Chapter 6

Method F: Noise loggers – non-correlating

Previous sections show how noise is created by a leak and propagates through a pipe. Leak noise loggers are designed to "pick up" this leak noise by being placed on available fittings, usually with a magnetic coupling (Figure 6.1).

The leak is identified by each logger unit individually based on the noise signature of a leak being consistent and loud against the background noise. Typically, measures of noise and consistency together

Figure 6.1 Noise logger schematic. (Source: Halma Water Management)

Editor(s): Stuart Hamilton and Bambos Charalambous
doi: 10.2166/9781789060850_0033

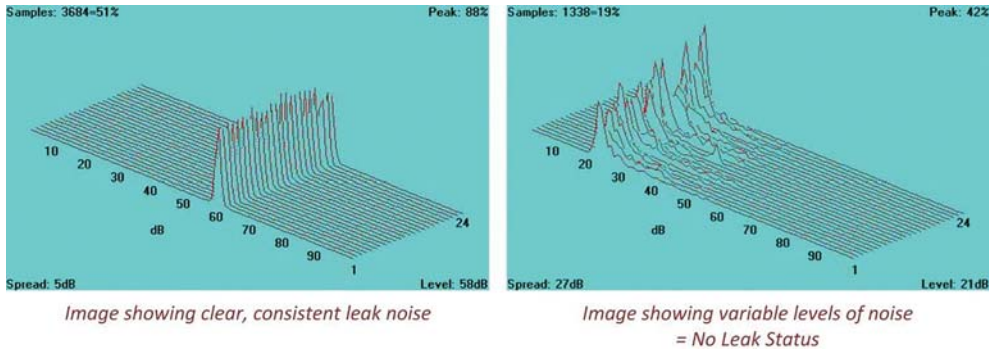

Figure 6.2 Typical leak/no leak display. (Source: Halma Water Management)

with a graphical representation are supplied to the operator. The leak position is "localised" to being between two loggers for follow up pinpointing. The objective is to survey large areas at low cost to maximise efficiency in an active leak detection strategy (Figure 6.2).

Loggers are usually programmed to log during the middle of the night where interfering noise (traffic, legitimate water usage, etc) is at a minimum and leaks can be most easily "heard". Exact sampling regimes vary across the available systems.

Early systems were manually programmed and downloaded with the operator determining whether or not a leak was present from data supplied. As mass deployment evolved the need to further automate and ease the process became apparent with the objective being to survey large areas quickly and "automatically" at low cost.

To the above end units with radio download and automatic leak determining algorithms were introduced in the early 2000's. Many such systems are now available. Unit cost has reduced drastically with volume and technological evolution and units are now deployed in large numbers with rapid cost effective surveys possible.

Multiple deployment methodologies have evolved to suit operating requirements as follows: direct download; drive-by patrol; lift and shift; and permanent installation. Each of these is described in the following sections.

6.1 DIRECT DOWNLOAD

Usually where smaller numbers of loggers have been installed and require manual download. This is commonly used where a specific problem is being investigated and the loggers will be removed after the problem has been located.

6.2 DRIVE BY PATROL

Loggers with a radio download facility are placed on site and their download device vehicle mounted for rapid drive-by sweeps of an area. This can be used in two ways.

6.2.1 Fixed

Where an area has the need for frequent surveys the loggers are left in place for immediate survey whenever required. In some instances thousands of units are deployed in this mode, particularly where leakage is being targeted in "open" networks where flow base zones (DMA's) are not in place.

6.2.2 Survey

Loggers are deployed in an area (often a problematic DMA) so that it can be surveyed and brought under control. Interestingly, experience shows that several sweeps are required to optimise leakage as initial sweeps reveal leaks that are masking larger, quieter leaks that are identified by subsequent downloads after initial leaks are repaired. When all leaks have been identified the loggers are moved to a new target area.

6.3 LIFT AND SHIFT

In order to survey very large areas quickly the industry has developed a "lift and shift" methodology where large numbers of loggers are moved daily. Data is downloaded automatically to handheld retrieval units via radio from which the leak list is transferred directly or remotely to a central office analyzing station for leak pinpointing follow up. Technology has evolved to suit the application of with GPS positioning, mapping and other aids enabling a highly efficient operation to be carried out (Figure 6.4).

Latest developments include apps to act as the programming and download device which takes advantage of third party technology to provide a number of benefits such as GPS location of the sensors and the point of interest, free offline-maps, remote upload of the measurements from site via cellular technology or WiFi, deployment photographs and reports made and uploaded remotely (Figure 6.3).

Figure 6.3 App for lift and shift correlation with upload function, cloud software to store and display individual measurements. (Source: Gutermann)

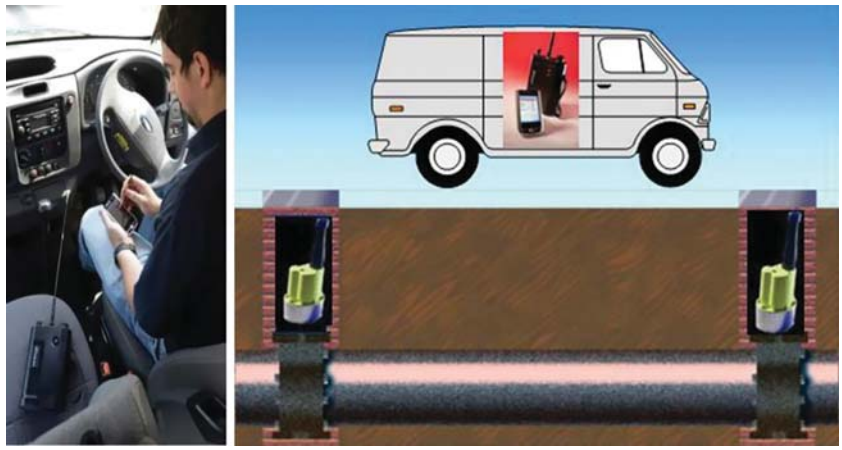

Figure 6.4 Drive-by patrol. (Source: Halma Water Management)

Figure 6.5 Lift and shift deployment and GPS mapping function. (Source: Halma Water Management)

The latest lift and shift noise loggers can also record leak noise when a leak is identified by noise logging. This data can be correlated locally or transmitted along with noise logging data for correlation by cloud-based viewing systems.

Technology has evolved to suit the methodology with GPS positioning, mapping and other aids enabling a highly efficient operation to be carried out (Figure 6.5).

6.4 PERMANENT INSTALLATION

Modern communication technology (SMS, GPRS, 3G, 4G, NBIoT, Radio) and the reducing costs of data transfer now means that noise logging can be economically installed as a field network. Tens of thousands of units have been permanently deployed in recent years. Various data transfer methodologies are available and common download platforms with AMR systems have also been introduced.

The following areas are particularly suitable for permanent installation: areas with a high burst frequency; areas that are traditionally difficult to survey (i.e. town centres and main roads); areas with no DMA structure in operation where acoustic noise logging offers a cost-effective alternative; and previous DMA "hotspots" where ongoing survey is required to ensure leakage levels remain manageable.

Leak noise data is automatically transferred to the central monitoring station. For ease of running, data is often linked with GIS or mapping systems, to provide a quick pictorial overview of the network (Figure 6.6).

The availability of immediate alarms reduces leak run time to a minimum and, with effective follow-up repair, provides a huge dividend in water saved.

The latest system transmit noise files for leaks in addition to logged data. This is used to correlate through cloud platforms providing the leak position. This can be combined with integrated GIS maps to provide 'autocorrelation' where leaks are identified through noise logging and automatically 'correlated' to give the leak position using data drawn from the GIS system.

Combining leak alarms with DMA flow data enables effective leak sizing to prioritise and optimise follow up activity. Survey labour expense is removed with leak detection becoming a more specialised pinpointing and repair activity.

The benefits of the fixed network approach are evident. With technology providing ease of installation the decision to deploy (or not) is now largely down to an economic comparison of labour costs against capital investment, and the additional savings and benefits of immediate notification.

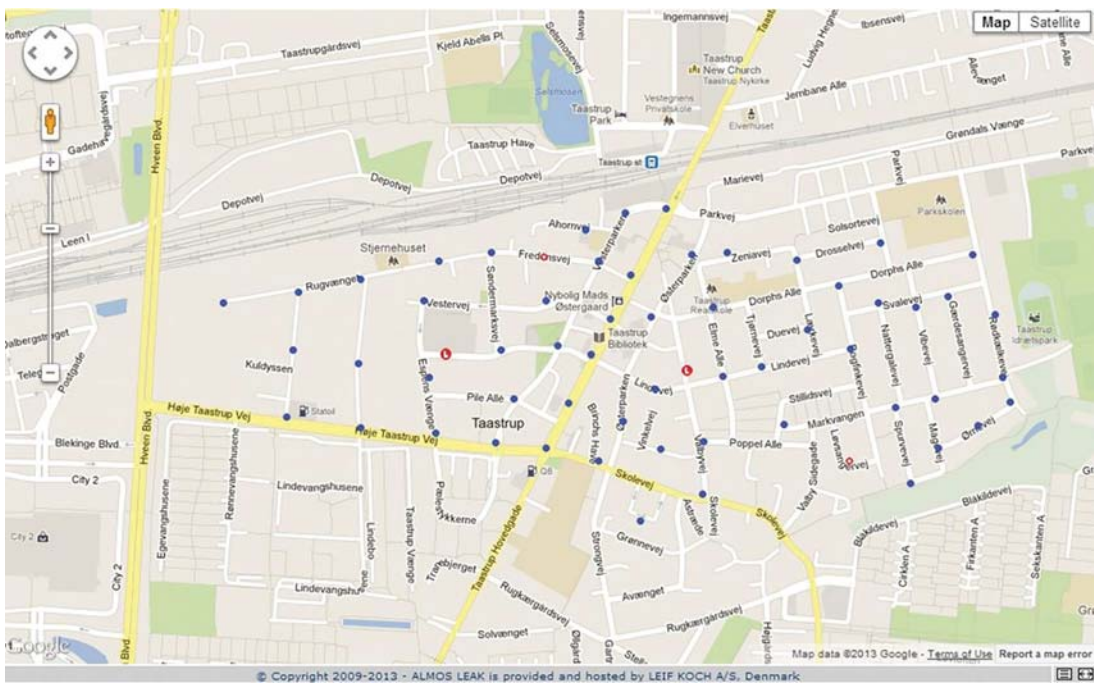

Figure 6.6 Permanent noise logger installation by street map only or full aerial view. (Source: Halma Water Management)

6.5 NOISE LOGGER PRINCIPAL OF USE

Leak noise logging has evolved in scale and technology to provide multiple methodologies for leak localisation. Consideration of labour costs, rate of intervention required, status of the network and availability of DMA's (flow zones) will allow strategy of deployment to be optimised (Figure 6.7).

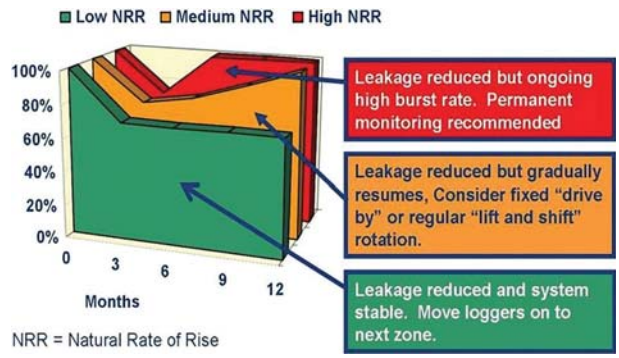

Figure 6.7 Theoretical model for leak noise logging methodology selection. (Source: Halma Water Management)