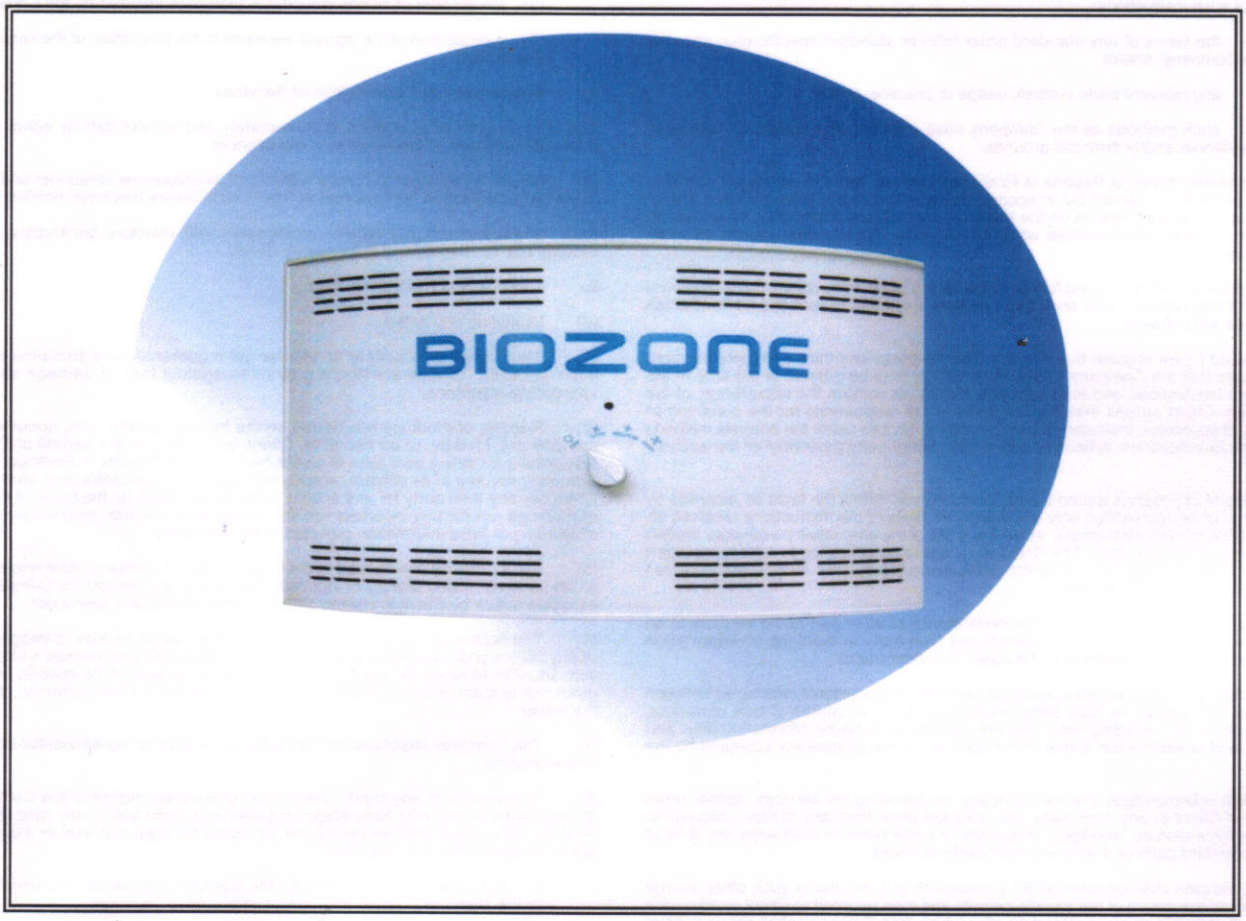
Parameter	A0603048	A0603075
Total Bacteria Count (cfu/m^3)	TNTC	< 3

Note : 1. TNTC - Too Numerous To Count.
2. cfu - colony forming unit.
3. Volume of air sampled for each sample of TBC analysis was 300 L.

*** End of Report ***

Test Report No. : 2001173/IEQ

PHOTO APPENDIX



SGS authenticate the photo on original report only

Authorized Signature

SGS Job No. : 1922869

1. Introduction

Report on laboratory testing of air samples collected from Tai Koo Shing using BIOZONE Model BI-510 (Serial No.: K-33108) on 17 - 18 March 2006.

2. Sample Identification and Test Requested

SGS Sample No.	Sampling Location as Reported by Client	Date of Sampling as Reported by Client	Test Requested
A0603072	太古城 (Before)	17 March 2006	TBC
A0603076	太古城 (After)	18 March 2006	TBC

TBC - Total Bacteria Count

Sampling : Conducted by SGS
Sampling address : Po Yang Court, Tai Koo Shing, Hong kong.
Reported by client
Sample receiving : The agar plates were received by SGS on the day of sampling. All agar plates were kept cool in an icebox.
Testing Period : 18 - 26 March 2006

3. Sampling and Analysis Methodology / 4. Results

Please refer to the following page(s)

****

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG
SECTION MANAGER

3. Sampling and Analysis Methodology

3.1 Sampling

Sampling was conducted by using Anderson air sampler whereas other equipment for sampling was as follows:

(a) Agar medium (55mm petri dish)
APHA plate count agar for total bacteria count
(b) Alcohol for sterilizing purpose
(c) An ice box

3.2 Analytical Method

The agar was incubated at 37 degree Celsius for 48 hours for total bacteria count

4. Results

Parameter	A0603072	A0603076
Total Bacteria Count (cfu/m^3)	120	10

Note : 1. cfu - colony forming unit.
2. Volume of air sampled for each sample of TBC analysis was 300 L.

*** End of Report ***

Test Report No. : 2001188/IEQ

PHOTO APPENDIX

SGS authenticate the photo on original report only

Authorized Signature

SGS Job No. : 1607586

Report on sampling and laboratory testings of Total Bacteria Count in Mini Bus for Full Point International Ltd submitted on 5 September 2004.

1. Introduction

Total Bacteria Count & Ozone

The sampling for Total Bacteria Count and Ozone were performed by SGS using SAS Bacteriological Sampler and USEPA B-1011, respectively. The details were described in the following sections.

2. Sample Identification and Test Requested

Total Bacteria Count (TBC)

SGS Sample No.	Sampling Location as Reported by SGS	Date of Commencing Sampling as Reported by SGS	Test Requested
A0409023	Mini Bus A Untreated (EH8663) Before	5 September 2004 0030	TBC
A0409024	Mini Bus A Untreated (EH8663) After	5 September 2004 0830	TBC
A0409025	Mini Bus B Low Power Biozone (DB8892) Before	5 September 2004 0040	TBC
A0409026	Mini Bus B Low Power Biozone (DB8892) After	5 September 2004 0840	TBC
A0409027	Mini Bus C High Power Biozone (CN3173) Before	5 September 2004 0050	TBC
A0409028	Mini Bus C High Power Biozone (CN3173) After	5 September 2004 0850	TBC
A0409029	Mini Bus B Low Power Biozone (DB8892) After	5 September 2004 0040-0840	Ozone
A0409030	Mini Bus C High Power Biozone (CN3173) After	5 September 2004 0050-0850	Ozone

Sampling : Conducted by SGS
Sampling address reported by client : Mini Bus A Untreated (EH8663); Mini Bus B Low Power Biozone (DB8892); Mini Bus C High Power Biozone (CN3173).
Sample delivery : The agar plates and absorbing tabes after sampling were delivered by SGS on 5 September 2004
Sample receiving : The agar plates and absorbing tabes were received by SGS on 5 September 2004. All agar plates were kept cool in an ice box.

3. Sample and Analysis Methodology / 4. Results

Please refer to the following page(s).

****

Signed for and on behalf of
SGS Hong Kong Ltd.

JESSICA LEUNG
SECTION MANAGER

SGS Hong Kong Ltd. 5/F - 6/F, Metropole Square, 2 On Yiu Street, Siu Lek Yuen, Shatin, N.T., Hong Kong. t (852) 2334 4481-9 f (852) 2754 3128 www.sgshk.com

3. Sampling and Analysis Methodology

A. Total Bacteria Count

3.1 Sampling
Sampling was conducted by SGS using SAS Bacteriological Sampler whereas other equipment for sampling was provided by SGS. The equipment provided was as follows :
(a) Agar medium (55mm petri dish)
APHA plate count agar for total bacteria count
(b) Alcohol for sterilizing purpose
(c) An ice box

3.2 Analytical Method
(a) Total Bacteria Count
The agar was incubated at 37 degree Celsius for 48 hours.

3.3 Testing periods for laboratory analyses
(a) Total Bacteria Count
5 - 8 September 2004 for samples submitted on 5 September 2004

B. Ozone Analysis
By USEPA Method B1011, 8 hr sampling during operating of Biozone installed at Mini Buses B (DB8892) and C (CN3173). The samples were then sent to the outside laboratory for analysis assessed as competent.

4. Results

A. Total Bacteria Count

SGS Sample No.	Sampling Location as Reported by SGS	Date of Commencing Sampling as Reported by SGS	Total Bacteria Count (cfu/m^3)
A0409023	Mini Bus A Untreated (EH8663) Before	5 September 2004 0030	50
A0409024	Mini Bus A Untreated (EH8663) After	5 September 2004 0830	50
A0409025	Mini Bus B Low Power Biozone (DB8892) Before	5 September 2004 0040	160
A0409026	Mini Bus B Low Power Biozone (DB8892) After	5 September 2004 0840	3
A0409027	Mini Bus C High Power Biozone (CN3173) Before	5 September 2004 0050	73
A0409028	Mini Bus C High Power Biozone (CN3173) After	5 September 2004 0850	3

****

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4. Results (Continued)

B. Ozone

SGS Sample No.	Sampling Location as Reported by SGS	Date of Commencing Sampling as Reported by SGS	Ozone ($\mu g/m^3$)
A0409029	Mini Bus B Low Power Biozone (DB8892) After	5 September 2004 0040-0840	< 50
A0409030	Mini Bus C High Power Biozone (CN3173) After	5 September 2004 0050-0850	< 50

Note : 1. cfu - colony forming unit
2. Volume of air sampled for each sample of TBC analysis was 300 L as reported by SGS.

*** End of Report ***

SGS Hong Kong Ltd. 5/F - 8/F., Metropole Square, 2 On Yiu Street, Siu Lek Yuen, Shatin, N.T., Hong Kong. t (852) 2334 4481-9 f (852) 2754 3125 www.sgshk.com

BIOZONE SCIENTIFIC INTERNATIONAL LIMITED
- Citylink Design and Build Limited, Room 505-508 5/F., Hilder Centre, 2 Sung Ping Street, Hunghom

Indoor Air Quality Measurement Report
Our Reference No.: 09/1530/RL/JC/001

BIOZONE AIR PURIFIER MODEL ID SERIES

MEASUREMENT RESULTS

The results of 12 parameters at the measurement locations are listed in the following table.

Parameter		**CO_2**	**CO**	**RSP**	**NO_2**	**O_3**	**HCHO**	**TVOC**	**Rn**	Airborne Bacteria	**Temp.**	**Rel Hum**	**Air movement**
Unit		ppmv	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	Bq/m^3	cfu/m^3	° C	%	m/s
Excellent Class		< 800	< 2,000	< 20	< 40	< 50	< 30	< 200	< 150	< 500	20-25.5	40 - 70	< 0.2
Good Class		< 1,000	< 10,000	< 180	< 150	< 120	< 100	< 600	< 200	< 1,000	< 25.5	< 70	< 0.3
Location	**Survey Date**												
After installation	17 July 2009	902	<2,000	28	53	<39	53	148	<4	488	23.7	67.3	0.04

RESULTS ASSESSMENT

From the above table, it shown the air quality of the measured parameters comply with the "Good Class" criteria of IAQ objectives in Hong Kong.

Prepared by:
LAWN ENVIRONMENTAL PROTECTION LTD.
Richard L.T. Liu
Technical Manager

Tel : 2148 1440
Fax : 2148 1445

Date: 8. September, 2009

BIOZONE SCIENTIFIC INTERNATIONAL LIMITED
- Hong Kong International School, Repulse Bay

Indoor Air Quality Measurement Report
Our Reference No.: 09/1539/RL/JC/001

BIOZONE AIR PURIFIER MODEL ID SERIES

MEASUREMENT RESULTS

The results of 12 parameters at the measurement locations are listed in the following table.

Parameter		**CO_2**	**CO**	**RSP**	**NO_2**	**O_3**	**HCHO**	**TVOC**	**Rn**	Airborne Bacteria	**Temp.**	**Rel Hum**	**Air move ment**
Unit		ppmv	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	Bq/m^3	cfu/m^3	° C	%	m/s
Excellent Class		< 800	< 2,000	< 20	< 40	< 50	< 30	< 200	< 150	< 500	20-25.5	40 - 70	< 0.2
Good Class		< 1,000	< 10,000	< 180	< 150	< 120	< 100	< 600	< 200	< 1,000	< 25.5	< 70	< 0.3
Location	**Survey Date**												
Before installation	27/07/2009	675	<2,000	52	71	<39	52	1,120	30	513	22.3	67.9	0.04
After installation	17/08/2009	496	<2,000	8	21	<39	25	963	4	119	22.6	59.5	0.01

Note: The TVOC re-measurement is conducted on 21 August 2009. The measured level is 124µg/m^3.

RESULTS ASSESSMENT

From the above table, it shown the air quality of the parameters of the Formaldehyde HCHO, Total Volatile Organic Compounds TVOC and Airborne Bacteria were improved from “Good Class” level into the “Excellent Class” level after air purification system installed. And the other measured parameters comply with the “Excellent Class” criteria of IAQ objectives in Hong Kong.

Prepared by:
LAWN ENVIRONMENTAL PROTECTION LTD.

Richard L.T. Liu
Technical Manager

Tel : 2148 1440
Fax : 2148 1445

Date: 8. September, 2009

BIOZONE SCIENTIFIC INTERNATIONAL LIMITED

- Room 1208, East Point Centre, 555 Hennessy Road, Causeway Bay, Hong Kong

Indoor Air Quality Measurement Report
Our Reference No.: 09/1563/RL/JC/001

BIOZONE AIR PURIFIER MODEL PR SERIES

MEASUREMENT RESULTS

The results at the measurement locations are listed in the following table.

Parameter		**TVOC**	Airborne Bacteria
Unit		µg/m^3	cfu/m^3
Excellent Class		< 200	< 500
Good Class		< 600	< 1,000
Location	**Survey Date**		
Before installation	27 August 2009	2,318	1,250
After installation	2 September 2009	595	688

RESULTS ASSESSMENT

From the above table, it shown the air quality of the parameters of the Total Volatile Organic Compounds TVOC and Airborne Bacteria were improved into the “Good Class” level after air purification system installed.

Prepared by:
LAWN ENVIRONMENTAL PROTECTION LTD.
Richard L.T. Liu
Technical Manager

Tel : 2148 1440
Fax : 2148 1445

Date: 21. September, 2009

STONCUTTERS ISLAND
- Sewage Treatment Works

Indoor Air Quality Measurement Report
Our Reference No.: 09/1654/003

BIOZONE AIR PURIFIER MODEL ID SERIES

MEASUREMENT RESULTS

The results of 5 parameters at the measurement locations are listed in the following table.

Date: 20 November 2009

Parameter	O_3	TVOC	Airborne Bacteria	Surface Bacteria	Temperature	Relative Humidity
Unit	µg/m^3	µg/m^3	cfu/m^3	cfu/inch^2	° C	%
Excellent Class	< 50	< 200	< 500	-	20-25.5	40 - 70
Good Class	< 120	< 600	< 1,000	-	< 25.5	< 70
Location						
Office	<39	248	986	21,750,000 (filter) / 20,000,000 (louver)	22.3	42.1
Outdoors	-	-	-	-	20.6	40.8

Date: 29 January 2010

Parameter	O_3	TVOC	Airborne Bacteria	Surface Bacteria	Temperature	Relative Humidity
Unit	µg/m^3	µg/m^3	cfu/m^3	cfu/inch^2	° C	%
Excellent Class	< 50	< 200	< 500	-	20-25.5	40 - 70
Good Class	< 120	< 600	< 1,000	-	< 25.5	< 70
Location						
Office	<39	142	50	<1 (filter) / 225 (louver)	20.5	65.2
Outdoors	63	-	-	-	-	-

Prepared by:
LAWN ENVIRONMENTAL PROTECTION LTD.
Richard L.T. Liu
Technical Manager

Tel : 2148 1440
Fax : 2148 1445

Date: 1. March, 2010

BIOZONE SCIENTIFIC INTERNATIONAL LIMITED

- Cathay Pacific Catering Services (HK) Ltd, 11 Catering Road East, Hong Kong International Airport, Lantau, Hong Kong

Indoor Air Quality Measurement Report
Our Reference No.: 09/1679/001

BIOZONE AIR PURIFIER MODEL PR AND ID SERIES

MEASUREMENT RESULTS

The results of 12 parameters at the measurement locations are listed in the following table.

Parameter		**CO_2**	**CO**	**RSP**	**NO_2**	**O_3**	**HCHO**	
Unit		ppmv	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	
Excellent Class		< 800	< 2,000	< 20	< 40	< 50	< 30	
Good Class		< 1,000	< 10,000	< 180	< 150	< 120	< 100	
Location	**Survey Date**							
Before installation								
EO Office	8 Dec 2009	507	<2,000	16	19	<39	25	
PC Office	8 Dec 2009	619	<2,000	18	23	<39	18	
After installation								
EO Office	31 Dec 2009	347	<2,000	14	18	<39	18	
PC Office	31 Dec 2009	545	<2,000	10	21	<39	15	

Parameter		**TVOC**	**Rn**	**Airborne Bacteria**	**Temp.**	**Rel Hum**	**Air movement**	**Airborne Yeast and Mould**
Unit		µg/m^3	Bq/m^3	cfu/m^3	° C	%	m/s	cfu/m^3
Excellent Class		< 200	< 150	< 500	20-25.5	40 - 70	< 0.2	<500
Good Class		< 600	< 200	< 1,000	< 25.5	< 70	< 0.3	-
Location								
Before installation								
EO Office	8 Dec 2009	210	96	750	20.8	68.8	0.14	25
PC Office	8 Dec 2009	238	59	400	21.5	68.1	0.19	13
After installation								
EO Office	31 Dec 2009	118	<4	338	20.9	62.5	0.10	6
PC Office	31 Dec 2009	110	30	288	20.9	69.7	0.09	4

RESULTS ASSESSMENT

From the above table, it shown the air quality of the measured parameters comply with the "Excellent Class" criteria of IAQ objectives in Hong Kong.

Prepared by:
LAWN ENVIRONMENTAL PROTECTION LTD.
Richard L.T. Liu
Technical Manager
Tel : 2148 1440
Fax : 2148 1445

Date: 18.January, 2010