SciCan: Your Infection Control Specialist

- Canadian company
- Founded in 1957
- 60 years of experience in the healthcare market
- Present in over 100 countries around the world
- 2 specific business areas:
  - SciCan Dental
  - SciCan Medical
Contamination control
Healthcare safety

Air Treatment Systems in Healthcare Settings

Thibaud BOISTON
Kelsey MAH
airinspace® worldwide cover

**FRANCE**  
Paris Assistance Publique Hospitals: Saint Antoine, Necker, Saint-Louis, Louis Mourier,  
University Hospitals: Marseille, Montpellier, Bordeaux, Lille, Strasbourg, Nantes, Brest, Dijon, Lyon, St-Etienne…

**GERMANY**  
Leipzig, Dresden, Munich, Berlin, Lubeck, Munchen, Bonn…

**CHINA**  
Rui Jin Shangaï, Pekin Hôpital 301 (military), Suhzou, Wuhan, Canton…

**JAPAN**  
Tokyo, Osaka…

**TURKEY**  
Ankara, Antalya, Izmir

**SAUDI ARABIA**  
Ryhad

**UNITED ARAB EMIRATES**  
Dubaï, Abu Dabi, Fujairah

**ALGERIA**  
Alger University hospital, Beni Messous, Batna, Pierre et Marie Curie, Blida…

**MAROCCO**  
Casablanca, Marrakech…
Our mission

Improve air quality in hospitals’ high risk areas.

- **Reduce** airborne infections and related costs
- **Comply** with international and/or local standards
- **Improve** patient and staff safety
Part I

Air quality – general principles
Contaminants that affect air quality

Different types of contaminants:
• Inert particles (mineral or organic)
• Airborne biocontamination
• Gaseous pollution

Different sources of emission:
• Natural
• Human
• Industrial

Various intrinsic parameters:
• Liquid, solid or gas form
• Concentration, size, mass, morphology
• Toxicity, pathogenicity, virulence

Specific risk assessment is required for adequate air treatment
Relative size of airborne particles

Human hair
Ø 100 µm

Visible particle
Ø 50µm

Particle of
Ø 0,5µm

Natural settlement speed (without interference)

0,5 µm 1 µm 3 µm 10 µm
41 h 12 h 1.5 h 8 min

Diameter, red blood corpuscles (warmed) 7.5 microns ± 0.3 micron
US infection control guidelines

**CDC Guidelines / List of pathogenic agents with airborne transmission risk**

<table>
<thead>
<tr>
<th>Evidence for airborne transmission</th>
<th>Fungi</th>
<th>Bacteria</th>
<th>Viruses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerous reports in healthcare facilities</td>
<td>Aspergillus spp</td>
<td>Mycobacterium tuberculosis</td>
<td>Measles (Rubeola) virus</td>
</tr>
<tr>
<td></td>
<td><em>Mucorales (Rhizopus spp.)</em></td>
<td></td>
<td>Varicella-Zoster virus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasional reports in healthcare facilities (atypical)</td>
<td>Acremomium spp.</td>
<td>Acinetobacter spp</td>
<td>Smallpox virus (Variola)</td>
</tr>
<tr>
<td></td>
<td><em>Fusarium spp.</em></td>
<td><em>Bacillus spp.</em></td>
<td>Influenza virus</td>
</tr>
<tr>
<td></td>
<td><em>Pseudoallescheria Boydii</em></td>
<td><em>Brucella spp.</em></td>
<td>Respiratory syncytial virus</td>
</tr>
<tr>
<td></td>
<td><em>Scedosporium spp.</em></td>
<td><em>Staphylococcus aureus</em></td>
<td>Adenoviruses</td>
</tr>
<tr>
<td></td>
<td><em>Sporothrix cyanescens</em></td>
<td><em>Group A Streptococcus</em></td>
<td>Norwalk-like virus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No reports in healthcare facilities ; known to be airborne outside</td>
<td><em>Coccidioides immitis</em></td>
<td>Coxiella Burnetii (Q fever)</td>
<td>Hantaviruses</td>
</tr>
<tr>
<td></td>
<td><em>Cryptococcus spp.</em></td>
<td></td>
<td>Lassa virus</td>
</tr>
<tr>
<td></td>
<td><em>Histoplasma capsulatum</em></td>
<td></td>
<td>Marburg virus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ebola virus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crimean-Congo virus</td>
</tr>
<tr>
<td>Under investigation</td>
<td><em>Pneumocystis carinii</em></td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Part II

Air treatment in healthcare settings
Air treatment must be considered supplemental to standard infection control practices (<20% HAI)

- MD sterility
- Prophylaxis (antibiotic / antifungal)
- Pre-operative shower
- Hands hygiene
- Biocleaning of surfaces / equipments
- Single-use PPE : Gloves/Gown/Hat/Shoe-covers
- Sealed windows, doors kept close
- End-point filtration of water point at risk
- clean / soiled circuits or « one way flow »
- Houseplants, flowers, cardboards forbidden
- (…)
Two strategies depending on risk nature: Protection or Isolation

**PROTECTION**
(Protective Environment – PE)

- Immune-suppressed / Immune-compromised patients
- Exposed patients (wounds, invasive MD)
- Sterile process: Compounding / MD sterilization / …

**ISOLATION**
(Airborne Isolation – AI)

- Septic patients
- Bio-safety laboratories
- Cytotoxic drugs
- Dangerous chemicals handling
Main medical applications concerned

Protection of immune-suppressed patients
- BMT unit (Hematology ICU)
- Hematology (AML / ALL / Medullar Aplasia)
- Organ transplants (post-surgery hosting in ICU)

Protection of exposed or immune-compromised patients
- CCU / ICU (depending on patients)
- Infectious diseases (AIDS patients)
- Burnt units (heavily burnt)
- Operating rooms or interventional radiology

Protection of sensible products or process
- Drug preparation (GMP scope)
- Central Sterilization
- Cell culture (biological contamination)
- IVF laboratories (biological and chemical contamination)

Airborne isolation of infectious patients or process at risk
- Infectious Diseases (TB wards, Airborne transmitted pathogens)
- CCU / ICU (Contagious patients at risk of env. dissemination)
- Bio-Safety Laboratories
- Cytotoxic drugs preparation
- Anatomo-pathology labs (chemical exposure)
- Endoscope disinfection facilities (chemical exposure)
Part III

Focus on fungal infection risk
Fungal infections transmission routes

- Fungi create very small spores
  (~ 3 μm pour Aspergillus spp)

- Fungal spores are naturally present in the air
  (morphology adapted for airborne transport)

- Spores are also present on surfaces

- Additional risk factors
  - Construction works
  - Renovation activities
Traditional mechanical filters are exposed to secondary contamination risks

Risk: Microbial growth
Described in numerous scientific studies:

Result: Microorganisms release
Numerous HCAI caused by poorly maintained air treatment systems.

Filters replacement is a high risk operation for technical staff.
Patients at risk of fungal infection

Patient typology

- Recipients of solid organ transplant
- Hematopoietic stem cell transplants
- Patients with hematologic malignancies
- Patients receiving immunosuppressive therapy
- Patients with severe aplasia
  - Polynuclear neutrophils (PNN) < 500/mm³
  - Platelets < 20 000/mm³
  - Reticulocytes < 20 000/mm³

Why more and more patients?

- Increase treatment proportion of patients with critical illnesses, previously considered lethal, due to rapid advances in medicine
- Development of more intensive chemotherapy
- Growing number of transplants
- Widespread of immunosuppressive therapies to treat autoimmune diseases

Salam et al., AJIC 2010
Part IV

Regulations, standards and guidelines
US infection control guidelines

CDC environmental guidelines / « Air » section

- List of airborne infectious diseases of concern
- HVAC systems conception (OT – PE – AI – CCU room)
- Construction work management
- Environmental monitoring (particles only with no target)
### International air quality standard

<table>
<thead>
<tr>
<th>ISO class number (N)</th>
<th>Maximum permitted number of particles per m³ of size ≥ to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,1 µm</td>
</tr>
<tr>
<td>1</td>
<td>10² b</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>1000</td>
</tr>
<tr>
<td>4</td>
<td>10000</td>
</tr>
<tr>
<td>5</td>
<td>100000</td>
</tr>
<tr>
<td>6</td>
<td>1000000</td>
</tr>
<tr>
<td>7</td>
<td>c</td>
</tr>
<tr>
<td>8</td>
<td>c</td>
</tr>
<tr>
<td>9g</td>
<td>c</td>
</tr>
</tbody>
</table>

*Extract from ISO 14644-1 French edition, 2016*
No targets – Methodology standard to establish biocontamination monitoring procedures

Air Sampling recommendations:

- Number of sampling points: 1 min (2 advised)
- Iterations of samples: 1 min (2-3 advised)
- Heighth of sampling: ~1000 mm
- Volume sampled per point: 1 m³ / 1000 L (500 L suitable for suspected high contamination)
- Advised culture media:
  - Bacteria (Total Mesophilic Flora): Plate Count Agar (PCA) or Trypticase Soya Agar (TSA)
  - Fungi (Total Fungal Flora): Sabouraud Agar or Malt Agar (+Gentamycine / Chloramphenicol possible)
- Advised Incubation:
  - Total Mesophilic Flora: +37°C – counted 24h / verified 48h
  - Total Fungal Flora: +24 - 30°C – verified 24h / counted 72h / verified 1 week
## NF S 90 351:2013
Performance targets for air contamination control

<table>
<thead>
<tr>
<th>Risk class</th>
<th>Particulate cleanliness class</th>
<th>Microbiological cleanliness class</th>
<th>1 log Particulate elimination time</th>
<th>Diff. Pressure (+ or -)</th>
<th>Airflow pattern</th>
<th>ACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>ISO 5</td>
<td>&lt; 1 CFU/m$^3$</td>
<td>&lt; 5 min</td>
<td>15 Pa ± 5 Pa</td>
<td>Unidirectional</td>
<td>6 ACH of fresh air +adequ. Air speeds for flow</td>
</tr>
<tr>
<td>3</td>
<td>ISO 7</td>
<td>&lt; 10 CFU/m$^3$</td>
<td>&lt; 10 min</td>
<td>15 Pa ± 5 Pa</td>
<td>Unidirectional OR Turbulent</td>
<td>&gt;15 ACH</td>
</tr>
<tr>
<td>2</td>
<td>ISO 8</td>
<td>&lt; 100 CFU/m$^3$</td>
<td>&lt; 20 min</td>
<td>15 Pa ± 5 Pa</td>
<td>Turbulent</td>
<td>&gt;10 ACH</td>
</tr>
</tbody>
</table>
### US Infection Control Guidelines

#### CDC Guidelines / Application-specific guidelines

<table>
<thead>
<tr>
<th>Specifications</th>
<th>All room (bronchoscopy included)</th>
<th>PE room</th>
<th>Critical care room §</th>
<th>Isolation anteroom</th>
<th>Operating room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air pressure</strong> ‡</td>
<td>Negative</td>
<td>Positive</td>
<td>Positive, négative or neutral</td>
<td>Positive or negative</td>
<td>Positive</td>
</tr>
<tr>
<td><strong>Room air changes</strong></td>
<td>≥6 TRH (for existing rooms)</td>
<td>≥12 ACH</td>
<td>≥6 ACH</td>
<td>≥10 ACH</td>
<td>≥15 ACH</td>
</tr>
<tr>
<td></td>
<td>≥12 TRH (for renovation or new construction)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**Sealed **</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Filtration supply</strong></td>
<td>90% (ASHRAE 52.1.1992)</td>
<td>99.97%</td>
<td>&gt; 90%</td>
<td>&gt; 90%</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td>(filtration of fungal spores at point of use (HEPA at 99.97% for 0.3 µm particles))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recirculation</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>(Recirculation possible if exhaust air first processed through HEPA filter)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§ Positive filter and HEPA filters may be preferred in some rooms in intensive care units (ICUs) caring for large numbers of immunocompromised patients

‡ Clean to dirty : negative to an infectious patient, positive away from an immunocompromised patient

** Minimized infiltration for ventilation control : pertains to windows, closed doors, and surface joints
Contamination control
Healthcare safety

PLASMAIR™

The reference in hematology and high risk areas
HEPA-MD™ technology

- Broad-spectrum efficacy: particles, microorganisms, and molecular pollution
- The risk of microbial growth is eliminated
- Low pressure drop profile: low noise emission, low energy consumption

1. Microbial Destruction
2. Biological decontamination and High Efficiency Particulate Arrestance
3. Catalytic Conversion
4. Molecular Trapping

Destruction of airborne microorganisms by exposure to strong electric fields and to oxidative species in unique non-thermal plasma chambers.

Charged materials exiting stage 1 are captured by an electrically active media where organic materials are continuously exposed to the plasma ions.

Oxidant chemical species are removed by a catalytic monolith (notably ozone and NOx).

Organic and mineral volatile molecular pollutants are adsorbed onto an activated carbon medium.
# HEPA-MD™ Technology evaluated by leading international Labs

<table>
<thead>
<tr>
<th>Species</th>
<th>Description</th>
<th>SPBR¹ Rate</th>
<th>Test Laboratories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus Subtilis (Gram+ bacteria / spore)</td>
<td>Very resistant bacteria. Model for Anthrax which is a bioterrorism threat</td>
<td>&gt;99.93%</td>
<td>HARVARD School of Public Health</td>
</tr>
<tr>
<td>BCG Mycobacterium Bovis (bacteria)</td>
<td>Vaccine against tuberculosis</td>
<td>&gt;99.99%</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus Aureus (Gram+ bacteria)</td>
<td>Most common cause of staph infections that cause skin infections, pneumonia, meningitis and endocarditis</td>
<td>&gt;99.84%</td>
<td>HARVARD School of Public Health</td>
</tr>
<tr>
<td>Aspergillus niger (Fungal / spore)</td>
<td>Pathogen filamentus fungi that cause aspergillosis in immuno-compromised patients</td>
<td>&gt;99.99%</td>
<td>HARVARD School of Public Health</td>
</tr>
<tr>
<td>Serratia Marcescens (Gram- bacteria)</td>
<td>Human pathogen involved in numerous HAIs, particularly urinary tract and wound infections</td>
<td>&gt;99.99%</td>
<td>HARVARD School of Public Health</td>
</tr>
<tr>
<td>H5N2 (Virus)</td>
<td>Avian influenza virus which can be lethal to human</td>
<td>&gt;99.999%</td>
<td></td>
</tr>
<tr>
<td>Vaccinia (Virus)</td>
<td>Very resistant airborne virus. Model for Smallpox which is a bioterrorism threat</td>
<td>&gt;99.2%</td>
<td></td>
</tr>
<tr>
<td>MS2 Bacteriophage (Virus)</td>
<td>One of the smallest known viruses (~20 nm in diameter)</td>
<td>&gt;99.999%</td>
<td></td>
</tr>
</tbody>
</table>

¹ Single-Pass Biological Reduction: highest SPBR rate achieved using AirInSpace HEPA-MD™ device in one of the above listed test laboratories.
A broad range products

PLASMAIR™ range include HEPA-MD™ technology

**PLASMAIR™**
- **Guardian**
  High capacity air decontamination unit
- **Sentinel**
  Light mobile air decontamination unit
- **C2010**
  Ceiling-mounted air decontamination unit
The reference in high risk area

- Very fast particle and microorganism reduction kinetic
- High flow rate (2500 m³/h)
- Fungi < 1 CFU/m³
- Reduce from ISO 9 to ISO 7/ISO 6 in a few minutes
- Very quiet
- 2 preset ventilation regimes (day/night) with automatic programmable change
- Continuous recording of in-use parameters with large data storage
- Large touch screen 4.3”
Compact and easy solution for securing high infectious risk areas (ISO7/ISO8) up to 50 m³

- Fully mobile
- Easy to use
- Small footprint
- Low noise level
- Low energy consumption

**Performance range (for rooms up to 50 m³)**

<table>
<thead>
<tr>
<th>Performance</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airborne Bacteriological class</td>
<td>&lt;100/&lt;10 CFU/m³</td>
</tr>
<tr>
<td>ISO Particulate cleanliness class</td>
<td>ISO8/ISO7</td>
</tr>
<tr>
<td>90% Decontamination kinetics</td>
<td>Within 20/10 minutes</td>
</tr>
</tbody>
</table>

**Dimensions and weight**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>150 cm</td>
</tr>
<tr>
<td>Width</td>
<td>70 cm</td>
</tr>
<tr>
<td>Depth</td>
<td>45 cm</td>
</tr>
<tr>
<td>Weight</td>
<td>100 kg</td>
</tr>
</tbody>
</table>

**Technical specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airflow range</td>
<td>400-600-850 m³/h</td>
</tr>
<tr>
<td>Max power consumption.</td>
<td>130 VA</td>
</tr>
<tr>
<td>Sound levels at 1 m</td>
<td>400 m³/h – 37 dB(A)</td>
</tr>
<tr>
<td></td>
<td>600 m³/h – 41 dB(A)</td>
</tr>
<tr>
<td></td>
<td>850 m³/h – 47 dB(A)</td>
</tr>
<tr>
<td>Frequency and voltage</td>
<td>~ 100 V/230 V – 50 Hz/60 Hz</td>
</tr>
</tbody>
</table>
HEPA-MD™ technology

1. Removable outlet grill
2. Reactor module
3. Electrical control Panel
4. Pre-filter

Decontaminated Air

Contaminated Air

1 : Microbial Destruction
2 : Biological and particulate arrestance
3 : Catalytic conversion
4 : Molecular trapping
The reference in high risk area
## Large & intuitive touch screen

![Touch screen image]

<table>
<thead>
<tr>
<th>Icons</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="OK icon" /></td>
<td>This icon indicates that the device is working correctly</td>
</tr>
<tr>
<td><img src="image" alt="Warning icon" /></td>
<td>This icon indicates a warning</td>
</tr>
<tr>
<td><img src="image" alt="Alarm icon" /></td>
<td>This icon indicates an alarm</td>
</tr>
<tr>
<td><img src="image" alt="Ventilation speed icon" /></td>
<td>This icon indicates the ventilation speed: DAY/NIGHT</td>
</tr>
<tr>
<td><img src="image" alt="Actual airflow and programmed volume icons" /></td>
<td>These icons indicate the actual air flow and the programmed room volume</td>
</tr>
<tr>
<td><img src="image" alt="Setup menu access icon" /></td>
<td>Access key to the Setup Menu</td>
</tr>
<tr>
<td><img src="image" alt="Automatic night-time programmer icon" /></td>
<td>Signal that automatic night-time programmer is activated</td>
</tr>
<tr>
<td><img src="image" alt="Manual mode activation icon" /></td>
<td>Signal that manual mode is activated</td>
</tr>
</tbody>
</table>
How to choose an efficient mobile filtration unit?

- Lowest noise
- Technology adapted to the nature of the contaminations
- No release of toxic substances
- Capability to decontaminate the entire room volume
- High flow rate adaptable to room volume and standard
- Intuitive controls
- Really mobile
- Easy to maintain
- Performances validated by independent laboratories and published studies
Examples of applications

Operating Room low surgery – 60 m³
PA-S blowing at 355 m³/h
ISO9 => ISO7 in less than 7 min
Positive pressure of 21 Pa

Operating Room. Ophtalmology 78 m³
PLASMAIR T2006NG – 1400 m³
ISO9 => ISO7 in less than 10 min
Example of applications

**Hematology – Autologous BMT Patient room 55 m³**
- PA-T2006NG – 1,000 m³/h
- ISO9 => ISO7 in less than 10 min

**Hematology – Allogenic BMT Patient room**
- IMMUNAIR w/T2006NG– 1100 m³/h
- ISO9 => IS05 in less than 6 min
Contamination control
Healthcare safety

Protective environment
BIOCAIR™
Modular isolation room or protective environment
INNOVATION 2016
BIOCAIR™ description

• Modular equipment to create a pressure controlled area
• Different configurations and dimensions are available
• Several options:
  • Flat screen TV
  • Decorated ceiling
BIOCAIR™ description

- Ceiling panel
- Clean room panel
- Panel with window
- Door Control Panel
- Automatic sliding door
- Electrical Box
- Panel connected to the air unit
- Pilot touch screen
2 different approaches

**BIOCAIR™ Positive pressure**
ISO5 to protect patients at risk

**BIOCAIR™ Negative pressure**
to avoid contamination spread out
Aeraulic simulation
BIOCAIR™ with positive pressure
BIOCAIR™ with negative pressure
Infectious Risk Management
Plasmair outlet connected to Hospital Air Exhaust
BIOCAIR™ Control panel

- 7-inch color touch screen control panel on the front outside to visualize in real time:
  - The differential pressure
  - The indoor temperature
  - Indoor relative humidity
  - The settable alarms
  - The blowing rate of the PLASMAIR unit
  - The adjustment parameters (pressure set etc ...)
  - Records (alarm log and warnings)

- Control panel also integrates a USB port to retrieve the data stored in text format (.txt / .csv)

A connection ModBus series is also available to connect the hospital network and system Building Management System
Examples of configurations

- Large BIOCAIR™ 20 m²
- Medium BIOCAIR™ 16 m²
Possibility of combinaisons

Large 20 m² (+30Pa) + Anteroom 8 m² (+15Pa)

Two isolation rooms 12 m²
airinspace®’s laboratory: Assemblying & Testing = 3 days
airinspace® mobile air treatment benefits

- **PLASMAIR™** Destroys microorganisms (unlike conventional mechanical filters)
- Reduced operational costs (low pressure drop profile / point of use air treatment)
- Robust and efficient (scientifically tested and validated thoroughly)
- Ease of set-up and use (plug-and-play designs)
Contamination control
Healthcare safety

THANK YOU!