Advanced Energy

Application Note

BREAKTHROUGH TESTING OF AIR PURIFICATION DEVICES

The Opportunity

Using precise multi-gas monitors is crucial for breakthrough testing of air purification devices to ensure that specific quality standards are being met.

Air purification devices, such as respiratory mask filters, have to be tested according to standard tests, in particular to check their compliance for breakthrough time.

Air filtration systems are being used in a wide range of industrial sectors for filtering airborne particulates. Many industrial facilities equip air purification systems on exhaust streams and with ever more stringent regulations on Indoor Air Quality, they have also become a primary component in many ventilation systems.

A variant appellation is air purification or air cleaning when involving the abatement (or removal) of hazardous gas compounds. For example, air handling units might include an air cleaning stage on the recirculation stream.

Another “air quality” application is found in the respiratory masks used by hazmat teams and military forces.

The Innova 1512 Photoacoustic Gas Monitor is conveniently located next to the test bench (inside the fume hood) and provides online measurement from direct sampling ports.

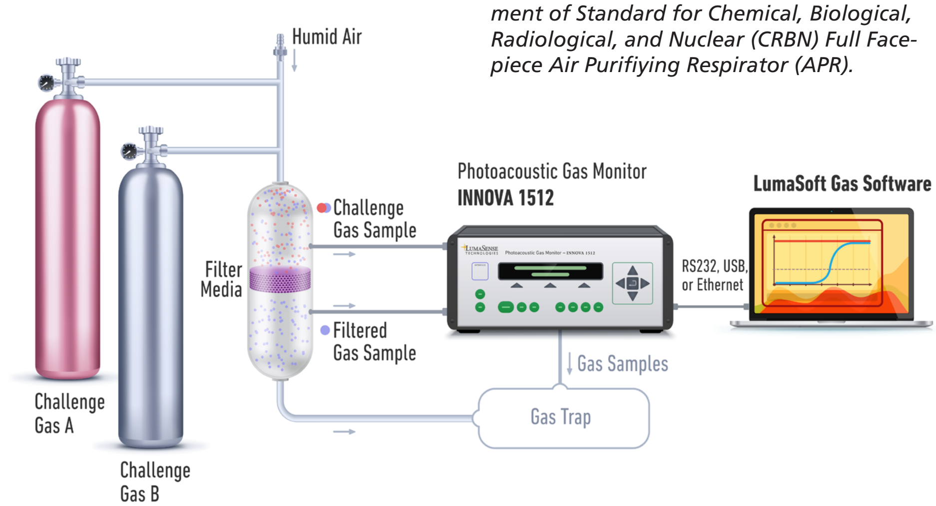
Monitoring Needs

One of our end-users, AirBoss Defense, develops and manufactures respiratory mask filters. Each device is subject to regulated quality standards, such as those published by the National Institute for Occupational Safety and Health (NIOSH). The qualification tests involve flowing a challenge gas across the filter material and monitoring the occurrence of breakthrough.

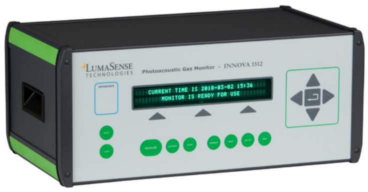
Typical challenge concentrations are in the 100’s to 1000’s ppm range. Breakthrough concentrations are dependent of the challenge gas, but are typically in the ppm range for most substances.

	Challenge Conc. (ppm)	Breakthrough Detection Level (ppm)	1512 Detection Limit (ppm)
C_6H_{12}	2600	10	0.2
C_4H_{10}	1000	10	0.5
SO_2	1500	5	0.6
NH_3	2500	12.5	0.3

The above table gives an example list of challenge gases, with challenge concentration and breakthrough detection levels. The values for cyclohexane, sulfur dioxide, and ammonia correspond to the NIOSH Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CRBN) Full Facepiece Air Purifiying Respirator (APR).



Schematic view of a typical set-up for testing of filter breakthrough characteristics, with a single Photoacoustic Gas Monitor capable of measuring both the upstream and the downstream concentrations for a selection of challenge gases.

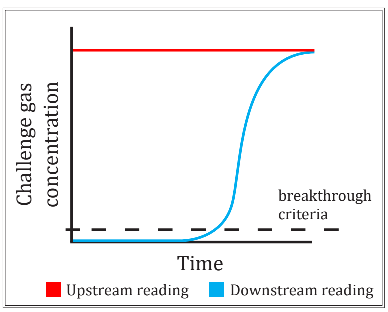


INNOVA 1512 Photoacoustic Gas Monitor.

Our Solution

The Photoacoustic Gas Monitor INNOVA 1512 is an excellent solution for this type of trace gas monitoring. It can be configured with up to 5 different optical filters corresponding to as many different gases to be monitored. In fact, LumaSense offers a portfolio of 27 optical filters within the mid-infrared spectrum, making it possible to measure almost any substance that an air filtration (or air purification) equipment manufacturer may need for their testing purposes.

Calibration banks for each individual optical filter are used to store different calibration data in the monitor's memory and can be freely selected by the test operator. The Photoacoustic Gas Monitor also has a wide dynamic range that is typically over 4 decades on a one-point span calibration and up to 5 decades with a two-point calibration. The high dynamic range finds its value in this kind of application when the same instrument can be used to measure the challenge gas concentration in the upstream flow, and monitor the breakthrough at trace level in the downstream flow.



Typical challenge gas breakthough curve.

Measurement Results

Testing at AirBoss Defense usually involves a single challenge gas at a time. The Photoacoustic Gas Monitor is switched upstream to confirm the concentration of the effluent gas and then switched downstream to monitor breakthrough. Typically, a test would take between 0.5 to 1.2 h per cycle depending on the type of challenge gas and test requirement.

As stated by a lead scientist at AirBoss Defense: *"We are very satisfied with the LumaSense photoacoustic multi-gas monitor which has proven to be a reliable and flexible instrument that meets our R&D needs. It's capacity to detect multiple different gases and linear detection response over a wide dynamic range positioned it perfectly for our application."*

Your Benefits

- ✓ **High-end measurement specifications for multi-gas applications: wide dynamic range, intrinsic stability from the PAS sensing technique**
- ✓ **User-friendly interface (local and via application software)**
- ✓ **Convenient database export cabability**
- ✓ **Does not require any advanced skills in analytical instrumentation: users can focus on their core expertise**
- ✓ **Low cost of ownership: few maintenance needs, no carrier gas needed**

Advanced Energy

For international contact information, visit advancedenergy.com.

sales.support@aei.com
+1 970 221 0108

PRECISION | POWER | PERFORMANCE