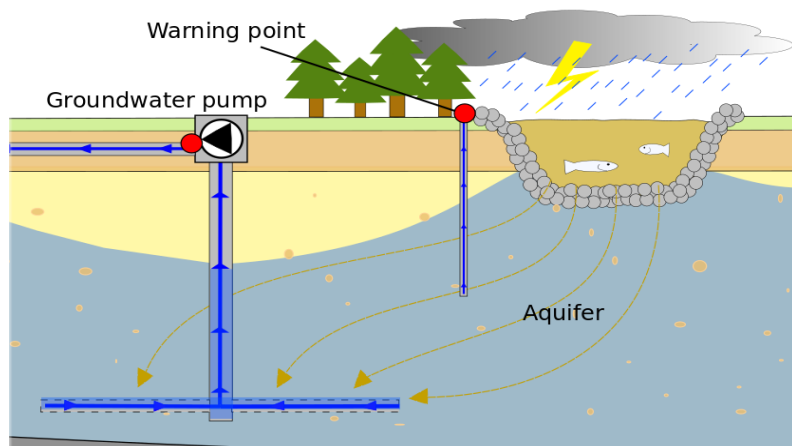


# Application Report

## Surveillance of the total cell count (TCC) in raw water [groundwater catchment with nearby river]

Groundwater catchment for drinking water often takes place in unconsolidated sand and gravel aquifers near rivers. These aquifers consist of loose gravel and sand, forming a porous layer. It serves as a natural filter and retains particular and biodegradable matter as well as microbes by adsorption and biological processes. If water flows through such a layer, it normally reaches a high quality and can be often directly used as drinking water. It is of prime importance to monitor the raw water quality in order to produce drinking water of continuously high quality.



**Figure 1: Scheme of a groundwater catchment with a pre-warning point.** The brown arrows indicates a potential flow of water of minor quality due to a flooding. The red dots mark potential measuring points of BactoSense.

### Use

Unconsolidated sand and gravel aquifers can be under the influence of nearby rivers. The water level of the river affects the flow velocity of the water through the aquifer. Floodings can increase the flow velocity and consequently, decrease the retention time of the natural filter. As a result, higher amounts of particles and microbes can reach the pumps. The online flow cytometer BactoSense can quickly and precisely identify an increase in microbe concentration.

It detects over 99% of all microbial cells and provides the results within only 20 minutes. Thanks to these measurements, actions can be taken to maintain a stable drinking water quality.



**Figure 2: BactoSense with cartridge**

### Typical application

Measurement points at a pre-warning point between the river and the pumping system or directly in the pumping system can monitor the water quality before entering the grid system. BactoSense measures the total cell count and HNA and LNA cell counts continuously and precisely. The total cell count (TCC) includes all intact microbial cells, while the HNAC and LNAC are measurements of the amount of large and small cells respectively. Measuring with BactoSense allows to detect an increase of microbe concentration in water within a few minutes. This early detection enables to take the right measures if the increased microbial exposure presents a danger for the drinking water treatment as well as for the drinking water quality. Furthermore, BactoSense provides the possibility to evaluate the influence of the water level of a nearby river or lake on the microbial quality of the groundwater. This is an important parameter to predict the quality of the water.

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Figure 3: BactoSense installed in a groundwater well

### Field Example

The influence of a river on a nearby groundwater catchment was investigated. During several weeks, BactoSense continuously delivered measurements at a regular interval of two hours. The comparison of these measurements with the water level of the nearby river shows a correlation of the water level and the cell counts. In Figure 4, it is observable that an increase in water level of a few centimeters is followed by an increase of cell counts a few hours later. However, the dependence of the water level with the cell count is not linear. For this reason, it is important to measure cell counts precisely and not to estimate them via the water level.

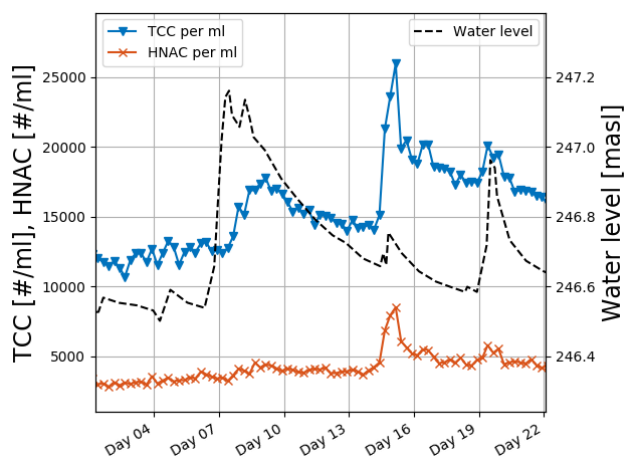


Figure 4: This graph shows the evolution of the total cell count (TCC) and the HNA cell count (HNAC: High Nucleic Acid Count) of pumped groundwater in comparison to the water level of a nearby river (Source: admin.ch). The measurement of day 15 shows that TCC can increase significantly even though the water level changes only little.

### Product

SIGRIST Products and configurations:

- BactoSense with online-sampler and I/O-Box for the analog outputs (4/20 mA)

### Parameter-configurations

- Analog output (4/20 mA) settings:  
Output 1: Signal source TCC,  
value range 4 mA = 0 TCC,  
20 mA = 500'000 TCC

### Alternatives, Competition

- Plating and cultivation (Heterotrophic plate count, HPC)
- Flow cytometry in laboratory (offline)



Figure 5: Simple control of the required water flow rate of 200 to 400 ml/min when continuously measuring with the BactoSense

### Advantages of the SIGRIST BactoSense

#### Customer benefits

- Fully automatic flow cytometer  
Sampling, incubation, analysis and cleaning are carried out automatically
- Results available 20 minutes after sampling
- Easy handling due to safe-to-handle cartridge system. No handling of chemicals and no sample preparation necessary.
- Compact instrument with a small footprint  
Allows various applications and easy transport
- Detection of more than 99% of microbial cells
- Low operation costs
- Easy system integration thanks to multiple interfaces
- User-friendly operation and maintenance concept
- Selectable measuring interval
- Integrated color screen shows results, graphs and hints directly
- Freely selectable gating