

INNOVATIVE TECHNOLOGIES TO DETECT LEAKS

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ABSTRACT

The invention of flame ionization (FI) technology 45 years ago was a major revolution in the methodology to detect leaks in gas transmission and distribution networks. Detection sensitivity in the parts per million (PPM) range was the key to the success of the FI technology, allowing gas companies to detect even small leaks from the surface. This was a major breakthrough over the existing method of sub-surface testing at specified intervals. Recent technological developments have launched a new revolution in leak detection instruments. The introduction of optical and laser-based technologies has proven to be the first major improvement in 40 years.

DEVELOPMENT

During the development phase of applying these new technologies to gas leak detection, one major goal had to be met: These instruments had to be as good as or better than FI instruments.

This challenge has been met. Some of the advantages of the optical and laser-based technologies over the FI instruments are:

- Maintaining PPM detection sensitivity.
- The elimination of fuel (hydrogen or hydrogen/nitrogen) necessary for instrument operation.
- Self calibrating – eliminating the need for external calibration gases.
- Methane specific – virtually eliminating false-positive indications from automobile exhaust and other hydrocarbons

These improvements in instrument technologies have shown to be a major improvement in gas leak detection capabilities for hundreds of gas companies throughout the world.

One of the major benefits of employing these new technologies is a dramatic increase in leak detection productivity, without sacrificing the quality of the leak inspection. Each of the new technologies has specific advantages in leak detection and productivity.

RESULTS

OPTICAL-BASED MOBILE APPLICATIONS

Many gas utilities have reported significant improvement to their mobile (vehicle-mounted) leak detection surveys of gas mains buried under the street and/or their transmission lines. These improvements are based on the rate of production that can be obtained when using an optical based instrument, as opposed to an FI instrument to conduct the leak inspection. For example, the speed of the vehicle can be increased to 40 km per hour (25 MPH) without missing leaks.





Many utilities have reported an increase in productivity of 20-45%, and in many cases, they are finding more leaks. These gains in productivity of gas leak inspection have distinct advantages to the gas utility:

- A dramatic reduction in the number of vehicles and people necessary for gas leak inspections.
- Distribution network—problem areas can be inspected more frequently.
- The elimination of false-positive indications results in increased productivity
- Transmission lines—the optical based instruments can be mounted on many types of vehicles, such as all-terrain vehicles (ATV.)

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FI vs OMD

Class I Leaks Detected (most hazardous)	121	180
Mobile Survey Man Days	774	522
Mobile Survey Productivity (miles per day)	18.9	28 (148% increase)
Total Man Days Saved	252	
Annual Cost Savings loaded)	US\$164,772.00 (fully	

LASER-BASED APPLICATIONS

The laser-based remote instruments offer significant gains in leak detection productivity because they can detect leaks in the PPM range from up to 30 meters (100 feet) away from the source. With traditional FI instruments, the operator must place the probe or the cart directly in the leak plume (cloud) in order to detect the leak.



Laser-based remote instruments greatly improve leak detection productivity and safety for several reasons.

- The operator does not have to walk the entire length of the customer service line to detect leaks.
- In most cases, both the gas main and the customer service lines can be inspected from one position
- The laser's detection beam can be scanned over a large area, from a single position. This allows the operator to inspect a larger area much faster, and results in more leaks being detected.
- Obstacles such as fences and dogs, no longer prohibit a complete leak inspection.

Here, four service lines are surveyed while standing in the center of the shaded area.



- With the remote capability of the laser beam, difficult areas such as bridge crossings, overhead rack-mounted gas piping and offshore platforms can be thoroughly inspected from a distance.

OPTICAL-BASED (PORTABLE) APPLICATIONS

The introduction of the optical based (infrared) portable instrument introduces additional features to the traditional FI instruments. These instruments have detection capabilities which are auto-ranging, from PPM through 100% gas. They are intrinsically safe; therefore, they can be used in a variety of situations that in which traditional FI instruments cannot be used.



Some of these advantages are:

A combination of two instruments – a search instrument (PPM) for leak inspection, and a Combustible Gas Indicator (% gas) in a single instrument.

- Can be used to both detect a leak (PPM), and confirm a leak indication, via a sub-surface test (% gas).
- Can be used in either a portable (walking) mode, or a mobile (vehicle) application.
- Can be used to check for gas inside of a structure.
- Can be used to pinpoint leaks.
- No fuel gas required for operation.
- Self-calibration eliminates the need for external calibration gases.
- Methane specific—eliminates false- positive indications.

CONCLUSIONS

New technologies that have been adapted to gas leak detection instruments have, no doubt, improved on the traditional methodologies to detect gas leaks in distribution, transmission and gathering systems.

Because the gas industry is slow to change, flame ionization (FI) instruments, which have been the world-wide standard for more than 40 years and will continue to be used for some time to come. However, as new technologies and more efficient methodologies are introduced, FI technology will eventually be replaced by more efficient and effective instruments as new technologies continue to evolve.

Thus far, optical and the laser-based leak detection instruments have proven to be reliable replacements for FI instruments. The very impressive increases in productivity, without jeopardizing the integrity of leak detection methods and results, will continue to garner attention.