Aero Environmental Consulting

Report: Indoor Air Quality Survey

Providing Comprehensive Environmental Assessments

Accurate, comprehensive, and independent environmental assessments helping to resolve your environmental concerns.

Company Background

Aero-Environmental Consulting was founded in 2002 as a professional consulting firm in the environmental science industry. Our team has the education, training, and experience required to meet all of your consulting needs. We hold a variety of certifications including Asbestos, Lead, and Microbial Consulting. We are committed to our program of on-going training and continuing education in order to best assist our clients with the greatest level of expertise and knowledge. The focus of our business has been to assist clients in identifying and resolving environmental issues. State and local governments, universities, school districts, and insurance firms turn to us when they have environmental concerns.

Mission Statement

It is our mission is to provide reliable, accurate, comprehensive, independent environmental assessments with state of the art equipment. Our experienced and certified environmental consultants help our customers resolve environmental concerns in their property.

Investigator

Jorge Vizcaino Certified Asbestos ConsultantCertified Microbial ConsultantCertified Infrared Building ThermographerRegistered Environmental AssessorCertified Lead Inspector/Assessor

Report Prepared By

Jorge Vizcaino, Owner/CEO

Disclaimer

This is Aero Environmental Consulting 's report of a walk-through, visual survey and an on-site measurement of the parameters described in this report. The test results only apply to those rooms or spaces that were tested and that are specifically described during the course of this survey.

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General Building Basic Survey Strategy

A walk-through visual site inspection of several occupied spaces on the floor where complaints have originated, plus a few representative spaces on other floors has been initiated.

In-situ spot testing has been logged at each of these spaces utilizing the equipment detailed near the end of this report. Data-log trending, over the course of a full work day, was initiated at the location that has been the main source area for complaints.

Notes have been taken when suspect conditions have been identified. Such conditions include: dirty or unsanitary areas, visible fungal growth, unusual or “moldy” odors, moisture on walls/floors/ceilings, staining or discoloration, smoke damage, cracks or holes at ground level that might indicate soil gas intrusion, the presence of hazardous substances, the presence of ozone generators or other personal air cleaners, poorly maintained filters, non-functioning HVAC equipment, blocked vents, overcrowding and other conditions that could impact IAQ.

During the walk-through, mechanical rooms have also been visually inspected.

A walk around the perimeter of the building, and visual inspection has also been conducted. Outdoor air was measured and recorded.

A USEPA/NIOSH Occupant Interview has been completed for each occupant in the complaint area. These documents are attached at the end of this report.

Site Information

ABC- Office Survey

Client: ABC Company

Text Note

ACME Office Building appears, upon initial impression, to be a well-maintained facility. Our plan is to take snapshot samples from one or two representative areas on those floors other than the 2nd floor from where complaints have emanated. We'll then take snapshot readings from numerous locations on the 2nd floor, and trend log, for the course of a work day, the 2 locations where the complaints have arisen.

Outdoor Air Data

Outdoor air table was not found

Basic Outdoor Air Info

Outdoor air conditions will change over the course of the day, and the above figures represent a "snapshot' of the outdoor conditions at the time that the readings were recorded. However, it is of practical interest to compare the outdoor air measured values, to those measured indoors on the same date.

Detailed Measurement/Parameter Info

Temperature

Why Measure Temperature

Temperature is among the most common of indoor air environmental factors implicated in occupant discomfort. It is often recognized as an aggravating factor, when other indoor comfort issues exist. In fact, numerous studies have found an association of increased air temperatures with Sick Building Syndrome symptoms and with perceptions of worsened IAQ. While direct temperature related health problems are unusual for IAQ surveys, extreme cold or extreme heat carry obvious health hazards. Elevated temperatures may also increase the off-gassing from building materials of irritating and, sometimes, hazardous compounds, including volatile organic compounds.

Government and Industry Guidelines for Temperature

US OSHA Standard Interpretations: 02/2003 - Reiteration of Existing OSHA Policy on Indoor Air Quality: As a general rule, office temperature is a matter of human comfort. OSHA has no regulations specifically addressing temperature in an office setting. However, Section III, Chapter 2, Subsection V of the OSHA Technical Manual, "Recommendations for the Employer," provides engineering and administrative guidance to prevent or alleviate indoor air quality problems. US OSHA recommends temperature control in the range of 68-76 F (20-24 C).

ASHRAE (American Society of Heating Refrigeration and Air-Conditioning Engineers) Standard 55-2004 states that occupant comfort may best be obtained by maintaining operative temperatures (approximated by air temperatures under specific conditions) between ~67F (19C) and ~80F (27C) at the maximum acceptable 62.2F (16.8C) dew point temperature or between ~71F (21.5C) and ~83F (28C) at very low humidity ~0F (-18C) dew point temperature. Clothing, radiant heat and many other factors influence the recommendations of this standard. Reference ASHRAE Standard 55-2004 for details.

Temperature detail for Executive Office (IQ610 + Trend Example + Notes)

Location	Date/Time	Temperature °F	Comments
Executive Office Trend (15-Mar-08)*	15-Mar-08 07:37:01 AM to 15-Mar-08 01:38:01 PM	74.3	*average reading

Relative Humidity

Why Measure Relative Humidity

Relative humidity indicates how moist the air is.

Relative humidity may be defined as the ratio of the water vapor density (mass per unit volume) to the saturation water vapor density, usually expressed in percent. Relative humidity is also approximately the ratio of the actual to the saturation vapor pressure.

Actual vapor pressure is a measurement of the amount of water vapor in a volume of air and increases as the amount of water vapor increases. Air that attains its saturation vapor pressure has established equilibrium with a flat surface of water. That means, an equal number of water molecules are evaporating from the surface of the water into the air as are condensing from the air back into the water.

Relative Humidity is among the most common of indoor air environmental factors implicated in occupant discomfort. Elevated humidity has been shown to be associated with a worsened perception of IAQ. High %RH is also an indicator of conditions favorable to mold and microbial growth.

Government and Industry Guidelines for Relative Humidity

US OSHA Standard Interpretations: 02/2003 - Reiteration of Existing OSHA Policy on Indoor Air Quality: Office Temperature/Humidity and Environmental Tobacco Smoke: As a general rule, office temperature and humidity are matters of human comfort. OSHA has no regulations specifically addressing temperature and humidity in an office setting. However, Section III, Chapter 2, Subsection V of the OSHA Technical Manual, "Recommendations for the Employer," provides engineering and administrative guidance to prevent or alleviate indoor air quality problems. OSHA recommends humidity control in the range of 20%RH-60%RH.

ASHRAE (American Society of Heating Refrigeration and Air-Conditioning Engineers) Standard 55-2004 states that occupant comfort may best be obtained by maintaining humidity ratio below 0.012. This can be calculated, at standard atmospheric pressure, as a maximum of approximately 56%RH at 80F (27C) up to approximately 86%RH at 67F (19C). Clothing, radiant heat and many other factors influence the recommendations of this standard. Reference ASHRAE Standard 55-2004 for details.

Per ASHRAE Standard 55-2004: There are not any established lower humidity limits for thermal comfort. .. However, non-thermal comfort factors such as skin drying, irritation of mucus membranes, dryness of the eyes, and static electricity generation, may place limits on the acceptability of very low humidity environments.

Relative Humidity detail for Executive Office (IQ610 + Trend Example + Notes)

Location	Date/Time	Humidity %RH	Comments
Executive Office Trend (15-Mar-08)*	15-Mar-08 07:37:01 AM to 15-Mar-08 01:38:01 PM	26.8	*average reading

Carbon Monoxide

Why Measure Carbon Monoxide

Elevated CO may be present in any type of space for a number of reasons: most commonly due to inappropriately exhausted combustion processes.

This insidious toxic gas is odorless, and often goes undetected prior to detrimental levels of exposure which may lead to short-term productivity issues and to long-term health effects. At highly elevated levels Carbon Monoxide MAY BE FATAL!

Health Effects Associated with Carbon Monoxide

At low Carbon Monoxide concentrations, fatigue in healthy people and chest pain in people with heart disease. At moderate concentrations, impaired vision and coordination; headaches; dizziness; confusion; nausea. Can cause flu-like symptoms that clear up after leaving the space that contains the elevated concentrations. May be fatal at very high concentrations.

Acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake leading to reduced brain function.

Typical Background Levels for Carbon Monoxide

Global CO background concentrations, outdoors, fall in the range of 60 to 140 g/m3 (0.05 to 0.12ppm).

Average levels in homes without gas stoves vary from 0.5 to 5 parts per million (ppm). Levels near properly adjusted gas stoves are often 5 to 15 ppm and those near poorly adjusted stoves may be 30 ppm or higher.

Per AIHA "The IAQ Investigator's Guide", 2006
Levels commonly found indoors*: ND to 4ppm

*Outside level may affect inside levels

Typical Sources of Carbon Monoxide

Elevated CO may be present in any type of space for a number of reasons: most commonly due to inappropriately exhausted combustion processes.

Idling motor vehicles such as gas or propane powered fork lifts; unvented kerosene and gas space heaters; leaking chimneys, boilers and furnaces; back-drafting from furnaces, gas water heaters, wood stoves, and fireplaces; gas stoves; generators and other gasoline powered equipment and tobacco smoke are all common CO sources. Incomplete oxidation during combustion in gas ranges and unvented gas or kerosene heaters may cause high concentrations of CO in indoor air. Worn or poorly adjusted and maintained combustion devices (e.g., boilers, furnaces) can be significant sources, or if the flue is improperly sized, blocked, disconnected, or is leaking. Auto, truck, or bus exhaust from attached garages, nearby roads, parking areas or air intakes improperly located near loading docks or rooftop heliports, for example, can also be a source.

Government and Industry Guidelines for Carbon Monoxide

The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for carbon monoxide is 50 parts per million (ppm) parts of air (55 milligrams per cubic meter (mg/m(3))) as an 8-hour time-weighted average (TWA) concentration [29 CFR 1910.1000 Table Z-1 as of Feb 2006].

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for carbon monoxide of 35 ppm (40 mg/m(3)) as an 8-hour TWA and 200 ppm (229 mg/m(3)) as a ceiling [NIOSH 1992].

ACGIH 2006 TLVs and BEIs; 25ppm (8 hour TWA).

ASHRAE Standard 62.1-2004 references US OSHA, NIOSH and ACGIH values. However, ASHRAE suggests that consideration must be taken that those values have been established for healthy workers. For indoor environments, where occupants may not be of excellent health, may be exposed to more than 8 hours per day, and may not be expecting any type of toxic exposure; exposures should always be lower than the worker exposure levels.

The U.S. EPA National Ambient Air Quality Standards, 1990, for outdoor air are 9 ppm (10 mg/m3) for 8 hours, and 35 ppm (40 mg/m3) for 1 hour.

The World Health Organizations guidelines for carbon monoxide exposure (1987):

- 100 mg/m3 (90 ppm) for 15 min
- 60 mg/m3 (54 ppm) for 30 min
- 30 mg/m3 (27 ppm) for 1 h
- 10 mg/m3 (9 ppm) for 8 h

Carbon Monoxide detail for Executive Office (IQ610 + Trend Example + Notes)

Location	Date/Time	CO ppm	Comments
Executive Office Trend (15-Mar-08)*	15-Mar-08 07:37:01 AM to 15-Mar-08 01:38:01 PM	0.6	*average reading

Carbon Dioxide

Why Measure Carbon Dioxide

CO_2 is measured as a tracer gas, to determine the outdoor air ventilation (dilution air) rate in an occupied space. It is rarely of toxic concern for indoor air quality applications.

People exhale CO_2 (at a concentration of almost 40,000 ppm), and therefore are used as the source of the tracer gas (although CO_2 may be injected into an unoccupied space as an alternative method).

Low CO_2 concentration, when measured during periods of average and higher occupancy, implies that human generated pollutants are being properly diluted. And in absence of a specific pollutant source, it is a rough estimator that the thousands of potential building generated pollutants are being dispersed. This makes it a key indoor air quality indicator.

Health Effects Associated with Carbon Dioxide

Carbon Dioxide is very rarely a pollutant of direct health concern, itself! Rather, because building occupants exhale CO_2 (at close to 40,000 ppm), the CO_2 that they breathe out is used as a tracer gas that is an excellent indicator of adequate (or inadequate) ventilation. Insufficient ventilation can lead to occupant complaints of discomfort and reduced productivity as human and building generated pollutants build up. Some combinations of these elevated pollutants may have short or long-term detrimental health effects.

CO_2 will generally only be of concern as a toxic gas itself in industrial processes where bottled CO_2 gas is utilized, such as breweries, or when there is an inadequately ventilated combustion process (where the other combustion gases will usually be of much greater concern).

Typical Background Levels for Carbon Dioxide

Typical outdoor CO_2 levels are 350 to 360ppm (although they can be 100 to 300ppm higher in urban areas). It is of note that the average outdoor CO_2 levels worldwide have increased >25ppm over the last 50 years.

Typical Sources of Carbon Dioxide

The concentration of CO_2 in the exhaled breath of building occupants approaches 40,000 ppm. For light office work, the estimated CO_2 generation rate of 0.6 cfm/min (0.3 l/s) per occupant is typically assumed. This will usually increase the CO_2 concentrations in the occupied space above the outdoor, ambient levels. The greater the outdoor (dilution) air ventilation rate, generally the less increase in CO_2 that will be observed.

In general, CO_2 will only be of concern as a toxic gas itself in industrial processes where bottled CO_2 gas is utilized, such as breweries and fire extinguisher mfg, or when there is an inadequately ventilated combustion process (where the other combustion gases will normally be of much greater concern).

Generally, house plants will have an insignificant impact in reducing the CO_2 concentrations that result from human occupation.

Government and Industry Guidelines for Carbon Dioxide

US OSHA Technical Manual (section iii, chapter 2), 1999, states that 1,000 ppm CO_2 should be used as an upper limit for indoor levels, as a guideline for occupant comfort.

US OSHA Regulation (Standards - 29 CFR), 1997 TABLE Z-1 Limits for Air Contaminants. - 1910.1000 TABLE Z-1 PEL (Permitted Exposure Level), updated as of Feb 2006: 5000ppm; 9000 mg/m3 for an 8 hour Time Weighted Average (TWA). It is of note that OSHA has published intentions to raise the 8 hour CO_2 TWA to 10,000ppm, but this change is yet to be approved.

OSHA 1994 proposed Indoor Air Quality Rules: If the indoor sample results show levels that are greater than 800 ppm or that the indoor levels are significantly more than the outdoor levels, initiate actions to investigate the functioning of the HVAC system and determine if the employees are affected. Note that the proposed 1994 IAQ rules have not been adopted by OSHA.

NIOSH 1992 REL (Recommended Exposure Limit): TWA 5000 ppm (9000 mg/m3) STEL (Short Term Exposure Limit) 30,000 ppm (54,000 mg/m3)

ACGIH 2006 TLVs & BEIs: 5000ppm 8 hour TWA, 30,000ppm STEL

ASHRAE Standard 62.1-2004 suggests maintaining a steady-state CO_2 concentration in a space no greater than about 700 ppm above outdoor air levels to remove human generated pollutants. Additional ventilation may be needed to dilute building generated pollutants.

ASHRAE Standard 62.1-2004 defines adequate ventilation for specific use designed spaces. For example, 17 cfm/person of dilution air is suggested for office spaces (because such spaces have additional pollutants introduced from copiers, laser printers, etc), which translates to a CO_2 concentration of roughly 600 ppm above outdoor air levels.

There are no USEPA outdoor standards for CO_2. Typical outdoor CO_2 levels are usually 350ppm to 360ppm (although they can be 100-300ppm higher in urban areas).

Carbon Dioxide detail for Executive Office (IQ610 + Trend Example + Notes)

Location	Date/Time	CO2 ppm	Comments
Executive Office Trend (15-Mar-08)*	15-Mar-08 07:37:01 AM to 15-Mar-08 01:38:01 PM	1035	*average reading

Ammonia

Government and Industry Guidelines for Ammonia

US OSHA Regulation (Standards - 29 CFR), 1997

TABLE Z-1 Limits for Air Contaminants. - 1910.1000 TABLE Z-1

PEL (Permitted Exposure Level), updated as of Feb 2006:
50 ppm TWA (35 mg/m3)

ACGIH TLVs (Threshold Limit Values) Guideline, 2006:
25ppm TWA, 35ppm STEL
NIOSH 35ppm STEL

STEL = Short Term Exposure Limit
TWA = Time Weighted Average (8 hour)

Ammonia detail for Executive Office (IQ610 + Trend Example + Notes)

Location	Date/Time	Ammonia ppm	Comments
Executive Office Trend (15-Mar-08)*	15-Mar-08 07:37:01 AM to 15-Mar-08 01:38:01 PM	0.0	*average reading

TVOC-ppb range

Why Measure TVOC-ppb range

A Volatile Organic Compound (VOC) is defined as any compound containing carbon, except methane, that can be readily vaporized. Total VOCs are known as TVOCs, Microbial generated VOCs are known as MVOCs.

VOCs are released into indoor environments from cleaning and disinfecting products, paints, wood preservatives, carpeting, building materials, copier machines, aerosol sprays, moth repellants, air fresheners, perfumes, dry cleaned clothing, microbial growth and a host of other sources.

The USEPA has consistently measured higher levels of VOCs in indoor environments when compared to outdoors (ref "Report to Congress on Indoor Air Quality: Exec Summary and Recommendation", Vol 1-3, EPA-400/1-89-001 A-D)

While some specific VOCs have adverse health effects at low concentrations, many others do not. When measuring the whole 'soup' of VOCs, an elevated TVOC reading, in that absence of a known benign VOC source, is an indication that a closer examination and possible air sampling for lab analysis may be justified.

A Photo Ionization Detector (PID) sensor based VOC monitor can also be useful, in some circumstances, to bloodhound the source of elevated VOCs.

The PID is one of the most widely used gas detection techniques. The main field of PID application is for detection of a wide variety of organic compounds and some inorganic gases in ambient air.

Note that a PID will not distinguish between different specific compounds; it is not a specific gas analyzer.

Health Effects Associated with TVOC-ppb range

In sufficient quantities, some VOCs can cause eye, nose, and throat irritation; headaches, loss of coordination, nausea; damage to liver, kidney, and central nervous system. Some organics can cause cancer in animals; some (such as Benzene) are suspected or known to cause cancer in humans. Key signs or symptoms associated with exposure to VOCs include conjunctival irritation, nose and throat discomfort, headache, allergic skin reaction, dyspnea, declines in serum cholinesterase levels, nausea, emesis, epistaxis, fatigue, dizziness.

The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those (such as Acetic Acid, an approximately 5% component of vinegar) with no known health effect. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics usually found in buildings or homes.

Typical Background Levels for TVOC-ppb range

The US EPA's Total Exposure Assessment Methodology (TEAM) studies have found levels of about a dozen common organic pollutants to be 2 to 5 times higher inside homes than outside, regardless of whether the homes were located in rural or highly industrial areas. Additional TEAM studies indicate that while people are using products containing organic chemicals, they can expose themselves and others to

very high pollutant levels, and elevated concentrations can persist in the air long after the activity is completed.

For buildings, toluene (one of the most prevalant VOCs in indoor air) has itself been reported in a majority of indoor air samples, at an overall average ~0.15mg/m3 (40ppb).

The USEPA initiated study "INDIVIDUAL VOLATILE ORGANIC COMPOUND PREVALENCE

AND CONCENTRATIONS IN 56 BUILDINGS OF THE BUILDING ASSESSMENT SURVEY AND EVALUATION (BASE) STUDY"; Girman, Hadwen, Burton, Womble & McCarthy, published in the Proceedings of Indoor Air 1999 found (for "randomly selected buldings"):
"Forty-eight VOCS were found indoors at quantifiable concentrations. Eight VOCS were found in all samples and an additional 26 VOCS were found in 81-99% of the samples....the twelve VOCs with the highest median indoor concentrations: acetone; toluene; d-limonene; m- & p-xylenes; 2-butoxyethanol; n-undecane; benzene; 1,1,1-trichloroetha.ne; n-dodecane; hexanal;nonanal; and n-hexane. Indoor VOC concentrations ranged from below the limit of detection to 0.45 mg/m3".

In a review of 12 studies of indoor VOC concentrations by Johansson*, the range was found to be 0.5 to 19 mg per cubic meter in new buildings, which is 10 times the range of older buildings (0.01-1.7 mg per cubic meter). The most common VOC's reported included alkanes (decane, undecane, nonane), and aromatic hydrocarbons (toluene most prominently).

*Johansson I. Kemiska luftfororeningar inomhus. En Litteratursammanstallning. Rapport no. 6/1982. Statens Miljomedicinska laboratorium. Stockholm. Cited in Molhave L. Volatile Organic Compounds as Indoor Air Pollutants. In: Gammage RB, et. al., eds. Indoor Air and Human Health. Chelsea, MI: Lewis Pub., 1985, 403-414.

Typical Sources of TVOC-ppb range

A wide array of volatile organics are emitted by products used in home, office, school, and arts/crafts and hobby activities. These products, which number in the thousands, include:

- personal items such as perfumes, after-shave, nail polish (and removers) and hair sprays;
- household products such as finishes, rug and oven cleaners, paints and lacquers (and their thinners), paint strippers, pesticides, mothballs, deodorizers;
- vinegar;
- dry-cleaning fluids;
- building materials and home furnishings;
- office equipment such as some copiers and printers;
- office products such as correction fluids and carbonless copy paper;
- graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.

Many materials, such as carpets, carpet adhesives, pressed wood products, paint, furniture and foam cushions will off-gas VOCs at a significantly higher rate when new.

The metabolic actions of bacteria and fungi, when in large concentrations, may also contribute detectible levels of Microbial VOCs ("MVOCs").

Government and Industry Guidelines for TVOC-ppb range

In North America and Europe, TVOCs are not generally regulated as a combination of compounds; rather some specific volatile organic compounds are regulated.

A few examples of the US OSHA worker Permitted Exposure Levels (8 hour TWA) for specific VOCs are listed below:

- Acetone 1000ppm

- Benzene 1ppm
- Ethanol 1000ppm
- Formaldehyde 0.75ppm (note that the GrayWolf 10.6 eV PID does not ionize this VOC. HUD has established a level of 0.4 ppm for mobile homes)
- Styrene 100ppm
- Toluene 200ppm
- Turpentine 100ppm
- Xylene 100ppm

TVOC-ppb range detail for Executive Office (IQ610 + Trend Example + Notes)

Location	Date/Time	TVOC ppb	Comments
Executive Office Trend (15-Mar-08)*	15-Mar-08 07:37:01 AM to 15-Mar-08 01:38:01 PM	375	*average reading

Site/Location Detail

Site Notes: Executive Office (IQ610 + Trend Example + Notes)

Text Note Site_Note

ACME Office Building appears, upon initial impression, to be a well-maintained facility. Our plan is to take snapshot samples from one or two representative areas on those floors other than the 2nd floor from where complaints have emanated. We'll then take snapshot readings from numerous locations on the 2nd floor, and trend log, for the course of a work day, the 2 locations where the complaints have arisen.

Location detail for Executive Office Trend (15-Mar-08)

DateTime	TVOC ppb	CO2 ppm	Ammonia ppm	CO ppm	Temperature °F	Humidity %RH
15-Mar-08 07:50:01 AM	84	703	0.1	0.5	68.5	27.6
15-Mar-08 08:04:01 AM	82	731	0.0	0.5	69.5	27.0
15-Mar-08 08:18:01 AM	85	764	0.0	0.5	70.3	26.7
15-Mar-08 08:32:01 AM	108	804	0.0	0.5	70.8	26.6
15-Mar-08 08:46:01 AM	138	844	0.0	0.5	71.3	26.5
15-Mar-08 09:00:01 AM	187	888	0.0	0.5	71.8	26.7

DateTime	TVOC ppb	CO2 ppm	Ammonia ppm	CO ppm	Temperature °F	Humidity %RH
15-Mar-08 09:14:01 AM	242	916	0.0	0.5	72.5	26.9
15-Mar-08 09:28:01 AM	310	958	0.0	0.6	72.9	27.1
15-Mar-08 09:42:01 AM	376	911	0.0	0.6	73.4	26.7
15-Mar-08 09:56:01 AM	421	965	0.0	0.6	73.7	26.6
15-Mar-08 10:10:01 AM	478	957	0.0	0.6	74.2	26.6
15-Mar-08 10:24:01 AM	519	1017	0.0	0.6	74.5	26.6
15-Mar-08 10:38:01 AM	543	1008	0.0	0.6	74.6	26.3
15-Mar-08 10:52:01 AM	545	1021	0.0	0.6	74.8	26.4
15-Mar-08 11:06:01 AM	546	1069	0.0	0.6	75.0	26.4
15-Mar-08 11:20:01 AM	573	1263	0.0	0.6	75.5	27.3
15-Mar-08 11:34:01 AM	596	1480	0.0	0.7	76.0	28.2
15-Mar-08 11:48:01 AM	557	1357	0.0	0.7	76.0	27.5
15-Mar-08 12:02:01 PM	513	1269	0.0	0.9	76.6	27.1
15-Mar-08 12:16:01 PM	493	1277	0.0	0.8	77.1	27.1
15-Mar-08 12:30:01 PM	455	1111	0.0	0.7	77.3	26.1
15-Mar-08 12:44:01 PM	450	1228	0.0	0.7	77.7	26.6
15-Mar-08 12:58:01 PM	420	1174	0.0	0.7	78.0	26.3
15-Mar-08 01:12:01 PM	399	1121	0.0	0.7	78.5	25.8
15-Mar-08 01:26:01 PM	382	1161	0.0	0.7	78.7	25.9

* Data displayed was condensed.

Text Note Executive Office Trend (15-Mar-08)

There have been complaints from the primary occupant of this office, a high level executive, over the past few months of stuffiness and smells. This office was partitioned 4 months ago, roughly half of the space of Executive Office 2, which was divided into 2 parts. There are 3 diffusers in that half of the office, and just one on this partition. There also is a roof leak in the NW corner, which leaks when there is heavy rain. There is visible evidence of staining and mold growth. Samples have been collected to send out to XYZ Laboratories for cultures.

There is obvious leaking from the ceiling onto one window sill. Weve measured 28.5% moisture at that spot with our Protimeter moisture meter. The diffuser directly above the executives desk has been taped over. According to the occupant of this office, there is too much of a draft when the air handling system kicks on. CO2 levels were a bit elevated at the time of the test.

Field Form Executive Office Trend (15-Mar-08)

Chemical Inventory

File Number: 001
Date: March 15, 2008
Building Name: Office Bldg

Address: 11 Main St
Completed by: John
Phone: (123) 665-1111

The inventory should include chemicals stored or used in the building for cleaning, maintenance, operations, and pest control. If you have an MSDS (Material Safety Data Sheet) for the chemical, put an "x" in that row. If not, ask the chemical supplier to provide the MSDS, if one is available.

Sections 2 and 6 discuss pollutant sources. Section 4 discusses MSDSs.

Date **3/15/08**
Chemical/Brand Name **Bleach / Clorox**
Use **Cleaning**
Storage Location(s) **Janitor Closet**
MSDS on file? No

Date _
Chemical/Brand Name _
Use _
Storage Location(s) _
MSDS on file? _

Date _
Chemical/Brand Name _
Use _
Storage Location(s) _
MSDS on file? _

Date _
Chemical/Brand Name _
Use _
Storage Location(s) _
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Chemical/Brand Name _
Use _
Storage Location(s) _
MSDS on file? _

Date _
Chemical/Brand Name _
Use _
Storage Location(s) _

MSDS on file? _

Trend Log Statistics Executive Office Trend (15-Mar-08)

Started at: 15-Mar-08 07:37:01 AM
Ended at: 15-Mar-08 01:38:01 PM
Duration: 06:01:00 h:m:s
Number of rows = 362

TVOC ppb:
Min = 81 at 15-Mar-08 08:08:01 AM
Max = 602 at 15-Mar-08 11:41:01 AM
Average = 375.3

CO2 ppm:
Min = 640 at 15-Mar-08 07:37:01 AM
Max = 1575 at 15-Mar-08 11:42:01 AM
Average = 1034.7

Ammonia ppm:
Min = 0.0 at 15-Mar-08 01:38:01 PM
Max = 0.2 at 15-Mar-08 07:45:01 AM
Average = 0.01

CO ppm:
Min = 0.3 at 15-Mar-08 07:37:01 AM
Max = 0.9 at 15-Mar-08 12:04:01 PM
Average = 0.62

Temperature °F:
Min = 67.5 at 15-Mar-08 07:38:01 AM
Max = 79.0 at 15-Mar-08 01:38:01 PM
Average = 74.32

Humidity %RH:
Min = 25.6 at 15-Mar-08 01:32:01 PM
Max = 29.2 at 15-Mar-08 07:39:01 AM
Average = 26.77

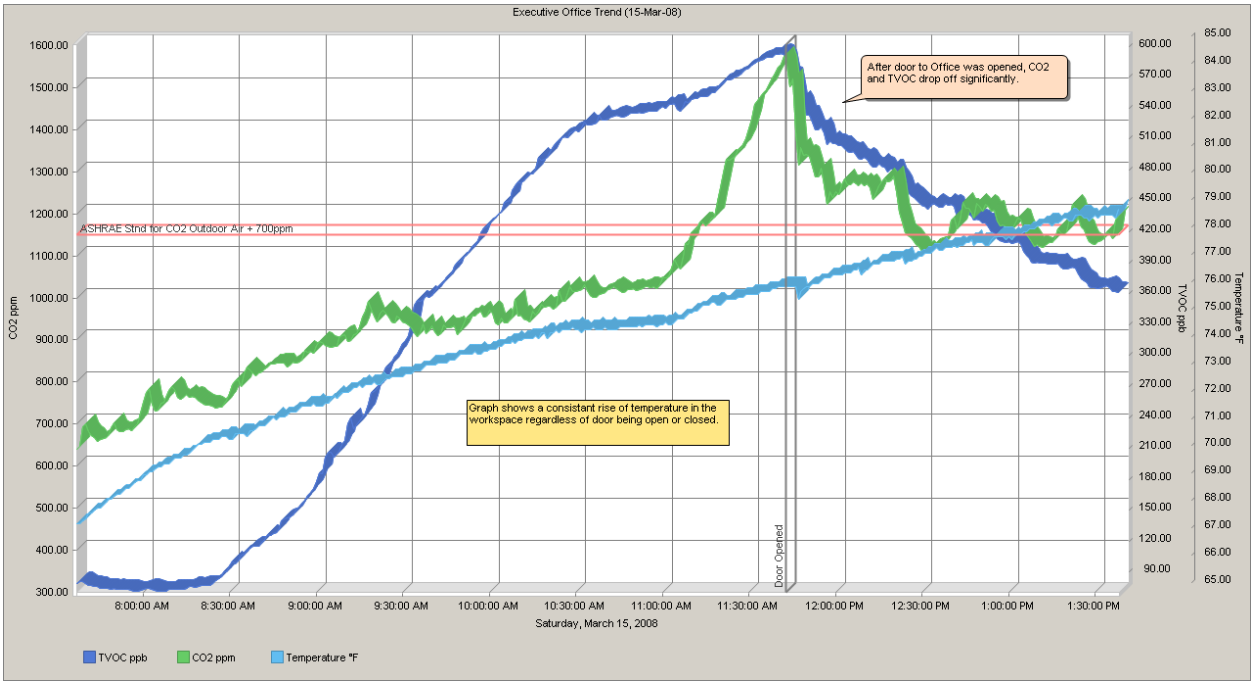
Event Note Executive Office Trend (15-Mar-08)

15-Mar-08 11:42:43 AM Door Opened

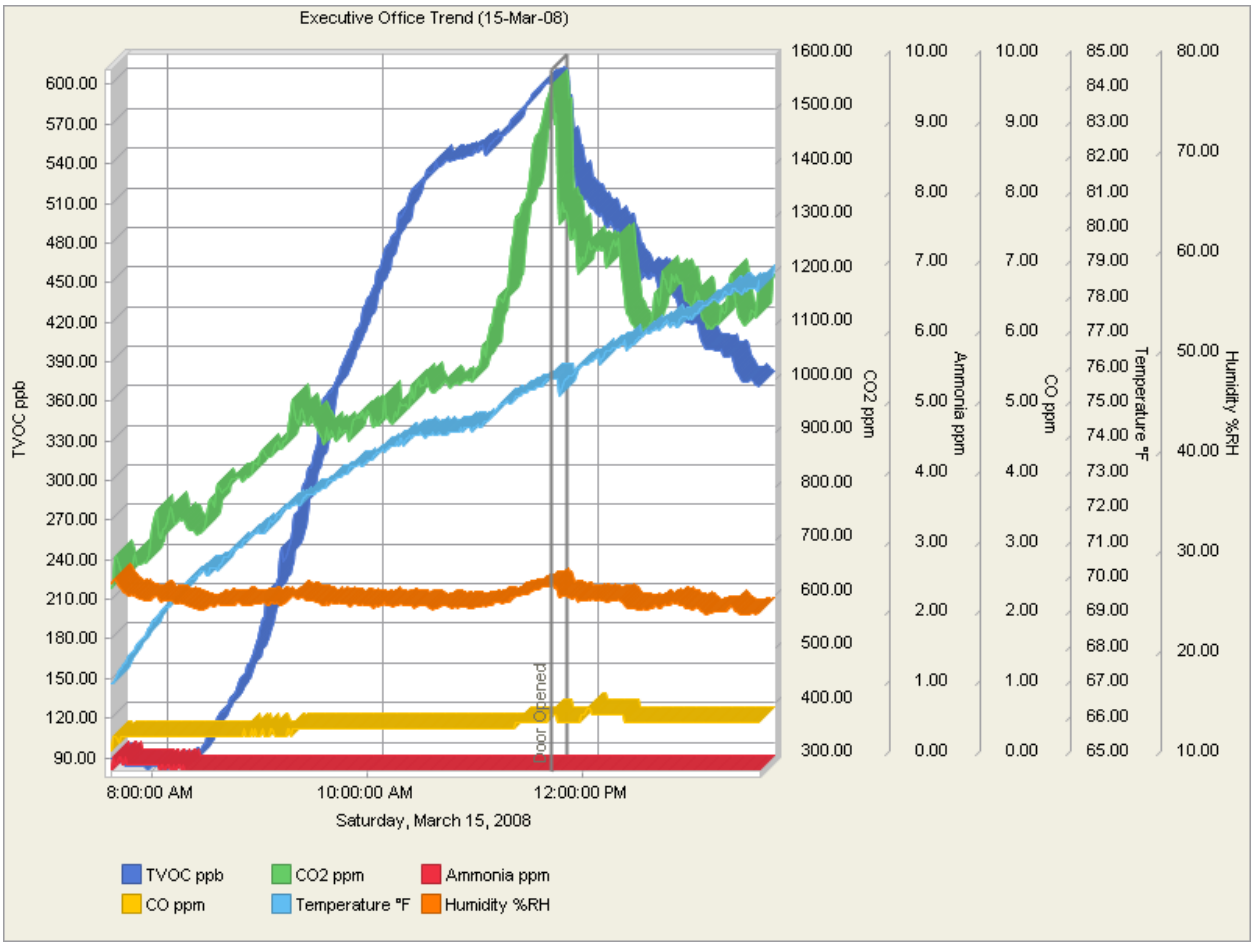
Photo Executive Office Trend (15-Mar-08)

Drawing Executive Office Trend (15-Mar-08)

Graph File Executive Office Trend (15-Mar-08)


Executive Office Trend (15-Mar-08)
After door to Office was opened, CO2 and TVOC drop off significantly.
ASHRAE Stnd for CO2 Outdoor Air + 700ppm
Graph shows a consistant rise of temperature in the workspace regardless of door being open or closed.
Door Opened
CO2 ppm
TVOC ppb
Temperature °F
8:00:00 AM
8:30:00 AM
9:00:00 AM
9:30:00 AM
10:00:00 AM
10:30:00 AM
11:00:00 AM
11:30:00 AM
12:00:00 PM
12:30:00 PM
1:00:00 PM
1:30:00 PM
Saturday, March 15, 2008
TVOC ppb
CO2 ppm
Temperature °F

Trend Graph for Executive Office Trend (15-Mar-08)



Conclusions and Recommendations

Equipment List

The following equipment was used to collect the data:

IQ-610

The IQ-610 probe utilizes highly accurate, rapid response sensors for ppb TVOC, CO2, CO, %RH, Temperature and Toxic Gas (plus derived Dewpoint, Wetbulb Temperature, Specific Humidity, Absolute Humidity and Humidity Ratio). The IQ-610 contains 1 upgradeable electrochemical gas sensor slot.

Sensor Specifications

Carbon Dioxide

Range: 0 to 10,000 ppm
Accuracy: +/- 3%rdg +/- 50ppm
T90 response time <75 seconds (in 50fpm, 0.25 m/s airflow)

Carbon Monoxide

Carbon Monoxide (solo) sensor (based on AlphaSense model CO-AF):

Range 0.0 to 750.0 ppm
Instrument resolution 0.1ppm
Limit of detection 0.5ppm
Sensor Drift 3%/year
T90 response time <25 seconds
Expected sensor life: 24 months
Sensor Accuracy: +/- 2ppm <50ppm, +/- 3%rdg >50ppm

ENVIRONMENTAL
Sensitivity @ -20°C % (output @ -20°C/output @ 20°C) @ 400ppm CO70 to 90
Sensitivity @ 50°C % (output @ 50°C/output @ 20°C) @ 400ppm CO 104 to 112
Zero @ -20°C ppm equivalent change from 20°C < ± 3
Zero @ 50°C ppm equivalent change from 20°C < ± 2

CROSS SENSITIVITY
SO2 sensitivity % measured gas @ 20ppm SO2 < 0.1%
NO sensitivity % measured gas @ 50ppm NO < 5
NO2 sensitivity % measured gas @ 10ppm NO2 < 0.1
Cl2 sensitivity % measured gas @ 10ppm Cl2 < 0.1
H2 sensitivity % measured gas @ 400ppm H2 at 20oC < 60
C2H4 sensitivity % measured gas @ 400ppm C2H4 < 25
H2S sensitivity % measured gas @ 20ppm H2S < 0.1
NH3 sensitivity % measured gas @ 20ppm NH3 < 0.1

KEY SPECIFICATIONS
Temperature range °C -30 to 50
Pressure range kPa 80 to 120
Humidity range % rh continuous 15 to 90

CO/H2S combo sensor (based on City Tech model 4COSH):
Range: 0.0 to 500.0 ppm CO
Limit of detection 1ppm CO
CO Sensor Drift 5%/year
T90 response time <35 seconds
Expected sensor life: 36 months
Sensor accuracy: -2ppm to +3ppm +/- 3% reading

CROSS SENSITIVITY
H2S sensitivity measured gas @ 15ppm H2S 0 to 6ppm CO
H2 sensitivity measured gas @ 100ppm H2 ~20ppm CO
NO sensitivity measured gas @ 35ppm NO <0.1ppm CO
NO2 sensitivity measured gas @ 5ppm NO2 <0.1ppm CO
Cl2 sensitivity measured gas @ 1ppm Cl2 0ppm CO
SO2 sensitivity measured gas @ 5ppm SO2 <1ppm CO

KEY SPECIFICATIONS
Temperature range °C -20 to 50
Pressure range kPa 90 to 110
Humidity range % rh 15 to 90 non-condensing

Relative Humidity

Range: 0 to 100 %RH
Accuracy: +/- 2 %RH <80 %RH (+/- 3 %RH >80%RH)

Temperature

Range: 15° to 160°F (-10° to +70°C)
Accuracy: +/- 0.3°C

GrayWolf Probe Calibration Data

Calibration as of 15-Mar-2008 07:37:00

Calibration information for IQ610 probe s/n 05-169
Last Calibration: 04-Jan-2008 12:41:39

Temperature: @+19.97C on 04-Jan-2008 (Factory)
Temperature: @+40.15C on 04-Jan-2008 (Factory)
TVOC: @+0.00ppb on 04-Jan-2008 (Factory)
TVOC: @+7600.00ppb on 04-Jan-2008 (Factory)
Carbon Dioxide: @+348.00ppm on 04-Jan-2008 (Factory)
Carbon Dioxide: @+1000.00ppm on 04-Jan-2008 (Factory)
Ammonia: @+0.00ppm on 04-Jan-2008 (Factory)
Ammonia: @+25.00ppm on 04-Jan-2008 (Factory)
Carbon Monoxide: @+0.50ppm on 04-Jan-2008 (Factory)
Carbon Monoxide: @+95.00ppm on 04-Jan-2008 (Factory)
Relative Humidity: @+8.40% on 04-Jan-2008 (Factory)
Relative Humidity: @+91.40% on 04-Jan-2008 (Factory)
Carbon Monoxide: @+0.00ppm (adj +0.18) on 19-Mar-2008 (User)
Carbon Monoxide: @+50.00ppm (adj +4.57) on 28-Feb-2008 (User)
Carbon Dioxide: @+300.00ppm (adj -47.93) on 22-Feb-2008 (User)
Carbon Dioxide: @+1000.00ppm (adj -44.33) on 22-Feb-2008 (User)
