

Role of O&M in Maintaining Good IAQ

by Aneesh Kadyan

Air Quality or the lack of it is a key topic of discussions in all forms of media these days. Rising air pollution levels are being recorded not only across all major cities in the country but also in smaller towns. There is also a greater awareness amongst the population of the ill effects of pollutions and the sources of pollution as well. People are now aware of the impact of Particulate Matter (PM) 10 and 2.5 in the air, a major change from a few years back when air pollution always meant smog. With greater urbanization and rapidly expanding population of cities and towns, the work is moving from outdoors as was the case with people employees in agriculture, to indoors. More and more people are spending more time inside buildings and work spaces than out one the open and hence, the quality of air within these spaces is as important as the air outside in environment.

Ventilation plays a key role in making buildings, work spaces as well as the places we reside in habitable. Traditional homes had natural ventilation arrangements such as openings near the ceiling to allow hot and stale air to move out as it got displaced by the cooler outside air. Modern buildings which house large numbers of workers can no longer rely on natural ventilation and mechanical ventilation is essential to make the space usable. Thus, ventilation of the work or living space is critical to ensure a healthy atmosphere for the occupants.

In office ventilation systems, air gets recirculated within the work space, with only minor (5 – 10%) of fresh air being introduced into the system. Thus, pollutants which are generated within the work space will remain in the system if not filtered out or treated. Some of the common pollutants found in office spaces and their effect on humans are shown in table below. In addition, good IAQ also involves having the right levels of light, correct thermal comfort and appropriate levels of carbon dioxide.

NO ₂	Irritation to the skin, eyes and throat, cough etc
CO	Causes: headache, shortness of breath, higher conc. May cause sudden deaths.
VOCs	Liver, kidney disorders, irritation to the eyes, nose and throat, skin rashes and respiratory problems Formaldehyde Irritation to the eyes, nose and throat, fatigue, headache, skin allergies, vomiting etc.
SO ₂	Lung disorders and shortness of breath
O ₃	Eyes itch, burn, respiratory disorders, lowers our Resistance to colds and pneumonia.

Office spaces are designed for optimal ventilation based on applicable standards such as ASHRAE 62.1 – 2010 “Ventilation for Acceptable Indoor Air Quality” and the National building code (NBC). Like any system however, if the system is not operated or maintained properly, the desired output, which is clean and healthy air will not be achieved.

Ventilation Systems in Buildings

The “V” in HVAC stands for Ventilation and is an important component of building systems that enable the occupants to work or inhabit the space in a safe and comfortable manner. Ventilation essentially means movement of air or circulation of air in the work space with the aim of transferring heat as well as maintaining a healthy atmosphere for the occupants. The key functions of a ventilation system in a building are

- Supply of fresh, outside air and removal of the stale air within the work space
- Filtration of recirculated and fresh air
- Removal of heat from the space – heat from equipment’s, occupants etc.
- Transfer of cool air to work spaces for comfort air conditioning
- Removal of odors in spaces such as washrooms, kitchens, closets etc.
- Excavation of smoke in emergencies

- Extraction of pollutants in basements from vehicular exhaust system

A typical building or office ventilation system consists of the following main elements

- The Air Handling Units (AHU)
- System ducting
- Air curtains where installed
- Exhaust systems (Basement, stairwells, washrooms)

All these elements are designed to operate at their peak efficiencies so that the whole system is able to deliver air as per project requirements. Like any mechanical system, there is a tendency for the components to deviate from the design points either due to wear and tear, improper operating or poor maintenance.



Operations and Maintenance Best practices for good IAQ

Typically, the focus of the O&M in a building is on the high value assets such as the Chiller, generators etc. While there is a preventive maintenance schedule for the ventilations system components, the adherence to the plan is often not so robust due to either lack of knowledge/awareness of impact of poor ventilation system maintenance or in many cases, lack of adequate resources to undertake the maintenance. The impact in either of the cases is the fall in IAQ which can have far more serious repercussions on employee health and productivity than a chiller failure.

There is thus a need for the O&M team to have a detailed maintenance plan and also ensure allocation of adequate resources for the activities. Some of the methods that building managers can adopt to ensure a high level of IAQ are shown in figure 1 and explained below:

- **Maintenance of AHU filters:** Filtration is the first step in preventing pollutants entering the work space. Most modern AHUs have multi-layer filtration systems and the maintenance team needs to carry out filter upkeep as per the manufactures guidelines. While this seems a very basic task, experience shows that filter cleaning is often not carried out due to inaccessibility of the filters, lack of staff or time for cleaning the filters or simply lack of awareness of the need to maintained the system.
- **Keep the AHU room clean:** Most occupants of a building do not ever enter an AHU room and hence do not know what's inside. Where the building management is not so concerned about IAQ, one would generally find the AHU rooms being used as store rooms or change rooms for the maintenance staff. Cleaning chemicals are often kept in the AHU rooms. Since the return air system takes in air from the AHU room for mixing with the return air, any contaminants due to these unwanted items in the AHU room will impact the IAQ



- **Maintain AC discipline:** Any air entering the work space other than from the AHU will be untreated air as it has not

passed through a filter. Thus, ingress of untreated air should be minimized by using suitable technologies such as air curtains and air locks. Awareness amongst the occupants on the need to maintain the air conditioned space discipline by keeping doors closed when not in use is also essential to improve IAQ.

- **Measure Air Quality:** What cannot be measured cannot be measured is a famous management phrase, and this applies to ventilation as well. Measurement of the air quality in the work space is essential to assess effectiveness of the ventilation system. The key parameters that are typically measured in an IAQ test are Carbon dioxide, particulate matter concentration and microbiological content in the air. While a six monthly measurement of IAQ is desirable, the test should be done at least once a year. Low cost measurement devices are now available that allow online measurement of a few important parameters such as CO and particulate matter.
- **Maintaining Outdoor Air Quality:** The air that circulates in a building comes from the surroundings of the buildings, and hence, efforts should be made to keep the environment around the building as healthy as possible. Air intake systems should be free from obstructions and no debris or air pollution causing agents should be allowed near the air inlets.
- **Operating AHU's at Design points:** The air flow rates of AHU's are designed keeping in mind the occupancy and layout of the office space. The air flow rate depends on the number of people as well as floor area. Thus, any change in the floor occupancy density will require a change in the AHU flow rates. This however does not occur in practice and leads to poor air quality in the work space.
- **Air Balancing:** The occupancy of the floor or the layouts keep on changing in any office environment, due to operational requirements or space constraints. The original ducting of the office is designed for the original layout and aims to provide the right quality of air to the various spaces in the office. When changes occur in the work space (e.g meeting room converted to cubicle seating), or the density of staff increases, the original AHU flow patterns do not work. There is thus a need to reassess the flow whenever such change occurs to ensure that the IAQ is maintained. This may also involve tweaking with the AHU air flow rates.
- **Duct Cleaning:** Ventilation system ducting typically remains out of sight and hence out of mind for the O&M team. Duct surfaces accumulate dust and microbiological growth over a period of time which impact both the energy consumption of the system as well as the quality of the air in circulation. A good practice to follow is an annual duct inspection at selected points in the system and a mandatory cleaning of the ducting in 3 years.

A well designed ventilation system provides occupants with clean, healthy air which is essential for employee wellness as well as overall organizational productivity. While the components of the ventilation system are simple, the whole system is complex as there are a number of interdependencies and variables. The O&M team should thus be fully conversant with the design intent of the ventilation system and the maintenance procedures of the components to enable the ventilation system to function at an optimal level. Simple and common sense practices are all that are needed to keep the ventilation system delivering the desired output and the O&M team plays a key role in ensuring this. Therefore, effective operations and maintenance of the ventilations system will go a long way to ensure a healthy and productive work force.

Author



Aneesh Kadyan

Director -
Operations, for a
leading real estate
services firm

Aneesh Kadyan, Director - Operations, for a leading real estate services firm, heads the operations of a large team of professionals in the building and facility management arena. He is a post graduate in Mechanical Engineering and has over 22 years' experience in management of services in technology intensive environments. His areas of interest include Maintenance management, corporate governance, and Strategic planning and technology interventions in Industry. Aneesh is a Professional Engineer (PE), a certified Energy Auditor and an IGBC Accredited Professional (AP). He is the president of the Delhi Chapter of ISHRAE for 2016 – 17.