4.1.6 MEASUREMENT AND MONITORING TECHNOLOGY FOR NATURAL GAS SYSTEMS

Technology Description

Handheld infrared remote imaging spectrometer for fugitive gas leak detection.

Hi-Flow™ Sampler to measure emission rates.

There are approximately 300,000 miles of pipeline in the U.S. natural gas transmission network. Along this network, compressor stations – with up to 2,500 separate components each – leak hundreds of millions of dollars worth of methane into the atmosphere every year. In addition, there are more than 700 gas-processing facilities that lose an estimated 30 billion cubic feet of gas each year. Through the use of effective leak detection and measurement technology as part of a directed inspection and maintenance program, methane emissions can be reduced significantly.

System Concepts

- Advanced leak detection and measurement technologies enable quick and cost-effective detection and quantification of fugitive methane leaks.
- Directed inspection and maintenance programs employ these technologies through the collection of screening and measurement data using comprehensive surveys in the first year. Information gathered on equipment with high leak rates is then used to direct surveys and prioritize cost-effective leak repair efforts in subsequent years. Because leak surveys and repairs are better focused and more accurate, they can be conducted less frequently, thereby reducing operation and maintenance costs.

Representative Technologies

- The Gas Technology Institute (GTI) has developed an advanced measurement technology known as the Hi-Flow™ Sampler. This technology is unique because it measures actual emission rates from sources that traditionally were not easily measured. The Hi-Flow™ utilizes a variable-rate induced-flow sampling system that provides total capture of the emissions from a leaking component. The instrument is designed to ensure total emissions capture, and prevent interference from other nearby sources. A dual-element hydrocarbon detector (i.e., catalytic-oxidation/thermal-conductivity), measures hydrocarbon concentrations in the captured air stream ranging from 0.01% to 100%. A background sample-collection line and hydrocarbon detector allows the sample readings to be corrected for ambient gas concentrations. A thermal anemometer monitors the mass flow rate of the sampled air-hydrocarbon gas mixture, and a mass rate is then calculated.
- GTI (in cooperation with Pacific Advanced Technology) is also developing advanced leak-detection technology. One of the emerging technologies is the IMSS camera, a handheld infrared remote imaging spectrometer for fugitive gas leak detection. It detects species by comparing differential absorption spectra. The device can detect low flow and underground methane leaks from a maximum of 300 feet away but is more effective at a distance of about 50 feet or less. Other hydrocarbon optical imaging technologies are now available for use.

Technology Status/Applications

- Traditional leak measurement technologies are currently available. Advanced technologies, like the Hi-Flow Sampler, are in the demonstration and deployment stage.
- Advanced imaging technology for leak detection is now in the advanced demonstration phase. Next-generation technology may provide the ability to both detect a leak and quantify the emission rate.

Current Research, Development, and Demonstration

RD&D Goals

- Complete the development of advanced measurement technologies like the Hi-Flow™ and ensure broad deployment throughout the industry.
- Advance the development of imaging technology for methane leak measurement and facilitate demonstration and deployment.

RD&D Challenges

- Advance imaging technology to quantify methane losses

RD&D Activities

- Advanced measurement technologies already are being demonstrated. Additional research to enhance this technology is underway.
- Identification and adaptation of new technologies for real-time remote optical leak detection, quantification, and speciation is underway. Preliminary testing indicates the ability to image low-flow conditions and under-ground methane leaks.
- The Kansas State University National Gas Machinery Laboratory and EPA's Natural Gas STAR Program are collaborating on a study to demonstrate the cost-effective use of measurement technology to reduce methane leakage from natural gas production and processing facilities.

Recent Progress

- As part of a cooperative R&D effort among the EPA, the Gas Technology Institute, and the natural gas industry, the effectiveness of utilizing the Hi-Flow™ Sampler measurement technology to reduce methane leakage at three gas-processing plants was evaluated. The value of natural gas losses at the surveyed sites was approximately $2.2 million, substantially offsetting the cost of the surveys.
- Preliminary testing of the IMSS technology for leak detection has been successful. In a recent test conducted by PAT, IMSS successfully imaged leaks as small as 0.01 cubic feet per minute in ambient conditions, using either a building or the sky as background.

Commercialization and Deployment Activities

- The Hi-Flow™ is being used by several large production, processing and transmission companies.

Market Context

- Gas production, transmission and processing companies are most likely to be interested in these technologies.