FLUID SEALING ASSOCIATION FSA

From the voice of the fluid sealing industry

SEALING SENSE

Is there a new way to monitor fugitive emissions?

The October 2008 *Sealing Sense* discussed new optical infrared technology authorized by the EPA for finding leaks. This month we will review in more detail the background, basis and future of this new way to monitor fugitive emissions.

Background

Method 21 is the current work practice (CWP) required by the EPA to detect and quantify leaks from components handling volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). Method 21 has been in use for more than 20 years. On April 6, 2006, the EPA published a voluntary alternative work practice (AWP) in the Federal Register. This new AWP allowed the use of optical gas imaging to monitor equipment such as pumps, valve, connectors, flanges, etc. After response to public comment, the final rule was published in the Code of Federal Regulations (CFR) on December 22, 2008.

Needs Analysis

The road to the final rule started in 1991 with a study performed by the American Petroleum Institute (API). From 1991 to 1996, API analyzed 11.5 million fugitive emission measurements from leak detection and repair (LDAR) programs. The intent of the study was to determine if certain components or applications were more prone to leaks.

The analysis revealed that about 5 percent of the components were responsible for 90 percent of the fugitive emissions. Nearly all of the 90 percent were due to leaks documented to be more than 10,000 ppmv. This small number of leaking components responsible for almost all of the emissions was random as to component type, process unit and application. Although no clear criteria to predict the occurrence of leaking components emerged from the study, it did become evident that a method was needed for detecting large leaks to repair more easily and quickly. As a direct result of the API study, development began on the use of optical leak detection methods.

I.R. Optical scanning system
(Courtesy of FLIR Systems, Inc.)

Optical Scanning

The AWP allows the use of optical scanning methods to detect leaks instead of vapor analyzers (a.k.a., sniffers) required by Method 21. This optical technology monitors in real time the presence of leaks from valves, pumps, flanges or any other components in the process plant. The method requires the following:

- Documenting the monitor's sensitivity
- Survey frequency ranging from 30 to 60 days depending on the chosen sensitivity of the monitor
- Method 21 survey used once a year for verification and to screen all the plant's components
- Checking a component for leakage after it has been repaired
- Retaining all documentation declaring that the facility has chosen to comply with the AWP's requirements
- Retaining all video records of daily instrument checks and survey results for 5 years

Optical Scanning Technology

Detection of large leak levels requires a technology that will quickly and easily find them without checking each of the tens of thousands of components in the plant. The technology emerging as the front runner is forward looking infrared (FLIR), which allows a handheld camera to be pointed at the

Table 1

Method-Property	CWP Method 21	AWP – FLIR Optical Methods
Cost	About $0.50 per component	Some estimate about $0.22 per component, but costs may be closer to CWP depending on the site and frequency of surveys.
Time to perform	• Labor intensive—requires each point to be measured. • Time consuming—each component must be visited to be monitored.	Many points are viewed at one time. Studies indicate that AWP takes a quarter the time of CWP.
Data analysis	Interpretation of data from surveys is straightforward.	Regulatory interpretation of video records to demonstrate inspection of every regulated component needs to be put into practice.
Leak quantification	Leak quantification—ppmv	No quantification. Only the presence of the leak is detected within a specified sensitivity level.
Perception	Necessary to achieve compliance	New, efficient and easier. Not widely accepted.
Frequency	Quarterly and yearly monitoring	Every 60, 45 or 30 days depending on sensitivity level chosen, plus one Method 21 survey per year.
Training	Training required. Generally viewed as basic technician skill level.	Higher skill level requiring training on camera use and leak recognition.
Repair	Monitor and repair only regulated components.	Entire areas are scanned; regulated and unregulated equipment are monitored. Currently, there is no requirement to repair unregulated equipment, but most end users will attempt to fix unregulated components.
Safety	LDAR technician is in potentially dangerous areas.	Technician is not close to the leak point. There can be a tripping hazard if the operator walks while viewing through the camera eyepiece.

component of interest. This technology is an extension of the military application of night vision goggles in which IR light senses the heat signature of objects, making them visible to the wearer. With IR gas analyzers, the IR camera has been tuned to see specific VOC/HAPs of interest. The IR light wavelength is tuned to a range similar to that of the gases viewed. The IR light is absorbed by these gas emissions and appears on the IR viewing screen as a plume of black smoke.

FLIR systems do not quantify leaks. However, the requirement to calibrate daily to a known mass flow rate ensures that the camera will see leaks of certain size. While there is no way to accurately correlate Method 21 ppmv readings to IR camera observations, it is generally accepted that standard FLIR equipment will detect leakage on the order of 10,000 ppmv and greater. The latest versions of FLIR system cameras report a fivefold improvement in sensitivity.

VOC leak detected with FLIR camera *(Courtesy of FLIR Systems, Inc.)*

Basis for EPA AWP

Questions have arisen because IR systems cannot reliably detect leaks less than 1,000 ppm. The AWP authors rationalized that the method will achieve the same ends as Method 21 for two reasons. First, the API study indicated more than 90 percent of the emissions come from the highest leaking 10 percent of the components. These are easily detected by optical methods. Second, EPA analysts determined that by allowing a lower sensitivity leak detection system and using it more frequently (six to 12 times per year), emission reduction results would equate to that of quarterly or yearly Method 21 surveys at a leak compliance threshold of 500 ppmv.

Comparisons of various attributes and perceptions of Method 21 and the AWP are in Table 1.

Conclusion

As industry continues to increase investment in FLIR-based technologies, it is apparent that the features and benefits bring incremental value to users even in the absence of EPA mandates. When applied correctly, AWP arguably provides controls that are easier to implement and maintain than current LDAR practices such as Method 21. Although the AWP monitoring is more frequent, the technology appears to be quicker, cheaper and safer. The net result should be speedier identification of leaks and implementation of repairs, resulting in lower VOC emissions. Reduced VOCs ultimately result in a safer, more environmentally-friendly workplace, so the AWP should continue to gain momentum.

Next Month: *What are the fine points of pump packing installation and adjustment?*

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingsensequestions@fluidsealing.com.

Fluid Sealing Association

This month's Sealing Sense was contributed by FSA Members Jim Drago, P.E. and Chris Hicks.

Sealing Sense is produced by the **Fluid Sealing Association** as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs and reps. As a source of technical information on sealing systems and devices, and in cooperation with the **European Sealing Association**, the FSA also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump technology issues on rational total Life Cycle Cost (LCC) principles.

The **Compression Packing** division of the FSA is one of five with a specific product technology focus. As part of their mission they develop publications such as the new joint FSA/ESA *Compression Packing Technical Manual* and *Pump & the Valve Packing Installation Procedures* pamphlet. These are primers intended to complement the more detailed manufacturer's documents produced by the member companies. In addition to English, they are available in a number of other languages, including Spanish and German.

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