Indoor Air Quality – Changing Expectations and the New Norm!

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Building Evaluation

Useful Life

- Utilities
- Structural
- HVAC
- Site Work

Cost to Remedy

- Immediate Deficiencies
- Short Term Reserves
- Deferred Maintenance

Building Modification

- Brand Specifications
- Cost Estimates
- Space Measurement
- Zoning Analysis

Industrial Hygiene

Indoor Air Quality

- Baseline IAQ Testing
- HVAC System Surveys
- Sick Building
- Odor Investigation
- Mold

Asbestos

- Pre-demolition Testing
- O&M Plans
- Surveys

Compliance Programs

- EH&S Program Design
- SOP Development
- Compliance Audits
- Training

Geo-Environmental

Due Diligence

- Phase I Environmental
- Transaction Screen
- Peer Review

Subsurface Investigation

- Soil & Groundwater
- Vapor Intrusion
- Delineation
- Remediation
- Storage Tanks

Geotechnical Engineering

- Subsurface Profiling
- Soil Bearing Capacity
- Design Recommendation
- Construction Monitoring

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What do Industrial Hygienists look at in Office Buildings?

IAQ related issues:

- Basic IAQ issues: CO, CO_2, VOCs
  Temperature, Relative Humidity,
  Particulates, mold

- Other IAQ issues: Off-gassing (formaldehyde),
  vapor intrusion, allergens, radon
  ozone, site specific concerns

What do Industrial Hygienists look at in Office Buildings?

Non-IAQ issues: Water Testing
Sanitation,
Contact Allergens

COVID related: Sanitation
Reopening Water sampling
CO_2 and particulates as proxies
Covid testing (air and surface)

IAQ Measurement and Testing

Secondary measurements: Not inspecting equipment; checking ambient air to see if HVAC settings are resulting in good environmental conditions.

Field Measurements- direct results from testing air with handheld equipment- common for most baseline IAQ parameters (CO, CO_2, total VOCs, some specific VOCs, particulates)

- Test length can vary from 5 minutes to 24-hours based on analyte and test purpose

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IAQ Measurement and Testing

Laboratory Analysis- Collect samples for off-Site analysis:

- Mold (typically cassettes),
- Specific VOCs – summa canister (EPA TO-15, TO-17)
- Specific Toxins (formaldehyde, sulfur compounds)
- Water samples (legionella, metals, general drinking water parameters)
- Surface sampling (mold, allergens, nicotine)

Visual inspection:

- Water Intrusion and Moisture (thermal camera)
- HVAC -filter condition and drainage
- Dust levels, general anomalies

Annual Baseline IAQ

Purpose: Internal Tracking, LEEDS Certification

Testing methods:

- Baseline, 5-10 minute measurements
- LEEDs: 24 hour or repeated 3-day testing, VOC summa
- Site specific concerns: per Lab testing method

Commonly Tested Parameters and Standards

- CO (toxic, source is incomplete combustion- heating systems, vehicle exhaust)
  NIOSH Recommended Exposure Limit (REL): 35 ppm, 8-hour time weighted Average (TWA)

Annual Baseline IAQ

- CO_2 Source: human breathing. Symptoms of moderately elevated CO_2 include: headache, dizziness, drowsiness, difficulty concentrating

  ASHRAE: (62.1) outdoor + 700 ppm (typically 1100 to 1250) This is not a standard, but generally indicates an appropriate level of ventilation under normal circumstances

- Temperature (68-75 winter, 73-79 summer ASHRAE) This range is based on comfort; being outside it may cause complaints and is not energy efficient, but generally does not cause health concerns.

- Relative Humidity (30-60% ASHRAE) Lower limit based on comfort, dropping below not significant concern. Upper limit designed to limit mold/bacteria growth, more important to meet.

Annual Baseline IAQ

- Particulates PM 10 (EPA:150 ug/m^3 per 24 hrs, 50 ug/m^3 annual)
  PM 2.5 (EPA: 35 ug/m^3 per 24 hrs, 12 ug/m^3 annual)

  EPA NAAQS is outdoor standard but can be used as indoor guide
  Sources: PM10: pollen, wind-borne dust PM 2.5: exhaust, smoke,
  Health concerns: irritation, allergy-like symptoms, worsens asthma and respiratory conditions, may cause long term chronic effects

- VOCs: Baseline: Typically field readings for total VOCs
  Total VOCs no enforceable standard, EPA guidance <3000 ppb
  US Green Building Council <500 ppb for new buildings for LEEDs

  LEEDS or specific concern: sample with summa cannister:
  Variable standards for individual VOCs

Annual Baseline IAQ

- **Mold** No enforceable standards; community consensus

  Health effects: allergy like symptoms; worsens asthma and respiratory conditions, susceptibility varies widely

  Total Indoor spores/m^3 <2,000 to 3,000 and/or less than outdoors

  Species distribution should also be comparable/less than outdoors

  Species Specific limits: Aspergillus < 500-700 spores/m^3 (one of first species typically noted after water damage)

  Stachybotrys (black mold) – even low levels a concern, typically only seen if there is long-term wetness

Real World Issues & Common Occurrences

High CO_2- insufficient ventilation, sensor lag, levels typically rise during course of day.
Time of day & occupancy for testing matters!

Mold- most common causes

- Unnoticed (small) water leaks,
- Condensation (IT rooms, HVAC lines above ceiling)
- Ongoing high humidity
- Historic leaks that were not properly remediated

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Real World Issues & Common Occurrences

Maintenance Issues- more common in buildings with no Facilities Staff

- Filters not changed at all
- Filters need variable schedules (kitchens, lobbies)
- Water leaks not properly addressed (any porous materials that are wet for 48 hours need to be replaced)

Low Humidity- seasonal, typically not a concern

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Covid and Reopening Issues

Long-term building closure; especially with reduced HVAC may lead to IAQ related concerns. Building may also have missed a year of testing if closed.

CDC guidance specifically recommends checking for potential mold growth, especially if high humidity levels occurred.

Reopening water testing; per CDC guidance:

Legionella, lead and copper (flush system first)

Other COVID related testing:

- Lab testing for airborne or surficial Covid-19 virus
- Proxy testing for particulates (.3 um) to test air filters (need to carefully set up controls for comparison)
- Sanitation/disinfection testing