Safety and quality

We have a nose for both

The 1930s is a period frequently referred to in past months. In the middle of the Great Depression, 18 March 1937, a major disaster struck a school in Texas. The New London School was built in 1932 and was one of the richest schools in America at the time. But not the safest, as events that afternoon would tragically demonstrate. An enormous gas explosion destroyed the building in a matter of seconds. With approximately 300 deaths and 200 casualties, it remains the third deadliest catastrophe in Texan history to date. The cause was later established to have been a gas leak, which had not been noticed because the gas used was odourless.

Gas odorization was known and practiced at the time, but only on a voluntary basis. Most natural gas suppliers did add odour to gas, but the gas used for the school heating system came from a residual pipeline from one of the many oil producing companies. It was then common practice to use this gas, often free of charge. Shortly after this fatal accident it was made obligatory to odorize the gas with ethanethiol, also referred to as ethyl mercaptan, which became the first odorant for natural gas. Since then, legislation worldwide adapted to this idea and today the odorization of natural gas is still common practice, the user's safety being the single objective. One of the first automatic odorization systems was invented by the company Peerless shortly after the incident (see Fig. 1).

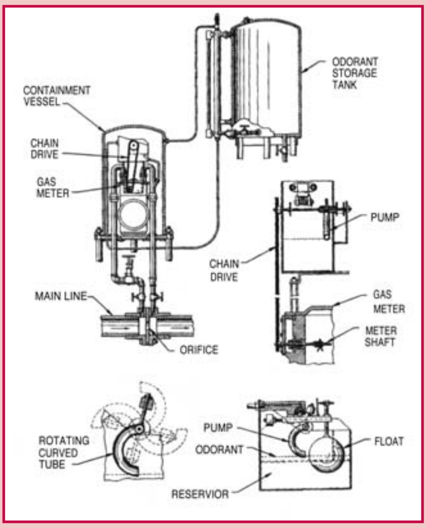
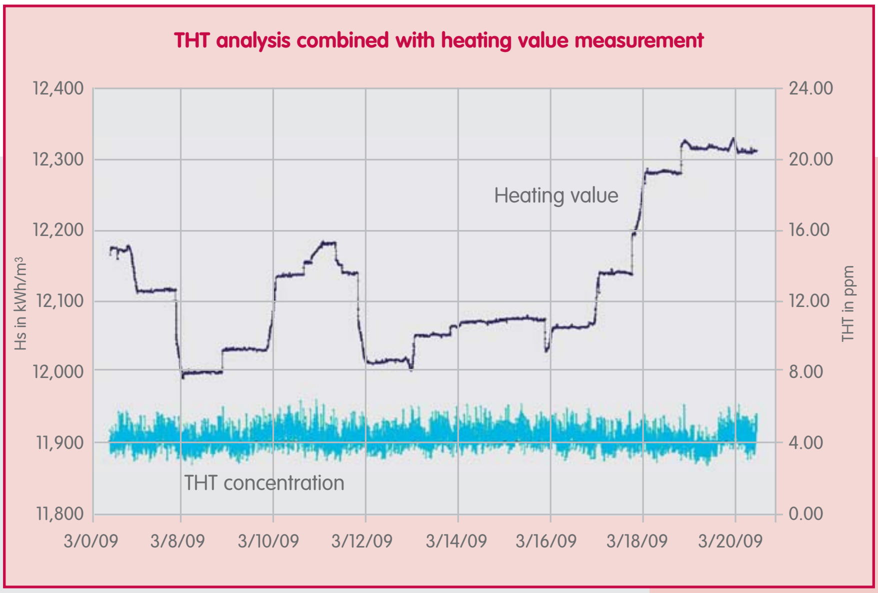


Fig. 1: Peerless type "M" odorizer

Many different odorizers have been – and still are – used, each with its own advantages and disadvantages. As indicated, ethanetiol was the first odorant to be added to natural gas. Meanwhile, several different components have been used for various reasons, such as TBM, MES, THT, and more recently the so-called sulphur-free odorizers are gaining in popularity because of their environmentally friendly nature.

To guarantee that people with an average smelling capacity will be able to detect natural gas, for example in case of leakage, concentration limits have been defined for the various odorizers. There is also a maximum concentration level to prevent false gas leak reports. Harmless leakages with a non-hazardous rate can occur in gas piping systems. In case of excessive odorization these acceptable rates will be noticeable, leading to unnecessary alarm



Apart from the special analytical hardware (column) for the THT measurement, the only additional requirement for the system to be able to measure the THT concentration, in addition to the heating value, is a calibration gas containing THT. The required concentration is approximately 5 – 10 ppm. Calibration gasses like these are commercially available, and the accuracy of the THT component varies from 2 – 10% depending on the supplier.

Field tests have proven minimum detection limits of 3 ppm for THT measurement in combination with the heating value analysis whereas 2 ppm is possible if the EnCal 3000 is dedicated to THT analysis only. The standard deviation of the measurement is max. 1 ppm but will typically be in the order of 0.5 ppm. In the left-hand figure, the results of a field test show both heating value and THT measurement over a period of 14 days. The average THT concentration found in this test is 4.2 ppm where the odorization system was set up to inject 16 – 18 mg/m³, equivalent to 4 – 4.5 ppm.

for the customer and, consequently, continuous alerts at the gas company.

A more dangerous situation, potentially leading to situations such as at the New London School in Texas, can result from too low odorizer concentrations. This could lead to liability issues with the responsible party having to prove correct odorization levels. Therefore, odorizer concentrations are often controlled by flow dependent odorization systems. These systems get the gas flow information from the gas meter in the station and, based on a ratio calculation, the amount of odorizer injected into the gas stream is adjusted accordingly. A quantitative check of the odour levels is often performed as discontinuous spot checks with a predefined time interval which may vary from country to country. Proving the odorant concentration levels on a certain day, or even at a certain hour, may be difficult due to this type of discontinuous measurement. To reduce the risk of odorization failures, continuous measurement devices dedicated to the analysis of various odorants are available on the market. These are often gas chromatography based analysers. Since the concentration levels that need to be measured are low, dedicated analysers are employed that are often equipped with electrochemical detectors, which require maintenance, may have a relatively short service life and are unsuitable for measuring the main components in natural gas required for the energy measurement itself. The components measured by these analysers may though include sulphur containing components so that the analysers can be used to measure the total sulphur content of the gas.

However, one may often be only interested in the single odorant injected, in which case the investment cost for a dedicated analyser could be a major obstacle. For these kind of applications the EnCal 3000

now offers an interesting solution: thanks to the MEMS technology (micro electro mechanical systems) used in the EnCal 3000, the thermal conductivity detector is so sensitive that it is capable of measuring low levels of THT. The use of THT as a single component odorant is widely spread all over the world. The concentration ranges of the odorant vary per country but are typically above the detection limit of THT which can be achieved with the EnCal 3000 (8 mg/m³ or ±2 ppm). What makes the application even more interesting is that it can be combined with the heating value measurement which is the main application for the EnCal 3000 gas chromatograph.

Thus we can safely say the EnCal 3000 provides a broad range of applications. In addition to heating value C6+ and THT, we can offer the extended heating value analysis up to C9+, H_2S measurement and the hydrocarbon dew point calculation. And there is more to come…

For more information, please contact:
Addy Baksteen
a.baksteen@elster-instromet.com
Bernd Brendemühl
b.brendemuehl@elster-instromet.com
Dr. Joachim Kastner
j.kastner@elster-instromet.com