



Protection Through Detection

## **Increase Safety, Reduce Costs With Wireless Gas-Detection in Oil and Gas**

RAE Systems, Inc.

## Introduction

Now that today's wireless gas-detection systems are field proven in oil-and-gas-industry applications, these industrial-grade systems are providing both increased safety and cost savings in exploration, drilling, production, as well as plant turnarounds and retrofits.

- These detection systems have become an attractive replacement to traditional fixed- or hard-wired systems, and are now available as stand-alone monitors or with rapid-deployment kits and self-healing mesh-radio systems.
- A key advantage to this generation of wireless gas monitors is the ability to re-broadcast alarms and data in real time. Wireless system users can now engage remote industrial hygienists, safety experts and managers in the same way doctors working in remote locations can work with medical-center specialists as things happen.
- Advances in secure Internet access and the ability to get data onto the Internet from almost anywhere have made this real-time interaction possible. Data access has now become an operational advantage to globally distributed safety teams as well as multinational firms.

Interoperability also has improved to the point where systems used in industrial applications can now share data with first responders on an emergency basis. First responders with mutual-aid agreements also can share wireless units and data with other responding agencies, which helps increase safety.

This paper will review how wireless gas-detection systems are being adopted to perform a range of industrial applications. In this paper, we will look at three wireless gas-detection applications: A methane gas extraction plant; a mobile natural-gas drilling operation; and a plant retrofit that includes confined-space entry in a coal-fired power plant.



## Saving Time and Enhancing Drill-site Safety

First, we will examine how wireless gas detection is benefiting a leading gas drilling safety-solutions provider in the U.S.

Oilind Safety, Inc. was tasked by one of its oil-drilling clients to streamline the rig-up and rig-down time for natural-gas wells while maintaining safety for on-site personnel and a local community in a remote area in the Rocky Mountains of Colorado. For Oilind Safety's Area Manager Aaron Chamberlain, the key concern was potential exposure to very high concentrations of hydrogen sulfide (H<sub>2</sub>S) gas if leakage or a valve failure were to occur.

Compounding the threat were the many challenges at the demanding drill site. It's a gas field with 200-shallow sweet-gas wells and nine very deep, high-pressure, sour-gas wells that range from 24,000- to 25,000-feet deep. It produces 330 million cubic-feet (9.3 million cubic-meters) of natural gas each day.



The site required continuous monitoring (24/7) while on-site communications were hampered by high vibration from equipment and noise levels that ranged from 65dB to 140dB. Temperature extremes ranged from 65F/19C during the day to minus 35F/-38C at night. Due to the high hazards of the site, all equipment had to be intrinsically safe.

In fact, the site had already presented serious problems for a fixed gas-detection system. That original system was mounted in the bed of a pickup truck, which was filled with spools of wires. This required trenching the wires underground to each of the well sites and then connecting them to sensor heads mounted on tripods. The trenching and rigging process could take up to two weeks, depending on the size of the site.

And the challenges did not end there. The fixed system, powered by solar panels, failed repeatedly, particularly during the winter months. Its performance also varied depending on the length of the wire runs to the detectors while faulty alarms due to temperature fluctuations were commonplace.

Oilind Safety then deployed RAE System's MeshGuard wireless gas-detection system, which provided a fast and flexible intelligent safety network used for hazardous gas detection in stationary applications. The MeshGuard family of intelligent, wireless, connected, toxic and flammable gas sensors is easy to transport, easy to deploy, and easy to operate in environments where rapid deployment means faster time-to-revenue.

The deployment included four H<sub>2</sub>S sensors on the well site itself, around equipment and personnel, and two heads stationed in the work camp to protect sleeping employees and on-site office workers. The monitors were calibrated once a week. For back up, six personal ToxiRAE 3 single-gas H<sub>2</sub>S monitors from RAE Systems were deployed for employees working directly on the drill site.



The deployment of the MeshGuard H<sub>2</sub>S system took less than two days, already a huge time saver compared to the fixed system. Determining where to use fixed or magnetic mounts for the wireless sensors used up most of this time. After some training and experience, the deployment of the wireless system was soon reduced to a matter of hours.

In the end, the time saved deploying the single-case portable MeshGuard system – which included six sensors and a base-station controller – more than paid for the entire system. The sensors were stable over the operating temperature range and there was no signal loss from the radios. That stability, along with reduced rig-up/rig-down times, provided a big success for Oilind Safety.

### **Faster Time-to-Production Without Compromising Safety**

The story is a similar one for a leading coal-seam methane-gas producer in Australia (name withheld) where the safety goal is to always exceed Occupational Health and Safety (OHS) best practices. It's that kind of safety commitment that also helps drive improvements across the company, including updating processes, work methods and equipment.

- The challenge for this company was to tap into methane-gas deposits, trapped by water and pressure in coal-bed seams 1,000 to 1,600 feet (300-500 meters) deep, while maintaining intrinsic site safety. It was also open to an alternative to the hard-wired, fixed heads and portable instruments it commonly used.
- The previous fixed-wire solution at the drilling site required that all of the cables be trenched and buried underground, a tedious and timely effort.

For this methane-gas production application, this company chose a wireless MeshGuard system which consisted of four lower-explosive-limit (LEL) monitors to detect flammable-gas leaks along with extended-run-time RAE PowerPaks, two hydrogen sulfide (H<sub>2</sub>S) monitors and an FMC 2000 controller.

The wireless MeshGuard system, which proved to be a dynamic new solution for the gas-production company, was installed at the drilling site and was operational in 30 minutes. The MeshGuard system eliminated the cable trenching and burial deployment step and accelerated time-to-production by several weeks.

### **Wireless Systems Provide Safety Beyond Personal Monitors in Confined Spaces**

S&R Environmental Consulting, Inc. of Denver, Colo. – a multidimensional, full-service environmental consulting firm – used a proven wireless solution from RAE Systems to bring a sense of manageable risk to a large, dangerous and highly sensitive confined-space-entry project.

The company was tasked with managing site and worker safety for an epoxy re-coating project for a major coal-fired power plant client inside a “bag house,” which is used to collect the solid-waste fly-ash particulates from the coal-fired plant.



The utility company had significant safety sensitivity due to an earlier accident – a lethal flashover incident – at one of its sites and this project was the first coating project after the accident. Because of the prior incident, the painting contractor, power-plant operator, remote industrial hygienist and on-site safety professionals all wanted access to the alarm and real-time sensor data as well as ongoing confidence in the detection/protection solution.

“This site had the potential to become an immediate danger to life and health at any point,” noted Rick Block, president of S&R Environmental consulting. Workers were required to use methyl ethyl ketone (MEK) to clear the mixing blocks and spraying guns while other site threats included nitrogen oxides (NO, NO<sub>2</sub>), sulfur

dioxide (SO<sub>2</sub>) and carbon monoxide (CO).

The bag house is a large, compartmentalized, multistory building, normally operating under negative pressure. Each compartment is 20-foot wide (6m), by 20-foot high (6m), by 40-foot long (12m). The project included coating the inside of the bag house – while it was still operating – with a plural-epoxy coating to increase its life span. Workers were grit blasting and applying plural coating in compartments that are isolated by large poppet valves. Leakage or valve failure could cause the isolated compartments to be quickly flooded with CO and SO<sub>2</sub>.

The gas-detection solution chosen for this site was an AreaRAE wireless 5-gas monitor with lower explosive limit (LEL), oxygen (O<sub>2</sub>), SO<sub>2</sub>, CO, and a photoionization detector (PID) for volatile organic-compound (VOC) monitoring. In addition to the site gas monitors, the data was shared over the Internet using a secure proprietary network, allowing all of the safety managers to see the same data in near real-time.



AreaRAE monitors were operating 17 hours a day and were calibrated each week. The wireless monitors were placed on a catwalk 40-foot (12m) high with 20 feet (6m) of tubing running from the units to the chamber being serviced. Typically, two chambers were serviced at any given time. The sample tube was placed at worker breathing height using a simple stand.

Additionally, wireless-unit data was validated with hand-held MultiRAE Plus, 5-gas, monitors configured with the same sensors as the wireless units. Extra sensors and intake filters were stored on-site for easy replacement.

Filters were generally changed twice for each 17-hour shift of operation.

There were two alarm incidents while the units were deployed. One was a rise in CO, eventually found to be from the exhaust of a compressor that was operating below the catwalk. The second was from VOCs, a difficult alarm to trace as there should not have been VOCs present. Eventually, it was traced to a solvent that workers were using to free stuck bolts.

The AreaRAE wireless system proved much stronger and more efficient than traditional handheld (non-wireless) units, which alarmed most often due to stalled pumps. The wireless units had fewer pump alarms and the data sharing from the system provided opportunities for group problem solving.

If this site had microclimates in the workspace, multiple monitors would have been provided for each confined space with sampling at different heights.

With the shared data, more supervisors were able to monitor the work situation and worker safety with real-time visibility for those involved, including plant executives who were viewing and commenting on monitoring results from a remote location.

All of this resulted in safety personnel being more attentive and analytical in their approach to any problems by having both real-time and historical data available. The combination of audible and visible alarms also was an asset.

This deployment highlights the limitations of traditional handheld gas monitoring. Personal monitors do not provide constant supervision, making workers responsible for managing their own response to their work environment. Even when there is an alarm, workers may choose to ignore it or may respond to pump alarms as opposed to limit alarms. All of which makes it difficult for confined-space operators to keep watch over the work environment of many workers.

## Summary

Wireless gas-detection systems continue to demonstrate their strong, effective field reliability as viable, cost-effective solutions in a wide range of oil-and-gas-industry applications.

Modern wireless systems can be easily interfaced to the Internet for real-time alarm and data sharing. Wireless systems are available in point-to-point and mesh-radio configurations, giving users a choice that fits their application and deployment environment. The reduced time-to-deployment of a wireless system often can be enough to justify the cost of changing equipment.

- The cost to deploy an industrial wireless gas-detection system has been reduced to between \$1,500 and \$7,500 per node, depending on the configuration.
- Today's systems are field proven in harsh and potentially hazardous areas with extended temperature operating ranges from -40-degrees Fahrenheit (-40C) to as much as +122-degrees Fahrenheit (+50C).
- Wireless gas detection systems are now available with a broad range of power options, including standard 110V/220V, battery or a battery with solar assist. These options give safety managers a new set of tools to deploy in a wide range of safety-management situations.
- Other applications for wireless gas detection include hazardous-material response, exploration drilling, refinery turnarounds, sewage/water treatment plants, petrochemical transportation, confined-space entry, leak detection, worker protection, fence-line monitoring, scrubber efficiency, and H<sub>2</sub>S safety and elimination.

Checklist items to consider when selecting and adopting a wireless solution include:

- The frequency and range of the data radios;
- Potential interference with existing systems; and
- The intrinsic safety certification of the system.



RAE Systems MeshGuard with a SolarPak power supply.

## Learn More: Additional Useful Information and Ideas

1. Register for a free Facility-wide Wireless Gas Detection Assessment and demonstration [HERE](http://www.raesystems.com/support/request-information) (<http://www.raesystems.com/support/request-information>)
2. Learn more about Oil & Gas wireless detection [HERE](http://www.raesystems.com/industry/oil-and-gas) (<http://www.raesystems.com/industry/oil-and-gas>)
3. Watch a video on use of the ToxiRAE Pro and ToxiRAE LEL single-gas monitors in Oil & Gas use cases [HERE](http://www.youtube.com/watch?v=bVwoBfGj9QU&feature=player_embedded) ([http://www.youtube.com/watch?v=bVwoBfGj9QU&feature=player\\_embedded](http://www.youtube.com/watch?v=bVwoBfGj9QU&feature=player_embedded))
4. Watch a video on the new MultiRAE, the world's first wireless portable multi-threat monitors that give safety professionals unprecedented visibility into chemical threats [HERE](http://www.youtube.com/watch?v=DY8p_uCy6lo) ([http://www.youtube.com/watch?v=DY8p\\_uCy6lo](http://www.youtube.com/watch?v=DY8p_uCy6lo))
5. Download an eBook on Gamma radiation detection [HERE](http://www.raesystems.com/radiation-white-paper) (<http://www.raesystems.com/radiation-white-paper>)

## About RAE Systems, Inc.

RAE Systems is a global sensor and wireless-system innovator that designs and manufactures a full line of fixed, portable, handheld and personal chemical- and radiation-detection instruments. The company's life- and health-saving detectors are used in 120 countries by many of the world's leading industrial corporations, first responders and government agencies.

RAE Systems offers a variety of rapidly deployable and custom-configurable sensor solutions for incident response and Oil & Gas site monitoring. RAE Systems delivers cohesive, wirelessly connected threat-detection solutions that create a layered defense against gas and VOC threats and other gas and combustible risks.

RAE Systems' experienced technical-detection consultants use the company's wide range of gas- and radiation-detection solutions to deliver around-the-clock monitoring for accidental deadly atmospheric gas releases and potential airborne attacks. RAE Systems' solutions for Oil & Gas monitoring and protection are:

- **Versatile:** RAE Systems' easily deployable fixed and portable monitors placed in sensitive areas transmit sensor information in real-time to a central location for quick interpretation, analysis and action.
- **Wireless:** Wireless atmospheric monitoring that utilizes cost-effective equipment that is easy to install and operate can assist plant managers and operations commanders and first responders with real-time information on potential hazards.
- **Proven:** With more than 15 years of experience, RAE Systems' innovative solutions have a verified track record.

RAE Systems offers a wide range of rugged, yet easy-to-use monitors that enable continuous, real-time safety- and security-threat detection in nearly every environment, along with wirelessly connected solutions that lead the industry in performance and reliability. RAE Systems' intrinsically safe and globally certified monitors help elevate safety for workers, responders and the public at large; reduce project downtime; and maintain regulation compliance.