HVAC SYSTEM HYGIENE AND INDOOR AIR QUALITY

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The IAQ objectives of a particular building environment will vary depending on the building, its use and the type of occupancy. For example the IAQ objectives in a hospital, pharmaceutical manufacturing plant, Hotel, food manufacturing plant or a commercial office environment will be different to some extent. Regardless of the level of air quality needed to protect the health of building occupants, immuno-compromised patients in a hospital, avoid contamination of manufactured products etc. one common theme to consider is the HVAC system hygiene or the level of HVAC system cleanliness. It is this topic that the rest of this article focuses on.

What contaminants are found in HVAC systems:

Contaminants that are present in HVAC systems and potentially distributed to occupied spaces are characterised as follows[1]:

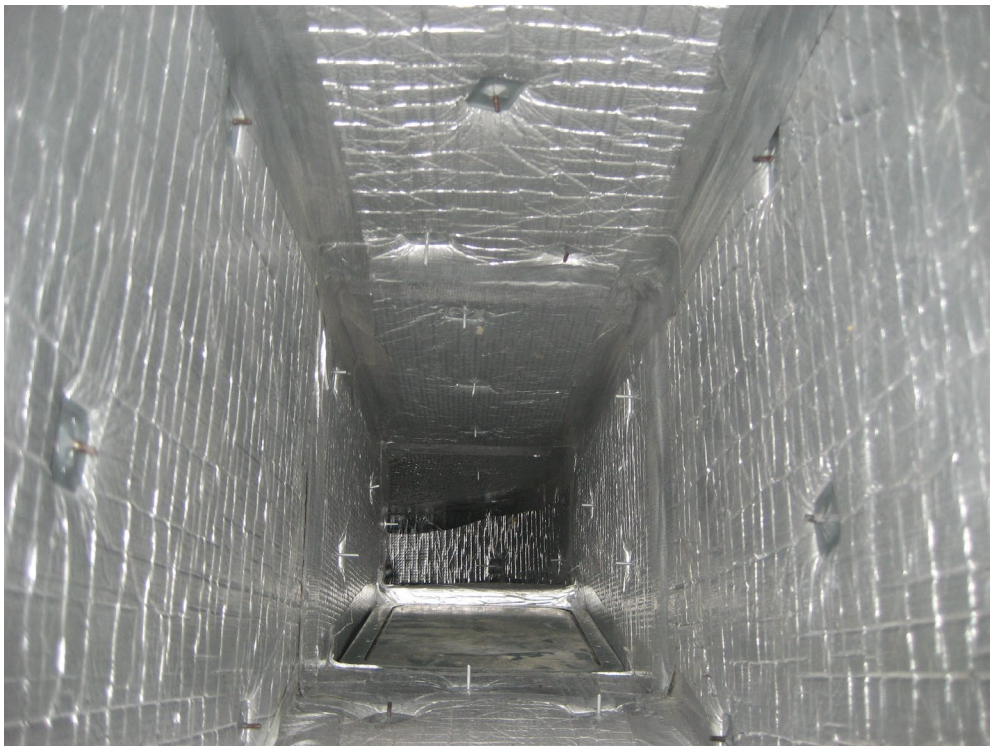
- Aerosols – solid or liquid airborne particles
- Biological contaminants – bacteria, fungi (mould and mildew), viruses, animal dander, mites, insects, pollen and the by-products of these elements such as glucans, endotoxins and mycotoxins
- Bioaerosols – airborne particles of biological origin
- Debris – any solid material including particulate substances and biological contaminants in the HVAC system, not intended to be present
- Hazardous contaminants- such as asbestos in older buildings or toxic fungi in water damaged systems,
- Fibres- apart from asbestos fibres such as fibres from delaminating porous insulation

Sites and sources:

Contamination sources within an HVAC system that may contribute to poor IAQ are:

- Outdoor air intakes and plenums.
- Ducting network
- Porous internal insulation. Water damaged, contaminated (fungal growth) and delaminating linings. The extent and success of the decontamination method chosen depends on the condition of the lining and the amount of contamination present and the associated risks from the contamination.
- Filters. These may be inefficient and harbour microbial growth. Also, filters that allow air by-pass increases the amount of contamination entering the system.
- Cooling coils and condensate trays. These become contaminated with organic dust and, when coils produce moisture, microbial growth results.
- Fans and fan housings. These may develop fungal growth due to the organic dust load accumulating on metal surfaces, especially under conditions of high humidity or water damage.

Mould growth in supply air ducting



After source removal and having been reinsulated.

Cleaning and decontamination:

To prevent the potential for indoor air quality issues to arise out of dirty and contaminated HVAC systems total system cleaning including all ductwork, fans, coils and other components is required to yield positive results. Special attention should be given to the condition of internal insulation in ducting, air handlers and

plantrooms. Naturally if only a portion of the system is cleaned and decontaminated, the areas which were not will quickly re-contaminate the rest of the system.

Cleaning and decontamination of HVAC systems provides the following benefits:

- Reducing the potential for contaminants that accumulate in the system to be released to the occupied space,
- Reduces the likelihood of those contaminants impacting on the health and comfort of occupants,
- Clean systems perform more efficiently and decrease energy usage (dirty coils effect the heat transfer and airflow)
- Well maintained HVAC components last longer and it reduces the need for costly replacements.

How often should HVAC systems be cleaned:

It is now common practice for HVAC cleaning projects to be conducted post construction to remove any accumulations of construction dust, debris and oil residues on the sheet metal ducts. Research[2] indicates that oil residues on recently constructed ducting have the potential to release VOC's (Volatile Organic Compounds) and provide organic material for the future growth of micro-organisms. This research concluded that new ducting should be cleaned before occupancy begins. The National Air Duct Cleaners Association (NADCA) standard ACR 2002 Assessment, Cleaning, &Restoration[3] of HVAC Systems also calls for newly installed HVAC systems and the ducting to be cleaned before operated. After post construction decontamination and cleaning of all components and the ducting the emphasis should be placed on regular scheduled inspections to determine the need for future cleaning and decontamination.

ACR 2006 Assessment, Cleaning & Restoration of HVAC Systems[3], sets out a visual inspection program that should form part of all facilities Indoor Air Quality Management Plans and Procedures. Table 1 below indicates HVAC cleanliness inspection schedules for different building use classifications.

Table 1: HVAC Cleanliness Inspection Schedule (Recommended Intervals).

Building Use Classification	Air Handling Unit	Supply Ductwork	Return Ductwork / Exhaust
Industrial	1 year	1 year	1 year
Residential	1 year	2 years	2 years
Light Commercial	1 year	2 years	2 years
Commercial	1 year	2 years	2 years
Healthcare	1 year	1 year	1 year
Marine	1 year	2 years	2 years

Source: ACR 2006 Assessment, Cleaning & Restoration of HVAC Systems.

Implementing HVAC hygiene procedures is a worthwhile approach to improving and maintaining acceptable indoor air environments and reducing the potential for contaminated systems to impact on the health and comfort of occupants and the quality of manufactured products such as foods and pharmaceuticals. When implementing these procedures the main areas to consider are:

- Regular and documented inspections of all HVAC plant, components, internal insulation and ducting,
- Where required the nature of the contaminants present in the system should be identified,
- Schedule of cleaning and decontamination based on the inspections,
- Methodology of cleaning and decontamination,
- Cross contamination control to protect the clients premises, equipment, furnishings and indoor air quality,
- Health and safety of the cleaning staff and building occupants,
- Use of sanitisers proven for safe use in air HVAC systems,
- Effective evaluation and planning of the project,
- Effective communication between building occupants, property owners and cleaning contractors and other interested parties,
- Validation of the project at completion to ensure acceptable levels of cleanliness have been achieved,
- Finally when specifications are written for the project or an ongoing program all of the above aspects should be included in the specification to ensure a successful project,

Conclusion

Although poor HVAC hygiene is not the only contributor to IAQ problems it represents a preventable problem if regular inspections dictate the need for remedial action. Including post construction HVAC cleaning in engineering specifications and a documented inspection schedule in maintenance programs to determine future needs for cleaning and decontamination must be viewed as responsible engineering practice.

Bibliography

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