PRISTINE DRINKING WATER IN EVERY WEATHER: AUTOMATION ENSURES QUALITY

A Municipality facing heavy pollution

In the Swiss municipality of Saxon, ensuring pristine drinking water has been a longstanding concern, particularly with the challenges posed by environmental factors like heavy rainfall and snowmelt. Historically, Saxon has relied on natural, untreated mountain spring water for its 7,000 residents. In recent years, significant bacterial contamination in spring water has occurred, prompting the municipality to seek innovative solutions. Partnering with an engineering firm, Saxon implemented a fully automated monitoring and control system, revolutionising their approach to water quality management.

Implementing a water quality monitoring system

Facing stricter water quality standards and fluctuating environmental conditions, including pollution incidents in 2019, the municipality sought a solution that maintained the natural purity of their water while ensuring compliance. The municipality carried out a risk analysis using the HACCP method, and implementation followed the standards of the SSIGE W12 directive. With the support of PMAX, a Swiss engineering firm, they designed an innovative system based on their risk analysis. The system's cornerstone is BactoSense, the fully automated flow cytometer, allowing real-time quantification of bacteria in selected reservoir inflows, particularly high nucleic acid (HNA) cells indicative of pathogens.

In addition, integration with the RainAlert system enabled adjustments based on real-time meteorological data, enhancing response during pollution-prone periods. Automation optimises measurement frequency, adjusting it based on prevailing conditions. Depending on the results, actions such as chlorine dosing, reservoir isolation, alternative water supply activation, or reservoir inflow interruption can be initiated. Additionally, real-time alerts can be issued to individual villages in case of contamination risks. All these actions in response to contamination risks are managed automatically with minimal human intervention.

Power consumption for the entire microbiological contamination risk management system is low (a few hundred watts), and the cost is around 4 to 5 cents per m^3 (amortised over 25 years). In 2022, 3.5 kg of chlorine were used. By contrast, continuous chlorination would have required around 129 kg of chlorine.

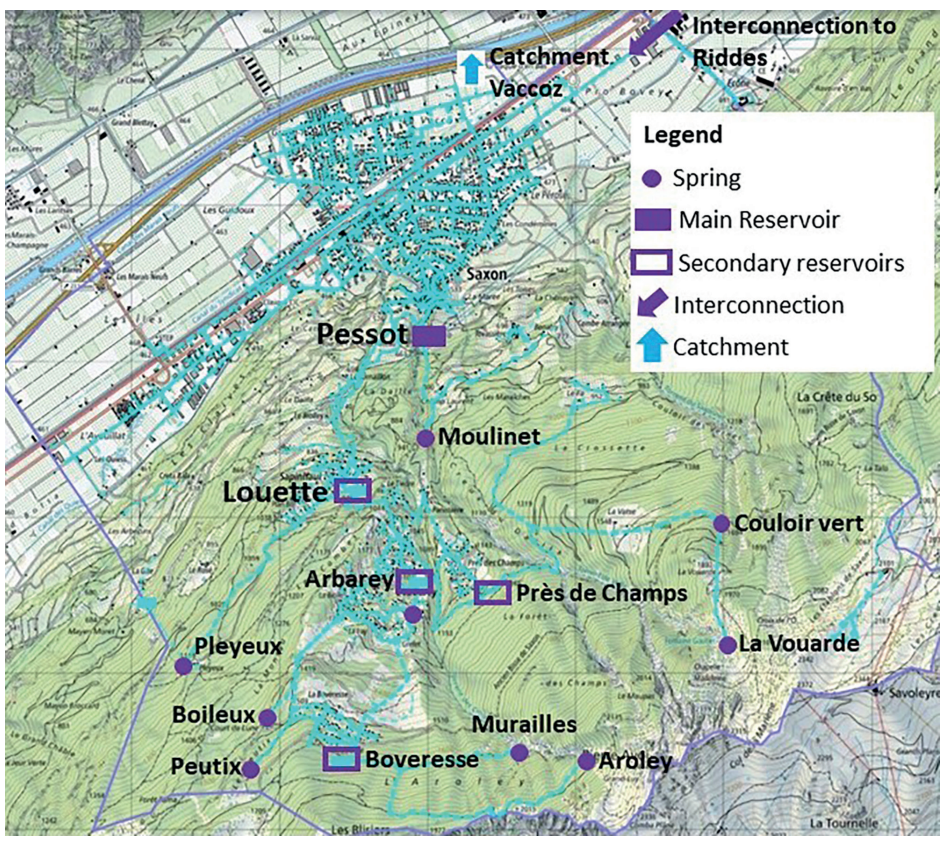

Figure 1: Location map of Saxon springs and network

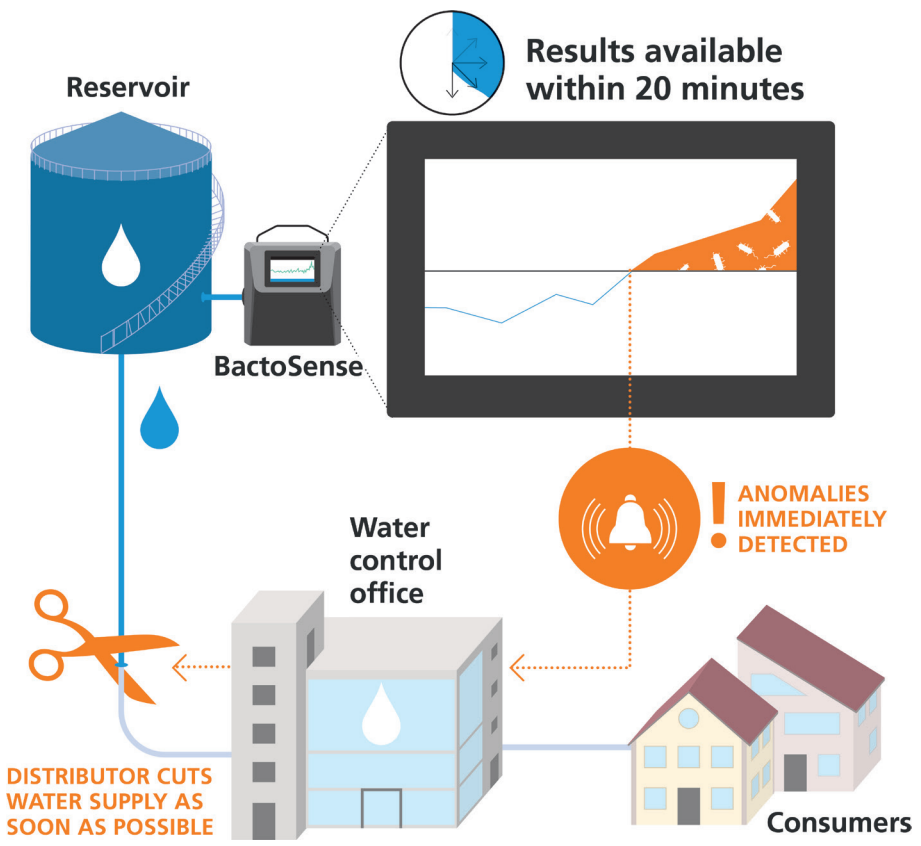

Figure 2: Diagram of the automatic hazard control system for Saxon residents.

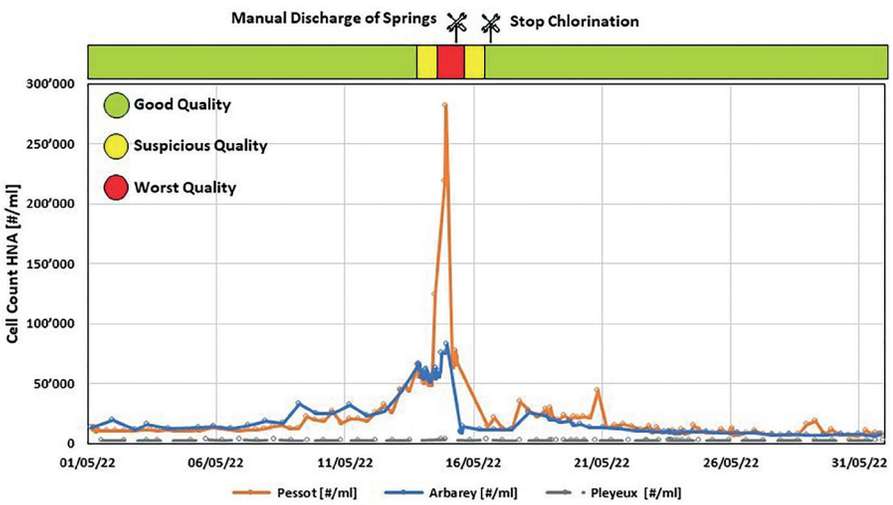

Figure 3: Number of HNA cells and determination of water quality with manual intervention in May 2022.

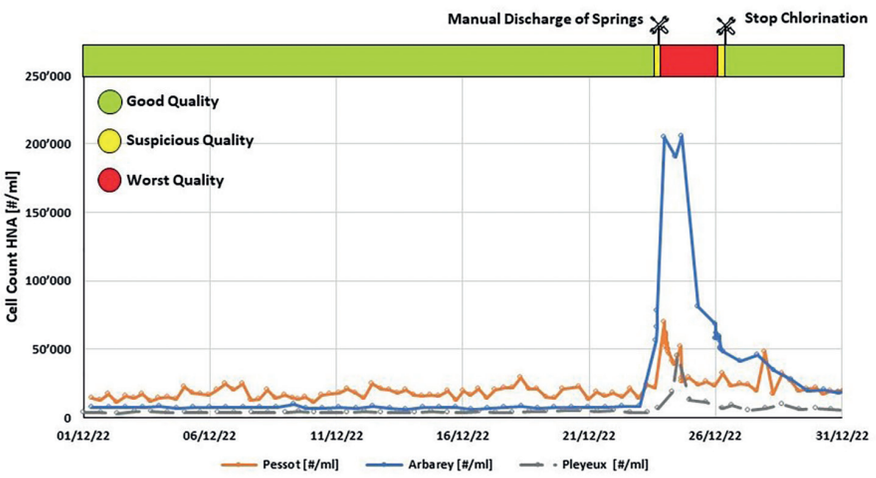

Figure 4: Number of HNA cells and determination of water quality with indications of verification measures in December 2022

RESULTS

In 2022, despite multiple contamination alerts triggered, no resident reported illness due to water pollution. Anomalies were swiftly addressed, often without manual intervention. Notably, most contaminations were traced to isolated sources, facilitating targeted mitigation efforts. For example, in May, the number of cells increased in both Louette and Pessot reservoirs, as shown in Figure 3. Investigations led to the rejection of certain springs, which a Saxon Water Department employee manually discharged. As a result, the cell count normalised and chlorination was stopped. Samples taken for follow-up microbiological analysis showed mostly compliant values, with only one Enterococcus found. The increase in bacteria could not be associated with a rain event, but a heavy snowmelt took place at the time.

In December, just before Christmas (fig. 4), the online flow cytometer detected an anomaly at the Louette reservoir. Chlorination of the Pessot reservoir was triggered, as was the isolation of the Louette reservoir. The situation was quickly brought under control, and the festive season was saved for many residents.

Comparison with traditional laboratory analyses highlighted the effectiveness of flow cytometry, with automated systems proving faster and more accurate in detecting contamination. This efficiency significantly reduced the need for continuous chlorination, minimising both environmental impact and operational costs.

Looking ahead, the system's success opens doors for broader applications in water safety, with potential scalability for various supply sites. Ongoing projects aim to enhance detection accuracy and explore new water resources, crucial amidst evolving climate patterns impacting water availability.

Saxon's experience underscores the pivotal role of automation and modern technology in safeguarding drinking water quality. By combining real-time monitoring with proactive response mechanisms, municipalities can ensure consistent access to safe drinking water, even amidst changing environmental dynamics.

Why was BactoSense intrumental?

BactoSense takes microbiological water quality control to a new level. While traditional plating methods in a laboratory take several days to deliver results, the fully automated analyser BactoSense does it on-site in only 20 minutes. This allows process optimisation and a fast reaction in case of contamination, avoiding health risks for the population.

BactoSense is a sustainable solution with a refillable cartridge, containing all chemicals required for microbial analyses. It is used at various stages in several industries.

BactoSense, developed by bNovate Technologies, the Swiss pioneer in cell analysis, is a completely automated and industrial online flow cytometer used for on-site water quality monitoring. BactoSense can be installed at any point of an industrial water system. Made in Switzerland, BactoSense aims to become the new standard in the water industry.

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