Implementation plan and schedule for demonstration cases

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1 Demonstrations plans

1.1 Demonstrations WA1

1.1.1 Demonstration of quantitative and qualitative long-term effects on groundwater resources

Associate utilities: Berliner Wasserbetriebe, DUNEA

DEMEAU Partners involved: KWB, HYDOR, KWR

	Description	Schedule	Adjustments with respect to original planning
Main objectives	Demonstrate the effects of typical existing European MAR systems onto groundwater availability and groundwater quality (tasks 1.1.1 and 1.1.2) with specific focus on trace organics, application of a methodology developed in task 1.2.1	Original starting date: M9 Original end date: M18 According to the DOW	The demonstration started, as planned. However, due to delay in data provision by the utility in the NL, the demonstration has not been completed yet. The new end date is envisaged to be M21. This will have no impact on other tasks / deliverables.
Initiation Phase	Development of an approach for assessing long-term impact; presentation to the involved utilities; discussion on extent of data to be transferred from utility to research partner;	Original starting date: M9 Original end date: M12 According to the DOW	
Installation Phase	Data provision by the utility	Original starting date: M12 Original end date: M12 According to the DOW	For the demonstration at the DUNEA site the complete data set was provided in M17.
Demonstration Phase	Application of the approach developed in WP 1.2	Original starting date: M12 Original end date: M15 According to the DOW	Due to the delay reported above, the DUNEA demonstration has a delay of 3 months (demo-phase to be completed by M 18)
Reporting Phase and Follow up	A report describing the outcomes of the impact assessment in Berlin has been prepared. The information from DUNEA is currently being supplemented	Original starting date: M16 Original end date: M18 According to the DOW	Due to the delay reported above, there is a 3 months delay also for the reporting phase
Evaluation			

1.1.2 Test-wise application of proposed toolbox for optimizing design & operation (including pre-treatment) at new sites

Associate utilities: Castillon municipality (no associate partner), green-house operator (NL – no associate partner), Berliner Wasserbetriebe

DEMEAU Partners involved: KWR, CETaqua, A21, KWB, HYDOR

	Description	Schedule	Adjustments with respect to original planning
Main objectives	Demonstrate the applicability of different approaches optimizing design and operation of MAR sites (tool-box, developed in task 1.2.3)	Original starting date: M24 Original end date: M36 According to the DOW	The demonstrations will start as planned.
Initiation Phase	Tool-box development (task 1.2.3 currently ongoing). Communication with utilities / municipalities is commencing.	Original starting date: M18 Original end date: M24 According to the DOW	
Installation Phase	Data collection	Original starting date: M24 Original end date: M28 According to the DOW	
Demonstration Phase	Application of the tool-box and discussion of the results with the end-user	Original starting date: M28 Original end date: M30 According to the DOW	
Reporting Phase and Follow up	Report due M36	Original starting date: M28 Original end date: M36 According to the DOW	
Evaluation			

1.2 Demonstrations WA2

1.2.1 Demonstration of the innovations and in reactor design of the Ceramac® technology.

Work Package: WP21

Location/site owner/associate utility: PWN Water Supply Company North Holland

DEMEAU Partners involved: RWB

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	An optimized reactor design of the Ceramac® system will be tested and demonstrated. The full scale system will be the ultimate	M1-M12 M12-M24	On schedule. The optimized reactor design is tested and the full scale reactors being build.

	demonstration of the innovative Ceramac® technology.		On schedule.
Initiation Phase	• Construction of a large scale pilot with innovations in top- and bottom plate. • Work on license for disposal of the IX regenerate solution.	M1-M12	Finished.
Installation Phase	• Large scale pilot with innovations was built and used for research and demonstration. • Full scale Ceramac® currently built.	M1-M12 M12-M24	Finished. Ongoing
Demonstration Phase	• Design, build and test an innovated large scale pilot reactor to validate the design. Especially the water forces and pressure during operation are tested. • Building and operation of the full scale Ceramac® system.	M1-M12 M12-M24	Finished Ongoing
Reporting Phase and Follow up	• MS21 report about validation of the new reactor. • New reactor design tested and ready for full scale applications.	M1-M10	Finished
Evaluation			

1.2.2 Optimise and demonstrate HCMS to increase the area of application of ceramic membranes

Work Package: WP21

Location/site owner/associate utility: Hamburg Wasser (originally), changed to WWTP Basel

DEMEAU Partners involved: KWR, FHNW

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	• Optimise the performance of HCMS (Task 2.2.1) and compare with state of the art (Task 2.2.2). • Demonstrate HCMS on demo-scale for ECO sanitation project in the city of Hamburg (Task 2.2.3).	M1-M24	ECO sanitation project in Hamburg is delayed. Therefore no demonstration in Hamburg in the Demeau project. After an extensive search, the optimization and demonstration of HCMS will be conducted at a waste water treatment plant in Basel (M16-M36).
Initiation Phase	• Political decision to build an ECO sanitation district. • Legislative changes in Switzerland are underway which will force 100 of the currently 700 operating WWTP to be upgraded with an additional treatment step to remove micro pollutants. • Conducting small scale pilot research to optimize HCMS.	Not in Demeau Not in Demeau M1-M18 M9-M18	 M16-M26 M24-M36

	• Construction of a pilot system for HCMS testing and demonstration.		
Installation Phase	• Small scale plate and frame pilot available and in operation in Basel. • Large scale pilot maybe not possible in Basel. To be discussed.	M1-M18 M1-M36	M16-M26 M20-M36
Demonstration Phase	• The small scale pilot should demonstrate the capabilities to remove organic micro pollutants from municipal waste water. The differences between a CMS and HCMS (with powdered activated carbon) are tested. Special focus on high membrane flux and cleaning strategy of the membrane. • Large scale pilot.	M1-M18 M1-M36	M16-M26 M20-M36
Reporting Phase and Follow up	• MS22 report delayed. Small scale pilot research just started. • D22.1	M18 M36	M26 M36
Evaluation			

1.2.3 To implement a new process control system based on artificial neural networks systems (ANCS) in an existing membrane treatment system in order to optimize the process performance.

Work Package: WP23

Location/site owner/associate utility: Wassergewinnungs- und aufbereitungsgesellschaft Nordeifel (WAG)

DEMEAU Partners involved: IWW, Aquatune

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	• Integration of the ANCS in the existing system (T2.3.1 to 2.3.3) and testing on pilot scale. • Demonstrating the benefit of the new ANCS as compared to the conventional system (T2.3.5).	M1-M24 M25-M36	M1-M28 (delay because of construction activities at the full scale plant and change of membrane type). M29-M36
Initiation Phase	• Configuration, installing and training of the ANCS (soft- and hardware), Task 2.3.1 and 2.3.2. • Pilot demonstration of the feasibility of ANCS (Task 2.3.3)	M1-M18 M19-M24	M1-M18 M19-M24
Installation Phase	• Implementation and demonstration of ANCS at large scale backwash-water treatment system.	M25-M28	M25-M29
Demonstration	• In a six month operation of ANCS with	M29-M36	M29-M36

Phase	the large technical scale backwash-water treatment plant it shall be demonstrated that the performance of the system can be improved in such a way, that the incoming backwash water can be treated without the intended extension of membrane surface.		
Reporting Phase and Follow up	• New controller based on artificial neural net (ANCS) with all necessary soft- and hardware (D23.1). This may be used in other applications as well. • ANCS completely trained and adjusted with the automatic functions (D23.2) • Start demonstration of ANCS to large technical membrane process (MS23)	M4 M18 M28	M6 M22 M28
Evaluation			

1.2.4 Demonstration of the nanoparticles analyser based on laser-induced breakdown detection (LIBD) to determine nanoparticle removal and on-line integrity of membranes

Work Package: WP24

Location/site owner/associate utility: to be decided

DEMEAU Partners involved: Cordouan, VERI

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	• Demonstrate the performance of a LIBD system on a large scale UF pilot reflecting industrial conditions. • Describing the specifications of a industrial LIBD system.	M19-M36	M24-M36. Lab and small scale pilot research caused a delay. Go/no go decision for large scale pilot testing will be made after small scale pilot testing (M20).
Initiation Phase	• Evaluation of the ultimate performances of the LIBD prototype. • Defining a standardized test protocol for pilot-scale trials.	M1-M28	M1-M28
Installation Phase	• Determine the level of performances required for the mobile LIBD system (sensitivity, repeatability/accuracy, dimensions and weight, power supply and mobility, integration constraints for online measurements, software functionalities, data treatment and display).	M1-M28	M1-M28
Demonstration Phase	Give an overview of the activities planned in the demonstration. If relevant, describe different demonstration activities, e.g. specific experiments • The LIBD system will be transferred to and setup at a large scale UF pilot	M19-M36	M24-M36

	reflecting industrial conditions. • Influencing parameters on calibration and achievement of reproducible measurements will be defined. Statistical sets of measurements will be carried out, following the procedure described in the test protocol.		
Reporting Phase and Follow up	Reports to be delivered (D24.1 and D24.2)	M28-M36	M28-M36
Evaluation			

1.3 Demonstrations WA3

1.3.1 Demonstration of the design, application, controlling and long-term stability of ozonation for wastewater treatment

Location/site owner/associate utility: Wastewater treatment plant ARA Neugut, Dübendorf, Switzerland

DEMEAU Partners involved: Eawag, ARA Neugut, Sigrist

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	Demonstration of advanced treatment of wastewater with Ozone (in full scale) followed by different biological post-treatments (pilot scale) to remove micropollutants and to evaluate oxidation transformation products (T3.1.1., T3.1.3., T3.2.2.)	Original starting date: Original end date: According to the DOW	-
Initiation Phase	In course of the discussion of a modification of the Swiss ordinance on water protection for micropollutant removal, WWTP Neugut decided to adapt to advanced treatment before the ordinance was approved.	Original starting date: Original end date: According to the DOW	The initiation phase took place from 2010-2012. Originally, the installation was planned for 2011, however, due to political reasons and delays for construction permits the installation was delayed.
Installation Phase	Installation of full scale ozonation reactor and pilot scale post-treatment technologies (e.g. actual installation, system design and optimization, related to	Original starting date: 2011 Original end date: M12 According to the DOW	Delay in starting (10/2012) and finish (forseen M20) of installation

	installation of equipment)		
Demonstration Phase	Experiments with full scale ozonation, regulation of ozone dosage, investigation of different biological post-treatments for eliminating transformation products of ozone treatment	Original starting date: M12 Original end date: M30 According to the DOW	Delay of starting date (forseen M21), end of demonstration phase will also be delayed (probably until fall 2015), however, first results should be available in M30.
Reporting Phase and Follow up	Milestone report (MS31) on the installation at the demonstration site Deliverable (D31.1) on Demonstration of design, application, controlling and long-term stability to WW oxidation technology	Original starting date: M0 Original end date: M30 According to the DOW	Milestone report was submitted in M14
Evaluation			

1.3.2 W Demonstration of design, application, controlling and long-term stability of ozonation for drinking water treatment

Demonstration title: Location/site owner/associate utility: Water Supply Zurich, Zurich, Switzerland

DEMEAU Partners involved: Eawag, Water Supply Zurich

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	Demonstration of advanced treatment of drinking water with Ozone or ozone/H2O2 followed by activated carbon filtration in a pilot plant to remove micropollutants; evaluation of oxidation transformation and by-products (T3.1.1., T3.1.3., T3.2.2.)	Original starting date: M0 Original end date: M30 According to the DOW	-
Initiation Phase	The initial activities in regard to planning and building the pilot plant were finished before the DEMEAU project.	Original starting date: before M0 Original end date: before M0 According to the DOW	-
Installation Phase	installation, system design and optimization was done within the project WAVE21 (2005-2008) and additional tests were done occasionally since then	Original starting date: before M0 Original end date: M12 According to the DOW	Additional to the pilot ozone reactor, a second reactor with a novel process (PROMIX) was supplied free of charge by XYLEM (in M15) and installed at the facilities of the Water Supply Zurich for parallel investigations employing AOP with ozone/H2O2

Demonstration Phase	Experiments with different ozone dosage, with/without H2O2, different pH and bromide concentration	Original starting date: M12 Original end date: M30 According to the DOW	Comparison of two reactors employing ozone/H2O2 to optimize the processes for maximum micropollutant abatement and minimal bromate formation (availability of PROMIX reactor: M16-M20)
Reporting Phase and Follow up	Milestone report (MS31) on the installation at the demonstration site Deliverable (D31.2) on Demonstration of design, application, controlling and long-term stability to DW oxidation technology;	Original starting date: M0 Original end date: M30 According to the DOW	Milestone report was submitted in M13 The renovation of the Moos plant at the Water Supply Zurich is currently planned and the knowledge from the pilot investigations will be included.
Evaluation			

1.3.3 Demonstration of up-scaling, controlling, and validation of advanced oxidative technologies for drinking water and waste water treatment

Demonstration title: Location/site owner/associate utility: Dunea, production site Bergambacht

DEMEAU Partners involved: e.g. KWR, van Remmen UV, Dunea

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	Dunea has decided to build a full scale advanced oxidation plant based on the combination of O3/H2O2 and UV. Pilot research will be required to optimize the process. An optimized UV reactor will be tested.	Original starting date: month 1 Original end date: month 30 According to the DOW	The start of both the pilot research and the building of the large scale treatment plant was delayed. This is due to the fact that the decision whether or not a full scale plant would be build was delayed, as several different forums had to agree. However, in March 2014 Dunea will present a detailed plan on the pilot research that will be carried out at Bergambacht, and in the second half of 2014 this research will start. For this purpose, the optimized UV/H2O2 reactor of van Remmen will be used.
Initiation Phase	In November 2013 the final decision on the building of a large scale plant at Dunea was made, and development of this plant was started. In March 2014 Dunea will present a plan for pilot plant research. In the meantime	Original starting date:1 Original end date:6? According to the DOW	The decision on pilot plant research was delayed as it depended on the decision on the large scale plant. However, in the second half of 2014 pilot research will be started at Bergambacht.

	van Remmen UV has optimized the UV/H2O2 reactor, which can be used for pilot experiments.. before the actual start of the demonstration		
Installation Phase	Summer 2014 the van Remmen reactor can be installed at Bergambacht, and pilot experiments can be started.	Original starting date:1 Original end date:12 According to the DOW	
Demonstration Phase	A detailed plan on the pilot research will be presented by Dunea in March 2014.	Original starting date:12 Original end date:30 According to the DOW	
Reporting Phase and Follow up	The results of the pilot research will be presented in a report, and possibly a conference proceeding.	Original starting date:24? Original end date:30 According to the DOW	
Evaluation			

	Description	**Schedule**	**Adjustments with respect to original planning**
Main objectives	Drinking Water Utility WML is planning pilot research at the Heel production plant.	Original starting date: Original end date: According to the DOW	As the building of a demonstration plant at Dunea was delayed and WML also appeared to be interested in advanced oxidation, it was decided to couple to pilot research at WML to Demeau too.
Initiation Phase	At the moment discussions on conditions for this pilot research between KWR and WML are in the final stage.	Original starting date: Original end date: According to the DOW	
Installation Phase	Summer 2014 the van Remmen reactor can be installed at Heel, and pilot experiments can be started.	Original starting date: Original end date: According to the DOW	
Demonstration Phase	In the second half of 2014 pilot research will be carried out.	Original starting date: Original end date: According to the DOW	
Reporting Phase and Follow up	The results of the pilot research will be presented in a report, and possibly a conference proceeding.	Original starting date: Original end date: According to the DOW	
Evaluation	.		

1.4 Demonstrations WA4

1.4.1 Selection and validation of bioassays for water quality assessment

Work Package: WP41
Location/site owner/associate utility: BioDetection Systems (BDS) bv, Amsterdam, The Netherlands
DEMEAU Partners involved: KWR, EAWAG, VERI, Griffith

	Description	Schedule	Adjustments with respect to original planning
Main objectives	The general aim of work area 4 (WA4) we aim to generate a system of powerful quantitative in vitro bioassays to effectively measure a wide range of major classes of toxicants and promote. their widespread use ❖ WP41 aims to select and validate a minimal panel of bioassays for cost effective and comprehensive toxicity screening of drinking and surface waters (T41.1 and T41.2) and set up automation steps in sample workup and in vitro toxicity testing that can facilitate implementation of these bioassays (T41.3) ❖ WP41 also intends to derive internationally accepted trigger values and implement and promote them for water quality safeguard (T41.4)	Original starting date: month 1 (01/09/2012) Original end date: month 24 (31/08/2014) According to the DOW WP41: M1-M24	The WP leader has been changed and the transfer of the tasks led to some delays in reporting. In addition there were inconsistencies in the DOW with respect to delivery dates, leading to slightly altered planning.
Initiation Phase	❖ Set the selection criteria for in vitro bioassays. ❖ Bioassay selection based on literature studies and their relevance in water quality monitoring	Original starting date: Original end date: According to the DOW ❖ Selection criteria M1-M4	Selection criteria M1-M4 Year 1 – fulfilled. Criteria selected, will be summarized in D41.1 Bioassay selection: the set of relevant bioassays are outlined, detailed description will be summarized in

	❖ Automation of the bioassays and the validation of the sample preparation methods are crucial part of future practical application of bioassays for water sample monitoring: ▪ Automation of the CALUX bioassays are introduced by the use of the 384 well plate liquid handling robot ▪ Within a collaboration of EAWAG various extraction methods were tested for their potential background activities in the selected CALUX assays ❖ The introduction to bioassays guidelines (Trigger values) is one of the most important task/challenge for drinking water practices. With these we derive a valid point of departure (POD) above which certain health risks can be expected.	❖ Bioassay selection: M4-M18 ❖ Automation: M19-24 ❖ Trigger values: M1-M3 M: month	D41.1 Automation: The automation of the CALUX bioassays is accomplished. Currently further efforts are being made to find universal sample work up method as automated as possible. Trigger values: will be summarized in D41.2
Installation Phase	▪ During the Validation process we plan to perform inter and intralaboratory studies, starting with the most relevant toxic endpoints: (anti-)estrogenicity/androgenicity and evaluate the current monitoring	Original starting date: Original end date: According to the DOW Validation: M8-M13	▪ Validation will be summarized in D41.2

	practices. ▪ We plan to screen existing toxicological databases for the toxic potencies of the currently target analyzed priority compounds (n=33+8), and then to compare to the selected relevant bioassay panel.		
Demonstration Phase	❖ Selection of the assay panel to be demonstrated in case studies by using developed universal sample extraction methods (EAWAG) and automated CALUX assays (BDS) ❖ Close collaborations via meetings with water utilities to discuss current state-of-art and challenges of bioscreening of water samples and promote their better acceptance ❖ The most important questions to be answered here are: 1. Do the currently target analyzed priority pollutants cover the activities found in surface/drinking waters? 2. Are this set of compounds indeed the most relevant set to be monitored?	Original starting date: Original end date: According to the DOW Continuous activity over the time frame of the WP (M1-M24)	▪ To perform case studies with collaboration in EAWAG (sampling of various water samples: n=18, sample workup) and BDS (bioscreening)
Reporting Phase and Follow up	❖ D41.1 in progress ❖ D41.2 in progress	Original starting date: Original end date: According to the DOW	▪ D41.1 Will be delivered on time ▪ D41.2

		Delivery date According to the DOW: ▪ D41.1 24 months (31/08/2014) ▪ D41.2 14 months (31/10/2013)	Delivery is slightly delayed 31/03/2014
Evaluation	❖ To our opinion, the set up of the tasks within this WP is clear and straightforward. ❖ After setting the criteria and introducing the trigger values for in vitro toxicity screening of water samples, the relevant bioassays can be selected. As a next step, the automation of sample workup/bioassays facilitate the implementation of the bioassays, further on reduce the analysis costs and enables repeatable/reliable analyses. Finally, the demonstration of the achievements via case studies and the evaluation of the toxicological relevance of the current monitoring practice will promote better acceptance of in vitro bioassays and remove existing barriers for implementation.	Schedule is very tight, especially for the deliverables, and some confusion has been caused due to late stage clustering of deliverables.	Minor adjustments are made according to the initial DOW.

1.4.2 Implementation of bioassays for water quality assessment

Work Package: WP4.2
Demonstration title: Implementation of bioassays for water quality assessment
DEMEAU Partners involved: KWR, BDS, EAWAG, VERI, Griffith University

	Description	Schedule	Adjustments with respect to original planning
Main objectives	The general aim of work area 4 (WA4) we aim to generate a system of powerful quantitative in vitro bioassays to effectively measure a wide range of major classes of toxicants and promote. their widespread use. • WP42 is focusing on the technical implementation of the selected and validated rapid toxicity screening panel at a selection of water utilities. Regulatory barriers are also addressed. Finally, in a later stage this workpackage will also serve as a platform to test technologies as developed in other work activities.	Original starting date: 6 Original end date: 32 According to the DOW WP42: M6-M32	The WP aims to produce two major deliverables namely 1) a position paper how bioassay derived data can be used for water quality assessment (D42.1) and 2) a report on the robustness of novel treatment technologies as determined with the selected bioassays (D42.2). D42.1 has not resulted in a position paper as of yet, but in a technical report orientated towards the international position of bioassays in regulatory frameworks. This deliverable will be finished and uploaded in march 2014. D42.2 is due in a later stage of the project (month 32), however extensive experience has already been made by applying a set of promising bioassays (AREc32 and Nrf2 CALUX bioassays) during ozone treatment at one of the launching utilities (Waternet). The latter work will be submitted for publication to a peer-reviewed journal.
Initiation Phase	One important aspect has been covered in more detail, namely the position of bioassays in regulatory frameworks. The outcome of this desk-top research will provide useful information how various international regulations deal with bioassays in general.	Original starting date: 6 Original end date: 12 According to the DOW	The report is more skewed towards regulatory acceptance of bioassays in regulatory frameworks as originally envisioned.
Installation Phase	During the project a logical testing framework will be developed in which bioassays are positioned. For the testing framework,	Original starting date: 13 Original end date: 16 According to the DOW	Not applicable.

	experiences with regard to the development of bioassay trigger values will be used from WP4.1. The interaction with analytical chemistry is still scheduled.		
Demonstration Phase	An important integrative application is aimed at demonstration studies that show the applicability of the selected panel of bioassays. Preliminary results have been obtained by applying the AREc32 bioassay for a selection of water samples treated with ozone. It is the intention of the present work program to expand this demonstration study by including other the WAs.	Original starting date: 23 Original end date: 32 According to the DOW	Pending
Reporting Phase and Follow up	D42.1 is almost finished and will be published together with a news story on the DEMEAU website.	Original starting date: 12 Original end date: 32 According to the DOW	Not applicable.
Evaluation	To our opinion, the setup of the tasks within the WP is straightforward. Experience with demonstration of bioassays will be expanded later in the project.		