Real-time data and analytical information from online instruments help utilities comply with water quality regulations. Aqua Metrology Systems' (AMS) CEO **Rick Bacon** and **Miquel Paraira Faus** of Aigües de Barcelona explain how the AMS online trihalomethane analyzer has become part of the utility's compliance strategy.

Online water quality instruments poised for growth

Increasingly stringent local, state, and national regulations, coupled with a heightened public awareness to maintain natural ecosystems and public health, have spurred the need for better and quicker information to monitor and track the composition of waters and wastewaters. Physical, chemical, and biological parameters of water and wastewater have historically been monitored using routine grab samples across utilities and industry. This approach collected only a relatively small data set, potentially missing important events occurring between sampling schedules. Moreover, the infrequent data sets from manual sampling offered little insight for utilities and industry to proactively manage, control, and mitigate contaminants such as disinfection byproducts (DBPs) and trace metals across their applications. The automation of sampling, analysis, and reporting – available through the growing suite of commercially viable online water quality instruments – offers great potential for onsite or remote process control automation, as well as for making management decisions on water quality at the source, intake, discharge, treatment plant, and distribution system.

Online water quality instruments provide the foundation of data required to make informed decisions for resource protection and treatment practices. Since water quality parameters are ever changing, a firm and immediate understanding of water quality is necessary in order to anticipate problems and maintain optimal treatment conditions. A step-by-step water quality analysis enables operators to maximize efficiency – and this type of productivity driven information has to be almost real-time in order to be useful. The high-frequency and continuous data obtained through online instruments is a powerful tool to anticipate problems and warn of contamination in source waters throughout treatment processes and in distribution systems. Moreover, the implementation of water safety plans benefits greatly from the data offered through real-time water quality analysis.

Worldwide changes, more online instrumentation

Online instrumentation, once a niche segment of the broader water quality analysis market, is poised for significant growth. The global market for water analysis instrumentation is forecast to reach US$1.86 billion by the year 2017, according to Global Industry Analysts' research titled, "Water analysis instrumentation: A global strategic business report." While laboratory-based water analysis instruments represent the largest product segment in the water analysis instrumentation market, online systems are emerging as the fastest-growing market segment with a compounded annual growth rate of 4.6 percent over the analysis period. This is happening for several reasons: regulatory changes, public awareness, economic benefits, and increasing consolidation of water utilities.

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Regulatory changes

More stringent regulations are being put into effect and results from external analysis are typically returned up to 10 business days later, which prevents the immediate implementation of preventative actions since the underlying water quality parameters have changed by the time analysis is received.

Aerial view of Aigües de Barcelona's Sant Joan Despí Drinking Water Treatment Plant. Photo by Aigües de Barcelona

Online instruments allow operators to ensure critical water quality parameters are in compliance with required target values, and also to check for deviations from stable values. Online instruments also afford operators and water quality managers the ability to effectively monitor treatment systems in real-time and proactively mitigate the impact of a potential regulatory breach through the timely adjustment of contaminant remediation processes.

Public awareness

Heightened public awareness and concern over water quality in natural ecosystems and drinking water treatment facilities increases the accountability for operators and water quality managers to ensure they better anticipate issues or problems instead of simply reacting to them after the fact. This then increases the demand to implement real-time water quality analysis across their operations.

Economic benefits

The high-frequency data provided through online instruments enable operators and water quality managers to optimize process controls and treatment schemes. Potential capital and operational cost savings can be realized by reducing energy and material consumption throughout the treatment process, limiting reliance on personnel to conduct manual samples, and limiting reliance on additional laboratory staff for the analysis.

Consolidation of water utilities

With increased consolidation of water utilities, stand-alone entities are now working together across broad geographical areas – relying on online instruments to provide remote monitoring and controls. Additionally, the creation of consecutive water systems resulting from the consolidation of utilities will use online instruments to ensure optimal water quality parameters are in place at handover points across networks and distribution systems.

In the absence of regulatory drivers calling for the implementation of online water quality instruments, operators and water quality managers have been installing online analyzers and monitors because they are convinced of their ability to improve operational efficiency and maximize optimal water quality. The functional efficiency of water and wastewater operations is dependent on the real-time and continuous data and analytical information derived from the use of online instruments. Capital improvement, expansion, and new projects – as well as full-scale operation – can benefit by using online water quality instruments during feasibility studies to ensure treatment schemes are engineered and optimized to meet water quality requirements.

Aigües de Barcelona validates online THM monitors

The water utility Aigües de Barcelona in Catalonia, Spain installed and fully integrated Aqua Metrology Systems' THM-100™ online trihalomethane (THM) monitors into their distribution network following an extensive validation carried out at the utility's laboratory during June and July 2012.

A firm and immediate understanding of water quality is necessary in order to anticipate problems and maintain optimal treatment conditions.

Aigües de Barcelona provides drinking water to more than 3 million people across the Barcelona metropolitan area from their Sant Joan Despí Drinking Water Treatment Plant (DWTP), with a capacity of 4.5 cubic meters per second. The Sant Joan Despí plant employs a mixed conventional-and-advanced treatment scheme – comprised of chlorine dioxide pre-oxidation, coagulation-sedimentation and sand filtration, ozonation, granular activated carbon, chlorine disinfection, ultrafiltration, and reverse osmosis. Source water is provided from the River Llobregat plus additional groundwater sources. To effectively meet the drinking water demands across their service area, Aigües de Barcelona purchases additional water – approximately 50 percent of the volume they supply – from Aigües Ter-Llobregat (ATLL). Aigües de Barcelona is certified by the ISO 22.000 standard (Preventive Risk Management System) and sets water quality targets of the purchased water from ATLL. When water quality falls below minimum agreed levels, ATLL can be penalized. Water quality provisions include all the parameters regulated by the European Union Directive 98/83/CE and special focus is given to THMs. Understanding total THM concentrations from incoming water purchased from ATLL at the entry point allows for reasonable growth within Aigües de Barcelona's distribution system, while maintaining regulatory DBP compliance.

Total THM measured values at the Sant Joan Despí DWTP typically range from 10 to 25 micrograms per liter; however, values can significantly increase up to 80 to 90 micrograms per liter in remote zones of the 4,700-kilometer pipeline throughout the distribution network. THM fluctuations are dependent on the season of the year, the quality of the surface water, the quality of the additional water purchased from and supplied by ATLL, and the residence time of water in the distribution network. While intermittent DBP measurements relative to volume of water supplied are necessary for regulatory compliance in the European Union, the frequency of sampling and analysis are inadequate for understanding the real-time and actual DBP levels within the water distribution system at any given moment. DBP levels can range significantly, even within the same day, due to temperature, water demand, pumping schedules, climate changes, rain events, and other factors.

As a result, Aigües de Barcelona decided to monitor THM levels more frequently and elected to use an online analyzer to provide accurate and timely information regarding the THM formation in their network. It was for this reason the Aigües de Barcelona Laboratory undertook an extensive validation of the THM-100™ online THM monitor in the summer of 2012. The validation compared results provided by the THM-100 with ISO 17.025 laboratory accredited techniques. Following the assessment of precision, trueness, and uncertainty, the THM-100 proved fully compliant with the European Union directive and Aigües de Barcelona laboratory's objectives. The successful validation study led to the installation and full integration of the online THM analyzer into the THM control strategy of Aigües de Barcelona.

As part of their ISO 22.000 certification, Aigües de Barcelona strives to have complete control and understanding of water sources entering their distribution network. These efforts led to the installation of four additional online THM analyzers across the network from 2012 to 2014. Aigües de Barcelona uses five online THM monitors in total. The first unit monitors THM levels in water discharged from the Sant Joan Despí DWTP in order to predict THM formation potential and levels in the distribution network 72 hours after treatment. Another unit monitors THM levels – at 72-hour residence time – in a storage tank containing treated water from the Sant Joan Despí DWTP. Two units monitor water supplied by ATLL from two of their DWTPs, while the final unit monitors THM levels in a remote tank that holds the water supplied by ATLL's drinking water facilities.

The online THM monitors have enabled Aigües de Barcelona to readily identify rapid changes in water quality so remedial actions can be taken. When the utility experiences low THM levels, treatment is adjusted and a lower percentage of water is treated through the reverse osmosis system or aeration system. The residence time of treated water in the network and storage tanks can also be reduced and, where feasible, lower re-chlorination doses can be used. Depending on THM levels, various water blending schemes can also be put into effect. All combined, these process optimization measures have lead to significant cost savings for the utility.

THM analyzers' preventive approach

Online THM analyzers have played an important role in Aigües de Barcelona's compliance strategy, helping the utility optimize their treatment processes, assisting in monitoring water quality at handover points from their water supplier, and reducing related expenses while ensuring regulatory compliance. In addition, the online THM analyzers have proved essential in Aigües de Barcelona's preventive approach on water quality management. Aigües de Barcelona had the first water safety plan to obtain certification to the ISO 22.000 standard in Spain and it is the first large utility to obtain this certification for the complete drinking water cycle in Europe.

The automated sampling, analysis, and reporting of online water quality instruments provide utilities and industry with real-time data on the ever-changing physical, chemical and biological parameters of their water and wastewater. As a result, online instruments are poised to be an integral tool aiding in management decisions on water quality from source to distribution.

Authors' Note

Rick Bacon is the chief executive officer of Aqua Metrology Systems Limited, based in Sunnyvale, California, United States. Miquel Paraira Faus is the water quality director and laboratory manager of Aigües de Barcelona, Catalonia, Spain.