# Lessons Learned and Outlook for 2022

Supporting a Water Resilient Future

In 2021, Aqua Metrology Systems (AMS) reached a major milestone — its 10th anniversary. It is hard to understate the scale of the transformation of the company over that period. From its earliest innovation — the industry's first online trihalomethane (THM) THM analyzer serving a single market — to where it stands today as a global market leader with a technology platform of advanced solutions to analyze and treat multiple trace metal and inorganic contaminants of concern across a broad range of industries and municipalities. AMS has used its unique blend of chemistry and engineering competencies to develop disruptive solutions to address several of the pressing problems facing the global industrial and municipal water treatment industry.

Rick Bacon, CEO, AMS

Through AMS Analytics, AMS has established a leading footprint in the U.S., Europe and the Far East for accurate and reliable, real-time, online water and wastewater quality analyzers backed by an unrelenting commitment to client service. Insights into the performance limitations and excessive capital and operating costs of traditional water treatment technologies gained through continuous monitoring of their performance on behalf of our clients validated our decision to launch a disruptive water treatment technology platform through AMS Environment.

As a result, AMS now holds a unique position of offering a proprietary technology that takes a radically new, affordable and sustainable approach to both the treatment of waterborne contaminants such as arsenic, chromium, manganese and phosphate and to corrosion inhibition in domestic and industrial water transport systems.

In 2021, the COVID-19 pandemic confronted AMS with multiple unprecedented challenges to every aspect of its business. Despite this disruption, the commitment, agility and flexibility of AMS employees ensured that we retained an unwavering commitment to our mission — to transform the way the world sees and treats water with the goal of protecting human health and the environment. That mission includes making a meaningful contribution to a water-positive zero net carbon future for subsequent generations.
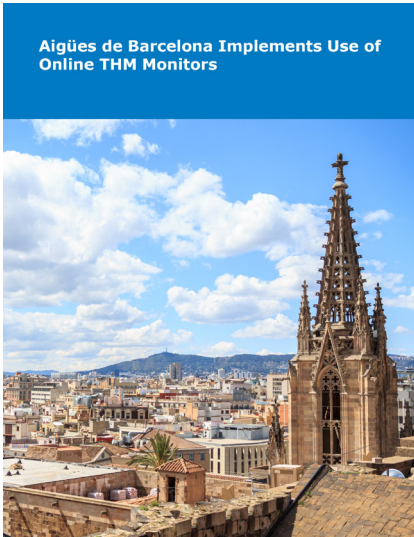
Aigües de Barcelona Implements Use of Online THM Monitors

Largest utility in Spain uses real-time THM data to optimize treatment process, minimize energy costs and reduce carbon footprint.

Against the backdrop of the pandemic, several other factors emerged during 2021 which will shape the future direction of the industrial and municipal water treatment industries in which we operate.

The industry accelerated adoption of digital technology innovations due to constraints on physical access to treatment systems and labor shortages, both consequences of the pandemic. This was particularly true of in-situ, real-time water quality monitoring technologies where awareness of the value of high-frequency data and predictive analytics of treatment system performance became far more widespread.

Supply chain disruptions threatened the integrity of water treatment operations, notably in the U.K. and U.S., where lack of key treatment chemicals prejudiced those operations and their capacity to meet regulatory standards for drinking water and wastewater effluent.

The regulatory environment, a significant driver for change in the water treatment industry, became much tougher over the past year. In January 2021, the revised European Drinking Water Directive came into force. Member states have two years to transpose the directive into national legislation in which significant reductions in chromium, lead and phosphates are anticipated. In the U.S., the EPA announced planned revisions to the Lead and Copper Rule designed to reduce the exposure of consumers to lead poisoning. California also announced that it plans to introduce a lower regulatory limit for hexavalent chromium in early 2022.

The acceptance of online instrumentation for regulatory control of water treatment systems in Europe is a forerunner of initiatives in other regulatory jurisdictions to replace infrequent laboratory and manual based sampling. This represents a paradigm shift in the use of online instrumentation in supporting the execution of regulations to protect consumers' health and the environment.

In November 2021, the U.S. Infrastructure Investment and Jobs Act was approved and anticipates $55 billion of additional spending for U.S. drinking water infrastructure. This will represent a significant boost to the industry.
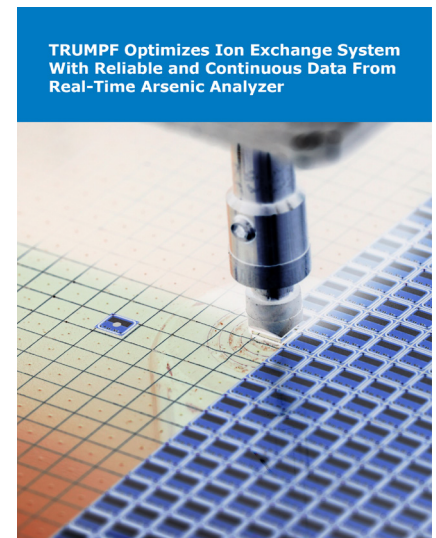
Concerns about climate change and its impact on the planet and humanity rose to the fore during 2021 and were brought into close focus by the 26th UN Climate Change Conference (COP26). The contribution of the water industry to carbon and greenhouse emissions began to receive increased attention, leading to questions about how the industry will more broadly adopt solutions to reduce its carbon footprint and greenhouse gas emissions that are already being practiced by industry leaders.

TRUMPF Optimizes Ion Exchange System With Reliable and Continuous Data From Real-Time Arsenic Analyzer

Accurate and reliable online arsenic data gave TRUMPF the confidence to move to a closed loop system and realize a 90% reduction in water use.

aqua metrology systems

2021 Progress Report

AMS' progress in 2021 had three main drivers:

1. AMS Analytics continued to deepen its presence with its long-standing clients and broaden its consumer base and secure new clients in the U.S. and overseas.

2. AMS Environment completed several demonstrations that validated the performance and competitiveness of its SafeGuard™ H2O on-site in-situ reagent generation technology.

3. AMS continued to invest in developing and patenting disruptive technological innovations for monitoring and treating industrial and municipal water and wastewater facilities.

AMS Analytics

AMS Analytics offers a range of fully automated online water quality instruments that monitor inorganic and trace metal contaminants in real-time. Our mission-critical instruments have an unmatched reputation for accuracy and reliability with leading corporations, engineers, regulators and municipalities worldwide. Our solutions are used by enterprises to reduce material and energy use, minimize lifetime costs and limit their carbon footprint.
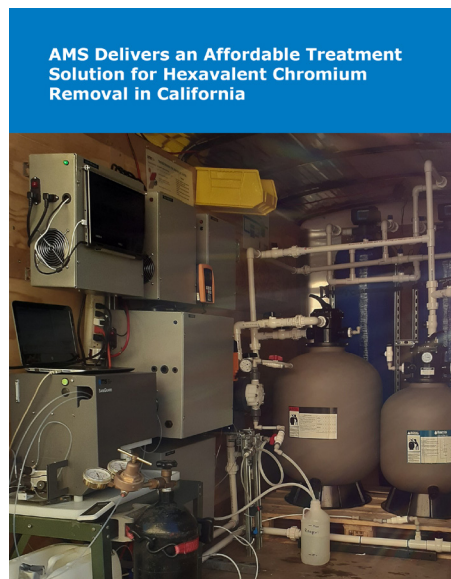
Throughout the year, despite the disruption caused by the pandemic, AMS Analytics' Data Quality Assurance Program maintained the high levels of uptime of its analyzers through continuous investment to enhance the autonomy of its instruments and their remote monitoring to ensure both minimal and prompt service interventions when needed.

Developments in Online and Predictive Analytics

In 2021, we launched the AMS Instran™ range of online inorganic water quality analyzers. The analyzers have been deployed in several municipal drinking and wastewater facilities and industrial wastewater treatment plants to provide accurate, real-time analysis of contaminants such as ammonia, fluoride, phosphate and nitrate.

The development of the MetalGuard™ Lead Alert!™ analyzer was completed. This technology provides water utilities and the consumers they serve with an advanced warning of increased risk of lead poisoning as a result of unexpected changes in water quality in the distribution networks and plumbing systems. By detecting changes in the risk of lead poisoning in real time, utilities and consumers who are exposed can be informed immediately and before poisoning occurs so that appropriate actions can be taken to avoid or mitigate that risk.

AMS Delivers an Affordable Treatment Solution for Hexavalent Chromium Removal in California

A 14,000 gallons/53,000 liters/day chromium remediation system serving a small community reduces Cr6 to non-detect levels.

At the end of 2021, AMS completed development of SafeGuard™ Pro designed to address a significant problem encountered by all industrial and municipal users of online water quality instrumentation. A major challenge faced by all online instrumentation users is the damage done to their instruments by interferences in the water which they are monitoring. These interferences compromise analyzer reliability and generate excessive lifetime costs caused by the need to clean or replace the sensor on a regular basis. The SafeGuard™ Pro significantly reduces the lifetime costs of many of the brand-name online instruments. It also improves their reliability and the trust users can place in the mission-critical data they generate.

AMS Environment

During 2021, AMS Environment made significant progress in the demonstration and validation of its SafeGuard™ H2O platform that removes a wide range of heavy metals and nutrients from water and wastewater and also inhibits lead, copper

and iron corrosion in water transport systems. These demonstrations included the removal of arsenic, hexavalent chromium, hydrogen sulfide and manganese from drinking water sources and corrosion inhibition in heating and cooling systems. In addition, SafeGuard™ H2O was demonstrated to recover non-renewable resources such as mercury, selenite and sulfur as tin sulfide which is a valuable industrial commodity.

AMS' SafeGuard™ H2O is unique in that it generates reagents on-site by the electrolytic decomposition of tin or mild steel to produce reagents that are non-toxic and safe to handle. The cost of reagents produced on-demand and on-site in this manner was demonstrated to be significantly below that of the same reagents delivered in bulk. Moreover, by generating these essential chemicals on-site, the exposure of industries and municipalities to disruptions in their supply chains for bulk chemicals is significantly reduced.

SafeGuard™ H2O can be powered by renewable energy sources, and because the reagents the system generates can be stored safely, this enables electricity load balancing by end-users. With these multiple features SafeGuard™ H2O will make a significant contribution to the efforts industries and municipalities to reduce the carbon footprint of their water treatment system.

Outlook for 2022

AMS Analytics enters 2022 with a strong sales pipeline for its online THM and trace metal analyzers. We expect the adoption of our online THM analyzer (THM-100™) for regulatory compliance analysis in the place of laboratories in a number of countries. Following the tightening of lead contamination regulations in the U.S. and Europe, we expect to see a shift away from expensive, inconclusive, after-the-fact manual, spasmodic testing of consumers' tap water to a data driven predictive analytics provided by continuous, online lead corrosion risk monitoring provided by MetalGuard™ Lead Alert!™.

The ever-wider adoption of online water quality instrumentation, the concern of purchasers about their significant lifetime costs and the accuracy and precision of their analysis is expected to generate interest from both the industrial and municipal sector in SafeGuard™ Pro to ensure trust in the data generated by their installed base of brand-name online analyzers.

For AMS Environment, 2022 will be a year of "scaling-up" from the successful demonstrations in 2021 of the disruptive SafeGuard™ H2O technology and commercializing this advanced solution across global industrial and municipal markets. We are eagerly anticipating the first commercial sales of SafeGuard™ H2O for arsenic, hydrogen sulfide, manganese and phosphate treatment. In addition, we expect to secure our initial orders for SafeGuard™ H2O as a corrosion inhibition system for a combined heating and cooling system.

AMS Supports the Drive to Net-Zero-Carbon in the Water Treatment Industry

AMS Analytics supports carbon reduction targets with its accurate, online, real-time water quality data for water treatment process optimization and control, including:

- Process optimization, reduced energy use and chemical delivery/use
- Process control, reduced water loss and frequency of treatment system failure
- Increased water reuse and recovery
- Reduced maintenance requirements
- Elimination of manual sampling logistics
- Elimination of manual monitoring of analyzer performance
- Extended instrumentation asset life

AMS Environment supports carbon reduction targets with an advanced on-site, on-demand, automated non-toxic reagent generation system by:

- Replacing toxic bulk chemical deliveries and handling
- Electrochemistry-based reagent generation based on renewable energy sources
- Reagent storage can be optimized for electrical power load balancing
- Small footprint and can be retrofitted into existing water treatment systems
- Non-toxic waste streams
- Recovering resources versus disposing of them
- Low process water loss
- Incorporating AMS Analytics for full-automation, process control and remote performance management

Significantly, AMS is ready to respond to the California communities affected by the widely anticipated introduction of a lower regulatory limit for hexavalent chromium — a carcinogenic contaminant of the water supplies found in hundreds of communities. Traditional technologies have been demonstrated to be unreliable and costly, both CAPEX & OPEX costs. They are completely unsuitable and cost-prohibitive for the smaller, under-served communities which are disproportionately affected by this carcinogen in their water supplies. Whereas the SafeGuard™ H2O technology has been proven to completely and reliably eliminate hexavalent chromium at a fraction of the capital and operating costs of traditional technologies.

Looking Beyond 2022

Moving and treating water is an energy-intensive process requiring significant capital investments with a long lifecycle. The water treatment industry is identified as the fourth largest industrial carbon generator through its use of electricity and chemicals and the embedded carbon in its water treatment plants.

GWI has estimated that the global water and wastewater industry accounts for 3.7% of global energy consumption. As such, our industry must take action to implement treatment solutions that consider the environmental impact and carbon footprint and be on the front line in the fight against climate change.

AMS has actively supported industrial and water treatment system operators to reduce their carbon footprint.

AMS Analytics supports carbon reduction targets with its accurate, online, real-time water quality data for water treatment process optimization and control. Our instrumentation solutions provide actionable data that supports utilities and companies in their goals to optimize chemical and energy use, determine when to blend water sources versus treat and reduce instrumentation surveillance costs. Improving energy efficiency is an essential part of keeping carbon emissions under control; spurring continuous upgrades to water and wastewater treatment processes that reduce the amount of energy and other resources used.

AMS Environment supports carbon reduction targets with an advanced on-site, on-demand, automated non-toxic reagent generation system that replaces the need to deliver and handle toxic bulk chemicals. This advanced electrochemistry-based reagent generation technology is based on renewable energy sources and reagent storage can be optimized for electrical power load balancing.

In reflecting on the progress AMS has made over the past 10 years and its plans for the future, it is important that we recognize the essential part played by our employees, investors and partners, the industrial and municipal enterprises who have been the early adopters of our technological solutions, the consulting engineers who have recognized how our innovations address the challenges faced by their clients in meeting ever more stringent regulatory standards aimed at protecting human health and the environment in as carbon neutral a way as possible.