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What is not as well known, are the relatively simple steps involved in the prevention of these and similar IAQ issues. It is possible to render a building immune to IAQ issues by following a few good design rules, diligently attending to the maintenance of systems, providing regular change out of disposable items and general cleaning.

This article explores several of the key aspects of maintaining good IAQ for Hotels and Resorts, highlighting some of the steps one can take to achieve acceptable comfort and health for staff and guests.

BUILDING DESIGN

"In tight buildings with closed ventilation systems, airborne-transmitted pathogens are not only recirculated and concentrated, but also efficiently dispersed through indoor living spaces."

A 1988 study of approx. 400,000 army trainees found that trainees housed in energy efficient and well-sealed “modern” army barracks were 50% more likely to develop a respiratory infection than trainees housed in older “more leaky” buildings where potential airborne-transmitted agents were diluted by fresh, outdoor air and relatively quickly exhausted from indoor spaces.

This is not an indictment of modern building design – but highlights that we need to adapt our practices to keep up with the specific demands of these buildings in order to maintain IAQ.

This is particularly true in humid or high-density CBD areas – where many Resorts or Hotels are found. Environmental forces such as humidity and poor external air quality place special pressures onto buildings and potentially massive loads onto their IAQ systems.

Most readers will have to deal with a building “as they find it”; therefore, we will explore the most significant steps that can be taken to improve an IAQ situation within an existing building.

CONTROLS

It has been well documented by the Australian Government, that Heating Ventilation and Air Conditioning (HVAC) systems are generally responsible for approximately 40% of total building energy consumption within non-residential buildings. We tend to ignore control systems for HVAC and other building operation systems as a possible area of improvement. However, virtually every year brings significant advances in these types of “sense, command and control” systems. Finer and more intelligent control of building operation systems will certainly save energy, improve client satisfaction and maximise a buildings potential for maintaining IAQ.

If a building is more than 5 years old, it is almost certain that a review of these operation control systems is worth considering, with a view to upgrades or changes. Changing from simple “time based” systems to ones that compensate for weather, temperature and sun aspect changes can more than pay for themselves over time – with significant client satisfaction gains.

MAINTENANCE

It is unfortunately true that maintenance is the single most significant area of short-fall within buildings that suffer poor IAQ.

Building owners need to be attentive to maintenance expenses as a whole – with...
consideration to energy consumption, consumable lifetime and efficiency. It is in their best interest to consciously select maintenance programs with a low “total cost” to the building, rather than just accepting the cheapest maintenance contract. If maintenance is skipped on, the downstream impact on both IAQ and precious plant equipment can be massive – far higher than what was saved on a “cheap” maintenance program.

Aspects of maintenance that impact IAQ are explored below:

Leaks
Mould and fungi thrive on dampness driven by standing water. Leaks, condensation, and high humidity areas (such as bathrooms, spa areas) all require rigorous cleaning and maintenance procedures to reduce issues. In tropical areas these issues are compounded by high ambient humidity and aggressive weather events.

The monitoring of cooling towers, water quality and leaks within condensate drains is also a critical step in safe operation. Modern dosing chemicals for cooling towers have significant advantages over older, “more aggressive” chemicals which may contribute to system corrosion and inadvertent leaks.

Humidity
In high humidity areas, regular cooling coil steam cleaning to remove deposits and bacteria will yield energy and IAQ benefits. In some conditions, consideration of advanced UV-C systems is worthy of consideration. Well-designed systems of this type can significantly reduce bacterial and fungal risk, keep coils cleaner and yield real, cost effective benefits. These UV-C systems must be well designed and implemented by reputable vendors with a proven record of success; as the cheapest option is not necessarily the best in these more advanced control techniques. These systems can modestly increase air filter life as well, as they decrease the downstream load of material to be trapped by filters.

Air Intakes
Ideally, the location of air intakes that are as far as possible from the cooling tower is favourable. Failing this, controlling air-flow to avoid air sourced from the cooling tower is best. Clearly in all cases the minimum distances indicated in AS/NZS 1668.2¹ should be followed. Additionally, location of intakes to capture the cleanest possible air in the first place will reduce load and costs through the entire HVAC system.

Pressure
Control of overall airflow direction – through building pressurisation can lead to significant improvements in “fugitive” ingress of outside air. While buildings are designed to ensure a given pressure profile, and probably achieve that at “hand-over” when furniture, clients, staff, decorations and plants are added – significant variations from the design intent can occur. Similarly, weather events such as real world prevailing winds and traffic effects can mock the designer’s initial intentions. If notable contamination or thermal issues are noted in lobbies and other high traffic areas, review of overall airflow patterns and pressurisation is probably worth-while.

The overall “air changes” for given functional rooms and areas is set out in legislated Australian Standards, (eg AS/ NZS 1668.2²). Initial building designs should have been compliant with these minimum standards, however, over time, lack of maintenance and changed conditions in the building may lead to areas dropping below the “design intent”. Stuffy rooms, eye irritation, complaints from asthma sufferers etc. are possible indications of areas falling below the intended IAQ levels, and a strong indication that an airflow review is required.

Filtration
One of the most important components of IAQ in the air delivery systems is the humble air filter. As these disposable devices are generally hidden in plant rooms, ducts and air handlers, there is a tendency for them to be forgotten. Along with the maintenance of the mechanical aspects of airflow, there is no maintenance element in the system that is more critical to IAQ. Relatively inexpensive, very effective when properly sourced and energy saving when changed at optimal times; disposable air filters can be effective controls on dusts, pollens, moulds, odours and chemical hazards.

Generally, common filter systems for Hotels may consist of two stages, whereby each stage removes sequentially smaller particles. The first stage filter is typically a G4 rated disposable pleated filter, designed to capture air particles sized between of 5.0-10.0 micron (dust, pollens). Despite their low cost and apparent simplicity – these are remarkably sophisticated devices. Each filter, typically 600x600x100mm will have more than 2.8sqm surface area of an advanced pleated media material that is both stable and reliable. The “cardboard” housing of better quality filters is made from coated board stock that is tolerant of humidity and physical stress. These are important factors in “by-pass” – as an air filter ceases to operate at its rated efficiencies if contaminated air finds its way around the filter edges.

These G4 filters are changed out at regular intervals, when the load of dust that has collected starts to increase the resistance to airflow significantly (~175Pa and above). Operation significantly above these values will inevitably strain fans, increase energy bills, reduce total airflow and ultimately allow particles to flow through the filter – contaminating all downstream areas and filters.
The second stage filter is typically a F7 rated disposable multi-pocket bag filter or similar. These filters remove particles in the 0.5-1.0 micron range (auto emissions, mould spores). These are really the workhorse filters of the systems. Protected from large particles by the inexpensive G4 filters, these filters remove fine particles and have capacity for months of operation at higher efficiency levels. As with the G4 filters, regular change outs should be driven by monitoring resistance levels to achieve the best IAQ and cost effectiveness.

Bag filters come in an enormous range of configurations and sizes, but independent of size, quality of construction, proof of efficiency test levels and availability at short notice are key elements of the supply equation. In common with the themes expressed above, lowest price seldom corresponds with the most cost effective “total solution”, as quality media and manufacturing has its costs.

An example is HEPA filtration – for freedom from very fine particles in premium rooms or areas where “hospital operating room” air quality is desirable. These filters are remarkable complex devices, with lifetimes measured in years (if used correctly), with capture efficiency of more than 99% of even 0.3 micron particles. These filters are so fine that they are even capable of removing smoke particles.

Specialty Filtration
In some cases – a third layer of filtration is used in challenging or specialty applications.

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Another class of specialty filter that has gained popularity within Hotel applications is the “chemical filter”. Generally based on activated carbon or more modern synthetic materials, these filters are able to capture many odours or harmful airborne chemicals. Unpleasant loading dock odours, sewer smells, garbage smells, harmful engine pollution emissions (VOCs etc) can be captured by these very effective devices. The more load and airflow these filters encounter – the shorter the life. Comparatively expensive, they form a very valuable tool in the protection of guests from unwanted odours or hazards.

Chemicals that may not be treated in any economic way include Carbon Dioxide and Carbon Monoxide. Adherence to minimum air change legislation and Australian Standards are critical for the safety of your staff and guests.

Hotel and Resort Restaurants are coming under increasing pressure from councils to be reasonably odour and smoke free to nearby neighbours. Several restaurant types, most notably steak house and modern Asian cuisine can suffer from relatively extreme odour and smoke issues, especially if the exhaust systems are “side exit” rather than ducted to the roof for stack emission. A number of successful strategies exist for these issues – either through replaceable, multi-staged combination filter systems or self-washing Electrostatic Precipitator units (ESPs). These systems must be rigorously designed to exceed the intent of the standards (AS/NZS 1668.2, 1668.1, AS 1682.1 and .2), and be responsibly installed and maintained. Most of these systems are surprisingly large and maintenance intensive compared to the HVAC systems. However, given the elevated temperatures, humidity’s, high airflows and very high particulate and grease load, these systems provide a remarkably effective operation when designed and serviced properly.

Multistaged, combination filtration system for kitchen exhaust

CONCLUSIONS
Indoor air quality is a critical parameter in guest and staff outcomes for Hotels and Resorts. This article has highlighted a number of the factors that contribute to IAQ, and some control aspects and decisions that can lead to better outcomes. An exemplary level of IAQ for leisure facilities is an achievable goal – it just takes quality design and implementation, and rigorous attention to detail in the operation and maintenance of the facility.

Airepure Australia offers a range of products, services and consulting expertise that can assist you with your compliance to AS/NZS 1668.1 and 1668.2. Airepure is a leading national air filtration company providing unique, powerful and integrated air filtration solutions, ranging from basic HVAC filtration and odour control right through to high end HEPA/ULPA filtration and airborne containment technologies. Airepure recommends ELTA and Fantech Fans. For more information, visit www.airepure.com.au or call 1300 886 353.

REFERENCES
7. AS 1670.1 “Fire detection, warning, control and intercom systems - System design, installation and commissioning - Fire”. Standards Australia (2015)