

Orthogonal Detection for More Complete Protection from Clandestine Methamphetamine Lab (Clan Lab) Chemicals

Gas detection technologies currently fielded for providing protection for first responders and investigators of clan labs are unable to see the complete picture and provide full protection for all the gas and vapor toxic threats present. New multisensory "orthogonal" technologies like the Environics' ChemPro100 provide the opportunity to detect all the toxic gases and vapors present in the clan lab environment and alert operators that a toxic event is happening that requires them to "mask up" or exit the lab environment.

Clan Labs Cause Chemical Contamination

There has been a dramatic rise in the number and geographical diversity of clan labs producing methamphetamines and other illegal drugs in the past few years. The chemical processing at these labs is often carried out by untrained "cooks" who, rather than having an extensive chemical background, just follow a simple "cookbook." This lack of chemical knowledge means that cooks don't have a professional chemist's respect for these toxic and flammable chemicals and this leads to widespread chemical contamination in and around clan labs.

Measurement is the Key to Risk Reduction

The lack of respect that clan lab cooks have for the chemicals they use requires responders to, and investigators of these crime scenes to protect themselves from the toxic and flammable gas and vapor threats left behind. Only after making an accurate assessment of the residual levels of contamination can clan lab investigators properly protect themselves from these threats. Clan labs are crime scenes and investigators often have to make quick decisions. The best way to assess on-scene risk is with a continuous monitor that provides instantaneous readings. Not only can portable monitors decrease risk to personnel; they can also reduce costs. The cost of medical testing for law enforcement personnel that have been exposed to clan lab chemicals can approach 6 figures in the case of a gross exposure.

Current Detection Techniques Can Miss Many Chemicals

There are four types of detection techniques commonly utilized to protect first responders and investigators in clan lab environments: wheatstone bridge/catalytic bead Lower Explosive Limit (LEL) sensors, Photoionization Detectors (PIDs), Electrochemical (EC) sensors and Colorimetric ("Draeger") tubes. But each of these techniques have "blind spots" that prevent them from providing complete protection to responders in the clan lab environment.

LEL Sensors

The most common continuously monitoring sensor used for these measurements by law enforcement groups is the wheatstone bridge/catalytic bead/pellister sensor ("wheatstone bridge"). The use of wheatstone bridge sensors is problematic in the clan lab environment because:

1. They can only measure flammable gases and vapors while some clan lab chemicals are not flammable.
2. They have difficulty measuring low vapor pressure and high flashpoints chemicals found in clan labs.
3. They don't have enough sensitivity for the ppm level measurements that are required for gauging toxicity threats.
4. Chemicals used in clan labs can permanently poison the wheatstone bridge sensor rendering it inoperable even for making even gross decisions about combustible gas decisions at LEL levels.

PID Sensors

PIDs are a broadband sensor that can fill in some of the gaps that LEL sensors have for measuring both chemical toxicity and 10% of LEL for clan lab investigators. And they provide a continuous means of measuring at ppm levels necessary for protection from the many toxic gases and vapors in the clan lab environment. However, the most common

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PID lamp is a 10.6eV lamp that misses some common clan lab chemicals such as Acetic Acid, Chloroform and Hydrogen Chloride that have ionization potentials higher than the 10.6 eV lamp. While higher eV lamps are available for PIDs, their high cost and extremely short life span generally rule out their use. In addition, a PID is a non-specific indicator that cannot differentiate the severity of threats and alarm accordingly. The PID only counts ions and while ammonia and phosphine ions appear similar to the PID, they have very different human toxicities.

Electrochemical (EC) Sensors

EC sensors are generally specific sensors to particular species of gas. In the clan lab application it is common to see ammonia (NH₃) and phosphine (PH₃) sensors fielded as part of multi-sensor detection products. These EC sensors are reasonably specific and are sensitive enough for TWA alarm limits.

However, these EC sensors have a limited life of only about a year, they are expensive to purchase and require frequent calibrations with expensive and short lived calibration gases. Colorimetric Tubes

Colorimetric or "Draeger" tubes are commonly used in clan lab response and investigations. But they are not continuous and not direct reading. So while a wide varied of colorimetric tubes are available to detect the gases and vapors present in clan labs, an operator must identify the potential presence of a particular chemical and then take the time to run a tube test. If a chemical isn't present at the beginning of an investigation a tube will miss it. If a chemical is vented during the investigation and a tube isn't used at that time to detect it, one will miss that potentially toxic event.

The benefit of continuous monitoring is that an operator doesn't have to stop and think about detection, it happens automatically and constantly providing protection from any changes in the environment.

An "Orthogonal" Solution

One of the meanings for orthogonal is the characteristic of being independent (relative to something else). In gas detection orthogonal has come to be used to characterize detectors that use multiple, non-redundant sensors to solve a detection problem. The Environics ChemPro100 is just such an orthogonal detector. While at its heart there is an aspirated Ion Mobility Spectroscopy (IMS) sensor, it uses this sensor with additional sensors and "fuzzy logic" to classify chemicals. The ChemPro100 has the ability to demonstrate warning for more threatening chemicals in the clan lab environment than any handheld detection technology. The ChemPro100 represents a systematic approach to monitoring the clan lab environment process for toxic gases and vapors. It has reduced logistics costs and maintenance requirements and much longer shelf-life relative to the currently fielded technologies.

References

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