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The Return On Investment of Innovative Measuring Instruments

Investing in new technologies are enabling operators to acquire knowledge that translates into cost savings in wastewater analysis and maintenance

Modern wastewater treatment is a multi-stage process optimized to speed up the natural processes of water purification. The final result is wastewater streams that ensure water quality and meet local and national laws and regulations. Current trends in wastewater treatment focus on reducing costs and maintenance requirements and improving efficiency and productivity. These trends also have to take into account the aging infrastructure of many plants. All of these trends can be used for modernizing existing plants as well as for new state-of-the-art facilities. For example, key developments include wireless technologies, new advanced sensor diagnostics, and re-buildable capabilities that extend sensor life and reduce maintenance requirements. These help plant operators safeguard water quality, while reducing labour and costs and improving regulatory compliance.

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Wireless Technologies

One of the most significant trends in the treatment of wastewater, both at municipal and industrial plants, is the increasing adoption of wireless technologies. As more plants embark on extensive wastewater treatment plant expansions and renovations, there is an opportunity to introduce wireless into plant networks inexpensively and conveniently. Currently such measurements as pH and conductivity are available in wireless analytical instruments, as are pressure and temperature measurements. Traditionally, analyzers located in critical processes have been connected to the plant's central network and asset management systems through expensive wired connections that are costly to install. More often, many liquid analyzers are installed in remote or hazardous locations where wiring them into a central network is inconvenient and expensive, so they often aren't integrated at all. The data and internal diagnostics on these isolated instruments must be accessed on-site by an operator, increasing costs and reducing efficiency. Wireless analytical instruments can be integrated with other wireless measurements like pressure and temperature and connected to the plant's existing network and asset management systems so that vital data can be captured continuously and automatically without the risk of human error. New wireless adaptor devices are also available that enable wireless communications with non-wireless devices to connect to the plant network.

Advanced pH Diagnostics

Wireless integration enables plants to take advantage of advanced diagnostic data available in today's instruments, such as pH slope, reference offset, glass impedance and reference impedance. These advanced diagnostics flag operators when a sensor is performing marginally or failing, allowing plants to estimate probe life and plan maintenance

schedules based on live data rather than replacing or cleaning sensors more frequently than required. Predictive diagnostics free up time for technicians, as many plants now have fewer resources as a result of retirement or cost-cutting measures. Diagnostics allow the I&E technicians to be more effective.

Historically, measurement data and diagnostics were often "stranded". Isolated from the network, the pH readings and diagnostics are essentially unavailable and many personnel hours are wasted in excess maintenance trips, or worse, unexpected regulatory violations. When these instruments are isolated, the vital operational information within these instruments must be collected manually in logbooks by personnel who could be performing functions elsewhere in the plant. Once collected, the data must be manually recorded with other operational data for the operators, management and governmental reports requiring more personnel time. With tighter budgets and fewer employees—whether due to layoffs or retirement—the manual collection of data places an even greater burden on the plant operations.

Wireless analyzers can communicate sensor diagnostic data and multiple process variables via WirelessHART digital protocol to the plant process control system, enabling operators to monitor the sensor condition and detect abnormal conditions, reducing maintenance costs and improving productivity. Current wireless technology can be enabled on existing analyzers with easily installed wireless adaptors that do not require additional software or major systems integrations or batteries.

Shrinking Work Force

The combined ability of advanced sensor diagnostics and wireless technologies, which enables the capture of more data, can also serve the purpose of helping to address a critical need facing many industrial and municipal wastewater treatment plants today – how to offset the loss of in-house expertise as senior plant personnel retire. As more experienced plant operators retire, plants need to replace that institutional knowledge of technologies, field processes and plant operations. A current trend is for plants to draw on external expertise, to help train staff and assist in knowledge transfer. Some suppliers not only provide training on the best use of their equipment, but also perform tasks the plant operators may no longer have the expertise for in-house. Often these training and other services can be offered for free or for a nominal fee by suppliers.

Anti-Coating and Rebuildable pH Sensor Technologies in Primary Treatment

One of the areas where new technologies are being implemented is in primary treatment processes where the solids are mechanically, physically or chemically separated from the liquid. Starting with influent treatment, plants must monitor the

influent pH and conductivity measurements as they can alert operators to possible upset conditions. The ideal influent pH range is between six and nine as a higher pH is harmful to the micro-organisms used to break down the wastewater and a lower pH will damage concrete. Since lime will gradually coat the pH sensor surface during primary treatment applications, new pH sensor technologies are designed to be coating-resistant by incorporating a large reference junction. A large surface area and high porosity provide a stable contact to the process to help resist coating providing a longer sensor life with minimal maintenance requirements. If coating does occur, today's sensors are designed so that the reference electrode can be rebuilt by simply replacing a clogged reference junction and recharging the electrolyte, significantly reducing maintenance and replacement costs.

Conductivity and ORP measurements are also important in primary treatment processes. A sudden change in influent conductivity may indicate an unusual discharge upstream from an industrial plant. A toroidal conductivity sensor with a large-bore sensor design is ideal in this process as it resists plugging and fouling and a metal frame reinforces the mounting shaft to withstand harsh conditions, reducing maintenance and sensor replacement costs. Additionally, a sharp decrease in influent ORP readings indicates an increase in strength of the biological loading at the plant influent.

Reduce Energy Costs

Driven by demands to reduce costs and meet sustainability goals, plants are actively seeking ways to reduce energy usage. One area where this is most evident is in the aeration basin. Power costs associated with the operation of the aeration process generally run from 30 to 60 percent of the total electrical power used by a typical wastewater treatment facility, so significant cost savings can be achieved by improving aeration efficiency.

Aeration is a biological process in which sewage micro-organisms are added to the wastewater in an aeration basin to remove up to 85 per cent of the remaining organic material. Dissolved oxygen (DO) is added to the aeration basin to provide oxygen to aerobic micro-organisms so they can successfully turn organic wastes into inorganic byproducts, specifically carbon dioxide, and water. Maintaining an environment conducive to keeping these microorganisms alive and most productive is a critical job. If the DO levels become too high, energy is wasted, expensive aeration equipment undergoes unnecessary usage and unwanted organisms (filamentous biology) are promoted. If the DO content is too low, however, the environment is not stable for these micro-organisms and they'll die due to anaerobic zones, the sludge will not be properly treated and plants will be forced to conduct an expensive and time-consuming biomass replacement process.

Plant energy costs may be reduced by as much as 50 per cent, according to the USEPA, when an automated aeration system with on-line continuous DO measurement is installed to maintain the correct amount of DO in aeration basins.

Conclusion

New technologies and important emerging trends enable wastewater plant operators to build upon what they know, while reducing labour and maintenance costs, improving regulatory compliance, ensuring water quality, and upgrading an aging infrastructure. **WWA**

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