



airandé

SUPERIOR DISINFECTION SOLUTIONS

THE FUTURE  
OF DISINFECTION  
IN TRANSPORTATION



## 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 CO<sub>2</sub> 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 workers are exposed on air, sea, and ground modes of transportation.
- Public transportation (ground, sea, and air) are all 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 any public 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 human transmission contaminating the air and surfaces during the journey.



## What do the experts say?

Li and Gale (2012)<sup>1</sup> 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)<sup>2</sup> has defined Hydrogen peroxide as "the ideal decontamination agent (including) 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 applicaiton against biological and chemical contaminants.

Troko et al (2011)<sup>3</sup> 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 accute respiratory infection (ARI).

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

Brown et al (2016)<sup>5</sup> 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)<sup>6</sup> 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 air pollutants that could lead to unhealthy human espouse 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. 18-20 Jun 2012. Delft, The Netherlands.

2. Kačer,P, Švrček, J, Syslová, K., Váciavik,, J., Pavlik, D., Zervený, and Kuzmer,M. (2012). Vapor Phase Hydrogen Peroxide - Method for Decontamination of Surfaces and Working Areas from Organic Pollutants. In: Puzyn, T. and Mostrag, (eds.) 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 Ahmed, S., Beck, CR., Nguyen-Van-Tam, J (2016). The roles of transportation and transporation 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 H<sub>2</sub>O<sub>2</sub> Disinfection System that allows Transportation Operators to:



Eliminate from the transportation environment the potential for contamination by bacteria, viruses, spores, yeasts, fungi, and moulds.

Reduce both the risks of micro-biological contamination and resulting illnesses among passengers and employees; and reduce employee absenteeism through lower incidents of illness from micro-biological contamination.

Use an approach to disinfection that is:

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

### Why H<sub>2</sub>O<sub>2</sub>?

- ✓ Efficient (researched, developed, innovated, and validated by scientific tests and data).
- ✓ A full spectrum of disinfection activity and unlike many other disinfectants does not encourage the growth of antibiotic resistant bacteria.
- ✓ Eco-friendly, biodegradable: H<sub>2</sub>O<sub>2</sub> decomposes into water and oxygen after use.
- ✓ Odourless.
- ✓ Not dangerous to users when used according to instructions.
- ✓ No residue effect.



## H<sub>2</sub>O<sub>2</sub> 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 H<sub>2</sub>O<sub>2</sub> 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 H<sub>2</sub>O<sub>2</sub> is the best alternative solution for disinfection

## The Airandé Disinfection System

### 3 Objectives:

1

High-volume disinfection through airborne circulation of dry-fog of 5–15 microns in particle size (using the Airandé DF-1 or Hygien'air and 7.9% H<sub>2</sub>O<sub>2</sub> solution).

2

Manual disinfection between patients or between high-volume disinfection cycles (using Airandé 3.25% H<sub>2</sub>O<sub>2</sub> solution).

3

Disinfection and removal of contamination of the air by photo-catalysis (ReSPR air and surface purification systems).

### Innovation, Engineering, Science, Manufacturing and Distribution

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

Airandé has its Principal Scientific Adviser located in Australia. Its global V-P Research and Development is located in Belgium.

The Design and Engineering of the System has been done across three continents: Australia, China and Europe.

Manufacturing of different elements of the system is done in Australia, Belgium, France, Germany, the USA, and China. All of our manufacturers and suppliers are accredited to ISO 9001:2015. Some are also accredited to ISO 13485:2016.

Airandé's Quality Management System is continuously reviewed and audited annually to allow the company to retain its certification as a Medical Devices Manufacturer under ISO 13485:2016 (Certificate MD 726599).

Product development has also benefited from collaboration with universities worldwide. Airandé's focus on innovation, research, and development in the disinfection field is extremely important in achieving its goal of providing leadership in the science and management of disinfection. This means that Airandé will continue to work in collaboration with the leading microbiologists and disinfection scientists globally.



## The Airandé Disinfection System

### The Airandé DF-1 Range



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 5m<sup>3</sup> and 285m<sup>3</sup>

Limited down-time of rolling stock, vehicles, vessels

Rapid diffusion: 11 min to 45 min

No volatile organic compounds

No residue

Ergonomic

Economical: 7ml/m<sup>3</sup>

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 DF-1 comes with an easy-to-manage trolley. The DF-1 can be simply removed from the trolley and carried in a specially designed bag. This enables the operator to take the DF-1 into small spaces.

### The Airandé Hygien'air

Similar operating functions to DF-1

Rapid diffusion: cycle time 13.6 minutes per 50m<sup>3</sup>

Portable



### Airandé Solution 8

7.9% SOLUTION OF H<sub>2</sub>O<sub>2</sub>



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 H2O2 Impregnated Wipes



H<sub>2</sub>O<sub>2</sub> impregnated wipes that enhance the manual cleaning of contaminated surfaces

The H<sub>2</sub>O<sub>2</sub> penetrates deep into the surface materials of dental treatment units and ensures that contamination is eliminated even from areas that are not visible to the naked eye

### Airandé Solution 3

3.25% SOLUTION OF H<sub>2</sub>O<sub>2</sub>



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 NH<sub>4</sub><sup>+</sup>, phenol, chlorine, biguamide, aldehyde, alcohol and VOC



ReSPR Flex



ReSPR HVAC



## The Manoa Hand and Object Disinfection

The Center for Disease Control (CDC) has suggested that 80% of infections are transmitted through hand contact with surfaces that are contaminated by bacteria, viruses, spores, moulds, fungi, and yeasts. Professor Lotti Tajouri (2021)<sup>1</sup> has described mobile phones as “Trojan Horses for coronavirus”. He also found that 97% of health care workers know that their mobile phones are contaminated - with 58% of them taking their mobile phones to the bathroom.

According to Prof Tajouri mobile phones are contaminated by *e.coli*, demonstrating faecal contamination, *pseudomonas aeruginosa* (which is extremely resistant to different types of antibiotics), salmonella and listeria. Other objects (documents, files, etc) are similarly contaminated.

The Manoa is an hand-and-object sanitising system that disinfects hands in 3 seconds and objects in 5 seconds. The Manoa is used by both staff and passengers on concourses and in transportation hubs.

An effective and cost effective means of ensuring a safe journey, free of microbiological contamination and pathogenic transmission.



## Airandé Internal Environmental Monitoring

The Airandé Internal Environmental Monitoring System helps transportation operators stay alert to and manage the risks of viral transmission by recognizing key factors that influence the propagation of viral populations.

Real-time monitoring and a visual display of a range of critical environmental factors can be displayed to transportation passengers and operational staff alike.

In addition, the Airandé IEMS through its unique Pod 2 technology can recognize and prompt remediation against volatile organic compounds and gases, odors, noise, and light.

Its sensors provide warnings about environmental factors that are likely to impact negatively on the productivity of employees and the well-being of employees and passengers alike.

The Airandé IEMS also helps operators save costs on cleaning and the use of chemicals in the operating environment. It can read the balance that against actual consumption, and make recommendations about future quantities.

Internal environmental quality is more than just air quality. Having the right internal environmental quality depends on air and surface cleanliness and the right comfort factors of lighting, temperature, humidity, odors, and noise.

Its capabilities makes the Airandé IEMS an ideal capstone to its portfolio designed to ensure the safest possible transportation experience for passengers and the safest possible healthy workplace for employees.



## Airandé IAQ-ASE Certification

IAQ-ASE is a certification provided to users whose air and surface purification systems meet the standards set by Bureau Veritas - one of the world's leading certification and standards bodies.

The IAQ-ASE certification ensures that Airandé's distributors, sales staff, consultants, designers, and installers each hold a key level of certification that attests to their knowledge and competence in relation to continuous air and surface sanitisation technologies.

An IAQ-ASE certification is issued to qualifying customers upon proof being provided by a Bureau Veritas supervised laboratory.

To ensure that a customer's certification is retained once awarded, Airandé actively monitors the performance of every machine that it deploys to every one of its customer sites wherever they are in the world. Importantly, these customers also have a real-time view of the performance of their continuous air and surface purification system.

The Airandé IAQ-ASE Certification and the Airandé IEMS are ideal technology companions for public transportation.



## ReSPR Air & Surface Purification Technologies

The ReSPR air and surface purification technologies target and kill pathogens in the air and on surfaces using a process of 3rd generation of photocatalytic oxidation by employing advanced Natural Catalytic Conversion™ technology.

Proven in independent laboratories, in field-testing, and in critical "real-life" environments such as hospitals and clinics, the ReSPR technologies eliminate 99.99% of pathogens using continuous flows of Hydrogen Peroxide at a level of 0.03ppm. Way below the global occupational health and safety standard of 1.00ppm - but strong enough to remove contamination and reduce Hospital Acquired Infections by more than 53%, and staff absenteeism by 42%.

The ReSPR can be installed in a HVAC system or used as a benchtop unit. It can safely be used in the presence of employees and passengers during all transportation operations.

The ReSPR Flex comes pre-installed with a ReSPR HEPA Filter 13 (rated MERV 16). Our HVAC design team can recommend the use of an appropriate HEPA filter for use in your HVAC system.

1. Tajouri, L., et al., (2021). Mobile phones of paediatric hospital staff are never cleaned and commonly used in toilets with implications for healthcare nosocomial diseases. *Scientific Reports*, 11(1), (12999). <https://doi.org/10.1038/s41598-021-92360-3>  
See also: Tannhäuser, R., et al., (2021) Bacterial contamination of the smartphones of healthcare workers in a German tertiary-care hospital before and during the COVID-19 pandemic, *American Journal of Infection Control*, (available online 16 October 2021), <https://doi.org/10.1016/j.ajic.2021.09.025>  
\* The catalytic reactor in the ReSPR FLEX has a warranty of 60 days. Otherwise the ReSPR FLEX and the HVAC systems have a warranty of 2 years.



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