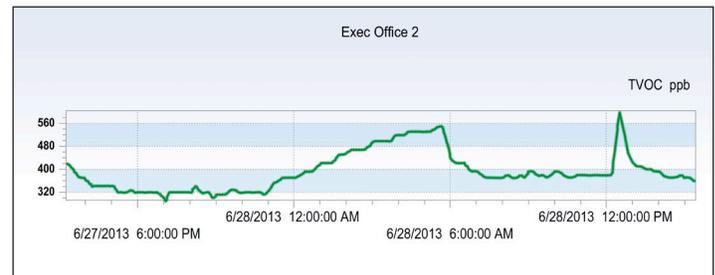




Utilizing PIDs (for VOCs) during IAQ Investigations: Photoionization detectors (PIDs) have become an invaluable tool for Indoor Air Quality (IAQ) investigators. PID applications in indoor air include:

- **Screening** for unusually high VOC levels, to determine if, where and when to take air samples for speciation.
- **Monitoring** TVOCs for screening or direct compliance to government and industry regulations and guidelines.
- **VOC source tracking** (a.k.a. “blood hounding”) to follow elevated VOCs to the source that they emanate from.
- **Spot-check** at supply diffusers and outdoors.
- **Comparative testing** to confirm VOC air concentrations before and after air cleaning or remediation.
- **Off-gassing evaluation** of TVOCs from various products.

or other lab analysis, to determine if the explicit levels measured are of concern. Specific VOCs have very different concentrations at which they become health concerns. For example, US OSHA's^A current permitted exposure levels (8 hour TWA) for Acetone, Toluene and Benzene are 1,000ppm, 200ppm and 1ppm respectively. And these are levels for healthy adult workers. Obviously, in lieu of determining the specific VOC source on site, air sampling may be essential to determine which specific VOC(s) are triggering the elevated PID sensor response.



Monitoring for Government and Industry Regulations and Guidelines

Many Asian countries, and a few in other parts of the world, have instituted maximum TVOC levels for indoor air. Some examples; China^B and Portugal^C 600 $\mu\text{g}/\text{m}^3$, Dubai^D <300 $\mu\text{g}/\text{m}^3$, Malaysia^E and Singapore^F 3ppm (1.5ppm isobutylene equivalent). In addition, the important USGBC LEED IEQ flush-out test, requires TVOCs to be <500 $\mu\text{g}/\text{m}^3$ ahead of occupancy. GrayWolf instruments can monitor, over time, to verify these levels (and/or screen if air sampling is specified by the specific legislation/guideline).

Blood-hounding (source identification)

With the almost instantaneous response of PIDs, walking around a facility can often track down VOC sources. For example, open chemical containers in a janitor's closet, “something” spilled on a section of carpet, or an employee that uses a lot of hairspray in the office are all easily identified (and remediated when appropriate) without the need for specific VOC determination.



PID technology has been available for handheld instruments for decades. But sensors for portables had comparatively poor resolution, generally to 0.1ppm (100ppb) at best. Now sensors are available with limits of detection to <5ppb. For IAQ applications a low LOD is important, but so too is low drift. Background TVOC levels, indoors, typically range from 50 to 400ppb. If logging VOCs over time, low zero drift is crucial, and lower range PIDs are preferable. User calibration for these sensors is also essential, and it should be made as easy as possible.

Screening before Air Sampling

Walkthroughs can easily reveal TVOC levels that are elevated compared to the normal background levels. Trend logging can reveal times of the day or facility conditions that lead to elevated TVOCs. If the TVOC source isn't easily identified by these tests, the elevated levels provide information about just where and when to go to the next stage of taking air samples for speciation via GC/MS,





Example Case:

A complaint of a strong “vinegar” smell in an attached, residential garage leads to a visual inspection that doesn’t reveal an obvious source. A handheld PID immediately shows exceptionally high >25,000ppb levels in the garage. Tests show roughly 2,000ppb in the rest of the residence, so opening the windows, regardless of outside temperatures, was immediately advisable. Opening the garage door quickly drops TVOC readings to 1,200ppb, while various cabinets and storage bins still read ~8,000ppb as their air hasn’t diluted as rapidly. But by poking the probe around,



>10,000ppb concentrations are identified near a portable generator, where it’s quickly recognized that a gasoline leak in the back, but hidden by clutter, has dripped, and pooled into a gap along the foundation. Although the high levels in the garage were not above worker exposure levels^G for gasoline, this was

a home with young children where such levels, and even the 2,000ppb levels throughout the residence, certainly wouldn’t be considered healthful. This situation was simple to remediate, without any need for expensive lab testing.

Spot-Checking at Supply Diffusers and Outdoors

Quickly spot-check supply diffusers to determine if the incoming ventilation air contains elevated VOCs. If so, also spot-check the outdoor concentration to decide if that is the source. If not, an investigation will likely determine how the VOCs are entering the supply air.



A. US OSHA 1910.1000 Table Z-1 Limits for Air Contaminants

B. China Ministry of Environmental Protection, GB/T 18883-2002

C. Portugal Ministério Das Obras Públicas, Transportes E Comunicações Decreto-Lei n.o 79/2006

D. Green Building Regulations and Specifications in the Emirate of Dubai, 2011-3-16.

E. Malaysia DOSH Industry Code Of Practice On Indoor Air Quality 2010, JKKPDP(S)127/379/4-39

F. Singapore Ministry of the Environment. Guidelines for Good Indoor Air Quality In Office Premises, 1996

G. US OSHA has no PEL for gasoline. However, the ACGIH TLV is 300ppm 8hr TWA, 2014

H. <http://www.epa.gov/mold/moldcourse/chapter1.html>



Comparative TVOC Testing

(before and after)

If you have cleaned up a spill or replaced suspected off-gassing carpet, insulation material, paint, etc. with a low emitting product, check readings before and after remediation. Test before and after using an air cleaning system, whether a simple portable device or a sophisticated, installed system. Many contractors and manufacturers use PIDs in the process of selling their own services or air treatment equipment.



Basic Evaluation of Off-Gassing

Organizations such as ASTM, ISO and the California State DEP have specific protocols to test off-gassing of VOCs from building materials (in environmental chambers). While it certainly doesn’t replace such detailed methods, a PID can allow for a very simple verification test before you invest in that particle-board, carpeting, etc. with a quick check of the material in the warehouse, or upon unpacking. Perhaps check the TVOC level after the product is installed in one room, ahead of proceeding with the full facility. Or test for unexpected elevated VOCs after construction to determine if extra ventilation and/or time might be appropriate ahead of occupancy.



Locating Mold via MVOCs

Per the USEPA^H “Some compounds produced by molds have strong smells and are volatile and quickly released into the air. These compounds are known as microbial volatile organic compounds (mVOCs)”. Anecdotal information from GrayWolf users indicates that rooms with comparatively elevated TVOC readings, in lieu of other obvious sources, may justify testing for mold as the source of the PID response. Some investigators will draw samples across the PID from wall cavities. High readings may trigger an inspection via borescope and/or instigate mold sampling for lab analysis.

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