TECHNEAU NEWSLETTER

July 2007

Welcome to the third issue of the TECHNEAU Newsletter. The newsletter is designed to disseminate news, scientific results and developments to stakeholders. Newsletters are issued every six months, with Newsletter 4 scheduled for December 2007.

TECHNEAU challenges the ability of traditional drinking water supply systems to cope with present and future global threats and opportunities. TECHNEAU will rethink options for water supply and - through innovation, research and development – will provide and demonstrate new and improved technologies for the whole water supply chain.

Newsletter 3 highlights recent activities and outputs from TECHNEAU. The Newsletter can be downloaded from the TECHNEAU website (www.techneau.eu / www.techneau.org) where comments on the Newsletter or on any project-related issue are welcome.

TECHNEAU publications are issued on the TECHNEAU website and can be downloaded free-of-charge. A list of available publications is shown on Page 8.

RTP: Technology for Safe Drinking Water in Southern Europe

Regional Technology Platforms (RTPs) are the main vehicle for consultation and dissemination in TECHNEAU. RTPs are held twice per year at locations across Europe to promote face-to-face consultation and knowledge transfer between local stakeholders and the TECHNEAU consortium.

The second RTP was held in Lisbon, Portugal, on 5 June 2007, hosted by LNEC, FUNDIC Águas de Portugal SA and EPAL. The RTP focused on "Technology for Safe Drinking Water in Southern Europe".

The conference was well supported by the local water community with around 80 delegates from Portugal and other Southern European countries hearing from a wide range of national and international speakers. Presentations discussing the drinking water challenges in Southern Europe and the Iberian Peninsula were interspersed with presentations describing relevant research and results from TECHNEAU.

An Integrated Project Funded by the European Commission under the Sustainable Development, Global Change and Ecosystems Thematic Priority Area.

Contract Number: 018320
Project Coordinator: Dr. Theo van den Hoven KIWA Water Research
Project Duration: 1st January 2006 to 31st December 2010

Delegates at the second RTP in Lisbon, Portugal

Drinking water supply on the Iberian Peninsula relies mainly on surface water sources, with groundwater supplying a small proportion of the population. Water supply in this semi-arid zone is characterized by occasional water scarcity and droughts, e.g. as experienced in 2005. Additionally, due to the high proportion of water used for agriculture and tourism, demand generally shows a seasonal variation with significant peaks in the summer months. Water consumption is highest in the metropolitan areas of Lisbon, Barcelona and Madrid, and in the coastal areas of Spain.

Over the last decade, enormous efforts in the establishment of new and improved water and wastewater systems have resulted in a considerable enhancement of water quality. Today, drinking water on the Iberian Peninsula shows a high level of compliance with water quality regulations.

(Continued on Page 2)

In this ISSUE:

Future projections suggest that water demand in this region will increase whilst the effects of water stress may become more severe as a result of climate change. Clearly, many challenges will have to be faced to maintain an adequate water supply.

The RTP identified several challenges to Southern Europe that will be addressed in the TECHNEAU programme:

- Water supply systems will have to adapt to increasing water scarcity and seasonally varying conditions by applying integrated management of the available surface and groundwater sources. Flexibility and reliability need to be increased.
- Water quality and quantity problems - frequently linked due to lack of dilution and overexploitation of resources - need to be addressed. Such problems may affect both surface and groundwater resources. The following steps should be considered:
    - The development and implementation of Water Safety Plans (WSPs) has to be encouraged.
    - Operation and control should be optimized and checked on a regular basis.
    - Based on the results of WSPs, measures to reduce microbiological contamination - such as disinfection - should be established.
- Efficiency of drinking water ‘consumption’ needs to be improved, e.g. by reducing water losses in the distribution networks and by raising public awareness of the economical use of water.
- New and ‘uncommon’ water resources have to be exploited through the application of new desalination or reclamation techniques, e.g. the use of seawater or wastewater.

Participants at the RTP expressed a strong interest in the results from TECHNEAU and the possible regional application of new technologies developed within the project.

Existing contacts between regional stakeholders and the TECHNEAU consortium - e.g. EPAL is an end-user in several work areas and in a major case study investigating the release of pathogens from biofilms in distribution - will be strengthened and extended, while opportunities for co-operation and networking with new stakeholders will be explored.

Further information exchange with the regional stakeholders and the strengthening of the newly established contacts will be facilitated by the Portuguese Partners, including LNEC.

For further information, contact Ronald Wielinga, WA8 Leader, or visit the TECHNEAU website (www.techneau.eu)).

Work Area Highlights

Riverbank Filtration Offers Sustainable Water Supply (WA5)

In many parts of the world, available surface water is polluted to the extent that the cost of conventional treatment would be prohibitive, particularly for developing countries. Groundwater, if available locally, offers benefits for public water supply and irrigation as the natural purification and storage capacity of soil and rock may offer the only possibility of a safe and sustainable water resource. Managed Aquifer Recharge (MAR) can utilise this natural purification capacity to pre-treat surface water for water supply or irrigation.

TECHNEAU Partners KompetenzZentrum Wasser Berlin gGmbH (KWB), the Indian Institute of Technology (IIT) in Delhi and the Freie Universität Berlin (FUB) have been evaluating MAR - with the main focus on Riverbank Filtration (RBF) - as a step to sustainable water resource management, especially in arid and semi-arid zones in developing and new industrialising countries. The evaluation has included detailed regional investigations, field studies and laboratory work.

A preliminary study was carried out prior to the TECHNEAU project to investigate potential sites for RBF in the city of Delhi (India). Three sites with different environmental conditions in Delhi were identified to be most suitable for RBF and are subject to deeper investigations with respect to sustainability and optimisation, and towards adjusted post-treatment.

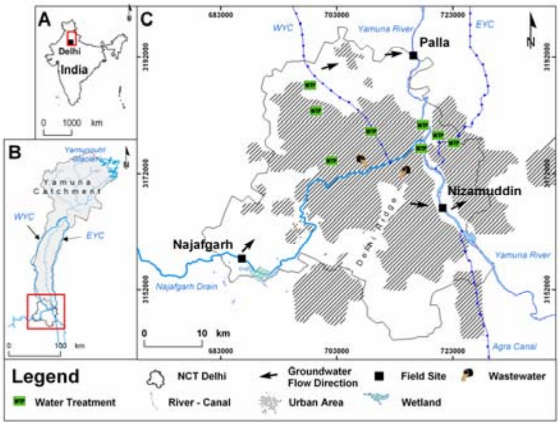

Figure 1 The Delhi study area

The city of Delhi is situated in the central northern part of the Indian subcontinent on the banks of the Yamuna River (Figure 1A). In northern Delhi, the Eastern- (EYC) and Western Yamuna Canal (WYC) represent the margins of the Yamuna watershed (Figure 1B). The Yamuna river, a tributary of the Ganga, flows in a southerly direction through the eastern part of Delhi and is the only perennial river in the area. Increasing water demand due to rapid population growth and increasing urbanisation and industrialisation has put the Delhi water supply under severe pressure. The use of groundwater is limited as a consequence of qualitative and quantitative problems.

The study has investigated the interacting hydrodynamic and biogeochemical processes between surface water and groundwater at three different field sites in the city of Delhi (Palla, Najafgarh, Nizamuddin) (Figure 1C). The sites represent a broad range of hydrochemical and hydraulic conditions between the surface water and the adjacent aquifer. At each of the field sites, several observation wells have been drilled to get a detailed insight to the geological and hydrogeological conditions. Lithological logs were made on site to provide information about sedimentological aspects such as lithology, stratigraphy, grain size distribution and thickness, and also hydraulic properties such as porosity and hydraulic conductivity. After drilling and levelling of the observation wells, monthly sampling campaigns were carried out at the selected field sites. Water samples were analysed for inorganics (major ions and tracers), stable isotopes ($\delta^{18}O$, $\delta^{2}H$), bacteria (total and faecal coliforms) and additional parameters (viruses, pesticides and organic trace substances) in IIT and FUB laboratories. Aquifer tests, including pumping- , open-end- and slug tests, were conducted to determine hydraulic properties of the aquifer – surface water system. Seasonal changes in the hydraulic regime were determined from monitoring temperature, discharge behaviour of the river and groundwater level fluctuations by the use of P-T data loggers.

This evaluation is continuing and will investigate further treatment needed to provide a safe and sustainable water supply.

Further details are included in TECHNEAU Report D5.2.1 that can be downloaded from the TECHNEAU website.

For further information, contact Sveinung Saegrov, WA5 Leader, or visit the TECHNEAU website (www.techneau.eu).

Taste and Odour Analysis (WA5)

Taste and odour (T&O) problems in drinking water are experienced worldwide and over the last 10 years the incidence of such events has increased. The presence of T&O in drinking water results in customer complaints and - although not a health risk - gives a negative impression of water quality, even though the distributed water quality may exceed all statutory regulatory requirements.

The origins of T&O compounds are numerous, ranging from manmade chemicals to indigenous environmental sources such as algae. Most of the T&O problems reported in the literature can be attributed to the occurrence of geosmin or 2-methylisoborneol, which impart an earthy-musty odour and are often found in surface waters.

Taste and odour compounds are usually present in at very low concentrations (nanogram per litre (ng/L) levels) and events are often unpredictable and short-lived - perhaps lasting only a few hours.

TECHNEAU Partners Anjou Recherche and Eawag have each developed analytical techniques to assist in the identification and removal of T&O compounds.

***In-situ* Capture of T&O Compounds**

Anjou Recherche has developed a sensitive, simple, fast and novel extraction technique that can be used as an alternative to conventional stripping methods. This technique is called Stir Bar Sorptive Extraction (SBSE) and is based on sorption instead of adsorption. In principle, a magnetic stir bar is incorporated into a glass jacket coated with a 0.5-mm layer of polydimethylsiloxane (PDMS), named a Twister™ (Figure 1). The Twister™ is added to the sample of water being analysed and stirring proceeds for 30-120 minutes.

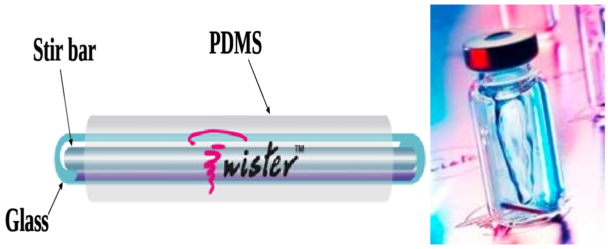

Figure 1 SBSE: The Twister™ support and its application

After extraction, the Twister™ is placed in a glass desorption tube in a thermal desorption unit and desorbed at 200-300°C. Compounds are detected using gas chromatography-mass spectrometry (GCMS). When compared to conventional techniques, SBSE has shown to be a practical tool for *in-situ* sampling and detection of odorous compounds, demonstrating sensitivity and sample stability. Detection is possible close to the sub-nanogram level while, once sorbed, compounds remain sorbed for at least two weeks even at room temperature. This is a great logistical advantage as transportation of water samples and the loss of odorous compounds is avoided.

The implementation of SBSE was demonstrated in a study at Nortalje, Sweden. For several years, the drinking water at Nortalje was characterized by a musty taste. This problem was exacerbated by the high natural organic matter (NOM) in the raw water extracted from Lake Erken and the long distribution system that resulted in residence times of up to 10 days. The Twister™ was instrumental in identifying eight new odorous compounds: four mixed haloanisols and their phenolic precursors. These results are being used to manage the T&O problem at Nortalje.

Advanced Organoleptic Analysis of T&O Compounds

A more general approach to the detection of T&O compounds is the application of sensory analysis with trained specialists. This approach provides information on the overall organoleptic perception of a water sample. However, with this approach it is difficult to detect individual T&O compounds or to provide quantitative data.

Eawag has further developed this general approach by combining the organoleptic detection of T&O compounds with instrumental trace analysis. This approach has already found wide application in the flavour and fragrance industry, where concentrations of volatile organic compounds are usually much higher than in drinking water.

Eawag is conducting a study to test the applicability of a method based on solid phase micro extraction with gas chromatography-mass spectrometry (SPME-GCMS) combined with an olfactory detector port (ODP or “sniff-port”) for the analysis of T&O compounds in natural waters and drinking water (Figure 1).

The method uses a sample volume of only 6 mL for SPME-GCMS analysis, which is fully-automated and solvent-free. One sample can be analysed in about one hour (e.g. SPME-extraction 30 minutes; GC-run 25 minutes). Detection limits are in the range 0.5-10 ng/L for most T&O compounds. For compounds exhibiting odour thresholds lower than 10 ng/L, the detection at the sniff-port is even more sensitive than the MS (< 1ng/L).

Figure 1 Analysis of T&O compounds at the olfactory detector port (ODP) performed simultaneously with GCMS detection

Initial results from the study of waters from three Swiss lakes have been promising. Six different T&O compounds were identified with this method (Figure 2). Furthermore, the method allowed the identification and quantification of the compound which led to several T&O complaints in two Swiss towns (2,4,6-trichloroanisole).

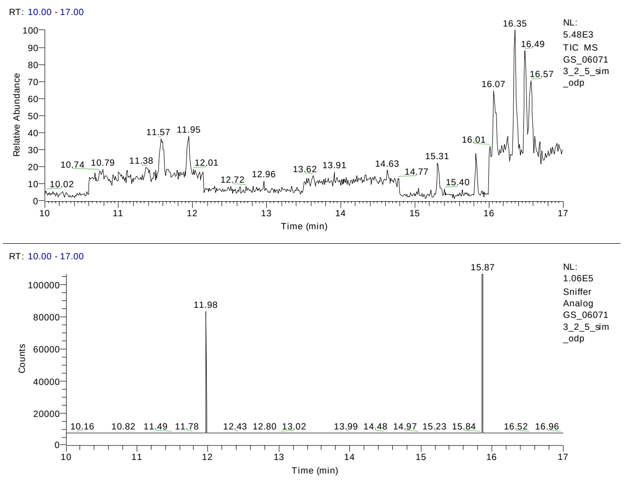

Figure 2 Results of a sample analyzed with SPME-GCMS/ODP: (a) MS chromatogram (total ion current), and b) ODP-signal ('sniff port')

Figure 2 compares the MS chromatogram for one of the lake samples with output from the ODP. The peaks at 11.98 minutes and 15.87 minutes corresponding to 2-isopropyl-3-methoxypyrazine (decaying) and β-ionon (violets), respectively. Clearly, the ODP complements the MS chromatogram and 'problem' peaks can be quickly identified. Rather than having to examine every MS-peak, it is possible to focus on the peaks with a corresponding ODP signal.

The implementation of the olfactory detection technique offers great promise as a reliable detection of T&O compounds is often not possible with MS alone. Also, compounds which are heavily overlapped by neighbouring peaks in the MS chromatogram can clearly be detected with the sniff-port.

For further information, contact Sveinung Saegrov, WA5 Leader, or visit the TECHNEAU website (www.techneau.eu).

Improved Networks … Improved Water Quality (WA5)

Most drinking water supplies will be affected at times by poor water quality due to turbidity (particulates), colour, taste and odour. The cause of the problem may lie at the water treatment plant with inadequate treatment but may also be due to deterioration of water quality in the distribution network. Several operation and maintenance techniques exist to cope with deterioration in distribution, and it is an objective in TECHNEAU to demonstrate how these can be used in an optimised and synergistic way.

Water quality degradation in networks may be due to:

- Inadequate water treatment resulting in the passage of particulates or elevated concentrations of contaminants such as DBPs or dissolved metals into distribution.
- The ingress of water into networks caused by shorter or longer periods of unpressurised pipes, e.g. due to breakages in the pipeline.
- Physical and chemical processes occurring between the bulk water supply and the pipe material (including sediment and biofilm).

Partners in TECHNEAU Work Area 5 (Operation and Maintenance) are seeking to minimise deterioration in networks in two ways: by modelling deterioration processes so that conditions causing deterioration can be avoided and by optimising operation and maintenance techniques so that the most appropriate measures can be taken proactively to avoid deterioration.

Important factors affecting water quality in networks include the variability of flow, water corrosivity versus the state of corrosion protection, and the frequency of bursts and leaks. The flow variability governs sedimentation and re-suspension of particulates, corrosion leads to iron in the water, and leaks and bursts introduce opportunities for ingress and also a risk of contamination during repair. Longer travel times increase the probability that these water degradation processes will occur and also the extent to which they occur.

Simple hydraulic calculations can be carried out to determine the travel times and to analyse the consequence of a revised network configuration that is often obtained when introducing leakage management. Since existing hydraulic models only present average situations with regard to water consumption, these will only give a rough indication of the actual travel times. This will be improved in TECHNEAU by more accurate modelling - incorporating advection and mixing processes - and calibration.

TECHNEAU is also developing water quality models that can be used to analyse and predict specific processes like biofilm growth, elevated iron from corrosion, and particulates in sediments and/or in the water supply. By using these water quality models, proactive strategies can be developed to minimise water deterioration through, for example, renovation and cleaning of pipes. The most appropriate maintenance techniques can be selected from a guidance manual of best practice.

Early on in the project, a questionnaire survey of several cities throughout Europe revealed that cleaning of pipes is a major concern of the engineers responsible for water supply and that this is carried out in several different ways. Field techniques developed prior to TECHNEAU have been improved for finding the pipe sections with the greatest potential for particle re-suspension. This is suspension related to normal variations in water consumption. Those pipe sections are then included in a regular cleaning program.

Understanding pipe condition is important in predicting - and avoiding - future leaks and bursts. Condition analysis may be carried out by analysing failure history compared to pipe length, age, material and diameter. This methodology should be applied for smaller pipes, where comprehensive statistics exist. Recently, non-destructive condition analysis methods for corrosion in metallic pipes and leak detection in large-scale pipes have been developed that may assist in accurately determining the condition for larger pipes. TECHNEAU will use these techniques to determine weak points in the networks and will propose how these methods can be included in optimised maintenance schemes.

Based on the modelling, operation and maintenance techniques described above, TECHNEAU is preparing a framework to guide operators, with the aim to protect the water distribution system against water quality degradation. This guidance will be published in a manual of best management practice for operation and maintenance of water distribution networks.

For further information, contact Sveinung Saegrov, WA5 Leader, or visit the TECHNEAU website (www.techneau.eu)

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Improved On-line Monitoring of Ozone and AOC (WA3)

TECHNEAU Partner s::can Messtechnik designs and builds on-line instruments for water quality monitoring. One instrument, the UV/Vis spectrophotometer (also known as the spectro::lyser™) is being developed within the TECHNEAU project to increase its range of application. Recent developments include application of the spectro::lyser™ for the on-line measurement of ozone and AOC.

To measure ozone, a spectral algorithm was developed. The spectral and chemical analyses for ozone showed a very high correlation (Figure 1). An accuracy of 0.005 mg/L in a measuring range of 0 - 5 mg/L was achieved when using a spectrometer with a 100-mm measuring cell length.

To measure AOC, a different approach was needed. AOC concentration is typically so low that a direct signal cannot be obtained in the UV-spectrum without prior concentration. Accordingly, the spectra before and after ozonation were compared. It was found that changes in specific areas in the differential spectrum were strongly correlated with the formation and removal of AOC. Thus changes in AOC levels can be predicted in real time based on the changes in the absorption signal in these regions.

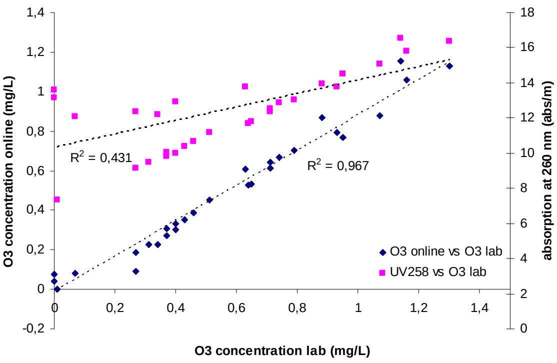


Figure 1 On-line ozone measurement vs. laboratory measurements (- compared to the poorer single wavelength correlation)

These algorithms were developed between May 2006 and April 2007 utilising data from two spectro::lyser™ UV-probes installed at the Weesperkarspel pilot plant of Waternet (water company for Amsterdam and surrounding areas). In order to investigate the different process steps simultaneously, one spectrometer was installed in a by-pass before the ozone reactor (Figure 2, Point 1) and a second probe was installed in a by-pass directly after the ozone reactor. The second probe was connected to sample lines from Points 2 - 6, using a time controlled switch to cycle the feed between all five sample points.

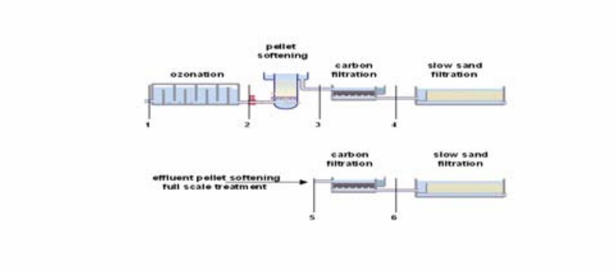


Figure 2 Overview of pilot plant and sampling points

The UV-probes measured turbidity, TOC, DOC and full UV/Vis absorption spectra every two minutes. Grab samples - analysed for ozone, AOC, DOC and UV absorbance - were used to identify the relevant parts of the spectrum for monitoring ozone and AOC. The algorithms were then developed using statistical analysis.

For further information, contact Frank Sacher, WA3 Leader, or visit the TECHNEAU website (www.techneau.eu).

FISH Detects Micro-Organisms in Biofilm (WA3)

Untreated water contains bacteria, protozoa, fungi and viruses, some of which may pass into drinking water and become established in biofilm, in the water distribution systems. Biofilm may, and often does, harbour pathogens. The most widely used methods for detection of micro-organisms use culture-based techniques where the sample is spread on a plate and colonies, grown from a single cell or cell cluster, are counted. However, these methods are time consuming and there is a risk that water will have reached some consumers before the results of the analysis are known. In such a case notification to water utilities and consumers of a microbiological incident will be too late. Furthermore, cells which are dormant - not able to divide - but still capable of causing illness will not be detected by these culture-based methods.

Ideally, modern analytical systems used for monitoring of micro-organisms in potable water must be able to rapidly detect the major groups of concern, including all metabolically active cells, capable of division or not.

TECHNEAU Partner RTU (Riga Technical University) is developing a rapid, simple and inexpensive detection method for pathogens and opportunists in drinking water biofilm based on fluorescence *in situ* hybridization (FISH).

RTU works mostly with a specific kind of probe (peptide nucleic acid or PNA probes (developed in the FP5 SAFER project)) which allows:

(i) the use of a simpler protocol compared to that for the more common DNA probes; and
(ii) microbial detection in the biofilm as well as in the drinking water.

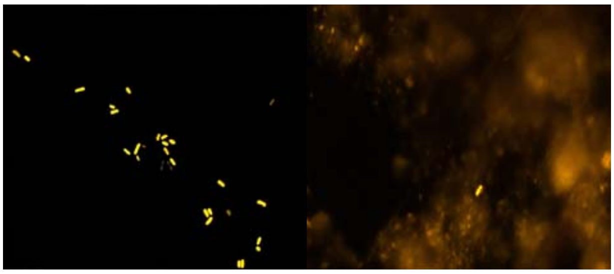
The sample is labelled with a specific probe (*e.g.* designed to bind only to the faecal pollution indicator *E. coli*) through a series of steps and is then viewed under a microscope.

The two main approaches used for the growth and collection of biofilm are:

(i) biofilm is grown in the biofilm reactor Propella®, which allows the influence of certain factors (e.g. presence/absence of nutrients and/or disinfectants) on the behaviour of cells to be studied; and
(ii) the installation of biofilm collectors (or ‘coupons’) (Figure 1) in selected locations in the treatment train and water distribution system.

In this project, a novel improvement to the PNA-FISH protocol was made which shortened the procedure to about 60 minutes and increased the signal by about 50% (Figure 2 A and B). The elimination of the washing step reduced the possibilities of false signals and cell loss, as well as reducing the usage of reagents.

Figure 1 A coupon holder containing two coupons used for biofilm collection



A **B**

Figure 2 *E. coli* detection in (A) an artificial mixed sample containing other drinking water bacteria (not visible), and in (B) drinking water biofilm taken in treatment after the first biological filters

The method is ready to be tested on field samples. Future plans include selection of best viability assays which can be used along with FISH for biofilm samples and performance of field experiments. The field experiments will focus on:

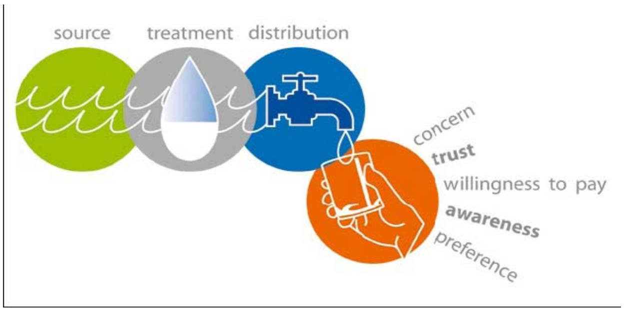
(i) the influence of different treatment steps on the presence and viability of *E. coli*; and
(ii) examination of the presence and viability of *E. coli* in the distribution network in various districts of the city of Riga.

For further information, contact Frank Sacher, WA3 Leader, or visit the TECHNEAU website (www.techneau.eu).

Consumer Trust is Vital (WA6)

Consumer trust and acceptance is an important factor in providing drinking water. Mistrust towards the water supplier or the drinking water supply for whatever reason may lead to the rejection of a source of healthy water and the adoption of a less safe source.

Consumer Trust and Acceptance is the subject of Work Area 6, where TECHNEAU Partners have been collecting information from the literature and from interviews with relevant stakeholders.



Accra, in Ghana, and Cyprus are two areas that have been identified for potential case studies. Both locations were visited in May 2007.

Accra was visited to interview key stakeholders and to understand the stakeholders' perception of consumer issues. In Accra, there is a lack of potable water and consumers depend on secondary supplies provided by tankers, sachet water or shared taps (where consumers pay per bucket). The lack of water is not due to limited water resources but rather to failure in meeting the needs of a rapidly growing urban population. This affects livelihoods to a large extent and consumer frustrations towards the water supplier are severe.

Cyprus was visited to carry out initial stakeholder interviews to gain insight into the stakeholders' perception of consumer issues and what consumers perceive to be important issues.

At both locations, interviews were carried out with suppliers, regulators and consumer representatives. The results from these interviews are being analysed and incorporated with the results from interviews made in the other WA6 case study areas.

Feedback will help operators understand consumer issues and respond to improve their image and the acceptability of their water.

Further information on Consumer Trust and Confidence, and Consumer Preferences are included in TECHNEAU Reports D6.1.1, D6.1.2, D6.2.1 and D6.2.2 that can be downloaded from the TECHNEAU website.

For further information, contact Chris Fife-Schaw, WA6 Leader, or visit the TECHNEAU website (www.techneau.eu).

Forthcoming Events

- **5-7 September 2007**
IWA AutMoNet 2007 (Automation in Water Quality Monitoring),
Gent, Belgium.
Organiser: IWA/Biomath-Universiteit Gent
Host: Biomath-Universiteit Gent
Further information: www.biomath.ugent.be/autmonet2007

- **24 September 2007**
Workshop on Ceramic Membranes,
Nieuwegein, The Netherlands.
Organiser: Kiwa Water Research
Host: Kiwa Water Research
Further information: www.techneau.eu

- **17-19 October 2007**
2nd Leading Edge Conference on Strategic Asset Management (LESAM) 2007,
Lisbon, Portugal.
Organiser: IWA/LNEC/CNAIA
Host: LNEC
Further information: LESAM Secretariat, www.lesam2007.org

- **25-26 October 2007**
TECHNEAU/TESTNET Workshop on On-line Monitoring Systems,
Organiser: DHI and Kiwa Water Research
Host: Kiwa Water Research
Further information will be available soon on the TECHNEAU website (www.techneau.eu).

- **29 November 2007**
TECHNEAU 3rd Regional Technology Platform,
Capetown, South Africa.
Further information will be available soon on the TECHNEAU website (www.techneau.eu).

TECHNEAU Delivered!

The TECHNEAU project has been running for 18 months and the number of available publications increases week-by-week. Publications are issued on the TECHNEAU website (www.techneau.eu) and these can be downloaded free-of-charge.

The following Table lists the publications available to-date. This Table will be updated in subsequent Newsletters to highlight all deliverables added since the preceding Newsletter.

(Continued on Page 8)

Report Number	Title
D1.1.1	Trend Report: Report on Trends in South Africa / Sub-Sahara Africa
D1.1.2	Trend Report: Report on Trends in Water-Stressed Regions
D1.1.3	Trend Report: Report on Trends in Eastern European Countries (Baltic States)
D1.1.4	Trend Report: Report on Trends in Southern European Countries (Portugal)
D1.1.5b	Trend Report: Report on Trends in Central Europe (Germany / Switzerland)
D1.1.6a	Spain: A TECHNEAU Case Study - Phase I: Climate Change
D1.1.6b	Spain: A TECHNEAU Case Study - Phase II: Climate Change
D1.1.6c	Long-Term Effects of Climate Change on Europe's Water Resources (Romania)
D1.1.9	Trend Report: Report on Trends Regarding Future Risks
D1.1.12	Report on Consumer Trends: Cross-Cutting Issues across Europe
D1.1.14	Trend Report: The Netherlands
D2.1.2	State-of-the-Art Report on Reverse Osmosis Desalination
D2.1.2b	New Prototype Pre-Filter for Seawater Reverse Osmosis: Protocol for Bench-Scale Testing
D2.3.3.5a	Ceramic Membranes: Case-Related Protocol for Optimal Operational Conditions to Treat Filter Backwash Water
D3.1.1/ 2	Monitoring and Control of Drinking Water Quality: Selection of Key Parameters
D3.2.1	UV-Vis Monitoring Station for Calculating 'Integrated Parameters'
D3.2.4	A Method for the Concentration of Microbes in Large Volumes of Water
D3.3.1	A Flow Cytometric Method for AOC Determination
D3.3.4	Development of a Toolbox for Identifying and Quantifying Membrane Biofouling in Drinking Water Treatment
D3.3.5	Assessing the Feasibility of Total Virus Detection with Flow Cytometry in Drinking Water
D3.3.7	A Protocol for the Determination of Total Cell Concentration of Natural Microbial Communities in Drinking Water with FCM
D3.4.3	Monitoring and Control of Drinking Water Quality: Preliminary Parameters for Construction and Adjustment of the Fish Biomonitor from Software Simulations
D3.5.1	Development of FISH Methods for Detection of Pathogens in Biofilm
D4.1.1/ 2	Identification and Description of Hazards for Water Supply Systems: A Catalogue of Today's Hazards and Possible Future Hazards

Report Number	Title
D4.1.3 D4.2.1/2/3	Generic Framework and Methods for Integrated Risk Management in Water Safety Plans
D5.2.1	Results of Background Work and Data Integration of MAR Systems for an Integrated Water Resources Management
D5.3.1a	Water Treatment by Enhanced Coagulation: Operational Status and Optimization Issues
D5.3.1b	Ozonation and Biofiltration in Water Treatment: Operational Status and Optimization Issues
D5.3.4a	Ultrafiltration with Pre-Coagulation in Drinking Water Production: Literature Review
D5.3.4b	Nanofiltration in Drinking Water Treatment: Literature Review
D5.3.6a	Ultra- and Nanofiltration in Water Treatment: Workshop on 'Operational Experience and Research Results'
D5.3.8	Impact of Chlorination on the Formation of Odour Compounds and their Precursors in Treatment of Drinking Water
D5.4.1	Models for Drinking Water Treatment: Review of the State-of-the-Art
D5.4.1a	International Workshop on Treatment Simulators: A Review
D5.4.2	Models for Drinking Water Treatment: Methodology for Integration
D5.5.1	Particles in Relation to Water Quality Deterioration and Problems in the Network
D5.5.4	Methodology of Modelling Bacterial Growth in Drinking Water Systems
D5.5.5	Review and Selection of Monitoring Parameters and Methods
D5.6.1/ 2	Evaluation Report on Operational Methods and Maintenance Schemes - Applied in Praxis and Compared to Best Practice
D6.1.1	Assessing Consumer Trust and Confidence: Methods Appropriate for the Water Utilities
D6.1.2	Consumer Trust and Confidence: An Overview
D6.2.1	Consumer Preferences: An Overview
D6.2.2	Assessing Consumer Preferences for Drinking Water Services: Methods Appropriate for Water Utilities

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