

H1N1 Swine Flu, Disinfection as a means of reducing transmission.

As the European Winter season begins, attention is once again focussed on a possible widespread outbreak of the novel A H1N1 “swine flu” virus; I will refer to it as H1N1 for the rest of this article. There are a couple of “real life” factors worthy of reflection, firstly that the fear of a pandemic may be worse than the reality, secondly that some passengers and staff are likely to become ill, whatever safeguards are put in place. This is also the case for other transmissible diseases such as H5N1 Avian Influenza, SARS and TB.

The important thing for any operator is to take the best possible precautions against transmission of the virus and to be able to show that they have done so. This reduces fear amongst passengers and ensures that if anyone falls ill, the risk of transmission to others is reduced. It is also important that the operator can demonstrate that their duty of care has been discharged properly both to their customers, crew and to port based staff who may encounter infected people.

Typical symptoms of H1N1 include fever, cough, sore throat, body aches, runny or stuffy nose, headache, chills and fatigue. The US Center for Disease Control says that droplets are the primary route of transmission from person to person. These can be airborne, carried from a cough or sneeze, or they can be picked up by touching a surface which has droplets on it, then touching the face or eyes where the transmission can occur.

Most of the advice available to operators focuses on how to deal with cases of people known to be infected.

- Be aware of the typical symptoms.
- If a passenger or crew member develops symptoms they should not board the aircraft.
- If passengers or crew develop symptoms after boarding they should cover their nose and mouth if coughing or sneezing. Contain this within a tissue and dispose of that in a waste receptacle. Dispose of all soiled material in a sturdy plastic bag that is closed and disposed of according to solid waste regulations.
- Minimise the number of people directly exposed to the ill person and separate them as much as possible from others. Interact as little as possible with the ill person.
- If possible ask the ill person to wear a facemask or at least to use tissues.
- Wash hands thoroughly before touching an ill person and after touching the person, facemask, garbage and surfaces which have been touched.
- Use disposable impermeable gloves when handling any of the above if possible. Use alcohol based hand cleaners.
- Where applicable notify port health authorities so that they can assist and implement control measures.
- Leave the aircraft ventilation/air conditioning system running until all passengers and crew have disembarked.

As the old saying goes, prevention is better than cure and disinfection products have an important role to play in this. By killing viruses that are deposited on hands after coughing and in droplets that fall onto any of the many commonly handled surfaces inside the cabin, the risk of transmission can be minimised. Additionally a residual effect of disinfection can kill viruses that land on these surfaces before it is possible to clean them again.

Important features of disinfection products include that they are

- Fully effective against a broad range of microbiological contaminants including H1N1.
- Approved for antiviral properties by qualified testing institutes
- Approved for use inside aircraft cabins according to industry standards and by airframe manufacturers
- Delivered in a range of options that allow all types of surface to be cleaned.

- Able to be audited by the operator to prove that viruses have been eliminated.
- Effective as general surface cleaners for the removal of typical soiling on all aircraft cabin, galley and toilet components.

These requirements can be examined by looking at one of our own products - PSA's Netbiokem DSAM, which is a leading disinfectant for cleaning purposes and for effectiveness against H1N1. This product is a good reference as it is used and recommended by several airlines and sanitary authorities.



Effective against H1N1

PSA (Produits Sanitaires Aeronefs) has commissioned thorough testing of Netbiokem DSAM in order to ensure that full effectiveness can be proven.

In the table is a selection of some of the more important test results obtained from well recognised institutes.

Norm	Test Method	Laboratory	Types tested
EN 14476	Virucide	PASTEUR	Influenza virus A H1N1
EN 1040	Bactericide	IRM	Pseudomonas aeruginosa Staphylococcus aureus
EN 1276	Bactericide	IRM	Salmonella enterica subsp. enterica serotype Typhimurium Salmonella typhimurium
T72-170	Bactericide	IRM	Pseudomonas aeruginosa Escherichia coli Staphylococcus aureus Enterococcus hirae
T72-300	Bactericide	IRM	Pseudomonas aeruginosa Escherichia coli Staphylococcus aureus Enterococcus hirae
EN 1276	Bactericide	PASTEUR	Pseudomonas aeruginosa Escherichia coli Staphylococcus aureus Enterococcus hirae
EN 1656	Bactericide	PASTEUR	Pseudomonas aeruginosa Proteus vulgaris Staphylococcus aureus Enterococcus hirae
EN 13727	Bactericide	PASTEUR	Pseudomonas aeruginosa Staphylococcus aureus Enterococcus hirae
EN 1275	Fungicide	IRM	Candida albicans
EN 1650	Fungicide	IRM	Candida albicans
T72-301	Fungicide	IRM	Absidia corymbifera Cladosporium cladosporioides Aspergillus versicolor var Niger
EN 13624	Fungicide	PASTEUR	Candida albicans Aspergillus niger
EN 14348	Mycobactericide	PASTEUR	Mycobacterium avium Mycobacterium terrae
T72-181	Virucide	IRM	Bacteriophages T2, MS 2, n° 66 et Ø X 174
EN 14675	Virucide	PASTEUR	Enterovirus bovine Type 1 (ECBO)

Aviation Approval

This is an important factor, as non-approved cleaning products can damage and reduce the life of non-metallic structures inside the cabin, such as plastics in meal trays and transparencies and film/paint coated surfaces such as sidewalls and bulkheads. In addition they can cause corrosion of metal components particularly if they creep into joints where they become trapped.

Netbiokem DSAM has been tested and has passed the requirements of key specifications such as AMS 1452B Disinfectant - aircraft general purpose, AMS 1453 Disinfectant cleaner for aircraft interior - general purpose liquid and Boeing D6-7127 Cleaning interiors of commercial transport aircraft – category disinfectant. These specifications test for damaging effect on the airframe and any effect on flammability. The test regimes are quite exhaustive but important elements are as follows.

- Sandwich and immersion corrosion on various aluminium alloys.
- Embrittlement of cadmium plate.
- Effects on immersion of rubber and sealants.
- Effects on paints, tedlar and vinyl, including softening, cracking and colour change.
- Effects on upholstery, carpets and leather, including flammability and colour change.
- Effects on transparent plastics and polycarbonate including crazing.

Netbiokem DSAM meets these requirements fully and is included in the Airbus CML (consumable materials list).

Delivery/Application Method

The variety of different surfaces presented in the aircraft interior means that several methods of delivering and applying disinfectant must be considered.

Ready to use Netbiokem DSAM is designed for hard and soft surfaces that can be reached easily by hand during routine cleaning. Either in bulk 5 litre containers for dispensing by the cleaning crew or in 500ml trigger sprays ready filled; this should drop straight into the regular cleaning procedures used by most leading servicing companies. In addition there is a 100ml pump spray for use by the crew for any contamination events that occur in flight.



For cleaning of hands, the PSA product family includes KioGel which is an alcohol based, hypoallergenic hand rubbing lotion. It is available in 2.5ml individual pouches for personal use as well as 30ml and 100ml bottles for crew use. It meets the A criteria for efficacy of antimicrobial preservatives recommended for preparations for local application by European Pharmacopoeia 5.1.3 (5th edition) and is active against H1N1 together with HIV virus, Rotavirus, Herpes simplex, BVDV (Hepatitis C indicator), PRV, MNV Poliovirus and Adenovirus.



All of these cleaning methods assume the most important thing – that the cleaning product is actually deployed on the surface. This can be one of the most difficult to ensure elements of the process as, however good the disinfectant product is, it will not work if it does not contact either the virus or the surface. Quick turn-round cleans cannot assure that every surface has been cleaned and some surfaces are difficult to reach. The flu virus can stay alive for a couple of days on a surface.

For this reason PSA has developed the DAF (Dry Aero Fogger). This device is placed in the empty cabin and creates a dry fog of very small ($5-6\mu$) particles of the cleaning product. The particles come into contact with each and every surface inside the aircraft and can deliver the antiviral effect throughout the cabin. A typical DAF event for a single class, single aisle aircraft of an A320 size would comprise of -

- Close the PAX doors and switch on the air ventilation system.
- Open all lockers, toilets and flight deck doors
- Lower all tables and seat rests
- Set the DAF in the front galley and direct the nozzle down the aisle.
- Adjust the time for $400M^3$ capacity
- Run for 1 x 24 minute cycle
- Allow 30-45 minutes to clear



Combined with the use of Netbiokem DSAM as a surface cleaner the DAF process can be done every 3 weeks to underpin the disinfection of the aircraft. The frequency could be increased if a pandemic were declared or it can be used after a flight where a passenger has been declared as infected.

Audit of microbiological activity

Many product users wish to verify that the cleaning process has been effective. It is possible to measure the biological activity on the surface using laboratory cultures. An example of a unit of measurement for this is the number of PFU (viral Plaque Forming Units, a measure of the number of particles capable of forming viable viral plaques per unit volume). Swab samples can be taken from various critical points in the cabin and the PFU value assessed before and after cleaning.

As an example of the effectiveness of Netbiokem DSAM, a Boeing 777 of a major Middle East based carrier was subjected to a trial by cleaning with the Netbiokem DSAM DAF system and biological assays taken before and after cleaning.

Swab Screening Results After DAF Disinfection With Netbiokem DSAM		
Location	Before Disinfection	Just After Disinfection
Meal table	400 PFU	<100 PFU
Toilet	300 PFU	<100 PFU
Galley	4.1×10^8 PFU	<100 PFU

Advances in small scale rapid microbiological testing mean that representative instant results can be obtained using hand held meters. The total amount of biological activity on a surface is proportional to the amount of any virus that is present. This can be measured by assessing the amount of ATP (adenosine triphosphate) present, ATP is the universal energy molecule found in all cells. It is gathered using the swab and when brought into contact with the test reagent, light is emitted in direct proportion to the amount of ATP. The amount of light is stated as RLU (reactive light units) and limits for acceptable readings can be set case by case. Guidelines for starting a database for readings can be based on figures of <100RLU being acceptable, 100-200RLU being a caution level and >200RLU being unacceptable.

A small swab test can be performed using a simple individual swab wiped on the surface. This is immediately inserted into a hand held meter and an RLU readout given. Pexa can provide this simple equipment as part of the total disinfection system.

Pexa was established in 2002 and has built a strong business as a supplier of surface finishing products to the aerospace industry. 4 years ago Pexa decided to use its qualifications and know-how in the application of surface modifying products for aerospace, to offer hygiene, sanitation and insecticide products to airlines, carriers and the companies that serve them. This has resulted in an excellent partnership with PSA Paris, which is one of the World's leading manufacturers of chemical products for these applications.

Sources –

US CDC Interim Guidance Regarding Flight Crews Arriving from Domestic and International Areas Affected by Swine Influenza.

PSA (Produits Sanitaires Aeronefs) Paris technical library.

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