Temporary Area Monitoring 101

Area monitors can be placed to create a buffer between hazards and people, so they know what they are heading into or what is coming their way.

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Temporary area monitors help safety personnel protect their workers from gas hazards in situations where permanently installed fixed systems are not available. They can also be used in addition to—or sometimes in substitution of—personal, portable gas monitors used as PPE. This happens most often when work occurs outside of normal operations in which the risks are higher and/or different: special projects, construction, maintenance, shutdowns, temporary sites or rigs, etc.

Knowing how to effectively use area monitors can be complex, especially for the workers who are placing the units in the field. If they make the wrong decisions, they could be exposed to, rather than protected from, potential hazards. While the technology has been around for well more than a decade, there are still many misperceptions related to the use of area monitors. This article will examine some of the questions people commonly have about area monitoring:

- What is the range of an area monitor?
- Where should I put an area monitor?
- How many do I need?
- Is it better to use a pump rather than rely on the air to come to the area monitor?
- Do I really need an area monitor when I have fixed systems?

It All Starts with the Sensor

If it's called an area monitor, it must cover an entire area, right? It must have a range, right? Wrong. The sensor technologies most commonly used in the industry are point sensors—meaning the sensor itself has to come in contact with the atmosphere it is meant to measure in order to work.

- Electrochemical sensors: Gas must come in contact with the sensor's electrode (inside the sensor itself) in order to excite the chemical catalyst to cause a reading.
- Catalytic bead (LEL) sensors: Gas must come in contact with the sensor's bead (inside the sensor itself) to burn and cause a reading.
- Infrared (IR) sensors: Gas must pass between the infrared source and the signal detector (inside the sensor itself) to cause a reading.
- Photoionization detection (PID) sensors: Gas must pass by the ultraviolet lamp to get ionized and detected (inside the sensor itself) to cause a reading.

The common theme is "inside the sensor." These sensors have no idea what is going on outside of them, even just an inch or centimeter away. Nonetheless, gas sensors work. Why? Because of diffusion.

Diffusion is:

"The intermingling of substances by the natural movement of their particles."

Even in still air (without wind), molecules are moving, bumping into each other, and spreading. Add to that air currents and the movement of people, equipment, machinery, etc., and the gas around us is constantly moving. Every gas detector on the market is designed to allow gas to get in (while keeping water and dust out) with no trouble. Diffusion works.

Note: There are sensor technologies (e.g., open path, ultrasonic, etc.) that do not require the gas to physically enter the sensor to read. However, these are still not widely used in area monitoring for a variety of reasons.

The 'Range' of an Area Monitor

Manufacturers sometimes give recommendations on how far apart to place area monitors if you want to "cover" a given area. These recommendations will range anywhere from 10 meters to 25 meters apart and will vary based on manufacturer and environment. For example, outdoor units typically should be placed closer together because the wind/air movement makes the gas stay in a smaller line, whereas indoors the gas can disperse into a wide body.

It is important to note that these distance recommendations are primarily based upon the nature of explosive gases. Explosive gas needs a certain concentration in order to explode instead of burn. Imagine a small, highly explosive ball of gas about the size a soccer ball. If it comes in contact with a spark, it will ignite and burn off quickly and is highly unlikely to hurt anyone or damage property. Now, imagine a mass of gas the size of a soccer field. If it ignites, it is a big problem.

Studies have been done to gauge the size of an explosive gas cloud that causes an explosion versus a quick burst of flame. That is where the 10-25 meters recommendations for area monitors are coming from. That is how close they need to be in order to make sure a big, dangerous, explosive cloud does not pass them undetected. But it still doesn't mean that area monitors have a "range." And it does not necessarily translate when you are trying to detect non-explosive gases. But given the complexity of the applications, it is a fairly good rule of thumb.

The Reality of Pumps

Some area monitoring users, aware of the limitations of the "inside the sensor" technologies, have turned to using units with pumps even when it might not be necessary for their work. This is because they believe it increases the "range" of a detector by drawing in outside air.

Pumps typically used in gas detection equipment are very, very weak; they might have flow ranges from 300-500 mL/minute. To grasp how slow that is, complete this exercise. Put your fingers in front of your mouth and take a single, fast breath in to fill your lungs completely. When you do, you can feel the air move between your fingers. Humans can fill their lungs (which typically hold 4-6 liters of air) in less than 3 seconds. That is 200 times faster than pumps in gas detectors! Now, again, put your fingers in front of your mouth and take a slow, shallow breath. It would take 10 minutes to fill your lungs completely. First, you will likely not be able to complete this task. Second, you will notice that you no longer feel any air movement on your fingers.

Pumps were added to gas detectors to assist in the need to measure remotely, particularly for confined spaces, using tubing and probes to bring a focused sample of gas from a different location to the monitor. They were not created to move massive amounts of air; they also have several restrictions that keep them from doing so:

- Physical limitations: Because they are transportable devices, pump technology is kept small.
- Power limitations: The harder you run a pump, the more it cuts into monitor runtime. Most pumps in the industry cut instrument runtime by 25-50 percent even with their slow flow rates. More than that would make instrumentation impractical.
- Sensor technology: Sensors, electrochemical in particular, do not like it when pumps run too quickly. They were designed to work in diffusion-style atmospheres. Pumping too quickly creates pressurization effects and suction, meaning readings become inaccurate and, in some cases, the sensor can become permanently damaged.

Other performance factors, such as gas response, recovery times, and accuracy, are also not significantly different when using a pump instead of relying on diffusion. Given these factors, if given a choice, pumps should be used only in remote or confined spaces, especially given the additional costs of purchasing and maintaining units. They offer no other benefits.

With Great Flexibility Comes Great Responsibility

Temporary area monitors offer a great deal of flexibility to users looking to protect personnel. Unlike fixed systems, they can move around easily and frequently as work and risks change. They also do not rely on infrastructure for power or alarms. And, unlike personal, portable gas detectors, which require your people to be within a hazardous condition before it can be detected, area monitors can be placed to create a buffer between hazards and people, so they know what they are heading into or what is coming their way. They also have additional features—such as loud alarms and wireless technology—that can ensure many people are alerted to hazards, and not just an individual.

Deploying area monitors can be complex. Because almost all use "inside the sensor" technology, those placing them must considers things such as: 1) the gases likely to be detected, 2) their behavior compared to natural air, given the conditions indoors or outdoors, 2) where the workers are, 3) where the hazards are likely to be, 4) what the prevailing winds are or what the airflow is like, 5) and more.

Savvy users combat this uncertainty in many ways. They ensure the people placing the units have proper training. They err on the side of caution, deploying more monitors than are strictly necessary. They do not count on the winds to stay the same, often creating a perimeter completely around a hazard or work group. They plan ahead prior to the work beginning and work with internal or external experts to ensure the necessary equipment is deployed correctly. They test their assumptions when possible. Above all, they understand the balance. They know improperly used area monitors could lead to a false sense of confidence and increased risk, while properly used area monitors are an incredible tool for increasing the safety of workers in the most hazardous of working conditions. OHS

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