



1 Editorial

Dear reader,

As DEMEAU is nearing completion, it is a good time to reflect and look back on our achievements and the way we got there.

First, our achievements. At the start of DEMEAU, we promised to push emerging pollutant related treatment and monitoring technologies from previous FP projects further to the application by water utilities and policy makers.

In 2014, the Dutch water supply company PWN opened their innovative ceramic membrane-based water production plant in Andijk. Zweckverband ARA Neugut in Switzerland has been successfully running their new ozone based waste water treatment plant in Dübendorf since March 2014, including a control system for ozone dosage. Bioassays for water quality assessment have been adopted by water utilities in the Netherlands, France, Switzerland and Germany. Actions such as the incorporation of bioassays in legislative frameworks will be a next step, supported by the development of trigger values for various assays.

These are all examples of innovative technologies that have reached the end user. Though this was not only the result of DEMEAU efforts, the project did play a supportive and catalysing role.

For other technologies and practices, DEMEAU developed supportive instruments for their implementation, such as a decision support tool for water authorities and utilities which consider including Managed Aquifer Recharge in their water production schemes (see also the news article on the MAR toolbox in this edition of the newsletter). For all technologies addressed in DEMEAU, Unique Selling Propositions are available to support their further application (see also the article on “From sustainability analyses to recommendations for market impact”).

Overall I think we can be proud of our performance. But this could only take place through the commitment and cooperation of the water utilities which acted as launching customers in the project. I'm grateful for their valuable contributions to the project.

I want to also thank the consortium partners for their great spirit and contributions. I very much enjoyed working with all of them.

Further thanks are due to the members of the Project Advisory Committee for their advice and comments as well as to the EC officer for her support and trust.

Theo van den Hoven

Project manager

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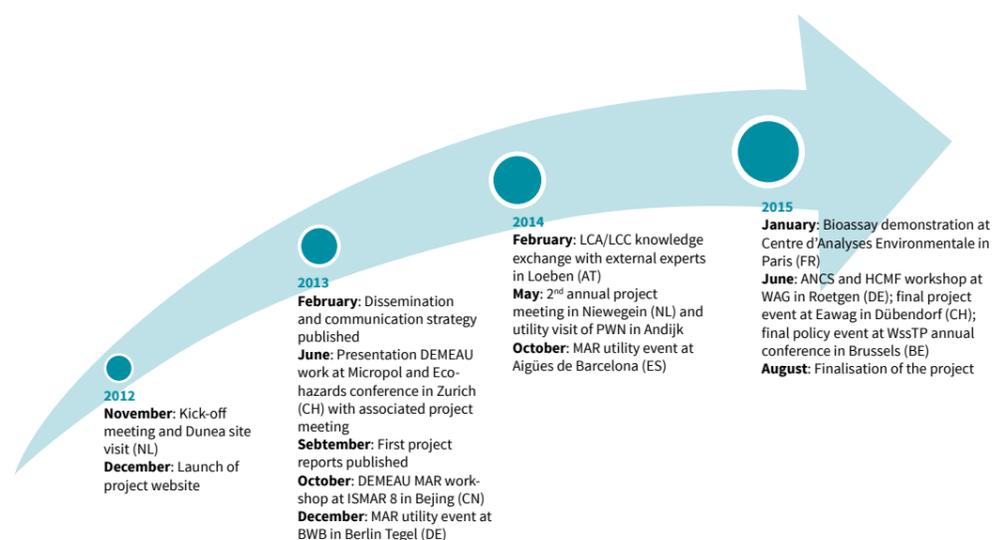


2 About DEMAU

Polluted and contaminated water is and has been a main source for diseases. In the developed world, this problem has been tackled since a century whereas 750 million people worldwide still do not have access to safe drinking water (WHO 2014). In Europe, there are upcoming challenges to react on. In face of demographic changes, climate change, ageing and deteriorating infrastructure, as well as the detection of emerging pollutants such as pharmaceuticals, personal care products and industrial chemicals, continuous innovation in the water and waste water sector is needed to ensure the long-term sustainability and quality of water resources. DEMAU demonstrates technologies that address emerging pollutants in water and wastewater, showcasing their benefits and feasibility through Life-Cycle and Life-Cost Assessments and highlighting current barriers for their uptake such as

regulatory and authorization issues. The project thus contributes to driving future development of legislation by compliance with current legislation in Europe. Companies and utilities need to work together to implement solutions that will drive down costs and improve both efficiency and water quality.

Within the DEMAU project 5 technologies have been demonstrated successfully. This was possible with the involvement of 17 partners of research institutes, technology developers and utilities. The institutions are based in 5 different European countries: France, Germany, the Netherlands, Spain and Switzerland. During the 36 months of the project's run time, the project partners conducted work in 14 different tasks resulting in 32 deliverables of which 23 are publically available. The timeline below features the key activities of the project.



DEMAU Partners



3 Interview with Ton van Remmen, Director of van Remmen UV Techniek: Advanced oxidation for drinking water production

Upon seeing the potential for a more efficient and effective UV reactor, we were developing a design for UV in Advanced Oxidation Techniques (AOT) at Van Remmen UV Techniek. Taking part in the DEMAU project offered us the possibility to test our application on a larger scale at Dunea, a Dutch drinking water utility.

Interviewer: Please introduce yourself, your background and your company. What got you interested in the field of water quality and water technology?

Ton van Remmen: I started this company in 1999 with a great passion for UV (ultra violet radiation) technology. I was always interested in technology and specifically in UV. My dream is to play a leadership role in UV technology and take the world of UV disinfection and UV oxidation to a higher plane. We have the facilities to do so, which makes us quite unique. We try to contribute to the world of water hygiene and safe (drinking) water. Our drive is to apply UV in a sensible way; sustainability has a high priority for us.

Within the DEMAU project, the reactor developed by van Remmen Techniek was applied for the first time in full scale as part of a demonstration installation at a water treatment plant. What was the development and innovation process like?

TvR: The standard approach to using UV for AOT is to use a standard UV water disinfection unit that is currently available on the market. The standard UV unit is adjusted for AOT by reducing the flow rate of the water inside the UV reactor by a factor 10–12 in order to generate the high UV dose that is required for AOT. In theory, this is correct but by reducing the flow rate, the velocity in the UV reactor and the flow pattern of the water is lost.

This gave us the idea to bring the UV reactor back to the drawing board and to make specific improvements for the conditions of AOT. In cooperation with KWR Watercycle Research Institute, we have developed a completely new reactor which is much better suited for the requirements of AOT. We've tested this design on a small scale.

The DEMAU project created an opportunity for us to upscale the UV reactor tests. We have implemented and tested the new reactor design for AOT for 10m³/hr at Dunea. The results show that this new UV reactor uses 20–30% less energy than our already efficient standard UV systems for disinfection.

What are the advantages of your technology over other Advanced Oxidation Techniques?

TvR: The advantages of our technology mainly lie in the fact that the energy consumption in this specifically designed UV reactor is much lower, up to 30% compared to standard low pressure UV systems. In addition, the energy consumption is radically lower than medium pressure UV systems on the market. Thereby, medium pressure systems have the disadvantage that there is also a risk of forming by-products in the oxidation process. In comparative research of UV-driven AOT where medium pressure



and low pressure systems are compared with ozone and/or hydrogenperoxide as radical former, the combination of low pressure UV-lamps and hydrogenperoxide, which we use, is consistently ranked as lowest potential for metabolite formation.

But more importantly, our system which has been tested in the DEMAU project is extremely easy to operate and maintain. The combination of a specifically designed UV reactor and low pressure lamps results in a very low total cost of ownership (TOC). All in all, our development makes AOT more manageable and affordable.

Water companies are not known as the most risk taking types of enterprises. What would be needed to convince them to apply innovative technologies?

TvR: Dunea liked our approach of AOT treatment and we have done a very exciting test at their premises. As mentioned earlier the results were very good – we've managed to develop a reactor that uses 20–30% less energy.

However, Dunea has planned a big upscaling in the next step to test at. We have only performed the test up to 10m³/hrs. Developing AOT applications to run at 500m³/hrs entails far greater complexity. Unfortunately, this was a too big and too soon of a step for a relatively small innovative organization like 'Van Remmen UV Techniek'.

Van Remmen UV Techniek is a SME. Did you profit from being part of a large EU funded research project or was it more of a barrier to your daily business?

TvR: We have really benefited from being a partner in this project. We have our own strategy and research work along with specific knowledge to bring to the project. We are not scientists but we have a lot of practical and theoretical knowledge of which the scientists are not aware. Therefore, the efficient and complementary combination is the most successful. Together

with KWR Watercycle Research Institute, we have benefited from this project and combined our knowledge and experience. The result is that we were able to measure the performance of our UV reactor design for AOT for 10m³/hrs at Dunea.

What does the future for Van Remmen Techniek look like? What are your next endeavours?

TvR: From participating in the DEMAU project, we have discovered that the design used at Dunea already generated very good results. We will continue to invest in the research and development of our UV systems for AOT and remove pharmaceuticals in water in order to develop a better product and introduce it to the market.

Besides this application of AOT for pharmaceuticals, we are also active in the fields of industrial waste water and horticulture. These other market segments offer us even greater potential for the future of UV in AOT because of a potentially greater demand and/or changing regulations for the market.

For more information please watch the video (<http://youtu.be/ddUM0DVMiPI>) and visit the website of Van Remmen UV Techniek <http://www.vanremmen.nl/>

4 Progress & Achievements

WA1: The DEMAU tool box for managing aquifer recharge is online

The tool box is an information platform for Managed Aquifer Recharge (MAR) techniques summarising the outcomes from work area 1 of the DEMAU project. It contains theoretical considerations, guidelines for laboratory tests and field investigations, information from MAR case studies, and recommendations for a wide range of various aspects of MAR (Figure 1).

The information within the tool box found under <http://demeau-fp7.eu/toolbox> is divided into four major topics:

What is Managed Aquifer Recharge?

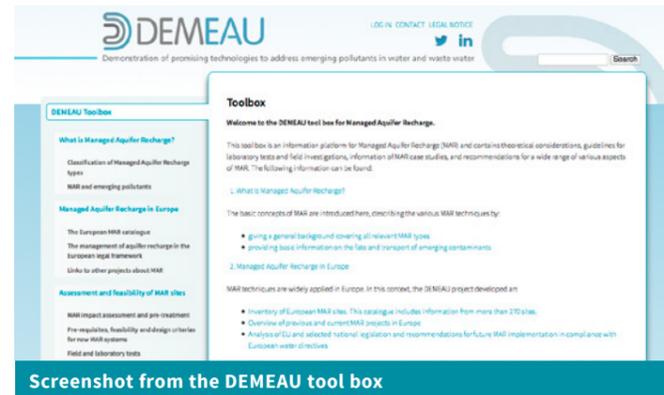
An overview and classification of Managed Aquifer Recharge types can be found here. Furthermore, this section describes the main transport processes related to emerging pollutants.

Managed Aquifer Recharge in Europe

This section contains an overview of site applications and important parameters of MAR in European countries, the management of aquifer recharge in the EU legal framework and links to other MAR projects in Europe. Information about the European wide inventory (MAR catalogue, see also <http://demeau-fp7.eu/news/239>) can be found here as well.

Assessment and feasibility of MAR sites

The environmental and human health impact assessment is an essential instrument to adequately evaluate hazards and associated risks. In this section, risk assessment based on the Australian guidelines is applied to different case studies in Europe.



Screenshot from the DEMAU tool box

DEMAU case studies and MAR profiling

The term MAR comprises a wide range of recharge and subsurface treatment techniques. In order to achieve inter-comparability of MAR sites, a set of essential attributes was developed. This MAR profile includes attributes covering the whole MAR chain, from the capture zone over the recharge and subsurface conditions to post-treatment and information for end-users. The MAR profile displays the main features of MAR sites at a glance. Additionally, a MAR glossary summarises the most frequently used technical terms.

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WA2: Technology Brochure on ANCS Released

DEMAU has released its third brochure as part of its series of technology brochures. A collaborative effort among several project partners including, Ecologic Institute, aquatune, IWW and WAG Wassergewinnungs- und -aufbereitungsgesellschaft Nordeifel mbH, the technology brochure aims to close the communication gap between scientists and end users regarding practical information on Automatic Neural Net Control Systems (ANCS). The brochure offers an accessible guide that summarises and presents key findings on the latest research from the project's work on ANCS.

Drawing upon results from the first DEMAU demonstration application of ANCS at the drinking water plant of the WAG in Roetgen, as well as experiences of ANCS applications for waste water treatment systems, the technology brochure synthesises key information regarding the practical application and implementation of ANCS for end users. Based on Artificial Neural Networks (ANN), a technology based on observations of the human brain that has become increasingly important in the operation of drinking water plants or waste water treatment

facilities, ANCS include furthermore an algorithm for optimisation. The brochure touches on the potential for ANCS to make a significant contribution to energy and economic optimisation for water treatment plant operations.

In addition to more general information on the status of this new technology, the technology brochure also showcases case studies that examine the added value of ANCS in water quality monitoring in real time at its demonstration sites. To read more, download the brochure in English and in German.

<http://demeau-fp7.eu/news/348>

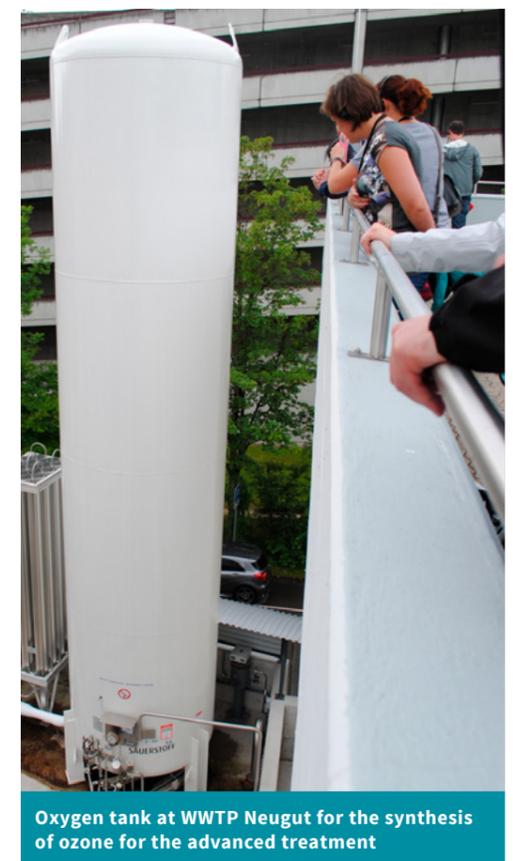


WA3: Wastewater treatment with ozone in full-scale

Switzerland adopted a new regulation on the treatment of wastewater to minimise the occurrence of emerging pollutants in natural water bodies. Therefore, it was decided to upgrade around 100 wastewater treatment plants with an advanced treatment step. As of March 2014, the waste water treatment plant (WWTP) Neugut in Dübendorf (CH) is the first plant to run with an additional ozonation step and serves as an example for the upgrade of other WWTPs. To evaluate the measure, a set of 12 compounds is currently proposed in Switzerland (amisulpride, carbamazepine, citalopram, clarithromycin, diclofenac, hydrochlorothiazide, metoprolol, venlafaxine, benzotriazole, candesartan, irbesartan, mecoprop). These substances represent a wide variety of compounds which are typically present in municipal wastewater as they are insufficiently eliminated in conventional wastewater treatment, and able to be easily analysed in a single run with LC/MS/MS. To fulfil the requirements, they need to be eliminated by 80% in the plant.

Within DEMAU, Eawag, the WWTP Neugut and the Ecotox Center in Dübendorf have investigated the effectiveness of the treatment technology for chemical and ecotoxicological quality at WWTP Neugut. It has been shown that an ozone dose of 2.0–3.3 mg/L (0.55 g ozone/g DOC) is the recommended dose to ensure the sufficient elimination of the 12 substances. At this ozone concentration, the investigated 52 substances are eliminated overall to more than 80% across the entire plant. The formation of ozonation by-products was studied according to the proposed tests to evaluate the treatability of wastewater with ozone (Schindler et al. 2015). The concentrations of bromate and N-nitrosodimethylamine (NDMA) expected in the receiving water body after dilution are below the drinking water standard of the World Health Organization (10 µg/L for bromate and 100 ng/L for NDMA).

Schindler, Y., Mestankova, H., Schärer, M., Schirmer, K., Salhi, E., & von Gunten, U. (2015). Novel test procedure to evaluate the treatability of wastewater with ozone. *Water Research*, 75, 324–335.

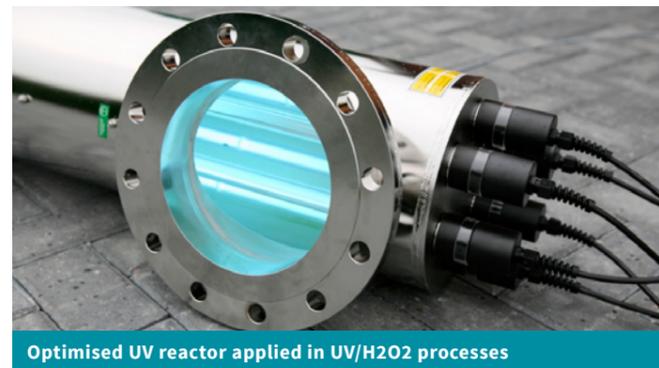


Oxygen tank at WWTP Neugut for the synthesis of ozone for the advanced treatment

WA3: Research on the optimization of UV/H₂O₂ reactors in the Netherlands

For UV/H₂O₂ processes, common UV disinfection reactors are generally applied which have been optimised for disinfection purposes but not for advanced oxidation. Through modelling, improved reactor designs were developed and the corresponding reactors were built within the framework of the DEMEAU project. These reactors were tested in pilot plants at Van Remmen UV Technology where the reactors were built and at two drinking water utilities in the Netherlands: Dunea and WML. It was found that the energy demand of the UV/H₂O₂ process strongly depends on the water quality, especially UV-transmission (UV-T), and on the type of emerging pollutants that have to be degraded. The improved reactor design also resulted in a 20–40% lower energy demand (depending on local conditions). At WML, with a UV-T value of about 94%, the UV/H₂O₂ process only requires a low UV dose. However, at Dunea (with a UV-T of about 75%), it was shown that pre-treatment of the water (by means of an O₃/H₂O₂ process or filtration over activated carbon) improves the composition of the water matrix and may result in

a 20–70% better performance in the UV/H₂O₂ process. Although in general it is believed that the UV/H₂O₂ process requires a large amount of energy, this research showed that a significant reduction in energy demand can be achieved by using an optimised reactor geometry or by applying pre-treatment to the water.



Optimised UV reactor applied in UV/H₂O₂ processes

WA4: Ecotoxicological evaluation of wastewater treatment – The first Swiss WWTP with full-scale ozonation in focus

Advanced treatment processes at WWTP Neugut, Switzerland

Emerging pollutants in wastewater related to human lifestyles, e.g. pharmaceuticals and personal care products, can be eliminated by advanced wastewater treatment techniques. The input of these substances in freshwater ecosystems can be diminished and drinking water resources can be protected. Previous studies have shown ozonation to be a promising technique to eliminate micropollutants, even though reactive and potentially toxic transformation products can occur. In order to remove transformation products, which are biologically degradable or bind to particles, post-treatments like sand filtration or granulated activated carbon are necessary and recommended e.g. by the Swiss Federal Office for the Environment (FOEN).

The wastewater treatment plant (WWTP) Neugut, one of the demonstration sites within DEMEAU, is the first Swiss WWTP with full-scale advanced treatment of wastewater with ozone.

Efficacy evaluation with Bioassays

In the present study, the efficiency of ozonation and various post treatments to reduce ecotoxicological effects still occurring in the conventionally (biologically) treated wastewater was assessed. To assess the ecotoxicological effects, various bioassays were applied in the laboratory as well as directly at the WWTP. Bioassays are able to measure the direct effects of chemical contaminants present in effluent waters. They provide a good approach for water quality assessment and are complementary to the analytical quantification of a limited number of individual chemicals.

Complementary to in vitro bioassays focused on in DEMEAU, in vivo bioassays with whole organisms were performed. For an overview, see **Table 1**.

In vitro assays – Pathway	Tool	In vivo assays – Organisms	Observations
Mutagenicity	Ames fluctuation assay	Primary producers (algae)	photosynthesis, growth
Genotoxicity		Primary consumers (water flea)	reproduction
Oxidative stress	CALUX assays	Secondary consumers (fish)	hatching, swim-up, length, weight, changes in tissues and organs, expression of various pollutant-relevant genes
Disturbance of lipid metabolism		Decomposers (luminescent bacteria)	general toxicity
Various hormonal effects		Detritus feeders (oligochate worms)	reproduction
Estrogenic effects	Yeast Estrogen Screen		

Overview of in vitro and in vivo bioassays applied at WWTP Neugut

Study outcome (first results)

The investigations revealed that the wastewater treatment with ozone resulted in

- significantly **reduced ecotoxicological effects**,
 - **improved growth and photosynthesis** of green algae,
 - **decreased toxicity** to luminescent bacteria, and
 - decreased estrogenicity,
- compared to effects measured in the conventionally (biologically) treated waste water.

The **post-treatments** partially led to further decreases in the effects. Only the reproduction of water fleas and oligochaetes was not influenced by any of the treated wastewaters compared to unpolluted control water.

The majority of the in vitro bioassays were performed within the scope of DEMEAU. A part of the in vitro and all in vivo bioassays were funded by the FOEN within the ReTREAT project.

For more information on the in vivo bioassay tests at WWTP Neugut, please watch also the video available at: http://www.eawag.ch/repository/newsletter/2015-02/neugut_en/

WA5: From sustainability analyses to recommendations for market impact

As the DEMEAU project is finalised, results from the different activities carried out by Work Area 5 (WA5) are almost completed. Environmental, economic and social analyses have been done during the past three years and findings were translated into recommendations for market impact in close cooperation with stakeholders involved in various DEMEAU case studies from all four technology work areas.

Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) provided structured and transparent approaches to compare different technology options, using environmental and economic criteria. The social drivers and barriers assessments involved multiple steps, including a preliminary inventory among experts, followed by an online survey among relevant stakeholders, and, in a last step, interactive workshops and/or interviews that aimed to elicit stakeholders' perspectives on necessary actions to overcome identified environmental, economic and social barriers and make best use of identified drivers (also see last

DEMEAU newsletter). The resulting insights provide the opportunity to increase understanding with regard to environmental and financial aspects of each of the studied technologies, and also – at least as important – to think about conditions necessary to foster market uptake of these technologies.

WA5 made an effort to stay close to the applications of the technologies in practice and to provide useful information for different stakeholder groups. While the detailed results of the sustainability analyses can be found in public DEMEAU reports, WA5 is now finalizing four briefs on 'recommendations for impact', bringing together key insights on each technology and translating those into specific recommendations for three groups of key stakeholders: 1) policy makers and public authorities, 2) scientists and technology developers, and 3) water utilities. The final documents, with a similar format to the 'technology brochures', will be available for download starting in mid-September at: <http://demeau-fp7.eu/content/d522>

WA6: Report from the final DEMEAU dissemination events

The final dissemination of the DEMEAU project is presented through four pathways: a final consortium meeting open to the public, a presentation and a booth of DEMEAU at the WssTP Water Innovation Europe Conference to inform and to reach out to water managers and representatives of the water sector, and a contribution to the FP7 Resource Efficiency Cluster meeting on 16 September in Brussels with European Commission (EC) policy makers as the target audience.



Final project meeting at Eawag, Dübendorf Switzerland

The final consortium meeting was held on June 17 and 18 in Dübendorf, Switzerland at the Swiss Federal Institute of Aquatic Science and Technology (Eawag). The meeting was attended by all consortium partners and several external people who engaged in collaborative knowledge exchange and discussions on the final research results, conclusions and contributions of the project. During the first day, the Work Areas presented their research. After the participants received the overview of all project outcomes, they discussed the contributions of the project to society focusing on technological and non-technological innovation, decreasing environmental impact, the creation of new markets and knowledge transfer in a "world café" atmosphere. The information was gathered for the project's final report and included in the DEMEAU presentation at the WssTP Conference in Brussels. On the second day of the event, the project's work at the advanced oxidation plants at WWTP Neugut and drinking water plant at Waterworks Zurich was presented.



Theo van den Hoven presents DEMEAU's final outcomes

Several representatives of the project attended the WssTP Conference "Water Innovation Europe" from June 24 to 26, 2015 in Brussels at the Diamant Conference Centre. The project coordinator, Theo van den Hoven, presented the project on June 24 to an audience of 80 representatives from the EC, research institutes, utilities and industries. His presentation created great interest in the project's outcomes made evident by the many audience questions.

Furthermore, the project was represented with a booth in the exhibition area of the conference. The booth was coordinated by Ulf Stein and Evelyn Lukat from Ecologic Institute who are responsible for the project's dissemination. The booth enjoyed great popularity with many of the 250 conference participants choosing from a variety of dissemination materials including the project's technology brochures on managed aquifer recharge, bioassays and automatic neural net control systems, information provided by the SME's involved in the project and general information on the project in a leaflet and the newsletters. The booth was also accompanied by the screening of the DEMEAU animated video.

5 DEMEAU final outcomes

Over the course of the DEMEAU project, its research contributed to 23 public deliverables. Most of them are already available on the project website at <http://demeau-fp7.eu/results> while others will follow in due course. The following is an overview of the most interesting deliverables whose content is summarised briefly.

Managed Aquifer Recharge

MS11 Characterization of European managed aquifer recharge (MAR) sites – Analysis:

Different types of MAR schemes are widely distributed and applied on various scales in European countries. This catalogue is the first attempt to systematically categorise and compile these sites according to a wide range of parameters, e.g. operational information, hydrogeological properties and water quality monitoring for different types of MAR. The database currently includes 270 MAR sites, but is neither a representative nor an exhaustive data compilation. <http://demeau-fp7.eu/content/ms11>

A last dissemination activity is scheduled for September 16, 2015. On this date, the final event of the Resource Efficiency Cluster will take place, of which the DEMEAU project is part. Ulf Stein will represent the project and make use of this event to reach out to EC policy makers.



DEMEAU booth at the WssTP conference exhibition area

D12.1 Decision trees for MAR impact evaluation: This report includes the results of a comprehensive bibliographic compilation of trace organic removal rates in different Managed Aquifer Recharge (MAR) sites. The aim is to provide guidance to the authorities and water suppliers to evaluate trace organic removal in existing or newly designed MAR facilities, including a review of the existing MAR relevant European legislation. <http://demeau-fp7.eu/content/d121>

D12.2 Pre-requisites and design criteria for new MAR systems in compliance with the EU WFD and GWD: Detailed knowledge of hydrogeological features is necessary for adequately selecting a site for MAR, but the initial exploration of a potential site is identified as one barrier for MAR implementation. Hence, a structured site exploration procedure was developed and described for surface spreading and well injection methods. The outcomes are presented in the MAR toolbox. <http://demeau-fp7.eu/toolbox/>

Hybrid Ceramic Membrane Filtration and Automated Neural Net Control Systems

D23.3 Demonstration of the use and benefit of ANCS after six month operation in the large scale plant: After neural net training, ANCS was adjusted with the automatic functions and was used to control the pilot plant automatically. The results in terms of flux rate, recovery as well as chemical and energy demand was compared to the respective results of the large technical scale backwash-water treatment plant operated without ANCS. This task showed successful modelling of start- and end permeability after/before backwashing and resulted in a cost reduction of 4–25% <http://demeau-fp7.eu/content/d233>

Advanced Oxidation Techniques

D32.1 Compilation of kinetics and mechanisms for the transformation of organic substances: This deliverable aims at presenting the reactivity of selected compounds towards the oxidative treatments investigated in Work Area 3, i.e. ozonation and UV photolysis. <http://demeau-fp7.eu/content/d321>

D32.3 Decision basis for implementation of oxidation technologies: Based on experiences during demonstration of different technologies, a decision tool for measures and processes for energy efficient removal of emerging pollutants will be developed. Key aspects include the reliable prevention of toxic by-product formation from the source water matrix and the assessment of the potential for toxic transformation product formation from emerging pollutants. <http://demeau-fp7.eu/content/d323>

Bioassays

D41.1 Selection criteria to select bioassays for implementation and use: A range of selection criteria were described that are considered to be of high importance when selecting bioassays for water quality monitoring. The criteria are subdivided into criteria for "applicability" and for "performance" of the assays, since end-users may assign a different weight to these individual primary criteria. <http://demeau-fp7.eu/content/d411>

D41.2 Establishment of trigger values and validation of bioassay panel: Current environmental monitoring of water bodies containing emerging pollutants is based on a comparison between concentrations of chemically analysed priority pollutants and their environmental threshold values. Given the unknown composition of the pollutant mixtures, this classical approach does not cover the entire load of pollution and may overlook the presence of bioactive chemicals. The general aim is to promote the applicability of effect-based bioanalytical tools for the safety assessment of drinking water by striving for faster, cheaper, reliable complementary techniques to traditional chemical analysis. In order to make a prediction about the potential ecological risks of the toxicant mixtures, the establishment of bioassay guidelines, e.g. the introduction to trigger values, is prerequisite. This deliverable is going to set the scene concerning the challenges in the application of trigger values for the risk assessment of drinking water with in vitro bioassays. <http://demeau-fp7.eu/content/d412>

D42.1 Position paper(s) how bioassay derived data can be applied for water quality assessment: A crucial step on the road to the implementation of in vitro bioassays is to demonstrate the validity of the reliability and reproducibility of

a test method. However, demonstrating the validity of a method is a complicated process. Overall, in vitro bioassays in water quality assessment have proven their usefulness. Testing with in vitro bioassays has advantages over analytical techniques, such as the relatively low costs, the possibility of high-throughput methods, the derivation of mixture effects, and the preference over in vivo tests due to ethical reasons. <http://demeau-fp7.eu/content/d421>

Life Cycle Analysis and Life Cycle Costing

D51.1 Unique selling proposition: LCA was conducted for five different case studies in which the DEMEAU technologies were applied. For all case studies, selected environmental indicators were calculated. They described the additional efforts of water treatment (e.g. energy demand, greenhouse gas emissions) and improvements in water quality (e.g. eutrophication, ecotoxicity, human toxicity) as well as the evaluation of the enhanced removal of emerging pollutants within the selected processes. Finally, key outcomes from LCA analysis have been formulated to define the unique selling propositions for the different technologies regarding their environmental profiles. <http://demeau-fp7.eu/content/d511>

D51.2 Final guidelines for sustainability assessment of water technologies: Nine micropollutant substances have been identified as high priority substances to be reported in all case studies based on their environmental relevance, coverage of chemical and physical properties, elimination rates by various technologies and the existence of an analytical method to identify them. Several considerations have been made for the assessment of the technologies. Characterisation factors for the toxicity model USEtox®, factors for water footprinting and water scarcity footprinting have been developed. <http://demeau-fp7.eu/content/d512>

D52.1 Implementation barriers: This deliverable presents a multi-stakeholder assessment of implementation drivers and barriers throughout various subsequent stages of the innovation cycle. Enabling factors (drivers) and constraining factors (barriers) for the implementation of the four innovative DEMEAU technologies that form the core of Work Areas 1 to 4 are identified at four different analytical levels (contextual, inter-organizational, intra-organizational and individual level) from the perspectives of various stakeholders that are involved in six selected case studies. <http://demeau-fp7.eu/content/d521>

D52.2 Recommendations for impact: Based on the results from the environmental LCA, the economic LCC, the enabling and constraining factors for a successful technology implementation and Unique Selling Propositions, recommendations for the actual implementation of the technologies studied in WA1–4 were developed. Stakeholder workshops and/or interviews were conducted for the selected case studies of WA1–4 in order to (i) present preliminary results from LCA, LCC and drivers and barriers analyses and to (ii) take these results as starting points for interactive discussions to compare the various perspectives on existing drivers and barriers and translate them into recommendations for successful implementation. <http://demeau-fp7.eu/content/d522>



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