

To minimize risks, a plant-wide gas monitoring system must meet the specific needs of the facility in terms of system inputs and outputs and data acquisition.

Plant-Wide Gas Monitoring for Risk Control

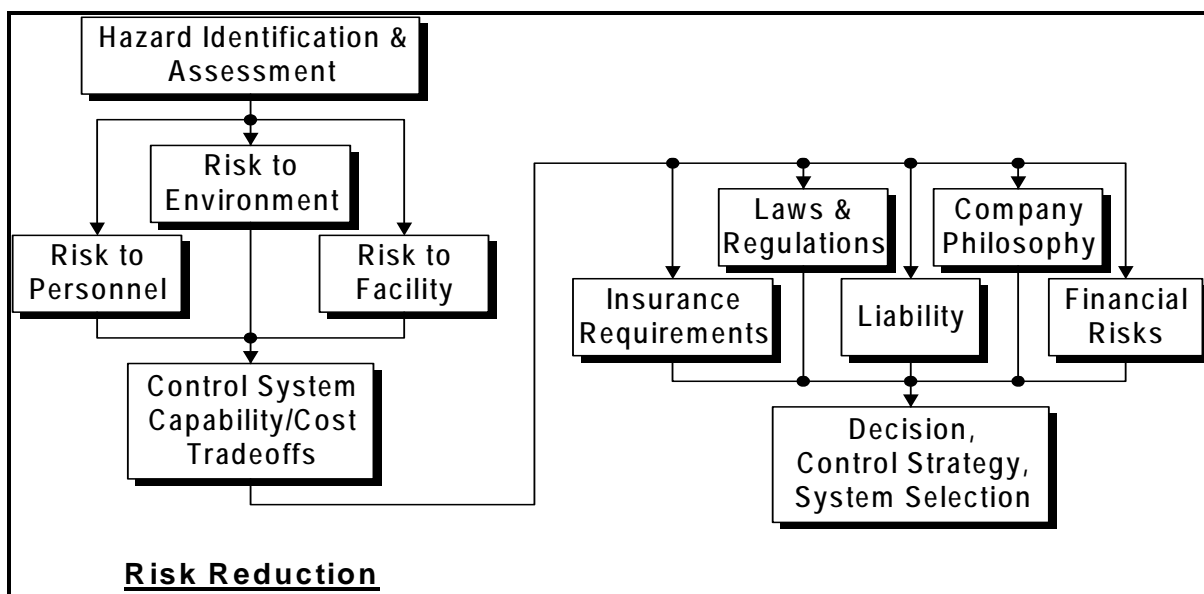
Gas monitoring has become an integral part of many environmental protection and safety programs. Because of increased attention to risks posed by gas, systems that simply announce an alarm condition are no longer adequate. Gas monitoring programs now comprise employee training, data analysis, multiple alarm strategies, self-diagnostic system verification, and documentation. Data communication has also become a fundamental component of system design and operation as well. And finally, environmental factors help guide the program selection process.

GAS MONITORING RATIONALE

Gas Monitoring is an integral part of environmental protection and safety programs. There are three major categories of hazardous gases. **Combustible gases** pose a risk to personnel and facilities through fire or explosion.. **Oxygen displacing gases** deplete workers' oxygen supply in confined spaces. **Toxic gases** create both immediate and long term risks to personnel. Toxic gases are those OSHA and other organizations have defined as hazardous to human health. They are typically monitored both below and above the threshold limit value (TLV). TLV is an 8-hour time weighted average concentration that is the highest value acceptable as a safe working environment. System design requirements such as the number of sensors required, sensor placement, and system alarm levels will vary according to the type of gas.

A properly designed gas risk management program can reduce risk. A successful program needs to first, identify the hazards at the facility, then assess the risk of a hazardous event to the plant, personnel, the community and the environment. Next, the program needs to comply with insurance, legal and regulatory requirements. Also, liabilities and financial risks need to be evaluated. Finally, the program must incorporate company safety philosophies.

Through such a program you can reduce the risks associated with hazardous gas leaks at your facility. Sierra Monitor offers products that provide critical data to prompt corrective action before a minor leak becomes a major event. Information can be retrieved from the equipment display, printed locally or recorded by a computer. This information aids in evaluating potential hazards in relation to operating practices.



GAS MONITORING OPTIONS

Gases are monitored with permanently installed (fixed) systems or portable instruments, or by taking samples for evaluation in a laboratory. Portables and sampling are by their very nature only spot checks and are appropriate only when the risk is extremely low or fixed instruments are not practical. As a general principle, areas where the risk is sufficient to justify periodic monitoring with a portable instrument, warrant a fixed system.

Conventional Technology. Fixed gas monitoring systems historically have been reactive systems consisting of a sensor and a controller. The sensor, which can be mounted remote to the controller, usually transmits an analog signal proportional to the gas concentration. Principles of detection include catalytic bead, solid-state/semiconductor, electrochemical and infrared.

Performance variables that should be considered for sensor performance include:

- Response speed
- Measurement range
- Resolution
- Interfering gases
- Operating range
- Temperature and humidity effects
- Sensor life span
- Ease and frequency of calibration
- Replacement cost

The gas monitoring system required depends upon the scope of the hazardous gas risk. For applications where the risk is minor, a simple gas monitor that sounds an alarm when the concentration reaches the setpoint may meet the need. Applications involving a higher risk generally require continuous output of gas concentration to a display, printer or other indicating or control device. Sierra Monitor's analog gas sensor modules offer a continuous 4-20 mA DC output and are available for a wide range of hazardous gases.

In applications with the highest level of risk or where the hazard is present throughout the facility, a smart gas sensor module such as the **IT Series** and/or the **Sentry Gas Risk Management System** will meet the need. With extensive diagnostic capability, flexible configuration, expandability, microprocessor controls, and the ability to interface with plant-wide control systems, Sierra Monitor IT Series and Sentry Systems are the choice for plant-wide monitoring systems.

System self-diagnostics on both the IT Series sensors and the Sentry controller and sensors help the user know that the data they are receiving is reliable and accurate.

Gas exposure data analysis needs to be available to prove due diligence in hazardous gas risk management. This data can be available either via preformatted reports available with the optional printer for Sentry or via a third party HMI package resident on a computer. Serial communication and the MODBUS interface enable Sentry and IT Series sensors to interface with the Human-Machine-Interface (HMI) package that can provide complete data analysis and information on the operator's computer. Such information would include alarm status, gas concentrations, alarm setpoints, fault alarms, and more. Hundreds of data points are available from Sentry via the serial communications port.

Sentry's ability to accept input from a wide variety of devices such as flame detectors, or other unique gas detectors provides a complete hazard monitoring system to improve the safety management of the facility.

PLANT-WIDE MONITORING

Plant-wide gas monitoring offers many benefits, among them:

- Centralized monitoring of all gas measurements
- Monitoring the status of control elements
- Establishing a "command center" to respond to alarm events
- Remote access to all system data
- Centralized reporting

In a plant that has been instrumented over a period of years, the gas detection system is likely to be an autonomous installation. The controller might be in the field close to the sensors or in a control room. Both approaches have limitations. Controllers in the field do not transfer gas concentration information to the control room. Alarm data are limited to local annunciation of an alarm event, or long wiring runs are required in order to report sensor-by-sensor alarm status to a central control room. Alarms are therefore usually limited to relays activated by groups of sensors and/or field controllers in a given area.

Controllers located in the control room usually require extensive wiring to the sensors and alarm activity is often minimized to reduce wiring cost. Furthermore, when the controller is in the central control room, there are no concentration data available in the field for plant personnel to make on-the-spot decisions; only an alarm light or horn is activated.

Systems designed for plant-wide monitoring avoid these deficiencies. They:

- Accept sensors for multiple gases
- Accept sensors from various manufactures
- Accept other environmental and process sensor measurements
- Provide local display of gas concentration
- Permit auto-adjusting calibration
- Accept feedback signals from final control elements
- Provide independent battery backup
- Allow low-cost communications link to the control room
- Provide relays for local alarm action
- Implement user-defined alarm strategy
- Provide centralized monitoring of sensor status as shown on the plant log plan and at each operation / facility with bar graphics, configuration screens, and real-time trends
- Provide centralized data logging
- Provide alarm acknowledgment from the control room
- Allow access to control room computer from other sites in facility
- Operate independently even if communications with the control room are severed
- Provide for easy system reconfiguration via computer at the control room

Distributed intelligence is central to system design philosophy. Because the field controllers can implement alarm logic and operate independently of the host computer, they do not interrupt or hamper field operation. A plant-wide monitoring system provides the user with clear, understandable data that make it possible quickly to analyze the situation and take appropriate action. A correctly designed plant-wide monitoring system offers the best features of local control, and centralized monitoring systemizes the entire monitoring process.

CRITICAL SYSTEM COMPONENTS

The components of the system are the sensors, the field controller, and the monitoring software. Sentry, from Sierra Monitor, is an example of a system that can implement plant-wide gas monitoring. The gas sensor modules can be multiplexed on a single cable back to the controller.

To offer complete solutions at each site, field systems need full I/O capability. Sentry fulfills this requirement by accepting a variety of sensors or 4-20 mA transmitters. The Sentry controller is an intelligent device that can access the sensor modules for diagnostic data, non-intrusive calibration and gas concentration information.

MODBUS communications interface enables Sentry and the IT Series sensors to easily interface with a PC-based Distributed Control System (DCS) providing a graphical display of hazardous gas conditions in the plant. PC-based

DCS software in conjunction with Sentry provides the operator enhanced data acquisition, alarming and alarm management, historical trending, distributed architecture, and integration into the plant's distributed control system.

Sentry's MODBUS communication interface provides over 620 different parameters accessible by the PC-based DCS software, including:

- Gas concentration
- Alarm setpoints
- Sensor diagnostic messages
- Historical reset time/date
- Power up/down time/date trouble alarm time/date
- Minimum/maximum values plus time/date
- High/low alarm latch/non-latched
- Auto calibration enabled
- Calibration status/coefficients
- Calibration concentrations
- Calibration due date
- Zone option enabled
- Operate mode

With the MODBUS communications option for Sentry and the graphic based man-machine software program a variety of graphic screens can be developed. These screens make it easy for the operator to efficiently monitor hazardous gas risks in any plant. Typically the system will include a main screen providing an overall view of the plant. This screen is linked to individual zone displays, historical and real-time trend charts, bar charts indicating gas concentration and alarm levels, and more.

SUMMARY

The key to any plant-wide monitoring system is the flexibility to configure system inputs/outputs and data acquisition to meet the specific needs of the plant. By monitoring sensors throughout the plant, better visibility of the ambient environment can be realized and more informed decisions can be managed in the event of gas exposure.

A plant-wide monitoring system using distributed intelligence coupled with advanced PC based software offers an improved approach to limit in plant risks. The benefits to employee safety and environmental responsibility are self-evident, as are the economic rewards of reducing the chance of loss from interruptions in operation and from litigation. Risk minimization, including plant-wide gas monitoring, makes good business and social sense.