

Media release, 12 September 2008

Drinking water: the need for constant innovation

Switzerland's drinking water is of excellent quality, but there is no room for complacency. The challenges are growing: undesirable contaminants are found in rivers, lakes and groundwater. Climate change is also warming waterbodies, with implications for water quality, and in developing countries more and more people are reliant on groundwater containing natural contaminants. In Switzerland water utilities are ageing and need to be renewed. In partnership with the water sector, the aquatic research institute Eawag is identifying ways of ensuring that high-quality drinking water supplies remain available in the future.

At this year's Eawag Info Day – to be held at Eawag today, Friday, 12 September – the latest findings of research on drinking water abstraction, treatment and monitoring will be presented to more than 250 scientists, water professionals, administration officials and policymakers.

Challenges of climate change

Various models predict that rising atmospheric concentrations of greenhouse gases will lead not only to increases in air temperatures but also to warming of waterbodies. This prediction has been confirmed by observations: since 1945, for example, water at a depth of 5 m in Lake Zurich has warmed by around 1°C in the winter and by almost 2°C in the summer. The same trend is apparent in rivers. For the first time, researchers have now also compiled long-term time series for groundwater temperatures. Taking the example of groundwater at Rheinau (Canton Zurich), they have shown that the temperature of the water in the winter has risen by about 3°C since the 1950s. At the same time, the oxygen content has constantly declined. During the 2003 summer heatwave, water completely devoid of oxygen was pumped from certain wells in the Thur and Glatt valleys. In the absence of oxygen, however, iron and manganese are dissolved below the surface. These substances then have to be removed before the water can be supplied to users. In lakes, higher temperatures can also have adverse effects on water quality: the spread of cyanobacteria (blue-green algae) is promoted. This may be problematic since these growths include species that produce toxins or taste and odour compounds. In addition, microorganisms generally grow more rapidly in warmer water. In future, more elaborate treatment methods could be required in places where drinking water has previously been supplied untreated or after only simple processing.

Facilitating rapid alerts

The safety of water supplies depends crucially on continuous monitoring. However, traditional methods for microbiological analysis of drinking water involve the growth of visible colonies of bacteria on nutrient plates. The plating method is time-consuming and underestimates the number of microorganisms contained in water samples. Eawag has now developed an analytical method based on flow cytometry. This process, in which cells pass through a laser beam, has mainly been used to date in medicine, e.g. for blood cell counts. At Eawag, it was adapted so as to permit reliable enumeration of bacterial cells. Rather than having to wait for 18–24 hours, results are now available within 15 minutes. In close cooperation with Zurich Waterworks (WVZ), the researchers demonstrated that the results stand up well in comparison with conventional methods. In fact, they even provide a

considerably more realistic picture, since special labelling means that the method also detects microorganisms which do not reproduce on nutrient media and have therefore been incorrectly considered to be inactive or dead. What makes the new method especially attractive – particularly for monitoring the microbiological safety of drinking water in developing countries – is the fact that, using specific antibodies, it is possible to screen samples for pathogens such as intestinal parasites and legionella or cholera bacteria. This would facilitate a rapid response in the event of contamination.

New treatment methods

In Switzerland, 43% of drinking water is sourced from springs, 40% from groundwater and 17% from lakes. Treatment is required mainly for lake and spring water. Together with partners from the engineering sector and WVZ, Eawag researchers have sought to identify the methods and combinations of processes best suited for meeting future challenges. Substantial investments are required to renovate water utilities, and new facilities are expected to have a lifetime of 30 or even 50 years. At a pilot plant in the WVZ Lengg lake water facility, it was shown that space-intensive sand filters could be replaced by ultrafiltration membranes with a pore size of 10 nm (1 nanometre = a millionth of a millimetre). Apart from the saving in space, membrane filters offer the additional advantage of representing an absolute barrier to microorganisms. The combination of ultrafiltration with ozonation and activated carbon filtration, both of which are already used today, adds up to an extremely effective process chain for water treatment. It guarantees microbiologically safe drinking water, which can be supplied without chlorination – a process frowned upon by consumers. Any trace contaminants are efficiently removed.

Taking precautions and identifying risks

Experts are agreed that the most important type of protection for drinking water is provided not by technical treatment processes, but by careful management of water resources. Pollution needs to be prevented wherever possible. Since many groundwater wells in Switzerland are located close to a river, Eawag researchers have investigated what happens when riverbeds are widened in restoration projects. Using a specially developed method, it is possible to predict how likely it is that the water at a nearby pumping station is no longer “genuine” groundwater, but river water which has not been sufficiently purified as a result of a short residence time in the subsurface. Depending on the risks involved, this may mean that it is necessary to abandon or impose restrictions on a given river-widening project.

Risk identification of a quite different kind is the subject of the “Water Resource Quality” research project (WRQ). Worldwide, millions of people rely on groundwater contaminated with health-threatening arsenic or fluoride of natural (geogenic) origin. With the aid of geological data and computer modelling, Eawag researchers have produced global maps indicating areas with a high risk for the occurrence of arsenic- or fluoride-contaminated groundwater. This mapping procedure, which has also already been successfully applied on the regional scale, is a valuable instrument for authorities, aid organizations and water suppliers. The WRQ project also involves efforts to develop and test simple, low-cost treatment methods particularly suitable for use in developing countries.

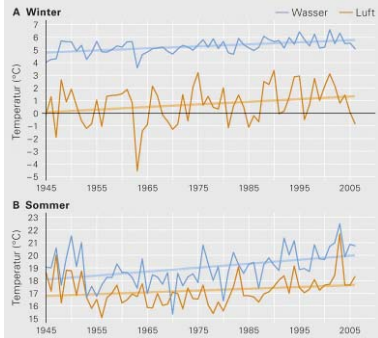
Further information on specific projects available **online**: www.wave21.eawag.ch/index, www.wrq.eawag.ch and www.ces.ethz.ch/projects/nature/Record

Photos and charts available for download at www.eawag.ch > Media

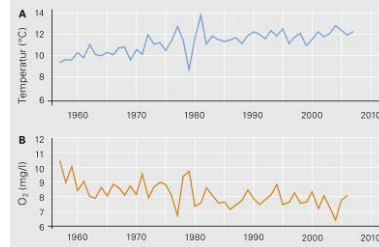
Proceedings - published in German as Eawag News no. 65:
http://www.eawag.ch/services/publikationen/eanews/news_65/index

To arrange interviews (to be conducted at the Info Day venue or by telephone), please contact Eawag Media Officer Andri Bryner on +41 (0)44 823 51 04 / +41 (0)79 721 19 93

Photos and charts: print-quality images can be downloaded from www.ewag.ch > Media
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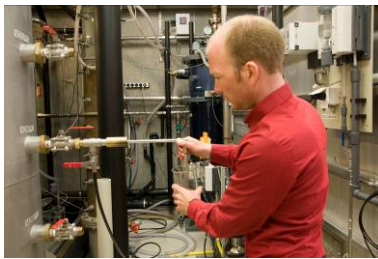
Development of water temperatures at a depth of 5 m in Lake Zurich



Curves for temperature and oxygen content of groundwater at Rheinau (Canton Zurich)



Eawag researchers at the flow cytometer



Collection of water samples from the activated carbon filter at the research and pilot plant in the Lengg lake water facility of Zurich Waterworks (WVZ)



Simple, but effective: bone char filters, as used in Ethiopia, can remove fluoride from drinking water. Eawag researchers are investigating, for example, how the lifetime of these filters can be extended.