



An Introduction to



Overview

- What is Gelair and how does it work?
- Why do I need Gelair?
- How does Gelair compare to other products?
- Who has used Gelair and how effective is it?



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Gelair is the Simplest way to Kill Mold, Bacteria & Viruses in your HVAC System

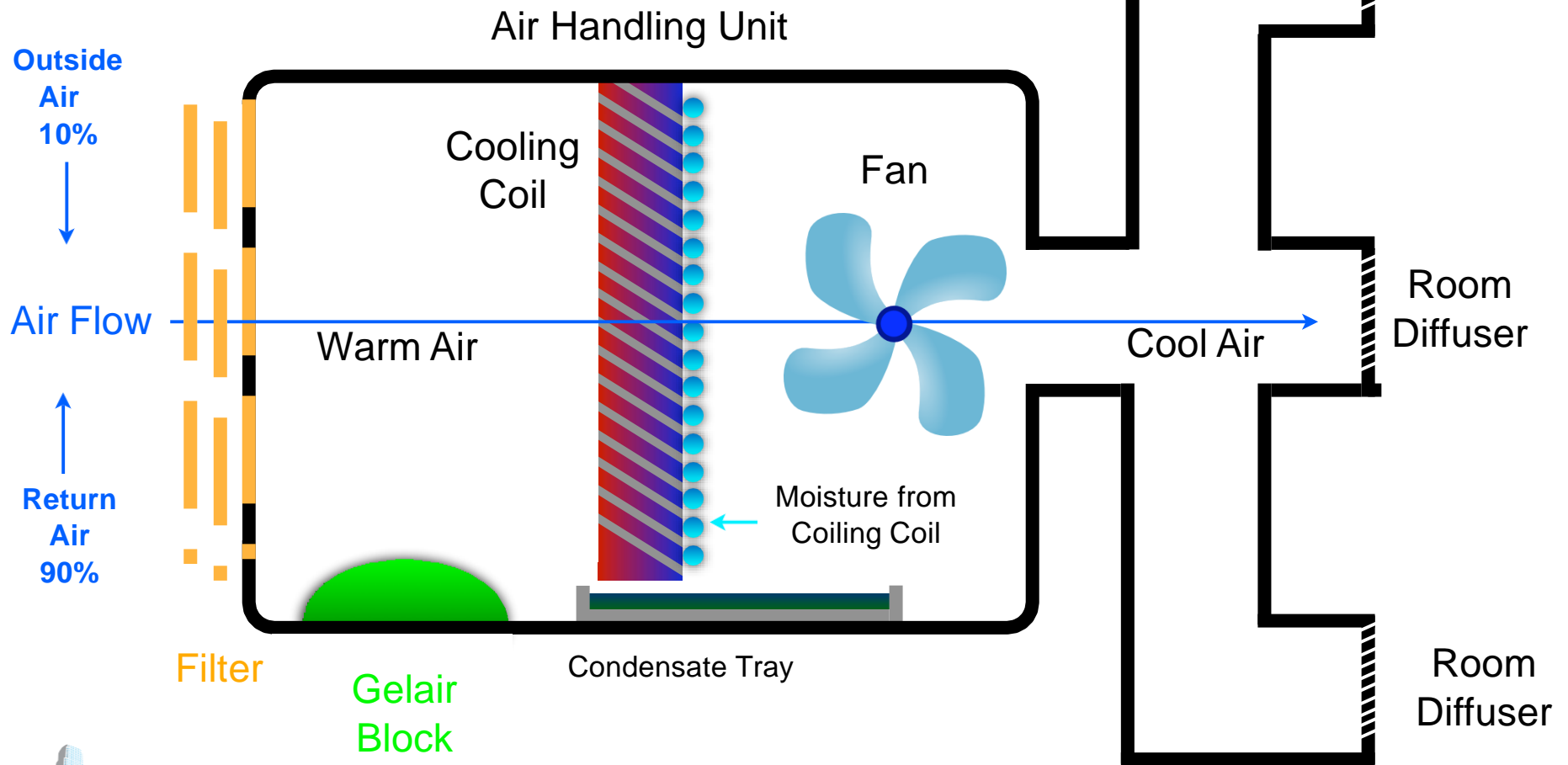
- A delivery system for a unique Tea Tree Oil (TTO) solution
- Disperses the TTO vapour throughout an HVAC system and into connected rooms
- The TTO vapour kills mold, bacteria & viruses
- Developed in Australia - used in US & Europe for 20 years



Gelair is a Gel-Based Product

- The gel serves 2 purposes
 - Hold the TTO solution in place
 - Release optimal concentrations of the TTO over a month to ensure the correct concentrations for maximum efficacy





TTO is the Active Ingredient

- TTO is a 100% natural essential oil
- Extracted from the Tea Tree (*Melaleuca alternifolia*)
- Used by Aboriginal Australians for centuries



Melaleuca alternifolia

Component	ISO 4730 (range %)
α -pinene	1 – 6
sabinene	trace – 3.5
α -terpinene	5 – 13
limonene	0.5 – 1.5
p-cymene	0.5 – 8
1,8, cineole	trace – 15
γ -terpinene	10 – 28
terpinolene	1.5 – 5
terpinen-4-ol	30 – 48
α -terpineol	1.5 – 8
aromadendrene	trace – 3
ledene	trace – 3
δ -cadinene	trace – 3
globulol	trace – 1
viridiflorol	trace – 1

TTO Composition



TTO is a Natural Biocide

- Kills Mold
- Kills Bacteria
 - Legionella
 - MRSA - The hospital superbug methicillin-resistant Staphylococcus aureus
- Kills Viruses
 - Herpes Simplex Virus (cold sores)
 - Inhibits the replication cycle of H1N1
- A Bio-dispersant (breaks down bio-film)
- No bacterial resistance issues



TTO is a Natural Biocide

CLINICAL MICROBIOLOGY REVIEWS, Jan. 2006, p. 50-62
 0893-8512/06/\$08.00+0 doi:10.1128/CMR.19.1.50-62.2006
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Melaleuca alternifolia (Tea Tree) Oil: a Review of Antimicrobial and Other Medicinal Properties

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INTRODUCTION

Many complementary and alternative medicines have enjoyed increased popularity in recent decades. Efforts to validate their use have seen their putative therapeutic properties come under increasing scrutiny in vitro and, in some cases, in vivo. One such product is tea tree oil (TTO), the volatile essential oil derived mainly from the Australian native plant *Melaleuca alternifolia*. Employed largely for its antimicrobial properties, TTO is incorporated as the active ingredient in many topical formulations used to treat cutaneous infections. It is widely available over the counter in Australia, Europe, and North America and is marketed as a remedy for various ailments.

COMPOSITION AND CHEMISTRY

TTO is composed of terpene hydrocarbons, mainly monoterpenes, sesquiterpenes, and their associated alcohols. Terpenes are volatile, aromatic hydrocarbons and may be considered polymers of isoprene, which has the formula C₅H₈. Early reports on the composition of TTO described 12 (65), 21 (3),

and 48 (142) components. The seminal paper by Brophy and colleagues (25) examined over 800 TTO samples by gas chromatography and gas chromatography-mass spectrometry and reported approximately 100 components and their ranges of concentrations (Table 1).

TTO has a relative density of 0.885 to 0.906 (89), is only sparingly soluble in water, and is miscible with nonpolar solvents. Some of the chemical and physical properties of TTO components are shown in Table 2.

Given the scope for batch-to-batch variation, it is fortunate that the composition of oil sold as TTO is regulated by an international standard for "Oil of *Melaleuca*-terpinen-4-ol type," which sets maxima and/or minima for 14 components of the oil (89) (Table 1). Notably, the standard does not stipulate the species of *Melaleuca* from which the TTO must be sourced. Instead, it sets out physical and chemical criteria for the desired chemotype. Six varieties, or chemotypes, of *M. alternifolia* have been described, each producing oil with a distinct chemical composition. These include a terpinen-4-ol chemotype, a terpinolene chemotype, and four 1,8-cineole chemotypes (83). The terpinen-4-ol chemotype typically contains levels of terpinen-4-ol of between 30 to 40% (83) and is the chemotype used in commercial TTO production. Despite the inherent variability of commercial TTO, no obvious differences in its bioactivity either in vitro or in vivo have been noted so far. The suggestion that oil from a particular *M. alternifolia* clone possesses en-

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TABLE 3. Susceptibility data for bacteria tested against *M. alternifolia* oil

Bacterial species	% (vol/vol)		Reference(s)
	MIC	MBC	
<i>Acinetobacter baumannii</i>	1	1	79
<i>Actinomyces viscosus</i>	0.6	>0.6	134
<i>Actinomyces</i> spp.	1	1	80
<i>Bacillus cereus</i>	0.3		61
<i>Bacteroides</i> spp.	0.06-0.5	0.06-0.12	75
<i>Corynebacterium</i> sp.	0.2-2	2	42, 61, 79
<i>Enterococcus faecalis</i>	0.5->8	>8	13, 61
<i>E. faecium</i> (vancomycin resistant)	0.5-1	0.5-1	115
<i>Escherichia coli</i>	0.08-2	0.25-4	13, 32, 67, 104
<i>Fusobacterium nucleatum</i>	0.6->0.6	0.25	134, 144
<i>Klebsiella pneumoniae</i>	0.25-0.3	0.25	61, 79
<i>Lactobacillus</i> spp.	1-2	2	75, 80
<i>Micrococcus luteus</i>	0.06-0.5	0.25-6	79
<i>Peptostreptococcus anaerobius</i>	0.2-0.25	0.03->0.6	75, 134
<i>Porphyromonas endodontalis</i>	0.025-0.1	0.025-0.1	80
<i>P. gingivalis</i>	0.11-0.25	0.13->0.6	134, 144
<i>Prevotella</i> spp.	0.03-0.25	0.03	75
<i>Prevotella intermedia</i>	0.003-0.1	0.003-0.1	80
<i>Propionibacterium acnes</i>	0.05-0.63	0.5	37, 61, 126
<i>Proteus vulgaris</i>	0.08-2	4	13, 42, 61, 104
<i>Pseudomonas aeruginosa</i>	1-8	2->8	13, 61, 79
<i>Staphylococcus aureus</i>	0.5-1.25	1-2	13, 32, 126
<i>S. aureus</i> (methicillin resistant)	0.04-0.35	0.5	31, 42, 104, 115
<i>S. epidermidis</i>	0.45-1.25	4	42, 79, 126
<i>S. hominis</i>	0.5	4	79
<i>Streptococcus pyogenes</i>	0.12-2	0.25-4	13, 33
<i>Veillonella</i> spp.	0.016-1	0.03-1	80

TABLE 4. Susceptibility data for fungi tested against *M. alternifolia* oil

Fungal species	% (vol/vol)		Reference(s)
	MIC	MFC	
<i>Alternaria</i> spp.	0.016-0.12	0.06-2	74
<i>Aspergillus flavus</i>	0.31-0.7	2-4	61, 74, 116, 137
<i>A. fumigatus</i>	0.06->2	1-2	74, 148
<i>A. niger</i>	0.016-0.4	2-8	15, 61, 74
<i>Blastoschizomyces capitatus</i>	0.25		117
<i>Candida albicans</i>	0.06-8	0.12-1	13, 42, 52, 59, 77, 111, 116, 117, 148
<i>C. glabrata</i>	0.03-8	0.12-0.5	13, 52, 59, 77, 111, 117, 148
<i>C. parapsilosis</i>	0.03-0.5	0.12-0.5	52, 77, 111, 117
<i>C. tropicalis</i>	0.12-2	0.25-0.5	52, 59, 148
<i>Cladosporium</i> spp.	0.008-0.12	0.12-4	74
<i>Cryptococcus neoformans</i>	0.015-0.06		111
<i>Epidermophyton floccosum</i>	0.008-0.7	0.12-0.25	42, 74
<i>Fusarium</i> spp.	0.008-0.25	0.25-2	74
<i>Malassezia furfur</i>	0.03-0.12	0.5-1.0	73
<i>M. sympodialis</i>	0.016-0.12	0.06-0.12	73
<i>Microsporium canis</i>	0.03-0.5	0.25-0.5	52, 74, 116
<i>M. gypseum</i>	0.016-0.25	0.25-0.5	52
<i>Penicillium</i> spp.	0.03-0.06	0.5-2	74
<i>Rhodotorula rubra</i>	0.06	0.5	71
<i>Saccharomyces cerevisiae</i>	0.25	0.5	71
<i>Trichophyton mentagrophytes</i>	0.11-0.44	0.25-0.5	52, 61, 116
<i>T. rubrum</i>	0.03-0.6	0.25-1	42, 52, 74, 116
<i>T. tonsurans</i>	0.004-0.016	0.12-0.5	74
<i>Trichosporon</i> spp.	0.12-0.22	0.12	71, 116



TTO is a Natural Biocide

Antiviral Activity

The antiviral activity of TTO was first shown using tobacco mosaic virus and tobacco plants (18). In field trials with *Nicotiana glutinosa*, plants were sprayed with 100, 250, or 500 ppm TTO or control solutions and were then experimentally infected with tobacco mosaic virus. After 10 days, there were significantly fewer lesions per square centimeter of leaf in plants treated with TTO than in controls (18). Next, Schnitzler et al. (132) examined the activity of TTO and eucalyptus oil against herpes simplex virus (HSV). The effects of TTO were investigated by incubating viruses with various concentrations of TTO and then using these treated viruses to infect cell monolayers. After 4 days, the numbers of plaques formed by TTO-treated virus and untreated control virus were determined and compared. The concentration of TTO inhibiting 50% of plaque formation was 0.0009% for HSV type 1 (HSV-1) and 0.0008% for HSV-2, relative to controls. These studies also showed that at the higher concentration of 0.003%, TTO reduced HSV-1 titers by 98.2% and HSV-2 titers by 93.0%. In addition, by applying TTO at different stages in the virus replicative cycle, TTO was shown to have the greatest effect on free virus (prior to infection of cells), although when TTO was applied during the adsorption period, a slight reduction in plaque formation was also seen (132). Another study evaluated the activities of 12 essential oils, including TTO, for activity against HSV-1 in Vero cells (110). Again, TTO was found to exert most of its antiviral activity on free virus, with 1% oil inhibiting plaque formation completely and 0.1% TTO reducing plaque formation by approximately 10%. Pretreatment of the Vero cells prior to virus addition or posttreatment with 0.1% TTO after viral absorption did not significantly alter plaque formation.

Some activity against bacteriophages has also been reported, with exposure to 50% TTO at 4°C for 24 h reducing the number of SA and T7 plaques formed on lawns of *S. aureus* and *E. coli*, respectively (41).

The results of these studies indicate that TTO may act against enveloped and nonenveloped viruses, although the range of viruses tested to date is very limited.



TTO is a Natural Biocide

Journal Abstract

In vitro antiviral activity of Melaleuca alternifolia essential oil

Lett Appl Microbiol. 2009 Dec;49(6):806-8. Epub 2009 Sep 18.

Garozzo A., Timpanaro R., Bisignano B., Furneri P.M., Bisignano G., Castro A.

Aims

To investigate the in vitro antiviral activity of Melaleuca alternifolia essential oil (TTO) and its main components, terpinen-4-ol, α -terpinene, β -terpinene, p-cymene, terpinolene and β -terpineol.

Methods & Results

The antiviral activity of tested compounds was evaluated against polio type 1, ECHO 9, Coxsackie B1, adeno type 2, herpes simplex (HSV) type 1 and 2 viruses by 50% plaque reduction assay.

The anti-influenza virus assay was based on the inhibition of the virus-induced cytopathogenicity. Results obtained from our screening demonstrated that the TTO and some of its components (the terpinen-4-ol, the terpinolene, the β -terpineol) have an inhibitory effect on influenza A/PR/8 virus subtype H1N1 replication at doses below the cytotoxic dose. The ID₅₀ value of the TTO was found to be 0.0006% (v/v) and was much lower than its CD₅₀ (0.025% v/v). All the compounds were ineffective against polio 1, adeno 2, ECHO 9, Coxsackie B1, HSV-1 and HSV-2. None of the tested compounds showed virucidal activity. Only a slight virucidal effect was observed for TTO (0.125% v/v) against HSV-1 and HSV-2.

Conclusions

These data show that TTO has an antiviral activity against influenza A/PR/8 virus subtype H1N1 and that antiviral activity has been principally attributed to terpinen-4-ol, the main active component.

Significance & Impact of the Study

TTO should be a promising drug in the treatment of influenza virus infection.



Is TTO Safe?

- Gelair is deemed a non-dangerous good
- Although it is safe to touch, it should not be ingested
- Gelair can be handled without any issues

Over the past 21 years two of the world's largest manufacturers of tea tree oil products have together sold more than

150 million bottles of product containing tea tree oil.

Both companies keep detailed records of any adverse reactions to their products. The product complaint rate over this period of time for this volume of products is

0.0016%. with only minor complaints reported



Products Using TTO



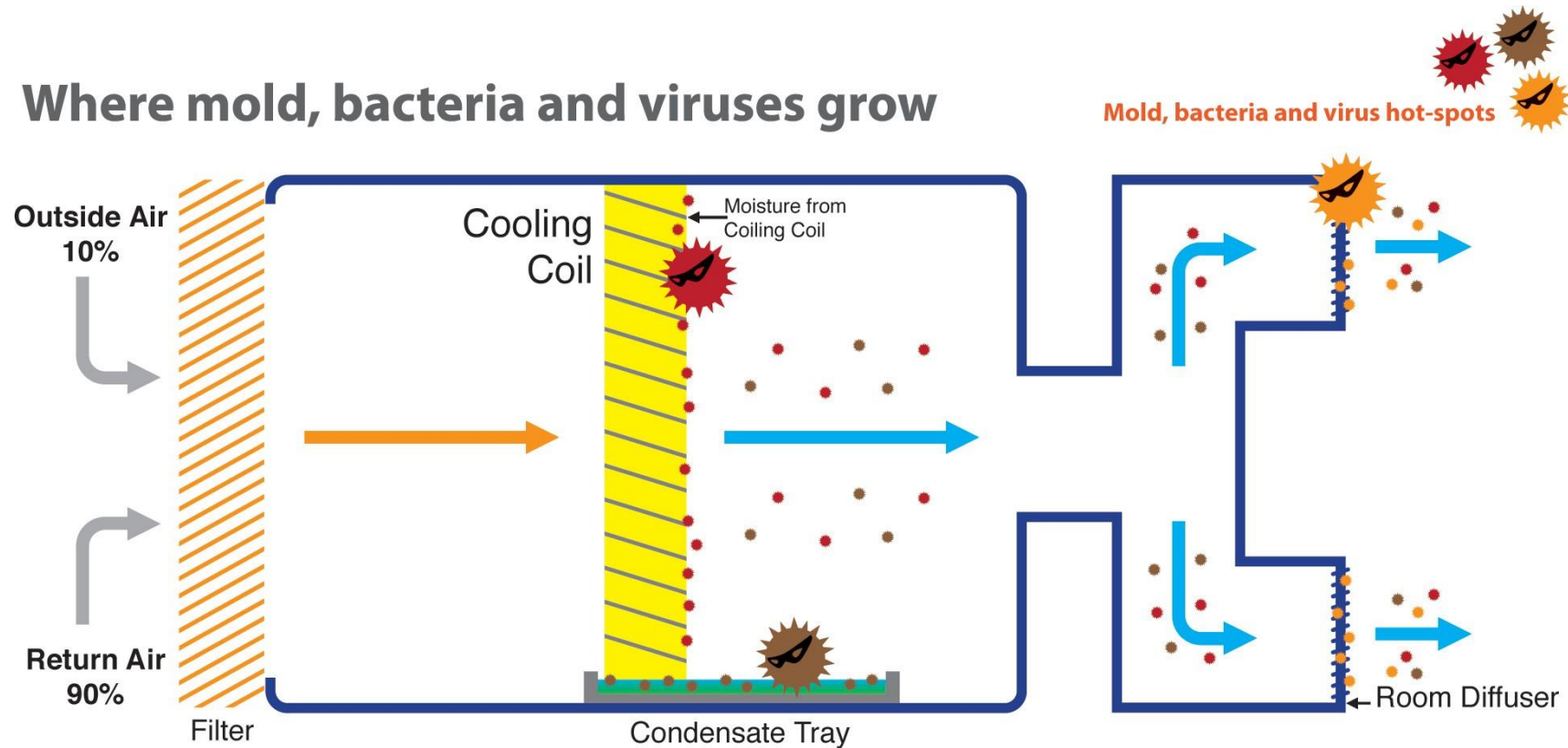
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HVAC Systems are Provide Perfect Conditions for Mold, Bacteria & Viruses to Grow

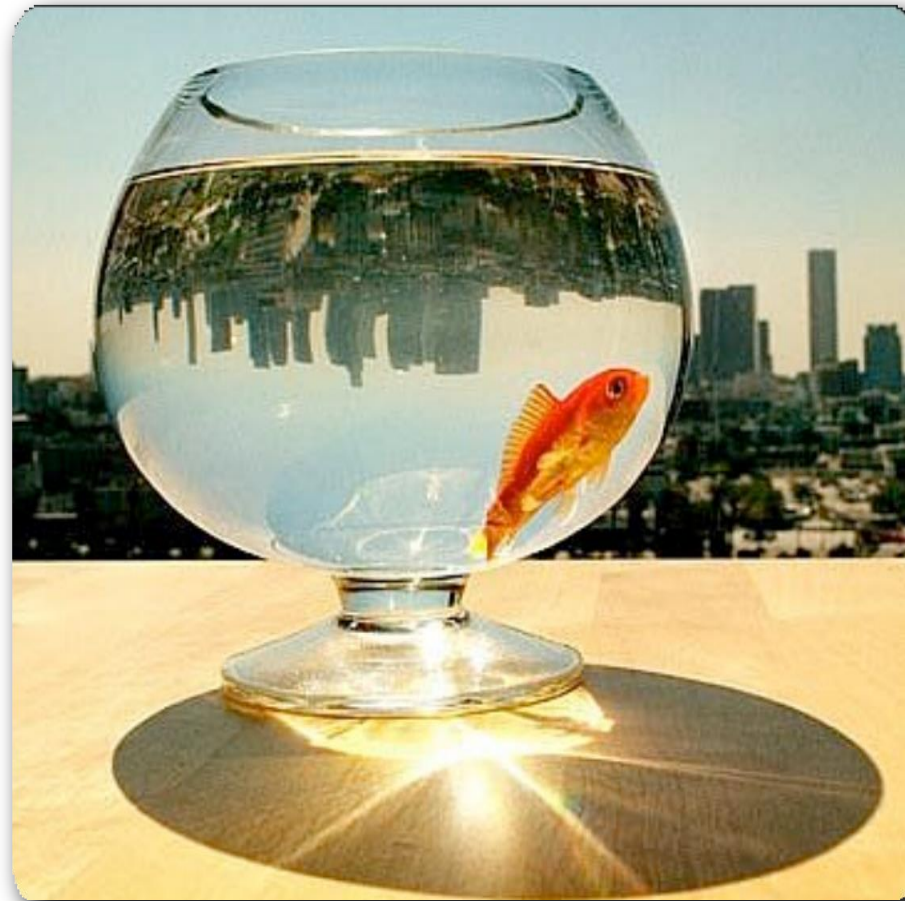
Where mold, bacteria and viruses grow



HVAC Systems are Provide Perfect Conditions for Mold, Bacteria & Viruses to Grow



Just because you can't see it, doesn't mean it
isn't affecting you



Indoor Air Quality (IAQ)

- Humans enter a space and introduce harmful bacteria
- The bacteria replicate in the idilic HVAC system conditions
- Levels get so high that they effect the occupants

- Gelair improves IAQ by killing harmful bacteria and viruses
 - Decreases the risk of transmitting viruses (decreased sick leave)
 - Increases staff well-being and comfort (often linked to increased productivity)

Imagine the benefits of reducing harmful bacteria and viruses in hospitals, schools/child-care, hotels, offices, exhibition centres, shipping vessels, off-shore rigs & spas



Indoor Air Quality (IAQ)

- The importance of IAQ has gained so much attention, that the Building Construction Authority of Singapore (BCA), have allocated numerous points for IAQ in it's Green Mark scheme



GREEN MARK FOR EXISTING BUILDINGS

Points allocation of Green Mark Criteria	Points allocated
Part 1: Energy Efficiency	
1. Energy Efficiency Index	7
2. Continual Improvement for Energy Efficiency	7
3. Electrical Sub-metering	2
4. Energy Efficient Systems & Features	6
5. Roof Top Gardens & Landscaping	3
Sub-total	25
Part 2: Water Efficiency	
1. Continual Improvement for Water Efficiency	6
2. Water Efficient Fittings	6
3. Water Efficient Irrigation and Landscaping	3
Sub-total	15
Part 3: Building Management & Operation	
1. Building Maintenance	3
2. Environmental Management System	8
3. Building Maintenance and Operation Guidelines	4
4. Preservation & Enhancement of Landscaping	3
5. Public Transport Accessibility	1
6. Recycling	4
7. Occupant Health	2
Sub-total	25
Part 4: Indoor Environmental Quality and Environmental Protection	
1. Effective Ventilation	2
2. High Frequency Ballasts	2
3. Luminance Level	2
4. Thermal Comfort	2
5. Noise Level	2
6. Indoor Air Quality Audit	2
7. Refrigerants	3
Sub-total	15
Part 5: Innovation	
1. Innovation	20
Sub-total	20
Total	100

Green Mark Award Rating

Green Mark Points	Green Mark Rating
85 and above	Green Mark Platinum
80 to <85	Green Mark Gold ^{Plus}
70 to <80	Green Mark Gold
55 to <70	Green Mark Award



Sick Building Syndrome

Definition from Wikipedia:

“Sick building syndrome (SBS) is a combination of ailments associated with an individual's place of work or residence.

*A 1984 World Health Organization report suggested up to **30%** of new and remodeled buildings worldwide may be linked to symptoms of SBS.*

Most of the sick building syndrome is related to poor indoor air quality.

Sick building causes are frequently pinned down to flaws in the heating, ventilation and air-conditioning (HVAC) systems.

Symptoms: sensory irritation of the eyes, nose, throat; general health problems; skin irritation; nonspecific hypersensitivity reactions; and odor and taste sensations.”



A study in Singapore showed
1 in 5 people suffer
from SBS



Epidemiology of Sick Building Syndrome & its Associated Risk Factors in Singapore

- **OBJECTIVES:** To investigate the occurrence of sick building syndrome in a tropical city, and its relation to indoor air quality and other factors
- **METHODS:** 2856 office workers in 56 randomly selected public and private sector buildings were surveyed.
- **RESULTS:** Symptoms typical of the sick building syndrome were reported in 19.6% of the respondents.
- **CONCLUSION:** The survey confirmed the presence of sick building syndrome and its risk factors in the tropics. A biopsychosocial approach to the problem involving symptomatic treatment, environmental control, good ergonomic design, and stress management is recommended.



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Options For Improving IAQ

Gelair is the only treatment option that manages the entire HVAC system.

Treatment Option	Air	AHU & Condensate Tray	Ducts	Diffusers	Occupant Zone
Gelair	✓	✓	✓	✓	✓
UV technology	✓	✗	✗	✗	✗
Silver ion filters	✓	✗	✗	✗	✗





Gelair is Superior to Other TTO-Based Products

- Gelair was an “industry-first”, and uses patented technology to ensure the correct concentrations of TTO are dispersed throughout the HVAC system over a month
- Not all TTO is the same & Gelair only uses top quality TTO in it's products
 - Farmed and extracted in Australia
 - Every batch of TTO is chemically analysed to ensure it meets the highest standards



Product Forms



Air Conditioning Blocks (Ducted AC)



Sachets for SPLIT ACs



Sachets for Vehicles



Cleaning & Sterilising Solutions



Gel Tub



Pods for Bilges and Evaporative ACs



Summary of Benefits

- Kills Mold
- Kills Bacteria
- Kills Viruses
- Improves Indoor Air Quality
- Kills odour causing bacteria instead of just masking the smell
- 100% natural
- Lack of resistance
- Treats the air, the ducting & the rooms
- Regular maintenance cycle (monthly applications)
- Simple to install



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**Almost every oil rig off the coast
of Australia uses Gelair**

**Several hundred superyachts use
Gelair**

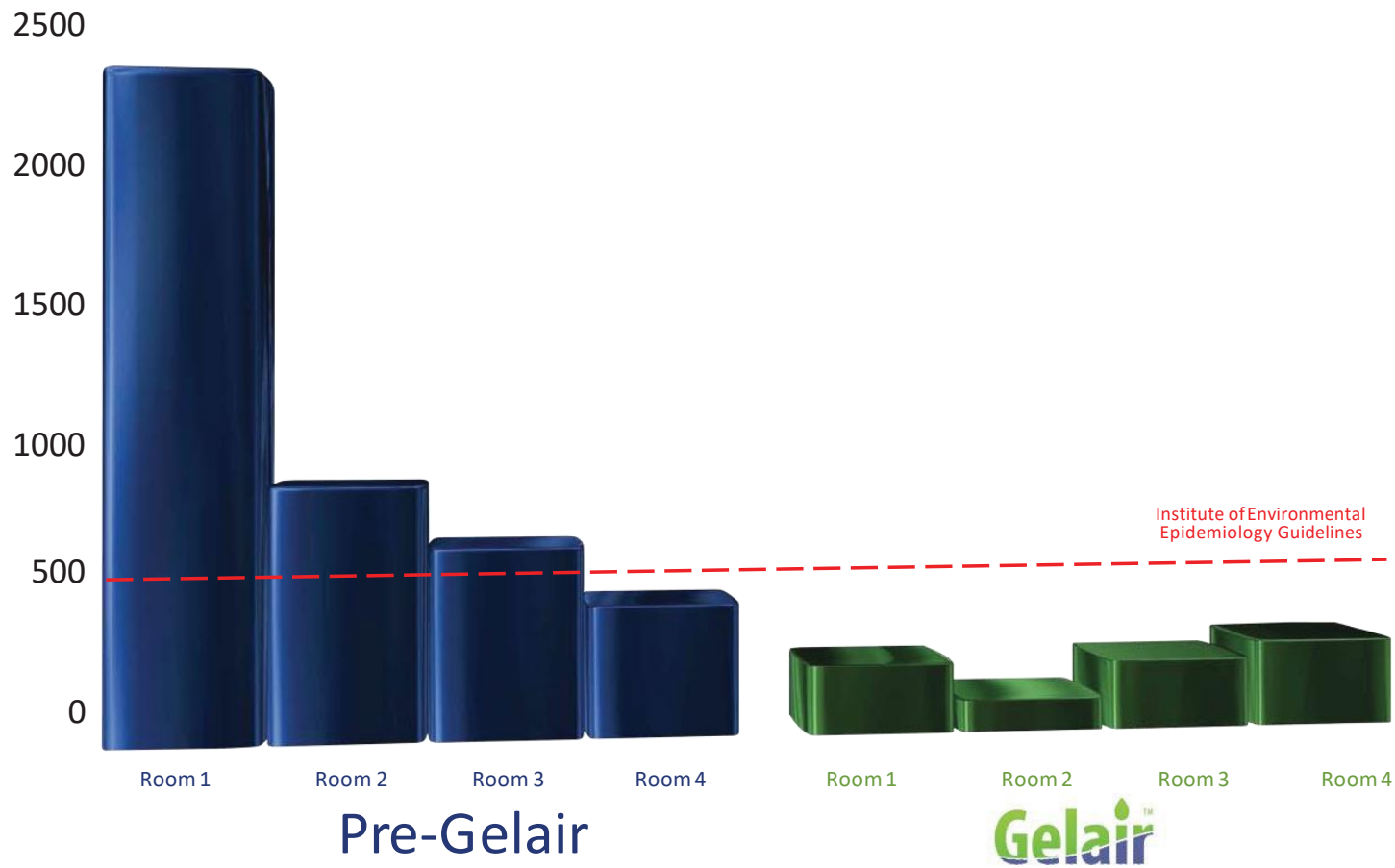


Gelair is Effective in the Harshest Environments

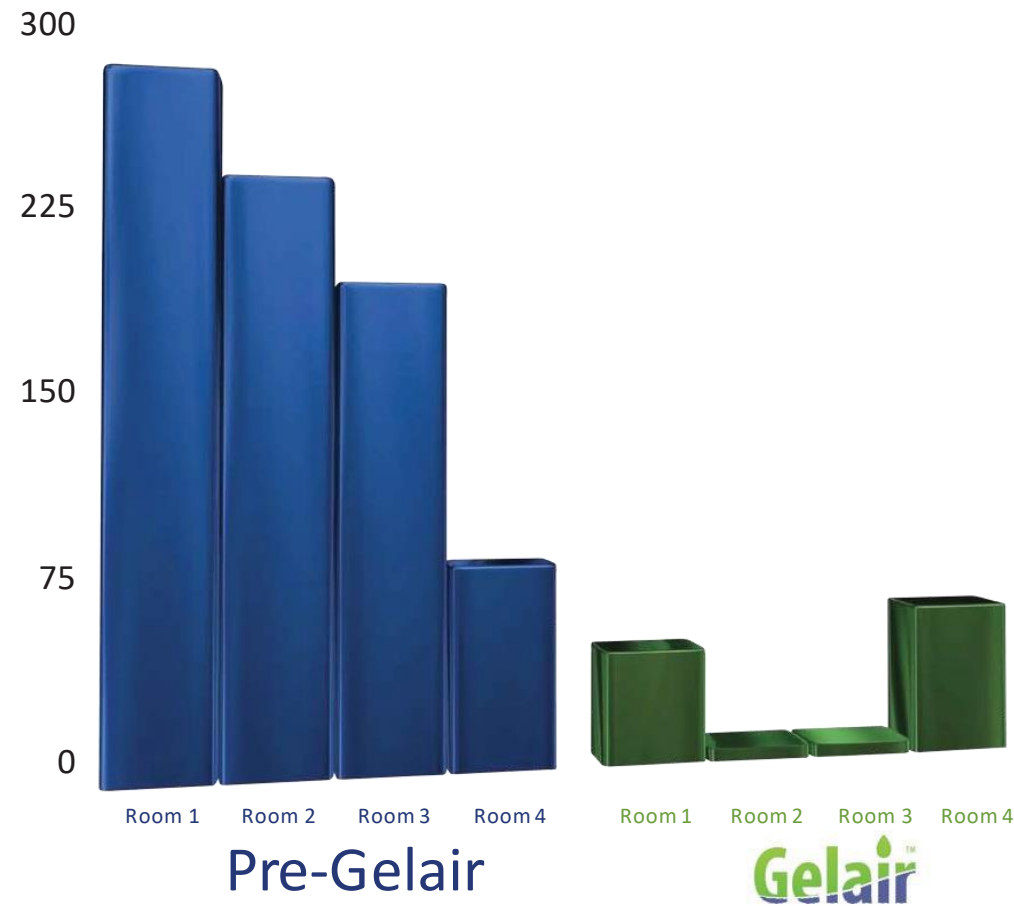
- Gelair is used extensively in the mining and oil & gas industry due to their extreme conditions (perfect for bacterial growth) and their high standards for air quality
- The following data is from a floating vessel used by the offshore industry for the processing and storage of oil and gas
 - located off the north west coast of Western Australia
 - Approximately 150 km from land
 - The conditions are always extremely hot and humid



Bacteria Counts (CFU/m³)



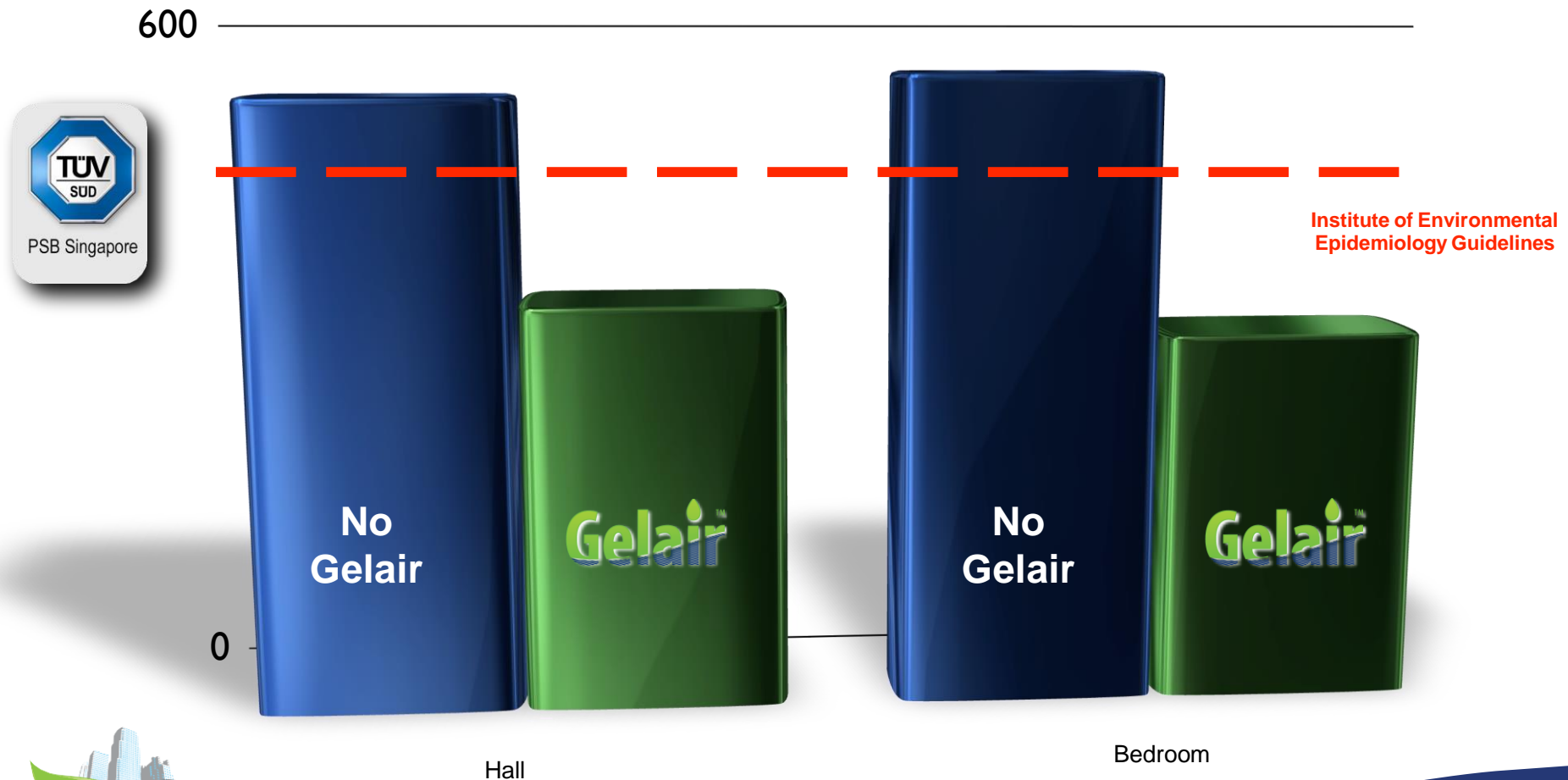
Yeast & Mold Counts (CFU/m³)



Case study in Singapore

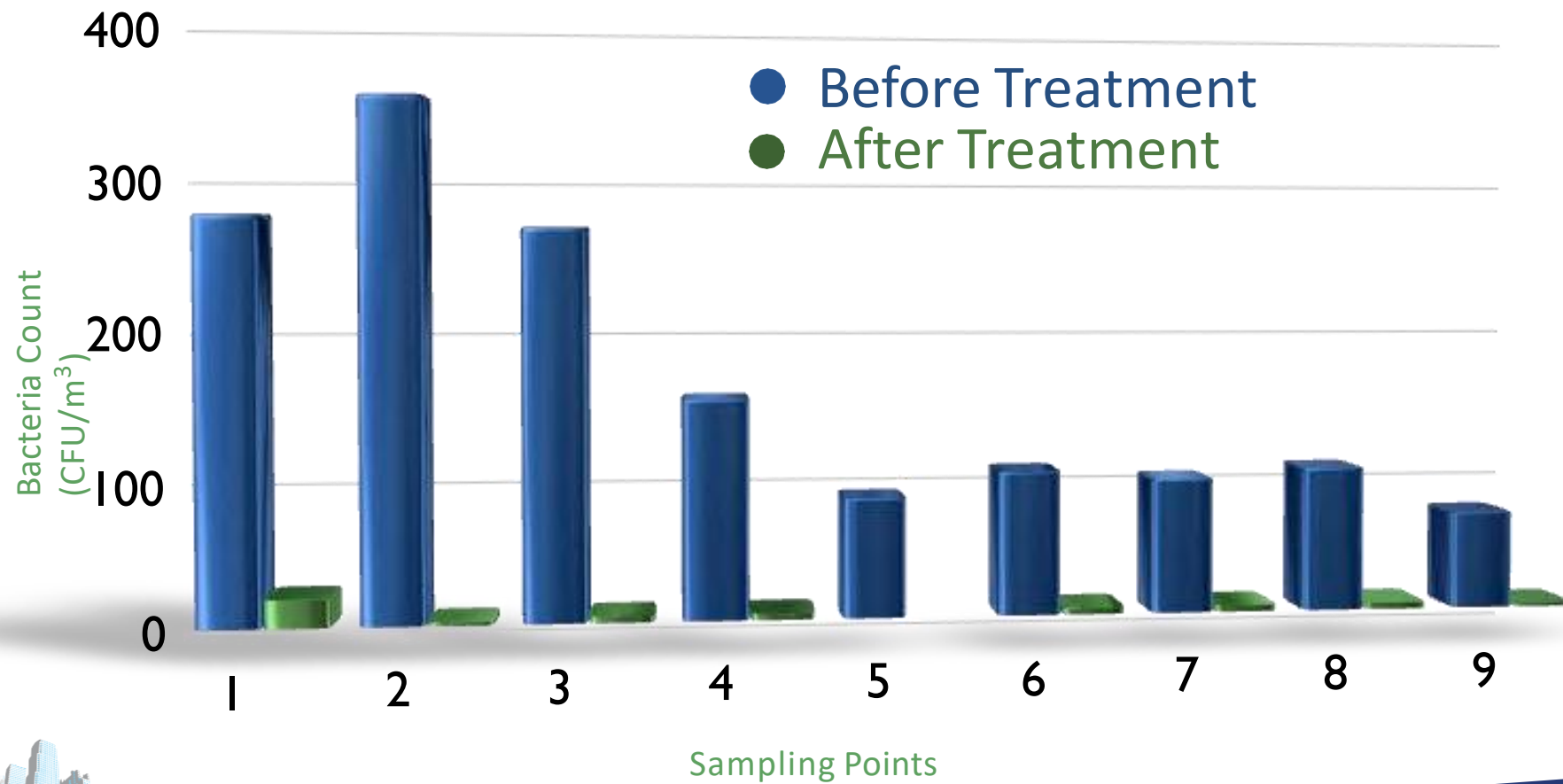


Data From March 2010: Bacteria Count (CFU/m³)



In just 2 days, Gelair controlled the bacteria levels to bring them well below the stated guidelines

Data From March 2010: Bacteria Count (CFU/m³)



Questions



Thank You

