A PHMSA (Pipeline and Hazardous Materials Safety Administration) study published in USA in 2012 showed that several pipeline leaks with unintentional release of fluid were reported in the period between January 2010 and July 2012 in USA. Of the 197 confirmed leaks with about 5 million gallons liquid release in total a large portion was on crude pipelines but large releases were also recorded on Highly Volatile Liquids (HVL). Five of the above mentioned 197 releases ignited and two of the five exploded.

The same PHMSA document reports some case studies of leaks and related consequences. In one leak reported on an Enbridge liquid filled pipeline in North Dakota an unintentional release in excess of 150k gallons caused an estimated property damage of about 4 million USD.

Recently the Oil and Gas Journal reported new proposals by PHMSA to improve on existing pipeline safety regulations especially focused on yearly evaluation of High Consequence Areas (HCA). Retrofitting existing pipelines with a leak detection system may prove costly if considering the full length of the pipeline. However, a targeted approach to monitor for presence of leaks at HCA is both economically feasible and ethically correct.

For this purpose very flexible monitoring devices that are designed to be plug-and-go leak detection systems (LDS) are highly necessary. Based on this concept of great flexibility and high performance A3 Monitoring has designed spotOn® AE, a non-intrusive LDS fully compliant with existing API standards that communicates either via satellite or SCADA the presence of leaks. SpotOn® AE is easy to install and does not need any new or pre-existing infrastructure. Provided that access to the pipe is available at the entry and exit point of the HCA at the time of installation, spotOn® AE can be easily
installed and setup to quickly inform the asset owners about presence of leaks within the target HCA.

Figure 1: Oil spill spreads near Santa Barbara, California, USA

SpotOn® AE

SpotOn® AE is an Acoustic Emission based and non-intrusive LDS compliant with existing API standards. Normally an area of interest is monitored using two sensors, one each at the entry and exit position of the area of interest (for example HCAs). The spotOn® AE sensors are placed on the outside of a pipe at a distance of up to 1km between them to be able to detect relatively small leaks within the area being monitored. Each sensor records the ‘acoustic activity’ and after an initial monitoring period to establish the baseline for the background noise, alarms can be set on each sensor.

Additionally, due to possible activity cycles in production and presence of noise due to scheduled internal inspection (e.g. an ILI tool running inside the pipe), the two sensors are compared in terms of their ‘acoustic activity’ and acoustic activity not due to leaks is identified, therefore reducing the problem of false alarms. The issue of false calls is a major problem in the industry and may lead (as it has happened) to a lack of belief in the alarms reported and failure to follow up appropriately real leak events. One example is the Exxon Mobil pipeline leak in Jacksonville Maryland that cost Exxon Mobil 495 million USD in compensatory damages and 1 billion USD in punitive damages.

The spotOn® AE unit is attached to the pipe using a stainless steel repair clamp with protective silicone on the inside and a sensor holder that protects the sensor and its electronics while enabling for the sensor to touch the outside of the pipe (see Figure 2).

Figure 2

Figure 3 below shows a typical spotOn® AE setup where the AE sensor is attached to the pipe at a buried location, the AE signals are transferred to a battery powered control unit via a rugged cable and encrypted data are sent to a dedicated server via satellite, GSM or SCADA. Data is therefore de-encrypted and displayed on the shieldCube software.

Figure 3

SpotOn® AE Case Study

This case study demonstrates the capability of the spotOn® AE system to detect leaks in fluid filled buried pipelines. In this case the leak monitoring was carried out on a 6” pipe which was coated and buried. The operating pressure of the pipe was 11 bar. Two sensors were buried at the entry and exit point of the section of interest at about 91m distance from each other.
The ‘acoustic activity’ was recorded at the two sensor locations and these data were encrypted and sent via satellite to the shieldCube online portal (www.shieldcube.com).

The monitoring data displayed below show that both sensors were reading similar level of acoustic noise while the pipe was operating in standard conditions. At the time when the leak started both sensors recorded the event with different level of ‘acoustic activity’.

Automated alarms set on the sensors were triggered by the leak and alarm emails were sent to pre-set list of emergency contacts agreed with the client.

As in this case the leak event was detected by two sensors it was possible to also identify the leak location using data from an attenuation calibration test carried out at the time of installation.

It was therefore predicted that the leak was at 33m distance from the closest sensor (downstream sensor in Figure 4) with a standard deviation of 1.1m. The leak was confirmed at 32.4m from the downstream sensor.

As a result of this monitoring campaign the client was able to receive fast notification of a leak on a fluid filled pipe. Additionally, it was possible to locate the approximate leak position.

For more information on the capabilities of the spotOn® System please contact APC Integrity Technologies at:
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