A FRESH APPROACH TO NATURAL GAS NETWORK SURVEYS

Against the current backdrop of a general review of energy issues, gas operators are playing a key role in national and local energy policies.
Even though their status varies by country - some are public, others semi-private or private - their mission is the same: transporting gas to the end user in a manner that offers the highest quality, the greatest safety and the least cost. While quality and cost issues are covered by the policies specific to each company, the risks inherent to gas make safety a concern that goes well beyond the operator: an issue of national or even supranational importance.

For example, European laws make it necessary for natural gas distributors to keep natural gas systems safe through the systematic survey of the totality of their network at least once every four years. In recent years, they have also been required to provide computerised traceability of surveys, with precise dating and location of the leak indices that may have been detected.

All of which makes gas network survey and leak detection a science that must be as exact as possible.

What Does Network Survey Mean?

A gas network survey is carried out within the regulatory framework set by each country, at frequencies that vary widely from one country to another depending on the characteristics of the system: age, type of pipes, service pressure, etc. Its purpose is to heighten the safety of the distribution network by giving priority to the detection of leaks with a major safety risk (explosion) and identifying leaks that need to be treated in a programme of preventive system maintenance.

Survey operations are generally carried out from a vehicle and/or on foot, with an appropriate detector. The survey of transmission pipelines involves the use of helicopters or drones with thermal cameras or a remote laser measurement system.

In all cases, the principle is the same: the aim is to measure the methane (or propane) in an atmospheric sample taken on the ground level, as close to pipes as possible.

Survey on foot or from a vehicle makes it possible to identify leak indices, which then need to be confirmed by precise location (sampling) or precise measurement above the ground. The risk generated by the leak will depend on the concentration level, the closeness of public buildings and/or dwellings or the risk of the gas flowing along sewers and underground electrical or telephone cables.

The Limits of Each Method

Historically, network survey was done on foot. Even today, it is the best method for detecting the smallest leak indices, for two reasons. The sample is taken directly on the ground, just above the pipe. The drawback is that an operator on foot can only cover 6 to 8 km on average every day. It is therefore easy to understand why the extension of distribution systems and economic constraints have contributed greatly to the development of vehicle-based network surveying. Depending on traffic density, a vehicle can cover 30 to 50 km every day, or 5,000 to 6,000 km every year.

However, vehicle surveying has its own limits: its on-board detectors must be more sensitive, and it does not allow access to all the zones requiring monitoring. Piping segments with connections and meters that can only be inspected on foot account some 10 to 15% of the totality of networks in many European Union countries.

The Many Constraints of Gas Network Surveying

Network surveying is subject to a number of constraints in the field, which are critical in defining the qualities of an effective detection system.

- Locating leaks outdoors using fast-moving mobile equipment demands ppm-level sensitivity. Low gas pressure in the pipe, the type of road surface, the presence of gases that are heavier than air, for example in butane-air or propane-air networks, also make inspection more complicated.
- Road traffic produces carbon dioxide and petrol fumes that can lead to false alerts. As a result, the measuring system must be perfectly methane selective.
- Increased inspection speed requires the shortest possible response time to locate the leakage point accurately.
- Changes in temperature and working conditions in the field make high demands of equipment, which is required to offer measurement stability over time.
- Lastly, the obligation to date and geolocate survey operations makes it necessary to use maps, digital if possible, which are precise and up-to-date. That requires device intelligence and communication.

Use of New Technologies

Measurement techniques were initially based on flame ionisation (FID) or semiconductors, but these have gradually given way to measurement systems using optical technology that are more reliable and more selective.

At GAZOMAT™, a French instrument manufacturer working in close collaboration with a number of gas operators like GRDF (formerly known as Gaz de France) in France, we aim to offer a comprehensive solution for network surveying. The range includes a laser spectroscopy methane analyser (INSPECTRA® LASER portable) and the NGS survey software that controls the analyser, the maps and the GPS system.

INSPECTRA® LASER portable analyzer with advanced Laser spectroscopy technonology for superior measuring performances

The NGS survey software installed on a PC or PC tablet provides real-time visualisation of the survey circuit with continuous display and recording of gas leak detected and survey events along with associated GPS co-ordinates.

The patented measurement principle of the portable INSPECTRA® LASER analyser from GAZOMAT is based on the emission of a laser beam in a wavelength specific to methane and a multipass cell to provide 1ppm sensitivity over a measurement scale up to 100% gas volume.

The principle of measuring methane absorption by photodetectors means that only methane is detected. The device does not respond to other hydrocarbon gases, and so provides accurate measurements. Selectivity reduces false alarms and unnecessary travelling by gas emergency intervention teams. The immunity of the device to humidity and temperature keeps the measurements stable. The INSPECTRA® system was developed to offer a very short response time, close to a second, with the benefit of less dilution of the detected leaks in the air, and a shorter operating time.

Lightweight and compact, the INSPECTRA® system is available in a portable version with the INSPECTRA® LASER detector for detecting leaks on foot, and a vehicle version named VSR INSPECTRA®, with an inspection speed up to 40 km/h.

For greater optimisation and survey simplification, we integrated the computerised recording of survey data, along with traceability and geolocation using an associated GPS system. The NGS system survey software developed in house thus takes care of interaction with measurement and geolocation equipment. It can be used on foot or from vehicles, with the same guarantee of traceable leak detection.

While the INSPECTRA® vehicle travels along pipes, atmospheric samples are taken directly from the surface of the ground through the intake manifold fixed to the front bumper of the vehicle. The sample is taken close - 4 to 5 cm maximum - to the surface of the ground, avoiding excessive dilution in the air. With standard vehicles, air is taken in up to 4 m on each side of the vehicle. A filtration device protects the instrumentation from water and dust.

Network survey vehicle with on-board INSPECTRA system, GPS receiver and sampling system fitted under front bumper.

Operator on foot with INSPECTRA laser portable analyser and GPS Tablet running NGS survey software for precise leak detection and quantification.

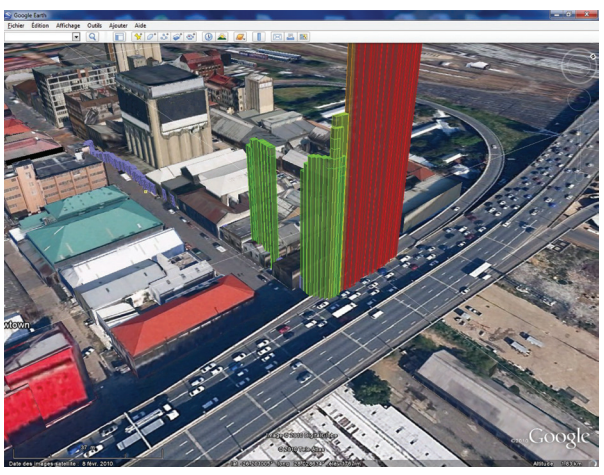
If the measured concentration exceeds a given limit, the operator can immediately verify it on foot using the portable INSPECTRA® LASER detector with a sampling rod ending in a suction cup that is set directly on the ground, and then resume survey from the vehicle. The other option is that the vehicle completes its journey and all the indices detected are then verified on foot using a portable INSPECTRA® LASER using the geolocated data as provided by the vehicle survey.

The combination of a short response time, total methane selectivity and ppm-level sensitivity guarantee the precision and accuracy of measurements and leak detection.

The NGS software combined with a high-reception quality GPS antenna (dead reckoning) continually positions the vehicle (compensating for the tunnel effect), even when satellite reception is poor due to buildings, underground car parks, etc.. The software links the indices detected and the GPS position in real time for accurate geolocation, making it easier to subsequently look for the leaks in the field.

The software operates with GPS type background maps of the country, which can be supplemented with information specific to each gas operator (system maps, pressure regulator stations, land registry maps, etc.) generated in a Shape format - a standard map format.

During an assignment, the software shows the position of the vehicle in real time along with the detected leak indices, maps and all the information loaded at the start (system map, distribution map, roads, buildings, etc.).



A dynamic 3D view of the journey completed is possible with Google Earth. It highlights in red the gas leaks detected that exceed the critical concentration level threshold.


Indice1

Information

Localisation :

Latitude : 49°5'57.15"N
Longitude : 2°45'30.05"E
Speed : 0,0
Concentration : 1,1PPM
Indice : Indice

Date 14/11/2016 13:06:43
Opérateur Frédéric DA SILVA Jérémy
Route

Groupe d'exploitation
Prestataire Gazomat
VSR ID Gazomat DF-503-TJ
Bouteille Réf M880987
Numero d'urgence
Météo

Sol : Sec
Vent : <25

Commentaire

Confirmation : 1900,0PPM /Possibilite de cheminement Non/Status Autre indice /Commentaire PTT MARQUAGE JAUNE.

A summary report in PDF format is automatically issued at the end of each survey mission with screen shot for each gas leak detected to facilitate its location later on.

The automatic logging of key survey data (measured concentrations, malfunctioning, annotations, measuring system tests, etc.) with their location in longitude and latitude and the precise date provides a detailed image of a section of the network at a given time.

At the end of the survey, a summary report is generated in PDF format that brings together all the events that have occurred, with, for each detected index, a separate detailed record with a screen shot for future location.

The simple graphics interface and the operating procedures make the work of operators easier and reduce the time for training use of the new technology, however advanced. The high usability of the software, which only displays vital data and guides the operator during the mission, even offers gas companies who wish to do so the facility of reducing the crew to just one operator/ driver, while complying with road safety rules.

The INSPECTRA's detection system adapts easily to all carriers, including those with a slight build, with the same performance. This recent innovation has made it possible to effectively combine detection on foot and from a vehicle for higher productivity and maximum efficiency in city centres and areas that are difficult to reach.

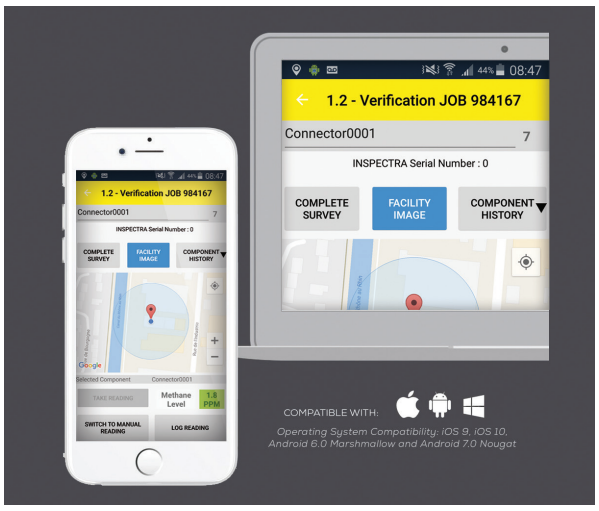
The EASY INSPECTRA™ mounted on an ATV makes it possible to survey gas transmission pipelines or off-road areas.

The EASY INSPECTRA™ equipment that can be installed in small-size carriers revolutionizes the very concept of network survey by combining both pedestrian and vehicular detection..

EASY INSPECTRA™ with single driver/operator.

INSPECTRA system adapts easily to all carriers

Latest advances in mobile communication systems and devices open up exciting new perspectives for gas leak monitoring. These are already changing the way field survey data may be collected, transferred and shared within the maintenance crews for immediate and focused action.



Mobile application for easy survey data transfer

The mobile application module recently developed by GAZOMAT, complementing the NGS software, aims to provide gas utilities with a fully interconnected and integrated monitoring system ensuring field data integrity as well as survey teams' time optimization. With such tools, gas operators will even be able to remotely follow, in real-time, surveys in progress.

These recent innovations have been developed to offer a number of dynamic solutions that can be deployed by gas operators on an "à la carte" basis to tailor the management of their systems to their needs.

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