BAPI Indoor Environment Quality Sensor offers an alternative to CO_2 for Demand Controlled Ventilation

True Blue IEQ BAPI®

Most system designers use CO_2 sensors to indicate room occupancy as part of their Demand Controlled Ventilation (DCV) setup. The problem with this method is that it ignores the harmful contaminants that may be present in the air even when the CO_2 levels are low.

BAPI's Indoor Environment Quality (IEQ) Sensor offers the best of both worlds. It allows for ventilation based on occupancy as well as air contaminants.

The IEQ sensor does this by measuring Volatile Organic Compounds (VOCs) then outputing a signal that corresponds to a CO_2 level of 0-2,000 ppm. This means system designers can use their existing CO_2-based DCV occupancy algorithms while monitoring both occupancy and VOCs.

One of the keys to the IEQ sensor is the fact that VOCs are as good an indicator of space occupancy as CO_2. That's because a large share of VOCs in an indoor space are generated by humans from our breath, sweat and skin or from colognes and perfumes, etc. (See Table 1.)

Extensive research was conducted on human occupancy, VOC levels and CO_2 levels in 1,500 offices, schools and homes to determine the relationship between these three factors. The research identified a complex correlation algorithm, and this algorithm was used to create the CO_2 equivalent output of the IEQ sensor. The accuracy of the IEQ output as compared to CO_2 levels and occupancy is shown in the two charts at right.

The IEQ output tracks occupancy and CO_2 levels in the two charts but also indicates when additional ventilation is needed because of other contaminants.

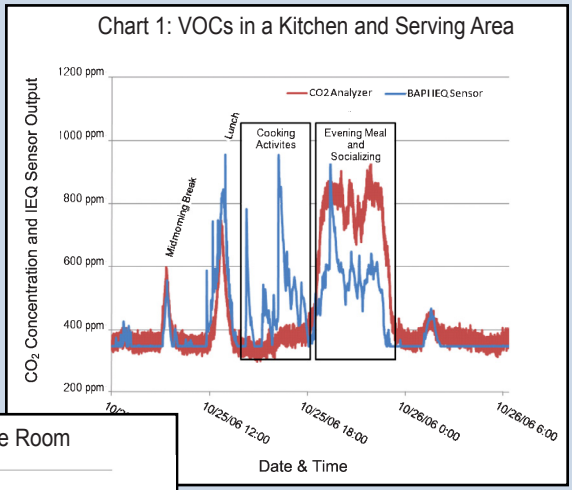
More information including a White Paper and Video are available on our website at **www.bapihvac.com**

Table 1 – Typical Indoor Contaminants (VOCs) and Their Source

Contamination Source	Emission Source	VOC
Human Being	Breath	Acetone, Ethanol, Isoprene, CO_2
	Skin Respiration & Perspiration	Nonanal, Decanal, alpha-Pinene
	Flatulence	Methane, Hydrogen,
	Cosmetics	Limonene, Eucalyptol
Consumer Products	Household Supplies	Alcohols, Esters, Limonene
Office Equipment	Printers, Copiers, Computers	Benzene, Styrene, Phonole
Combustion	Engines, Appliances, Smoke	Unburnt Hydrocarbons, CO, CO_2
Building Materials	Paints, Adhesives, Carpets	Formaldehyde, Alkanes, Alcohols, Aldehydes, Ketones
Furniture	**P**oly **V**inyl **C**hloride (PVC)	Toluene, Xylene, Decane

Data shows direct correlation between VOCs and occupancy

Chart 1 shows the kitchen and serving area in a cafeteria during a 24-hour period. The red line is the measured CO_2 in the zone and the blue line is the output of the BAPI IEQ sensor. The VOC levels measured by the IEQ sensor followed the CO_2 levels during the time that the space was heavily occupied ("Midmorning Break", "Lunch" and "Evening Meal and Socializing"). That's because the majority of the additional VOCs were generated by the people in the space. But BAPI's IEQ sensor also detected non-human generated VOCs during the "Cooking Activities" period that the CO_2 sensor did not detect. The IEQ sensor will allow these VOCs to be ventilated away while the CO_2 sensor will not.



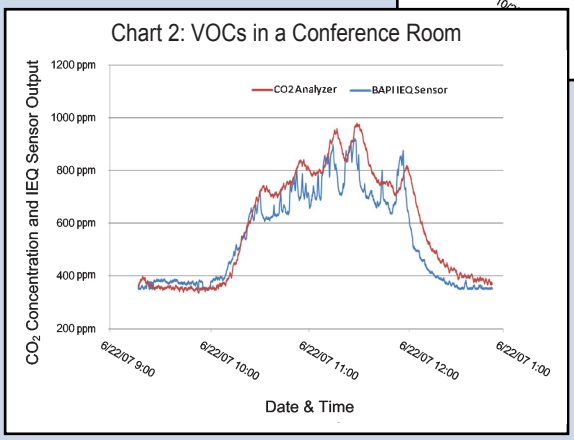


Chart 2 shows a large conference room where 70 people come and go during a 95 minute period between 10 AM and 11:35 AM. The increase in CO_2 levels and VOC levels during that time are both generated by the people in the space, thus BAPI's IEQ sensor is nearly an exact match to the CO_2 sensor, showing that VOCs are an accurate indicator of space occupancy.

Chart data was compiled by the Institut für Bauphysik (IBP), part of the Fraunhofer Institute, a group of academic institutes focusing on applied sciences located in Stuttgart, Germany. The tests were conducted using sophisticated instrumentation including Gas Chromatography, Mass Spectrometry (GC/MS) and GC olfaction, along with standard NDIR CO_2 sensors and BAPI's IEQ sensor.