Industrial Hygiene in the Workplace

Gas Detection

Contents

2 How to Use Gas Detection Data to Your Advantage

4 Managing the Risk of Gas Hazards in Confined Spaces

6 Enhancing Gas Detection with Pattern-Finding & Predictive AI

8 Gas Detection and Monitoring in Confined Spaces

10 DOD Technologies – The Leader in Low-Level Gas Detection

12 Democratizing Connectivity: The Future of Gas Detection

15 Is Real-Time Data Important? 3 Reasons Why the Answer Is 'Yes.'

18 Fixed Gas Detection: Issues and Answers

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How to Use Gas Detection Data to Your Advantage

By: **Dave Wagner**, *Contributor*

It's not uncommon for workers to doubt gas alarms. Always make sure gas detection software notifies a safety manager if workers shut off gas monitors while in alarm. Be sure to follow up and make sure proper protocol is followed in the future. *(photo courtesy Industrial Scientific)*

If you use gas detectors on your worksite but only look at the data they collect after an incident, you may be missing out on critical insights about your work environment; behaviors of those wearing the monitors; and the health and performance of the gas detectors themselves. Here are a few ways you can use your data to make the workplace safer and ensure your gas detection program is hitting peak performance.

Overcome Human Error & Fight Complacency

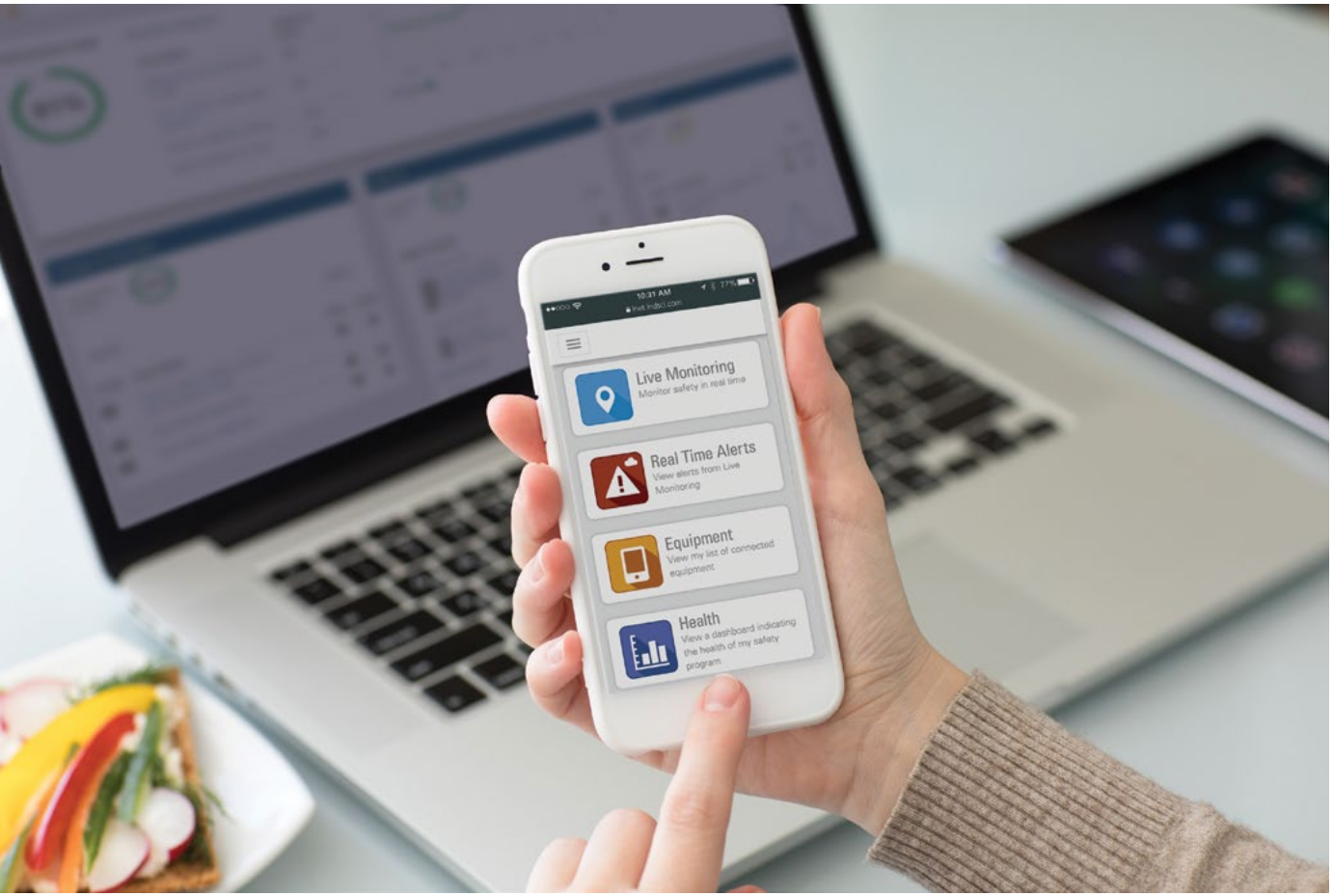
It's not uncommon for workers to doubt gas alarms, especially when doing a task with which they're already familiar. It can be tempting to ignore or turn off the alarm and continue to work just to get the job done. However, if this behavior occurs without consequences, it can desensitize workers to alarms and could lead to a major incident. Always check to make sure that your gas detection software notifies a safety manager when workers have shut off gas monitors while in alarm. Then, you can follow up with them; gather any needed information; and make sure the proper protocol is followed in the future.

If there are any doubts about the accuracy of an alarm, dock the monitor and create a full report of the gas hazards it detected, including concentration and gas type. Some gas monitors can even connect to the cloud and notify you of gas hazards in real time. You can then use this data to develop a plan to protect workers from the hazards specific to your worksite with PPE or safety procedures.

Maintain Equipment and Track Compliance

You can also track and document compliance using data by generating reports that include the most recent bump test and calibration dates. You can receive email alerts and forward them to the team as a quick reminder when you see that someone has used a monitor without it being bump-tested or calibrated. Data can bring awareness to habits your team might not even realize are endangering them and can help you move forward with the best protocols to keep everyone safe.

Some systems even allow you to create custom reports that help you assess and maintain the health of your gas monitors and equipment. For example, a report might show that a sensor in a gas detector has failed or that the calibration gas has expired. Using this data to your advantage means that your team can keep your gas detector fleet in good repair and ready to use during each shift.



By using gas detection management software, you can make the most of the data your gas monitors collect, while saving time and money. *(photo courtesy Industrial Scientific)*

Manage Exposures

Incident investigation is significantly easier when your data is stored digitally. You can trace alarms back to the individual, along with location, gas hazard type, concentration and duration. Many gas detection management programs will allow you to assign gas monitors to individual users, displaying their name along with the information about their assigned device. That way, when an exposure occurs, you can tell exactly who was in the affected area. With access to this information, it's easier to determine your next step based on insight rather than guesswork, so workers exposed to gas hazards will receive the appropriate follow up.

Identify Trends to Prevent Incidents

What are the stakes of not assessing your gas detection with management software? The first thing that might come to mind is added administrative burden. When an incident occurs, it leaves you with a pile of paperwork. By using gas detection management software, you can automate reporting, so you can focus more on how to avoid a similar exposure and less on digging through data looking for the relevant information.

When you don't pinpoint the source of gas exposures, you also run the risk of repeated incidents. This leads to wasted time and money. Most importantly, workers may be exposed to an ongoing hazard. With a gas detection management system, you can more easily identify the trends in historical data that could protect your workers from running into the same exposures time and time again.

For example, an alarm summary report might show that several workers have been exposed to hazardous gases while working near the same pipe. After you examine the peak gas readings, duration and location, you determine where the problem area is and the nature of the exposure. From there, you can investigate for gas leaks and develop working practices specific to that area until the issue is fixed. Finding the root cause of the exposure through data is the best way to resolve it while keeping workers safe.

By using gas detection management software, you can make the most of the data your gas monitors collect, while saving time and money. When safety and health are involved, don't cut corners on collecting and using data to make your gas detection program perform at the highest level. IHW

[Dave Wagner is the Director of Applications Engineering and Product Knowledge at Industrial Scientific.]

Managing the Risk of Gas Hazards in Confined Spaces

By: **Industrial Scientific**

While it's often necessary for workers to enter confined spaces, the nature of these spaces presents special challenges and dangers that workers must be prepared to confront.

OSHA estimates that confined spaces are responsible for about 200 deaths each year, around 60% of which are would-be rescuers, or those who were attempting to help another person. Low oxygen levels are the most common gas-related cause of death in confined spaces.

So how can you reduce the risk of working in confined spaces?

Managing Gas Hazards in Confined Spaces

No two confined spaces are the same, but they all have the potential to harm workers if you don't identify, monitor, and control the dangers within.

A safe confined space monitoring strategy requires a great deal of teamwork. Supervisors need to ensure that workers (including contractors) understand the hazards of the space and that they have the safety and communication tools they need.

If you're responsible for managing confined spaces, take these three critical steps to ensure worker safety.

1. Plan Ahead

Before workers enter a confined space, supervisors must complete a risk assessment (examining the environment in/around the confined space for entry location and size, energy or chemical sources, and lockout points), hazard assessment (examining what hazards workers could be exposed to), identify the personal protective equipment workers will need, and select properly-trained workers to perform the job.

The results of these assessments will determine how your workers will perform the job. If you don't have staff that has been trained to conduct a complete site assessment, you should consult a third-party.

2. Test Atmosphere

Standards around the world require workers to test the atmosphere prior to entering a confined space. Although there are a few different ways to conduct pre-entry testing, the recognized best practice is to use a portable gas monitor equipped with a remote sampling pump. When the pre-entry testing is complete, it is also a best practice—and a requirement of some standards—to continuously monitor the atmosphere inside the space throughout the entry.

Pumped gas detectors like the Ventis® Pro5, when paired with the Radius® BZ1 Area Monitor, allow users to take samples of a space before entering and continuously monitor the space throughout the work. Although traditional confined space atmospheric testing calls for a hand-held portable instrument, the Radius BZ1 Area Monitor can reduce the costs and increase the efficiency and safety of confined space operations, particularly those calling for extended, continuous monitoring.

3. Communicate

After pre-entry testing, confined spaces must also be monitored by an attendant. One attendant can serve multiple confined spaces, as long as he or she can monitor the atmosphere and communicate with the entrants in all of the spaces. As you can imagine, this can sometimes make it difficult for the worker inside to communicate with the attendant. The concern here is that the atmosphere inside the confined space can change quickly and unexpectedly. But if the worker inside the space doesn't have a monitor, and the attendant is addressing an issue within another confined space, that worker could be in grave danger. The safest practice, therefore, is for a worker within the confined space to have a personal monitor that can share gas readings to the attendant's monitor, such as the Ventis Pro5. If a worker inside the confined space encounters a gas hazard, is immobilized, or needs emergency assistance for any other reason, the cause of the alarm is instantly relayed to the attendant's gas detector.

As unfortunate as it is, injuries and even death are not uncommon in confined spaces. To make matters worse, additional deaths can occur if rescuers attempt to help a worker in need, only to be overcome by those same atmospheric hazards. You can help prevent would-be rescuer tragedies by using personal and area gas detectors that can automatically share gas readings and alarms, so all workers know when a peer needs help and what conditions they're facing ■

Table of Contents

The best teams

COMMUNICATE... so do the best GAS DETECTORS

With the **Ventis® Pro5** from Industrial Scientific, Mike's teammates will know he's entered a high H_2S environment, so they can **respond faster** with more information—when every second counts.

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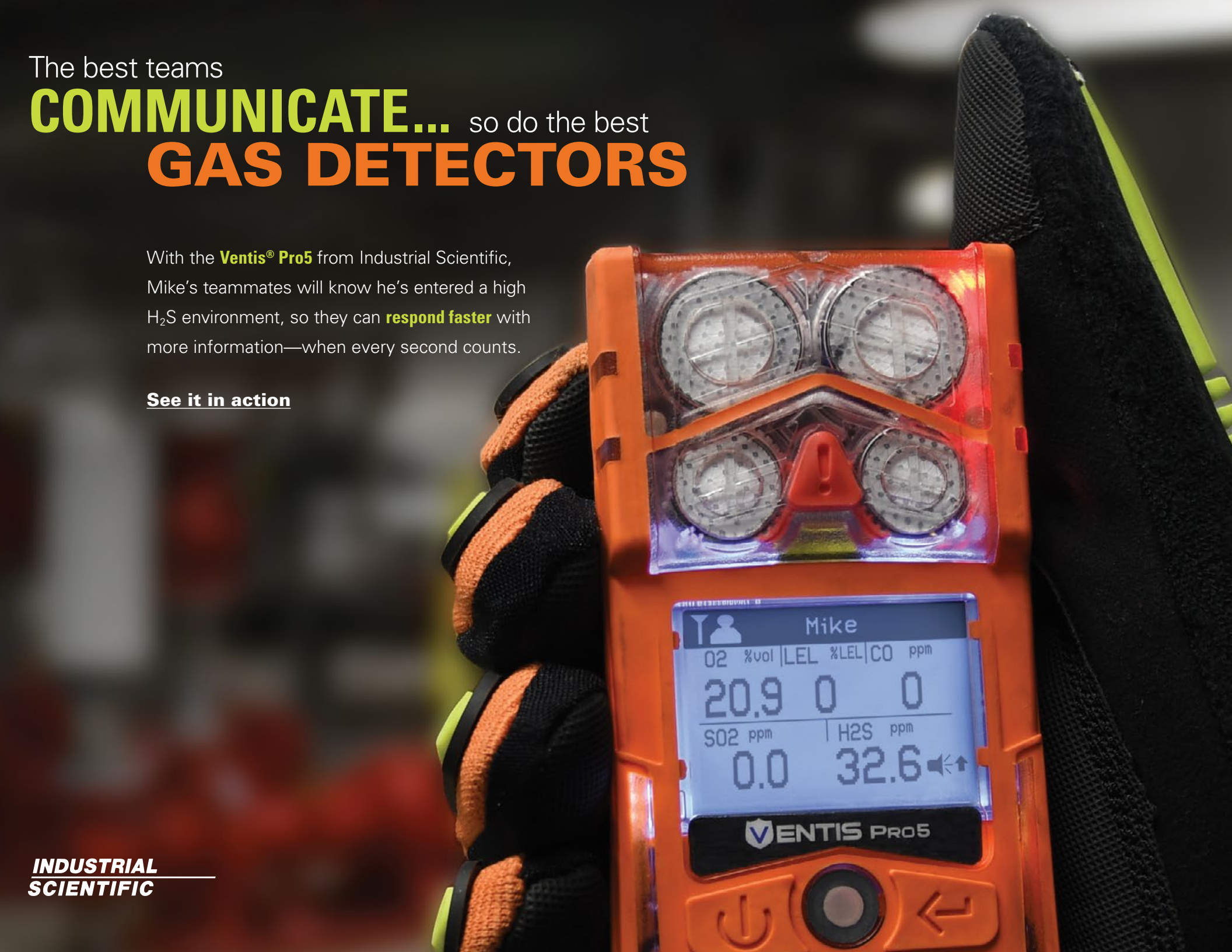


INDUSTRIAL SCIENTIFIC

Enhancing Gas Detection with Pattern-Finding & Predictive AI

By: **Sean Stinson**, *Chief Revenue Officer*

A Brief History of Gas Detection

For years, gas detection solutions have been hardware-driven. When looking to solve a problem, companies have typically invested in and relied solely upon sensors with gas-detecting capabilities, such as gas alarms from fixed or personal gas monitors. Additionally, site managers and industrial hygienists will conduct periodic manual assessments across a worksite in order to identify problem areas, observing infrastructure and gathering testimony from employees.

While these tools have proven effective, opportunities still exist to enhance gas detection as industry continues to digitize. For example, by just relying on sensors and human testimony, companies might miss a developing pattern of volatile organic compounds (VOC) readings, among others, from a certain area of a site that data and more advanced tools would identify. This narrow approach can result in oversights—leaving gaps in gas detection and workplace safety.

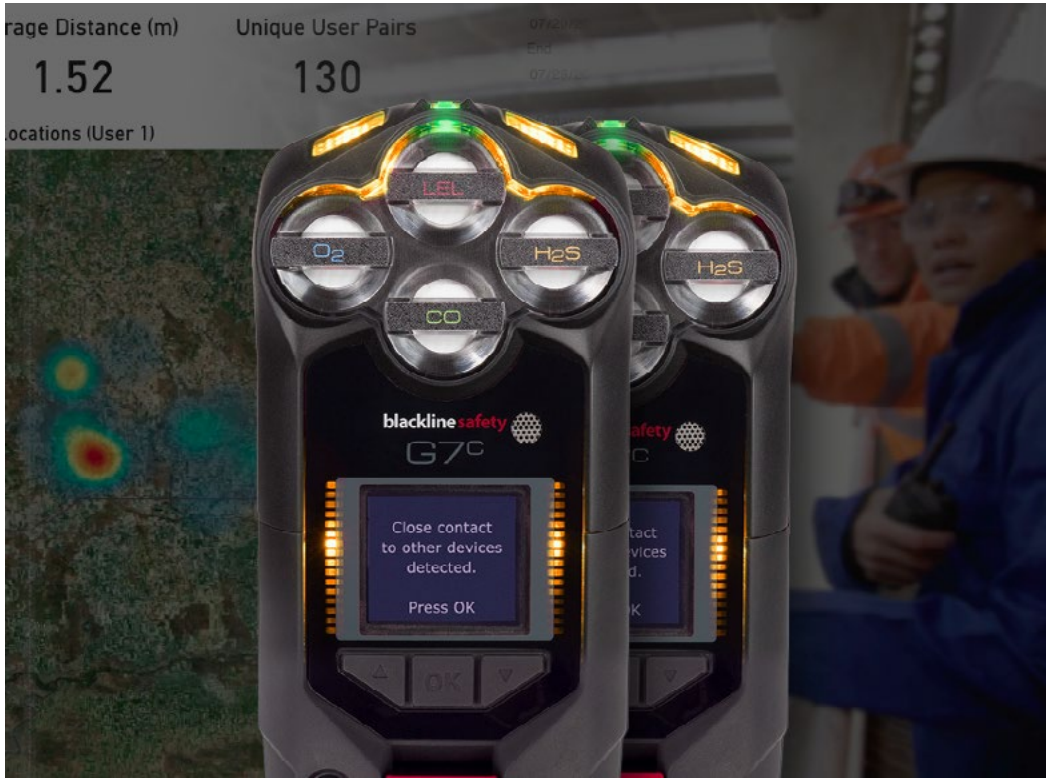
Leveraging Artificial Intelligence for Gas Detection

Enter artificial intelligence, otherwise known as "AI." AI is quickly increasing its footprint across industrial worksites. At its broadest definition, AI is a program tasked with solving a specific problem using data. AI works 24/7 to turn data into information that is of interest to and actionable by a person.

While the term "AI" was officially coined in 1956, advancements in AI have only begun to disrupt the industrial sector in recent years, as organizations started to invest and see the value in digital transformation. Since then, applications and opportunities to improve both productivity and safety have multiplied quickly.

For gas detection, AI is a tool that—when combined with data produced by industry-leading, cloud-connected sensors—automates the process of clustering non-zero gas readings, providing organizations with stronger situational awareness of safety threats across operational assets both in the past and into the future.

Specifically, this application of AI can assist IH professionals and the broader HSE teams to automatically surface patterns from all the non-zero gas readings logged by worker wearables, area monitors and cloud-connected sensors. This enables HSE and IH professionals to identify and address issues across operational assets—before they become mission-critical. Without AI, the safety team's field of vision is quite narrow, involving manual and costly work. It may take weeks or months for enough gas to escape from a small leak for traditional instruments to pick it up and alert employees, prompting an investigation—all while workers are exposed for 10-plus hours each day.



Additionally, AI keeps HSE teams from having to do the guesswork of thinking about gas presence based on testimony or information that only tells a narrow story. An AI module uses its pattern-finding capabilities to also help predict where gas leaks may occur in the future, empowering safety teams with better visibility and the insights needed to proactively look ahead and solve emerging problems. This application can

also help in cost-effective and proactive deployment of fixed gas emission monitoring systems.

When leveraging AI, the risk of human error or overlooking patterns in low-level gas readings is mitigated, improving organizations' ability to keep their people safe by identifying short- and long-term exposure threats, especially those related to VOCs.

In addition to worker safety, AI can also be an effective tool for compliance and supporting the worldwide effort of reducing greenhouse gas (GHG) emissions.

U.S. President Joe Biden's recently issued an Executive Order, which aims to reduce methane emissions in the oil & gas industry, is the latest example of how organizations will be faced with the task of reducing gas exposure both for their people and the environment. Using AI to better detect and address these leaks can serve as a meaningful part of an organization's gas detection strategy and GHG reduction program.

Implementing AI: How it Works

With the right tools and partner, the process of incorporating AI into an organization's operations is seamless. The most important prerequisite is utilizing an instrument that collects millions of data points across a worksite every day, which is possible through a modern, cloud-connected gas sensor. If a team is already equipped with gas monitors with these capabilities, then integrating AI requires no additional equipment or infrastructure.

The AI, along with a team of data experts, does the work from there. The module's algorithm will automatically gather data from the devices and will surface gas clusters. In many cases, safety teams and industrial hygienists will be provided with a digital map of the worksite with markings of where these hotspots are present. The module can also provide the opportunity to analyze each reading further, helping see where and how long – and often – each reading has been happening and how it's trending.

The beauty of AI is that it is highly customizable and can be tailored over time to address specific challenges. Whether a safety team seeks a macro view that summarizes the levels of gas readings over time, or a more micro view of each gas reading for industrial hygienists to review and address, AI provides the insight and learnings needed to enhance safety, visibility, efficiency and sustainability.

AI is the Future of Gas Detection

From successfully teaching a machine to master the game of checkers, to tech-giants such as Amazon and Google using machine learning for a significant commercial advantage, AI has proven its effectiveness across a broad range of industries and applications. And the opportunities for implementation are going to only continue to grow.

With AI finally making its way to the industrial landscape, organizations that have often been limited to traditional methods of gas detection can now take their processes and safety programs to the next level.

A criticism that is frequently cited in reference to AI is that it takes jobs away from people. It is important to note that in this application, AI is, in fact, doing the opposite. We consider it AI-assisted HSE, as it is providing people with data and insight to do their jobs more effectively and safely. AI assistants are everywhere, helping people to focus on their work, much like Siri or Alexa in your kitchen—while they don't cook for you, they help you pull up recipes and play music while your hands stay busy with the job at hand. AI for gas detection serves a similar purpose.

Through practical and pattern-finding insight, using existing infrastructure, companies can empower their industrial hygienists and HSE teams with greater situational awareness of gas levels across worksites and operational assets. It also provides organizations with an added tool to reduce greenhouse gas emissions, furthering their sustainability goals.

As AI continues to increase its footprint in the industrial sector, organizations that see how machine learning can help them proactively address challenges will come out most successful. While AI helps meet our important objectives of improving operational efficiency and corporate sustainability, it also helps us accomplish our critical, common goal: keeping our people free from harm in the short and long term so they can work with confidence knowing they are safe. ■

Gas Detection and Monitoring in Confined Spaces

By: **Barbara T. Nessinger**, *Chief Editor*

Employees of industrial firms often find themselves, for a multitude of reasons, working in a confined space. Worker health and safety is critically important in these situations. To that end, the U.S. Occupational Health and Safety Administration (OSHA) has many regulations which focus on providing a safe working environment for workers who must work in these confined enclosures.

Having adequate gas-detection equipment is a big part of maintaining awareness and compliance regarding confined spaces. Gasses present a particular risk for workers with little maneuvering room, because they are often odorless and colorless. Therefore, without the proper detection tools, workers can be unknowingly exposed. Such hazards can be mitigated by sufficient personal gas-detection systems.

However, before acquiring solutions, companies should be fully informed on what is required and what is available to help meet the requirements and secure their employees' safety.

WHAT IS A CONFINED SPACE?

According to OSHA's definition, a confined space:

- Has adequate size and configuration for employee entry;
- Has limited means for access or egress; and
- Is not designed for continuous employee occupancy.

A few examples of confined spaces include underground vaults in the telecommunications industry, aeronautical fuel tanks, sewers, silos or coal mines, and other places where it is difficult for employees to enter and exit.

The term "permit-required confined space," as defined by OSHA, is one that meets the definition of a confined space, above, and has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing the entrant;
- Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- Contains any other recognized serious safety or health hazards.

GAS DETECTION

Per OSHA's rules, companies need to monitor enclosed spaces for gases before allowing workers to step into these areas. OSHA standards require that before an employee enters the space, internal atmosphere must be tested with a calibrated direct-reading instrument for the following conditions: oxygen content, flammable gases and vapors, and potential toxic air contaminants. Additionally, there may be no hazardous atmosphere within the space whenever any employee is inside. This standard is the impetus for using a multi-gas monitor to perform atmospheric testing, prior to entering a confined space.

Employers can install gas-detection machines to measure the level of air contaminants. Proper air monitoring is an OSHA requirement for permit-required confined spaces, because of the potential presence of atmospheric hazards.

Companies can use single-gas monitors or multi-gas monitors to ensure hazardous gases are not present in enclosed spaces, before workers enter. In fact, OSHA clearly dictates that employers perform continuous gas monitoring.

CHOOSING THE RIGHT MONITOR AND SYSTEM

When choosing a monitor to test and continuously monitor a confined space, several attributes should be considered. The most important thing is to have a multi-gas monitor that is capable of monitoring for all OSHA-required hazards (oxygen, flammable gases and potential toxic air contaminants that may be present as a result of the processes that take place in or around the confined space). Next, consider a monitor that has either an internal or external pump that is capable of properly drawing the air sample back to a fresh air-monitoring point during initial testing of the space. The monitor also should have the capability of continuously monitoring the occupied space to ensure workers' continued safety. Other equipment/accessories, such as sampling probes, durable carrying cases and rechargeable batteries, can be complementary and useful.

Most modern monitors are equipped with bright visual and loud audible alarms to warn of potential hazards. An internal datalogger helps employers comply with the documentation of the spaces' hazards. A datalogger is a device containing a microprocessor; it stores information electronically taken from an instrument. The levels of all hazards being monitored can be downloaded from the datalogger to a computer or printed, for reference and record-keeping.

An automated instrument docking system is also extremely helpful when working with confined spaces. Such systems provide a myriad of benefits, including automated calibration/bump-testing (OSHA requires a "calibrated direct reading instrument" to safely detect a hazardous atmosphere); record-keeping; datalogging; and recharging. (Docking systems can be used to charge monitors when not in use. This ensures the monitor is fully charged for its next use). In addition, many automated maintenance systems

include technology that helps diagnose potential problems/issues with the monitor.

Portable gas-monitoring systems may be designed for a single substance, or they can be fitted with multiple sensors. Some measure up to six gases and include piercingly audible, attention-getting, 360-degree visual alarms.

An alternative or addition to personal monitors is a transportable area monitor. Many have area monitoring, via diffusion or with a sampling pump; wireless communications capabilities; and a waterproof housing with continuous operation of approximately 60 hours. Extra run time helps increase productivity by minimizing new checks of the atmosphere for each shift change or when the space may be unattended. Portable gas monitors are lightweight and can be as small as a cellphone. They run on either rechargeable or replaceable batteries.

Another important aspect of managing confined space gas-monitoring programs is on-going maintenance. The best way to be certain a monitor is in peak shape is to utilize the services of a manufacturer's factory service center. Using factory-trained service technicians ensures the monitor will be repaired or serviced by qualified individuals. Some of the key services to look for include in-house calibration and service; maintenance and warranty repair; and on-site mobile service/repair. Leasing or renting an instrument is also an attractive option, especially in cases of shutdowns or planned maintenance, where more instruments might be needed to perform the work within a specific timeframe.

WAY OF THE FUTURE

The global market for gas detection systems has seen notable growth recently, something that Transparency Market Research (TMR) claims will continue into the 2020s. In a recent report, TMR said the worldwide gas-detection equipment market will grow at a compounded annual growth rate of 5.6% to $5.6 billion by 2024. In 2015, the market value was $3.4 billion. TMR cited the rising tide of rule-making and worker safety-focused regulations being enacted—not only in the U.S., but also in the developing world.

The shift toward natural gas is one more factor that is causing greater demand for gas-detection systems. Coal has seen significant declines in recent times (despite recent U.S. promises to "bring coal back"), and natural gas has risen to the top of many consumers' preferences for heating and energy. The increased number of gaspowered installations multiplies the chances where workers might be in enclosed spaces— and increases the possibilities of gas leaks.

Persistence Market Research also found considerable opportunities for market expansion, given the high rate of infrastructure projects in the developing world. Researchers highlighted India and Brazil as countries undertaking particularly large projects that will elevate demand for gasdetection systems.

More companies than ever are investing in gas detection systems. It's important to choose the system that is right for a company's needs to safeguard the health of all employees working in confined spaces. ■

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DOD Technologies – The Leader in Low-Level Gas Detection

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photo courtesy Blackline Safety

Democratizing Connectivity: The Future of Gas Detection

By: **Sean Stinson**, *Contributor*

Connectivity has reshaped our world. From the smartphones in our pockets and networked smart homes to social media and wearables that track our wellbeing, connected devices have made instant awareness an expectation in both our personal and professional lives. Connectivity has disrupted retail, travel and banking and is now delivering on long-awaited promises in typically less-responsive, heavily regulated industries.

Gas detection is a mature market where the pace of innovation has been slow and lacked major reform—lagging behind other technology segments where connectivity is taken for granted. The landscape has changed in the last few years, where integrated connectivity has begun to transform modern gas detection, as well as the definition of what it means to keep industrial workforces safe, connected and productive.

This article examines the new era of gas detection that leverages instant connectivity; the industrial-internet-of-things (IIoT) with large sets of data that drive safety; and fact-based decision making. It offers real-world examples and insights on how connected gas detection can advance a company's digital transformation and help an organization achieve operational excellence. But, before we examine where we are and where we can go, let's start with a historic look at innovation in gas detection.

A Look Back at Gas Detection: from the Canary to the Clip-on Personal Gas Monitor

Gas detection has come a long way since its inception over 200 years ago.

In the mining industry, the earliest form of gas detection involved a designated worker who entered a coal mine with a wet blanket over his head and shoulders and a flaming wick to detect for gas. If methane or carbon monoxide were present, the flame would cause the gas to ignite, and the wet blanket would serve as the worker's only form of protection.

Both the Davy and Geordie lamps were created in England in 1815 and became the first tool to help protect miners from flammable gas, such as methane and carbon monoxide. Though operating with different principles, The Davy and Geordie lamp provided a trustworthy indication to miners of the presence of flammable gases.

Dating back to 1911, John Scott Haldane introduced a second major innovation in the personal gas detection world to help protect miners from carbon monoxide with the use of so-called "sentinel species"—the proverbial canary in the coalmine. Canaries are very sensitive to carbon monoxide and other toxic gases and provided early warning for miners, giving them the time to evacuate the area. Industry went as far as creating resuscitation chambers to rescue birds that were in danger through gas exposure.

As technology advanced, so did gas detection methods and applications. The first modern gas detection device used a

catalytic bead, or pellistor, sensor to accurately detect the amount of gas present in an environment using two platinum wires, each encased in a ceramic bead and one coated with a catalyst. When placed into a Wheatstone Bridge and one bead is exposed to gas, a resistance change in the heated bead is measured and correlates to the gas concentration. Though the pellistor sensor is still widely used today, this sensor now produces highly accurate readings for a target gas and is more or less sensitive to other types of combustible gas.

The introduction of portable gas detection systems defined the new era of gas detection we are familiar with today.

Democratizing Connectivity for a New Era of Gas Detection

For the first time since the 1990s and early 2000s, we are experiencing a major revolution in the gas detection market—this time driven by connectivity. The integration of cellular and satellite communication into safety and gas monitoring solutions not only keeps workers safer than ever before, but also empowers companies to realize the full potential of their digital transformation.

While other forms of connectivity are available, including Wi-Fi and mesh networks, there are some limitations with these other options. Wi-Fi systems are expensive to install and maintain, plus they do not provide universal coverage. Unlike Wi-Fi, mesh networks are short-range, ad hoc networks that don't require IT team oversight. Unless they're tied into cloud services through a cellular or Wi-Fi gateway, they are isolated from the business. With operating range, they can also see interruptions where users or area monitors become unavailable due to workers moving out of range or an obstruction that blocks a signal.

Teams are now, more than ever before, able to make data-driven decisions that improve safety, agility and the overall performance of their company's operations.

Businesses leveraging cloud-connected gas detection and data analytics technologies have instant and complete visibility of their workforce and worksites available at their fingertips. Leveraging data streamed from devices in the field through cellular or satellite channels to the cloud, teams can use online dashboards and interactive reports to see the real-time safety status of their workers; ascertain the compliance condition of their gas detection fleet; and view employee behavior as a leading indicator and mitigate risks before they become dangerous. Going further, these technologies are being used to look at proactive safety in a new light—and to illustrate how information can be leveraged to increase efficiency and overall quality.

At a fundamental safety level, real-time collection and communication of data powers the shift from reactive to proactive safety—while opening the door to look at worksite optimization and programs that focus on quality and efficiency. For example, a business can use location-enabled data from personal gas monitors to analyze how the geographic ratio of supervisors-to-workers has the chance to influence the behaviors of personnel.

From the canary in the coalmine to the clip-on personal gas monitor, gas detection has come a long way since its inception 200+ years ago. *(photo courtesy Blackline Safety)*

Our early research on this topic has shown that how employees use their connected safety wearables correlates with how recent a supervisor has been seen in the area. While more research is required, it's likely that mindful use of safety equipment will correlate with safe work practices and the potential for an improvement in near-misses and incident rates.

This situational awareness, coupled with features such as two-way voice calling and messaging, increases the efficiency of a rescue in the event of an emergency. In addition to incident reduction, connected gas detection technology can improve workers' confidence that their call for help will never go unanswered, allowing them to focus on the task at hand. Combined with mass notifications and location technology, personnel can be confident that it's easy to initiate an evacuation of a site and account for everyone along the way.

Technology adoption for the purpose of protecting a workforce creates a more engaged, safer workplace across all levels and locations of a business.

Guiding Digital Transformation

Intrinsic to digital transformation is the use of technology to improve your business

model, processes and culture at every level—including worker safety. An example of how leading connected gas detection can support a company's digital transformation goals is DCP Midstream, a Fortune 500 company and one of the largest producers and processors of Natural Gas Liquids (NGLs) in the U.S.

By nature of its business, DCP relies heavily on technology and innovation to meet the ever-changing needs of their consumers. Its digital transformation initiative, DCP 2.0, aims to increase digitalization, automation and technology adoption by its 2,600 employees across nine states and over 66,000 miles of pipeline. The company leveraged cloud-connected devices for gas detection and lone worker monitoring, which enable workers and managers to more quickly identify and respond to emergency situations.

For example, the cloud-connected device alerted DCP employees to a carbon monoxide exposure due to a faulty heater at one location and two faulty exhausts on two company vehicles. The device has also immediately alerted operations and safety staff, who contacted emergency services and responded to an employee who was injured in a utility terrain vehicle collision.

These swift responses are possible because of DCP's investment in emergency response drills, commitment to safety and use of cloud-connectivity. The company is seeing improvements, as it decreased its total recordable injury rate by 44% from 2016 to 2019.

Data-Driven Decision Making

In addition to driving safety, connected technology can also drive decision making to increase an organization's agility. Data, with the proper visualization tools and reports, enables strategic and fact-based decisions that are proactive in informing safety procedures and flexible in response to emergency incidents.

For example, managers can use data collected by cloud-connected devices to study movement patterns and optimize workflow to better understand the relationship between incidents and workplace programs and procedures. This approach expands the role of traditional organizational charts, which don't account for the ongoing deployment and movement of personnel. Having the ability to capture these movements and exposures provides the opportunity to be more agile in the development of both effective training and operating procedures.

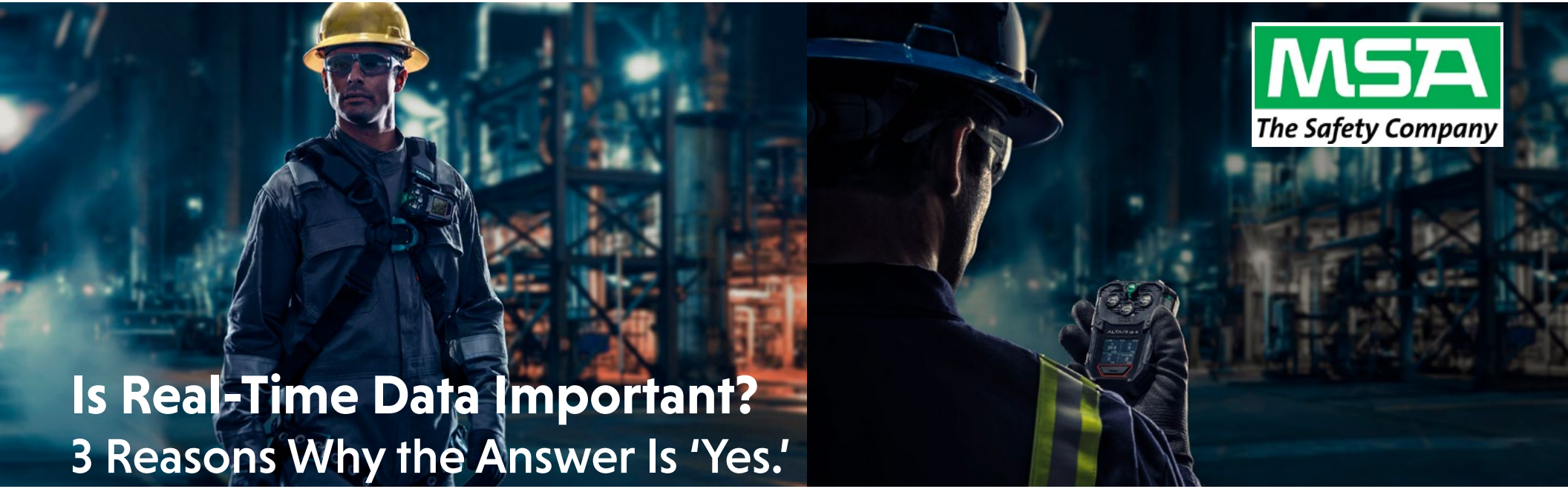
Data also helps identify hot spots or gas exposure in areas it may not have previously identified. Not only does it help identify potential safety concerns; organizations can use data science to quickly trace the root cause of the problem and develop the correct solution.

Implementing cloud-connected technology helps companies become more agile in their decision making by leveraging more accurate and real-time data to address safety issues. Traditionally, companies have relied on employee reporting to identify a potentially dangerous situation. Due to the subjectivity of reporting processes, evaluating the validity, impact and cause of exposure is a manual process, especially over multiple locations. With connected gas detection programs, companies can identify employee exposures with certainty, as well as the duration of the exposure.

Scaling these insights across an entire workforce, managers can use this data to identify gas exposure hazards and calibrate its response accordingly. This real-time data allows managers to be agile and effective in making decisions surrounding workplace safety and procedures. In addition to increasing safety, this also greatly increases the response times in the event of an emergency with 24/7 monitoring services.

By seeing real-time data across a company's network, safety professionals remain focused on eliminating hazards; improving engineering controls; standardizing workplace procedures; and continuing to build a culture that is focused on the safety of its employees.

Cloud-connected gas detection improves worker safety and efficiency and gives workers and managers the confidence and information they needed to get the job done. While connected gas detection is not the only component of digital transformation, it is a leading indicator of an industrial organization's true commitment to safety and digital transformation. IHW



Is Real-Time Data Important?
3 Reasons Why the Answer Is 'Yes.'

There's been a lot of talk in the world of safety about the need for real-time data. Although most will agree that real-time data benefits safety programs by providing information for better decision making, some may wonder if real-time data is as crucial as they've heard.

The short answer is yes, and here's why.

A properly calibrated and bump-tested gas detector is a powerful personal protective device. By itself, however, it's simply not enough to help ensure the highest level of safety.

That's where a connected work platform comes into play.

A connected work platform combines real-time data, connected PPE/detection wearables, and advanced software solutions, providing the best possible visibility across workers, worksites, and workflows.

In fact, connectivity enables the kind of visibility that can lead to **a stronger safety program and improved safety outcomes**. Even better? A strategic connected worker-worksite-workflow platform helps simplify safety, curb risk, and boost productivity. Plus, it sets you up for a scalable and adaptable safety program. Consider these three reasons why real-time data via a connected platform is a must for worker and worksite safety:

1. Real-time data enables real-time visibility for safety teams.

By nature, remote workforces leave safety managers disconnected from what's happening on the job. So, what's a disconnected and physically distant safety manager to do in the event of an unsafe incident, especially when every second counts?

They can ensure that lone workers are not alone, using the visibility provided by a connected platform. If workers, worksites, and workflows are *not* connected, there's likely going to be too much lag time between incident and information, that's costly to both worker safety and infrastructure.

With connectivity-enabled real-time data, safety managers can have continuous situational awareness. That means seeing the state of workers and monitoring their safety behaviors in the field. It means you'll get gas exposure alerts, man-down alarms, panic button presses, and device concern warnings in real-time so you can act swiftly. Plus, it means simplifying compliance and improving productivity to reduce risk and costly downtime.

The key to leveraging critical real-time data is having your hardware or gas detection devices connected to both the right software and to the cloud through a seamlessly integrated solution. While the device does its job of collecting data, the software empowers safety managers with information and insights to drive a more proactive safety culture. Even better is that this creates a more unified and streamlined workflow. No relying on cumbersome file transfers and downloads. No more time spent on the tedium of piecing together information for incident reporting.

A comprehensive hardware-plus-software connected solution gives the entire safety team a single place (accessible anytime, anywhere with an internet connection) for the data and support required to support operational efficiency and enhanced safety.

2. Real-time data helps improve operational efficiencies.

Gas detector check-ins and check-outs can be extremely slow and inefficient. They are, however, crucial to ensuring that workers use their PPE devices correctly – and that the devices are properly returned to the fleet. Based on our work with clients across a variety of industries around the world, MSA estimates that roughly 20% of gas detection devices never make it back to the fleet. Not only are the devices lost, but in a disconnected program, the data is also gone forever.

Thanks to a connected program, safety managers can assign a device to a worker, enabling real-time, worker-specific data. That leads to significant operational efficiencies, including:

- Automated check-in and check-out for daily, project-specific, and long-term use
- Increased worker accountability for the device
- Faster understanding of what's happening with the worker, including the type and level of exposure
- Easier identification of noncompliant workers, so they can be trained or re-trained on proper safety procedures and protocols

3. Real-time data better safeguards lone workers for better peace of mind.

There are more than 50 million lone workers in the U.S., Canada, and Europe, mostly found in the oil & gas, telecommunications, utilities, construction, and industrial industries.1 Their working conditions are uniquely and inherently fraught with a variety of potential hazards, including accidents, emergencies, and illnesses that require trained, capable, and properly equipped workers to do their jobs under such conditions.2

Connected workers, conversely, can be better kept free from harm. Compliance, fleet manager, or live monitoring services extend visibility, ensuring that critical data points are delivered in real-time from on-site workers to off-site safety managers. Not only does this help protect the lone worker from gas exposures, but it also connects them to real and tangible help when needed.

As any lone worker can attest, *working* alone is not the same as *being* alone. Thanks to in-the-moment monitoring and real-time data, lone workers can have the peace of mind, knowing their safety team has their back whenever and wherever they're on the job.

What Safety Teams Can Do

Now that you know the benefits of a connected work platform, the next step is to take a deeper dive into understanding where you are on your connected journey. The MSA Connected Work Platform seamlessly integrates connected workers, connected workflows, and connected worksites to help you build and maintain a flexible and proactive safety program that only gets better with time.■

1 https://www.ishn.com/articles/104413-how-to-protect-remote-lone-workers
2 https://www.hsa.ie/eng/Topics/Hazards/Lone_Workers/

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By: **Bob Henderson**, *Contributor*

Fixed Gas Detection: Issues and Answers

Dealing with the actual or potential presence of dangerous gases and vapors in the workplace involves a complex series of decisions. Decisions related to "what to do" should be implemented by means of an integrated protection plan based on a hierarchy of priorities. The most desirable approach—when feasible—is to implement engineering controls and practices that completely prevent the release or formation of dangerous gases and vapors. If it is impossible to completely control or eliminate the possibility, the next best solution is to implement use of equipment and techniques to monitor for the presence of gas and take appropriate action when dangerous conditions are determined to be present.

There are two basic approaches to atmospheric monitoring: portable gas detectors assigned to workers who enter the affected area or fixed detection systems. Fixed detection systems are permanently installed and function 24 hours/day. They can be used to display readings, activate alarm lights and sirens, control ventilation fans, notify internal and external emergency responders, or be used in process control applications. Another important function is demonstrating compliance with regulatory requirements. Monitoring records can be used to document conformity with OSHA or EPA limits, for example.

A fixed gas detection system that monitors 24/7 can often provide better protection than portable instruments used only when qualified workers are present to determine whether conditions are safe. This is particularly true when the area is routinely entered by workers in the course of their normal duties. Fixed systems are often the more cost-effective solution, especially when training and maintenance costs are factored in.

Sometimes the best approach involves the combined use of both fixed and portable monitors. Deciding which approach to use is not always a trivial exercise. The following questions provide a guide for making this decision.

What kind of atmospheric hazard is potentially present?

The hazard to be measured determines the type of detector. Although some detection techniques are more commonly used than others, fixed systems are available with virtually every commonly used gas detection technology. In fact, there are more detection options available with fixed as opposed to portable instruments, since power requirements, as well as the size of fixed systems components, are less of a concern.

The batteries used in portable instruments can only store so much power, and the low-power sensors used in portable instruments to extend operation time are often more vulnerable to sensor poisons and operation in adverse conditions. On the other hand, fixed systems are usually powered by means of a line power connection, so power requirements are generally not an issue—making it possible to use more robust detection technologies.

The type of atmospheric hazard also determines the type of warning needed. The more rapidly the hazard affects workers, the more urgent it is for the system to provide an immediate warning. For instance, a concentration of only 1,000ppm is enough to "knock down" workers with a single breath. While oil industry workers are routinely equipped with personal H2S monitors, many sites are additionally equipped with fixed detection systems that monitor the general area for this hazard. This "belt and suspenders" approach ensures that both general conditions affecting everyone in the area, as well as localized conditions affecting a single worker, are discovered as quickly as possible.

How do you determine what to measure and when?

Make sure to fully assess the causes and risks before you decide on the monitoring response. Is the source of the hazard readily identifiable? Is the hazard associated with the work being performed? Is the danger present all the time or only under certain circumstances? What industrial processes are occurring that might generate or affect the presence of the hazards? Are there additional risks under emergency circumstances? Fixed detection systems should always be considered as an option when hazards are known to be chronically present in areas where workers routinely enter without special precautions.

What is the physical nature of the area affected?

Is the entire facility affected or only specific areas? Are the areas of concern out-of-doors and subject to good ventilation? Are the areas of concern indoors or in localized areas that prevent rapid dispersal of contaminants? Is the area congested by equipment or structures that prevent or interfere with worker evacuation? Monitoring programs need to provide workers adequate time to "self-rescue" during an emergency. The harder it is for workers to leave the area, the more desirable it is for

The GMA200 MW4 is a complete one-to-four point controller system that includes display, push-button controls, programmable relays, and built-in alarm lights and high-intensity alarm. It can be used as a complete standalone system or integrated into a larger monitoring network. *(photo courtesy GfG Instrumentation)*

The IR-29 is an intrinsically safe, fixed-system gas transmitter used to measure LEL gas. The intrinsically safe design does not depend on an explosion-proof housing, which reduces noise and improves performance. *(photo courtesy GfG Instrumentation)*

a 24-hour-a-day "sentry" system to provide the earliest possible alarm.

Should the affected area be maintained safe for continuous worker occupancy?

Entry into hazardous locations is controlled by means of permits, training, need to enter and physically limiting access. Anyone entering "controlled" areas must use special procedures, as well as the required equipment, including portable gas detectors. When workers routinely enter the area without special procedures or precautions, if the hazards cannot be permanently eliminated, the better approach is often to make the area safe for continuous occupancy. Addition of a fixed detection system coupled with other engineering controls, such as permanently installed ventilation, may allow the reclassification of the area as a non-hazardous location.

The cryogenic storage systems in the basements of many hospitals are good examples. Tissue samples and other biological materials are stored in liquid nitrogen in large thermos-like Dewar vessels. When the lid is opened, or in the event of a leak, the release of nitrogen vapor can rapidly create a deadly oxygen deficiency. Typically, fixed O2 monitoring systems that include a display visible from outside the cryo-bank area are used to alert hospital staff before they enter. There are many industrial areas, such as the pits under automotive assembly lines and occupied areas of sewage lift stations, where the same ventilation and monitoring strategy is used to verify the area is safe at all times.

What is the level of control over worker activities in the affected area?

The lower the level of control over worker activities, the more desirable a continuously operational fixed detection system becomes.

What is the level of training of potentially affected workers?

One of the advantages of fixed detection systems is that workers entering the monitored area usually are not involved in the day-to-day operation of the system. All workers entering the area need to do is follow company procedures in the event an alarm sounds.

What are the trade-offs in cost?

Equipping workers individually with gas detectors can be expensive. A permanently installed system can often reduce gas detection costs. The image that usually comes to mind of a fixed gas detection system includes dozens of gas detector transmitters in explosion-proof housings that are connected by cabling installed in expensive, stainless-steel conduit and connected to a controller or expensive programmable logic controller (PLC) in a central location. That is only one alternative. Many fixed systems are simple one- or two-sensor standalone systems that include built-in, high-intensity alarm lights and horn. Even the sensors can be built into the standalone housing. Installation of smaller, self-contained systems can be as simple as terminating them to line power. Of course, they can still be connected to a controller or PLC or to the Internet if the real-time monitoring information needs to be communicated to additional remote locations.

What about fixed systems installed in hazardous locations?

The equipment used to monitor for the presence of flammable gas must be designed for use in the intended hazardous location and must carry an appropriate certification from a qualified testing laboratory or agency. In North America, qualified testing laboratories are referred to as Nationally Recognized Testing Laboratories (NRTLs). OSHA maintains and publishes the list of currently recognized laboratories at the following website location: https://www.osha.gov/nationally-recognized-testing-laboratory-program/current-list-of-nrtls.

Equipment that is used in areas that potentially contain flammable gas must be designed so that hot surface temperatures, electrical discharge and other forms of stored energy associated with the equipment are not capable of causing ignition of the flammable gas, given the type and severity of the hazardous conditions in which the equipment is installed or operated. The product documentation, as well as the certification label, include the protection method, ambient operating temperature range and types of gas to which the certification applies.

What are the protection methods for fixed system components?

There are three commonly used protection methods used to prevent the ignition of flammable gas by equipment designed for use in hazardous locations: (1) contain the explosion by means of "flame-proof" or "explosion-proof" conduit and enclosures; (2) physically separate or isolate electrical parts and hot surfaces from the ignitable gas by means of techniques such as encapsulation, pressurization and use of electrical (Zener diode) barriers; and (3) limit the energy.

Intrinsically safe equipment is designed to limit the energy (thermal and electrical) capable of being released by the equipment. Certification for intrinsic safety is based on the maximum energy that is capable of being released both during normal operation, as well in fault conditions. Equipment that is certified as intrinsically safe is not capable of releasing the minimum ignition energy necessary to ignite the type and temperature class of gases, over the ambient operating temperature range to which the certification applies.

The GfG CC-33 is a fixed system gas transmitter equipped with a catalytic LEL sensor. The transmitter is certified as a flameproof device for use in combustible gas hazardous locations. *(photo courtesy GfG Instrumentation)*

What are some of the other fixed system benefits?

Fixed detection systems monitor the atmosphere continuously. An advantage of installing a fixed detection system is that workers entering the monitored area are not usually involved in the day-to-day operation of the system. Procedural issues are much more complex when workers are required to use personally assigned portable gas detectors. Addition of a fixed detection system coupled with other engineering controls, such as permanently installed ventilation, may render otherwise hazardous areas safe for continuous occupancy and eliminate the need for procedural controls, such as entry permits.

Don't be afraid of considering fixed system solutions!

Larger systems can be complicated, but your manufacturer partners are there to help you through the specification process. The most common solutions are often based on small systems with 1 to 4 points of detection. And don't go it alone. The manufacturer, distributor and consultants are all there to help.

Are fixed systems expensive?

Purchase and installation of a fixed gas detection system can be a significant capital expense. However, equipping workers individually with atmospheric monitors can also be expensive—especially if training, testing, calibration and maintenance are factored in. A permanently installed, fixed system is often the more cost-effective solution. The system can be configured as a simple standalonesystem that provides information and alarms on a local basis or as a larger, integrated system that can communicate real-time monitoring results literally on a world-wide basis. Small, single-point systems are often no more expensive than the portable instruments used to measure the same hazard.

What are the major components in a fixed gas detection system?

Fixed gas detection systems consist of a number of different components and assemblies, including sensors, gas transmitters, controllers and peripheral equipment (i.e., alarm lights and horns). The gas detecting sensor and associated electronics are referred to as the "gas transmitter." The gas transmitter is installed in the area that needs to be monitored. Controllers are typically installed outside of the hazardous location or in a central location.

The transmitter is available with or without a display; with or without a local control interface; and may be connected to controllers and other system elements by means of (typically) a 4-20mA line power connection or integrated digitally with the controller and other system elements by means of RS-485, MODBUS or HART protocol connection. It is also possible to integrate the system by means of wireless communication methods.

Controllers are used to communicate with the gas transmitters; process the monitoring results; display readings; activate alarms; control peripheral equipment; and log data. The flow of information through the system may stop at the controller, or the controller may be connected to a"higher order" logic center, such as a Programmable Logic Controller (PLC), Distributed Information System (DIS) or Environmental Health and Safety (EHS) computer. Alternatively, gas transmitters may be wired directly to the PLC or EHS computer. Alarms and realtime readings can be displayed at the transmitter, at the controller, at the PLC or redundantly displayed at multiple locations.

How do you make sure you have the needed information to discuss fixed system options with the manufacturer or distributor?

Ask if the manufacturer or distributor you are working with has a "Fixed System Questionnaire." Clarifying what you need by means of a detailed questionnaire reduces the chances for specifying or purchasing the wrong equipment. If you do not have a copy, contact the manufacturer. Answer as many questions as you can, but don't worry if you can't answer them all. The manufacturer will tell you if there is something that must be nailed down before they can provide advice or generate a quote. And don't be afraid to ask the manufacturer for help with the answers. IHW

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