AirTest™
Sensors That Make Buildings Smart!

CO_2 Ventilation Control For Smoking Areas In Hospitality Applications

Overview

This paper provides a brief overview of how CO_2 based ventilation control can be used in the hospitality industry to ensure adequate ventilation is provided at all times to safely control the byproducts of smoking. This approach can also reduce energy costs and is easily verifiable by third parties using low cost portable instrumentation readily available in the marketplace.

Ventilation In Smoking Environments

It is possible for facility operators to maintain a smoker friendly policy, while at the same time ensure good air quality for all building occupants. This approach involves providing adequate outside air ventilation to dilute contaminants in the space that may be produced by both occupants and their activities such as smoking. ASHRAE standard 62-1999 "Ventilation For Acceptable Indoor Air Quality" (Standard 62) has established ventilation rates for both smoking and non-smoking environments. In non-smoking environments Standard 62 recommends a minimum ventilation rate of 15 cfm/person (1). In smoking environments ventilation rates must be increased to 30 cfm per person. By ventilating on a per person basis, ventilation can be controlled in proportion to occupant activity.

Energy Impact Of Ventilation

Outside air ventilation is not free. Outside air introduced to a space must be conditioned to meet the comfort requirements of the space. It must be either heated cooled and in some climates humidified or dehumidified before it enters the space.

The traditional approach to providing ventilation in buildings has been to provide a fixed rate of ventilation based on maximum assumed occupancy. This approach was primarily developed for low-density applications like office space that tend to have fairly static occupancies at or near full capacity. However, the same approach can prove quite costly for the hospitality industry where occupancies are periodic and highly variable. The cost of continuously ventilating a space at a fixed rate based on maximum possible occupancy to control smoking (30 cfm[1] per person) could prove prohibitive for most hospitality facilities.

Control Of Ventilation Based On Occupancy

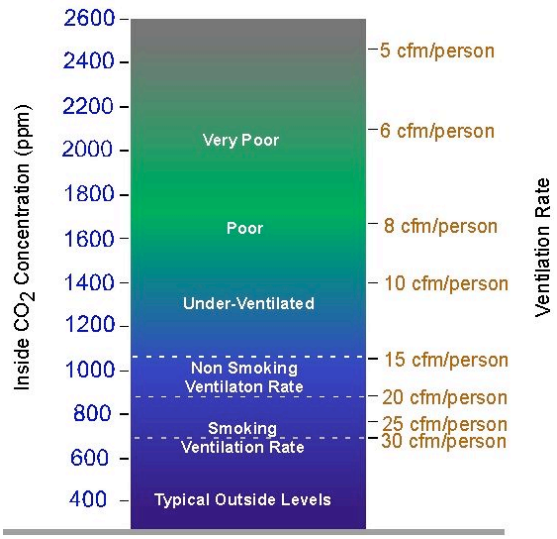
Modulating ventilation according to actual occupancy within the space can significantly mitigate the energy impact of providing higher rates of ventilation for smoking. Increasingly, building control systems are using the concentration of carbon dioxide (a major component of exhaled breath), as a indicator of occupancy and ventilation rates within a space. Most major building control companies now offer this type of ventilation control that can ensure that a target cfm/person is maintained.

This occupancy-based approach to ventilation control is based on the fact that concentrations of CO_2 in outside air are consistently low (typically near 400 parts per million – ppm). Inside buildings, people are the sole significant source of CO_2. As a result, an indoor CO_2 measurement is a dynamic measure of the

[1] cfm = cubic-feet-per-minute of outside air.

number of people in the space exhaling CO_2 and the amount of low concentration outside air introduced by ventilation. As a result the CO_2 concentration in a space can be directly related to a ventilation rate per-person in the space. CO_2 Concentrations can both be used to actively control ventilation rates in a space and can also be used by third parties to verify that current levels of ventilation meet the cfm per person requirements of local codes or regulations.

The principal of using CO_2 based ventilation control is recognized by ASHRAE Standard 62-89 as a viable, occupancy-base ventilation approach. It is also recognized by the International Mechanical Code and has been adopted as a method of verifying adequate ventilation as part of the recently implemented BC Workman's Compensation Board requirements for indoor air quality in non-industrial work environments. The attached chart shows the relationship between CO_2 levels and cfm-per-person ventilation rates. For every ventilation rate there is a corresponding CO_2 level. Assuming a outside concentration of 400 ppm a CO_2 concentration of 1100 ppm would be considered equvalent to 15 cfm per person and a concentration of 700 ppm would be considered equvalent to 30 cfm/person. It is important to note that the correlation of CO_2 levels to ventilation rates is applicable regardless of occupant density.



In hospitality applications guidelines appropriate ventilation for smoking environments could be maintained by requiring that CO_2 levels not exceed 700 ppm during occupied periods. This approach would allow ventilation only for the number of people in the space and avoid costly over ventilation resulting from continuously ventilating for full occupancy.

CO_2 Measurement Technology

Technology used to measure CO_2 in buildings is well established. The total cost of installing a CO_2 control into an existing system is about $500 per sensor point. Easy to use portable CO_2 sensors are also readily available that measure CO_2 and that can be used for inspection and verification purposes.