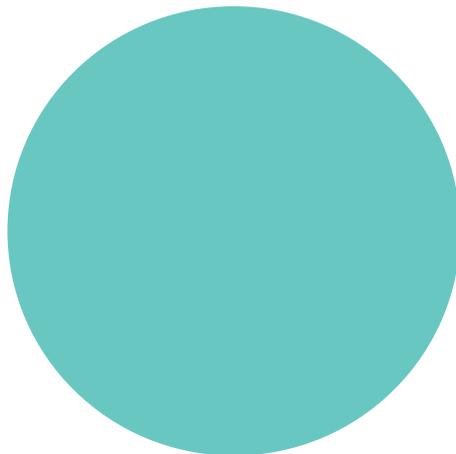
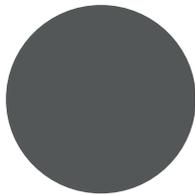


airandé

SUPERIOR DISINFECTION SOLUTIONS

THE FUTURE OF
DISINFECTION IN
TRANSPORTATION



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Contamination: Risks to Passengers, Staff, and Drivers in Transportation Settings

Contamination in different transportation settings poses significant health dangers to passengers, operational staff, and drivers.

Transportation creates an environment in which there is a rich source of dangerous pathogens, micro-bacterial activity and causes of cross-infection as well as pollutants that cause illness and trigger upper respiratory (and other) illnesses:

- Passengers on public buses and trams are at significant individual risk of acquiring acute respiratory infection/s.
- Passengers and workers on ground transportation (buses, trains, taxis) are often exposed to unhealthy levels of CO₂ concentration that are far in excess of national indoor air quality standards, and they are often exposed to unacceptable concentrations of particulate matters when their mode of transport stops at a station, bus-stop, etc
- Influenza, coronaviruses (e.g., SARS and MERS), staphylococcal bacteria (*S. aureus*), and norovirus all create health risks to which passengers and transportation workers are exposed on air, sea, and ground transportation
- Public ground, sea, and air transportation is recognized as places where there is a strong possibility of the transmission of respiratory infections (*S. pneumoniae*, *Mycobacterium tuberculosis*)
- Drivers and passengers in automobiles (either privately owned and operated or operated as taxis) are exposed to volatile organic compounds associated with microbial growth in automobile air conditioning systems

The transmission of infectious agents in the transportation mode can occur:

- By direct contact with contaminated surfaces such as handrails, seats, and other internal surfaces.
- By indirect contact through the contaminated hands or unhygienic practices of co-passengers.
- By inter-human transmission contaminating the air during the journey.





What do the experts say?

Li and Gale (2012)¹ note that the growth of modern civil aviation raises significant ongoing concerns over routine air travel and these concerns are vastly magnified in the event of an epidemic/pandemic/terrorist attack using chemical and biological agents because: (A) air travel transports infected individuals to new locations; (B) aerosol person to person transmission can occur within the cabin; (C) transmission can occur via cabin surfaces.

In all three cases, efficient infection control strategies are needed such as decontamination or sanitization of aircraft. Aircraft Decontamination (may consist) of delivering VHP (Vaporized Hydrogen Peroxide) through a stand-alone system, in an efficient way, without requiring bulky vaporisers or other heavy equipment within the cabin, such that the system is capable of delivering controlled quantities of VHP to achieve sporicidal conditions throughout the cabin.

Vaporised hydrogen peroxide (VHP) is a promising method for infection control and sanitization of aircraft.

Kacer et al (2012)² has defined Hydrogen peroxide as “the ideal decontamination agent...due to the non-toxic products of its decomposition - water and oxygen (and its) well-described antimicrobial activity and strong oxidative potential are also a good precondition for its wide application against biological and chemical contaminants.

Troko et al (2011)³ observed in a study of bus passengers in 2008/2009 that recent bus or tram use within five days of symptom onset was associated with an almost six-fold increased risk of presenting to a GP for treatment of acute respiratory infection (ARI).

Feske, Teeter et al (2011)⁴ found significant links between a high correlation between bus journey duration and school bus passengers found to test positive with *Mycobacterium tuberculosis* (MTB).

Browne et al (2016)⁵ have conducted an extensive review of the literature and have found that transportation and transportation hubs are extremely influential in the spread of influenza, SARS, and MERS. Aircraft, shipping, and trains are all significant in the way that these viruses spread to passengers and to new parts of the world.

Xu, Chen, and Xiong (2018)⁶ report that while commuters typically spend only 5.5% of their time in vehicles, the emissions from various interior components of motor vehicles as well as emissions from exhaust fumes carried by ventilation supply air are significant sources of harmful air pollutants that could lead to unhealthy human exposure due to their high concentrations inside vehicles' cabins.

1. Li, H and Gale, WF (2012) Analysis of removal and decomposition pathways of Vaporized Hydrogen Peroxide (VHP) for aircraft decontamination operation. In: Curran, R, (ed.) Air Transport and Operations: Proceedings of the 3rd International Air Transport and Operations Symposium 2012. Third International Air Transport and Operations Symposium 2012, 18-20 Jun 2012, Delft, The Netherlands.

2. Kačer, P., Švrček, J., Syslová, K., Václavík, J., Pavlík, D., Zervený, and Kuzmar, M. (2012). Vapor Phase Hydrogen Peroxide - Method for Decontamination of Surfaces and Working Areas from Organic Pollutants. In: Puzyn, T. and Mostrag, (eds.) A. Organic Pollutants Ten Years After the Stockholm Convention. London: InTechOpen.

3. Troko, J., Myles, P., Gibson, J., et ors. (2011), Is Public Transport a risk factor for acute respiratory infection? *BMC Infectious Diseases*, 11:16.

4. Feske, ML., Teeter, L. D., Musser, JM., and Graviss, EA. (2011). Giving TB wheels: Public transportation as a risk factor for tuberculosis transmission. *Tuberculosis (Edinb).Dec 91 Suppl 1: S16-23*.

5. Browne, A., St-Onge Ahmad, S., Beck, CR., Nguyen-Van-Tam, J. (2016). The roles of transportation and transportation hubs in the propagation of influenza and coronaviruses: a systematic review. *Journal of Travel Medicine* 23(1).

6. Xu, B., Chen, X., and Xiong, J. (2016) Air quality inside motor vehicles' cabins: A review. *Indoor and Built Environment* 27(4).

How to Manage Contamination in the Transportation Settings

Airandé - the complete H₂O₂ Disinfection System that allows Transportation Operators to:



Eliminate contamination and reduces the risk of contamination through bacteria, viruses, spores, yeasts, fungi, and molds.

Reduce the risks of contamination to passengers, staff, and drivers.

Use an approach to disinfection that is:

- broad spectrum in its action: bactericidal, virucidal, sporicidal, and fungicidal, environmentally friendly,
- compatible with most materials found in transportation settings,
- efficient and cost effective, saving transportation operators and owners time and labour in their disinfection routine.

Why H₂O₂?

- ✓ Efficient (researched, developed, innovated, and validated by scientific tests and data).
- ✓ A full spectrum of disinfection activity.
- ✓ Eco-friendly, biodegradable: H₂O₂ decomposes into water and oxygen after use.
- ✓ Odourless.
- ✓ Not dangerous to users when used according to instructions.
- ✓ No residue effect.



H₂O₂ is More Effective Than Existing Disinfection Modalities

Summary of Disinfection Modalities:

	BACTERIA	YEASTS	FUNGUS	ENVELOPED VIRUSES	VIRUS	MYCOBACTERIA	BACTERIAL SPORES
ALDEHYDES*	●	●	●	●	●	●	●
ALCOHOLS	●	●		●			
PHENOLIC DERIVATIVES	●	●	●	●			
CHLORINE DERIVATIVES	●	●	●	●	●	●	
QUATERNARY AMMONIUM CATIONS	●	●		●			
BIGUANIDES	●						
PERACETIC ACID*	●	●	●	●	●	●	●
HYDROGEN PEROXIDE	●	●	●	●	●	●	●

* Aldehydes, Peracetic Acid, and H₂O₂ are the only full spectrum disinfection substances. But, not all full spectrum disinfection substances are safe:

- **Aldehydes** are highly toxic and irritating
- **Peracetic Acid** is corrosive, explosive at high concentration, malodorous, and must be handled with great caution.

Full Spectrum and Safe:

	BACTERIA	YEASTS	FUNGUS	ENVELOPED VIRUSES	VIRUS	MYCOBACTERIA	BACTERIAL SPORES
HYDROGEN PEROXIDE	●	●	●	●	●	●	●

This means H₂O₂ is the best alternative solution for disinfection

The Airandé Disinfection System

3 Objectives:

1

Manual disinfection
during end-of-day shifts or between high-volume disinfection cycles (using Airandé H2O2 Solution 3).

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2

High-volume disinfection
and airborne circulation of dry-fog of particles sizes measured in microns <20 (using Airandé Nebulizer and H2O2 Solution 8).

.....

3

Disinfection and removal
of contamination of the air by photo-catalysis (using an Airandé Air Purifier).

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Innovation, Engineering, Science, Manufacturing and Distribution

The Airandé Disinfection System is the result of innovation in public, clinical, and scientific settings. It has drawn on the expertise of the very best thinkers and practitioners in the disinfection world.

Airandé's unique approach will change the way operators and manufacturers manage contamination in their transportation systems and products.

It will help reduce the risk of passenger and staff infection and illness caused through cross-contamination in buses, trains, aircraft, and concourses - and even in taxis.

Airandé's scientific team is headquartered in Australia. The leadership of Airandé's global Research and Development team is located in Belgium.

The development of the Airandé Disinfection System has benefited from collaboration with universities worldwide working alongside senior research and development teams.

The Design and Engineering of the Airandé System has been done across three continents: Australia, China, and Europe. Manufacturing of different elements of the system is done in Germany, Australia, China, and the USA.

All of our manufacturers and suppliers are accredited to ISO 9001:2015. Some are also accredited to ISO 13485:2016.

Airandé maintains a QMS system which is currently being reviewed and audited to allow the company to be certified under ISO 13485.

Distribution of the Airandé System is undertaken direct by Airandé, through its distributor network, and in conjunction with its manufacturing partners and their distributor networks.

The Airandé Disinfection System

3 Steps to Using the Airandé Disinfection System in Public Transport

Step 1

Manual Cleaning

Airandé H2O2 Solution 3 + Airandé H2O2 Wipes



Step 2

Nebulizer

Airandé Nebula, Aridus, Hygien'Air



Step 3

Photocatalysis

Airandé Air Purifiers



The Airandé Disinfection Solution

- Effectiveness against micro-organisms (bacteria-fungi-viruses-spores-molds):
 - Airandé's H2O2 Nebulizers : log 4 to log 5 reduction (99.99% to 99.999% of micro-organisms)
 - Airandé's Air Purifiers: log 3 reduction (99.9% of micro-organisms)
- Sanitation cycle:
 - Airandé's H2O2 Nebulizers: weekly or more often dependent upon decontamination and whether treatment is preventative or curative
 - Airandé's Air Purifiers: 24 hours, 7 days
- Destroys Odors; Reduces VOCs; Chemical free – ecologically friendly solution
- Active technology – high efficiency
- Airandé's Air Purifiers are safe to use in the presence of humans
- Airandé's H₂O₂ technology should be used in isolation of the human operator
- Complete range of devices – flexible/adaptable for all applications

The Airandé Disinfection System

Nebulizers: The Airandé Nebula & The Airandé Hygien'Air



Ensures optimal surface disinfection after manual cleaning

Extended spectrum of activity to remove contamination from a wide range of sources including bacteria, viruses, spores, and moulds

Disinfects spaces between 5m³ and 165m³

Limited down-time of rolling stock, vehicles, vessels

Rapid diffusion: 11 min to 45 min

No volatile organic compounds

No residue

Ergonomic

Economical: 7ml/m³

Easy to use

- Reaches all surface areas
- Dry – not wet
- Captures and kills all sources of surface contamination – including bacteria, viruses, spores, and moulds

The Nebula offers traceability of use, date, operator, room ID, reason for disinfection: all downloadable through USB

The choice of Nebula or Hygien'Air will be subject to the operational requirements of the customer

Airandé Solution 8

7.9% SOLUTION OF H₂O₂



Used in conjunction with the Airandé Nebulizer

Ready-to-use solution: no mixing or onsite dilution required

Single-use ensuring purity of product

No surface residue

No residual humidity

Biodegradable

No corrosion on most materials

Airandé Solution 3

3.26% SOLUTION OF H₂O₂



Used for manual cleaning of surfaces in between scheduled use of the DF-1

Ready-to-use solution: no mixing or onsite dilution required

No surface residue

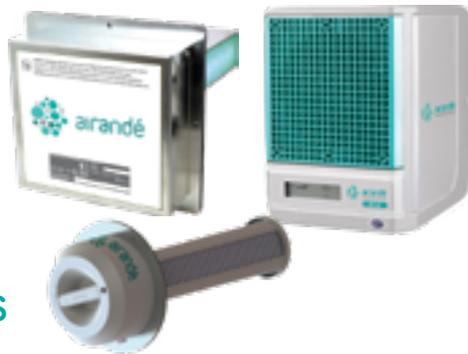
Biodegradable

No corrosion on most materials

No trace of NH₄⁺, phenol, chlorine, biguamide, aldehyde, alcohol and VOC

The Airandé Disinfection System

Airandé Air Purifiers



The Airandé range of Air Purifiers has been developed by ReSPR - our global partner in air purification. They are a leader in the innovation and development of air purification technologies.

At the heart of Airandé's Air Purification technology is photocatalysis.

Our technology is the only one that combines up to five nature-based technologies working together to treat indoor air like nature cleans outdoor air - using two types of ionisation to reduce particles, UV and a catalyst to create oxygen and hydrogen based friendly oxidisers to reduce microbial contaminants, and low level ozone to reduce odours.

In order to best solve the air purification needs of our transportation customers, Airandé has a number of product options which allow a customised solution depending on the surface areas to be disinfected - from a single vehicle, to a bus, train, aircraft, concourse and platform or public areas and services such as security screening.

Airandé H2O2 Impregnated Wipes



H₂O₂ impregnated wipes that enhance the manual cleaning of contaminated surfaces

The H₂O₂ penetrates deep into the surface materials of surfaces such as seats, window sills, tray tables and ensures that contamination is eliminated even from areas that are not visible to the naked eye.

The H₂O₂ is kind to the surfaces on which it is applied and unlike chemical disinfectants H₂O₂ will not crack, corrode, or deteriorate most surfaces and materials.

What do you get when you buy an Airandé Disinfection System?

Obviously each component of a transportation system is different. And the operational conditions of each system are different.

This means that our first step is to work with our customers to look at the elements of the Airandé Disinfection System and to develop a configuration that best works.

Nonetheless, the base elements of the Airandé Disinfection remain the same although the quantities of each element will change according to the needs and circumstances of the customer. The elements are:

1. An Airandé Nebulizer – either the Nebula or the Hygien’Air
2. H2O2 Solution 8 – for preventive disinfection
3. H2O2 Solution 7 – for curative disinfection
4. HO2 Solution 3 – for manual disinfection
5. H2O2 Wipes – for manual disinfection
6. Airandé Air Purifier – configured to the customer’s needs



Contact Airandé's President & CEO,
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Sales and Distribution enquiries

**Take the time to speak with us at the
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and after the Trade Show, contact us as follows:

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Brett.Stuart@airande.global, and
(Australia) [Tom Hovey@airande.global](mailto:Tom.Hovey@airande.global)
