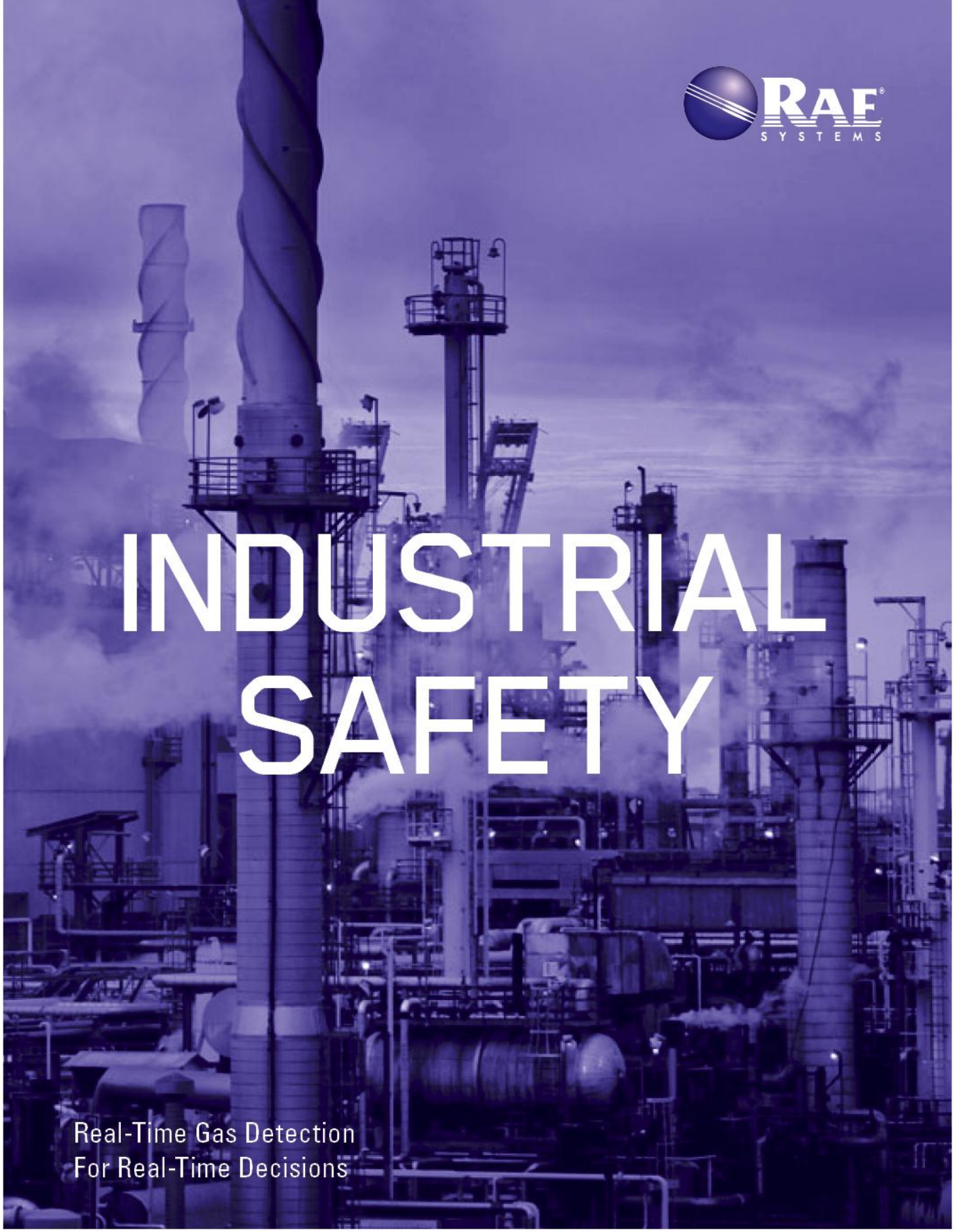

Advantages of Wirelessly Connected Atmospheric-Hazard Monitoring Equipment

Rae Systems, Inc.

Introduction

It was an eerie sound. But one everyone on the salvage team that approached the capsized barge recognized as the sound of metal buckling and welds popping. They also knew it meant this HazMat incident had taken yet another disastrous turn for the worse.

For four days, the first-response commander operated in full-alarm mode, coordinating with state and federal environmental authorities to develop plans, only to discover new problems requiring new plans.

From the time it capsized at a refinery dock in Texas City, the listing barge – loaded with 235,000 gallons of sulfuric acid –began seeping its toxic, corrosive load into the 30-foot-deep waterway. Even more dire now was what those sounds meant: Water mixing with sulfuric acid inside the hull had begun to corrode the steel of the barge. This process reduced the structural integrity of the barge and created reactions inside the sealed compartment that generated a cloud of highly flammable, highly pressurized hydrogen gas – just one spark away from a calamitous blast. It was time for new plan.

That plan included federal and regional Environmental Protection Agency (EPA) personnel expanding the "hot zone" and deploying three wireless AreaRAE multi-gas monitors from RAE Systems to provide real-time data and 24/7 monitoring of the acid cloud.

This rapidly deployable gas-detection network monitored the incident area to help keep response crews and salvage workers safe and created a virtual command center. Good thing: The incident lasted 10 days with 100 responders on-scene at its peak.

In the end, holes were drilled in the hull using remotely controlled equipment to allow pressurized gas to escape and, ultimately, the safe removal of the sulfuric acid.

While this 2003 incident still gets reviewed in HazMat course work for its string of mounting problems and successful outcome, it's also a good illustration of the advantages of using wirelessly connected atmospheric-monitoring equipment for the detection of airborne hazards, including detecting volatile organic compounds (VOCs).

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: An industrial cleaning operation; gas-monitoring in the Gulf of Mexico oil spill in 2010; and a plant retrofit that included confined-space entry in a coal-fired power plant.

What are Wireless Atmospheric Monitoring Systems?

Wireless systems for atmospheric monitoring for chemical and compound detection use standard and proprietary wireless technologies to deliver reliable "always on" cable-free connections for fast, easy and flexible deployments. Wireless solutions provide proven long-term results, even in the harshest of environments, by combining battery-powered sensors and integrated radio-frequency (RF) technology operating over license-free frequency bands.

One of the cost effective uses for wireless systems is in scheduled plant retrofits, upgrades or turnarounds. These operations often require multiple "permit-required" confined work spaces. The traditional process for this type of operation required the project manager and safety officer to re-certify each work space after each worker regress. Using a wireless command center approach each work space can be continuously monitored and only require re-certification if there has been an alarm condition or if work site conditions have changed. The elimination of the constant re-certification has often been sufficient to fully cover the cost of deploying the wireless monitoring system.

A range of environmental applications can benefit from wirelessly connected gas-detection systems. Today's industrial-grade wireless systems provide reliable safety monitoring that keeps workers and responders safe, and companies in compliance with government regulations – all while having a positive effect on the bottom line. (See related story on Page 4). Use-case applications range from hazardous waste services such as industrial cleaning and overhaul applications to environmental remediation services using wide-area atmospheric monitoring,

In recent years, wireless detection systems have become an intrinsically safe and attractive replacement to traditional fixed- or hard-wired systems that require large trenching projects and running cables to power fixed sensors. Such projects often take weeks to execute, and involve trained technicians or electricians.

Alternatively, a wireless mesh system, with its self-forming network of monitors, can be installed and fully operational in 30 minutes. What's more, if one of the sensors goes offline, the network reconfigures itself and continues to operate without interruption.

Why Real-Time Detection Monitoring?

A key advantage to this new generation of wireless detection monitors is the ability to broadcast alarms and data in real-time. Advances in secure Internet access and the ability to get data onto the Internet from almost anywhere have made these real-time interactions possible.

- Such access to data has now become an operational advantage to globally distributed safety teams as well as multinational firms.
- This provides several advantages, including allowing wireless system users to engage remote industrial hygienists, safety experts or plant managers in the same way doctors working in remote locations can work with medical-center specialists.

Improved wireless system interoperability is another advantage. Interoperability allows systems used in industrial and environmental applications to share data with emergency responders. Similarly, emergency responders with mutual-aid agreements also can share wireless units and data with other responding agencies, which helps increase public and team/responder safety when disasters strike.

Also, wirelessly enabled instruments, such as personal and hand-held monitors, include an alarm notification system that sounds local alarms as soon as a threat is detected. The devices can also immediately send wireless remote alarms to the safety team so that help can be dispatched faster. Data from these monitors can also be wirelessly transmitted to a central location for data logging and analysis. This allows organizations to archive information for compliance review, mediation and remediation, and for access later to evaluate situational responses, or to provide training and corporate governance.

Wireless Monitoring Systems Bring Cost Advantages

Depending on specific configuration and system requirements, wirelessly connected hazard-detection monitoring systems can provide substantial cost savings, especially compared to fixed, hard-wired approaches.

Wireless detection systems eliminate the need for costly and time-consuming trenching and burying cables to achieve intrinsic safety while delivering a multitude of other advantages over traditional wired solutions, including rapid deployment, ease of installation and portability. These cost savings, combined with increases in productivity, help wireless systems provide total cost-of-ownership benefits, where the system quickly pays for itself.

The real-time, continuous data-collection capabilities of wirelessly connected systems also can translate into tens of thousands of dollars in savings in regulation compliance and information-processing time. Benefits that provide a return on investment include:

- Less time making manual readings and entering data into record-keeping databases.
- Elimination of recurring recertification for scheduled plant retrofits, upgrades or turnarounds.
- Reduction in travel and fuel costs as personnel rely on transmitting data wirelessly from remote locations.
- The ability to gather more data from more sources for wide-ranging, cohesive evaluations of a plant, facility or incident.

Exceeding Mandated Standards – Example: EPA Compliance in Industrial Cleanup

Method 21 is a set of guidelines developed by the EPA that require using portable instruments to detect VOC leaks from individual sources, including various process equipment and vacuum trucks. The rules are beginning to gain traction at the state level. California and Texas have adopted new standards based on Method 21. The Texas Commission on Environmental Quality (TCEQ) adopted Method 21 rules in 2009, and Louisiana is considering implementing the guidelines.

As a result of the new Method 21 regulations in Texas, Aquilex HydroChem developed proprietary equipment and processes to lower exhaust emissions, including VOCs, with its industrial cleanup vacuum methods. Aquilex HydroChem uses the AreaRAE systems for worker safety and to verify that VOC emissions remain under the 100 parts-per-million (ppm) threshold mandated by the TCEQ.

Aquilex HydroChem, a global leader in providing integrated services in industrial cleaning, is using wireless AreaRAE systems on its industrial vacuum trucks to help their customers meet new stringent regulations.

"We not only wanted to meet those standards, but to exceed them," says Scott Holland, a regional maintenance manager for Aquilex HydroChem. "It's part of our corporate philosophy and culture to lead the industry, but to do so in an environmentally mindful way."

Aquilex HydroChem uses portable wireless modems to extend the monitored coverage area of its AreaRAE systems, which sends readings in real-time to a centralized location at job sites. The system can monitor multiple trucks working on different jobs at a single plant. This allows the company to provide its customers with detailed reports that verify monitored data. Aquilex HydroChem often places a detection-monitoring specialist onsite, who works with its customer's environmental team to monitor readings and alert vacuum crews of dangerous trends or alarms related to their work.

"The wireless capability enables our work crews to stay focused on their area of expertise, and not have to worry about monitoring vapor emissions," says Holland.

The company also utilizes the AreaRAE's capability of adjusting alarm thresholds to accommodate its customers who want to keep emissions below mandated levels. And with the systems' multi-gas capabilities, Aquilex HydroChem now offers customers additional real-time detection services, such as identifying specific threats and lower explosive limit (LEL) monitoring.

When Disasters Hit – Example: Gulf Oil Spill

In the Gulf of Mexico oil spill in 2010 is considered the largest marine oil spill in the history of the petroleum industry and one that included a combined response from local, state and federal agencies, private companies and contractors. Capturing atmospheric-hazard data on a large scale was a critical element.

During the extensive cleanup effort, wireless AreaRAE multi-gas detection systems were deployed for use on ships involved in the massive response effort. The data capture/logging and use of AreaRAE monitors for real-time detection was part of a highly coordinated effort led by Total Safety, an industrial safety services company and a leading provider of detection and monitoring instruments and systems.

During the three-month response effort, ships were moving through the oil- and air-contaminated waters to provide command and cleanup support, and other worker services. Workers aboard these ships risked exposure to harmful toxins, including benzene, a component of crude oil and a known carcinogen. Each ship was equipped with MultiRAE and UltraRAE portable hand-held monitors, along with two wireless AreaRAE multi-gas detectors strategically placed aboard the ships for continuous atmospheric monitoring.

Key to the operation was the wireless capability of the AreaRAE systems, which logged atmospheric conditions for each ship and sent the information in real-time back to a command center. There, information from literally hundreds of vessels was analyzed in various ways, logged and stored. That data is retrievable for mediation or remediation purposes.

AreaRAE wireless detection systems also were used in monitoring air quality along the coastlines of Texas, Louisiana, Mississippi, Alabama and Florida during the Gulf response. The systems performed continuous, “always on” monitoring of the shoreline and inner waterways around the Gulf region. This provided environmental-monitoring agencies, such as the Louisiana Department of Environmental Quality, and state and territorial agencies of the EPA, with a continuous stream of information on the lowest to the highest readings for air quality to protect people, equipment and the environment. The system also gave monitoring organizations the flexibility and portability to easily disconnect and move hazardous-detection monitoring equipment to other locations as needed.

Worker Safety: Solid Waste Particulates – Example: Coal Fired Power Plant

One case of wireless confined space deployment was an epoxy re-coating project inside a "bag house" used to collect the solid waste fly-ash particulates from a coal fired electric power plant. S&R Environmental Consulting Inc. managed the safety of this project.

This utility had significant safety sensitivity due to an earlier accident at one of their sites and this project was the first coatings project after the accident. Because of the prior lethal flash-over accident, 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 **IDLH** at any point. Workers were required to use Methyl Ethyl Ketone (MEK) to clear the mixing blocks and spraying guns. Other site threats included Nitrogen Oxides (NO, NO_2), Sulfur Dioxide (SO_2) and Carbon Monoxide (CO).

The bag house is a large, compartmentalized, multistory building, operating under negative pressure. Each compartment is 20 feet wide (6m), by 20 feet high (6M), by 40 feet long (12m). The project was to coat the inside of the operating bag house 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_2.

An AreaRAE, wireless five-gas monitor was chosen for the site and included Lower Explosive Limit (LEL), Oxygen (O_2), SO_2, and CO sensors, and a Photoionization Detector (PID) for volatile organic compound (VOC) monitoring. The data was shared over the internet using a secure proprietary network. All of safety managers were all able to see the same date in real-time.

There were two alarm incidents while the units were deployed. One was a rise in CO, eventually found to from the exhaust from a compressor that was operating below the cat-walk. The second alarm was from VOCs. This was traced to a solvent that workers were using to free stuck bolts.

With the shared data, more people were able to be aware of the work situation and worker safety had real time visibility to all of those involved. Even the Plant's executives were viewing and commenting on results from a remote location. Safety personnel were more attentive and analytical in their approach to any problems by having both real-time and historical data. The combination of audible and visible alarms was also an asset.

Summary

Today's wirelessly connected monitoring systems for the detection of dangerous atmospheric gases and compounds provide a range of benefits for industrial and environmental companies. Rapid deployments with flexible and portable detection implementations, easy setup and reliable remote monitoring are key benefits that allow organizations to provide unsurpassed worker and responder safety, and comply with industry regulations.

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 time to deploy a wireless system can be enough to justify the cost of change. Things 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.

Wireless gas detection systems are now available with a broad range of power options including standard 110V/220V, battery and 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_2S Safety & Elimination.

The capability of broadcasting alarms in real time gives safety managers unprecedented control of detection data, and software solutions provide new ways to view and aggregate data from multiple sensor sources. Advances in secure Internet access and the ability to get data onto the Internet from almost anywhere have made these real-time interactions possible.

Learn More: Additional Useful Information, Videos, Reference Data and Links

1. Learn more, and see videos on wireless gas detection including how to obtain remote access to real-time gas, radiation, and biometric data to enhance safety **HERE**
2. Download the new Application Note, AP-236, (Monitoring Benzene and Choosing an Appropriate Monitor for Personal Protection and Compliance with Exposure Limits) **HERE**
3. Register for a free Event Hazard Assessment **HERE**
4. Learn more about the AreaRAE – the transportable multigas, wireless monitor that can be set up in minutes and will transmit real-time gas/radiation measurement data securely over the Internet or to a command center **HERE**

About RAE Systems Inc.

RAE Systems is at the forefront of hazardous-atmosphere detection-monitoring technology. The company develops and manufactures field-proven wireless systems that enable incident commanders, plant safety managers and industrial hygienists in a wide range of industries to easily and affordably extend their monitoring capabilities, integrate meaningful information and share critical data with a multitude of stakeholders in a situation-specific way – all in real time as emergencies unfold.

At RAE Systems, it is our intention to continue delivering a wide range of wireless functionality in our atmospheric-hazard detection-monitoring solutions. We have standardized our wireless instrument modules so that different radio frequencies and standards can be interchangeable during manufacturing to give our wireless customers access to a range of wireless approaches in products available today and in the future. This provides greater flexibility by giving our customers the best wireless approach for their specific task.

RAE Systems, a global gas-detection and wireless-system innovator, delivers a wide range of rugged, yet easy-to-use detection instruments and systems that do just that: Simplify the job of plant safety managers and industrial hygienists with innovative product designs that help increase safety, improve incident-response times and reduce downtime.

With its proven technological leadership and more than 37 patents in the detection-sensor field, RAE Systems' extensive line of fixed, portable, hand-held and personal instruments enable real-time safety-threat detection of chemicals, including VOCs, and radiation for industrial and environmental safety applications worldwide. The company's reliable and cost-efficient products protect workers, contractors and the public from hazardous and potentially deadly exposures from radiation, gases such as hydrogen sulfide (H_2S), and hundreds of VOCs, including benzene, toluene and formaldehyde.

RAE Systems' solutions 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**: Atmospheric monitoring that utilizes cost-effective wireless equipment that is easy to install and operate can assist event officials and first responders with real-time information on potential hazards.
- **Proven**: With more than 20 years of experience, RAE Systems' innovative fixed, portable, transportable and wireless solutions have a verified track record.

*For more information, contact RAE Systems **HERE***