Innovative Infection Control

Tested Proven Approved

Infection Control Matrix

Policy

- If current policy is not comprehensive and inclusive you cannot solve the problem.

Product

- If current product is not comprehensive and inclusive you cannot solve the problem.

Procedure

- If current procedure is not comprehensive and inclusive you cannot solve the problem.

Typical I.C. Policy

- Takes a generalized approach to the I.C. issue by segment.
- Is usually a compilation of various other existing policies.
- Does not get updated frequently with product updates.
- Does not get updated frequently with procedural updates.
- Is typically a ***“one size fits all”*** policy.

Most Overlooked Issue

The most critical component of complete I.C. is not understood by 99.9% of practitioners.

16,800

Most Overlooked Issue

A research study commissioned by the California Environmental Protection Agency confirmed the following fact.

The average adult inhales

16,800 liters of air/day

Air Content

Typical content of standard air

- Nitrogen 78.09%
- Oxygen 20.95%
- Argon 0.92%
- Carbon Dioxide 0.04%

Air Content

Unfortunately Air Also Contains Entrained Particulates

- Fungi
- Bacteria
- Yeasts
- Viruses
- Non volatile particulates (dust, dirt, etc.)

Entrained Particulates

Mechanical: Typically non viable

Added by powdering, crushing, cracking, transport of non-cohesive materials, soil erosion (by wind for example), etc. These particles are usually a few microns to a few hundred microns in diameter.

Entrained Particulates

Chemical or Thermal: Typically non viable

These particles form when chemical reactions or high-temperature evaporation followed by condensation change the state of the material. These particles range in size from a few nanometres to under 1 micron.

Entrained Particulates

Biological: Viable, Hazardous, Infectious

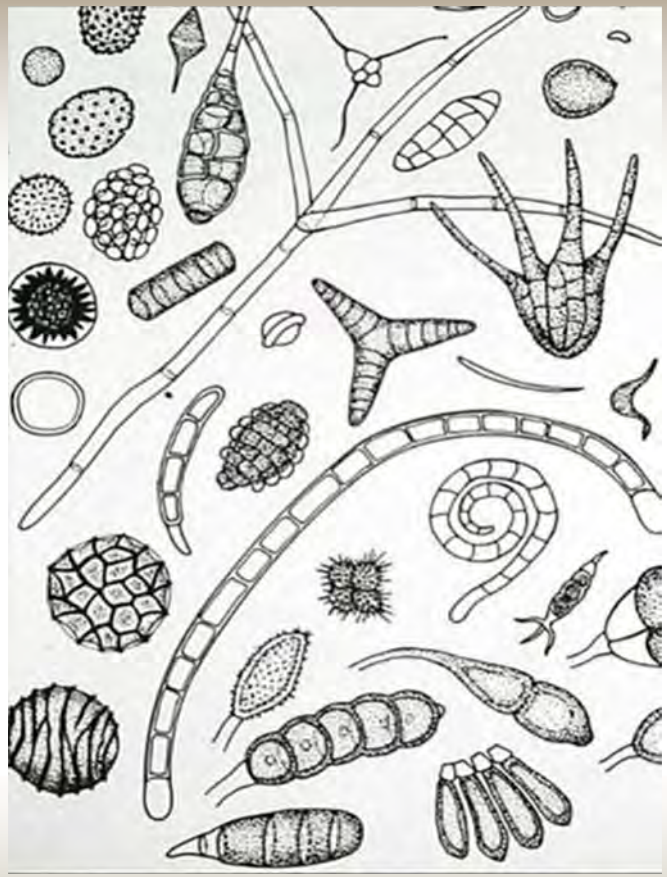
Pathogenic Bio-aerosols

- Fungi
- Bacteria
- Yeasts
- Viruses

These represent the most serious and most overlooked part of the I.C. matrix

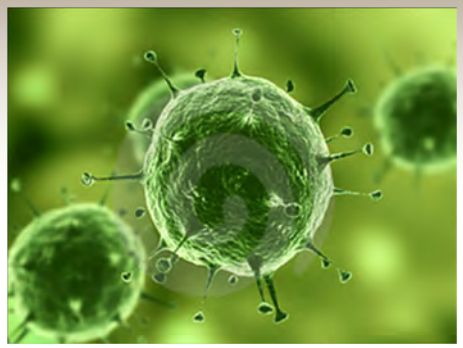
What is a Bioaerosol

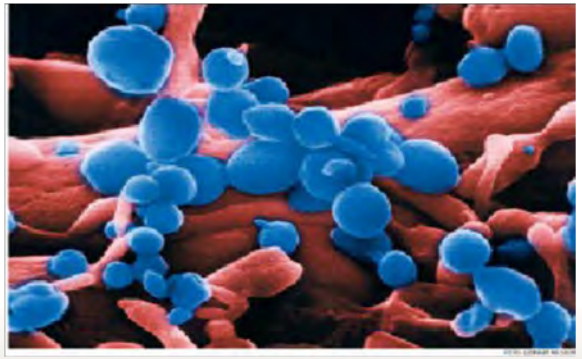
A bioaerosol is an assembly of particles of variable biological origin suspended in a gaseous medium (e.g. air) long enough to enable observation and measurement



What is a Bioaerosol

It is an aerosol of bacterial, viral, or fungal origin capable of initiating an infectious process in a susceptible host.
Such aerosols usually consist of a mixture of mono-dispersed and aggregate cells, spores, or viruses, carried by other materials, such as respiratory secretions and/or inert particles.





Bioaerosol Properties

Infectious agents have discrete size ranges:

~ 2.0-5.0 µm for fungal spores

~ 0.3–10 µm for most bacterial cells

~0.02-0.30 µm for viruses,

Their size changes as they are aerosolized and exposed to environmental factors (RH, temperature) that favor desiccation or hygroscopicity.

Bioaerosol Properties

With rapid desiccation, the resultant smaller aerosols can remain airborne longer.

Larger aerosols may initially fall out and then become re-suspended after desiccation. Excess gravimetric weight makes them become surface contamination posing physical contact risks.

Infectious Bioaerosols

Respiratory disease agents are expelled from the respiratory tract within a matrix of mucus and other secretions that typically begin to desiccate upon expulsion. The dried residuals are called droplet nuclei.

Infectious Bioaerosols

Infectious agents generated from wet environmental sources (such as HVAC and cooling tower water laden with Legionella) can also result in droplet nuclei.

Infectious Bioaerosols

Infectious aerosol carriers generated from

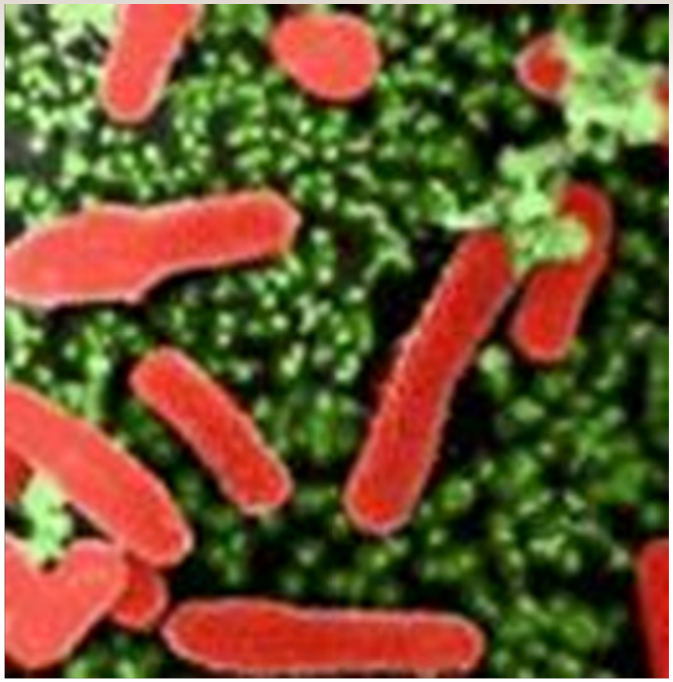
dry sources (such as construction dusts

with Aspergillus spores) may absorb water in the airborne state, yet still measure in the droplet nuclei size range.

Infectious Bioaerosols

Particle size and shape determine the behavior of the agent suspended in air.

Airborne particles, regardless of size or shape are referred to in terms of their equivalent, aerodynamic diameter.



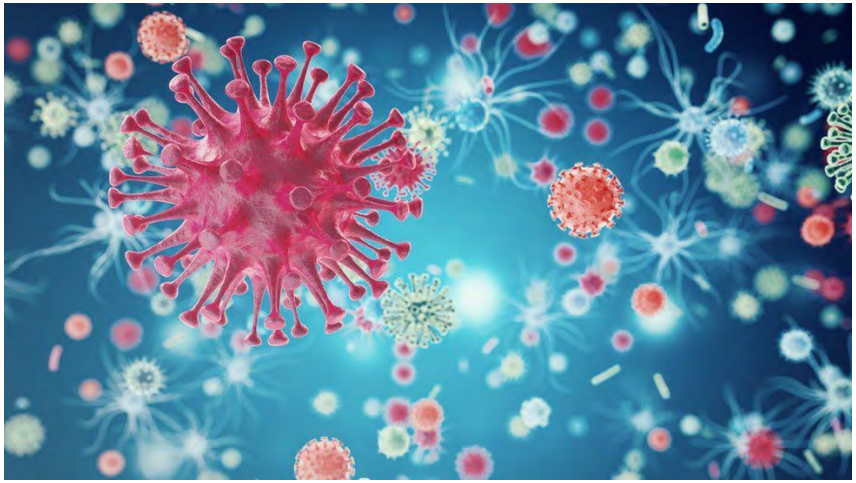
Infectious Bioaerosols

Aerodynamic diameter is equivalent to the diameter of a sphere having the same value or physical property as the irregularly shaped biological agent.

~ 2.0-5.0 µm for fungal spores

~0.02-0.30 µm for viruses,

~ 0.3–10 µm for most bacterial cells/spores



Infectious Bioaerosols

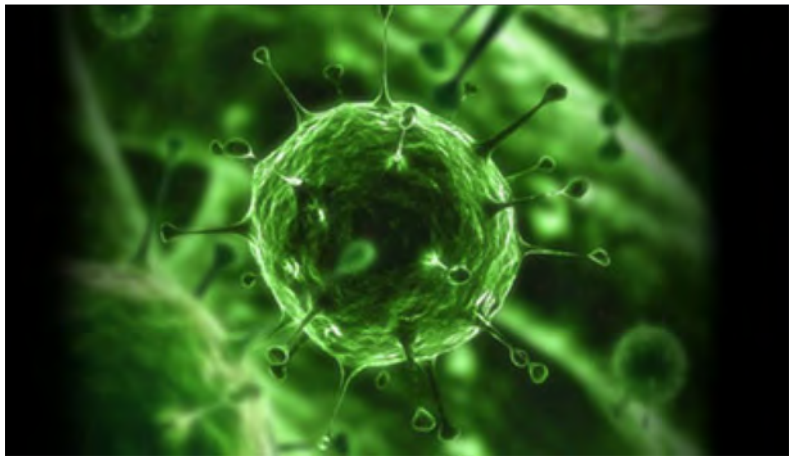
A particle may be extremely complex in shape, such as an agglomerate, wherein a significant part of the internal volume is comprised of voids. This agglomerate particle can be referred to in terms of mass-equivalent diameter, as the particle is compressed into a spherical particle without voids. This final bulk density is important relative to gravitational settling velocity.

Infectious Bioaerosols

Generally, it is considered that particles up to 100 µm in diameter are capable of remaining airborne long enough to be observed or measured as aerosols (or droplets) and hence able to transmit infectious agents.

Infectious Bioaerosols

Particles expelled from humans during coughing, sneezing, or even talking, although laden with moisture from respiratory secretions, begin to dry immediately upon expulsion to the air.



Infectious Bioaerosols

Particle drying, while dependent on atmospheric RH and temperature, typically proceeds rapidly, thus changing the aerodynamic diameters to the droplet nuclei range. Thus a sneeze can generate as many as 40,000 droplets, most of which can evaporate to particles (droplet nuclei) in the 0.5 to 12 μm range.

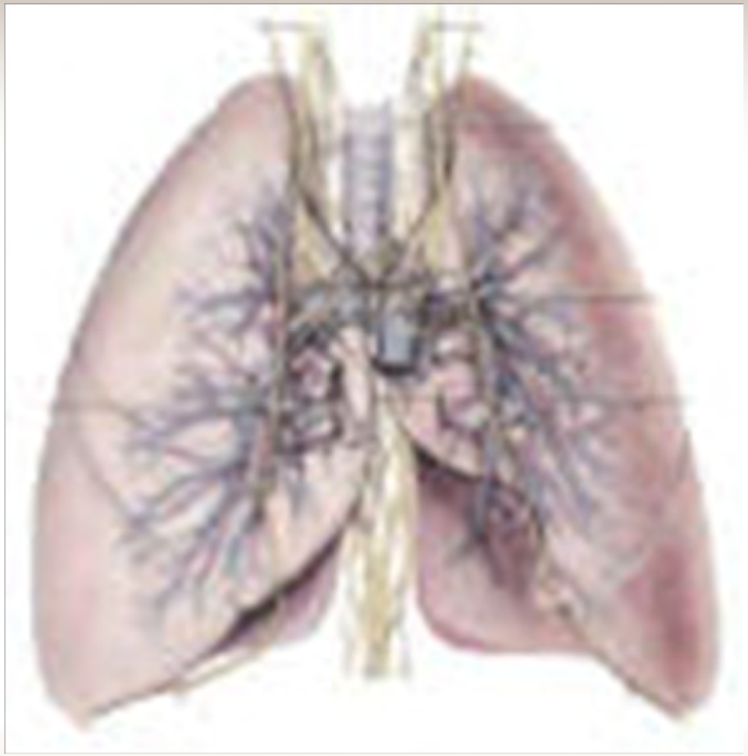
Infectious Bioaerosols

EVAPORATION

Studies of aerosolized pure water droplets have shown very brief drying times. Water droplets with diameters of 100 µm and 50 µm falling in 50% RH air, had drying times of 1.3 and 0.3 seconds, respectively.

Infectious Bioaerosols

Pure water droplets with diameters of 20 μm and smaller evaporated in less than 1.0 second. It is recognized however that ***respiratory droplets contain dissolved substances*** and microorganisms and therefore would dry less quickly.



Infectious Bioaerosols

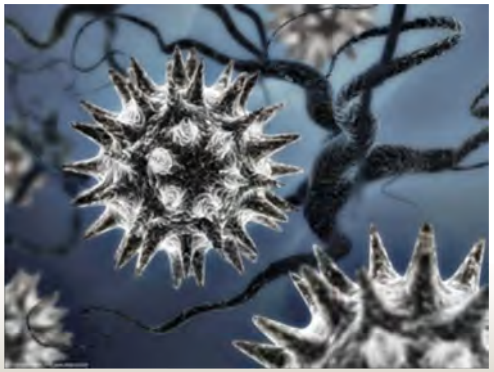
GRAVITATION & AIR FLOW

A droplet in air settles due to the gravitational field at a velocity dependent upon its mass. As the rate of fall increases, so does the drag or viscous frictional force acting on the particle. When the two forces are equal the droplet attains its final terminal velocity.

Infectious Bioaerosols

Droplet aerosols <100 µm can remain suspended for prolonged periods of time because typical room air velocities exceed the terminal settling velocities of the particles.
~0.02-0.30 µm for viruses,

Aerosols >100 µm are typically very large, fall out of the air rapidly, and are usually described as splash or splatter.



Infectious Bioaerosols

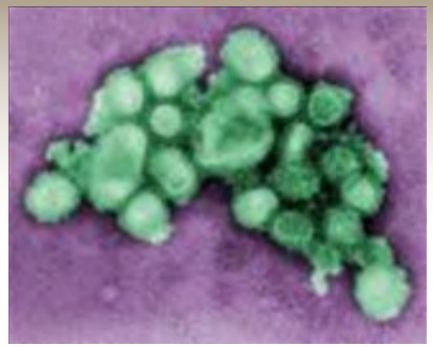
Other Relevant Factors

Other physical parameters also affect the fate of droplets and include diffusional, thermal, and electrostatic field effects in addition to temperature and relative humidity.

Transport, desiccation, and landing (deposition) of infectious microbes within the droplets must survive additional stressors such as radiation, oxygen, and other pollutants.

Infectious Disease Process

The ability of infectious microbes to initiate and spread disease depends on how well they survive (ability to reproduce) and maintain infectivity (ability to cause infection).



840+ H1N1 cells can be lined end to end and they will span a distance that is less than the diameter of an average human hair.

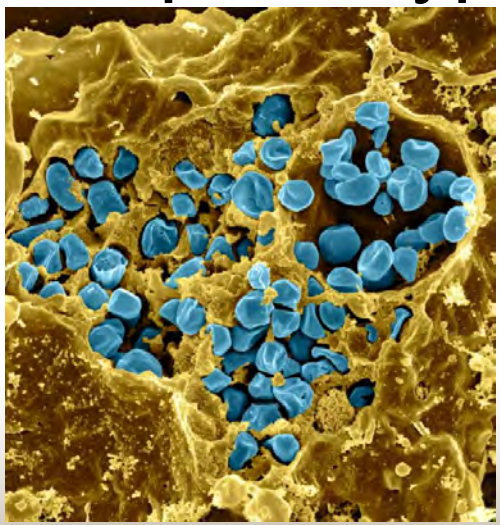
Infectivity

For man, the initiation of some diseases requires only small infective doses because the agents have an affinity for specific tissue and possess one or more potent virulence factors that render them resistant to inactivation.

Toxicity = dose x duration.

Infectivity

Infection with *Francisella tularensis* is reported to result from a single organism whose virulence is associated with a cellular capsule type structure.



A pathogenic species of Gram-negative, rod-shaped coccobacillus.Aan aerobe bacterium. It is the causative agent of ***Tularemia***, the pneumonic form of which is often lethal without treatment.

Infectivity

Only a few cells of Mycobacterium *tuberculosis* (TB) are required to overcome normal lung clearance and the inactivation mechanisms in a susceptible host.

- 2016 there were 10.4 million cases globally
- 2016 there were 1.7 million deaths globally
- CDC estimates 1/3 global infection rate

Infectivity

- Critical to the infection process initiated by the inhalation of infectious droplet nuclei is the area of deposition within the respiratory tract.
- Such deposition is influenced by hygroscopicity, which causes an increase in the size of the inhaled particles (~0.02-0.30 μm for viruses) through moisture take-up as they move within the airways.

Critical Factory Summary

Transmission of infectious disease by the airborne route is dependent upon the interplay of all critical aerosol factors being present.

- Size and Shape
- Microbe virulance
- Aerial transmission
- Diffusion
- Temperature
- Humidity
- Internal deposition
- Susceptible host

Estimated HAIs by Infection Site

Major site of Infection	Estimated Number
Healthcare-Associated Infection	1,737,125
Surgical Site Infection (SSI)	290,485
Central Line Associated Bloodstream Infections (CLABSI)	92,011
Ventilator associated Pneumonia (VAP)	52,543
Catheter associated Urinary tract Infection (CAUTI)	449,334
Clostridium difficile associated disease (CDI)16	178,000

CDC USA 2016

Cost Consequences

The average attributable per patient costs of HAI by selected sites of infection adjusted by 2016 CPIs for all consumers and inpatient hospital services

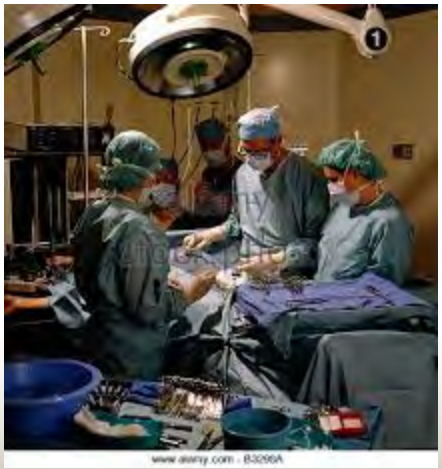
Infection site	*Low Estimate $*	*High Estimate $*
SSI	**12,443**	**27,546**
CLABSI	**7,734**	**24,939**
VAP	**13,897**	**27,072**
CAUTI	**2,589**	**4,758**
CDI	**7,042**	**9,179**

Diseases Coordinating Center for Infectious Diseases
Centers for Disease Control and Prevention Feb 2017

Social Costs Of HAI Infections

Direct Hospital Costs

- Fixed Costs for Buildings, Utilities, Equipment
- Labor (laundry, environmental control, administration)
- Technology
- Staff labor and time



Social Costs Of HAI Infections

Variable Cost

- Medications
- Food Consultations
- Treatment Procedures
- Care and treatment devices and suppplies
- Testing (laboratory and radiographic) supplies

Social Costs Of HAI Infections

Indirect Costs

- Lost/Wages
- Diminished worker productivity on the job
- Short term and long term morbidity + Mortality + Income lost by family members
- Forgone leisure time = Time spent by family/friends for hospital visits, travel costs, home care

Social Costs Of HAI Infections

Intangible Cost

- Psychological Costs (i.e., anxiety, grief, disability, job loss)
- Pain and suffering … *The lawyers love this one!*
- Change in social functioning/daily activities

MANAGEMENT/CONTROL STRATEGIES

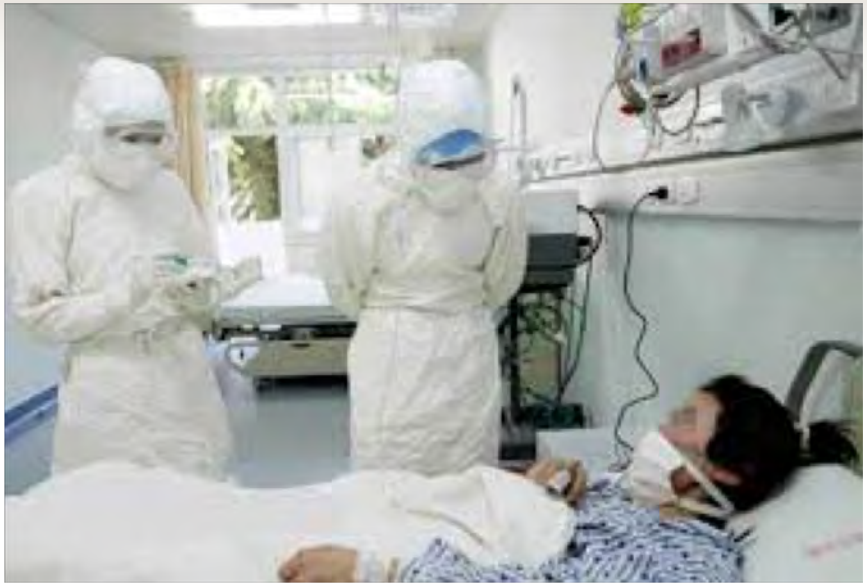
Source Management

Every infectious agent comes from a source, whether human, animal, a surface material, or a process. Sources can be managed, either through removal, such as mold-contaminated building materials, or modification, such as purging hot water systems to eliminate Legionella species.

MANAGEMENT/CONTROL STRATEGIES

Source Management

Patients with active TB can be housed in negative-pressure rooms, required to wear respiratory protection, and/or placed in laminar-flow beds until confirmed as non-infectious.



MANAGEMENT/CONTROL STRATEGIES

Source Management

Sources can also be managed through a program of building maintenance, cleaning, and disinfection that also ensures routine inspection of potential sources, such as various HVAC components.

MANAGEMENT/CONTROL STRATEGIES

Activity Management

This is the process of ensuring that a building or section of a building is used for the activities that it was designed to accommodate, and if not, that proper renovations have been carried out within a framework of operational infection control practices.

MANAGEMENT/CONTROL STRATEGIES

Activity Management

For example, if a section of an existing hospital is to be used for immune compromised patients, then renovations must ensure a dedicated HVAC system, with high-efficiency air filtration, and patient rooms operated under proper pressurization.

MANAGEMENT/CONTROL STRATEGIES

Activity Management

The use of a facility in the way that was originally intended also facilitates and promotes a routine program of inspection, maintenance, cleaning, and disinfection.

MANAGEMENT/CONTROL STRATEGIES

Design Intervention

Buildings (with their furnishings) need to be designed so they can be effectively inspected, cleaned, and maintained. Design intervention is important when designing new facilities as well as when renovating or remodeling an old structure for new use.

MANAGEMENT/CONTROL STRATEGIES

Design Intervention

Such interventions might include special exhaust ventilation or other airflow requirements, the application of an anti-pathogenic solution, or the removal of certain building or furnishing materials that are particularly susceptible to microbial contamination such as ceiling tile, wicker and carpet.

MANAGEMENT/CONTROL STRATEGIES

Ventilation and Filtration

Dilution is the process used to make airborne pollutants less concentrated by replacing contaminated air with clean air. For the capture of infectious particles, this is typically combined with controlled air flow and high-efficiency filtration, and should be done in conjunction with anti-pathogenic treatment.

MANAGEMENT/CONTROL STRATEGIES

Ventilation and Filtration

A study investigating airborne TB control showed that ventilation plus recirculation air filtration could achieve reductions of droplet nuclei concentrations with 30-90% effectiveness.
Further carefully calculated micro-vaporization of a broad spectrum anti-pathogenic solution could significantly lower transmission potential in high-risk settings.

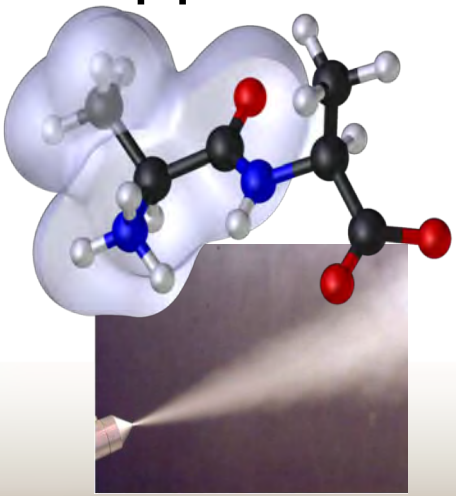
Predictive Air Management

An exhaustive 10 year study investigating airborne pathogenic bioaerosols control showed that ventilation plus recirculation air filtration could not achieve complete effectiveness. The study was conducted in the United States as well as S.E . Asia.

HEPA type filtration cannot be applied in some circumstances due to the systems inability to draw air through a true HEPA filter. This causes fan cavitations and system malfunction.

MANAGEMENT/CONTROL STRATEGIES

HVAC micro-vaporization treatment is highly effective when the configuration of system air distribution is carefully studied and is properly applied and combined with an EPA, FDA, OSHA approved anti pathogenic disinfectant solution.



The M3 System®

Complete facility control of pathogenic bio-aerosols is available to you now

Measure Manage Monitor

The M3 System®

Unites States Patent and Trademark

#4,032,797

The M3 System®

- Scientifically developed by one of the world's leading authorities on the control of pathogenic bio-aerosols in buildings.
- Allows the ability to have a thorough understanding of conditions in your facility ***in real time.***
- Allows you to correct deficiencies ***in real time.***

Measure

We establish a baseline bio-aerosol pathogen matrix of the facility.

This is accomplished through a systematic pathogen matrix assessment of the entire facility with emphasis on problematic areas as a priority.

Manage

We construct a protocol based on laboratory results to mange pathogen levels that will enhance Infection Control policies and reduce nosocomial infections.

Monitor

We formulate a comprehensive long term program with guidelines to monitor results that will keep the facility on track with their infection reduction goals.

Summary Of Benefits

To Staff:

The benefits of going organic to your organization are numerous including directly to staff who sanitize their hands multiple times a day.

Alcohol based sanitizers can cause severe skin issues with constant use.

Hand Sanitizer Survey

A survey recently published in a medical industry journal (APIC) indicated that out of 231 Health Care Workers who used Alcohol Based Hand Rub:

- 36.4% suffered dry skin
- 22.5% reported dry, red and chapped skin
- 15.6% reported eczema
- *12.1% reported contact dermatitis*

Ethyl Alcohol Sanitizer

- Active ingredient: ethyl alcohol 65% (minimum to be effective).
- Alcohol improves penetration of other chemicals through the skin by “de-fatting” the skin, which is a disruption of the oils in the skin.
- This is also the quality that makes alcohol dry out the skin.

Isopropyl Alcohol

- Isopropyl alcohol, also called rubbing alcohol, is a petrochemical that can be absorbed through the skin and through inhalation of vapors.
- It is a known neurotoxin, meaning toxic to the nervous system.
- It also dries the skin out.
- Some research shows toxicity even in low doses when used around the eyes and lips.

Benefits To Patients

The most serious concern of any patient is that they may enter the hospital with one problem and come in contact with something to give them an additional problem

Secondary Infections

As we have previously detailed, secondary infections cause problems for patients and also for your facility.

Benefits To Hospitals

Secondary Infections

$$$$$

Cost your facility money

and

Lead to loss of profits

21st Century Hospitals

- Protect their patients
- Protect their staff
- Protect their visitors
- Take advantage of technology

21st Century Technology

Utilizes available

Tested Proven Approved

Materials and Methods

21st Century Hospitals

Are

Path-Away®

Protected

Path-Away® Solution

Tested Proven Approved

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

USDA

FDA U.S Food and Drug Administration

IFOAM ORGANICS INTERNATIONAL

MADE WITH NON-GMO INGREDIENTS

GRAS GENERALLY RECOGNIZED AS SAFE BY THE FDA

IOAS

Environmental Protection Authority Te Mana Rauhi Taiao

JAS

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