Researchers at the UK's Centre for Ecology & Hydrology (CEH) have conducted trials on the river Thames to evaluate a new remote phosphate monitoring technology (Cycle-P)as part of a high-frequency (hourly resolution) monitoring programme that is studying river nutrient concentrations and how they are affected by algal abundance. The monitoring system ran continuously over the summer of 2014,measuring total reactive phosphate levels in the river, day and night, seven days a week. These results have now been compared with manually collected samples that were analysed in a laboratory with the traditional Murphy and Riley spectrophotometric method on unfiltered samples, and Dr Mike Bowes, senior nutrient hydrochemist at CEH, says: "The Cycle-P is working really well; the system operated independently for long periods and produced results that tracked our lab samples closely."

Most water quality parameters are relatively simple to measure with low-power accurate sensors. However, the measurement of phosphate necessitates colorimetric analysis and this presents a significant challenge in remote locations with difficult access or where mains power is not available. The Cycle PO4 from OTT Hydrometry (known as the Cycle-P) is therefore gathering considerable interest because it is battery powered and able to operate unattended in the field,running over 1,000 tests before a field service is necessary to change the reagents.

The Cycle-P is an in-situ total reactive phosphate analyser that has been designed for operation by non-chemists. Combining microfluidics with state-of-the-art optics to provide high levels of precision and accuracy,the Cycle-P stores results in an onboard logger, but when combined with telemetry, delivers almost real-time data at user-selectable intervals (typically 1 to 4 hours).

The quality of the instrument's data is underpinned by QA/QC processing in conjunction with an on-board NIST standard.The Cycle-P methodology is based on US EPA standard methods, employing pre-mixed onboard colour coded cartridges for simple reagent replacement in the field.

Phosphate is a key nutrient in the maintenance of aquatic animal and plant life. However, it is also considered to be one of the most important pollutants in surface waters. Excessive quantities, through natural accumulation or derived from human activities such as wastewater treatment and agricultural runoff, can stimulate excessive growth of algae - algal blooms.Thisreduceslight for plants and can lead to oxygen depletion, bacterial growthand eutrophication. In addition, some algal blooms produce toxins that are harmful to other organisms. High phosphate concentrationscan therefore cause enormous ecological and aesthetic damage to streams, lakes, canals, rivers and oceans.

The River Thames basin is facing growing pressures from rapid population growth, intensive agriculture, climate change and water resource challenges. Researchers are therefore investigating the changes in water chemistry and ecology that are taking place as water quality improvements are implemented under the EU Water Framework Directive. These monitoring activities provide vital scientific evidence that inform future catchment management decisions.

Dr Bowes has been running a Cycle-P in the Thames at Goring in Oxfordshire since 18th March 2014, as part of the CEH Thames Initiative Research Platform ( www.ceh.ac.uk/science/thames/river-thames-initiative.html ).
Mike is head of the Water Quality Processes group, which has a long track record of using phosphorus auto-analysers, and is therefore an ideal person to assess the merits of this new technology. Furthermore, his research interests include: the impact of changing water quality on periphyton and phytoplankton biomass in rivers; nutrient loads to rivers from sewage and agriculture, and the identification of factors that control the timing and magnitude of algal blooms.

Mike has tried a number of phosphate monitoring technologies in the past but has found them to be either too unreliable or power-hungry. "Much of our work involves monitoring rivers in remote sites that do not have mains power, so I was naturally very interested to learn about the Cycle-P," he explains. "Our research is designed to identify the causes of algal blooms and to understand the factors that trigger both blooms and algal dieback; the ability to monitor phosphate in remote locations is therefore critical to the success of our work, because manual or even automatic sampling for laboratory analysis, incurs significant delays and increases costs."

“We were very pleased to be able to help with this research,” adds OTT Hydrometry’s Nigel Grimsley. “The impact of phosphates from agricultural run-off and wastewater treatment is one of the major issues affecting surface water quality and reliable continuous monitoring is essential if this issue is to be managed effectively.

“The Cycle-P has already worked extremely well in a variety of international projects, but it was vital for its capabilities to be demonstrated in UK waters, and the CEH Thames Initiative provided an ideal platform to do so. I am grateful to CEH for the opportunity that they have provided and I look forward to reporting feedback from a number of recent further UK installations.”