TECHNEAU NEWSLETTER

January 2009

Welcome to the sixth 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 7 scheduled for June 2009.

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 6 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 Pages 6-8.

RTP: Technology for Safe Drinking Water under Water Scarcity Conditions

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

The fifth RTP took place in Barcelona, Spain, on 15 December 2008, hosted by CETaqua, a joint institute of AGBAR, the Universitat Politècnica de Catalunya (UPC) and the Spanish National Research Council (CSIC). The event provided an invaluable insight into the enormous challenges facing Catalonia to ensure the drinking water supply of its population. Droughts and increased urbanisation and salinity are some examples of problems that have affected the region in recent years.

With consideration for the water-stressed regions in Southern Europe, the workshop focussed on the challenges to the drinking water sector arising from climate change and increasing water scarcity.

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 KWR
Project Duration: 1st January 2006 to 31st December 2010

Theo van den Hoven (KWR) addresses the fifth RTP in Barcelona

Presentations from Spanish and international experts highlighted specific aspects of water supply in Catalonia with particular reference to Barcelona. TECHNEAU consortium members presented results from the project of research relevant to the region.

With population growth in coastal urban areas and greater impacts from climate change - such as water scarcity - the supply of safe water is an increasing challenge in Europe, especially in the Mediterranean region. Traditional measures such as leakage control and demand management may alleviate problems of supply, but in the longer term alternative water sources and processes, such as seawater desalination, water reuse and managed aquifer recharge, will have to be considered.

(Continued on Page 2)

In Issue No.6:

In 2007, Spain experienced significantly less rainfall than normal. This led to a severe drought and water scarcity, especially in Catalonia which relies mainly on surface water sources for the provision of drinking water. For example, the Barcelona Metropolitan Area depends principally on water from the Ter and Llobregat Rivers, which is impacted by salt discharges from upstream salt mines. Groundwater sources used for water supply in Barcelona are also at risk from saltwater intrusion as a result of over abstraction of coastal aquifers.

Water management in the region is highly vulnerable to changing circumstances. As in 2007, severe droughts in early 2008 threatened Barcelona`s water supply and drastic short-term measures had to be taken to guarantee the availability of drinking water. A pipeline was extended to channel water from the Ebro River to Barcelona whilst drinking water was shipped in from Tarragona and Marseille. These measures were reported by the international media and raised awareness in the region that led to reduced consumption of drinking water. Despite substantial rainfall in June 2008 which normalised the supply situation, consumption remained at a reduced level.

In order to solve the problems faced by Catalonia in the longer term, the regulating administrative body - Agència Catalana de l'Aigua - is implementing a series of water stress mitigation measures promoting water saving (Urban Water Saving Programme) and more efficient use of water whilst advocating water reuse (Catalan Water Reuse Programme). This programme was approved in 2008 and aims to increase the reuse of treated water from 3.3% in 2008 to 22% in 2015. Furthermore, plans for Efficient Water Reuse in Agricultural Irrigation and Drought Management are in preparation.

In addition to the water stress mitigation measures discussed above, it is recognised that to ensure and increase water availability, water treatment plants must be improved and new infrastructure built. A new desalination plant scheduled for 2009 will help to relieve the chronic shortage of drinking water in the Barcelona Metropolitan Area. Additional infrastructure is required to increase the available capacity and flexibility of the system (water reuse, interconnection of networks) as well as indirect infrastructure to improve the water quality (improved treatment, minimum maintenance flows, planning fluvial spaces, and recovery of riparian forests and wetlands).

The water treatment plants supplying Barcelona must deal with changing characteristics of the water sources including:

- massive fluctuations in water quantity due to periods of drought followed by floods; and
- highly varying water qualities, e.g. the Llobregat WTPs must deal with surface water with high salinity (bromide), NOM, high temperature, high microbiological load and occasional industrial pollution, whilst the Ter WTP must deal with reservoirs at risk from algal blooms.

In order to adapt to these characteristics and to optimize plant design and operation, the Catalonian water companies are implementing a joint project called MODPLANT, analysing the existing water treatment plant using modelling and simulation tools whilst considering economical and operational aspects.

In conclusion, the RTP highlighted the challenges facing Catalonia - including drought and increased urbanisation and salinity - and facilitated an intensive exchange between TECHNEAU and regional water experts from water companies, research institutes and the local universities. The existing national water research programmes such as SOSTAQUA and MODPLANT offer the possibility for mutually beneficial co-operation and further collaboration is foreseen with the local water utilities and other bodies.

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

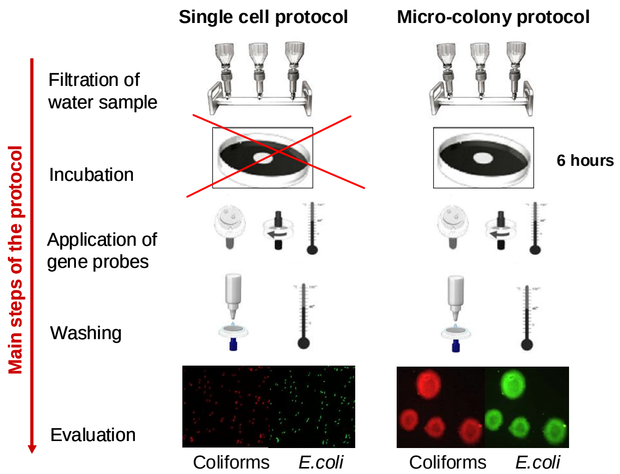
Work Area Highlights

FISH detects *E. coli* and Coliform Bacteria in Drinking Water (WA3)

Monitoring of microbiological contaminants in water supplies requires fast and sensitive methods for the specific detection of indicator organisms or pathogens. The standard cultivation methods are too time consuming to match the requirements of modern water safety management, i.e. approaching the equivalent of online measurement. TECHNEAU WA3 has developed improved 'online' monitoring systems that better meet these requirements.

FISH (Fluorescence In-Situ Hybridisation) is a proven and sensitive molecular method for the specific detection of micro-organisms. The use of this technique for the analysis of drinking water requires quantification of cell counts. Accordingly, major modifications and adaptations of the standard FISH-techniques were developed by TECHNEAU partners Vermicon and TZW. First development was a protocol for the simultaneous detection of *E.coli* and coliform bacteria. An existing slide-based FISH-technology approach was transferred into the protocol, which can be applied on filter membranes leading to quantitative results after filtration of a specified volume of water.

One approach taken allowed the direct detection of the *E.coli* and coliform bacteria cells on the filter membrane. A second approach included incubation on a nutrient agar plate for some hours to allow the detection of micro-colonies. Both approaches were optimized for the analysis of spiked water samples. The figure below compares both procedures - for the detection of *E.coli*, a green fluorescent dye was used; for the detection of coliform bacteria, a red dye.



Comparison of single cell- and micro-colony-based protocols

For the validation of the single cell protocol, the effects of heat and chlorine disinfection were tested in water samples spiked with pure cultures. The results obtained by the FISH technique were compared to results obtained by culture-based methods and by total cell counts.

After heat treatment, cells were microscopically visible by total cell counts, but no *E.coli* (green fluorescence) or coliform cells (red fluorescence) were detected by FISH or culture-based methods. This indicates that the specific FISH probes did not bind to heat treated cells and therefore that heat-killed *E.coli* and coliform cells are not detected by the FISH technique.

After chlorination, similar results were obtained for the coliform cells (red fluorescence) which were not detected by FISH after killing them by chlorination. Results with green fluorescence were more problematic. Both target and non-target cells showed a green fluorescence when they were treated by chlorination. Though the signal was slightly different from the specific *E.coli* signal, further testing was carried out with alternative green dyes to avoid false-positive results. However, the results of these tests indicated that the green dyes were unsuitable for use in chlorine disinfected samples.

It was therefore decided to use red-labelled probes for both *E.coli* and coliform cells and to carry out the analysis in two parallel samples. For micro-colony detection, the effect of chlorination is irrelevant due to pre-incubation of the bacteria on the filter. Thus, red and green labelled probes can still be used for micro-colony detection of *E.coli* and coliforms.

The TECHNEAU partners continue to develop the method to make it more practicable, including automated evaluation and counting.

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

European Water Treatment Simulator (WA5)

With growing pressures on water treatment there is now a greater need to optimise waterworks, whether to increase throughput, reduce operational costs, or minimise capital expenditure. TECHNEAU partners TU-Delft and WRc are collaborating in WP5.4 on the development of a European Water Treatment Simulator (WTS) that will enable the simulation of a virtual water treatment works to investigate and optimise performance.

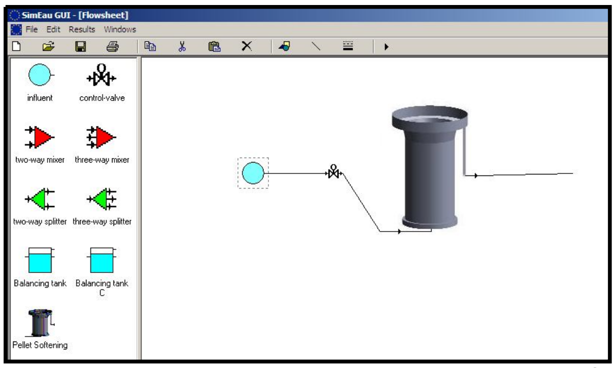
Water treatment flowsheeting packages have been available for some time. Although programs for individual treatment processes - of varying quality and in different programming languages - exist, there are only a few packages for the simulation of the entire treatment plant. The TECHNEAU research builds on these packages to develop an integrated European framework. Models describing individual or multi-unit processes will be implemented within the framework linking input and output with respect to pertinent process variables. The user of the WTS will be able to trace the fate of chemical and microbiological parameters through treatment and will also be able to visualise waste streams.

The state-of-the-art of existing water treatment simulators was reviewed in the first deliverable (D5.4.1) of this project. The review concluded that OTTER, developed by WRc, Stimela, developed by TU-Delft/DHV and Metrex, developed by the University of Duisburg/IWW were the most appropriate existing platforms to act as the foundation for the European framework.

The methodology for integration was described and discussed in the second deliverable (D5.4.2).

The third deliverable (D5.4.3) presented the conceptual design of the new modelling platform and gave an overview of the selected treatment processes and determinands. It was concluded that the WTS should be free to use, easy to handle and readily extendible with new processes and determinands if required. By calibrating and validating process models for different raw water qualities and with data from different water treatment plants, the simulator should be robust and widely applicable. In addition to existing process models, new process models will be developed within TECHNEAU describing NOM removal, biological treatment and membrane filtration.

At present a second version of the WTS is being developed. This includes the latest modelling framework, basic models for influent, flow control, flow division and mixing, and descriptions of the first process models: balancing tank, filtration and pellet softening. These process models are used to test the framework for different applications and degrees of complexity. A typical flowsheet including influent, flow control and treatment (pellet softening) is shown in the figure below.



The European Water Treatment Simulator: Example of a flowsheet for a pellet softening plant

Each process model is compiled and stored in a separate Windows DLL making it easy to extend the simulator should this be required. Models are stored as at least two files in a standard location. The first file is the compiled DLL; the second file contains information about the model, including the DLL filename and the two entry points to the DLL. One entry point is used to define and calculate the differential equations, and the second is used to assign stream output variables. At present, only one integration technique is supported, a Runge-Kutta code chosen for its suitability for moderately stiff problems.

At the start of the simulation, a process ordering algorithm is called with the aim of minimizing the number of recycle loops needing iterative solution. Because the program carries out dynamic simulation, the recycles usually vary little from one output time to another, so that a simple iterative scheme is adequate to resolve the recycles. For this reason, the process ordering algorithm is also simple, rather than the more complex approaches found for steady-state simulators.

The core modelling engine is written in Fortran, to simplify re-use of the availability of a large body of integration (and optimization) routines readily available at Netlib. The use of dynamically-linked model files, rather than the more traditional approach of containing all models within one program, has required the use of one Fortran extension, Cray pointers, to map the DLL routines to the Fortran code. Cray pointers provide, in Fortran 95, the ability to carry out the same kind of indirection as provided by pointers in the C language.

The European Water Treatment Simulator enables users to construct a virtual water treatment plant for drinking water production and to simulate its performance based on measured raw water quality. The development of the WTS will be a significant step towards the projected '2050 scenario', where it is assumed that a water treatment plant will be controlled from a central control centre. The system can then evaluate the effects of control decisions for future decision-making processes, leading to an increase in knowledge about the treatment plant.

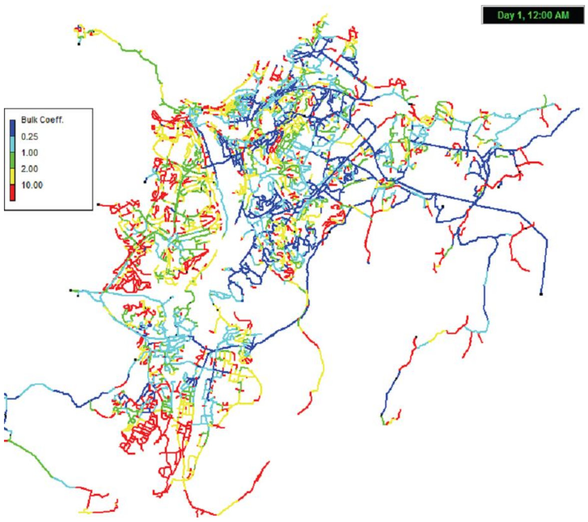
Simulation of Water Quality Changes in Networks (WA5)

The TECHNEAU Water Quality Model (WQM) framework has been developed in WA5 (WP5.5/5.6). The WQM comprises a water quality modelling framework based on an event-driven, hydrodynamic water supply network model. It provides a basis for the integration of the results of research being carried out in TECHNEAU into specific physicochemical and microbiological processes taking place in the water and the network. Individual models describing phenomena such as biofilm regrowth, corrosion and sedimentation will be incorporated into the WQM framework as they become available.

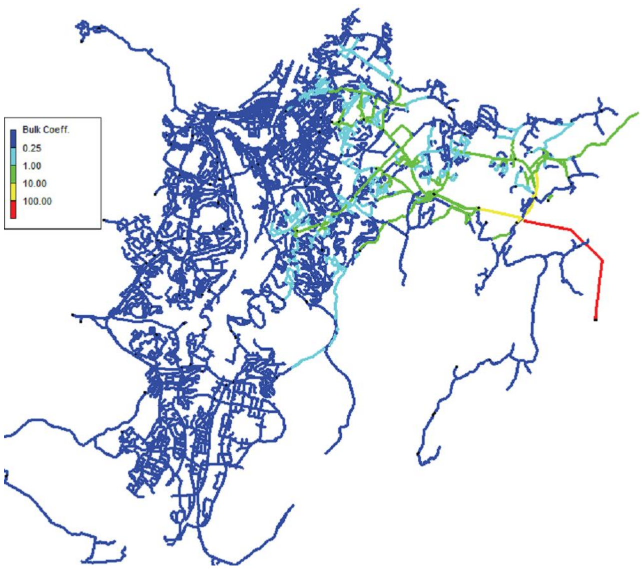
The WQM includes a hydrodynamic model based on Epanet 2.0 and makes available the Epanet MSX multi-species water quality programming library. This allows users of the WQM to specify any water quality process at run time, with full flexibility to change and adjust the model and re-test as needed. The framework provides a graphical and numerical user interface for result analysis. A network mapping facility, for spatial visualization of results, is under development.

At present, the WQM framework is available as a hydrodynamic model and includes one prototype process module which simulates biofilm regrowth in the network.

Although not yet ready as final versions for inclusion in the TECHNEAU WQM framework, some preliminary tests on the practical application of the corrosion and biofilm regrowth models have been carried out. Typical results are shown in the figures below simulating corrosion and biofilm regrowth in the Trondheim water supply network.



Simulated corrosion in the Trondheim network (Bruaset, 2008)



Simulated biofilm regrowth in the Trondheim network (Bruaset, 2008)

Particle Behavior and Sedimentation in Networks (WA5)

Particle behavior and sedimentation in networks is an important research topic in TECHNEAU, in terms of both understanding and modeling the phenomena as well as optimizing cleaning programmes.

A model describing particle behaviour and sedimentation in the network is being developed in WP5.5 and will be incorporated into the WQM framework (see **Water Quality Changes in Networks Simulated**).

On a practical level, a method for optimizing cleaning of networks has been demonstrated in WA5 and will be included in WA7 Case Studies. The Resuspension Potential Method (RPM) measures turbidity as networks are systematically flushed and identifies sections of the network that are most at risk from sedimentation. An optimum cleaning programme is developed that specifies flushing frequencies throughout the network.

The Resuspension Potential Method has been demonstrated successfully in the Lisbon and Riga Case Studies (see figure). In 2009, further testing is planned in the Bergen Case Study.


Equipment developed for RPM measurements in the Lisbon Case Study

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

TECHNEAU Case Studies - Demonstration of Project Outputs (WA7)

TECHNEAU is now in its fourth year and a large number of project outputs - tools, procedures and technologies - have been developed in Work Areas 1-6. These outputs have been tested within their respective Work Areas. Many have been selected for wider demonstration and validation in the integrated large-scale case studies being carried out in WA7.

Six case studies have been selected to demonstrate the application of a wide range of TECHNEAU outputs:

- Windhoek Case Study: Demonstration of a multi-barrier approach to reclamation and treatment of wastewater to produce drinking water (Case Study Leader: Swartz; End-user: Windhoek Goerangab Operating Company (WINGOC))

- Lisbon Case Study: Implementation of a monitoring and management strategy to understand and reduce the risk of release of pathogens from biofilms (Case Study Leader: LNEC; End-user: EPAL)

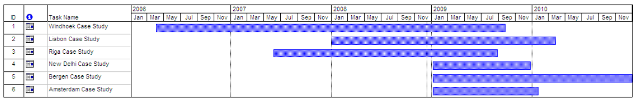
- Riga Case Study: Implementation of a monitoring and management strategy to reduce the risk of water quality deterioration in distribution networks (Case Study Leader: RTU; End-user: Riga Water)

- New Delhi Case Study: Demonstration of monitoring and analysis and feasibility of the OBM process for developing and newly-industrialised countries (Case Study Leader: KWB; End-user: Veolia India)

- Bergen Case Study: Optimisation of operation and maintenance of water treatment plants and water distribution systems (Case Study Leader: SINTEF; End-user: Bergen Municipality / Bergen Water)

- Amsterdam Case Study: Integrated, sustainable and optimised operation of drinking water treatment, with emphasis on achieving biostability in distribution (Case Study Leader: TUD; End-user: Waternet)

The case studies are at various stages, with Windhoek, Lisbon and Riga all well underway and New Delhi, Bergen and Amsterdam at the early stages of planning, as indicated below.



WA7 Case Studies Gantt chart

The case studies have been selected to provide demonstration of as wide a range of TECHNEAU outputs as possible under a range of applications. In total, 47 outputs are being demonstrated in the six case studies by 19 partners.

Details and results from the case studies will be highlighted in future issues of the Newsletter, with Windhoek and Riga featured in Newsletter 7.

For further information contact Ian Walker, WA7 Leader, or visit the TECHNEAU website (www.techneau.eu).

Forthcoming Events

- **16-22 March 2009**

5th World Water Forum
Organiser: World Water Council, General Directorate of State Hydraulic Works, Municipality of Istanbul
Host: Istanbul, Turkey
Further information: http://www.worldwaterforum5.org/

- **17 March 2009**

Session at the 5th World Water Forum (see above)
European Water Research: Highlights from TECHNEAU, SWITCH and RECLAIM WATER

- **2-3 April 2009**

2nd European Water Conference 2009
Organiser: EC DG Environment
Host: Brussels, Belgium
Further information: **www.semide.net/thematicdirs/events/2nd-european-water-conference-2009**

- **8-10 June 2009**

6th IWA/GRA Specialised Conference on Assessment and Control of Micropollutants / Hazardous Substances in Water
Organiser: IWA, Groundwater Resources Association of California
Host: Hyatt Regency Hotel, San Francisco
Further information: www.grac.org/micropol.asp

- **17-19 June 2009**

1st TECHNEAU Conference: Safe Drinking Water from Source to Tap - State-of-the-Art and Perspectives
Organiser: RWTH Aachen University
Host: Crowne Plaza, Maastricht, The Netherlands
Further information: Christian Kazner (Christian.Kazner@avt.rwth-aachen.de)

- **23-25 June 2009**

Singapore International Water Week: Water Convention 2009
Organiser: PUB, IWA
Host: Suntec Singapore
Further information: www.siww.com.sg/waterconvention.php

TECHNEAU Delivered!

The TECHNEAU project has been running for 3 years and the number of available publications increases week-by-week. Publications are issued on the TECHNEAU website (www.techneau.eu) and can be downloaded free-of-charge. Publications available up to December 2008 are listed below.

Report Number	Title
	WA1 Rethink The System
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/b	Spain - A TECHNEAU Case Study: Phases I & II - Climate Change
D1.1.6c	Long Term Effects of Climate Change on Europe's Water Resources (Romania)
D1.1.7	Global Trends Affecting the Water Cycle: Winds of Change in the Water World
D1.1.9	Trend Report: Report on Trends Regarding Future Risks
D1.1.11	Organisation and Financing Models of the Drinking Water Sector: Review of Available Information on Trends and Changes
D1.1.12	Report on Consumer Trends: Cross-cutting Issues Across Europe
D1.1.13	Existing Foresight Studies: A Literature Review
D1.1.14	Trend Report: The Netherlands
D1.2.1	Adaptive Strategies: Integrated Approach and Flexibility under recognition of Local Conditions
	WA2 Treatment Technologies
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
D2.3.1.1	Organic Micropollutants with Nanofiltration
D2.3.1.2	A Nanofiltration Retention Model for Trace Contaminants in Drinking Water Sources
D2.3.1.3	Influence of Electrostatic Interactions on the Rejection with NF and Assessment of the Removal Efficiency during NF/GAC Treatment of Pharmaceutically Active Compounds from Surface Water
D2.3.2	Coagulation Pre-treatment for Microfiltration with Ceramic Membranes
D2.3.2.1	Ceramic Microfiltration as the First Treatment Step in Surface Water Treatment
D2.3.2.2	Removal of Particulate Matter by Ceramic Membranes during Surface Water Treatment: Interim Report
D2.3.2.3	Superground PAC in Combination with Ceramic Microfiltration
D2.3.3.5a	Case-Related Protocol for Optimal Operational Conditions to Treat Filter Backwash Water
D2.3.3.5b	Ceramic Membrane Applications for Spent Filter Backwash Water Treatment

D2.4.1.1	UV Disinfection and UV/H_2O_2 Oxidation: By-product Formation and Control
D2.4.1.2	Fenton Process for Contaminant Control
D2.4.2.5	Modelling Micropollutant Removal by Ozonation and Chlorination in Potable Water Treatment
D2.4.2.6	Modelling of Micropollutant Removal by Ozonation and Chlorination in Potable Water Treatment
D2.5.3	International Market Survey on Membrane-based Products for Decentralised Water Supply: Bibliographic Report
D2.5.4	Decentralised Water Supply and Membrane Processes: Workshop
WA3 Monitoring And Control Technologies	
D3.1.1/2	Monitoring and Control of Drinking Water Quality: Selection of Key Parameters
D3.1.3	Monitoring and Control of Drinking Water Quality: Inventory and Evaluation of Monitoring Technologies for 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
D3.2.5	Interim SOP for HPLC-based Analysis of New Algal Toxins (Dissolved State) in Natural Waters
D3.2.7	Redesigned Monitoring Station based on UV/Vis Spectrometry
D3.3.1	A Flow Cytometric Method for AOC Determination
D3.3.2	Feasibility Report of a Quantitative Method for Rapid Assessment of Microbial Population Composition in Drinking Water using Flow Cytometry combined with FISH
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
D3.3.8	Cultivation-independent Assessment of Viability with Flow Cytometry
D3.3.9	A Report on the Growth of Pathogenic Bacteria on Natural Assimilable Organic Carbon
D3.3.10	A Comparison of AOC Methods used by the Different TECHNEAU Partners
D3.3.12	Development of a Toolbox for Identifying and Quantifying Membrane Biofouling in Drinking Water Treatment
D3.4.6	Odour and Flavour Tests: Human Panel and Electronic Testing Compared
D3.5.1	Development of FISH Methods for Detection of Pathogens in Biofilm
D3.5.2	UV-Vis Monitoring Station for Calculating 'Integrated Parameters'
D3.5.3	Detection of Number and Viability of *E. coli* and *A. hydrophila* with the FISH Technique
D3.5.5	Portable Monitoring Station
D3.6.8.1	Survival of *E. coli* in Drinking Water Biofilm: The Application of the FISH Technique
D3.6.8.2	Fate of *E. coli* in Biofilm of Water Treatment Plant and Distribution Networks: The Application of the FISH Technique
WA4 Risk Assessment And Risk Management	
D4.1.1/2	Identification and Description of Hazards for Water Supply Systems: A Catalogue of Today's Hazards and Possible Future Hazards
D4.1.3 / D4.2.1/2/3	Generic Framework and Methods for Integrated Risk Management in Water Safety Plans
WA5 Operation And Maintenance	
D5.2.1	Results of Background Work and Data Integration of MAR Systems for an Integrated Water Resources Management
D5.2.2	Inorganic Substances and Physiochemical Parameters listed in Indian and German Drinking Water Standards: Preliminary Report
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
D5.3.2	Water Treatment by Enhanced Coagulation and Ozonation-Biofiltration: Intermediate Report on Operation Optimisation Procedures and Trials
D5.3.4a	Ultrafiltration with Pre-Coagulation in Drinking Water Production: Literature Review
D5.3.4b	Nanofiltration in Drinking Water Treatment: Literature Review
D5.3.5a	Ultrafiltration with Pre-Coagulation in Drinking Water Production: Survey on Operational Strategies
D5.3.5b	Nanofiltration for Removal of Humic substances: Survey on Operational Strategies
D5.3.6a	Ultra- and Nanofiltration in Water Treatment: Workshop
D5.3.8	Impact of Chlorination on the Formation of Odour Compounds and their Precursors in Treatment of Drinking Water
D5.3.10	Backwash Characteristics of Granular Activated Carbon (GAC) from Asia
D5.4.1	Models for Drinking Water Treatment: Review of State-of-the-Art
D5.4.1a	International Workshop on Treatment Simulators: Review
D5.4.2	Models for Drinking Water Treatment: Methodology for Integration
D5.4.3	Conceptual Design of Modelling Framework
D5.4.4	TECHNEAU Water Treatment Simulator: Modelling Framework (Version 1.0)
D5.5.1	Particles in Relation to Water Quality Deterioration and Problems in the Network
D5.5.3	Database on the Formation of Sediment in Drinking Water Distribution Systems
D5.5.4	Methodology of Modelling Bacterial Growth in Drinking Water Systems
D5.5.5	Review and Selection of Monitoring Parameters and Methods

D5.5.9	Modelling Planktonic and Biofilm Growth of a Monoculture (*P. fluorescens*) in Drinking Water
D5.6.1 / D5.6.2	Report on Operational Methods and Maintenance Schemes: Applied in Praxis and Compared to Best Practice
WA6 Consumer Acceptance And Trust	
D6.1.1	Assessing Consumer Trust and Confidence: Methods Appropriate for the Water Utilities
D6.1.2	Consumer Trust and Confidence: An Overview
D6.1.6	Stakeholder Interviews: Final Report
D6.2.1	Consumer Preferences: An Overview
D6.2.2	Assessing Consumer Preferences for Drinking Water Services: An Overview
D6.2.6	Stakeholder Interviews: Final Report
WA8 Dissemination And Training	
D8.1.1	Scan of Promising Technologies in the SME Network

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 KWR
Project Duration: 1st January 2006 to 31st December 2010