**Marcellus Shale: Monitoring for Methane and other Combustible Gases in Compression Stations**

Natural gas from the Marcellus Shale is a potentially vast energy resource and there are many reasons for tapping the natural gas in the shale. The supply of natural gas in the United States is more reliable than imported fossil fuels and the delivery system is less subject to interruption. Natural gas has a high energy content (about 30 $kJ/m^3$ [1000 $Btu/ft^3$]). It is efficient and clean burning, emitting approximately half the carbon dioxide ($CO_2$) than that emitted by coal burning, as well as lower levels of sulfur dioxides ($SO_x$), nitrogen oxides ($NO_x$), carbon monoxide (CO), and mercury (Hg) .

The main concern during the acquisition and processing of natural gas from the Marcellus Shale is safety—the need to protect human life—and also protect the processing plant, property and equipment against fire or explosion.

Natural gas is transmitted via pipelines to a midstream compression station, then on to a processing plant. The station may contain two to four compressors, which cool the natural gas and compress it so that pressure is high enough to move the gas through the pipelines to the processing plant. These processes can cause extreme heat and vibration within the station and over time these factors can lead to methane gas leaks, especially around flanges and seals.

Since methane ($CH^4$) is a major component of natural gas, any leakage—especially in the confinement of a compression station—can lead to fire and explosion. Early detection of methane gas leaks in compression stations is crucial in mitigating this risk.

To safeguard these facilities then, every natural gas processing plant must have a reliable system for warning of elevated methane levels or other hazardous conditions within these compression stations.

To monitor for a range of combustible gases, including methane, choose a monitor that utilizes infrared (IR) sensing. IR sensors are ideal for monitoring toxic and combustible gasses. They

can be made specific to a particular gas, they require less calibration than other sensors, there is no contact with the gas, no minimum level of oxygen is necessary, and they are relatively maintenance free.

We recommend installation of an explosion-proof "smart" methane gas detector that can be connected to the existing PLC, DCS or EMS system. Be certain the methane/combustible gas monitor provides a local display also and is designed for use in hazardous or classified locations, with an industry standard 4-20 mA analog output signal, and a simplified calibration procedure to enable quick, nonintrusive, adjustment-free calibration.

The lower explosive limit (LEL) of a gas is the concentration needed for the gas to ignite and explode. Concentrations lower than LEL are "too lean" to burn. Methane gas has a LEL of 4.4% (at 138°C) by volume, meaning 4.4% of the total volume of the air consists of methane. At 20°C the LEL is 5.1 % by volume. If the atmosphere has less that 5.1% methane, an explosion cannot occur even if a source of ignition is present. When methane concentration reaches 5.1% an explosion can occur if there is an ignition source. Keeping this in mind, then, be sure the monitor has a 0-100% LEL detection range and takes into account temperature and pressure.

Choose a methane/combustible gas monitor with an industry standard 4-20 mA analog output signal that can be connected to any existing PLC, DCS, or EMS system. The monitor should also feature a simplified calibration procedure to enable quick, non-intrusive, adjustment free calibration.

In choosing a gas detection/monitoring partner, it is very important to choose a local vendor who can provide quick response and turnaround. Installation time and costs can be significantly reduced if all monitors are shipped factory preprogrammed, calibrated, and tested on the day of shipment. Installation costs are also reduced significantly when the units can optionally be connected on a single 4-conductor cable via RS-485 instead of having to route individual cables to each unit.