

A NEW LAYER OF RELIABILITY FOR HCA PIPELINES

Harry Smith, leak detection expert at Atmos International, UK, discusses effective turnkey leak and theft detection for remote operations on liquid pipelines.

Being able to monitor your pipelines with ease is a vital aspect of remote operation. Pipeline operators need to not only be able to control the starting and stopping of pumps, or the opening and closing of valves, but they also need to be able to detect when there is a leak or theft activity.

For pipelines in remote or harsh environments, or in high consequence areas (HCAs), leak detection systems (LDS) are critical. However, it's not practical, safe or cost-effective to complete site inspections on a regular basis. This challenge is further compounded when you consider the recent issues faced with the COVID-19 pandemic, limiting the ability to perform site inspections further for pipeline operators with reduced headcounts. This is even more challenging for many smaller pipeline operators, as many of their employees work from home for an extended period.

There's a focus on digitisation, to run pipelines not only safely but optimally, even in HCAs. This is possible by leveraging the data that pipeline leak detection systems collect. Here we'll discuss various turnkey LDS technologies for liquid pipelines that can help with remote operation, enabling pipeline operators to:

- ▶ Rapidly implement non-intrusive solutions.
- ▶ View, analyse and respond to data.
- ▶ Support working from anywhere.

Monitoring pipelines remotely in HCAs

Having effective leak and theft detection is crucial to protect the environment, communities and pipeline operators from the dangerous impacts of leaks or ruptures. In HCAs such as river crossings and urban environments, it is especially important to consider

how to put data at the fingertips of the key pipeline personnel.

Hardware like Atmos Eclipse has already been installed on thousands of miles of pipeline around the world, from the UK, to Europe, Asia and Africa. Atmos Eclipse is non-intrusive and measures flow, pressure and temperature for Atmos' leak detection software (Atmos Wave Flow and Atmos Pipe) to effectively detect and locate leaks. The pipelines where Atmos Eclipse units are installed are often long-distance and in remote areas, where regular site inspections are difficult.

The data that Atmos Eclipse collects is sampled at 60 Hz (60 samples/sec), to allow for high levels of sensitivity, a quick response time and accurate leak location. It's a cost effective and easy to install unit, that can be implemented with minimal downtime of the pipeline. The unit is good for harsh climates where remote monitoring is crucial:

- ▶ Operates in -20°C to 60+°C temperatures.
- ▶ Is explosion proof, ATEX certified (ATEX/IECEX: Zone 1 Gas IIA, T6).
- ▶ Can be buried to a depth of 2 m (maximum).
- ▶ Flash memory is available in case of communications outages (up to 4.5 hours).
- ▶ Can operate using solar and wind power (90-250 Volts AC line or 24 Volts DC).
- ▶ Multiple communications options (TCP/IP, line of sight radio, GSM (3/4G) and Modbus).
- ▶ Works on painted lines.

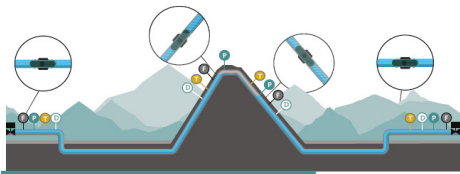


Figure 1 - Operating in high elevation areas

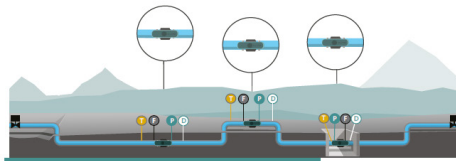


Figure 2 - Long distance with limited instrumentation

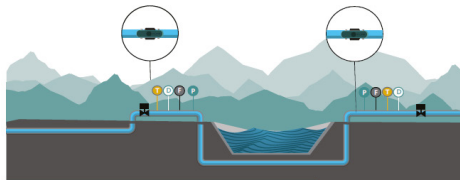


Figure 3 - Short pipelines in HCAs eg river crossings



Figure 4 - Short pipelines in urbanized areas

Figure 1. A variety of scenarios where Atmos Eclipse can be installed for remote monitoring.

- Works for liquid pipelines like crude oil, multiproduct and water.

The Atmos Eclipse can be installed in a variety of difficult scenarios, including within tight spaces. The integrated solar and wind power capability enables the pipeline leak detection to work not only as part of a networked environment, but also standalone in hostile and remote locations. This is a futureproof approach to leak detection considering the move to renewable energy sources.

Atmos Eclipse is excellent for real-time leak and theft detection in these areas. Recently, it was able to detect theft activities on a multiproduct pipeline with a length of around 100 km and diameter of 12 in. at a location in Europe. The thieves had been running a sophisticated operation.

Atmos Odin can also be used alongside LDS software to detect leaks and thefts in remote operations. It differs from Atmos Eclipse in that it is an easy-to-use data acquisition unit, also designed for use in areas without power or communications. Atmos Odin is self-powered through battery and attaches directly to the pipeline at any available tapping point. It is also effective for remote operation:

- Requires no external power or communication.
- Certified for Zone 1, Ex d, ATEX, and IECEx.
- Minimal installation requirements (existing tapping points).
- Easily concealed from vandals and thieves.
- Long operating time (three weeks).
- Works for liquid pipelines like crude oil, multiproduct and water.

Working alongside Atmos Theft Net to display the data, Atmos Odin is excellent for detecting theft because it uses

pressure sensors that are in contact with the pipeline fluid. The theft detection hardware has recently been implemented in remote locations of Congo and Indonesia, where there can be regular theft activities. The areas where Atmos Odin has been installed also have a very limited access to power and communications.

Non-intrusive and rapid installation

Being able to install LDS on HCA pipelines quickly and easily is crucial. Having to carry out highly impactful engineering activities on pipelines in urban areas can cause major disruptions to communities; likewise for pipelines that are in environments that are natural

habitats to an ecosystem. It is also important from a safety point of view that pipeline personnel should not work for long periods of time on HCA pipelines running through some very harsh environments.

Both Atmos Eclipse and Atmos Odin offer a rapid installation. Atmos Eclipse is non-intrusive and doesn't require any tapping points, removing the need to drill, weld or cut the pipeline and reduces the risk of thieves using existing tapping points to steal product out of the pipeline. The unit clamps on to the outside of the pipeline, without interfering with the cathodic protection systems. With a weight of just 6.6 kg, Atmos Eclipse is easy to transport to the section of pipeline where it is to be installed and requires minimal human resource to fit into place.

Atmos Odin simply attaches to the pipeline at any available tapping point. There's no need for external power or communications and it is easily concealed from vandals and thieves, to avoid arousing suspicion. Over a three week period, Atmos Odin can collect data, with no need to charge in between.

The installation of both solutions can be completed with minimal to zero downtime of the pipeline making them effective from a financial standpoint.

View, analyse and respond to data

With the need to keep site inspections down to a minimum, access to data into the integrity of remote pipelines is a vital aspect of monitoring. Atmos Eclipse can connect to cellular, radio, and standard RS485 and TCP/IP communications, to transmit the data it collects in real-time.

The data gathered from Atmos Eclipse is backed up and secured in Atmos Cloud. It can be pulled into supervisory control and data acquisition (SCADA) systems and a web GUI to present a visual view to pipeline operators, accessible anywhere by desktop. The web GUI is customisable, so you can setup a range of views. For example, displays for engineers could include a map displaying the layout of the



Figure 2. Atmos Eclipse in operation using solar and wind power in a remote location.



Figure 3. Atmos Odin installed on a pipeline.

pipeline, with different graphical charts for leak and theft detection.

When Atmos Odin is installed, the internal GPS transmitter acquires the location with accuracy, these GPS signals are continually logged with measurements from its internal pressure sensor. The data that Atmos Odin collects is downloaded and analysed by Atmos' team of experienced engineers in Atmos Theft Net. Offline data analysis like this is unique to Atmos and provides better theft detection sensitivity than conventional online LDS. This helps to accurately locate illegal tapping points, to within metres.

Support working from anywhere

The impact of COVID-19 outlined the importance of the ability to work from anywhere as part of remote operations. Some of the smaller pipeline operators were particularly affected, advising control room staff to work from home during the height of the pandemic.

Access to the data into the integrity of the pipeline is crucial for remote operations, whether off field, working from home or in the control room. The web GUI supplied for Atmos solutions like the Atmos Eclipse can be accessed anywhere on a desktop. With the ability to connect to a virtual private network (VPN), it is secure and addresses cybersecurity concerns often associated with working from locations outside the control room.

Pipeline leak detection software that work with Atmos Eclipse such as Atmos Wave Flow also supports control room staff with intelligent learning. This means the LDS can compensate for variations, correcting any metre errors present in the system. Uncertainty in the system has a direct correlation with response time. The intelligent learning helps greatly reduce false alarms, building trust in the system for pipeline operators and therefore improving their response to alarms.

Atmos Wave Flow can also report a variety of alarms through different communication channels, SMS and email for instance, an ideal way of reporting for when working both on and off field.

A new layer of reliability for HCA pipelines with turnkey solutions

Ultimately, forming an effective LDS strategy that works as part of your remote operation is crucial for detecting leaks and thefts. Pipelines are always being built in places that are HCA, either because they are urbanised or challenging environments that can be hazardous for site inspections.

Pipeline leak and theft detection instrumentation such as Atmos Eclipse and Atmos Odin add a new layer of reliability to your LDS without a huge financial burden. They are robust systems that are easy to install, work even under harsh climates or in areas where there is little or no power.

Site inspections can therefore be kept to a minimum and data is easily accessible. Atmos Eclipse, for example, pulls through real-time data to a web GUI that's accessible from anywhere by desktop. Going forwards, the advancements in solutions like this are going to continue to play a vital role in effective and safe remote pipeline operation. 