Early Warning System FOR GAS LEAKS

For more information...

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Gas leakages from commercial refrigeration systems are an environmental hazard and can prove costly for food retail outlets and cold storage facilities. A new generation of low cost, micro-miniaturised sensors currently being developed to detect these emissions early is proving to have equal relevance for aerospace and other industry sectors.

The enticing display of fresh produce in your supermarket's chiller cabinets is kept in peak condition by a complex refrigeration system that uses refrigerant gases as a cooling agent. As much as 60% of the gas can leak before its loss is noticed – even a minor leak can result in the loss of up to 20% of refrigerant gas if nothing is done about it. Hence 70% of gas sold to retailers is used for 'topping up' their systems.

This leakage is a matter of concern for a number of reasons, not least because the quality and safety of the produce is compromised. From an environmental point of view there's the damage the emissions do to the ozone layer, while the financial consequences can significantly affect a food retailer's or manufacturer's bottom line. Energy consumption increases to maintain the refrigeration equipment's cooling capacity; in a worst case scenario the system may break down altogether, resulting in down time, spoilt food and maintenance costs. It is estimated that as much as £40 million per annum could be saved on energy costs by reducing leakage levels.

On-The-Spot Solution

Constant monitoring enables a leak to be detected at an early and manageable stage, before too much damage is done. While the commercial refrigerant gas detectors currently on the market can detect minute traces of gas and generally do a good job, they are cumbersome, very expensive and complex to install. They typically consist of a central control room-based chamber which sucks in air samples via a network of hundreds of metres of tubes from different parts of a supermarket or cold store and analyses and measures the gas in the sample.

The consortium collaborating on Eureka project E! 1811 Euroenviron Pampas, an acronym for Practical Applications of Micro-Miniaturised Photo-acoustic Sensors, identified commercial opportunities in Europe and the US for a new generation of improved refrigerant gas detectors which they believed would be less expensive and much easier to use. Their solution was elegantly simple: a 'point sensor' which could be installed in a plant control room or, if sufficiently inexpensive, plugged into individual chiller units rather like a domestic smoke alarm, eliminating the need for an intricate network of sample collecting tubes.

SensorTechnology

The sensor utilises a long established technique for detecting gases, the photoacoustic principle (PA), which was first discovered by Alexander Graham Bell in the 1890s. PA is both highly selective and sensitive and works on the principle that when a gas sealed in a photoacoustic cell is irradiated by a beam of infrared light it absorbs light energy which causes a change in the pressure of the gas proportional to its concentration and which is measurable with a microphone, hence the photoacoustic effect. The food store or cold store staff are alerted to the nature and seriousness of the leak, enabling them to take corrective measures. '

'The key innovating factor we've introduced is based on research carried out by our Oslo-based partner Sintef,' explains Dr Martin Lloyd, Research Director of the project's lead partner, UK technology consultancy Farside Technology Ltd. 'At the same time, our understanding of the market and product specifications has come from our industrial partners JTL Systems Ltd and Anglo Nordic Burner Products Ltd. This collaboration has led to the radical re-application of the PA effect to the design of the detector, and the way we've put it together with some very neat electronics and software. The basic technology is very versatile because it is generic. It enables you to measure the validated concentration of a family of gases using the same design of sensor, because the gas sealed into the detector is the target gas of interest. The detector lends itself to miniaturisation and volume production once one gets the costs of the surrounding electronics down to an affordable level.'

This versatility has led to a bifurcation of the original Pampas project into two directions: a further Eureka-endorsed project, E! 2805 Vespas, to re-engineer the existing Pampas prototype into high volume, market-ready devices for a much wider range of applications (for example, the oil and gas industry, toxic and climate-affecting gases, industrial process control systems, medical instrumentation and domestic applications); and an EC-funded project called Netgas to develop a sensor capable of detecting CO, CO2 and other gases for various applications, including the very early warning of fires in aircraft cargo holds.

Terrific Results

Farside Technology's lead partner in Netgas is Munich-based European Aerospace and Defence Systems (EADS), a major shareholder in Airbus. 'We're getting terrific results from Netgas, thanks to the excellent facilities and collaborative relationships we have with EADS, Sintef and other laboratories,' reports Dr Lloyd. 'We've addressed many of the fundamental challenges we uncovered in Pampas and have a robust manufacturing solution for the end product. With regard to Vespas, we already have UK funding in place from Eureka and we're actively seeking European partners to take the project forward.'

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New Laser Infrared Detection Technology Applied to Gas Leak Detection

The INSPECTRA® LASER® range developed by **Gazomat** (France) uses new technology - frequency modulated laser diode infrared absorption spectrometry coupled with a Herriot cell. It does away with the need to use hydrogen and offers sub-ppm sensitivity and methane selectivity.

INSPECTRA® LASER® is designed for gas leak detection and the monitoring of gas network distribution systems and is available in two types of product; a portable laser detector (1 ppm – 10,000 ppm or 1 ppm-100% gas vol.) and a vehicle-mounted monitoring system.

The technology, which revolutionises technical performance, functionality, productivity and safety, is set to supplant flame ionisation detection.

When mounted in a vehicle, the response time is reduced to a third and sensitivity is doubled. Monitoring speed can range up to 50 km per hour.

When applied to a portable detector, the technology offers measuring dynamics extending from 1 ppm to 100% gas volume. That unique feature enables INSPECTRA® LASER® to cover the entire field detection, which called for the use of several devices until now. The laser technology means that leak detection can now be carried out inside homes and in sensitive areas, as it offers intrinsic safety.

INSPECTRA® LASER® is the first detector to use a high-tech laser system and offers exciting new possibilities in the area of gas leak detection.