

VIRIDOR SHOWS ITS COMMITMENT TO BEST PRACTICE IN OPTIMISING CARBON FILTERS



The STS Siloxane Monitor

Recycling and Renewable Energy Company Viridor has taken a market leading step in the procurement and installation of an STS Siloxane Monitor to help optimise their activated carbon filters at the Calne Landfill site in Wiltshire.

Following a trial of the STS Siloxane Monitor at the Viridor, Calne site over a two month period in early 2015 STS were able to demonstrate that carbon filter contamination can be identified, quantified and managed. Viridor have now purchased and installed a STS Siloxane Monitor to provide continuous data on filter condition enabling accurate and cost effective changeover and management. Viridor has adopted this unit as best practice and become market leaders in their proactive management of carbon filters.

The Viridor landfill site at Calne generates a gas supply of 2500 m³/hr which supplies 4 x Jenbacher 320 engines generating 4MW of electrical power (enough to power 7700 homes). Gas supplied to the engines is cleaned by passing it through a chiller to remove water, then a series of 3 carbon filters which remove siloxane and other contaminants. Siloxanes are a class of organic chemicals containing silicon, which burn in the engines, producing silica, in effect sand, which is highly damaging to engines and results in major, frequent engine damage and hence overhauls.

STS approached Tim Evans, Process Engineer for Viridor to discuss the implementation of a continuous online monitor to supply hourly data on the concentration of total siloxanes leaving the carbon filters.

Tim explained the situation before filters were installed. "The use of activated carbon has greatly reduced issues on the landfill site. Before the gas clean up system was installed, the engines suffered numerous trips due to spurious high exhaust temperatures, an oil life of only 600hours and spark plugs lasting just 16 weeks which were replaced during a "dust-off" (de-coke). The 20,000 hour service was carried out after just 16,000 hours. After installing the gas clean-up system, trips are now rare, oil life is 1,800 hours, spark plugs last 8,000 hours, no "dust-offs" are required and the engines are serviced at 20,000 hours resulting in a generation improvement of 10%"

Jim Ward, Operations Director, STS Instruments Ltd

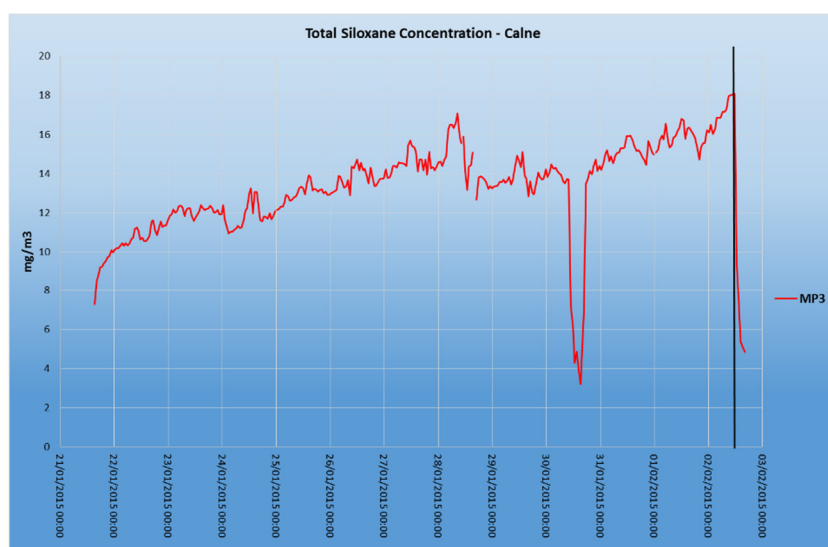
Having established that the filters are doing their job in protecting the engines, it was of huge concern to Viridor that the siloxane removal potential by the filter system be maximised whilst engine protection was maintained. Viridor tested several monitoring systems and identified the STS system as most suitable and cost effective for the task. Unlike other monitoring options available the STS Siloxane Monitor has been designed from the ground up specifically for the monitoring of total siloxanes and this has enabled cost optimisation to produce an affordable instrument with a simple user interface.

The Siloxane Monitor is designed to quantify siloxanes in biogas using NDIR (non dispersive infrared) technology, this technique uses an optical system to measure individual gases in the presence of others. Many chemicals absorb IR light, and the wavelength at which they do is characteristic of the chemical. D series siloxanes absorb IR, so the instrument has an optical filter which passes this light and rejects everything else. The instrument is thus specific for these chemicals.

Within the instrument, an IR emitting source passes through the filter, then down the gas cell, to a solid state detector which measures the IR signal. The sample flows through the gas cell and the system makes a continuous reading.

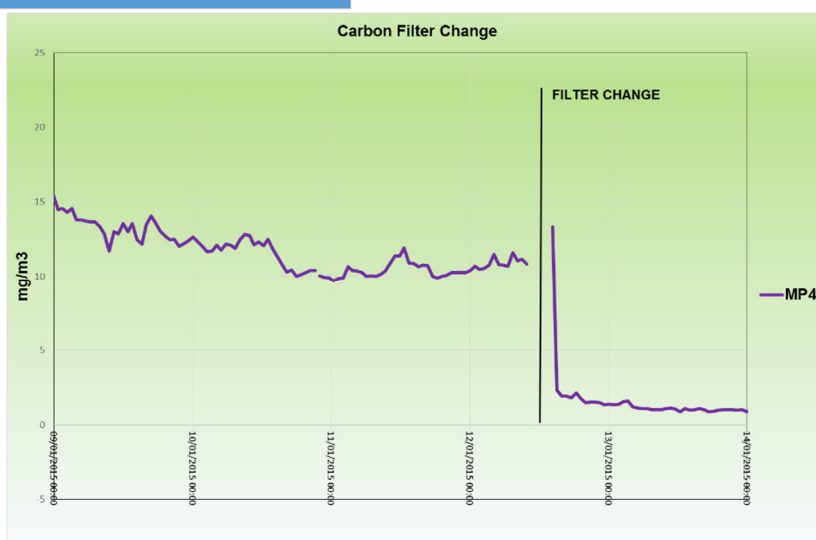
This system is very robust and sensitive – the standard detection limit for the SM is 1 mg/m³.

The trial results had shown that the instrument could measure siloxane loads down to acceptable levels and also that it would rapidly identify the increasing contamination from a saturating filter.



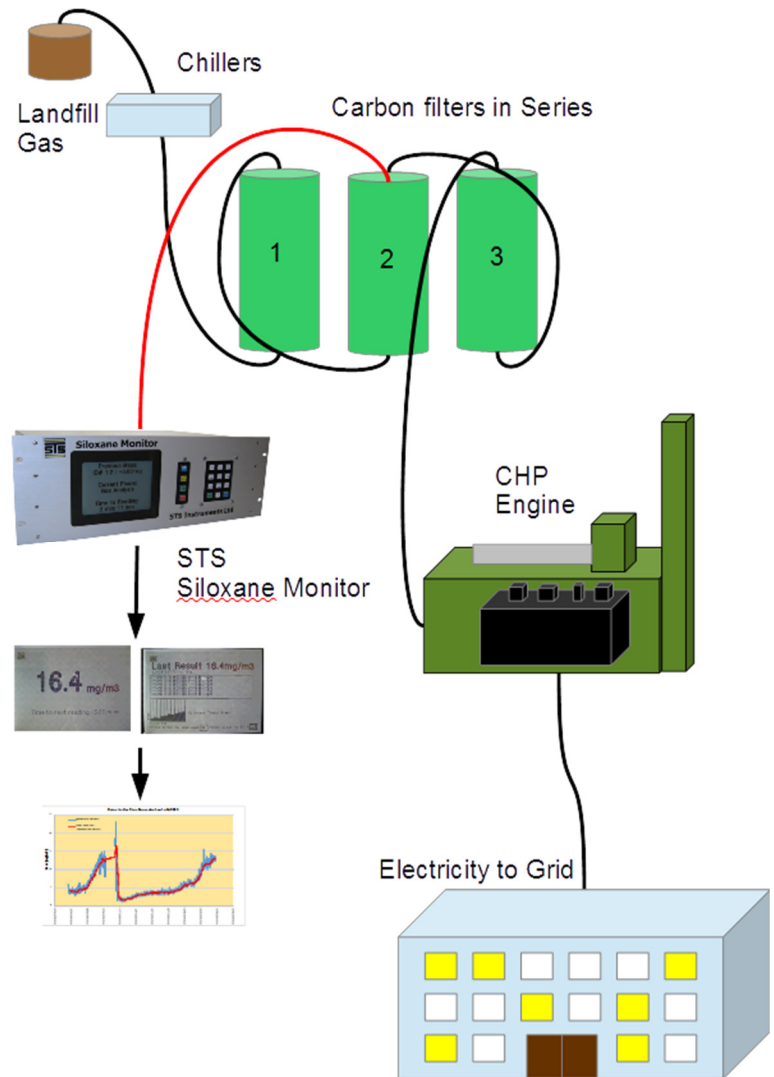
Rise in Siloxane Levels before filter change

Resultant drop in Siloxane level post change-over of filter



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At the Calne site there were several options to consider. Should the monitor be connected to a manifold so that all 3 carbon filters could be monitored or should the monitor just measure the output from the final filter? The decision was taken to monitor at the output of the 2nd filter before the gas enters the final and cleanest filter. The regime at Calne is that the filters are rotated so that Filter 1 which receives the dirtiest gas is replaced by Filter 2, Filter 2 by Filter 3 and the new filter is situated in place of Filter 3. This means that the final filter is always as clean as possible which allows it to effectively polish the gas to a very clean standard typically less than 3 mg/m³.



The challenge for the STS Siloxane Monitor was to enable the site operators to extend the changeover period for as long as possible but without exposing the engines to damaging levels of Siloxanes.

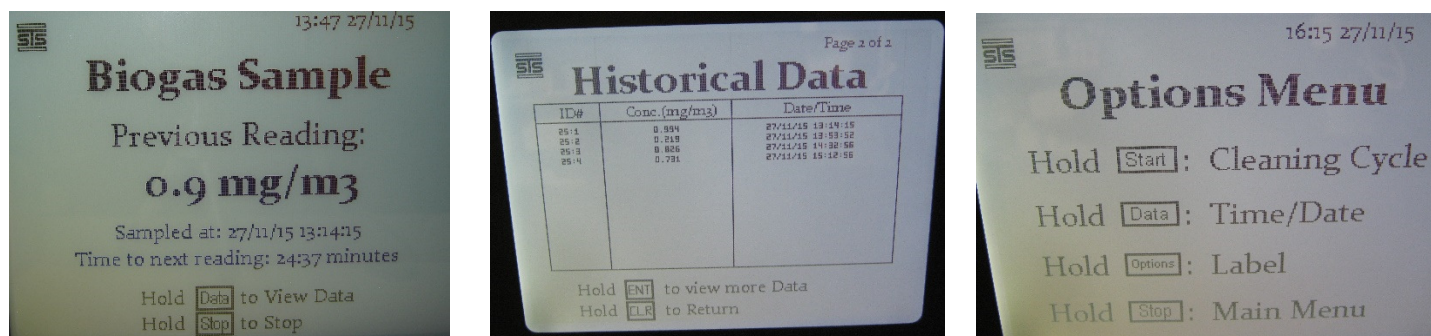
The STS instrument was therefore sited in an available container and connected using a heated line to maintain gas temperature and hence reduce the potential for siloxanes to condensate out onto cold pipe surfaces.



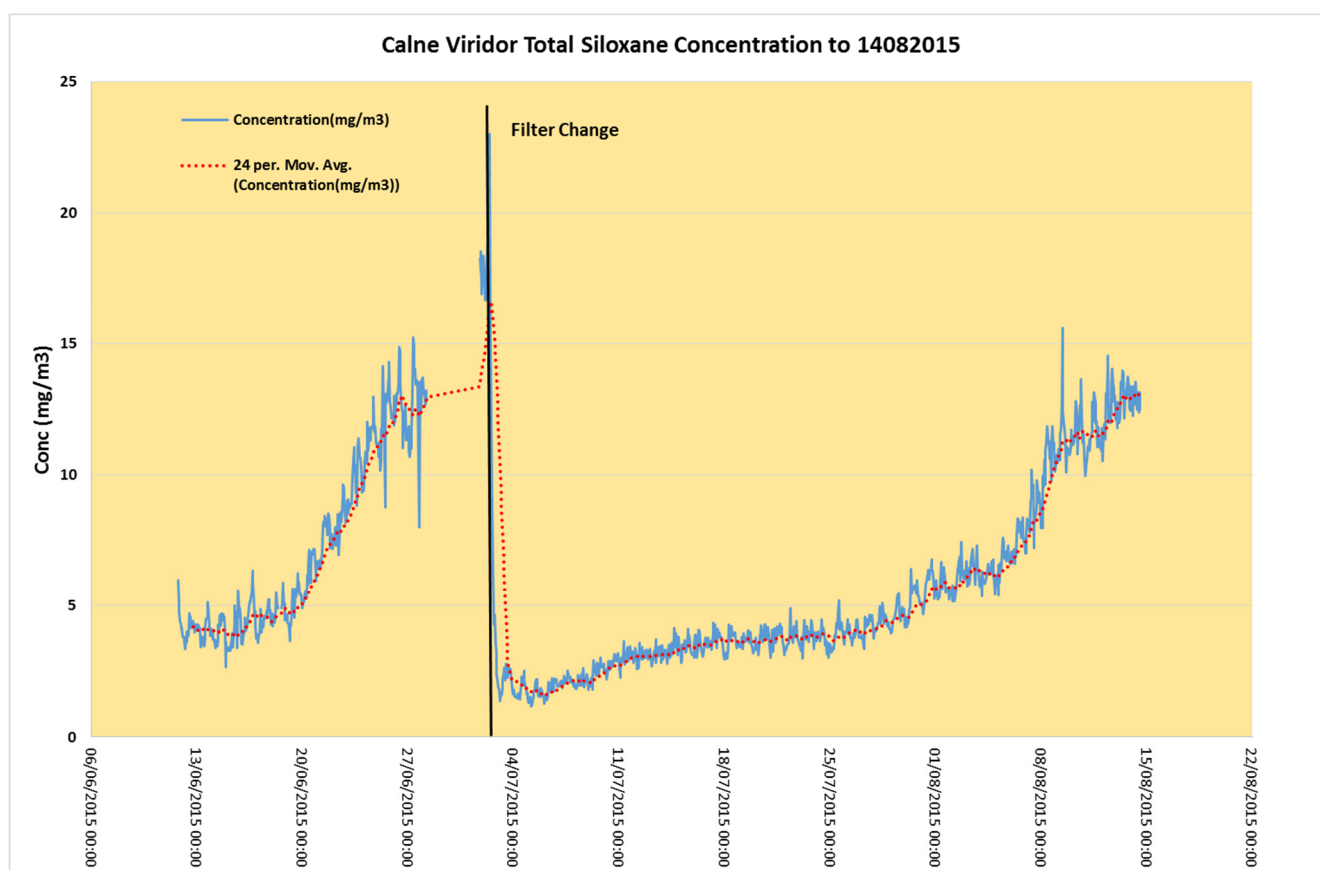
The STS Siloxane Monitor housed in a temperature controlled rack cabinet.

The monitor was fitted into a rack cabinet with integral temperature controlled cooling fans to maintain a steady instrument temperature. An automatic drain water trap and secondary coalescing filter ensured a dry gas supply to the instrument.

The unit was set up to take a sample of gas of 1litre once an hour, this volume being sufficient to empty the line volume several times and therefore take in new gas from the filter on each occasion. The results generated are displayed on screen as a current reading, the last 200 being available to view on screen from the data menu and are also written to an SD card which can be removed to download the data to a PC.



Siloxane Monitor example screen displays



Newly installed monitor showing the Siloxane contamination trend of the filter pre and post change.

Since installation the monitor has recorded over 1700 measurements from the filters at Calne, this resolution of data has provided significant confidence in the results obtained and in their use to forecast filter breakthrough. Siloxane levels are constantly shifting and even within the space of a single day at Calne a fluctuation from 8mg/m³ to nearly 15mg/m³ was seen – this could easily have led to either an early filter change if the agreed level was 15 or to no action as the level was 8 and well below the set threshold.

By plotting the trend of the average readings it was shown that a level of 11mg/m³ was entering the engine and subsequently the filter was able to be left online for a further 7 days before being changed. Even extending a filters life by 2 days makes substantial savings over 12 months.

Previous assumptions that the Siloxane loading in the gas will be constant are at odds with the fluctuations shown by the monitor on a daily and weekly basis. This could be due to any number of variables including, flow, gas temperature, humidity, environmental conditions, balancing of gas wells etc.

The STS Siloxane Monitor requires only a biannual service where consumable components are changed and calibration completed on site. The annual service charge includes all call out charges, parts and labour.

STS would like to thank Viridor for their cooperation in both trialling the instrument and in aiding publication of this article.



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For further information on the STS Siloxane Monitor please visit our site at:

www.siloxanemonitoring.com or call us +44 (0) 1344 483563