



**Safe Training Systems Ltd.**



# SMF 4

## Portable Fluorimeter

- Measurement of organic pollutants in water giving BOD equivalence.
- Instant readings on site without laboratory analysis costs and timescale.
- Tracing pollutant sources back to origin.
- Data logging & remote monitoring capabilities.
- Can be used by unskilled operators for routine monitoring.
- No consumables or reagents required

Safe Training Systems Ltd – Holly House, Maidenhead Road, Wokingham, Berkshire RG40 5RR  
Tel: +44 (0)1344 483563 Fax: +44 (0)1344 485175 Email: sales@safetrainingsystems.com  
Web: safetrainingsystems.com Registered in England No.02654899 VAT no. GB572853808

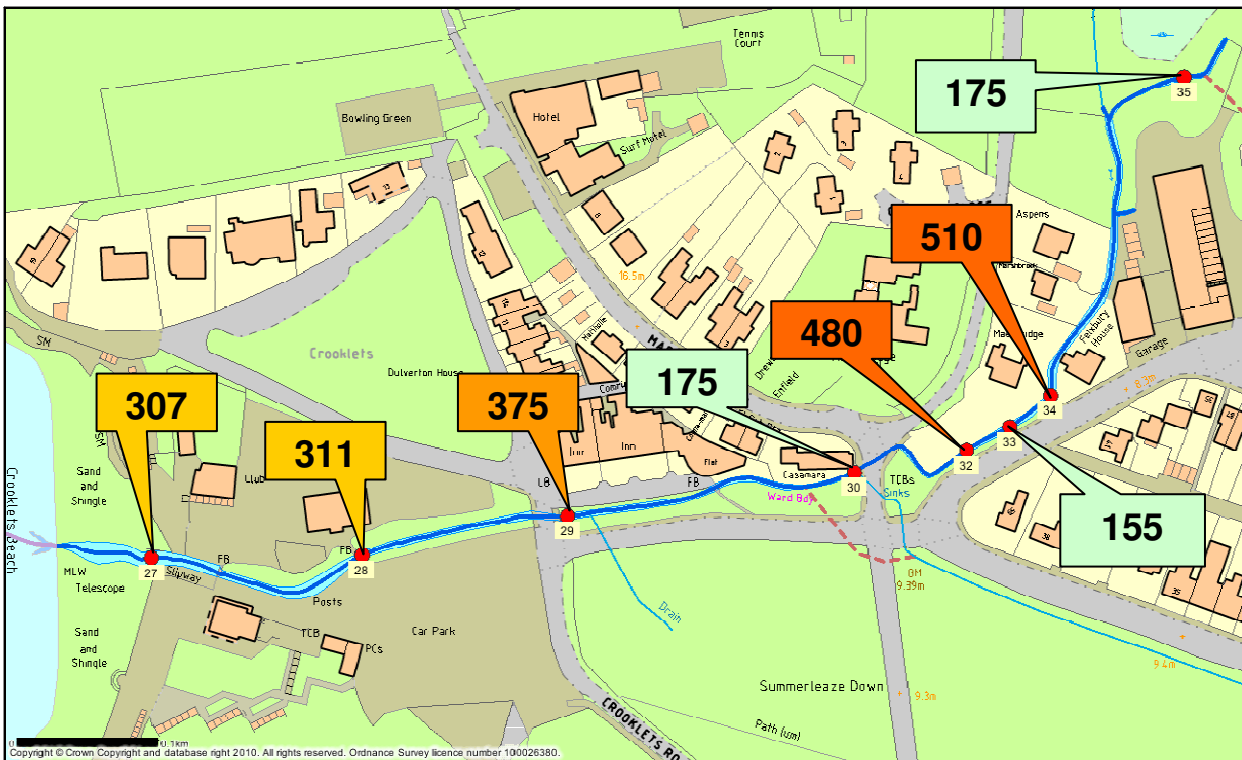
## Application of the STS - SMF4 Fluorimeter

STS have produced the fully portable SMF4 Fluorimeter which allows instant quantification of Tryptophan, a surrogate for BOD, in water samples on site, allowing immediate decisions to be taken regarding water quality and control actions.

This technique simplifies and quantifies investigations into cross connections in sewers and recycled water systems, illegal discharges to surface waters and monitoring consent agreements. Operation and control of the instrument has been streamlined so that it can be used by non scientific staff.

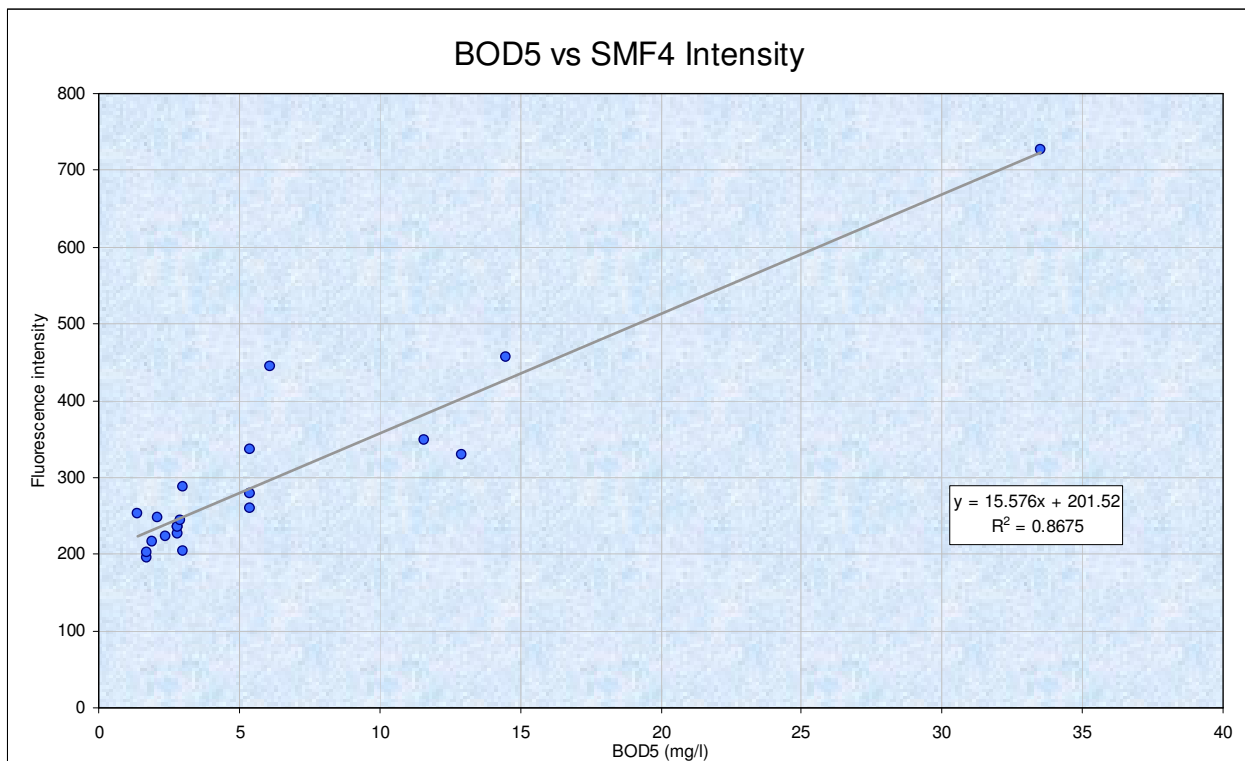
The great benefit of the SMF4 is the speed of measurement enabling large surveys to be undertaken, recorded and analysed within a matter of hours, whilst also giving real time information on immediate pollution issues.

The example below is of a river monitoring exercise carried out in Bude (UK). The darker orange figures show elevated readings above normal background suggesting pollution of the watercourse with organic matter. These point sources can then be traced back up the outflows to identify the actual source of the pollution in real time without having to send samples back to the lab for costly analysis.



The design of the SMF4 draws heavily on the research carried out by Prof Andy Baker and his team at the University of New South Wales & formerly of Birmingham University (UK), who showed that Tryptophan is an excellent indicator of anthropogenic pollution and that its measurement by fluorescence was straightforward. Further research allowed strong correlations to be made between tryptophan and the standard Biological Oxygen Demand test, but with an instant result rather than a 5 day delay. (research papers are listed at the end of this document)

The graph below shows an example of the established correlation between BOD and SMF4 fluorescence intensity counts.



The instrument is capable of detecting concentrations of BOD equivalence as low as 1 BOD and up to 300+ BOD (with very high BOD's some dilutions may be necessary to reduce turbidity) giving the instrument a very wide scope of use from Final Effluent analysis through to direct pollution from farm, industrial and household point sources.

SMF4 units are being used in the field for online monitoring of reverse osmosis plants in Australia, analysis of borehole water in South Africa and Cross Connection of foul water sewers to culverted streams and storm water drains in the UK. Systems have also been used for tracing of pollution events in surface water systems and in the analysis of final effluents where discharge consents are difficult to achieve due to fluctuating loads. The SMF4 also has a function in determining required energy input and possible recirculation decisions in treatment plants based on the final effluent BOD equivalent readings.

Users of this instrument are therefore in both the water companies, seeking to improve energy efficiency, resolve cross connections and achieve required consents, and the enforcement agencies, in their monitoring of such consents and in the identification of diffuse and point source pollution.



## Technical Specification for the STS - SMF4 Fluorimeter

### Instrument Dimensions

- Size including carrying handle 18 x 30 x 15 cm
- Weight including batteries 2.2 Kg
- Splash proof sealing

### Instrument Features

- LCD Display 93 x 70 mm
- Dimmable Backlight
- Internal rechargeable batteries
- Alphanumeric & Navigation Keypads
- Cell holder and Cover
- Internal Memory data capture of up to 2000 sample records
- Automated serial sample data recording

### Instrument Function Menu

The instrument menu is accessible from the keypad and offers the following user defined settings:

Data Input	-will allow specific sample number and location information to be attached to a sample record. Each sample captures a unique ID number, date, time and reading in addition to the 2 user definable parameters.
Set Sensitivity	-the instrument has 3 sensitivity settings accommodating a wide range of Tryptophan concentrations. Concentrations can be measured from 0.025ppm to 25.0ppm Tryptophan.
Backlight	-may be set to desired intensity as light conditions require and will automatically be turned off after 5 minutes of inactivity to preserve battery life.

**Auto Sampling** -using a flow cell and pump the instrument may be set up to carry out a series of measurements over a specified period at user defined intervals. The results may be written to either the internal memory or to an external data logger.

The internal memory is capable of storing approximately the following:

1.3 days sampling at 1min intervals  
20 days sampling at 15min intervals  
83 days sampling at 1hr intervals  
250 days sampling at 3hr intervals

**Internal Memory** -may be downloaded via an RS232 port. A 9 pin RS 232 to RS232 / USB output is provided to connect the SMF4 to either a PC or data logger. PC requires Windows 98/2000/XP/7. The internal memory may also be cleared using the download function.

**Set Date/Time** -date and time are set in dd/mm/yy and hh/mm

### **Battery Information**

The SMF4 is powered by NiMH rechargeable batteries, which give a useful operating period of approx 30hrs with the backlight on. When logging in sleep mode at hourly intervals the battery life is approximately 4 weeks. Approx 8hrs full recharge time required using provided charger. Battery life is shown by a battery level indicator icon on the LCD display.

### **Sample Cell**

Cell holder accepts standard fluorescence cells of 10 x 10 x 40 mm  
Cell holder and cover will accommodate flow through cells for auto sampling.

## Relevant research in the water analysis area,

N Hudson, A Baker, D Reynolds (2007). “Fluorescence analysis of dissolved organic matter in natural, waste and polluted waters.” River Research 23: 631-649.

A Baker (2001). “Fluorescence excitation-emission matrix characterization of some sewage impacted rivers.” Environmental Science & Technology 35(5): 948-953.

A Baker (2002b). “Spectrophotometric discrimination of river dissolved organic matter.” Hydrological Processes 16: 3203-3213.

A Baker, RGM Spencer (2004). “Characterization of dissolved organic matter from source to sea using fluorescence and absorbance spectroscopy.” Science of the Total Environment 333:217-232.

A Baker, et al. (2004). “Measurement of protein-like fluorescence in river and waste water using a handheld spectrophotometer.” Water Research 38:2934-2938.

M Bieroza, A Baker, J Bridgeman. (2008) “Relating freshwater organic matter fluorescence to organic carbon removal efficiency in drinking water treatment” Science of the Total Environment 10.1016.

M Bieroza, A Baker, J Bridgeman. (2009) “Exploratory analysis of excitation-emission matrix fluorescence spectra with self-organising maps as a basis for determination of organic matter removal efficiency at water treatment works” Journal of Geophysical Research 114:G00F07

Cumberland SA & Baker A. (2007) “The freshwater dissolved organic matter fluorescence in total organic carbon relationship” Hydrological Processes 21 2093-2099

Hambly AC, Henderson RK, Baker A, Steutz RM, Khan SJ (2010) “Fluorescence monitoring for cross connection detection in water reuse systems; Australian case studies” Water Science & Technology 61.1.2010

Henderson RK, Baker A, Murphy KR, Hambly A, SJ Khan (2009) “Fluorescence as a potential monitoring tool for recycled water systems –a review” Water Research 1-19 2009



To find out more about other **STS Portable Fluorimeters, Portable Spectrofluorimeters and Surface Monitoring Fluorimeters** - visit our website at:

[www.safetrainingsystems.com](http://www.safetrainingsystems.com)

### SMF4



Portable Fluorimeter for organic pollution monitoring



QUOTE



DATA SHEETS



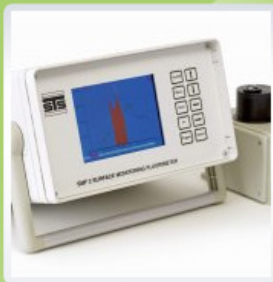
STS have produced the fully portable SMF4 Fluorimeter which allows instant quantification of Tryptophan (an indicator of BOD) in water samples on site, allowing immediate decisions to be taken regarding water quality and control actions.

This technique simplifies and quantifies investigations into cross connected sewers, illegal discharges to surface waters and monitoring consent agreements. Operation and control of the instrument has been streamlined so that it can be used by non scientific staff.

- Portable instrument for the measurement of organic pollutants in water (BOD equivalent)
- Instant reading on site without laboratory analysis costs and timescale
- Tracing pollutant sources back to origin
- Data logging & remote monitoring capabilities
- Can be used by unskilled operators for routine monitoring
- Laboratory use for pre-screening BOD samples to reduce multiple dilutions
- Monitoring of river water quality's impact on bathing waters



### SMF2



Liquid Sampling & Surface Monitoring Probes



QUOTE



The SMF 2-LSP (Liquid Sampling Probe) uses conventional optical geometry to measure the fluorescence of solutions in standard 1 cm cells. However, the compact size and battery based operation allow the instrument to be used in the field to make measurements that, until now, required large laboratory spectrometers.

This portability then allows the user to make measurements at the point where the sample is taken and hence take immediate action on the results.

Applications of the SMF 2 LSP include, for example:

- measurement of tryptophan and other biomarkers in river and water treatment plant studies
- measurement of industrial pollutants in rivers and sewage works
- measurement of materials swabbed from surfaces in industrial hygiene studies
- fluorescent tracer measurement
- identification of unknown materials in landfills and fly tipping



### SMF3



Whole Body Surface Monitoring Fluorimeter



QUOTE



The SMF 3 Surface Monitoring Fluorimeter is a whole body dosimeter which is used to study the spreading and penetration characteristics of any hazardous material where quantitative measurements of skin and clothing contamination and absorption are required.

These measurements enable the spreading, accumulation and removal of contamination to be better understood. This in turn allows researchers to develop safer working practices and design more efficient clothing.

There are several applications for the SMF 3 Surface Monitoring Fluorimeter:-

- Studies involving tasks with hazmats and Chemical Warfare Agents
- Improvement in garment design to reduce contamination
- Demonstration of how contamination is acquired
- Studies of the functions of protective clothing and design of donning and doffing procedures
- Penetration studies of garments during use
- Studies of the processes of decontamination on skin and protective clothing
- Comparison of effectiveness of decontamination procedures

