STS INSTRUMENTS LTD

STS SILOXANE MONITOR

EXECUTIVE SUMMARY

The STS Siloxane Monitor has demonstrated that Carbon tower filter failure and regenerative processes can be identified, trended, and quantified. The resultant data may be used to manage filter change regimes to potentially extend filter life, to optimise regenerative processes, and or, prevent engine damage from siloxane laden gas.

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

STS INSTRUMENTS LTD

INTRODUCTION

Siloxanes are a class of organic chemicals containing silicon, which burn in CHP engines, producing silica, in effect sand, which is highly damaging to engines and results in major, frequent engine damage and hence overhauls. The solution is to remove the damaging siloxanes in the Biogas or Landfill gas before they reach the CHP engine, this is achieved by using either an activated carbon filter or a regenerative filter. The problem however arises that carbon filters have a finite life span and are relatively expensive to change and that regenerative processes can be energy intensive dependent on the regeneration cycle. By monitoring the gas flow post filter the total siloxane load can be seen and a trend graph produced to show when carbon filter failure is likely or when a regenerative process should be started.

The STS Siloxane Monitor constantly measures the filter output putting the operator in possession of accurate and understandable data on which to make an informed decision on plant optimisation.

INSTALLATION

The instrument should be located outside the ATEX zone but as close to the final filter outlet as possible. Connections to the instrument are as follows. The biogas supply is made with ¼" OD PTFE or (SS) and should be heated (particularly where there is a long run) to prevent condensing of the siloxanes in the piping.

The Siloxane Monitor requires a nitrogen supply from a cylinder and a vent line, taking the biogas from the instrument after analysis to waste. A 110V, 32A mains supply is required to run the instrument and associated water traps, heated line and cabinet heater. STS can provide a fully packaged monitor housed in a weatherproof kiosk ready for direct connection to installed sample and ancillary lines.

DATA NETWORKING

STS provides a data communication package for remote access to instrument data. A standard 4-20mA data link is available or there are a number of options available including GSM and radio repeaters for poor signal areas, email alerts may be set for notification of instrument alarm conditions and threshold breaches for siloxane concentration. Interface into existing systems may also be possible dependant on site systems. A quote will be provided following the conclusion of a site survey and supply of information regarding required protocols.

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

STS INSTRUMENTS LTD

COST BENEFIT OF CARBON & REGENERATIVE FILTER MONITORING

The reason for considering installation of the SM is to optimise carbon usage by tightly regulating the point when a filter is changed – too early a change wastes carbon, too late inflicts damage on the engines. Typical payback on the installed cost of the instrument is approximately 1 year – this will of course depend on the filter change or regeneration regime.

In the other direction, if the carbon filter is changed too late, then engine damage results. This will appear as shortened life of oil, shortened intervals between top end overhauls, increased cost of replacement components, especially sparking plugs and most importantly, downtime resulting in loss of electricity sales and ROC payments. This is difficult to calculate, but with suggested costs of top end overhauls in the £25,000-50,000 range, oil at £0.6/litre and sparking plugs at £10000 a set, a very few days of siloxane damage may be very expensive. The considerations above equally apply to regenerative systems where electrical heating of the media during regeneration cycles is a significant operating cost.

STS SILOXANE MONITOR

INSTRUMENT SPECIFICATION

DESCRIPTION

The Siloxane Monitor is designed to quantify siloxanes in biogas using NDIR technology and is aimed at the sewage and landfill biogas industries.

Applications include monitoring to optimise carbon filter changes or regeneration cycles, determination of likely engine damage, or evaluation of boreholes for siloxane potential.

The instrument contains a pump which draws the biogas into the system, a concentration section and a gas cell which allows very low level detection.

The outputs of the instrument are a 320*240pixel LCD display showing operating parameters and current siloxane value and recent measurement data; an SD card port for data download; and an optional 4-20mA output or telemetry communications service. Instrument control is by an alphanumeric keypad.

Calibration is required at 12 monthly intervals and is achieved via an injection system.

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

STS INSTRUMENTS LTD

SPECIFICATION

The STS Siloxane Monitor is CE certified and complies with IGE SR25 requirements.

The Siloxane monitor has the following requirements:

1. 110V 6A – (IEC rear connector) wired to flex outlet from Distribution box.
2. N2 carrier gas line: ¼" Nylon/PTFE/SS piping (1/4" Swagelok connector supplied) Set at 1Bar at cylinder regulator Technical Grade 99.999%.
3. Biogas feed line - ¼" PTFE/SS piping (1/4" Swagelok connector supplied) Maximum 1Bar input pressure.
4. Vent line - ¼" PTFE/SS piping (1/4" Swagelok connector supplied) Vented ~2m above head height (U bend to prevent water ingress) , end of Line flame arrester to be fitted.

The water Traps require the following:

1. 24V supplied from instrument via Ancillary Box for auto drain (WT)
2. Water Drain line - ¼" PTFE piping (Push fit connector)
3. Water Vented external to kiosk at ground level.
4. Biogas Gas connections – The water trap (WT) uses a 1/4" Swagelok connection. The Coalescing filter is a ¼" Swagelok & the Flame arrester is a ¼" Swagelok.

The heated Line requires the following:

1. 110V 10A – Directly wired from distribution box.
2. Temperature set to 60degC.
3. Cut to length - Requires sealing at cut end.

Cabinet Heater

1. 110V , 400W , 10A – via thermostat set at 20C
2. Provides frost protection and maintains gas above condensation point to prevent siloxanes being deposited in pipework

Biogas Flow rates:

The instrument samples approx. 2L of biogas during a 20minute window every 1hour, at a flow of approx. 100ml/min. This is passed through the instrument then vented to atmosphere.

N2 Flow rate:

The instrument consumes approx. 4L of N2 every hour. Resulting in 0.1m3 of N2 per day. This is passed through the instrument then vented to atmosphere.

STS recommend using the largest N2 cylinder to avoid regular replacement.

Air Products: X47S: 80kg 200bar 8.9m3. Technical Grade.

Regulator : BOC 8500 or similar, 300Bar inlet , 0-4 bar outlet.

This should last approx. 90days, 3 months.

Kiosk requirements:

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

A GRP kiosk is required as per the manual specification.

The kiosk will require 6 external connections:

1. Biogas IN
2. N2 IN
3. Vent OUT
4. Drain OUT
5. Heated Line out
6. Heated Line Sensor out.

Biogas Supply:

Regulated in the kiosk to 35mbar, normal inlet pressure to the regulators should not exceed 350mbar. If a higher pressure is present, the regulator will require re-specification.

The electrical supply:

A 110V earthed connection is required to the externally mounted switch. This is routed to a Distribution box in the kiosk where there are a 6A RCD to the instrument, and 2 10A RCDs directly wired to the heated line and cabinet heater. All earthed.

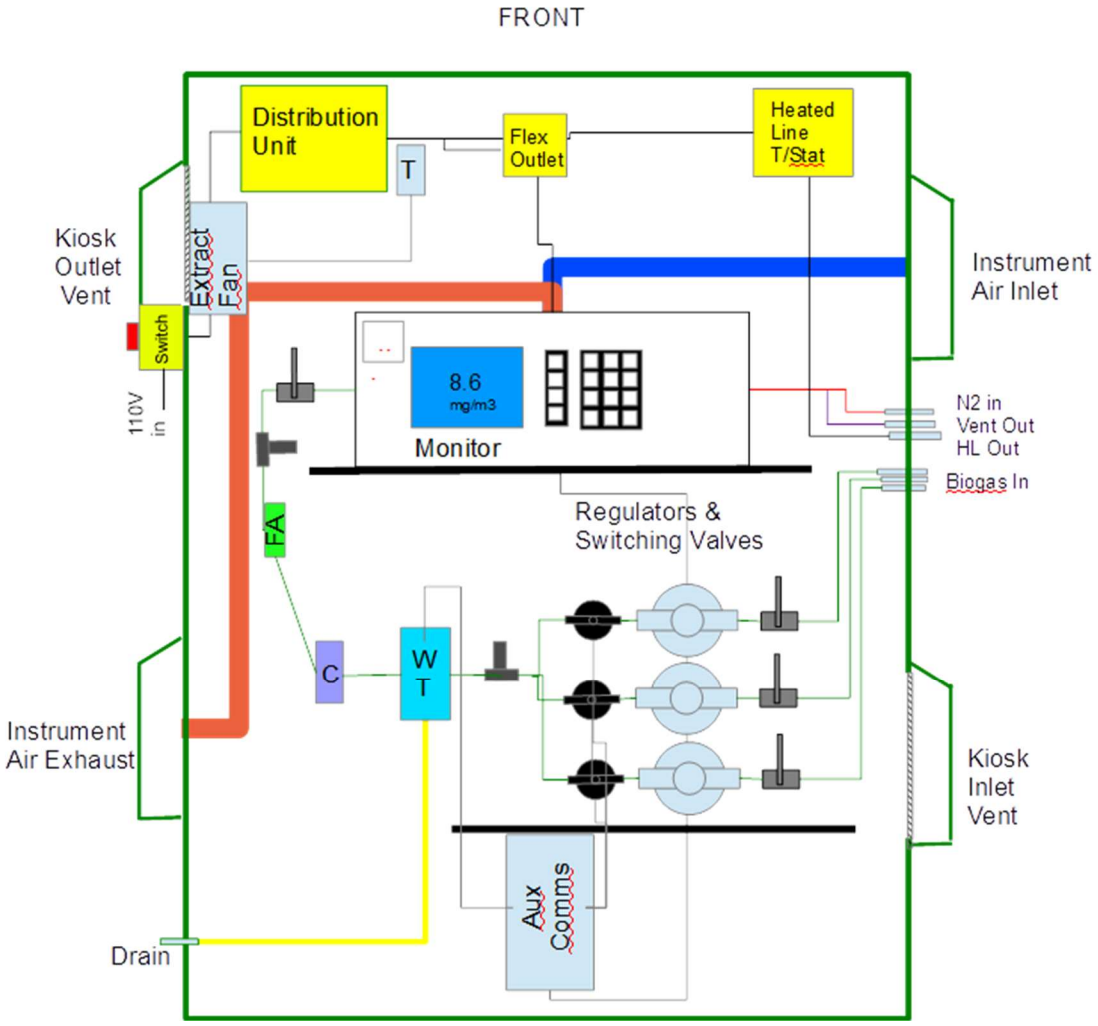
Safety:

1. The instrument uses an air purge system to ensure safe operation, this is achieved with 2 high capacity fans mounted in the instrument which force a constant stream of air through the case. The instrument fans are connected to vent plates in the kiosk by flexible hoses. The flow of air through the instrument ensures that even in a catastrophic joint failure that the LEL of CH4 would not be exceeded. The purge fans are monitored so that if they are inactive the instrument will be placed into "Safe Mode"
2. The instrument has an on-board methane sensor which will place the instrument into "Safe Mode" if it exceeds 10% of the LEL. An on-board temperature sensor will place the instrument in "Safe Mode" if the temperature in the cabinet exceeds 50C.
3. Incoming bio-gas lines are controlled by Solenoid valves which are in the Normally Closed position unless activated, the instrument also has a solenoid valve on the incoming biogas line which is Normally Closed, any power failure will therefore close these valves stopping gas flow. "Safe mode" shuts the incoming gas valves, turns off all heaters and runs the case fans to vent.
4. The kiosk itself is cross ventilated from a further two ventilation grilles.

The Siloxane Monitor & Kiosk is not EX or Atex rated and as such should be sited outside of any zoned area.

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

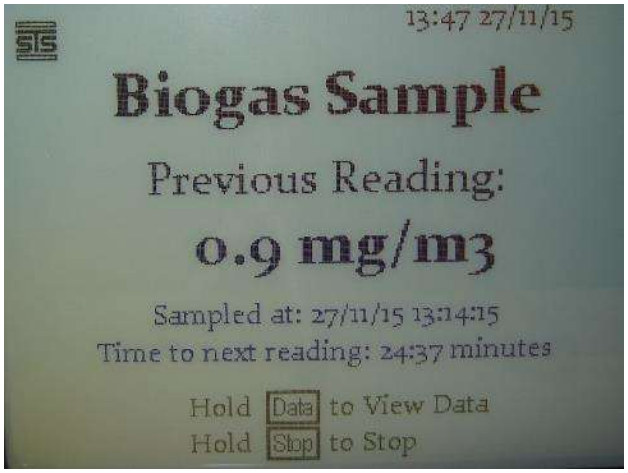
Instrument Kiosk Layout



STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

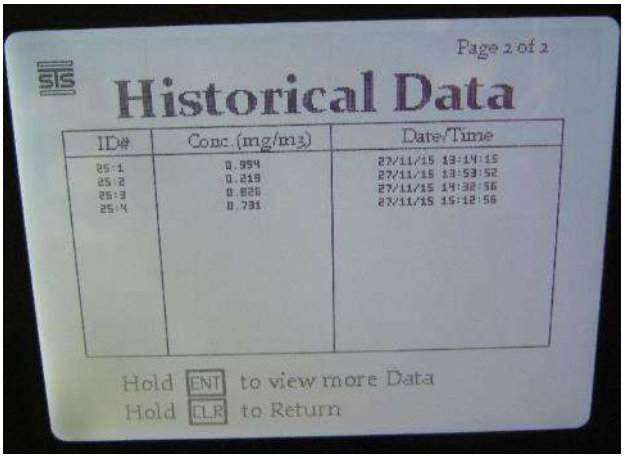
STS INSTRUMENTS LTD

Example User Interface Screens

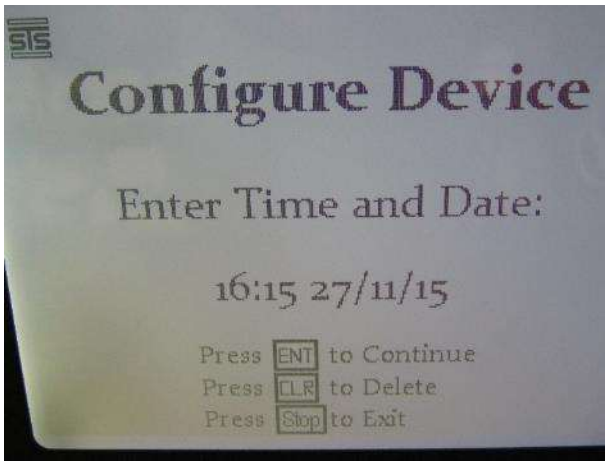


Default -Home Screen displays last reading and time until next reading.

Options menu allows approved users to run cleaning cycles and update sample reference and time/date stamp.



Data Screen – Displays historical data and trend information without the requirement to download data for analysis

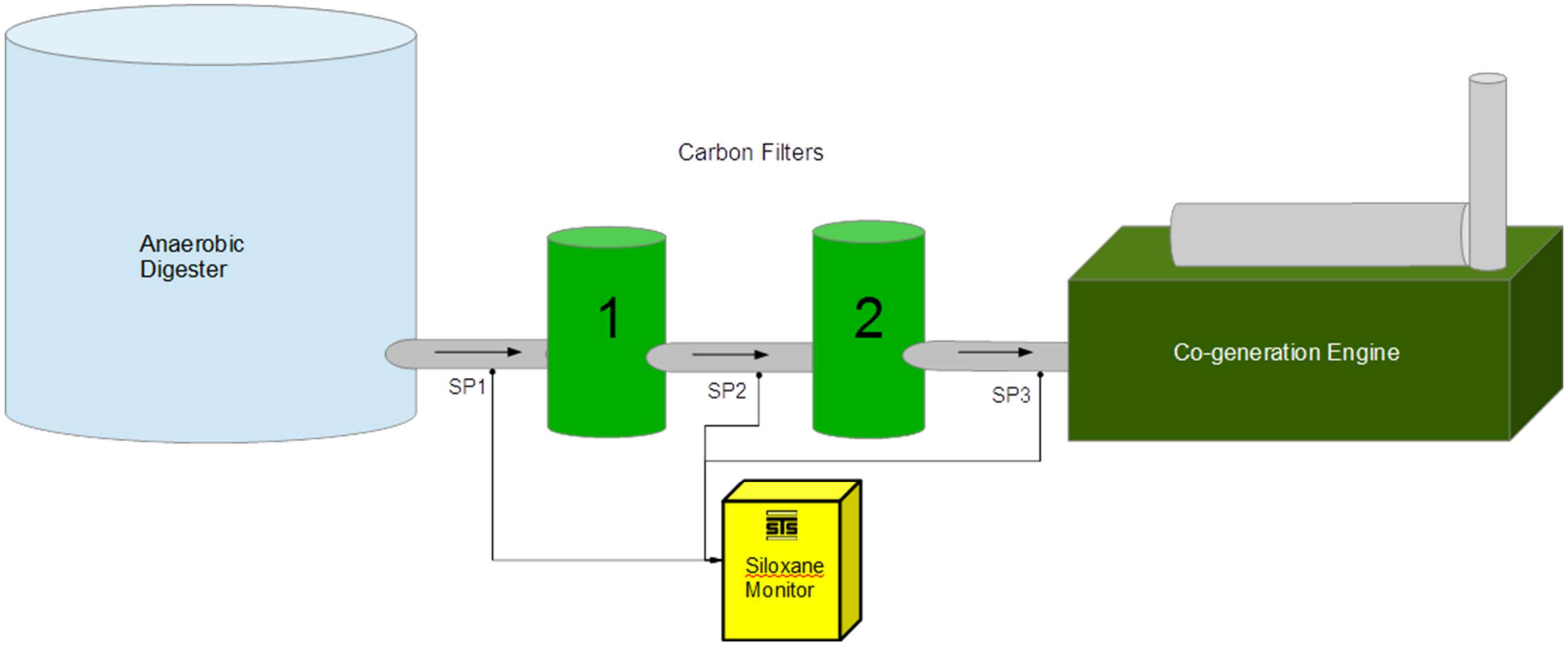


The Time and Date and Sample Site Reference can be set on screen these are retained even after unexpected power loss.

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

STS INSTRUMENTS LTD

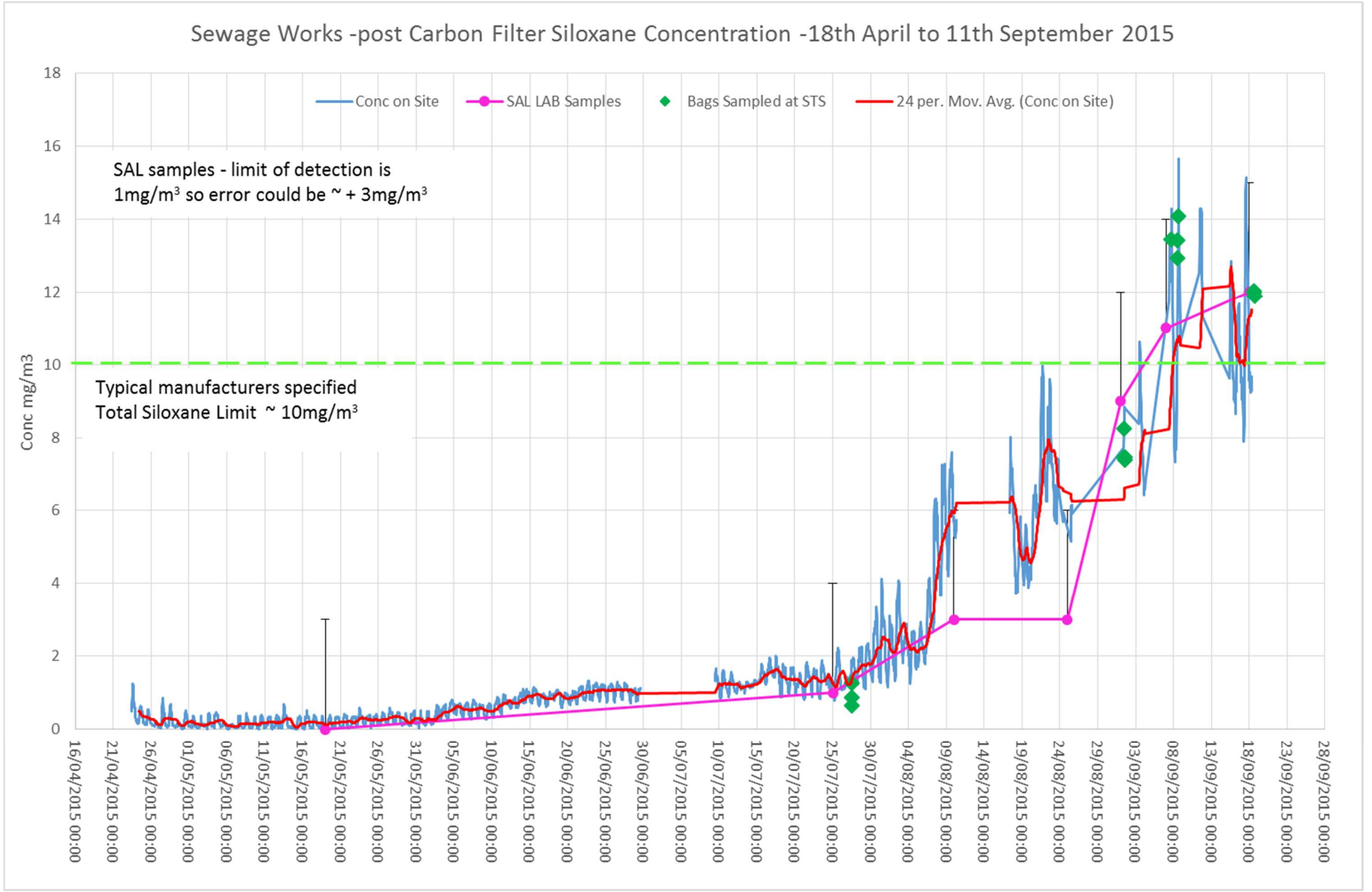
STS Siloxane Monitor Application



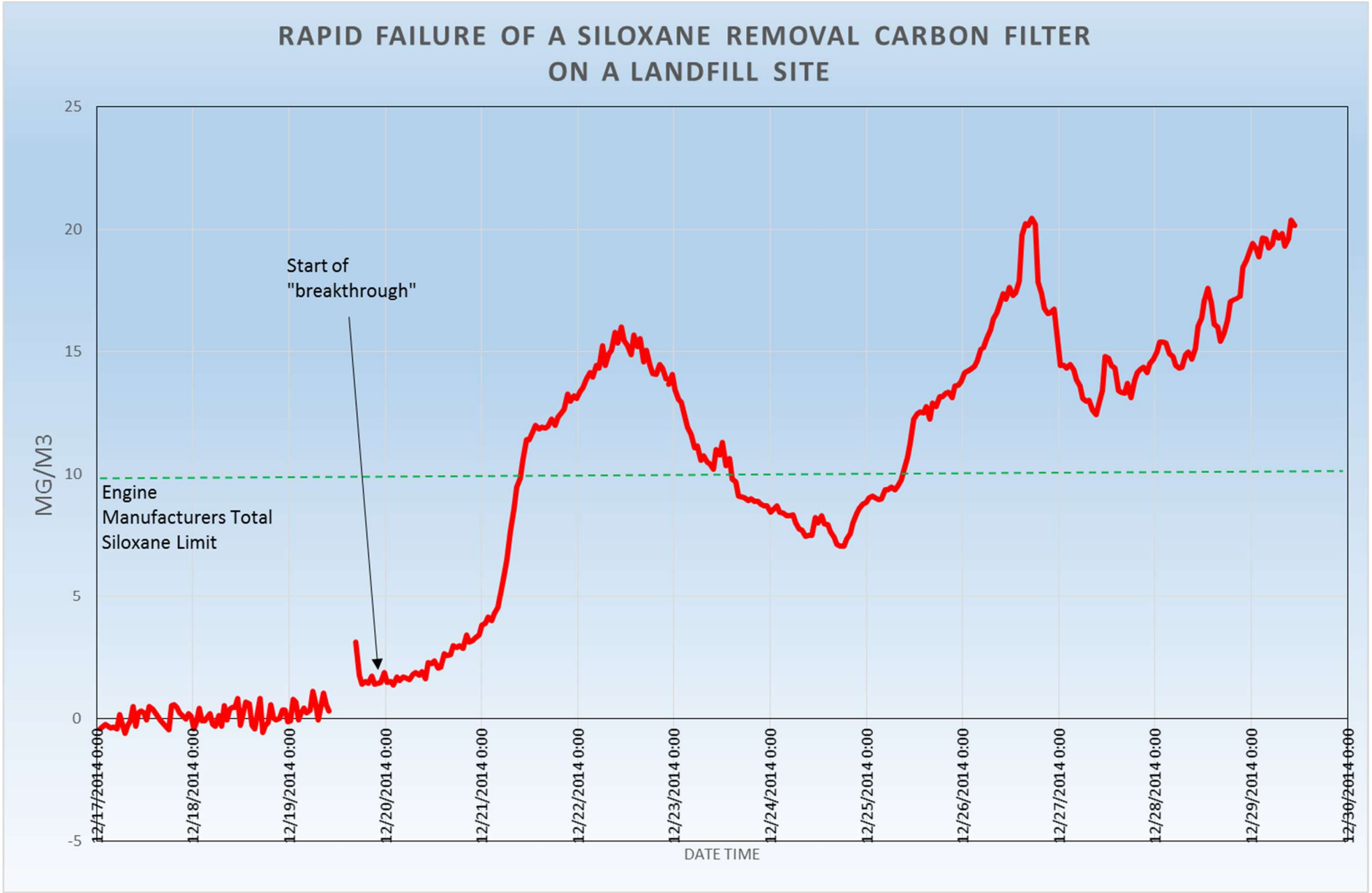
The STS Siloxane Monitor can sample from up to 3 points between the incoming gas stream and the engine. In typical application, these would be before the Activated Carbon filter (eg unfiltered gas), between a pair of filters where they operate a “primary and secondary” system and after the final filter (eg clean gas). The Monitor can therefore be used to trend filter use and predict filter failure and optimise filter change regimes.

STS Instruments Ltd, Holly House Maidenhead Road, Wokingham, RG40 5RR, UK
www.siloxanemonitoring.com Sales@safetrainingsystems.com +44 (0) 1344 483563
Registered in England No 02654899 VAT GB 572853808

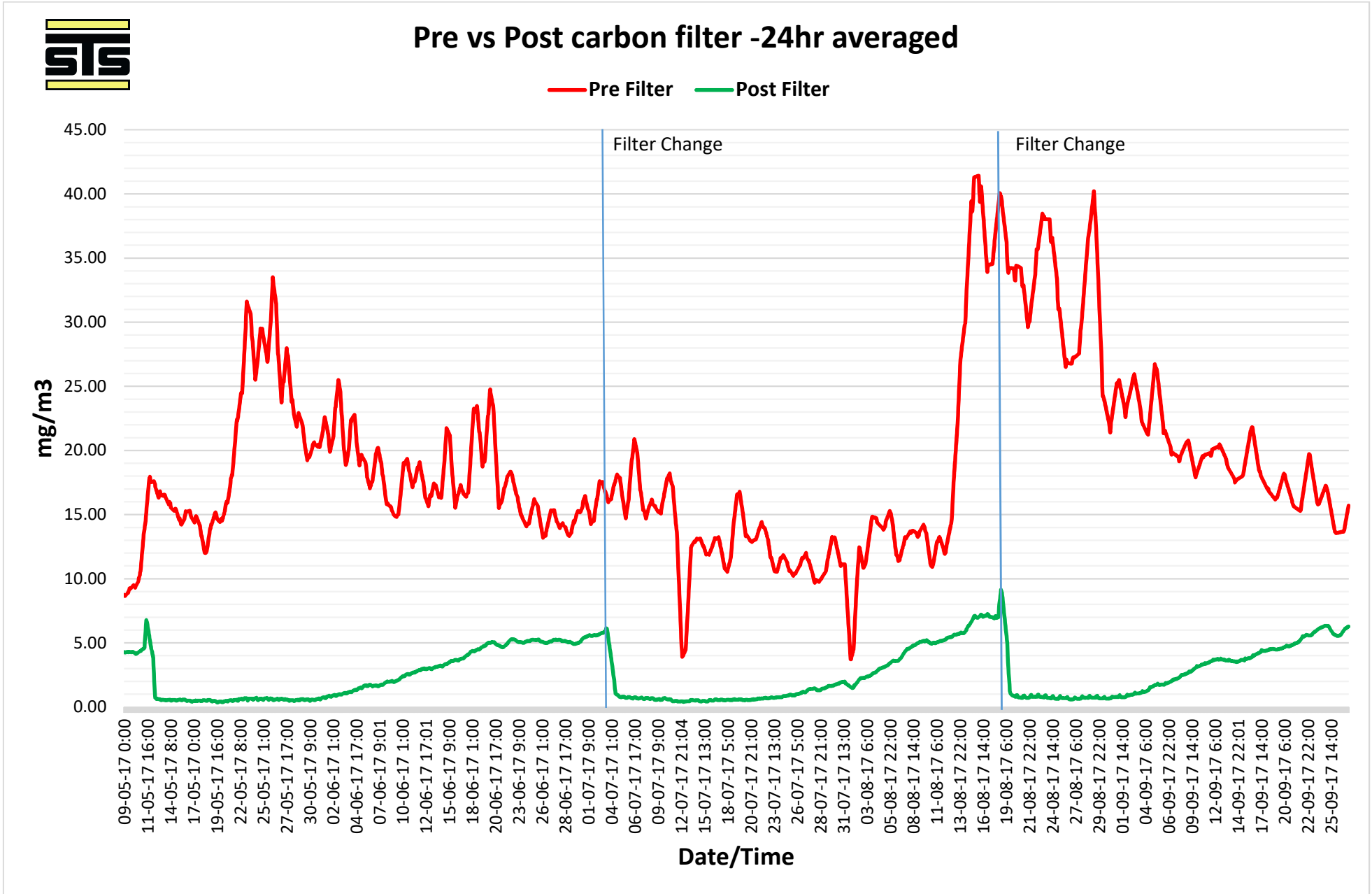
STS INSTRUMENTS LTD



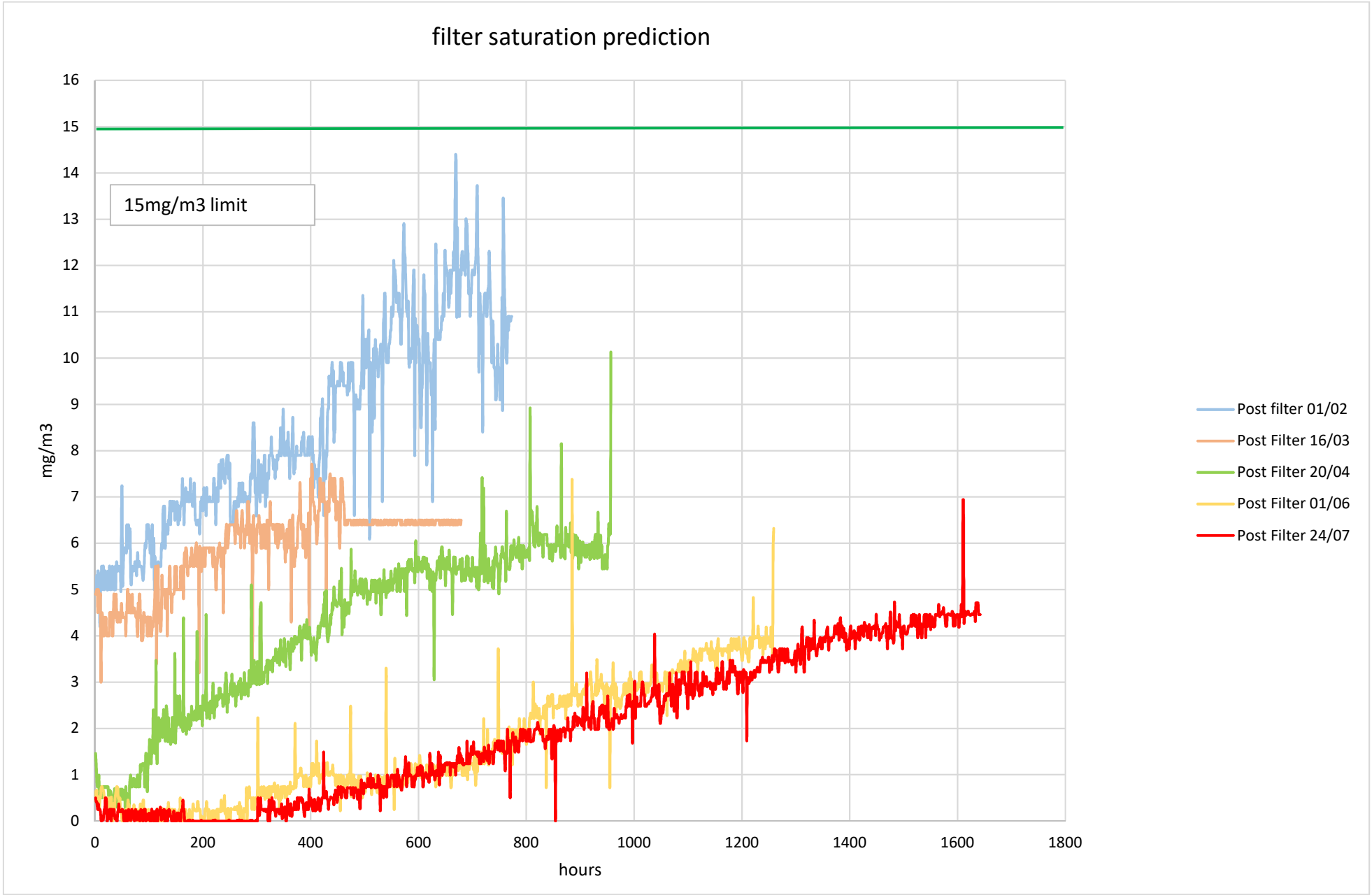
STS INSTRUMENTS LTD



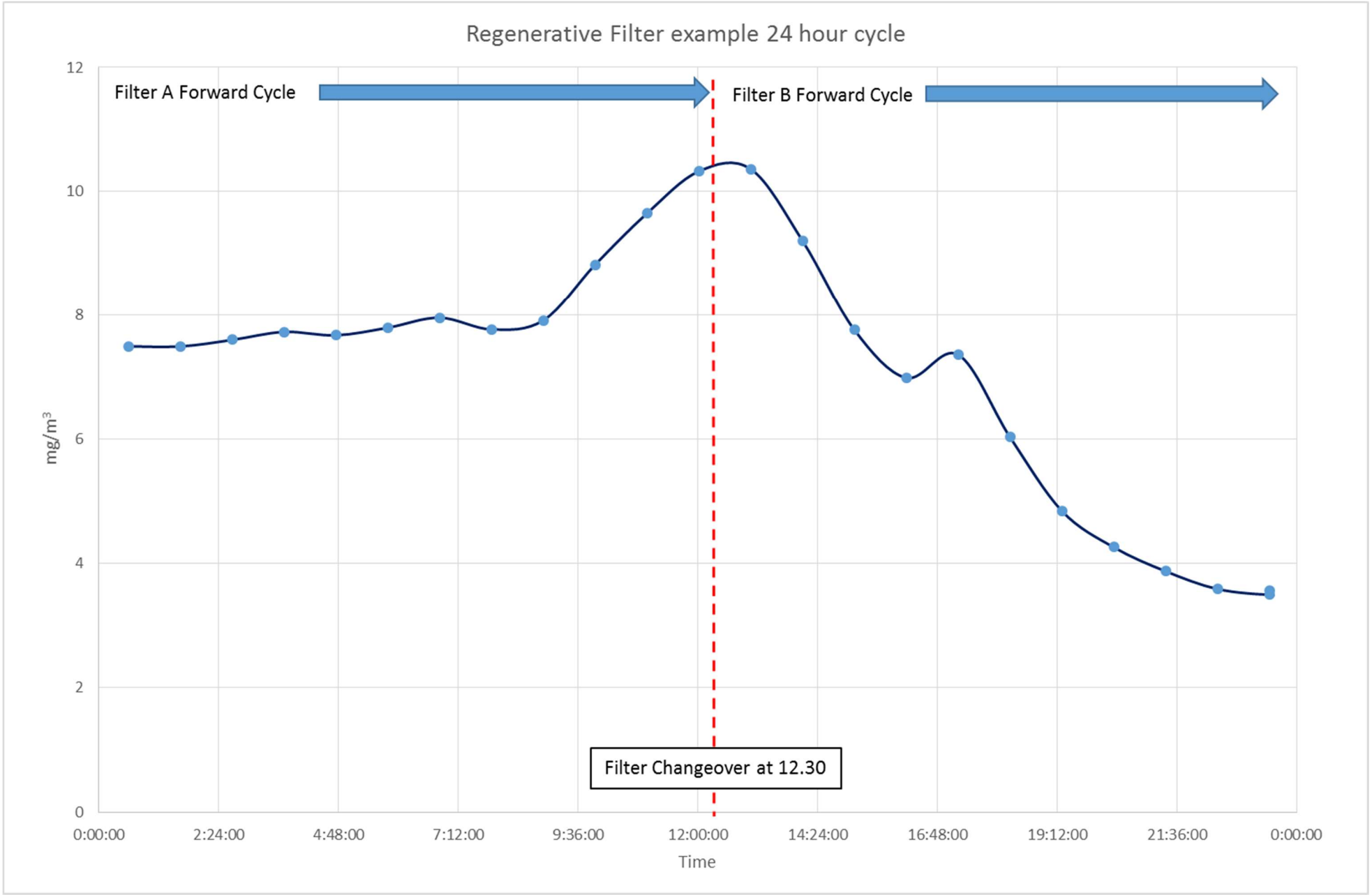
STS INSTRUMENTS LTD



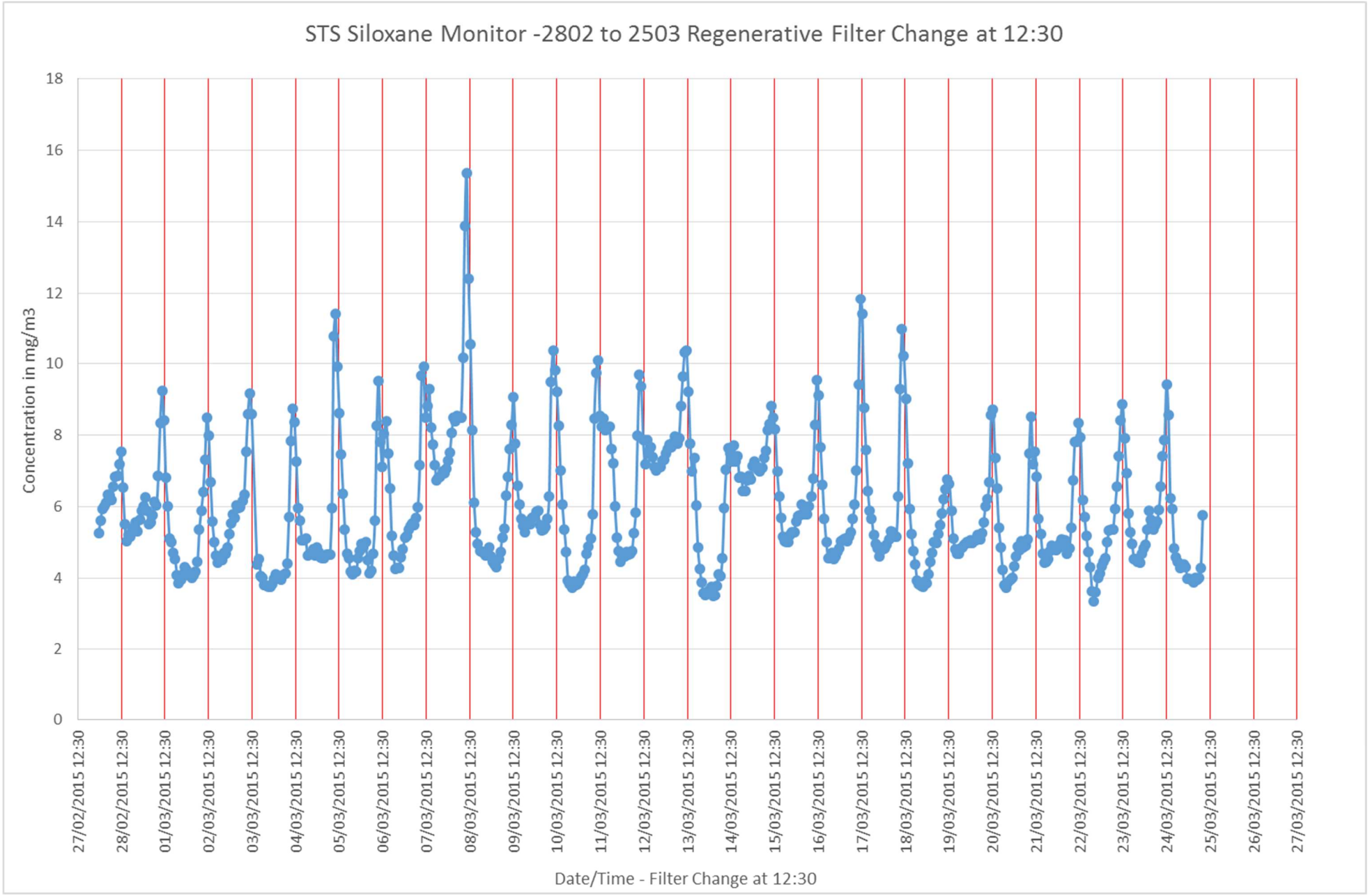
STS INSTRUMENTS LTD



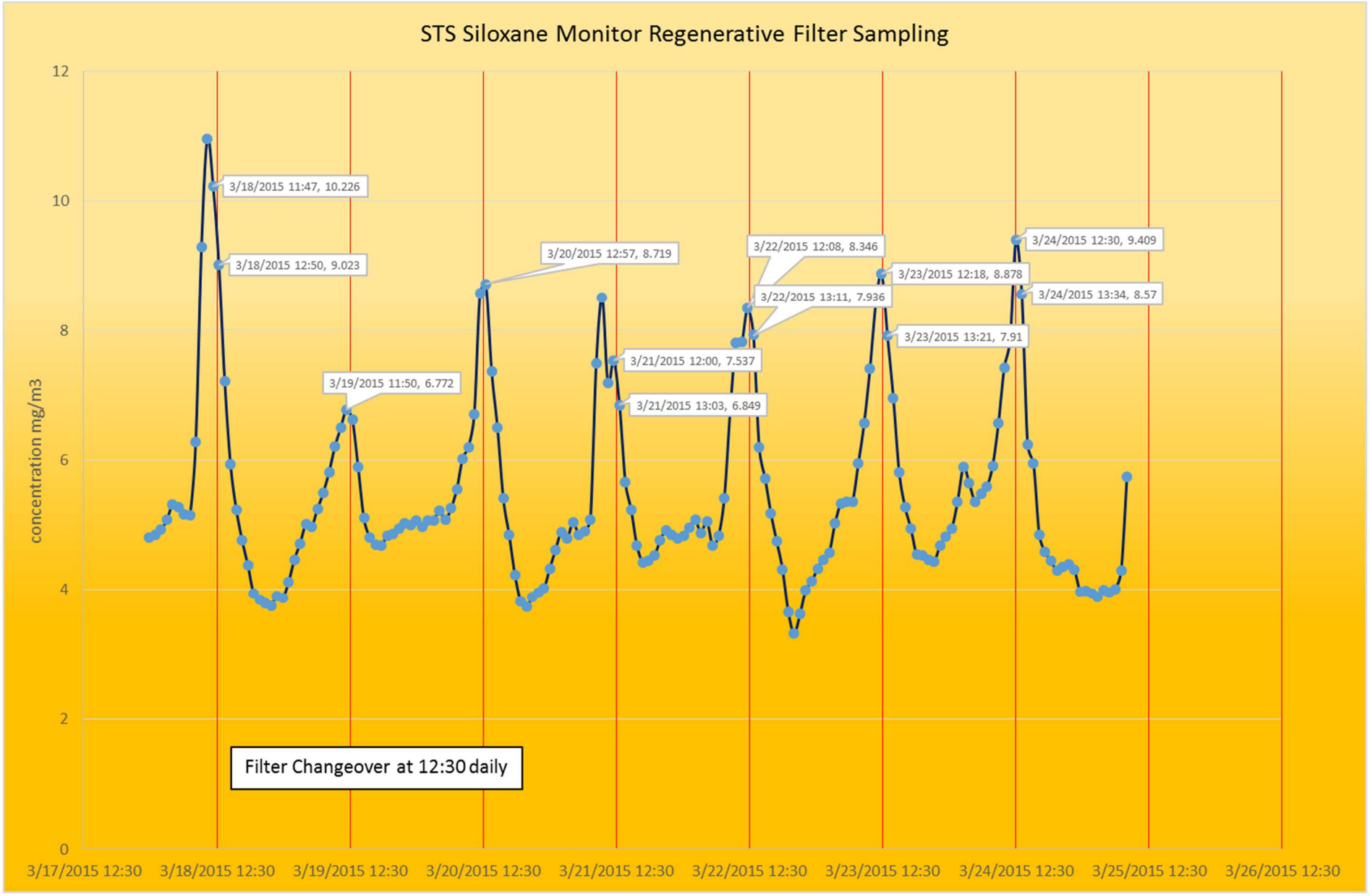
STS INSTRUMENTS LTD



STS INSTRUMENTS LTD



STS INSTRUMENTS LTD



STS INSTRUMENTS LTD

FOR FURTHER INFORMATION ON THE STS SILOXANE MONITOR PLEASE CONTACT DAVID OR JIM AT:

+44 (0) 1344 483563

SALES@SAFETRAININGSYSTEMS.COM

WWW.SILOXANEMONITORING.COM

STS Instruments Ltd

Holly House

Maidenhead Road

Wokingham

RG40 5RR