

ONE SIZE DOES NOT FIT ALL

Tank Storage Magazine looks at how leak detection equipment is embracing the digital transformation

► IMPLEMENTING GAS and liquid leak detection systems to storage tanks helps to reduce potential harm to the environment and personnel. Pipelines remain the safest means of transporting any product from one location to another, but they are not without risks. Managing these risks effectively ensures that customers can minimise the downtime of their pipeline network. 'Regularly monitoring for leaks using technology ensures that leaks are identified quickly and located accurately before they escalate into spills, ruptures and explosions which can cause not only reputational damage to the operator, but damage to the environment,' explains Jun Zhang, CEO of pipeline detection company, Atmos.



THE CONSEQUENCES OF LEAKS

Pipeline leaks can have serious consequences including impacts on human safety; damage to the environment, property and reputation and; financial loss through fines, loss of production and clean-up costs.

'If you have ever seen pictures or videos of the Buncefield incident in 2005, you know that no one wants this type of incident repeated,' says Paul Whiteley business development manager at Aquilar. Early warning leak detection, overfill or spill detection play an essential part of the measures required to mitigate the chances of a repeat.

Undetected leaks can cause massive damage to the environment if they are unnoticed for long periods. Appropriate

leak detection systems can give early warning to mitigate these risks and even avoid issues completely.

There are also cost implications. Fuel is not getting any cheaper and waste through undetected leakage can cause companies huge financial losses. To minimise the consequences of leaks pipeline operators must have a system they can rely on that they can detect leaks quickly, locate leaks accurately, issue minimal false alarms, be easy to retrofit, and work effectively under all operating conditions.

THE HARDWARE

Aquilar, a supplier of leak detection technologies, found that there was no single manufacturer that offered

a solution for all applications. Aquilar embarked on a customer-focused programme, talking to specifying engineers to determine what other products were needed. 'We manufacture and distribute a wide range of monitoring panels and sensors for a wide range of liquid hydrocarbon fuels. As more and more reporting technology moves over to the cloud we are constantly developing new solutions for the detection of leaks and distribution of warning information,' says Whiteley.

Thin Film Carbon/Polymer Technology is typically used in leak detection. Should a liquid hydrocarbon come into contact with the probe, a small amount of the spilt liquid will absorb into the carbon-enriched polymer. This will cause swelling at the point of contact after sufficient fuel (less than a ml) has been absorbed into the polymer. The monitoring instrument detects the sudden increase in resistance and reports that a leak has been detected.

In most cases, the probe will reset when removed from the contact of the spill and the fuel is allowed to evaporate. 'Reaction time is typically less than a few seconds for light or middle-weight fuels such as gasoline, jet fuel, and diesel. It is also responsive to crude oil and some heavier weight fuels and heating oil, but becomes progressively slower as the fuel viscosity increases and the volatility decreases,' says Whiteley.

Crowcon manufactures portable and fixed monitors for protecting personnel and environment from risks of flammable

SENSING CABLE DETECTION

A crude oil tank refinery in France wanted to ensure no major threats to operational safety and potential for disaster due to undetected leaks hidden beneath its four crude oil tanks.

Aquilar was able to provide a solution by supplying the TraceTek TT5000 oil and fuel sensing cable. This specialist sensing cable quickly detects the presence of liquid hydrocarbon fuels at any point along its length, without reacting to the presence of water. The sensing cable is connected to a TraceTek sensor interface module that provides a continuous ability to detect and pinpoint any oil leak. Early detection allows a response team to react before the situation becomes critical.

Each of the four crude oil storage tanks at the refinery now has a TraceTek TT5000 cable buried beneath its perimeter constantly ready to alert the operators to any fuel leakage.

and toxic gases and oxygen depletion. The company offers high-integrity point-type infrared (IR) detectors and open-path IR detectors for vapour leak detection in storage tank applications.

'We have recently introduced Molecular Property Spectrometer (MPS) sensor. MPS sensor operates by measuring changes in the thermodynamic properties of the air/gas mixture,' explains Andy Avenell from Crowcon. The sensor rapidly detects when the normal air mixture changes due to the presence of flammable gases and vapours, and indicates the %LEL gas/vapour concentration via a local display and to control systems via an analogue signal, relay contacts and/or RS-485 Modbus communications.

Unlike established IR and catalytic bead sensors currently deployed in tank storage applications, the MPS sensor provides an accurate %LEL gas/vapour concentration indication for a variety of substances. 'This feature is vital where tanks may be filled with different products over time, or where tanks with varying substances need to be monitored in the same area,' says Avenell.

DIGITALISING DETECTION

Tank storage owners and pipeline operators want to be using the best possible equipment for leak detection monitoring. To do this, companies are combining hardware equipment with software algorithms and programmes to protect their infrastructure to the highest possible level.

According to a paper by the University of Oklahoma's department of chemical engineering and materials science on pipeline leak detection, hardware is typically sensitive to small leaks and quite accurate regarding location. However, the high level of

A THOUGHT FOR FIRE

'Detecting leaks from tanks containing flammable liquids at the earliest opportunity is essential to prevent the possibility of potentially large scale fires or explosions occurring,' says Andy Avenell at Crowcon. Fire detection apparatus such as flame detectors are usually deployed, however gas/vapour detection systems provide the potential to detect leaks before an ignition occurs.

Detecting leaks of toxic gases helps to protect personnel working on the site and also protect populations in the vicinity of the plant. Monitoring around storage tanks provides the earliest warning of leakage.

instrumentation results in significant installation and maintenance costs. Installation can be complex, requiring a considerable amount of work below the surface, since many pipelines are buried.

Software can be easier to implement and is more resilient. Operators can collect a higher data yield from their equipment and track patterns and their results. For example, the Atmos Pipe uses algorithms which manage thermal and hydraulic transients to optimise sensitivity and accuracy in pipelines. The software is able to detect small movements within the pipelines that humans and other hardware may not.

Atmos leak detection equipment works with a combination of software and hardware. These products provide valuable information about leak size, location and amount of product lost when a leak occurs. 'Atmos works with an understanding that one size does not fit all industries or pipelines,' says Zhang.

The Atmos Wave detects the negative pressure wave (NPW) caused by a leak in a pipeline. 'Using fast response pressure meters, Atmos Wave filters the pressure signals to find those with the frequency and magnitude of a leak, meaning the time at which the pressure signal reaches each pressure meter is used to determine the location of the leak

03



extremely accurately,' explains Zhang.

The advanced software algorithms at Atmos are complemented by a range of hardware products too. For example, the Atmos Eclipse can be retrofitted to pipelines to provide non-intrusive leak detection for pipeline networks with limitations such as lack of communications, lack of power, lack of instrumentation or lack of housing for its instrumentation. 'At the same time, Atmos Eclipse can help improve leak detection performance in areas such as sensitivity, response time and leak location accuracy,' explains Zhang.

Atmos worked with energy provider Rotterdam Rijn Pijpleiding (RRP) on a leak detection project spanning three of RRP's underground pipelines that transport crude oil and refined products. Atmos provided two separate Atmos software solutions which resulted in round-the-clock monitoring, reducing detection time and increasing location accuracy.

Not only liquid leak detection, but gas leak detection is vital for tank storage owners for safety of staff, environment and loss of product. 'Continuous emissions monitoring with fixed sensor network helps customers shift to event-based monitoring for timely emissions detection and corrective actions. It

02



EMISSION DETECTION

A large U.S. refinery sought the solution from mPACT2WO to mitigate abnormal emissions and ensure a safer working environment. At the refinery, an authorized emission source at a tank farm conservation vent experienced an abnormal condition that could have persisted for several weeks with increased risk of exposure.

The operations team received a real-time alert that showed a PSL (potential source of leak) on the sitemap. The control room identified the source in the vicinity of numerous tanks and associated piping. This allowed the control room to decide on an appropriate troubleshooting approach. Within minutes of the alert, operations personnel were dispatched to the area, but an initial inspection of the area did not identify the source of the leak. An infrared camera was deployed, and within 4 hours of initial notification, emission source was located and corrected shortly thereafter.

Early indication and location information enabled operations to find and correct tank farm stuck conservation vent within hours, rather than weeks, of occurrence. This avoided potential unsafe condition and/ or personnel exposure due to the abnormal equipment condition.

helps improve operational efficiencies, reduce emissions, enhance maintenance procedures and safety. Industrial operators can now efficiently implement compliance programs with real-time alerts, response workflows and timely corrections,' says says Krishna Uppuluri, vice president and general manager of mPACT2WO.

mPACT2WO's AirCompliance solution is an integrated industrial internet of things (IIoT) solution consisting of gas sensors, software-driven AI/ML analytics, and automated response workflows for emission leak monitoring. The solutions aim is to enhance sustainability and help industrial operators in oil and gas, petrochemical, refineries, chemical, and other industrial facilities to minimise emissions from volatile organic compounds (VOCs) and greenhouse gases (GHG).

'Present leak detection methods are mostly manual, handheld and time or schedule-based monitoring approaches. For such existing methods, customers use a variety of legacy sensors with low-medium fidelity based on ppm (parts per million) level, speciation and

portability,' says Uppuluri. mPACT2WO's AirCompliance solution is a network of sensors that detects ppb (parts per billion) level leaks in real-time, providing visual guidance on leak source location, enables timely leak isolation and corrective actions by plant operators.

SUSTAINABLE MAINTENANCE

'Leak monitoring is vital to make the pipeline industry more sustainable. Identifying a leak as soon as possible supports pipeline operators in their net zero targets to reduce their carbon emissions and provide greener fuel transportation,' explains Zhang. Monitoring the pipeline also extends the lifetime of the pipe itself, meaning fewer replacements and materials used to build new ones. This allows assets to stay in the best working order for longer.

The fuel transition from natural gas to hydrogen is at the forefront of what is happening in the global energy industry. 'As hydrogen blends increase, we've noticed greater discussion around the current state of hydrogen knowledge,' says Zhang. For example, whether the

pipeline workforce will be able to reskill in time, if the security of supply can be maintained and how to prioritise leak detection as hydrogen is more likely to leak due to its smaller molecular size. This has generated interest in pipeline simulation, like Atmos's, to ease the transition to hydrogen and provide insight into what future operations could look like.

Leak detection is vital for companies, economically and environmentally and they are now combining software algorithms and hardware equipment for the best possible results.

For more information:

www.atmosi.com/en/solutions/leak-detection/

www.aquilar.co.uk

www.crowcon.com

www.mpact2wo.com/



- 01 Aquilar leak detection on tank perimeter
- 02 Atmos Eclipse onsite installation
- 03 Crowcon Gasman MPS device
- 04 mPACT2WO AirCompliance illustration