

Water Quality Monitoring 40 Metres Below the Sea Bed!



Summary

Natural groundwater collected around the tunnels operated by Eurotunnel is continuously monitored before being pumped to the coast and discharged into the sea. Six multiparameter water quality monitoring systems have been custom-designed by HACH LANGE to ensure that there is no potential for harmful water to enter the pipelines.

Each monitoring system is connected to a sophisticated data collection and alarm system that is able to divert water into vast underground sumps if alarm conditions occur. To-date, no such emergency has taken place.

Commenting on the new monitoring system, Eurotunnel Senior Technician Specialist Michael Edwards, says "The two major benefits are improved reliability and a lower maintenance requirement."

Background

The Channel Tunnel is 50km long, with the 39km undersea section making it the longest undersea tunnel in the world. The Eurotunnel system actually consists of three separate tunnels: two rail tunnels through which the trains travel, and a central service tunnel. This "safe haven" is used for maintenance and evacuation, and is linked to the rail tunnels every 375 metres. On average, the tunnels lie 40 metres below the seabed of the English Channel.

The service tunnel is maintained at a higher air pressure and thus remains free from smoke and fumes in the event of an incident. It provides access to a wide range of assets that ensure safe and efficient operation of the tunnel. This includes the water monitoring systems, the pumps and pipelines.

The excavation of the tunnels was one of the world's most significant construction projects. Work began in the UK during December 1987 and in France during February 1988 and over the entire construction period sufficient soil was removed to fill Wembley stadium 13 times.

The water that seeps down to the tunnels is a mixture of groundwater and seawater. It is collected at six drainage stations and is continuously monitored.

The main purpose of the monitoring system is to protect the enormous pumps (capable of almost 1000 m³/hr) and pipes from corrosive attack. It also serves to ensure that water discharged to the sea is not harmful to the environment.

The early monitoring system suffered from a number of problems that largely resulted from blockages in the small pipes that passed water to the sensors and HACH LANGE was tasked with the development of a more reliable, less labour-intensive system.

Water Quality Monitoring

The HACH LANGE and Eurotunnel engineers decided that a flow-through holding tank would resolve potential problems with blockages; large bore pipes could be employed and sediment could be removed easily. In addition, the latest sensor technology meant that the requirement for recalibration was much lower. Each of the six flow-through tanks contains sensors for conductivity, turbidity, dissolved oxygen, pH, Redox and temperature and data is transferred to a PLC that is programmed to raise alarms when pre-specified conditions occur.

If an alarm is raised all water is immediately passed to an underground storage sump and remains in quarantine until tested and passed as fit to be allowed into the pipeline.



The monitoring system returns to normal once water quality levels leave the alarm condition. Any quarantined water can then be removed by bowsers.

In the early years, water was passed through a wastewater treatment works near Dover, however, the water quality was found to be consistently of good quality so the treatment works was decommissioned and water is now passed directly to the sea

under a discharge consent from the Environment Agency.

Naturally, the monitoring system prevents the discharge of any water outside the consent conditions.

Kevin Rivers, Senior M&E technician at Eurotunnel was responsible for the configuration of the monitoring and control system. Comparing the HACH LANGE system with its predecessor, he reflects "The new system is far superior because it is more reliable, it requires less maintenance and is easier to operate. The water quality monitoring sensors are connected to SC100 controllers which are 'plug and play' – all you have to do is tap the serial number into the controller and it starts to monitor correctly automatically. The reliability of the new system means that we no longer experience false alarms, which is a major benefit; there are strict procedures in place before an M&E team can enter the tunnel to investigate an alarm and coupled with the amount of time it takes to drive to the monitoring equipment, false alarms are very costly. We estimate that the new system requires about one quarter of the maintenance that was previously necessary, which saves a great deal of time and money. One of the reasons for this is the new dissolved oxygen sensor, the LDO™ (Luminescence Dissolved Oxygen), which employs an optical monitoring technology that does not require recalibration – we simply change the sensor cap every year.

In order to prevent sensor fouling, we have fitted a compressed air system that automatically cleans the sensor heads"

Following installation of the monitoring systems, HACH LANGE ran short training courses on both the UK and French sides of the tunnel and Eurotunnel staff are now responsible for operation and maintenance. HACH LANGE simply provides a yearly service and calibration check.



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Commenting on behalf of HACH LANGE, Project Manager Clive Murren said "These installations have been successful because the technological requirements identified by the Eurotunnel team coincided with the development of new monitoring equipment. As a result, the instrumentation has been deployed in a customised monitoring system, designed specifically to overcome the problems that had been previously experienced."

It was a pleasure for us to be involved in such an unusual application, however, plug-and-play technology coupled with advanced low maintenance sensors enable us to help develop and supply customer-specific solutions very easily."

Eurotunnel is a unique and highly important project and Michael Edwards says that "Whilst the tunnel construction was carefully engineered, the water seepage levels have been significantly lower than was originally estimated and the three quarantine sumps have enormous capacity so the whole monitoring and control system is running significantly under capacity. However, this provides the reassurance that we would be more than capable of handling any emergency. Furthermore, the system that we have developed with HACH LANGE has helped to radically reduce the running costs whilst significantly improving reliability, which is good news for everyone"



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Simultaneous Parameter Monitor

Tethys Instruments (France) announces the launch of its new generation of on-line water analyser UV400. Up to 12 parameters can be monitored simultaneously in one instrument. The new design gives an easy access to the flow cell(s) and to any part of the analyser. A USB port enables the download of the measurements and parameters with any USB key. The user-friendly colour touch screen interface gives an easy way to check and calibrate each parameter.

Based on UV spectroscopy for the main parameters (ammonia, COD, hydrocarbons and nitrate) it offers an unparalleled reliability and stability with an



extremely low operating cost. Thanks to large bore tubing and optical compensations, the measurements can be done directly on wastewater without filtering (even with activated sludge). A new flow cell design enables very high values of suspended solid (like paper mill wastewater) without risk of clogging. Phosphate is measured by standard colorimetric methods while pH, conductivity and dissolved oxygen are using standard external probes. A low range turbidity cylinder enables measurements down to very low values for drinking water applications. Different interfaces are available: RS485/MODBUS, RS232, GSM modem as well as analogue 4-20 mA outputs.

Reader Reply Card no 140

ATEX certified FLOWex is Flexible and Easily Operated



ORI GmbH (Germany) introduces the ORI FLOWex that is one-of-its-kind with the combination of high measuring accuracy and easy operation. ATEX certified, the flow meter is for the use in explosive areas, where it is essential to measure the water level or drainage in sewage water systems (II 2G EEx eib IIb T4). The compact and light housing is easy to install even in small manholes.

The combined sensor with an ultrasonic and pressure sensor is one of the smallest systems. The pressure sensor still works with high sensitivity and accuracy at low water levels. The ultrasonic sensor measures with the Puls-Doppler technology the velocity in different levels and determines automatically the average velocity.

The ORI FLOWex is equipped with an intrinsically RS 232 and Pulse Output. In combination with an automatic sampler volume- and flow proportional sampling can be done even in hazardous areas.

The data is logged in 2 MB data memory; this allows long autonomous measurement periods.

ORI FLOWex is controllable and adjustable via PC or a mobile PDA.

The read out and evaluation of the data and the settings of the parameters are carried out by the so-called "FileInspector", a very powerful software program also for the graphical and numeric illustration of the measured data.

Reader Reply Card no 141

Intake Protection System is Simply Better



Severn Trent Water was one of the first utility companies to try **YSI's** (UK) new multiparameter Intake Protection System, the 'HydroSAM', and works manager Natalie Horton says "The performance of the new water quality monitor has been absolutely brilliant."

The HydroSAM is designed to replace older water quality monitoring systems that draw samples through a network of pipes which feed a series of in-line sensors. In contrast, the HydroSAM has been designed for minimum maintenance and long-term deployment, offering lower cost/less complicated installations.

The HydroSAM employed by Severn Trent Water upstream of the Shelton WTW near Shrewsbury monitors pH, temperature, conductivity, turbidity, dissolved oxygen and ammonia. However, it would be possible to add other sensors such as those for chlorophyll and blue/green algae.

Looking back over the HydroSAM trial Natalie Horton says "The main benefit for us has been the reduced requirement for calibration and maintenance; site visits used to be necessary every week, but now a simple 6-weekly calibration check is all that is needed. We have been delighted with the HydroSAM - it was simple to install and operate, it has proved to be reliable, and it saves labour costs."

Reader Reply Card no 142

No Compromise Level Measurement to 10 metres

IMP

Pulsar's ultrasonic know how is second to none and with IMP, you can see exactly what's happening inside tanks, sumps, silos to 10 m depth.

IMP not only looks good, it allows you to continuously monitor material levels accurately using proven ultrasonic digital software.

- Solids, liquids, slurries etc
- Simple menu set up
- 3, 6 or 10 m versions
- 2 or 3 wire (2 relays) configuration choice

- ATEX I.S.
- IP 67 rated, -20 to +85°C
- Ideal in restricted areas - IMP is only 175mm high x 130mm dia.

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