PIDs As Arson Investigation Tools

Flammable hydrocarbons, including gasoline, kerosene, and paint solvents, are often used as accelerants in starting intentional fires. Investigation of these fires can be greatly aided if the presence and locations of residual accelerants can be determined at the site as soon as possible after a fire is extinguished. Because of their ability to sense low levels of accelerant (parts per billion to 10,000 parts per million); photoionization detectors (PIDs) are a valuable tool in arson investigations. PIDs can help detect areas of higher hydrocarbons that may indicate the presence of an accelerant, so samples for further lab analysis may be taken. PIDs can be used to confirm that samples are "hot" and worth sending out for lab analysis.

What is a PID?

Photoionization detectors are sensitive total hydrocarbon sensors that measure hydrocarbon vapors in low concentrations of from less than ppb (parts per billion) to 10,000 ppm (parts per million). A PID is a very sensitive broad-spectrum monitor, not unlike a low-level LEL monitor.

Are PIDs Better Than a Dog for Arson Investigation?

Trained dogs are a benchmark against which all other arson investigation tools are judged. Dogs can be trained to detect residual accelerants at the parts per billion level. In addition, dogs can be trained to distinguish between the smell of accelerants and other hydrocarbons that are present as a result of a fire. However, dogs have the following disadvantages:

- They are expensive to train and maintain.
- Like humans, dogs suffer from olfactory fatigue. After a period of time on a scene they become accustomed to chemical smells and can no longer identify accelerants without a period of rest away from the scene.
- Dogs can become distracted by the commotion of overhaul and investigation activities.
- Dogs often bond to a particular handler, making their use more difficult in larger agencies with multiple arson investigators.

PIDs Aren't Specific to Accelerants

Unlike a dog, PIDs cannot distinguish accelerants from the other hydrocarbons present after a fire. But in the hands of a skilled investigator they can help to locate high concentrations of accelerant for lab samples.

Using a PID for Arson Investigation

Hold the end of the PID probe at the point where accelerant may be present and watch or listen to the PID for any sign of hydrocarbons. Check at joints or cracks between boards, under baseboards or plates in contact with flooring. Pry up boards to form a small crack where the PID probe can be inserted. Also check under unburned portions of rugs or upholstery, or at any point where accelerant may have soaked in and remained. Concrete floors can also hold a high amount of residual accelerant. If elevated levels of hydrocarbon contamination are detected, trace the source to the point of maximum reading. This is the point where samples should be taken for further lab analysis.

PIDs can Accurately Trace the Extent of Accelerant

One user took a photograph of the extent of the gasoline spilled on a carpet over a concrete floor in a burn room. After the room was burned, the carpet reminants were removed, and the PID was able to precisely trace the extent of the gasoline spill without the aid of the photo that was taken before the burn.

Using PIDs for Testing Samples

Once samples are collected the PID can be used to confirm the samples that have a high concentration of accelerant (hot) and weed out the samples with low concentrations (cold). "Headspace Sampling" is a term from the environmental clean-up industry. Once samples are collected, the sealed sample container should be stabilized at room temperature (approximately 68^{o} F, or 20^{o} C). Then the lid should be cracked open and the PID used to sniff the "headspace" above the sample. "Hot" samples give high readings on the PID and "cold" samples read substantially lower. Stabilizing the samples to room temperature is important. Cold samples do not release the accelerant they contain, and hot samples might exaggerate the amount of accelerant they contain.

RAE Systems Inc.
3775 N. First St., San Jose, CA 95134-1708 USA
Phone: +1.888.723.8823
Email: raesales@raesystems.com
Web Site: www.raesystems.com

Why not use a MOS Sensor?

Semiconductor, or Metal Oxide, Sensors (MOS) are among of the oldest and least expensive measurement technologies used in portable instruments for arson investigation. While MOS sensors can detect a broad band of chemical contaminants, they are prone to a number of shortcomings that limit their effective use in arson investigation. While typically found in inexpensive arson investigation monitors, MOS sensors are not particularly accurate, plus they respond positively to moisture and can be poisoned.

Why PIDs Aren't More Common

In the 1970s, PIDs moved from the lab to the field for surveying sites for chemical contamination. The ability of PIDs to identify the presence of hydrocarbons without costly and time-consuming laboratory testing made PIDs invaluable to many environmental clean-up firms. But the high cost of purchase and maintenance, lack of durability, bulky size, heavy weight, sensitivity to humidity and radio-frequency interference (RFI) limited the use of early PIDs. Breakthroughs in PID technology have addressed these shortcomings and now provide arson investigators with a powerful yet affordable measurement technology.

RAE PIDs for Arson

Because arson investigations require a fast "sniffer," RAE recommends that only our PIDs with pumps be used for forensic investigations. All RAE PIDs can charge on 12 volts DC, making them uniquely suited to storage on emergency vehicles.

ppbRAE Plus PID

The ppbRAE Plus is a 0 to 200 ppm PID with resolution down to *parts per billion* (ppb). The ppbRAE provides unsurpassed accuracy, capable of continuous detection down to 1 ppb. For arson investigations, the ppbRAE can detect accelerants below the olfactory threshold. Its quick 3-second response makes it uniquely suited to arson investigations because it can quickly locate accelerants. When in survey mode, the "Geiger counter" feature of the ppbRAE, the unit beeps at a higher frequency as the concentration increases. If a burn pattern is suspicious, its audible and visual alarms increase as concentrations of acclerants increase. This allows the ppbRAE Plus to accurately narrow down suspected areas of accelerant for laboratory analysis.

MiniRAE 2000 PID

A less expensive alternative to the ppbRAE Plus, the MiniRAE 2000 is a 0 to 10,000 ppm PID with resolution of 0.1 ppm.

RAE Systems Inc.
3775 N. First St., San Jose, CA 95134-1708 USA
Phone: +1.888.723.8823
Email: raesales@raesystems.com
Web Site: www.raesystems.com