TECHNEAU NEWSLETTER
July 2010

Welcome to the ninth 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 10 scheduled for December 2010.

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 9 highlights recent activities and outputs from TECHNEAU. The Newsletter can be downloaded from the TECHNEAU website (www.techneau.eu) 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: Advances in 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 eighth RTP was held in Tel Aviv, Israel on 9 June 2010, hosted by Mekorot, the Israeli National Water Company. The RTP focused on 'Advances in Technology for Safe Drinking Water under Water Scarcity Conditions', highlighting the challenges faced in water stressed regions arising from climate change and increasing water scarcity.

The RTP included presentations from local and international water experts that highlighted specific aspects of water treatment and distribution in Israel as well as relevant research 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 KWR
Project Duration: 1st January 2006 to 31st December 2010

Dr Bracha Limoni-Relis (Mekorot) addresses delegates at the eighth TECHNEAU RTP held in Tel Aviv, Israel

Until recently, Israel had three drinking water sources: Lake Kinneret - the main source providing drinking water to about a quarter of Israel's population - groundwater and spring water. However, Israel's water demand exceeded that available from these sources and the country is developing desalination technologies to produce drinking water from seawater and brackish water. Desalination is expected to become the major source of drinking water in Israel

The current decade has seen substantial investment in infrastructure development to satisfy the growing demand for water and to improve water quality:

- In 2002, following a prolonged drought (1998-2002), the government enacted the construction of five large seawater desalination plants along the Mediterranean coast. These reverse osmosis installations will supply 305M m^3/yr of drinking water by the end of 2010. Three plants at Ashkelon, Palmachim and Hadera are in operation and two others are

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under construction. In addition, there are around 30 small desalination plants producing about 30M m^3/yr, mostly from brackish water.

- Mekorot is planning to invest in a new national water distribution system which will include several east-west arteries complementing and partly substituting for the National Water Carrier. The new pipelines will supply drinking water from the five seawater desalination plants to most of the country's population.

In order to maintain security of the water supply and water quality, Mekorot has developed a comprehensive water security strategy which combines various barriers, early warning systems and response protocols:

- Barriers include physical protection of the water infrastructure, physical and electronic devices to prevent unauthorized contact with the drinking water and backflow prevention devices at strategic points to protect the main water systems.
- The early warning system comprises dozens of on-line stations located along the distribution system continuously monitoring water quality. At central junctions, water quality is assessed by measurement of conventional parameters, bioassays and specific sensors.
- A number of on-line early warning biomonitoring technologies using local fish and invertebrate organisms have also been installed. The biomonitor organisms were selected for their resilience to changes in water characteristics - particularly salinity - due to blending waters from different sources (surface water, groundwater and desalinated water). In addition, the application of biomonitors in distribution necessitated prior treatment of the sampled water to remove carbon dioxide (from groundwater) and chlorine to protect the organisms.
- Procedures and protocols have been developed and implemented which determine measures for an alarm response in case of contamination.

Several presentations from the TECHNEAU consortium and from other EU-projects disseminated research results with special relevance for the region:

- Israeli research into membrane bioreactors (MBRs) for pretreatment of seawater prior to desalination was described. This work - part of the EU-funded Medina project - focused specifically on the reduction of TOC levels and nutrients, and included testing of a laboratory-scale MBR at the Ashkelon desalination plant.
- Application of the TECHNEAU Water Safety Plan (WSP) toolbox.
- Application of TECHNEAU tools to monitor drinking water quality - the EDC toolbox and fish biomonitor.
- Application of TECHNEAU tools in the modelling of bacterial transport in water distribution.
- Discussion of micropollutants in the urban water cycle and removal options in advanced wastewater treatment (EU-funded Neptune project and the Swiss FOEN Strategy Micropoll project).

The workshop also discussed other relevant issues including the identification and removal of odorous compounds from water and the role of modelling in the management and operation of water supply systems.

The RTP provided an intensive insight into the enormous challenges faced by Israel to assure the drinking water supply of its population and facilitated a lively exchange between TECHNEAU and regional water experts from Mekorot, research institutes and local universities.

Many participants expressed a strong interest in results from TECHNEAU and the possible application of new technologies developed within the project. Opportunities for future co-operation will be explored by the Israeli project partner, Mekorot.

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

Work Area Highlights

TKI: TECHNEAU Knowledge Integrator Launch (WA7)

The TKI - TECHNEAU Knowledge Integrator - is an intelligent decision-support tool developed to enable users to access water-related information easily and quickly.

TKI Home Page

The TKI has been developed by TECHNEAU Partners in WA7 using Zope and Plone - open source content management software - and populated with deliverables generated in other work areas and sourced externally.

Information stored in the TKI is accessed by either of two search methods: a simple free-text search of abstract and document text, or an advanced search where the user is prompted to select keywords from a hierarchical list covering water supply from source to tap. An appropriate list of 'hits' is returned which may include TECHNEAU deliverables as well as links to key external documents and websites.

Information is stored as topic-related 'Knowledge Packages' that include one or more related documents. As well as TECHNEAU Knowledge Packages, external 'Key Knowledge Packages' have been/are being developed covering key areas including:

- Water-related legislation and guidelines
- Risk assessment/water safety plans
- Treatment and distribution
- Sampling, monitoring and analysis
- Small and private water supplies
- Water-related microbiology

These Key Knowledge Packages provide an overview of the topic areas with links to key documentation and websites. The range and scope of the Knowledge Packages will be extended based on feedback from users and with the assistance of TECHNEAU partners. External content from other water-related EU projects will be sought and encouraged.

Users can access the TKI from the internet (http://tki.techneau.org) or from a link on the TECHNEAU website. A comprehensive user guide can be downloaded from the home page.

For further information contact Ian Walker, WA7 Leader, Glenn Dillon, TKI Content Manager (glenn.dillon@wrcplc.co.uk) or visit the TECHNEAU website (www.techneau.eu).

Windhoek Case Study: Multi-barrier Treatment of Wastewater Provides Safe Drinking Water (WA7)

In water-stressed regions where natural water resources are limited, the treatment and recycle of wastewater is increasingly considered as an option. The Windhoek Case Study demonstrates a multi-barrier approach to the reclamation and treatment of wastewater to produce drinking water at the New Goreangab Water Reclamation Plant (NGWRP), Windhoek, Namibia.

TECHNEAU Partners undertook a series of sampling and monitoring campaigns at the NGWRP to determine the overall performance of the plant, as well as that of selected unit processes, for the removal of specific emerging and conventional contaminants. In addition to the data collection and analysis, a risk assessment was carried out to highlight potential hazards in the treatment train.

Risk assessment
As a first step in the risk assessment, a Hazard and Critical Control Point (HACCP) analysis was carried out to determine the main critical control points in terms of risks to health. The risks indentified were prioritized in a risk matrix that considered both occurrence and consequence of the risks. This initial risk assessment - carried out Chris Swartz Water Utilisation Engineers, Chalmers University and the case study end-user WINGOC (Windhoek Operating Company) - identified weaknesses in the treatment train in terms of microbiological and chemical monitoring.

The risk assessment was subsequently extended to include Fault Tree Analysis (FTA). FTA attempts to quantitatively determine the probability of specific 'high level' hazards by considering the probabilities of lower-level contributory events. Chalmers University completed the framework for the FTA and this was forwarded to WINGOC and CoW (City of Windhoek) to be populated with risk data. The risks will now be modelled and the results discussed with WINGOC to identify risk reduction measures to address the high risk areas.

Sampling
A third sampling campaign was designed to address the weaknesses identified by the risk assessment, as well as to elucidate the results of two previous campaigns. The third campaign was carried out during the period 28 September - 8 October 2009 and demonstrated a range of monitoring, sampling and analytical techniques developed in TECHNEAU.

Analysis
EDC analysis (BDS, Anjou/Veolia) was performed using methodologies developed in TECHNEAU. A total of seven samples were taken after different unit processes in the NGWRP treatment configuration and submitted to the CAE Laboratory (Anjou/Veolia) for extraction. Portions of the extracted samples were analysed by BDS and Anjou/Veolia. As with the first and second sampling campaigns, estrone and nonylphenols were detected in the blended raw water, but no EDCs were detected in the process waters or final water.

The CAE Laboratory also analysed for phenols and bromates. Bromates showed elevated levels after ozonation and in the final water. The results will be correlated with operating conditions at the time of sampling and process changes investigated.

Algal toxins were analysed by TZW who had performed a number of pre-tests earlier in the year and again before the third sampling campaign to confirm the presence and toxicity of algae. During the third sampling campaign, a significant algal bloom was present at the Goreangab Dam. Samples were submitted to TZW for measurement of microcystin and other algal toxins using methods developed in TECHNEAU.

Chris Swartz (Chris Swartz Water Utilisation Engineers) inspects the algal bloom at the Goreangab Dam

AOC analysis was carried out by EAWAG. EAWAG had previously performed AOC analysis on samples from Windhoek with good correlation of the results with BDOC analysis carried out by CoW. The results of the AOC analysis from the third sampling campaign again showed good correlation with CoW BDOC measurements.

The 'Hemoflow' crossflow ultrafiltration membrane system, developed by KWR, was used to concentrate samples for analysis of viruses and phages. Samples were subsequently analysed by

KWR with duplicate analysis carried out by CoW and the University of Pretoria, South Africa, to compare the different methodologies.

The micro-colony based FISH (fluorescent in-situ hybridisation) method was used to determine pathogens in the source and process waters. The sampling methodology, developed by Vermicon, was used in the laboratories of CoW by TZW and the actual identification done in TZW laboratories in Karlsruhe, Germany. CoW also determined total coliforms and E. coli in their Windhoek laboratory to compare the results of the different procedures.

Monitoring
Two S::can UV/Vis spectrometers were evaluated over a period of six months, starting three months before the sampling campaign. One probe was used to monitor the raw water sources while the second was installed for monitoring final water quality. On-line measurements from the instruments are being compared with the results of discrete samples taken and analysed by CoW before and during the third sampling campaign.

Workshops
Two workshops are planned to disseminate the results of the case study and the technologies and methodologies developed in the TECHNEAU project. A two-day training seminar/workshop will be held in Pretoria, South Africa on 12-13 October 2010. This will be followed by a workshop held in Windhoek, Namibia on 15 October 2010.

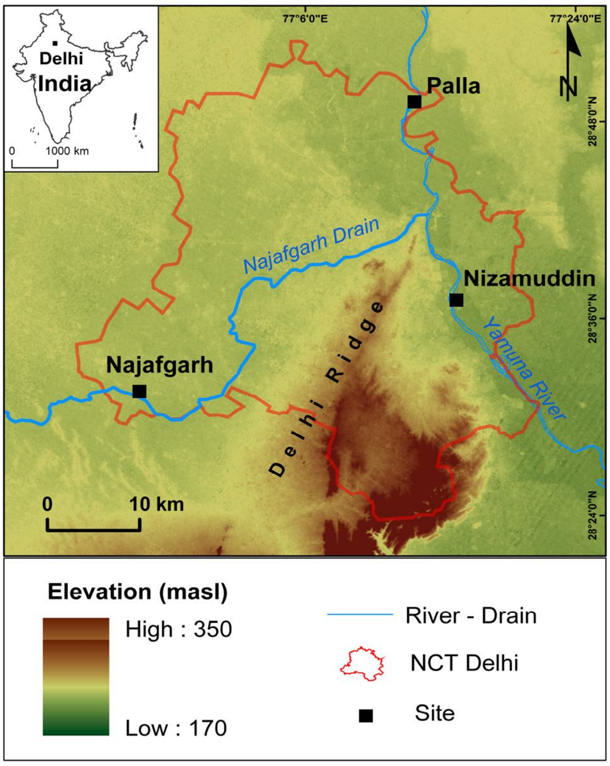
For further information contact Ian Walker, WA7 Leader, Chris Swartz, Windhoek Case Study Leader (cswartz@mweb.co.za) or visit the TECHNEAU website (www.techneau.eu).

New Delhi Case Study: Benefits and Constraints of River Bank Filtration (WA7)

River bank filtration (RBF) has been used as a natural water treatment process for drinking water production in Europe since the beginning of industrialisation in the 19th century. Compared to conventional water treatment, RBF is a simple low-cost technology with considerable potential for developing and newly-industrialized countries, particularly with regard to meeting the United Nations Millennium Development Goals and coping with future challenges resulting from climate change.

TECHNEAU Partners investigated RBF in WP5.2 and the New Delhi Case Study (WP7.9) and demonstrated benefits and constraints under a wide range of environmental conditions. In Delhi, as in many parts of north India and worldwide, freshwater resources are stressed by intensive land use and rapid industrial and population growth.

From 2006, field investigations and monitoring programmes were carried out in Delhi at three bank filtration sites: Najafgarh, Nizamuddin and Palla (see Figure).



Location of the Delhi field sites with the main geomorphological and hydrological features (modified after Lorenzen & Sprenger 2008)

The efficiency of RBF as a treatment (or pre-treatment) for drinking water production was shown to be very site-specific, depending on the local geology and source water quality. In Delhi, the parameters that may limit the capabilities of bank filtration were identified as:

- Surface water quality Due to the high proportion of untreated waste water and fertilizers in the Yamuna River at the Nizamuddin site, ammonia levels around 15 mg/L were measured in river water. The degradation of organic matter during underground passage further increased ammonia concentrations in the bank filtrate.
- Groundwater quality Saline and brackish groundwater at the Najafgarh site with chloride concentrations up to 3015 mg/L (for shallow groundwater) would require energy-consuming treatment (i.e. reverse osmosis) to produce drinking water.
- Aquifer geochemistry Reductive dissolution of iron hydroxides at the Nizamuddin site resulting in mobilization of iron, manganese and arsenic, necessitating post-treatment.

Despite these constraints, benefits of RBF were identified such as the efficient removal of suspended solids, algal toxins, some trace organics and pathogens, even after short travel times (e.g. 5-log removal of bacteriophages after 5 m of travel distance) (Sprenger *et al.*, 2008). Table 1 shows contaminants relevant for developing and newly industrialized countries and their corresponding removal by RBF (from Huelshoff *et al*., 2009).

Table 1 RBF removal of contaminants

Parameter	Relevance for developing countries	Relevance for newly industrialized countries	Bank filtration removal
Suspended solids	High	High	Good
Pathogens	High	High	Good
Algal toxins	High	High	Good-to-moderate
Nutrients	High	High	Poor
Anions and cations	Low	Low	Poor
Heavy metals (geogenic)	High	High	Moderate-to-poor
Heavy metals (anthropogenic)	Low-to-moderate	High	Site-specific
Pesticides	Low	High	Site and substance specific
Chlorinated hydrocarbons	Low	High	Moderate-to-poor
Aromatic hydrocarbons	Low	High	Moderate
Endocrine disrupting chemicals	Low	High	Good-to-moderate
Pharmaceuticals	Low	Low-to-moderate	Site and substance specific
Disinfection by-products	Low	Moderate-to-high	Moderate-to-good (preferably under anoxic conditions)

To complement these field investigations and to better characterize the water quality, monitoring tools developed within TECHNEAU WA3 were integrated into the case study. Two short sampling campaigns were organised in 2009 (before and after monsoon events) to measure EDC activity using the CALUX method (BDS) and to analyse algal toxins (TZW). Results confirmed the significant levels of contamination at the Nizamuddin site and the requirement for significant post-treatment for drinking water production.

One possible post-treatment option is the OBM (Oxidation-Biofiltration-Membrane) process developed in WA2. The feasibility of this process for the Nizamuddin site - and more generally for developing countries - was investigated by SINTEF.

The OBM process is a robust “multi-barrier” treatment incorporating oxidation, biofiltration and membrane filtration. SINTEF carried out a desk study to investigate the feasibility of the OBM process for the Nizamuddin site. The removal of the different contaminants present in river bank filtrate at Nizamuddin was evaluated by each treatment step within the OBM process (Table 2). With the exception of fluoride, all the evaluated contaminants could potentially be removed by the OBM process. With additional treatment, such as activated alumina filtration or coagulation, treatment could potentially be improved to provide a safe drinking water.

Table 2 Potential treatment of RBF water at the Nizamuddin site by the OBM

	Oxidation	Biofiltration	Membrane filtration
Turbidity	None	Low	High
Particles	None	Low	High
Viruses	High	None	Low to Good depending of the pore size
Bacteria	High	Low to Good	High
Pathogens	High	None	High
DOC	Low but modification	Low to Good	None
Iron	High	Good	None
Manganese	Good	Good	None
Ammonia	Low to Good	Low to Good	None
Arsenic	Low	Low to Good	None
Fluoride	None	None	None

In conclusion, RBF in conjunction with post-treatment such as OBM could provide safe drinking water from significantly contaminated source water. It must be noted, however, that the OBM desk study was qualitative and that a programme of pilot trials would be needed to confirm performance and design parameters.

References

Lorenzen, G. Sprenger, C. (2008). Results of background work and data integration
of MAR systems for an Integrated Water Resources Management. TECHNEAU Report D5.2.1

Huelshoff, I., Greskowiak, J., Wiese, B. & Gruetzmacher, G. (2009). Relevance and opportunities of RBF to provide safe water for developing and newly industrialised countries. TECHNEAU Report D5.2.9.

Pekdeger, A., Lorenzen, G. & Sprenger, C. (2008). Preliminary report on data of all inorganic substances and physicochemical parameters listed in the Indian and German Drinking Water Standards from surface water and groundwater at the 3 (+1) field sites. TECHNEAU Report D5.2.2.

Sprenger, C., Lorenzen, G. & Pekdeger, A. (2008). Occurrence and fate of microbial pathogens and organic trace compounds at riverbank filtration sites in Delhi, India. TECHNEAU Report D5.2.6.

For further information contact Ian Walker, WA7 Leader, Gesche Grützmacher, New Delhi Case Study Leader (gesche.gruetzmacher@kompetenz-wasser.de) or visit the TECHNEAU website (www.techneau.eu).

First Consumer Workshops held in Cyprus (WA6)

The first two of a series of TECHNEAU workshops aimed at informing industry representatives of the outcomes of the TECHNEAU project took place in Limassol and Nicosia in early April. It was pleasing to note that participants included representatives from Northern Cyprus as well as a range of representatives of the local water suppliers, regulators and health professionals.

The workshops were a mix of research presentations with debates and 'hands-on' scenario management exercises. One of the scenarios involved a simulated 'real-time' crisis management exercise where participants were required to deal with a contamination event under time pressure. The scenarios were based on a mix of real-life contamination incidents from around the world and posed particular consumer communication problems. A second scenario required participants to explore water conservation initiatives based around changing behaviours rather than seeking technical solutions to shortage problems.

Thanks are due to Prof Antonis Theocharous at Cyprus University of Technology in Limassol and Prof Manfred Lange of the Cyprus Institute, Nicosia for kindly hosting the two events.

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

Forthcoming Events

- **19-24 September 2010**

IWA World Water Congress and Exhibition: Water - The Lifeblood of the World
Organisers: IWA, CWWA, CAWQ
Host: Montreal, Canada
Further information: www.iwa2010montreal.org

- **27-28 September 2010**

4th European Water and Wastewater Management Conference
Organiser: Aqua Enviro Technology Transfer
Host: Royal Armouries, Leeds, United Kingdom
Further information: www.ewwmconference.com

- **27-28 October 2010**

13th Aachener Membran Kolloquium
Organiser: AachenVerfahrentechnik, RWTH Aachen Universtiy
Host: VIVTA - Verein zur Förderung des Instituts für Verfahrenstechnik der RWTH Aachen
Further information: www.amk.rwth-aachen.de

- **10-12 November 2010**

IWA Water and Energy Conference 2010
Organiser: IWA
Host: Amsterdam, The Netherlands
Further information: www.moorga.com

TECHNEAU Delivered!

The TECHNEAU project has been running for over 4 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 June 2010 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
D1.3.1	Case Study Report Sub-Saharan Africa: Assessing Validity of Adaptive Strategies
D1.3.2	Case Study Report Baltic States: Development of Adaptive Strategies (Latvia)
D1.3.3	Case Study Report Brabant Water: Flexibility Enhancing Adaptations
D1.3.4	Case Study Report Cyprus: Flexibility in Coping with Water Stress and Integration of Different Measures
D1.3.6	Adaptive Strategies: Integration in Work Area 7
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
D2.1.3/4/5/6	Pre-Filtration for SWRO Membranes: Comparison of Cartridge Filters and a Novel Pre-Filter Design
D2.2.3	Comparison of Polymeric and Ceramic Membrane Filtration for Particles Removal in the OBM
D2.2.4	Comparison of Different Oxidation Processes for the OBM
D2.3.1.1	A Semi-Quantitative Method for Prediction of the Rejection of Uncharged 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
D2.3.2.6	Combination of Fenton Oxidation Process and Ceramic Nanofiltration
D2.3.2.7	Removal of Phages and Nanoparticles by Ceramic Membranes
D2.3.3.1	Treatment of Trace Organics in Membrane Concentrate
D2.3.3.5a	Ceramic Membranes: 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
D2.4.1.2/3	Fenton Process for Contaminant Control
D2.4.1.5	Assessment of the UV/TiO_2 Oxidation Process
D2.4.1.6	Effect of UV/TiO_2 in Combination with Different Oxidants on NOM removal
D2.4.1.7	Performance of the UV/TiO_2 Photocatalytic Oxidation Process for Micropollutants Removal in Drinking Water
D2.4.2.3	Comparison of Ozonation and AOPs in Various Waters and Assessment of Oxidation Efficiency
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
D2.5.4	Decentralised Water Supply and Membrane Processes: Workshop
D2.5.5	Preparation of the Demonstration Study of Compact Units for Decentralised Supply
D2.5.9	Scaled-up Trials with a Gravity-driven Ultrafiltration Unit in France
D2.5.11	Decentralised Water Supply: International Networks and TECHNEAU Activities - Workshop
D2.5.13	Development of UV-LED Disinfection
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
D3.1.4	Concepts for Data Evaluation

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
D3.2.6	Final SOP for HPLC-based Analysis of Cell-bound and Dissolved Nodularin in Natural Waters
D3.2.7	Redesigned Monitoring Station based on UV/Vis Spectrometry
D3.2.9	Final SOP for HPLC-based Analysis of Saxitoxins (Cell-bound and Dissolved State) in Natural Waters
D3.2.10	Final SOP for HPLC-based Analysis of Amino-acid-like Algal Toxins (Cell-bound and Dissolved State) in Natural Waters
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
D3.3.13	Characterisation of Biofouling on Hollow Fibre Membranes using Confocal Laser Scanning Microscopy and Image Analysis
D3.3.14	A Report on Bioassay to Estimate the Growth Potential of Pathogenic Bacteria in Drinking Water
D3.4.6	Odour and Flavour Tests: Human Panel and Electronic Testing Compared
D3.4.12	Monitoring of Toxins in Drinking Water by the ToxProtect64 Fish Monitor
D3.4.15	Validation of the FISH-based Detection and Quantification of E.coli and Coliform Bacteria in Water Samples
D3.4.17	Automated Quantification of FISH-labelled Bacteria
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
D3.5.4	Integrated UV-Vis Parameters for Distribution Network Monitoring
D3.5.5	Portable Monitoring Station
D3.5.6	Redesigned Monitoring Station and Central Station for Monitoring of Integrated UV/Vis Parameters

D3.6.2.1b	A Novel Assay to Detect Genotoxicity
D3.6.3.4	Monitoring of Toxins in Drinking Water by the ToxProtect64 Fish Monitor: Training Material for End Users
D3.6.5.1	A Comparison between AOC, FCMTCC and Conventional Drinking Water Parameters
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
D3.6.8.5	Rapid and Specific Quantification of Indicator Bacteria in Biofilms and Water Concentrate
WA4 Risk Assessment And Risk Management	
D4.1.3 / D4.2.1/2/3	Generic Framework and Methods for Integrated Risk Management in Water Safety Plans
D4.1.4	Identification and Description of Hazards for Water Supply Systems
D4.1.5a	Risk Assessment Case Study: Goteborg, Sweden
D4.1.5b	Risk Assessment Case Study: Bergen, Norway
D4.1.5c	Risk Assessment Case Study: Amsterdam, The Netherlands
D4.1.5d	Risk Assessment Case Study: Freiburg-Ebnet
D4.1.5e	Risk Assessment Case Study: Breznice, Czech Republic
WA5 Operation And Maintenance	
D5.1.2	Framework for Operational Cost Benefit Analysis in Water Supply
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
D5.2.3	Analysis of the Vulnerability of Bank Filtration Systems to Climate Change
D5.2.5	Bank Filtration Simulator: Manual
D5.2.6	Occurrence and Fate of Microbial Pathogens and Organic Trace Compounds at RBF Sites in Delhi, India
D5.2.9	Relevance and Opportunities of Bank Filtration to Provide Safe Water for Developing and Newly Industrialised Countries
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
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D5.3.4a	Ultrafiltration with Pre-Coagulation in Drinking Water Production: Literature Review
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D5.3.7a	Input for Process Simulator
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D5.4.2	Models for Drinking Water Treatment: Methodology for Integration
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D5.4.4	TECHNEAU Water Treatment Simulator: Modelling Framework (Version 1.0)
D5.5.1/2	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
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WA6 Consumer Acceptance And Trust	
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WA7 Integrate, Validate and Demonstrate	
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