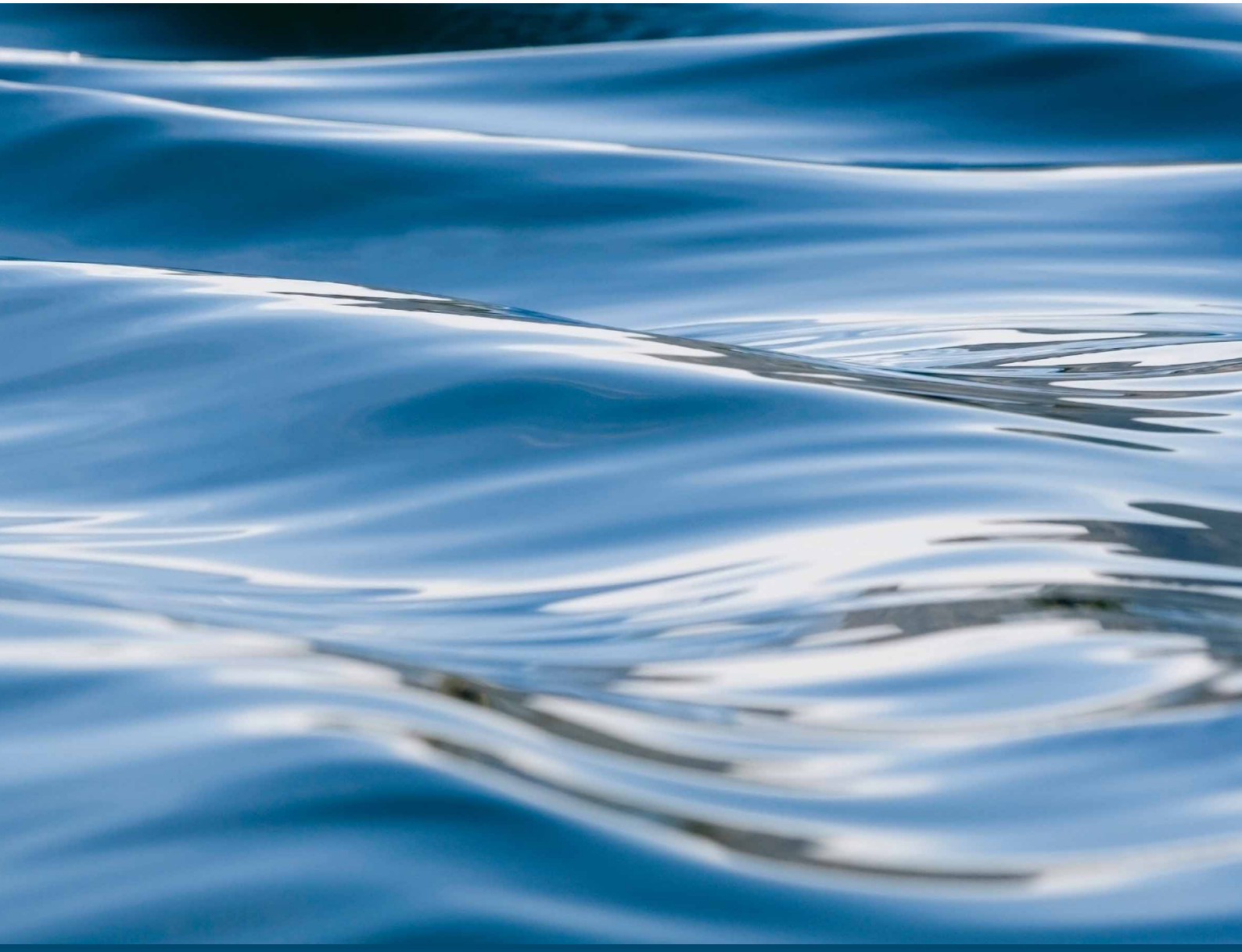
WATER

InnovationsAllianz
DER NRW-HOCHSCHULEN E.V.



THE UNIVERSITIES OF NORTH RHINE-WESTPHALIA: YOUR PARTNERS FOR EUROPEAN RESEARCH PROJECTS

WATER

COMPETENCIES OF NORTH RHINE-WESTPHALIA'S UNIVERSITIES

InnovationsAllianz
DER NRW-HOCHSCHULEN E.V.

THE UNIVERSITIES OF NORTH RHINE-WESTPHALIA:
YOUR PARTNERS FOR EUROPEAN RESEARCH PROJECTS ON "WATER"

With a total of 68 universities, approximately 500,000 students and more than 50 non-university research institutes, North Rhine-Westphalia can boast the most concentrated science and research landscape in Europe. The universities and universities of applied sciences in the German state North Rhine-Westphalia offer outstanding development potential and research expertise.

The NRW Innovation Alliance was founded in 2007, to better reflect the universities' performance, maintain and deepen contact to industry, and promote research and knowledge transfer. This organisation is a cooperative network of universities, universities of applied sciences and university spin-off [transfer] organisations in North Rhine-Westphalia.

In June 2010, NRW Innovation Alliance invited representatives of the European Commission and interested stakeholders from other universities and companies to the NRW Representative Office in Brussels to discuss the challenges and the opportunities dealing with economic, technical and social issues arising from "The Ageing Society". Here, the universities of North Rhine-Westphalia outlined their competence and high potential for collaborative and transfer-orientated research. More than 100 people took part in this first series of symposiums on "The Universities of North Rhine-Westphalia: Your Partners for European Research Projects".

Based on this successful start, the symposium series will continue with "Water" as a theme. This is a research topic that poses basic questions regarding social, environmental and economic needs, including water and drought management, flood risk management, assessing and achieving quality standards for drinking water, and cleaning of polluted wastewater. These are only some of the many issues that our society will have to tackle in the coming decades. This is why "Water" is part of the Europe 2020 Strategy and the 8th Framework Program for Research and Technological Development (FRP). A key objective of the Innovation Union at the core of the Europe 2020 strategy seeks to address the social and environmental challenges posed by water, while at the same time converting them into economic opportunities.

On May 26th 2011, North Rhine-Westphalia's universities and universities of applied sciences will demonstrate their potential input, scientific excellence and multiple resources for developing and shaping current and future European research programmes. This symposium will take place in Brussels, providing access to a potentially large audience, including the European Commission, European Parliament, political parties and associations.

The NRW Innovation Alliance has prepared this catalogue to adequately illustrate the entire spectrum of the universities' research capacities on "Water". It intends to provide the information in an enduring format. The projects address a wide range of technical, economic, ecological and socio-economic questions. Key terminology includes drinking water and health, impact of climate change on water supply and hydrology, innovative strategies to determine flood areas, rural water supply and distribution.

The catalogue contains an extensive listing of scientists in North Rhine-Westphalia's universities, their research activities and contact information. This will enable representatives from other scientific institutions and companies all over Europe to make direct contact with appropriate potential partners.

A short presentation of the NRW Innovation Alliance concludes this publication.

On behalf of the board of directors of the Innovation Alliance of the Universities of North Rhine-Westphalia

Prof. Dr. Gisela Schäfer-Richter
Prof. Dr. Wilhelm Schäfer

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InnovationsAllianz
DER NRW-HOCHSCHULEN E.V.

YOUR PARTNERS FOR EUROPEAN RESEARCH PROJECTS THAT ADDRESS "WATER"

AIMS

With this catalogue, the Universities in North Rhine-Westphalia outline their excellent research in dealing with the many aspects of water, an issue that is of enormous importance to all members of the European Union. The presentations document the universities' scientific capacities, highlighting the issues and research that should be taken into consideration by the European Union in present or future funding programmes.

The collection of high-quality references in this catalogue enables European companies and research institutions to easily contact relevant research partners in North Rhine-Westphalia's universities.

THE FIRST STEP

In Summer/Autumn 2010, the "EU-Lobbying" team from the NRW Innovation Alliance, comprising representatives from more than ten universities, conducted an inquiry at all universities in North Rhine-Westphalia asking for research projects dealing with various aspects of "Water".

GUIDELINES

- Focus on excellent research projects, e.g. collaborative research centres and priority programmes funded by the German Research Foundation (DFG, Deutsche Forschungsgemeinschaft), the Federal Ministry of Education and Research (BMBF), the European Union, companies etc.
- Not just basic research, but also applied projects.
- Various points of contact for the issue "Water", e.g. technical, environmental, economical, socioscientific questions.
- Cooperation with business partners.
- European dimension, Cooperation with partners from other European countries.
- Not more than three projects per university (one page per project).
- Easy-to-read representations.
- Contact information on project leaders and participants.

17 universities participated in this survey and submitted details for 40 research projects.

PROJECT PRESENTATION

ALL ARTICLES ARE STRUCTURED AS FOLLOWS:

- Project title.
- Name of the university, contact.
- Abstract – description of work, objectives, main targets.
- List of participants, business partners, research institutions, networks etc. (from North Rhine-Westphalia and from other member states of the EU).
- Project start and duration, total costs and funding.
- Perspectives, approaches and ideas for further development at the European level.

1.1 CUVE WATERS
SOLAR THERMAL DESALINATION

ABSTRACT

In Namibia, the most arid country south of the Sahara desert, the central northern region is the most densely populated area, with 42 % of the Namibian population living there. The supply of drinking water is affected by seasonal alterations of drought and heavy rainfall, climate change, mostly saline groundwater, and the small number of steady-flowing rivers; factors which combine to make water management more difficult. Namibia's ecological system is under severe stress due to population pressure (2.1 % annual growth) that has resulted in high population density with ongoing urbanisation, soil degradation and an absence of sanitation facilities.

Based on a feasibility study, the CuveWaters project aims to support the conceptual development and practical implementation of integrated water resources management (IWRM) in Namibia. This IWRM will be embedded in existing processes and will be adapted to the specific natural, political, social and economic conditions. The general task is to optimise water distribution to the various sectors and to consider interlinkages between water utilisation and use of other resources, such as land, energy and nutrients. Application will deploy knowledge management, technology transfer, adaptation, and participation. Its aim is to secure and develop the resource potential of the region.

The sub-project addresses problems of groundwater desalination by the use of solar driven desalination systems. As part of the subproject, the Solar-Institut Jülich (SIJ) and the Engineering Office for Energy and Environmental Technology (IBEU) have developed a new, solar-thermal desalination system, with two different options for supplying solar heat. The systems were adapted to the climate and sociocultural conditions in Namibia to assure a long-term operation.

A suitable concept for a solar-thermal desalination system is a multistage evaporator unit. The design for the condensation process utilises a heat recovery mechanism which substantially increases the rate of drinking water output in comparison to other solar-thermal desalination systems. This heat recovery process considerably reduces the energy requirement per litre of drinking water, when compared to a simple solar distil. Depending on the number of condensing stages, the production rate can be improved by a factor of 3 - 5 compared to the solar distil. This represents an increase in drinking water production to 15 - 20 litres per square meter collector area. Furthermore, besides solar energy, this system needs neither chemicals nor additional energy supply. There is very little demand in maintenance and none requiring qualified personnel. Moreover, the system is self-regulating. The price of water reached is around 1 - 2 Euro-Cents per litre.

The system is particularly suited for decentralised operation in coastal settlements, in places with saline groundwater, and in areas with groundwater contaminated with arsenics, fluorides or lead. Consequently, the multi-stage evaporator unit contributes to a sustainable improvement of the environment and living conditions of the population.

LIST OF PARTICIPANTS

Aachen University of Applied Sciences, Solar-Institut, Jülich

Engineering Office for Energy and Environmental Technology (IBEU), Jülich

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: May 2009 – April 2012

Costs: 320,880 Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Projects in European countries and worldwide in cooperation with international partners should support the dissemination of these technologies. There is a big demand for efficient solar thermal driven desalination units in small and medium sizes with low maintenance requirements, no external energy suppy and self-regulation control.

Solar-thermal desalination plant *Solar-Institut Jülich, Univ. Appl. Sci. Aachen Solar-Campus Jülich*

CONTACT: Solar-Institut Jülich, **Dr.-Ing. Spiros Alexopoulos**

University of Applied Sciences Aachen

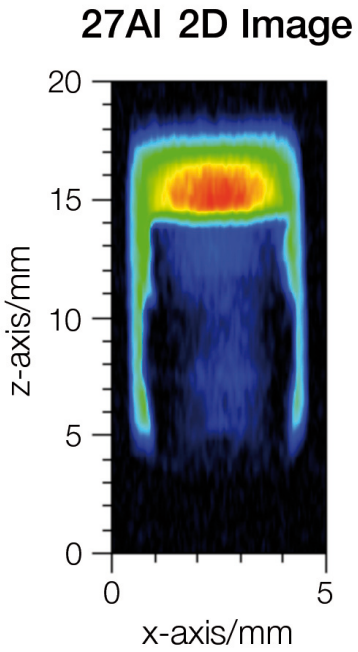
1.2 INTELLIGENT HYDROGELS

ABSTRACT

Hydrogels are three-dimensional polymer networks that can absorb very large amounts of water. Due to this behaviour, they are often incorporated into products like babys' nappies, cosmetics, drug delivery systems, contact lenses, and ameliorant.

By contrast, hydrogel research for the building sector has focussed on developing sealant materials against pressurised water. For example, by absorbing pressurised water, the sealing material in gaps between concrete segments swells and fills these gaps, evenly building up a tightening pressure (figure 1). Special efforts have also been made to develop sealant materials which will function in seawater. Furthermore, thermosensitive hydrogels filled with magnetic nanoparticles have been developed for ameliorants and drug delivery systems to serve as contactless, directable depots for pharmaceutical drugs.

Basic research has sought to understand the molecular mechanism underlying swelling procedures in different media, aiming to use hydrogels as intelligent materials. In response to an external stimulus, such as temperature, pH or ion concentration, hydrogels can reversibly change their shape. MRI-techniques have been used to detect such changes on a molecular level. For example, the exchange reactions between different ions have been investigated with 23Na and 27Al MRI during the individual stages of the collapse and regeneration of gels. Such exchange reactions can also be made visible by imaging techniques (figure 2).



^{27}Al-ion density image of a charge-gradient hydrogel followed by ^{27}Al MRI *Univ. Appl. Sci. Aachen*

LIST OF PARTICIPANTS

Aachen University of Applied Sciences, Institute for Applied Polymer Science, Prof. Dr. Th. Mang

BBZ GmbH, Willich

RWTH Aachen University, Institute for Biomedical Engineering

RWTH Aachen University, Institute for Technical and Macromolecular Chemistry

Technical University Ilmenau, Department of Technical Physics II

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Several Projects: 2001 – 2012

Costs: 1.1 million Euro

Funding: Ministry for Innovation, Science and Research of North Rhine-Westphalia

MIWFT NRW

Federal Ministry for Science and Technology (BMBF)

German Science Foundation (DFG)

BBZ GmbH, Willich

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Cooperation with Hogeschool Zuyd in Heerlen (Netherlands) and Hogeschool Limburg in Diepenbeek (Belgium); Aplication for EU-funding. Topics among others are water permeability of foils.

Sealed tunnel made of tubing segments *Dätwyler AG, Altdorf, Schweiz*

University of Applied Sciences Aachen

1.3 IMMOTHERM
IMMOBILIZATION OF THERMOPHILIC MICROORGANISMS

ABSTRACT

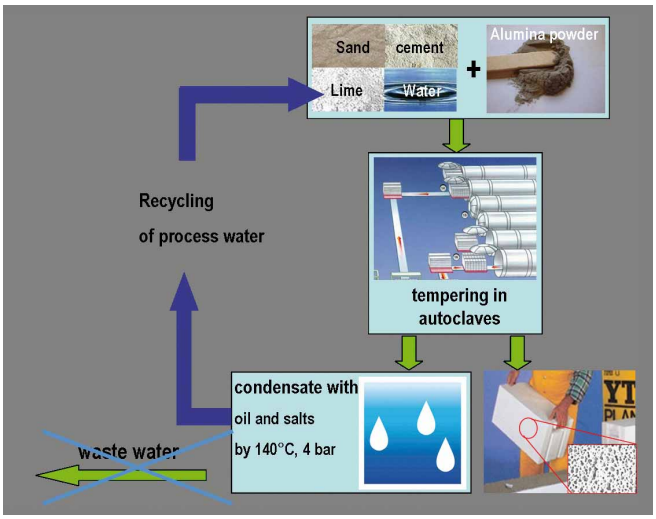
Moulding oil is used for the production of porous concrete by Xella Baustoffe GmbH and its associated companies, functioning as a release layer. Oil is intensively mixed with condensate in the autoclaves used for the production of porous concrete. This produces stable oil-in-water emulsions, but prevents reutilisation of condensate as boiler feed water in a closed-loop. As a consequence, steam is generated with a 0 % return of condensate, resulting in high energy and water costs.

The aim of the IMMOTHERM project is to develop an emission-reduced technology for the porous concrete production process that purifies polluted water at high process temperatures within a closed cycle. Under these boundary conditions, the successful completion of this project should lead to reduced CO^2-emissions and improved water recycling.

In a first production step, the contained solid particles and oil constituents in the oil-laden condensate will be reduced with a sand filter and/or various adsorbents, without the need to considerably cool it. Subsequent pollutant removal will employ a biological treatment. Here, the application of thermophilic microorganisms is being analysed. The concentration of pollutants can be reduced considerably as a result of combining filtration with the immobilising material and biological de-composition. After pre-treatment, the condensate is desalinated in a reverse osmosis process, such that the quality requirements of the boiler water can be guaranteed, even under high temperatures.

Within the IMMOTHERM project, various purification methods have been tested. The multi-stage test system proved to be the most promising. Insensitive to pollutants in the process water, sand filters were used in a first purification step to separate the solids and undissolved oil. In a second purification step, a biochemical reactor was built to optimise the process using mixed manure as the inoculum. After this second purification stage, the discharge of biomass must be minimised. In the last filtration stage, a sand filter is used. In contrast to the first filter, a special absorber is added which binds organic carbon, such as biomass or dissolved alkanes. Multiple tests (e.g. COD and "KW300") confirmed that the wastewater components are reduced to a point where there is a lower risk of fouling for a downstream, reverse osmosis installation.

A first prototype, including the different filtration steps, will be constructed and installed in one of Xella's German concrete plants.



Project scheme *Solar-Institut Jülich, Univ. Appl. Sci. Aachen Solar-Campus Jülich*

LIST OF PARTICIPANTS

Aachen University of Applied Sciences, Solar-Institut Jülich, Jülich

Xella Baustoffe GmbH, Duisburg

INWATEC GmbH & Co. KG, Bergheim

Stobbe Tech Ceramics A/S, Denmark

i+f process GmbH, Hürth

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: July 2008 – February 2011

Costs: 320,000 Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

If the results meet expectations, the developed process can be used by Xella in its other concrete manufacturing plants. It may also be used for other industrial processes that are affected by oil impurities.

University of Applied Sciences Aachen

2.1 RESEARCH MICROPOLLUTANTS NRW
ELIMINATION OF PHARMACEUTICALS AND ORGANIC TRACE ELEMENTS FROM WASTEWATER

ABSTRACT

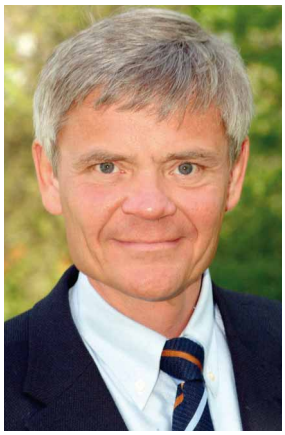
The Institute for Environmental Engineering of RWTH Aachen University is the leader of the consortium "Research Micropollutants NRW" which comprises five R+D-sub-projects.

The MIKRORUHR sub-project is investigating the potential for reducing industrial pollution of the Ruhr river. In addition to identifying and quantifying the eco-toxicological and hygiene effects of the relevant organic micropollutants (e.g. industrial chemicals), (technical) strategies are being developed to reduce their emissions into the aquatic environment. The fate of these chemicals in wastewater treatment plants and surface water will be analysed. A water quality model will be used to calculate their concentrations in the Ruhr river.

The MIKROIND sub-project assesses the industrial input of micropollutants and investigates whether the input of these substances can be avoided by employing suitable process-integrated or additive process engineering methods. In the MIKROFLOCK sub-project, the technical, operational and economic aspects of a full scale use of filter units in North Rhine-Westphalia will be investigated using different technological approaches. The dosing of powdered activated carbon (PAC) into the supernatant liquor of one filter chamber and an improvement of the existing filter material with granular activated carbon (GAC) will be examined. In addition, the dosage of PAC into the effluent of the final settling tank with a technical PAC separation prior to the sand filtration unit will be tested at laboratory and/or pilot scale.

The sub-project MIKROMEM explores possible applications of membrane technology for the elimination of pharmaceuticals and other organic micropollutants in municipal wastewater treatment plants. The project focuses on dense membrane processes for treatment of wastewater treatment plant effluent including the treatment of resulting concentrate streams and the upgrading of membrane bioreactors (MBR) by adding specialised strains of bacteria (bio-augmentation) or PAC. Tests are conducted in large-scale applications.

Within the sub-project MIKROLIGHT, laboratory experiments are being conducted to investigate the elimination of micropollutants by UV-radiation. These will investigate process combinations of UV radiation and ozonation, addition of hydrogene peroxide or titanium dioxide. Furthermore, experiments with short wave UV radiation (<200 nm) are being planned. A pilot plant will be constructed at a wastewater treatment plant.



Univ.-Prof. Dr.-Ing. Johannes Pinnekamp

LIST OF PARTICIPANTS

RWTH Aachen University,
Institute for Environmental Engineering (ISA)

RWTH Aachen University, AVT Aachener Verfahrenstechnik (Aachen Technical Engineering)

RWTH Aachen University, Institute for Hygiene and Environmental Medicine

Aggerverband, Gummersbach

Erftverband, Bergheim

IWW Water Centre, Mülheim/Ruhr

Leibniz University of Hannover, Institute for Water Quality and Waste Management (ISAH)

Linksniederrheinische Entwässerungs-Genossenschaft, Kamp-Lintfort

Lippeverband, Essen

Ruhrverband, Essen

SAG-Engineers Süddeutsche Abwasserreinigungs-Ingenieur GmbH, Ulm

Tuttahs & Meyer Ingenieurgesellschaft, Aachen

University of Applied Sciences Northwestern Switzerland FHNW, School of Life Sciences, Institute for Ecopreneurship, Basel/Muttenz, Switzerland

University of Stuttgart, Institute for Sanitary Engineering, Water Quality and Solid Waste Management (ISWA)

Wasserverband Eifel/Rur, Düren

Wupperverband, Wuppertal

Wupperverbandsgesellschaft für integrale Wasserwirtschaft (WiW), Wuppertal

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

These five R+D-projects (12 to 18 months, depending on each project) started in July 2010. Projects are funded by the Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the State of North Rhine-Westphalia with approx. 1.9 million Euro.

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Pharmaceuticals and other organic micropollutants are found ubiquitously in the environment, sometimes even in ecotoxicologically relevant concentrations. The majority of these substances pass through wastewater treatment plants unchanged or transformed, and enter the water cycle through receiving waters. The results of the R+D-projects will lead to new approaches within the wastewater treatment and are transferable to other European countries.

www.micropollutants.net

RWTH Aachen University

2.2 NEW ED

BIPOLAR MEMBRANE ELECTRODIALYSIS FOR REMEDIATION OF HIGHLY SALINE WASTE STREAMS

Univ.-Prof. Dr.-Ing. Thomas Melin

ABSTRACT

In the chemical industry, a large number of production processes emit highly saline waste effluents. These salt streams result either from processes that require salts or from the neutralization of acids and bases. Sodium chloride effluent streams, for example, emanate from a number of processes such as the production of polycarbonate, vinyl chloride, or amino acids. Sulphate streams are emitted in large quantities from paper manufacture, phosphates from fertilizer production and nitrates from the nuclear industry.

With the current treatment technologies, the salt constituents of these waste effluents cannot be recovered. Instead, the saline waste streams are often discharged directly into surface waters. Depending on the nature of the salt components, this can result in various pollution problems such as eutrophication. Generally, discharging these brine streams creates a heavy burden for the eco-system.

Changes in environmental regulations are making the disposal of chemical wastes more difficult and costly, such that recycling of valuable components in the waste is becoming more economically attractive.

Membrane technology might offer a solution to the treatment of brines, providing a means to prevent pollution and recover resources. Water treatment using membrane technology has reached maturity in many drinking water and wastewater applications. However, membrane treatment of highly saline process waters using current membrane technology requires high pressures in a very energy-intensive process that is not economically feasible.

In 'New ED', we are aiming at the conversion of salt wastes into its more valuable components. This will be achieved by developing bipolar membrane technology and new bipolar membranes to economically recover acid and base from saline wastewater streams.

Industrial leadership in 'New ED' is provided by Fumatech GmbH, a leading manufacturer of ion exchange membranes used in electrodialysis and related processes. New ED's academic project partners come from the University of Twente (the Netherlands), Ben Gurion University (Israel) and RWTH Aachen University (Germany). The groups involved are specialized in membrane material science as well as membrane process technology. Considerable industrial interest for this project and its products has seen the participation of two large industrial end-users, Bayer Material Science (Germany), and Prayon S.A. (Belgium), both of whom are part of the 'New ED' consortium.

Although the core of the 'New ED' project is the development of highly efficient bipolar membranes, its approach goes beyond just a material science research project. We are also looking towards an energy-efficient process technology, starting with the development of the new bipolar membrane, and the optimisation of the current module technology. Pilot testing of 'New ED' products will be conducted on the relevant wastewaters. Finally, the 'New ED' technology will be integrated into the appropriate production processes to prove their environmental and economic feasibility.

LIST OF PARTICIPANTS

RWTH Aachen University, Chemical Process Engineering, Prof. Dr.-Ing. Thomas Melin (Coordinator)

Twente University, Netherlands

Ben Gurion University, Israel

Fumatech GmbH, Vaihingen

Bayer Material Science, Leverkusen

Prayon S.A., Belgium

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: Juni 2009 – Mai 2012

Costs: 1.654,846 Euro

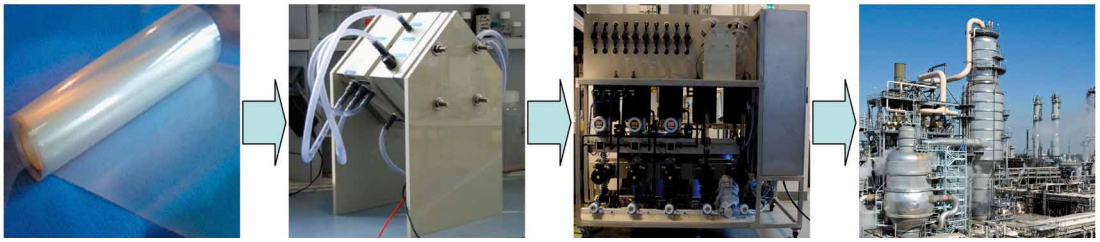
Funding: 1.163,159 Euro from EU FP7

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

'New ED' will reduce waste production and energy consumption in various industrial production processes. It will thus have a direct positive impact on water utilisation and carbon dioxide emissions.

Acids and bases are among the most popular commodity chemicals in the world with more than 50 million tons produced annually and converted into salt at the end of their life-cycle. As result of 'New ED' electrodialysis with bipolar membranes will enable us to recover acids and bases from their salts. 'New ED' is further expected to enhance the productivity of salt splitting and thus reduce investment and operating costs for acid and base production.

This improved technology will lead to new environmentally compatible processes, strengthen industry and create new jobs. These benefits will have a positive impact on the chemical industry, food and beverage industry, power generation, and industrial production processes. Fumatech GmbH, a producer of bipolar membranes and related equipment, expects to strengthen its world-wide market position.



From membrane development to process integration.

Chemical Process Engineering (AVT), RWTH Aachen University

RWTH Aachen University

2.3 *dynaklim*
DYNAMIC ADAPTATION TO THE EFFECTS OF CLIMATE CHANGE IN EMSCHER-LIPPE REGION (NORTH RHINE-WESTPHALIA)

ABSTRACT

The *dynaklim* project focuses on the possible impact of climate change upon the regional water cycle in the Emscher-Lippe region (Ruhr basin) and its likely effects on the local population, economy, and environment. The *dynaklim* work programme encompasses interdisciplinary research into the impact on the regional water balance and various application projects for flexible adaptation on the ground.

By setting up a sustainable regional network, a web-based knowledge management system, and a region-spanning roadmap process ("Regional Adaptation"), *dynaklim* assists the region to develop itself into a future-based conurbation with an improved ability to innovate and to adapt to climate change.

Six sub-goals have been formulated for *dynaklim*'s project work:

(1) By developing and sustainably implementing Roadmap 2020 "Regional Climate Adaptation", the region will receive a reference framework for a future, regional adaptation strategy that both connects previously isolated individual topics, and co-ordinates the goals and activities of regional administration, politicians, the economy and society. Working results from the project`s five thematic Platforms will be continuously introduced into the roadmap.

(2) Networking and Knowledge Management bring together actors in the region, setting up efficient structures to adapt, work, and strengthen knowledge transfer while implementing the region's adaptation measures. The goal is to institutionalize and perpetuate the *dynaklim* network, which will later continue to develop and implement the roadmap.

(3) The Water Management sub-goal addresses new concepts for sustainably managing regional water balance strategies, planning processes, and technological solutions. This will help experts and decision makers to anticipate the effects of climate change on water supply, urban drainage, wastewater treatment, and urban microclimates.

(4) Innovation and Competitiveness strengthens the regional economy's adaptation process by aiming to recognise, utilise, and expand its market and innovation potential. Together with the region's actors, the project will develop a strategy for promoting climate-focused business.

(5) The Financing and Organisation sub-goal investigates how water management services can be made climate-resilient through more flexible organisational and financial means and how the efficiency of adaptation measures an other water-related services can be assessed.

(6) Politics, Planning and Administration: In close co-operation with decision makers and municipalities, regional institutions, and non-governmental actors, *dynaklim* will develop and implement concrete ways to improve Regional Governance and the effective regional management of the adaptation process.

www.dynaklim.de

LIST OF PARTICIPANTS

The open *dynaklim* network currently includes more than 40 partners like water management companies, state authorities, industrial entrepreneurs, decision makers from politics and administration, research partners, regional interest groups and a number of thematically related projects in North Rhine-Westphalia and neighbouring European states.

Project coordination:

- FiW Research Institute for Water and Waste Management at RWTH Aachen University; www.fiw.rwth-aachen.de

Project Partners:

- ahu AG Wasser – Boden - Geomatik, Aachen; www.ahu.de
- dr. papadakis GmbH, Hattingen; www.drpapadakis.de
- Emschergenossenschaft und Lippeverband, Essen; www.eglv.de
- IWW Water Centre, Mülheim/Ruhr; www.iww-online.de
- RISP Rhein-Ruhr-Institute for Social Research and Political Consulting; www.risp-duisburg.de
- University of Duisburg-Essen:
  Institute for Urban Water- and Waste-Management;
  www.uni-due.de/abfall/abfalltechnik-essen
  Institute for Applied Climatology and Landscape Ecology,
  www.uni-due.de/klimatologie
- RWTH Aachen University, ISA Institute for Environmental Engineering; www.isa.rwth-aachen.de
- RUFIS, Ruhr-Forschungsinstitut für Innovations- und Strukturpolitik, Bochum; www.rufis.de
- Technical University Dortmund:
  sfs Sozialforschungsstelle; www.sfs-dortmund.de
  Fachgebiet Stadt- und Regionalsoziologie;
  www.raumplanung.uni-dortmund.de/soz/srs
- Wuppertal Institute for Climate, Environment and Energy;
  www.wupperinst.org

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: July 2009 – June 2014

Costs: 13.5 million Euro

Funding: 12 million Euro from the German Federal Ministry of Education and Research (BMBF) via the program KLIMZUG "Managing climate change in regions for the future" (www.klimzug.de)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

As a model project, *dynaklim* will take on national and international significance for climate change adaptation of conurbations and their environs. This concept of dynamic adaptation to climate change in regional planning and development processes can be transferred to other European regions and cities with similar problems.

RWTH Aachen University

2.4 TOTWAT – INTERDISCIPLINARY THINKING
TRAINING-OF-TRAINERS PROGRAM IN INTERDISCIPLINARY WATER MANAGEMENT

ABSTRACT

A Training-of-Trainers Program on the theme of water has been formed by an alliance between the RWTH Aachen, the Institute for Advanced Studies (Vienna), and the Egyptian National Water Research Center (Cairo), Cairo University (Irrigation and Hydraulics Department), and Fayoum University (Engineering Departments). The project was realised by the Academic and Research Department Engineering Hydrology at RWTH Aachen University, which is the grant-holder.

The main goal of the project was to develop an interdisciplinary training program in the field of water management that is tailored to local needs. Furthermore, the project needed to be sustainable, such that it could be independently operated by the partners beyond the project lifetime.

The trained trainers serve as multiplicands - they should not only transfer their knowledge to many colleagues, but also share this ground-breaking, multimedia-based form of knowledge transfer throughout the local water economy. Due to the deep integration of the Egyptian water economy, specific requirements for employees of the Egyptian ministry had to be carefully designated.

Profound analysis of water-specific requirements showed that knowledge transfer should focus on five different subject areas:

- technical aspects of the water economy
- interdisciplinary aspects of the water economy
- socio-economics of the water economy
- environmental aspects of the water economy
- general IT skills for knowledge transfer

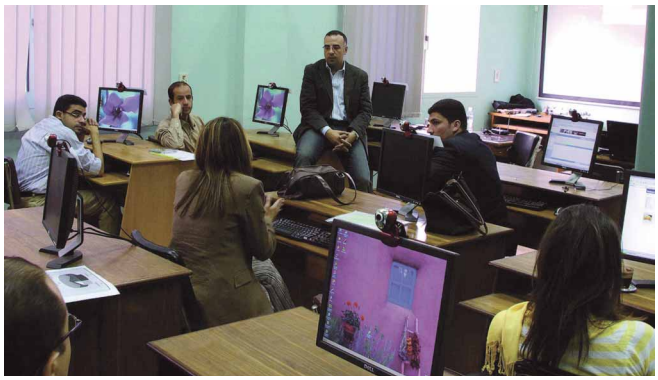
The entire training consists of five different modules, each dealing with separate aspects of the five subject areas. The contents of the modules were first intensively discussed and agreed by the partners, then realised in workshops. Every workshop had at least 30 participants who were Egyptian professors and assistants from the partner universities, and was held in Egypt, Germany, or Austria.

Multimedia-based knowledge transfer also involves advanced training in the didactics of media studies, as well as adjustments in the IT-infrastructure to match current technology standards. A second focus was on sustainability beyond the project lifetime. To achieve this, an open-source eLearning environment was set up on servers at the partner universities, and highly portable content in terms of SCORM (Shareable Content Object Reference Model) compatible media was produced.

Potential Egyptian trainers were themselves intensively trained to produce multimedia-based knowledge content. They were able to do this on their own after the training courses.

As a result, 18 courses have been created, with topics like geoinformation systems, socio-economics, irrigation problems, and the impact of climate change. The intention of creating these courses as modules was also to deliver knowledge to others interested in these fields. This is why these modules are available free of charge. Anyone can register to work with them by accessing: http://totwatmoodle.lfi.rwth-aachen.de.

Beyond the project's lifetime, this website will remain available and be provided by the Academic and Research Department Engineering Hydrology of the RWTH Aachen. Further information can also be obtained on the website: http://totwat.blip.tv.



Project coordinator Dr. Hani Sewilam with Egyptian partners at one of many e Learning workshops. *RWTH Aachen University*

LIST OF PARTICIPANTS

RWTH Aachen University, Academic and Research Department Engineering Hydrology

Cairo University, Irrigation and Hydraulics Department, Egypt

Fayoum University, Engineering Departments, Egypt

National Water Water Research Center Cairo, Egypt

Institute for Advanced Studies, Vienna, Austria

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2006 – 2009

Costs: approx. 500,000 Euro

Funding: European Commission, Executive Agency Education, Audiovisual and Culture, TEMPUS

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Our modern world tends to be unthinkable without multimedia learning techniques, because they are easy and readily accessible. Future development could lead to a clustering of many different eLearning systems and many different cultures.

Univ.-Prof. Dr.-Ing. Heribert Nacken

RWTH Aachen University

3.1 ENVIRONMENTAL QUALITY ASSESSMENT IN AQUATIC ECOSYSTEMS – FROM SINGLE SPECIES TOXICITY TESTING TO COMMUNITY MONITORING

ABSTRACT

Sediment contact tests with benthic organisms are required to assess the risk of hydrophobic chemicals (according to REACH) and contaminated environmental samples (dredged material and sediments, according to EU-WFD). Due to the complexity of the sedimentary matrix and the influence of confounding variables, such sediment contact tests have to be thoroughly standardized (sediment contact test with Caenorhabditis elegans - ISO 10872).

The analysis of benthic communities can be used to estimate and monitor the quality of aquatic systems, especially eutrophic and contaminated sediments. As the most abundant group of metazoa found in sediments, nematodes are particularly suitable as indicator organisms. A new metric, the NemaSPEAR (Nematode Species at Risk) index is being created to compare different water systems all over Europe and the world. In contrast to single species tests (e.g. Caenorhabditis elegans) this index is based on the species composition of nematode communities living in the habitat investigated, indicating anthropogenic pollution (e.g. pesticides or heavy metals) of a given sample.

LIST OF PARTICIPANTS

Bielefeld University, Institute for Animal Ecology, Prof. Dr. Walter Traunspurger

Ecossa (Ecological sediment and soil assessment), Starnberg

Institute for Biodiversity – Network (ibn), Regensburg

ECT Ecotoxicology GmbH, Flörsheim

UFZ (Helmholtz-Center for Environmental Research), Leipzig

GSF (Helmholtz-Center Munich – German Research Center for Environmental Health), Neuherberg

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

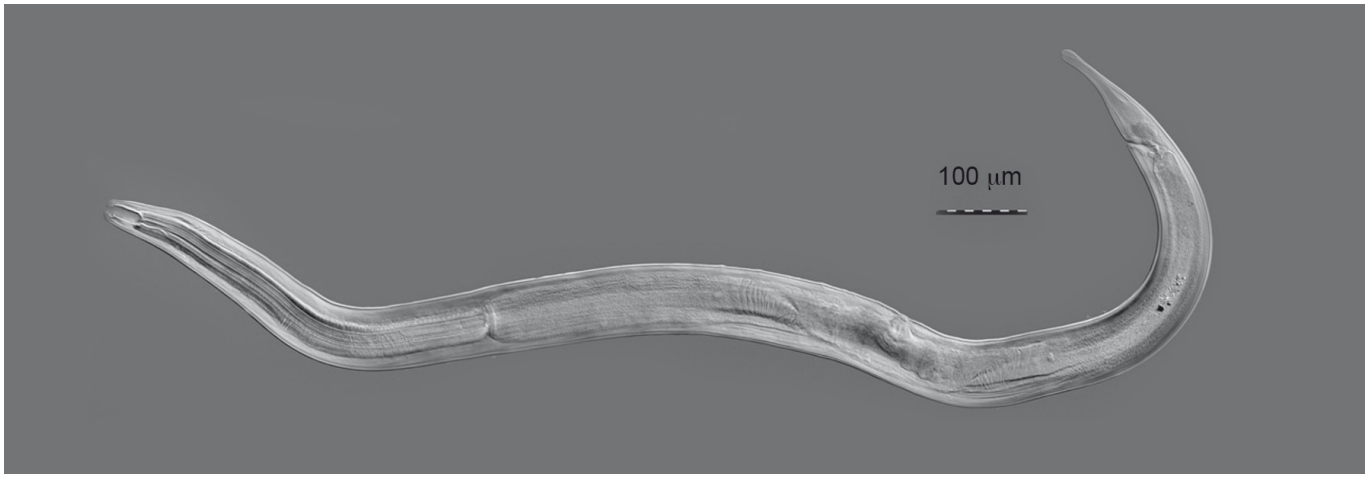
Project: 2000 – 2010

Costs: approx. 500,000 Euro

Funding: Federal Institute of Hydrology (BfG)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Implementation of toxicity test strategy for EU-Water Framework Directive (EU-WFD) and REACH (Registration, Evaluation and Authorisation of CHemicals)
- Evaluation of the ecological status of aquatic systems
- Assessment of contaminated sediment (e.g. dredged material)
- DNA barcoding
- Genomics (e.g. microarrays)
- Risk assessment of new hazardous com pounds (e.g. nanoparticles)
- Drinking water protection
- Evaluation of groundwater remediation
- Biofilms in waste water treatment



Nematodes of the genus Mononchus indicate anthropogenic pollution of water and sediments.

Prof. Dr. W. Traunspurger / University of Bielefeld

Bielefeld University

3.2 CLIMATE WORLDS LIVING WITH CLIMATE CHANGES IN VARIOUS COASTAL AREAS OF THE WORLD – A GLOBAL ETHNOGRAPHY

ABSTRACT

Climate change is a topical issue of considerable social importance. Melting glaciers, rising sea levels, high winds and flooding cause high (social) costs and attract the attention of the media, forcing people in politics, the economy and science to make unambiguous statements. But what exactly is climate change? How is it experienced in everyday life and what are its social consequences?

The causes and physical consequences of climate change (for example, from rising sea levels) can be investigated using methods from the natural sciences. However, social costs and cultural patterns of interpretation (and management) cannot be so easily derived from physical models of the earth's surface. This is because, even if we assume that climate change concerns the whole globe, it can only be experienced in everyday life through various forms of cultural coding and interpretive patterns.

Since April 2010, a global collaborative team of ethnographers, the "Climate Worlds" research team, has been studying if, and how, climate change is perceived and interpreted at a local level. What culturally specific practices have formed for coping with ocean dynamics in various coastal regions of the world?

The concept of a globally designed collaborative video-ethnography is innovative and unique to date. Five graduates in social anthropology, cultural studies, political science, and sociology from several universities in Austria and Germany are participating in the project. The team members' studies are located at sites on several continents around the globe, all of them highly threatened or already affected by rising sea levels and/or global warming. In Tokyo and San Francisco, two of the young researchers explore the ways in which societies with different cultural backgrounds perceive and cope with rising sea levels in metropolitan environments. In contrast, the researchers located on the West Frisian Islands, Cape Verde and Churchill/Hudson Bay, are investigating culturally specific ways in which small and remote (island) communities, which are economically and culturally close to the sea, perceive and handle the consequences of climate change. Jointly the research team follows climate change-related local discourses in order to identify how, and by which social actors and institutions, knowledge about global climate change is constructed and disseminated. These studies will be combined to form a teleidoscope, in which a central topic of the global climate debate is broken down into a wide variety of local cultural interpretations. A documentary film producer is recording the entire research process on film, thereby ensuring a lasting record of the research project. The project's results will be published using a multimedia format that will also appeal to the general public. In this way, Climate Worlds will make both a direct contribution to intercultural (media) education and also constitute an experiment in the digital communication of scientific results and knowledge. www.uni-bielefeld.de/bghs/programm/klima/index.html

Climate Worlds - field & work impressions *Dr. Heike Greschke*

LIST OF PARTICIPANTS

Bielefeld University, Graduate School in History and Sociology (BGHS), Prof. Dr. Jörg Bergmann, Dr. Heike Greschke

Bielefeld University, Center for Interdisciplinary Research (ZiF), Germany

Institute for Advanced Studies in the Humanities (KWI), Prof. Dr. Claus Leggewie, Essen

Team members: Jelena Adeli, Claudia Grill, Robert Lindner, Julia Schleisiek, Lea Schmitt

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: October 2009 – September 2012

Funding: German Research Foundation (DFG)

Japanese Society for the Promotion of Science (JSPS)

Kulturwissenschaftliches Institut Essen (KWI)

Landesanstalt für Medien NRW, Düsseldorf

University Bielefeld Center for Interdisciplinary Research (ZiF)

Bielefeld University

3.3 MOLECULAR RECOGNITION OF ICE SURFACES BY ANTIFREEZE GLYCOPROTEINS AND SYNTHETIC ANALOGUES

ABSTRACT

At sub-zero temperatures, ice formation can occur in the cellular interior of organisms living in cold regions of the biosphere. Once such ice crystals form, they can grow to larger crystals at the cost of smaller ones via the process of recrystallization. However, this can lead to destruction of cell membranes.

A similar process occurs in frozen food and is the reason why the cold storage of biological tissues and organs is still problematic. In nature, plants, fish and insects synthesize antifreeze proteins to prevent intracellular ice growth. By adsorbing to the surface of ice crystals, the proteins inhibit ice crystal growth and associated cell damage. However, some of the mechanisms involved are still unresolved.

We are investigating the processes that occur during ice recrystallization, and developing tools for quantifying the retardation of ice crystal growth by different proteins. Moreover, we have established routes for the chemical synthesis of natural antifreeze glycopeptides and several non-natural analogues, and have also characterised their antifreeze activity. This improved knowledge is aimed at facilitating the development of mimetics.

LIST OF PARTICIPANTS

Bielefeld University:

Physical Chemistry, Prof. Dr. Thomas Koop

Organic and Bioorganic Chemistry, Prof. Dr. Norbert Sewald

Applied Laserphysics and Laserspectroscopy, Dr. Mark Schüttpelz

University of Würzburg, Biotechnology and Biophysics, PD Dr. Sören Doose

Eötvös Lorand University Budapest, Dept. of Organic Chemistry, Prof. Dr. Zsuzsa Majer, Hungary

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

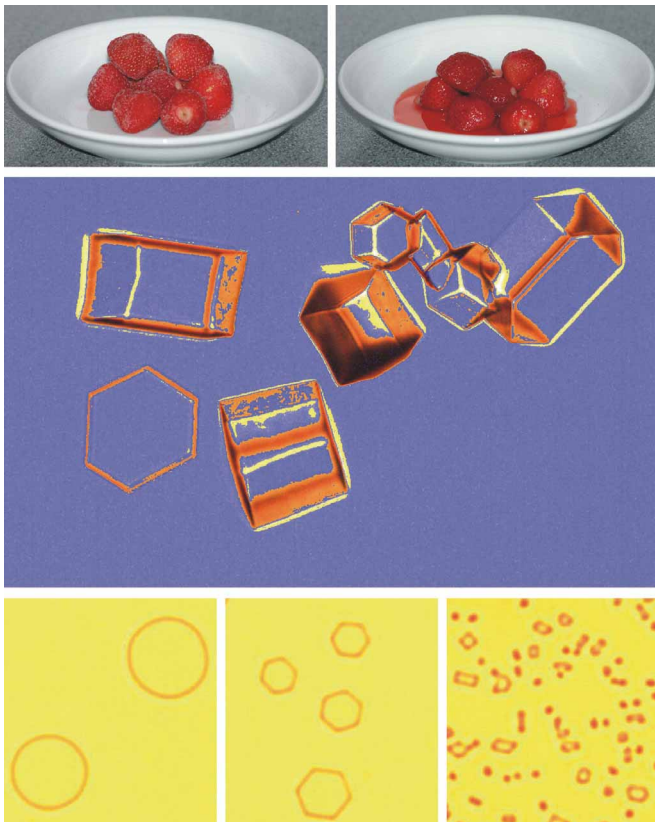
Project: 2009 - 2012

Costs: 323,000 Euro

Funding: German Research Foundation (DFG) through a Collaborative Research Centre (SFB 613 "Physics of single-molecule processes and of molecular recognition in organic systems")

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Development of mimetics for applications in the cold storage of frozen food and biological tissues.



Carsten Budke, Prof. Dr. Thomas Koop

Top: Frozen strawberries appear to be intact, but after thawing they lose their sap because ice crystals have destroyed cell membranes.

Middle: Synthetic antifreeze peptides adsorb to the surface of ice crystals, thereby changing their morphology and inhibiting their growth.

Bottom: Upon addition of synthetic antifreeze glycopeptides, the average ice crystal size is strongly reduced (left to right).

4.1 IMPROVED FLOOD PROTECTION BY TECHNICAL FLOW RETENTION

INTEGRATION OF MULTIVARIATE HYDROLOGICAL LOADS BY IMPRECISE PROBABILITIES

ABSTRACT

One result of the severe floods in Europe at the turn of the millennium was an accelerated shift from safety-oriented flood control towards flood-risk management. However, incorporating risk awareness into flood protection necessitates new planning methodologies. Furthermore, the effectiveness of technical flood control measures depend on many different factors that cannot be described by traditional statistics.

In this project, multivariate statistical characteristics of hydrological loads were estimated, and applied, to evaluate complex flood control measures in large river basins. Nevertheless, statistical characterisation of these criteria based on observed data is difficult, since the use of past time series is often not sufficient to analyse the variety of possible future events. In order to generate such data, Monte-Carlo simulations of precipitation fields were applied as input in complex hydrological simulation models. Using the resulting deterministic-stochastic flood generator, a large variety of flood events were simulated that could be used as scenarios for possible hydrological loads.

However, these simulations imply many uncertainties. The results are biased by the basic assumptions of the modeling tools. Thus, the probabilities of the simulated flood scenarios differ from probabilities which would be derived from long-term observed time series. To account for these 'known unknowns', the bias of the simulations was considered by imprecise probabilities, based on Fuzzy-Logic. Here, probabilities derived from measured flood data were combined with probabilities which were estimated from simulated long-term series. To consider the resulting imprecise probabilities in planning, fuzzy sets were used to distinguish between design floods that were more or less possible. The advantages of this unique approach were demonstrated when planning a polder system for the 6000 km^2 basin of the Unstrut River in south-east Germany.

LIST OF PARTICIPANTS

Ruhr-Universität Bochum, Faculty of Civil and Environmental Engineering, Chair for Hydrology, Water Management and Environmental Engineering, Prof. Dr. Andreas Schumann, (Coordination)

RWTH Aachen University, Chair of Hydraulic Engineering and Water Resources Management and Institute of Hydraulic Engineering

Institute for Ecological Economy Research GmbH, Berlin

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

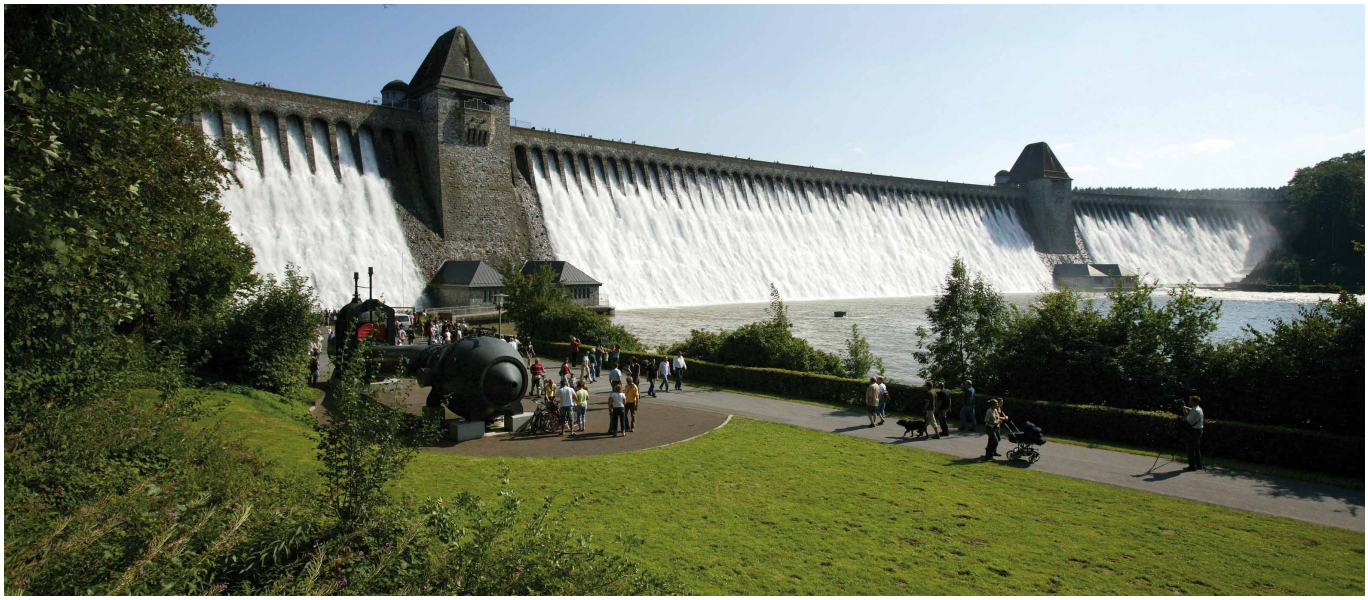
Project: February 2005 – May 2008

Costs: 955,000 Euro

Funding: Federal Ministry for Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The 2007 European Flood Directive (2007/60/EC) was based on a traditional safety-oriented approach. It did not address the risk of failure of existing and planned flood retention facilities. The extension of the developed methodology to other European Regions could close this gap and ensure a cost-efficient and improved flood protection within the EU.



Not every flood can be stored completely within a reservoir (Möhne-Reservoir in August 2008) *Heidefuss*

4.2 NEW TOOLS FOR FLOOD FORECASTING AND OPERATIONAL FLOOD MANAGEMENT
ENSEMBLE TECHNIQUES TO HANDLE UNCERTAINTIES

ABSTRACT

Decisions about flood warnings as well as costly measures for flood-risk reduction (e.g. by evacuation) both depend on reliable forecasts. However, complex meteorological and hydrological forecasts are inherently uncertain. Ensemble forecasts can be used to frame these uncertainties about potential developments in the hydro-meteorological situation. Probabilistic evaluation of ensemble components can be used to communicate forecast uncertainty to decision makers.

Here, an ensemble system for operational flood forecasting was developed that combines forecasts from the European weather prediction systems, COSMO-LEPS, SRNWP-PEPS, and COSMO-DE. A multi-model, lagged average super-ensemble is generated by recombining components from different runs of these meteorological forecast systems. A subset of the super-ensemble is selected based on pre-determined model weights, which are obtained from ensemble calibration. Flood forecasts are simulated by a rainfall run-off model. The parameter uncertainty within the model is represented by a parameter ensemble. This is generated from a comprehensive uncertainty analysis during model calibration and is driven by historic rainfall events. The forecast can be updated with new information from short-range forecast systems or by assimilation of measured data.

A prototype of the developed framework has been applied to a case study in the Mulde River basin in Eastern Germany. It has been operational since 2010 and supports the added value of ensemble forecasts and their probabilistic evaluation for flood management decisions.

LIST OF PARTICIPANTS

Ruhr-Universität Bochum, Faculty of Civil and Environmental Engineering, Chair for Hydrology, Water Management and Environmental Engineering, Prof. Dr. Andreas Schumann (Coordination)

DHI-WASY GmbH, Dresden

Deutscher Wetterdienst DWD (German National Weather Service), Offenbach

Büro für Angewandte Hydrologie, Berlin

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: February 2005 – May 2008

Costs: 983,000 Euro

Funding: Federal Ministry for Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Further improvements to meteorological ensemble techniques and the availability of new data sources for data assimilation (notably Radar) provide new options for further research. This is especially promising on a European scale since an exchange of models and information would better cover the range of uncertainties in operational flood forecasts.

Prof. Dr. Andreas Schumann

Extreme floods endanger residential areas (Location at the Mulde-River in Saxony 2002) *Prof. Dr. A. Schumann*

5.1 SANSED – CLOSING NUTRIENT CYCLES IN THE MEKONG DELTA
SANIRESCH – SANITARY RECYCLING ESCHBORN

ABSTRACT

SANSED

Different technologies with a high potential for the recycling of nutrients were tested in the Mekong Delta (Vietnam) for the decentralised treatment of wastewater: source separation, anaerobic fermentation (2-step-biogas digester), DeSaR system, MBR, and soil filtration. Further treatment was performed to concentrate nutrients and/or to render the substrate hygienic: precipitation and stripping of yellow water, solar urine evaporation, urine storage, (vermi-) composting. The quality of the water and substrates were checked, as well as their re-use in agriculture and aquaculture. User acceptance was also examined. In a feasibility study, different wastewater treatment systems were evaluated for a district in Can Tho. The University of Bonn coordinated 10 sub-projects.

SaniREsch

The project aims at optimising different steps from wastewater production to its re-use of a source separation system at the headquarters of the German Technical Cooperation GmbH (GTZ) in Eschborn. This involves the toilet system (Roediger Vacuum GmbH), treatment systems for the separated wastewater (DeSaR, Huber SE), "product" treatment and monitoring (RWTH Aachen, FH Giessen), and re-use in agriculture (Univ. Bonn). The project evaluates performance, risks, cost, and the acceptance of users.

Application of yellow water to wheat at the Campus Klein-Altendorf *Dr. Ute Arnold*

LIST OF PARTICIPANTS

Sansed

Rheinische Friedrich-Wilhelms-University Bonn, Institute of Crop Science and Resource Conservation (Coordinator)

Ruhr-University Bochum, Environmental Engineering and Ecology

Gottfried Wilhelm Leibniz University Hannover, Soil Science

Huber SE, Berching

Gewitra mbH, Troisdorf

Bioenergy Consult B3, Bornim

Bioreact GmbH, Troisdorf

Ingenieurbüro für technische Hydrologie - Th. Herrmann, Bayreuth

Ingenieurbüro für Aquakultur und Umwelttechnik (IBAU), Bergholz

GSan – Ökologische Gewässersanierung mbH, Berlin

Sachsenwasser GmbH, Leipzig

SaniResch

Dt. Gesellschaft für technische Zusammenarbeit = German Technical Cooperation GmbH, (GTZ), Eschborn (Coordinator)

Rheinische Friedrich-Wilhelms-University Bonn, Institute of Crop Science and Resource Conservation

RWTH Aachen, Institut für Siedlungswasserwirtschaft (ISA)

University of Applied Sciences Gießen-Friedberg

Huber SE, Berching

Roediger Vacuum GmbH, Hanau

Several partners are connected to the working group on New Sanitation Systems (NASS) of the DWA (Dt. Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V.), and the Alliance of Sustainable Sanitation (SuSanA). Cooperation with other EU members (e.g. SLU Uppsala)

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2002 - 2008

Costs: approx. 2.5 million Euro

Funding: Federal Ministry of Education and Research (BMBF)

Project: 2009 – 2012

Costs: approx. 1 million Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

"New sanitation systems" are aimed at improving wastewater treatment by saving and recycling resources (water and nutrients, especially phosphorus). Different solutions adaptable for site-specific conditions are available, but still need to be optimised. Affordable solutions are needed to improve the sanitation situation world wide (Millennium Development Goals). A focus should be put on recovering valuable products, assuring their application and safe re-use in agriculture.

CONTACT: Institute of Crop Science and Resource Conservation – Plant Nutrition, **Prof. Dr. Heiner Goldbach, Dr. Ute Arnold**

University of Bonn

5.2 GLOWA VOLTA AND THE FOLLOW-UP PROJECT: "SUSTAINABLE DEVELOPMENT OF RESEARCH CAPACITY IN WEST AFRICA"

ABSTRACT

The interdisciplinary GLOWA VOLTA project had two central objectives:

(1) Analysis of the physical and socio-economic determinants of the hydrological cycle in the West African Volta Basin in the context of global climate change.

(2) Development of decision support tools through education and the involvement of stakeholders.

The follow-up project, "Sustainable Development of Research Capacity in West Africa", builds on the outcome and capacity developed in the GLOWA Volta project. It seeks to strengthen research capacity in West Africa and to promote an "enabling environment" for research and its implementation. The focus lies on the development of human capital, infrastructure, technology, and institutional capacity, using the resources obtained from the GLOWA Volta Project.

Both projects are part of the GLOWA (Global Change in the Hydrological Cycle of West Africa) project framework: www.glowa-volta.de.

LIST OF PARTICIPANTS

Principal European cooperation partners:

German Aerospace Center (DLR), Bonn

University of Würzburg

Institute for Meteorology and Climate Research (IMK-IFU), Garmisch-Partenkirchen

Centre de Coopération Internationale en Recherche Agronomique pour le Dévelopement (CIRAD, France)

Delft University of Technology (Netherlands)

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

GLOWA Volta project: 2000 – 2009
Costs: 11 million Euro

Sustainable Development of Research Capaicty in West Africa based on the GLOWA Volta project: 2009 – 2010

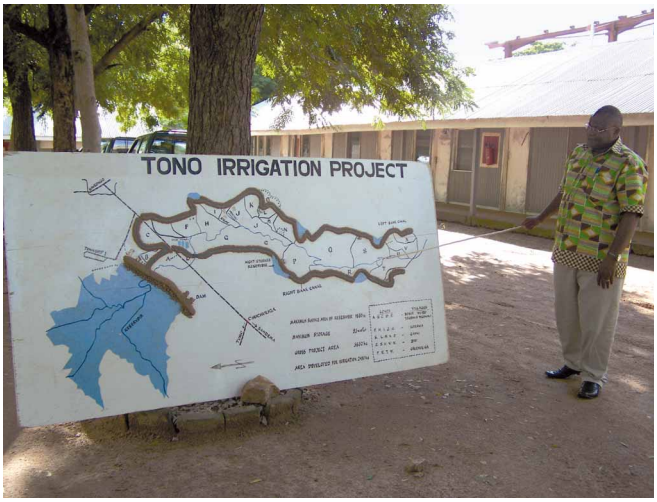
Costs: 566,000 Euro
Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

For several decades, it has been recognised that research into climate change adaptation in Africa is valuable because it improves the local population's resilience to the changing environment, and also unlocks the agricultural potential of these areas. It has also been understood that solutions to future needs are rooted in local capacity. The EU could contribute by linking European and African researchers such that they can jointly address the questions of water resources, climate change, and land use. This would stimulate the advancement of science and build local capacity.

Zentrum für Entwicklungsforschung
Center for Development Research
Universität Bonn

Tono irrigation project, Ghana *Alma van der Veen*



Tono irrigation project, Ghana *Katharina Moraht*

6.1 EFFICIENT SPOT USE OF ELECTROCHEMICAL OZONE FOR SAFE FRESH WATER

ABSTRACT

Objective: To develop and commercialise a low-cost, efficient, ecologically-sound product that makes hot water distribution systems microbiologically safe.

Main Targets: Reducing the energy consumption of hot water distribution systems by decreasing their temperature to that required at the point of use. At the same time, the water must be absolutely safe, without any contaminating microorganisms, such as Legionella. For this purpose, an integrated system is being developed, which can avoid the growth of Legionella and the development of biofilms by applying minimal, sensor-controlled doses of ozone (at p.p.b. levels), generated in situ.

Description of Work:
The development will include the following work packages:

1. Development of a special electrochemical microcell which can be easily installed at critical sites in existing, or newly designed, hot water systems for in situ production of ozone.

2. Development for the control circuits of the necessary, low-cost ozone-sensing system.

3. Systems integration of distributed ozone generation and control.

4. Confirmation of microbiological effectiveness in field studies.

LIST OF PARTICIPANTS

Bonn-Rhine-Sieg University of Applied Sciences, Rheinbach, Germany (for sensor development and micobiological studies)

Innovatec Gerätetechnik GmbH, Rheinbach, Germany

Apaco AG für Apparatebau, Grellingen, Switzerland

CWR Systems, Oss, Netherlands

SKD cistiace systemy s. r. o, Oponice, Slovak Republic

D.i.s.a. Brno, Czech Republic

Technical University of Crete, Chania, Greece

INNOVATEC// Gerätetechnik GmbH

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Preparation for the FP 7 EU call 5, THEME 6: ENVIRONMENT

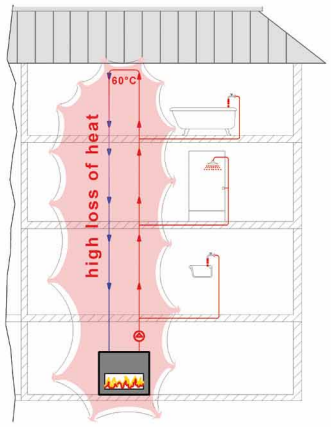
Work program topic addressed: ENV.2011.3.1.9-1 Eco-innovation

Budget for 3 years: 3.004,800 Euro

Project: 2011 - 2014

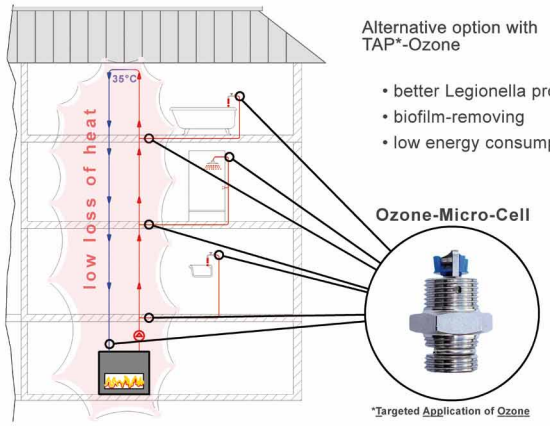
PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

In order to avoid unnecessary energy expenditure and potentially harmful chemicals, the concept of controlled and targeted application of ozone generated in situ has wider potential, not just for hot water systems. The concept could be extended to cover all kinds of water treatment and related disinfection processes in industrial and domestic applications.



Example of a standard house-installation with hot water protection against Legionella

- latent risk of Legionella infection
- no protection against biofilms
- high energy consumption



Alternative option with TAP*-Ozone

- better Legionella protection
- biofilm-removing
- low energy consumption

7.1 OWARA

OPTIMISING WATER ALLOCATION IN RURAL AREAS OF UPPER EGYPT

ABSTRACT

The OWARA project is a research network of German and Egyptian researchers and other stakeholders, whose main goal is to contribute solutions for the development of sustainable water management of agricultural settlements in the Lake Nasser region (governorate of Aswan). A framework and methods will be developed to study and improve the supply of drinking and irrigation water to the settlement villages, and for wastewater treatment.

The project is structured into three parts and their respective objectives.

(1) Rural Settlements and Water

The development of a concept for the settlements' water supply and wastewater disposal.

(2) Water and Agriculture

- Identify solutions to raise agricultural productivity, and the local population's income, without jeopardizing the environment.
- Search for improved production technologies and resource management strategies.
- Analyse drip irrigation as a means of raising irrigation efficiency.
- Optimise the irrigation system's layout (cost-benefit analysis) and irrigation schedule.
- Analyse the potentials for solar-powered, low pressure irrigation systems in the desert climate.

(3) Socio-economic, Cultural and Institutional Factors

Analysis of technology adoption potentials (willingness to adopt). Institutional solutions for water allocation in irrigated agriculture as a contribution towards the optimisation of irrigation management.

LIST OF PARTICIPANTS

Cologne University of Applied Sciences, Institute for Technology and Resources Management in the Tropics and Subtropics (ITT)

Ministry of Agriculture and Land Reclamation (MARL)

World Food Program (WFP)

South Valley University (SVU), Qena, Egypt

Lake Nasser Development Authority (LNDA), Egypt

PROJECT START, DURATION AND FUNDING

Project: July 2007 – September 2010

Costs: approx. 400,000 Euro

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The OWARA project, that just finished end of September 2010, was the first project of the ITT in the region and is included in the institute's long-term strategy for the Nile Basin. The ITT intends to build a strong consortium with other EU-Partners for research in the Nile region under the topic: "Integrated Water Resources Management in the transboundary context of the Nile Basin". The research aims at addressing the present pertinent problems of the Nile Basin regarding the scarce water resources and problems immanent from political history on water allocation rights and the dynamic development of riparian countries, their growing populations and water needs. Exacerbating these socio-economic developments climate change and weather increased variability induce rising risks in water management at the basin, demanding for joint solutions and cooperation between all the Nile Basin' riparians.

Secondary Irrigation water channel

Solar powered low pressure irrigation system at the trial station of the OWARA project

CONTACT: ITT, Prof. Dr. Lars Ribbe (project leader), Dipl.-Volkswirt Rui Pedroso (coordination)

Cologne University of Applied Sciences

7.2 LUCCI – LAND USE AND CLIMATE CHANGE INTERACTIONS IN THE VU GIA THU BON RIVER BASIN, CENTRAL VIETNAM

ABSTRACT

In Central Vietnam, land and water resources are under pressure due to population growth, economic development, and changing climatic conditions. Climate change is already affecting the region. The rising sea level and salt water intrusion into rice fields is currently jeopardizing the existence of rural populations. The scientific basis for possible adaptation and mitigation options concerning Global Climate Change has been intensively reviewed in the recent past, e.g. in the 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). However, in terms of region-specific climate change scenarios, only a few cases have been investigated. The knowledge base on developing regions, such as Central Vietnam, lacks predictive data about the future climate and its impact on vegetation, the water cycle, and the local economy. The LUCCI project will develop strategies for sustainable land and water management in Central Vietnam, taking into account regional socio-economic development, national planning elements, and climate change predictions, as well as the potential for mitigation and climate change adaptation.

LUCCI's Main Goal:

To help shape resilient landscapes in the Vu Gia Thu Bon River Basin by developing innovative land and water management concepts that cope with the impact of climate change and global dynamics on regional environments and socio-economic set-ups.

Main Research Questions:

- What are the main types of driving forces and trends affecting the pace of change and the levels of stress in the VGTB river basin?
- What is the regional impact of climate change on the basin's water cycle, future water availability, future land and water use, agricultural productivity and hydropower?
- How do we assess and include the river basin's carbon stock and the preservation of ecosystem functions, services and biodiversity in a sound land management concept?
- What is the potential role that agriculture can play in Climate Change (CC) adaptation and mitigation in the VGTB river basin?
- What are the outcomes of different land and water management strategies for CC adaptation and mitigation?
- How do we include stakeholder concerns in the assessment of the basin's current state and the development of sound land and water management concepts?

LIST OF PARTICIPANTS

Cologne University of Applied Sciences, Institute for Technology and Resources Management in the Tropics and Subtropics (ITT)

Friedrich-Schiller-University of Jena, Dept. of Geoinformatics, Hydrology and Modelling

Friedrich-Schiller-University of Jena, Dept of Geoinformatics, Earth Observation

Karlsruhe Research Center (IMK), Institute for Meteorology and Climate Research, Atmospheric Environmental Research

Ruhr University Bochum, Institute of Environmental Engineering and Ecology, Faculty of Civil Engineering

IHP/HWRP Secretariat, Federal Institute of Hydrology, Koblenz

Vietnamese Partners:

Vietnamese Academy of Water Resources (VAWR)

HUE University of Agriculture and Forestry (HUAF)

HUE College of Economics

Vietnamese Ministry of Agriculture and Rural Development (MARD)

Vietnamese Ministry of Natural Resources and Environment (MONRE)

International Partners:

International Rice Research Institute (IRRI)

PROJECT START, DURATION AND FUNDING

Project: July 2010 – December 2015

Costs: approx. 4 million Euro

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

In the framework of the LUCCI project, research development will aim to engage in Vietnam with other EU-partners to improve research and scientific methods applied to the regional impact of climate change (at the basin level), changes in land use and hydrology, the adaptation potentials of local populations and their economies, and to the analysis of dam operation and its impact at the basin level.

In the present case, a pertinent problem not directly addressed (for the moment) by LUCCI, but certainly an objective of future research, will be to include competencies from other EU research institutions on hydropower dam operation and its interactions and impact on other sectors, like agriculture. Modeling of dam regulation is an important issue in a region like the Vu Gia Thu Bon River Basin where many hydropower dams already exist and many others are in planning. The operation of these dams has a strong impact on downstream water users and major implications for flood and salt water intrusion control. A throughput analysis of possible synergies and trade-offs in this field is needed for a more comprehensive research approach.

CONTACT: ITT, Prof. Dr. Lars Ribbe, Dipl.– Volkswirt Rui Pedroso, Alexandra Nauditt

Cologne University of Applied Sciences

7.3 OPTIMISATION OF INDUSTRIAL WASTEWATER TREATMENT ACCORDING TO GREEN CHEMISTRY PRINCIPLES

STEPS Sustainable Technologies and Computational Services for Environmental and Production ProcesseS

ABSTRACT

The project aims at optimising the treatment of industrial wastewater at its source, particularly for wastewater containing azo dyes from textile production and finishing processes, as well as organic phosphorous compounds that are used as fire retardants in the textile industry. This also includes industry-relevant organic compounds such as PFT in liquid systems.

In general, the project focuses on improving the process development and reactor design by investigating the mechanisms of biochemical (combined anaerobic-aerobic) and/or sonochemical processes (AOP) through online process-analytical methods involving continuous microfiltration-based sampling and LC-MS/MS analysis.

STEPS (Sustainable Technologies and Computational Services for Environmental and Production Processes) additional competences include process development and controls for chemical, sonochemical, photo-chemical and microbiological processes in the water phase; and projects in the area of canalisation, sewage plants, waters, drinking-water production and river management.

LIST OF PARTICIPANTS

Cologne University of Applied Sciences

University of Cologne and several other European Universities

Industrial partners:

Clariant GmbH, Frankfurt/Main

Lanxess AG, Leverkusen

Bayer HealthCare AG, Leverkusen

Bayer Material Science AG, Leverkusen

GECO▶C (michael.bongards@fh-koeln.de) and several smaller companies in the region of NRW.

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: January 2007 - December 2011

Costs: 1 million Euro

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Establishing an international Graduate College (Course of post-graduate lectures and research learning groups).
- Cooperation with the University of Cologne and other universities in Germany and the European Union.

STEPS research centre of excellence: membrane technology and process analytics

CONTACT: NRW Research Center of Excellence "STEPS", **Prof. Dr. Astrid Rehorek**

7.4 ADVANCED INTELLIGENCE CONTROLS FOR OPTIMISING WASTEWATER TREATMENT PLANTS

Gummersbach Environmental Computing Center
GECO▶C

ABSTRACT

Reducing energy consumption of wastewater treatment plants (WWTPs) has been a central theme for many recent technical developments. Rising energy costs and tighter regulatory requirements for discharges present major challenges. Therefore, the development of control technology aims to increase the cleaning efficiency of WWTPs while minimising their energy consumption. In this context, the research group GECO▶C (Gummersbach Environmental Computing Center) has developed new and innovative control systems for WWTPs that are based on methods of computational intelligence (CI). These methods include, for example, fuzzy and feature state controllers, and neural networks. Here, a key tool is the dynamic simulation of the highly non-linear biological and physical processes within WWTPs.

The project's scientific approach is always focussed on practical application. Hence, the innovative solutions will be tested and implemented in real operation.

Clarification in wastewater treatment plant GECO▶C

LIST OF PARTNERS

Cologne University of Applied Sciences, Gummersbach

Aggerverband (public corporation), Gummersbach

Wupperverband, (association for integrated water management), Wuppertal

ADWASO®, Advanced Water Solutions Limited, Taunusstein

CURRENTA GmbH & Co. OHG, Leverkusen

Steinhardt GmbH Water Technology, Taunusstein

HST System Technology GmbH, Meschede

National University of Ireland (NUI), Dept. of Electronic Engineering, Prof. Dr. Sean McLoone, Ireland

Cologne University of Applied Sciences, STEPS Sustainable Technologies and Computational Services for Environmental and Production Processes, Prof. Dr. Astrid Rehorek

Activated sludge tank in wastewater treatment plant GECO▶C

PROJECT START, DURATION AND FUNDING

More than eight national and European, ongoing and finished, research projects – four projects in preparation.

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Development of feature state-controllers using intelligent and fully-automated state identification and prediction. This could be achieved by exploring reverse modeling of WWTPs and neural networks, as well as clustering and classification methods, like Self-Organising Maps (SOM) and Support Vector Machines (SVM). The objective is to design a controller which is self-adaptive and thus easily applicable to different kinds of WWTPs under changing operating conditions.
- Establish projects throughout the EU where new intelligent control strategies are being applied to different WWTPs whose performances require a more energy-efficient control.
- A new approach to be exploited is the development of soft sensors for relevant plant parameters that can reduce costs for additional online-measurement systems (for example, NH4-N, NO3-N and phosphate).

Cologne University of Applied Sciences

7.5 AGENT-BASED INTELLIGENT AND INTEGRATED CONTROL OF SEWERAGE NETWORKS AND WWTP'S

Gummersbach Environmental Computing Center
GECO▶C

ABSTRACT

Most sewerage systems in Germany are still operated in a static way. In many cases, this leads to inefficient utilisation of the hydraulic capacities. When there is heavy rain, some storm water tanks are only partly filled while others already discharge into the associated river. This leads to unnecessary water contamination for the affiliated rivers.

Application of intelligent control strategies to sewerage systems represents a cost-efficient approach for a better utilization of the existing hydraulic capacities. It also contributes towards environmental protection. The research team GECO▶C at the Cologne University of Applied Sciences has addressed these problems by utilising modern simulation tools, innovative control approaches, and data processing structures.

The best advantage of software agents exists in their universal applicability. This means they can be easily transferred to sewerage networks with deviating characteristics and/or different configurations.

LIST OF PARTNERS

Cologne University of Applied Sciences, Gummersbach

Aggerverband (public corporation), Gummersbach

Gelsenwasser AG, Gelsenkirchen

Technische Werke Emmerich am Rhein GmbH, Emmerich

Kläranlage Wetzlar, Wetzlar

Steinhardt GmbH Water Technology, Taunusstein

Queen's University Belfast, Questor Centre, Northern Ireland

National University of Ireland Maynooth (NUI), Dept. of Electronic Engineering, Prof. Dr. Sean McLoone, Ireland

Cologne University of Applied Sciences, STEPS Sustainable Technologies and Computational Services for Environmental and Production Processes, Prof. Dr. Astrid Rehorek

Fritz Husemann GmbH & Co. KG, Gütersloh

and others

PROJECT START, DURATION AND FUNDING

More than 3 national and European, ongoing and finished, research projects – 3 projects in preparation.

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Our goal is to develop intelligent measurement systems for sewerage structures with a low energy consumption by using self-organising wireless sensor networks. The perspectives for such measurement systems are very promising since they are a prerequisite for the practical application of innovative control and optimisation strategies.

Special requirements apply for the development and test of control and optimisation systems because of a lack of EU infrastructure with respect to small, decentralised sewerage systems. To address this particular problem of sewerage systems with minimal infrastructure, the existing methods could be adapted to provide different solutions for the optimal configuration and installation of innovative control systems.

Agent system (laptop), pumping station GECO▶C

Exit of the sewerage system GECO▶C

8.1 REVISITED.

PHOTOGRAPHY AND ARCHIVAL IMAGES

ABSTRACT

- A photographic documentation and artistic exploration of the industrial river Emscher and its feeders, being reconverted from its former function as a repository for industrial sewage into a re naturalised body of water.
- Visualisation of changes in the Emscher fluvian topography during the course of history which goes back more than 100 years.
- A visual exploration of the scenic, sociological and cultural environment of the Emscher region.

Twelve students of photography at the Dortmund University of Applied Sciences, Faculty of Design, under the guidance of Professor Jörg Winde and Bernd Dicke, thoroughly dealt with the Dortmund urban districts crossed by the Emscher river and its feeders. The seminar´s aims were to analyse the principle of the second image and the re-interpretation of photographic subjects.

Historical pictures of the photographic archive of our co-production partner, EMSCHERGENOSSENSCHAFT in Essen, served as a starting point for the project. The originals, dating between the late 19th century and the 1960's, show the reconstruction of the river scene and were sorted by the students. Next, the students took pictures at the very sites where the historic shots had been made, requiring accurate re-enactment.

The structural changes shown in the landscape and locations surrounding the Emscher river, titled REVISITED, were the basis for the third design state: A deepening photographic examination focused on subjectivity. The employed spectrum of photographic genres/methods ranges from landscape and architecture stills to portraiture and staging along the Emscher. Thus, every student´s work consists of two parts which complement and contrast each other at the same time: On one hand, they document the historic relevance of the project, on the other hand, they also uplift the artistic expressiveness and design capacity of the participants.

Quality-determing criteria:

- elevated perception of students and recipients
- practical relevance for students
- historical relevance
- variety of genre in photography
- regional reference
- research as part of teaching
- public responsiveness by field work
- handling of sensitive issues
- course enhancement offered by enlisting external experts
- professional public relations --> broad public
- professional design --> attention and cultural value
- cooperation partner of an extrinsic discipline --> win/win situation
- cooperation partner of excellent reputation
- in direct contact with the management level of the cooperation partners --> increase in social acceptance
- sustainability by publications
- gain in kudos for the Dortmund University of Applied Sciences

CONTACT: Faculty of Design, **Prof. Jörg Winde**

LIST OF PARTICIPANTS

University of Applied Sciences and Arts Dortmund,
Prof. Jörg Winde

Emschergenossenschaft, Essen

Museum for Art and Cultural History, Dortmund

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

REVISITED I: September 2008 – March 2009, 11,300 Euro
Exhibition and illustrated book (April – July 2009), 19,400 Euro

REVISITED II: (September 2009 – March 2010), 11,300 Euro

REVISITED III: (September 2010 – March 2011), 12,600 Euro

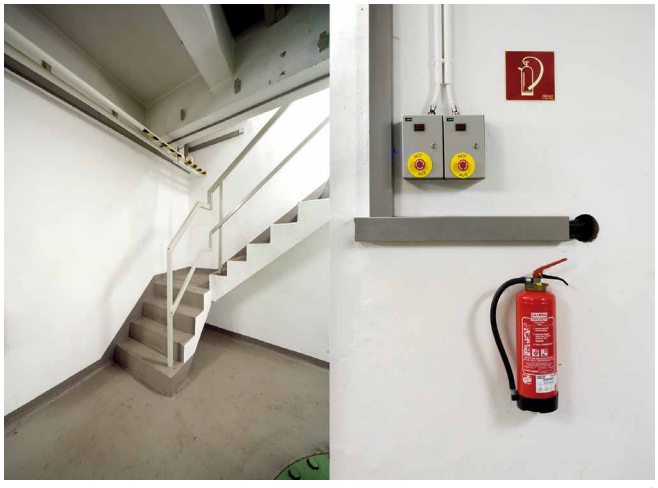
PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Cooperation with European partner universities and associations for water management
- Possible project proposal in the Interreg-program

Pumping Station Dortmund-Dorstfeld, 1961/2009

Südkamen, 1927/2010

Images: Emschergenossenschaft (2), B. Benisch, M. Weigl



Wasser. Bau. Werk *Annika Feuß*

University of Applied Sciences and Arts Dortmund

9.1 FATE AND METABOLISM OF SELECTED VETERINARY MEDICINES IN THE RHIZOSPHERE

ABSTRACT

We are studying the transformation rates and metabolisation patterns of antibiotics and their metabolites in soil pore water after it has been manured. To do this, veterinary medicines are sprayed onto soil under different experimental designs. The fate and metabolism of these drugs is monitored by collecting pore water from the rhizosphere (root-soil-interface). In both lab and field experiments, we have followed the fate of the antibiotics and their metabolites from the micro- to the meso-cosm. The data on antibiotic residues in soil pore water will help us to understand how antibiotics behave in the soil and leach into ground water, before ending up in drinking water. In other experiments, we will investigate the photodegradation of veterinary drugs in water.

LIST OF PARTICIPANTS

Technische Universität Dortmund, Institute for Environmental Research (INFU), Prof. Dr. Dr. h.c. Michael Spiteller

University of Bonn, Institute of Crop Science and Resource Conservation, Soil Science and Soil Ecology, Prof. Dr. W. Amelung

University of Osnabrück, Institute for Environmental Systems Research, Prof. Dr. M. Matthies

HelmholtzZentrum München (German Research Center for Environmental Health), Terrestrial Ecogenetics Department, Prof. Dr. M. Schloter

Federal Biological Research Centre for Agriculture and Forestry, Institute for Plant Virology, Microbiology und Biosafety, Prof. Dr. K. Smalla, Braunschweig

University of Trier, Soil Science Dept. Prof. Dr. S. Thiele-Bruhn

Forschungszentrum Jülich, Institute of Chemistry and Dynamics of the Geosphere: Agrosphere, Prof. Dr. H. Vereecken

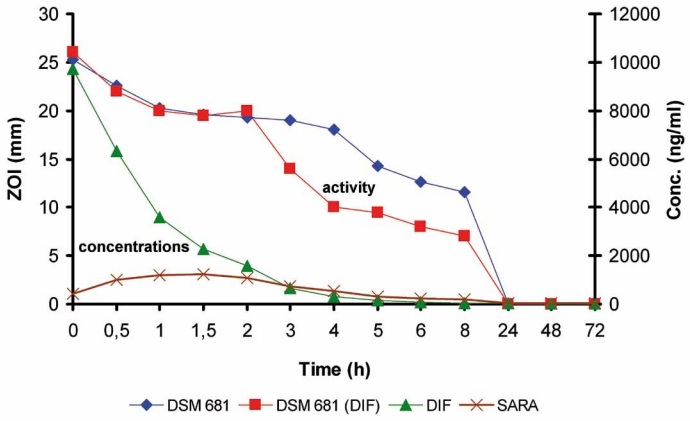
Berlin University of Technology, Dept. of Landscape Contamination, Institute of Ecology, Prof. Dr. B.-M. Wilke

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: April 2005 – April 2011

Costs: approx. 900,000 Euro

Funding: INFU



TU Dortmund

Residual Antibacterial Activity of residues of Difloxacin (DIF) after photolysis in water in comparison to standard DIF at equivalent concentrations, against DSM 681 (Klebsiella pneumoniae subsp. ozaenae).

The photodegradation of DIF and formation of the metabolite sarafolxacin (SARA) is plotted on the secondary axis for comparative evaluation.

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Following agricultural use, a large number of compounds pass into the general environment. Assuming that these compounds (and their more polar metabolites) are highly mobile, they may enter the ground water and subsequently affect the whole water cycle. To predict their risk, knowledge about their degradation and metabolisation is needed. At INFU, TU Dortmund, the fate of such chemicals and their metabolites is studied, and the mechanisms for the formation of non-extractable residues and leaching into the ground water are investigated. The main focus is to identify and conduct activity studies of unknown metabolites and new degradation products.

10.1 WISER WATER BODIES IN EUROPE – INTEGRATIVE SYSTEMS TO ASSESS ECOLOGICAL STATUS AND RECOVERY

ABSTRACT

WISER will support the implementation of the Water Framework Directive (WFD) by both developing tools to assess the ecological status of European surface waters (with a focus on lakes and coastal/transitional waters), and through the evaluation of recovery processes (under global change constraints) in rivers, lakes, and coastal/transitional waters.

The project will:

(1) analyse existing data from more than 90 databases, compiled in previous and ongoing projects, that cover all water categories, Biological Quality Elements (BQEs), and stressor types;

(2) perform targeted field-sampling exercises, including all relevant BQEs in lakes and coastal/transitional waters.

New assessment systems will be developed and existing systems evaluated for lakes and coastal/transitional waters. There will be a special focus on how uncertainty affects classification strength, resulting in a complete set of assessment methodologies for these water categories. Biological recovery processes in all water categories, and under different climatic conditions, will be analysed with a focus on the mitigation of hydromorphological and eutrophication pressures. Large-scale data will be used to identify linkages between pressure variables and BQE responses. Specific case studies, using a variety of modelling techniques, will address selected pressure-response relationships and the efficacy of mitigation measures. The responses of different BQEs and different water categories to human-induced degradation and mitigation will be compared, with a special focus upon response signatures of BQEs within and among water categories. Guidance for the next steps of the intercalibration exercise will be given by comparing different intercalibration approaches. To include stakeholders from the outset, small teams will be formed that comprise stakeholders and project partners responsible for a particular group of deliverables. This will ensure the applicability and swift implementation of results. www.wiser.eu

LIST OF PARTICIPANTS

University of Duisburg-Essen, Faculty of Biology, Applied Zoology/Hydrobiology (coordination)

Norwegian Institute for Water Research, Oslo, Norway

Natural Environment Research Council / Centre for Ecology & Hydrology, Swindon, UK

AZTI-Tecnalia Foundation, Sukarrieta (Bizkaia), Spain

University of Hull /Institute of Estuarine & Coastal Studies, Hull, UK

Aarhus University / National Environmental Research Institute, Aarhus, Denmark

French Research Institute for Agricultural and Environmental Engineering, Fresnes, France

Swedish University of Agricultural Sciences, Uppsala, Sweden

European Commission Joint Research Centre, Brussels, Belgium

Institute of Environmental Protection; Warszawa, Poland

Forschungsverbund Berlin e.V., Berlin

Finnish Environment Institute, Helsinki, Finland

Spanish National Research Council (CSIC), Madrid, Spain

ALTERRA Green World Research /Wageningen University & Research Centre, Wageningen, The Netherlands

University of Natural Resources and Life Sciences, Vienna, Austria

Estonian University of Life Sciences, Tartu, Estonia

University College London, London, UK

Institute for Ecosystem Studies, Rome, Italy

Stichting Deltares, Delft, Netherlands

University of Coimbra / Institute of Marine Research, Coimbra, Portugal

Bulgarian Academy of Sciences / Institute of Oceanology, Varna, Bulgaria

Trinity College Dublin, Dublin, Ireland

University of Salento, Lecce, Italy

University of Bournemouth, Poole, UK

La Sapienza University of Rome, Rome, Italy

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: March 2009 – February 2012

Costs: 9.022,000 Euro

Funding: EU (6.984,000 Euro)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Methods to successfully restore rivers under the Water Framework Directive
- Pan-European database of monitoring results from freshwater ecosystems

Sampling on Lake Candia, Italy (Torben L. Lauridsen, National Environmental Research Institute Department of Freshwater Ecology, University of Aarhus, Denmark)

CONTACT: Applied Zoology/Hydrobiology, **Prof. Dr. Daniel Hering**

University of Duisburg-Essen

10.2 DETECTION, RISK AND CONTROL OF TEMPORARILY NONCULTURABLE PATHOGENS IN DRINKING WATER INSTALLATIONS

ABSTRACT

The project aims at setting up a database which defines the precondition for a risk analysis considering viable, but temporarily nonculturable pathogens (i.e. the pathogenic microorganisms are still viable, but not culturable - VBNC) within water installations. The results are of immediate importance for localising contamination sources and the implementation of sanitation measures. They are needed for the proper design and operation of drinking water installations (plumbing systems) in public buildings. They also enable the water industry, health authorities and other responsible parties to come to well-founded decisions about further actions based on new and relevant knowledge.

Using the scientific knowledge gained from this project, a specific management of the negative impacts of pathogens in the VBNC state will be designed to develop principles for improving the hygienic quality of water in drinking water installations.

LIST OF PARTICIPANTS

University Duisburg-Essen, Biofilm Centre, Prof. H.-C. Flemming (coordinator), Dr. J. Wingender

Rheinische Friedrich-Wilhelms-Universität Bonn, Institute for Hygiene and Public Health, Prof. Dr. T. Kistemann, Prof. Dr. M. Exner, Dr. J. Gebel

Technische Universität Hamburg-Harburg, DVGW German Technical and Scientific Association for Gas and Water, Dr. B. Bendinger, Prof. Dr. K. Wichmann

IWW Water Centre Mülheim, Dr. G. Schaule, Dr. S. Grobe, Prof. Dr. E. Dopp, Prof. Dr. H.-C. Flemming

Technische Universität Berlin, Institute for Environmental Microbiology, Prof. Dr. U. Szewzyk

15 companies as business partners

Stadtwerke Duisburg AG

DVGW, Deutscher Verein des Gas- und Wasserfaches e.V. (Technisch-wissenschaftlicher Verein, Bonn)

Zweckverband Gruppenwasserwerk Dieburg (Wasserwerk Hergershausen, Babenhausen)

Grünbeck Wasseraufbereitung GmbH, Höchstädt a. d. Donau

Hammann GmbH (Trinkwasserrohrnetze, Impuls-Spül-Verfahren), Annweiler am Trifels

Deutsche Bahn AG (Bahn-Umwelt-Zentrum), Brandenburg-Kirchmöser

domatec GmbH (Technology & Services for Facility and Hygiene), Mühldorf

Pall GmbH Medical (Filtrationstechnologie), Dreieich

Deutsches Kupferinstitut e.v. (Düsseldorf) and European Copper Institute Brussels, Belgium

Viega GmbH & Co.KG (Gas-, Wasser- und Heizungsinstallation), Attendorn

Geberit International AG (Sanitär- und Rohrleitungssysteme), Jona, Switzerland

Hansa Metallwerke AG (Sanitärarmaturen), Stuttgart

REHAU AG + Co (Polymere, Innovation und Systeme), Erlangen

BRITA GmbH (Filtrationsprodukte für Haushalt und Gewerbe), Taunusstein

Georg Fischer JRG AG (Systeme für Haus- und Heizwasserversorgung), Sissach, Switzerland

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: September 2010 – August 2013

Costs: 2.2 million Euro

Funding: Federal Ministry of Education and Research (BMBF) and 17 business partners

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The project's scientific objectives are very promising. Already in an earlier project, the consortium showed that these objectives were essential and logically consistent. In this context, it has already started to develop appropriate methods to address them. Fundamental knowledge about the transition of pathogens into the VBNC state and their subsequent reversion back to a cultivable state in drinking water environments will be acquired throughout the project.

To meet the requirements of the public health system, the detection of hygienically relevant organisms is of fundamental and practical significance. Therefore, a close collaboration and engagement with industry partners has been set up.

Two successful implementations of these results are envisaged:

a) The development and validation of methods for the detection of non-cultivable microorganisms.

b) The clarification of mechanisms that induce the VBNC state and which are involved in its reversion.

Based on these findings, strategies and measures can be derived to secure the safe use of drinking and process water.

The optimised microbiological methods used in this project will serve as additional tools for monitoring hygienic water quality. Cultivation methods are still considered the best standard for monitoring, even though the limits of these methods have already been recognised. Therefore the results of this project reach far beyond the current system and might fundamentally contribute to advances in the practice and reality of hygienic monitoring of drinking water and other types of water for human use.

CONTACT: Biofilm Centre, **Prof. Dr. Hans-Curt Flemming**

University of Duisburg-Essen

10.3 IMPACT STUDIES OF NON-THERMAL PLASMAS FOR TRACE ORGANIC COMPOUND DEGRADATION IN WATER

ABSTRACT

Corona discharge is emerging as a promising advanced oxidation process (AOP) for the treatment of a variety of organic contaminants, including compounds that are not effectively destroyed by more common AOPs. The non-thermal plasma used in our project is a corona formed inside the water volume. The project's objective is the characterisation of the plasma reactions with emphasis on quantification of the reactive species and investigations of the kinetics. Furthermore, the plasma generator has to be adapted to create a long-term stable discharge inside the water volume. This includes the optimisation of the electrode material and geometry as well as the experimental parameters e.g. pulse repetition rate, electrode distance, conductivity of the water, etc. A bench-scale unit for the treatment of real wastewater from clinics and sewage plants will be tested. To improve degradation efficiency, typical and refractant contaminants will be selected as indicator compounds. Finally, the costs relating to degradation and energy efficiency need to be calculated.

LIST OF PARTICIPANTS

University of Duisburg – Essen, Instrumental Analytical Chemistry

University of Duisburg – Essen, Technical Physics

Institut für Energie und Umwelttechnik (IUTA e. V.), Duisburg

PulsPlasmaTechnik GmbH, Dortmund

Siemens AG

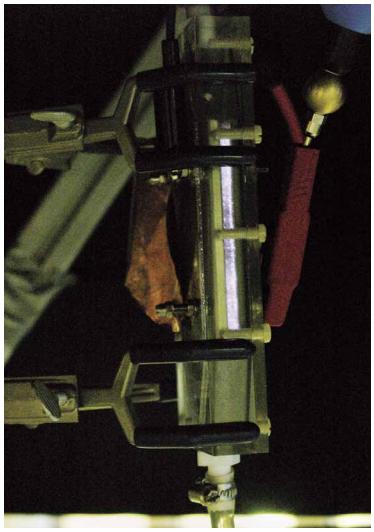
PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

- May 2009 – June 2012: German Science Foundation (DFG), 348,190 Euro
- August 2009 – October 2012: Arbeitsgemeinschaft industrieller Forschungsvereinigungen – Zentrales Innovationsprogramm Mittelstand (AIF-ZIM), 153,402 Euro
- February 2010 – May 2010: Arbeitsgemeinschaft industrieller Forschungsvereingungen – Industrielle Gemeinschaftsforschung (AIF-IGF), 268,400 Euro
- October 2010 – November 2013: Marie-Curie Advanced Technologies for Water Resource Management (ATWARM) (in cooperation with IWW Mülheim)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Future prospects include the implementation of a bench-scale unit in pilot-scale plants at European locations with a variety of contamination problems. The studies of basic chemical and physical characteristics must be extended to these pilot-scale plants. Studies will focus on the long-term stability of these plants under industrial conditions and their maintenance.

Corona discharge in water generated by using plate electrodes coated with alumina oxide.



PD Dr. Ursula Telgheder

CONTACT: Instrumental Analytical Chemistry, **PD Dr. Ursula Telgheder**

University of Duisburg-Essen

11.1 boot 2011

DÜSSCOVER – EXPLORE, EXPERIENCE, LEARN

ABSTRACT

The boot is the largest trade fair for water sports worldwide, taking place in the North Rhine-Westphalian capital Düsseldorf. For several years now, the University of Applied Sciences Düsseldorf participated with several water related projects. For the upcoming boot 2011, the topic will be: Düsscover - Explore, Experience, Learn. The visitor can experience a totally new virtual level of water related subjects.

With the help of various modern techniques of visualisation the panorama of the city of Düsseldorf can be seen from different points of view. A further new and unique experience is the "Boat-Configurator" where every visitor can design his dream boat and sail it through a blue lagoon. After having found the perfect spot, the boat can be easily moored with the virtual "Park-a-boat" game. At the end, the visitor can sign the virtual visitor's book.

LIST OF PARTICIPANTS

Department of Media, Prof. Dr.-Ing. Günther Witte,
Prof. Dr. rer. nat. Christian Geiger, Prof. Dr.-Ing. Sina Mostafawy

Department of Mechanical and Process Engineering,
Prof. Dr.-Ing. Martin Nachtrodt

Messe Düsseldorf GmbH

Franz Hoppe GmbH & Co. KG, Olsberg

Paul Petau Modellbau, Meschede

SIGMA AV, Düsseldorf

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

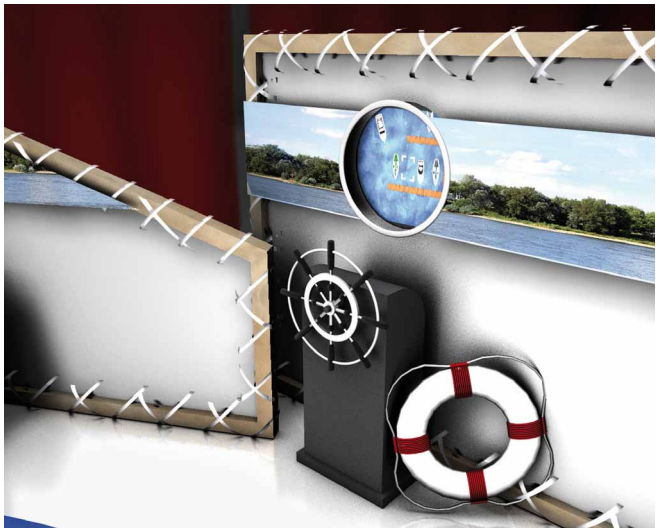
Project: April 2010 - February 2011

Costs: Sponsoring of 260 m² Stand Area and Material for Exhibition Equipment, approx. 20,000 Euro from different Sponsors and from the University of Applied Sciences Düsseldorf

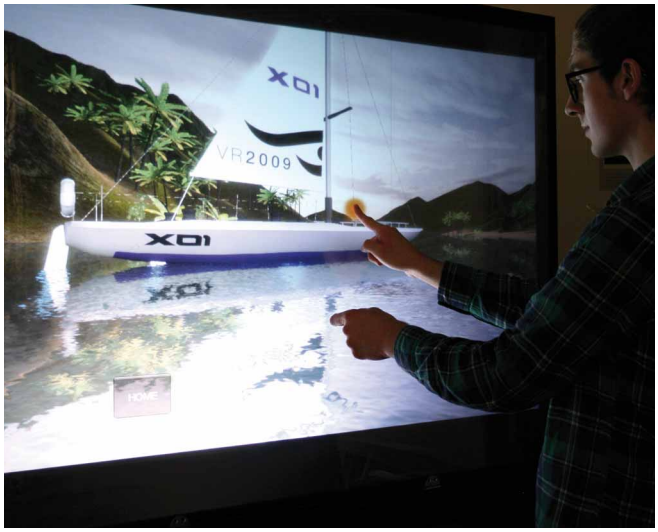
PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The primary aim is to show the high degree of expertise regarding media techniques that the Düsseldorf University of Applied Sciences can offer. The „boot" is the largest trade fair for water sports worldwide and is therefore an ideal place to present the developed ideas to an international audience and to establish new partnerships with the industry.

By these activities Düsseldorf University of Applied Sciences focuses its competences into one of the most important markets connected with water. But the proposed tools are not only applicable to the consumer market, they also support the area of the strategy for watercourses and their interaction with urban settlement.



"Boat-Configurator"



Prof. Dr. Christian Geiger (2)

CONTACT: Department of Media, **Prof. Dr.-Ing. Günther Witte**

Düsseldorf University of Applied Sciences

11.2 TRANSNATIONAL INCUBATOR

TRANSEUROPEAN LOW CARBON INCUBATOR

ABSTRACT

This research project aims at creating an incubator on a regional urban scale. Incubators are programs designed to accelerate the development of new entrepreneurial companies, technologies, and policies, through an array of business support, resources, favourable laws and services.

The incubator's defined zone stretches from the UK to Germany. This is a territory where the future of European cities is being tested, where laws, regulations, and innovation are tackling the problem of cities in their relationship to energy. The incubator's goal is to define key conflicts, develop a toolbox of technologies, build up a network of key stakeholders, and to organise a series of actions/events.

Two of the project's zones are intrinsically linked to water: The Thames Gateway (Sector T) in the UK is a zone that stretches east from London to the North Sea. Sector E diagrammatically links the main transport flows from Rotterdam to the Rhine-Ruhr Area, a territory that includes the Rhine delta, Brabantstad, and Düsseldorf. Both of these territories are natural environments that belong to the most densely populated places in Europe, and are large traffic arteries.

LIST OF PARTICIPANTS

Duesseldorf University of Applied Science, Peter Behrens School of Architecture, Professor Raoul Bunschoten

ZIES Institute (Centre for Innovative Energy Systems)

London Metropolitan University, UK

EnergieAgentur.NRW (EnergyAgency.NRW), Düsseldorf

City of Duesseldorf, Germany

City of Rotterdam, Netherlands

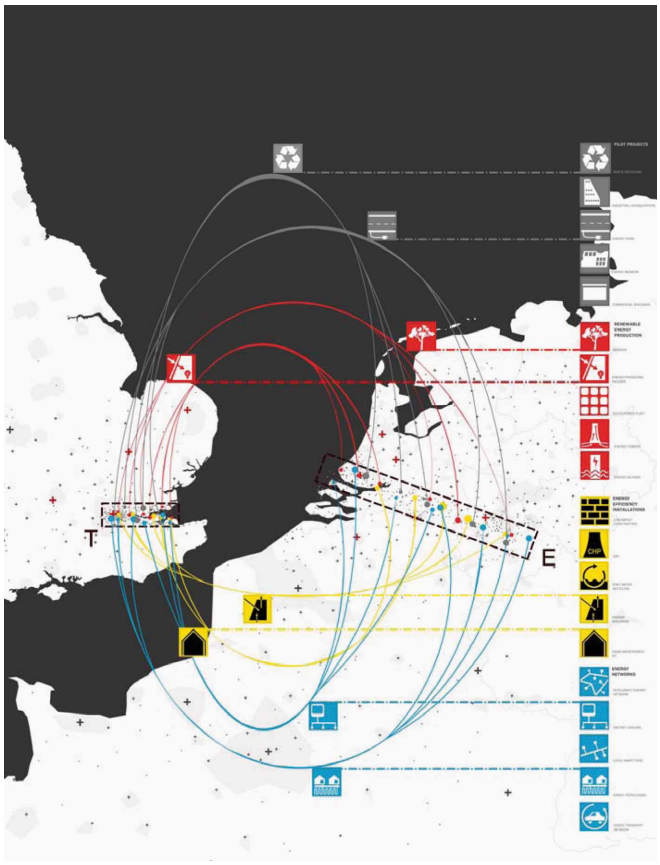
FluxS Eindhoven, Netherlands

Technical University Delft, Netherlands

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: March 2011 – 2013

Funding: Netherlands Architecture Funds, Netherlands
Arts and Humanities Research Council (AHRC), UK
Engineering and Physical Science Research Council, UK
NRW Bank
Land of North Rhine-Westphalia
German Federal Ministries



Transeuropean Climate Change Incubator, 2010 *CHORA*

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

A Trans-European Incubator that addresses the need to reduce CO^2 emissions from cities is in line with European policy. It is also a cultural project addressing European urban identity. An application for EU Grants is scheduled (i.e. Eurocult, Intelligent Energy Europe).

Düsseldorf University of Applied Sciences

11.3 CIVIC DESIGN

INTELLIGENT USE OF WATER RESOURCES

ABSTRACT

Water is destined to become the future's most valuable resource. The worldwide availability of water is imbalanced. Interdisciplinary issues related to a fair distribution of water include economic and environmental questions and political implications.

NRW is an area rich in water. It is determined to provide the best practical example for a responsible, sustainable use of water. At the same time, NRW wants to make better use of its water resources, to find life quality advantages and even economic benefits for local communities.

In terms of water management, CIVIC DESIGN is exploring connections between top-down planning and the population's bottom-up desires. It seeks to connect individual advantages with society's overall benefits. Two preliminary reserach projects have already been started:

1) Drink your city: reduce environmental impact through bottled water consumption and enable additional income for underfunded NRW communities.

2) Ruhrlandsee: natural terraforming of a Montan-Region in transition with a perspective on better ecology and new employment in the region.

We intend to produce a monographic publication on the interdisciplinary scope and scale of water use in NRW with special emphasis on best practice activities.

LIST OF PARTICIPANTS

Düsseldorf University of Applied Sciences

Dept. of Design, Prof. Dr. Rainer Zimmermann, Prof. Philipp Teufel, Prof. Victor Malsy

PBSA, Peter Behrens School of Architecture

Exhibition Design Institute (EDI)

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

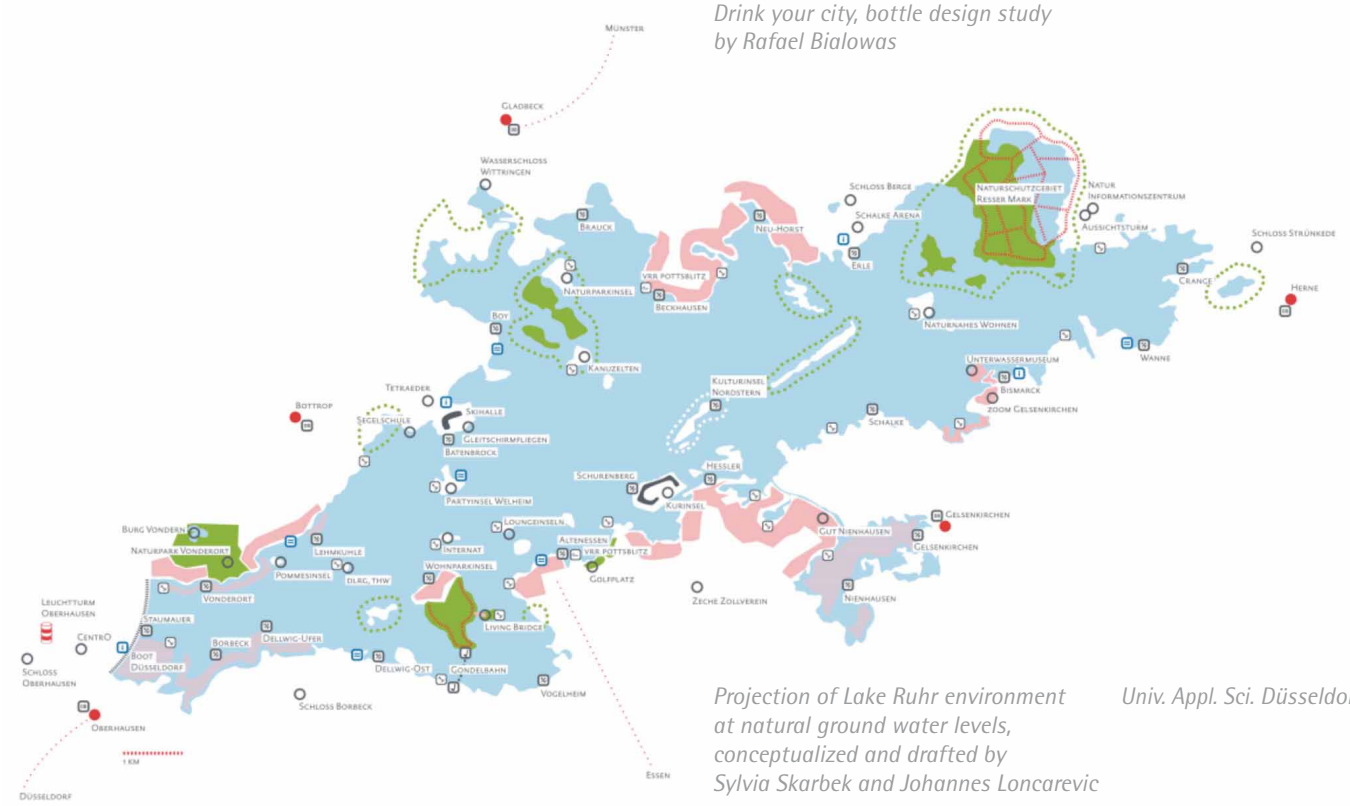
Project: 2010 – 2013

Costs: approx. 130,000 Euro

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Extension of the pilot project to further European regions.

Drink your city, bottle design study by Rafael Bialowas



Projection of Lake Ruhr environment at natural ground water levels, conceptualized and drafted by Sylvia Skarbek and Johannes Loncarevic

Univ. Appl. Sci. Düsseldorf

12.1 DRINKING WATER HARVESTED USING RADIATION EXCHANGE

ABSTRACT

The project's goal is to develop an efficient process for collecting water from air humidity. Tools for harvesting water from fog have recently been demonstrated in the trade wind zones. The use in semi-arid zones of such methods for harvesting water from dew requires energy and cooling facilities. However, a surface can be cooled down without any energy input by using radiation exchange with the upper atmospheric layers.

We have developed an absorber which can be cooled by 6°K compared to the ambient environmental temperature. Using this device, we could harvest up to 970 ml water per m2 per night. This approach can be used both to collect drinking water in critical regions and to supply re-forestation programs with water.

LIST OF PARTICIPANTS

Project partners:
South Westphalia University of Applied Sciences, Iserlohn (Coordination)

Koch Anhängerwerke GmbH & Co KG, Winsen/Luhe

Münchenbernsdorfer – Folien GmbH, Münchenbernsdorf

Instituto de Radio Astronomia Milimétrica (IRAM), Granada, Spain

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: April 2004 - November 2009

Costs: 219,395 Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Pilot runs are being conducted in Spain and France. Subsequently, we want to carry out long-term tests, for example, in the Extremadura region of Southern Spain, which is currently under partial re-forestation. For this purpose we need new cooperations and partners. We are interested in forming a European Research Association that develops the production framework and facilities for water harvesting and delivery to plants under economic conditions.

Water sampler on the roof of IRAM

Prof. Dr. D. Ihrig (2), Michalel Licht

13.1 TREATMENT, RECYCLING, AND RE-USE OF WASTEWATER STREAMS AND MEMBRANE CONCENTRATES FROM THE TEXTILE FINISHING INDUSTRY

ABSTRACT

Wastewater from the textile finishing industry is often strongly coloured and contaminated with organic compounds, for example, from textile sizing. Additionally, residual liquors can have high chemical oxygen demand values.

In this context, the project's aims were:

a) to minimise use of additives while maintaining constant product quality;

b) to find more efficient treatments of the concentrated residual liquors;

c) to find an additional use for these concentrates.

During the project, a wastewater register was established for the partner company, Voss-Biermann und Lawaczeck (VBL), permitting a detailed analysis of its fresh and wastewater situation. Based on this analysis, measures have been taken to control fresh water consumption and to regulate the amount and quality of wastewater. This has lead to a 30 % reduction in water consumption and a 10-20 % reduction in energy use.

Wastewater from the dying mill and washing machines has been treated in a downstream pilot plant using an ultra-filtration unit and reverse osmosis. This treated wastewater can be used again in all production areas, including dying, without further post-treatment. The recycled water is colourless and displays better qualities than fresh water for textile finishing processes.

The concentrated residual liquors can be post-treated with chemical (wet oxidation) and thermal methods. After the latter treatment, the water can also be used again, but this procedure is not economically viable. Our findings show that the combination of ultra-filtration and reverse osmosis can lead to more cost-efficient wastewater treatment in the textile industry.

LIST OF PARTICIPANTS

Niederrhein University of Applied Sciences, Faculty of Textile and Clothing Technology, Prof. Dr. Ulrich Eicken, Mönchengladbach

MDS Prozesstechnik GmbH, Moers

Voss-Biermann und Lawaczeck GmbH & Co. KG (VBL), Krefeld

Official Textile Testing Institute of the Niederrhein University of Applied Sciences and imat-uve, Mönchengladbach

Niersverband, Viersen

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: February 2005 – April 2006

Costs: 517,500 Euro

Funding: Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the German State of North Rhine-Westphalia

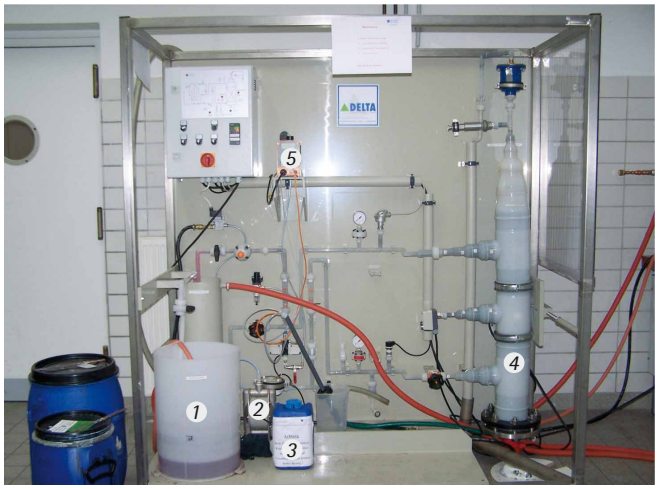
PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

To enhance the efficiency of combined ultra-filtration and reverse osmosis, the order of their combination could be examined. Moreover, additional analyses, using methods like HPLC, would provide details about the chemical composition of wastewater and how it changes during treatment. This chemical analysis will provide additional support for the further use of recycled water in the finishing process.

Result of wastewater treatment:

1: Coloured wastewater, 2: Filtrate of ultra-filtration, 3: Permeate of reverse osmosis

Wet oxidation pilot plant:



1: Coloured wastewater, 2: Circulation pump 3: H2O2 reservoir, 4: Oxidation reactor, 5: Dosing pump for H2O2

Niederrhein Univ. Appl. Sci. (2)

Niederrhein University of Applied Sciences

13.2 DECONTAMINATION OF WATER IN SWIMMING POOLS

ABSTRACT

Conventional decontamination of swimming pools mostly employs chlorine gas. However, this involves a substantial risk for pool employees. Extensive occupational health and safety precautions must be taken. Leakage of chlorine gas is also a possible risk for the surrounding area. As such, alternative, safe methods of decontamination are needed.

Previously, we have developed and patented a three-dimensional electrode - the rod-bundle electrode - that is constructed like a heat exchanger. Its three-dimensional design increases the reaction site on the anode surface.

Using the rod-bundle electrode, chlorine dioxide can be electrolytically generated from an inexpensive chlorine-containing chemical. This chlorine dioxide could be used for the decontamination of swimming pool water.

This research project will also analyse the generation of other chlorine species, some of which are short-lived.

LIST OF PARTICIPANTS

Niederrhein University of Applied Sciences,
Faculty of Chemistry, Prof. Dr. Rüdiger Kaus

Niederrhein University of Applied Sciences, Faculty of Mechanical and Process Engineering, Dipl.-Ing. Angela Rheindorf

Parts of the rod-bundle electrode *Niederrhein Univ. Appl. Sci.*

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Duration: 2 years

Costs: 110,000 Euro

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The three-dimensional rod-bundle electrode can be used in many areas, for example, for the degradation of drugs in hospital wastewaters.

Niederrhein University of Applied Sciences

13.3 OXIDATION OF CYANIDES IN WASTEWATER FROM THE GALVANIC INDUSTRY

ABSTRACT

During the production of decorative metallic coatings, cyanides are added to the galvanic baths where they function as brightening agents. These highly ecotoxic substances pass into the rinsing waters from the production process, requiring decontamination of wastewaters.

One solution is to evaporate the rinsing waters and feed the residues into the waste disposal system. A second option uses a chemical treatment (oxidation) of the cyanides. However, to not exceed the maximum legal concentration of 1 mg cyanide per litre wastewater, a 500-fold chemical excess is necessary.

A third possibility uses electrolytic oxidation of the cyanides. Yet, previously used plate electrodes failed to reduce the concentration of cyanide-containing wastewater to the legal limit. For this reason, a three-dimensional electrode was used in connection with the plate electrode system. The anode consists of a feeder electrode and a particle layer composed of either manganese or Ebonex®. This arrangement provides a large surface at the anode. Because these electrode reactions are at the surface, there are many different reaction sites, even at low cyanide concentrations. Hence, the limiting legal value of 1 mg cyanide per litre can be met.

A first research project financed by the Federal Ministry of Education and Science resulted in a patent. Currently, the electrolytic cell's capacity is being improved and tested by industrial partners.

Design of the apparatus for the electrochemical destruction of cyanides. *Dipl.-Ing. Angela Rheindorf*

LIST OF PARTICIPANTS

Niederrhein University of Applied Sciences

Faculty of Chemistry, Prof. Dr. Rüdiger Kaus

Faculty of Mechanical and Process Engineering, Dipl.-Ing. Angela Rheindorf

AQUA-TITAN Umwelttechnik GmbH, Dortmund

Heico Befestigungstechnik GmbH, Ense-Niederense

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Federal Ministry of Education and Science (BMBF): November 2001 – May 2003, 185,824 Euro

Patent: DE 103 45 594 A1

Spezial Prize for cooperation with industrial partners in November 2003,

endowed with 5,000 Euro by PRO Vendis

Further development: 4,000 Euro by AQUA-TITAN

Heico Befestigungstechnik (Heico Fasteners), Ense-Niederense

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The goal is to develop an electrolytic cell requiring minimum maintenance that is suitable for everyday use and that reliably complies with the limiting value of 1 mg cyanide per litre.

Niederrhein University of Applied Sciences

14.1 TREATMENT OF TAPIOCA WASTEWATER AND SUSTAINABLE WATER POLLUTION CONTROL MANAGEMENT IN KEY ECONOMIC ZONES OF SOUTH VIETNAM

ABSTRACT

In tropical zones, surface water is often the only source for drinking and industrial water supply. However, due to numerous discharges of untreated wastewater, bodies of surface water are often highly contaminated. The main objective of this project is to develop procedures and techniques to sustainably improve the water quality of polluted surface waters in tropical and sub-tropical zones under given socio-economic and ecological constraints. This includes experimental studies of tapioca wastewater treatment and the application of numerical simulation techniques to the water cycle and water quality.

A treatment concept has been developed that consists of a mechanical and chemical pre-treatment, followed by anaerobic degradation, and post-treatment in vertical sub-surface flow wetlands. Using a pilot plant, this innovative process combination will be adapted and optimised. The results of this wastewater treatment will be integrated into a numerical water pollution control management system (WPC-MS) of the area around the pilot plant.

A partial view of the pilot plant with some of the project partners and a group of Vietnamese visitors. *Prof. Dr.-Ing. J. Fettig*

LIST OF PARTICIPANTS

Technische Universität Braunschweig, Department of Hydrology, Water Management and Water Protection, Leichtweiss-Institute for Hydraulic and Water Resources Engineering (LWI), Prof. Dr. G. Meon (coordination)

Ostwestfalen-Lippe University of Applied Sciences
Department of Environmental Engineering, Campus Höxter

Institute for Environment and Resources (IER),
National University of Ho Chi Minh City, Vietnam

Hager & Elsässer GmbH, Stuttgart, Germany

Enviplan Ingenieurgesellschaft mbH, Lichtenau, Germany

Blumberg Consulting Engineers, Göttingen, Germany

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: March 2009 – February 2012

Costs: 1.158,653 Euro

Funding: Federal Ministry of Education and Research (BMBF)
Ministry of Science and Technology (Vietnam)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Wastewater treatment in developing countries (and countries in transition) is a global scientific problem that necessitates cooperation between local authorities and international partners. Establishing a network with universities, organisations, and municipalities on a European level should facilitate the dissemination and transfer of the project results to other settings.
- Development of a comprehensive water pollution control management system in industrialised countries will provide a valuable tool for planning purposes in other parts of the world.
- Working together with international partners will allow them to more easily gain access to the European Research Area (ERA) and could result in a higher level of research mobility and knowledge exchange ('brain circulation').

CONTACT: Ostwestfalen-Lippe University of Applied Sciences, **Prof. Dr.-Ing. Joachim Fettig**

Ostwestfalen-Lippe University of Applied Sciences

15.1 TAWI – TIGRAY AND AFAR WATER INITIATIVE FOR SUSTAINABLE WATER SUPPLY IN ETHIOPIA

Women and girls have to carry water for their families several times a day over long distances. A better water supply is a substantial improvement in their daily lives.

Construction of the first groundwater dam in Koraro (Tigray).
MUAS (2)

ABSTRACT

Tigray and Afar are two regions in northern Ethiopia with semi-arid climate, unpredictable rainfall pattern, severe soil erosion, environmental degradation, continuous malnutrition and occasionally disastrous crop failure. The existing water ponds and micro-dams show severe problems in design and operation. However, instead of increasing the food security and wealth of the people, storing water in open ponds and using it for irrigation may cause a severe decline in public health. This is because open water bodies serve as breeding zones for mosquitoes that are vectors for Malaria, Dengue and Yellow fever.

The project's aim is to develop and propagate awareness of adapted solutions for water and sanitation supply, such as sub-surface storage (groundwater dams) and covered cisterns for the rural population, without increasing the disease incidence from water-borne and water-related diseases, like Malaria or Schistosomias. For example, sub-surface dams store water underground.

One important approach of the project is to empower the local people to help themselves through their inclusion in the development and construction of the water supply, and instruction about its continued maintenance. Training local water authorities is also necessary.

LIST OF PARTICIPANTS

- Münster University of Applied Sciences, Laboratory for Hydraulic Engineering and Water Resources Management, Prof. Dr.-Ing. Rainer Mohn
- Ingenieure-ohne-Grenzen e.V., Marburg
- Mekelle University, Ethiopia
- University of Münster and University Medical Center Münster

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2007 - 2014

Funding: National Geographic / Bayer AG Global Exploration Fund
German Embassy Addis Abeba
Ingenieure ohne Grenzen e.V., Marburg
Gelsenwasser AG (regional water provider), Gelsenkirchen
private Donors

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- Propagate adapted technologies, especially in rural areas where the majority of the population live in developing countries.
- Improve and advance sub-surface storage and other adapted methods of rural water supply.
- Contribute to the achievement of the United Nations' Millenium Goals.

CONTACT: Laboratory for Hydraulic Engineering and Water Management, **Prof. Dr.-Ing. Rainer Mohn**

Münster University of Applied Sciences

15.2 REBEWI THE EFFECTIVENESS OF STORMWATER TANKS IN STORMWATER TREATMENT IN URBAN DRAINAGE

ABSTRACT

Stormwater tanks are used to treat stormwater in combined or separate sewerage systems and in road drainage. As sedimentation plants, they are suitable for reducing the passage of particulate and particulate-bound substances into surface water. As such, stormwater tanks help to meet minimum water protection requirements for urban drainage. In Germany, there are around 29,400 stormwater tanks and overflows representing an investment of 30 billion Euro. However, there is a considerable lack of knowledge about the effectiveness of stormwater treatment using these widely differing tank types. Single, complex investigations have shown that the highly variable effectiveness of stormwater treatment is extremely sensitive to flow conditions in the respective tanks.

The aim of the project is to develop a diagnostic procedure to investigate, quantify and assess the effectiveness of stormwater treatment in the stormwater tank of combined and separate sewer systems.

Process analysis and assessment is based on a procedural and system-theoretical portrayal of the decisive sub-processes underlying water and solute transfer in stormwater tanks. The procedure developed to diagnose the stormwater treatment capacity of stormwater tanks consists of three steps:

1. In-situ investigation of flow behaviour using fluorescent tracers;
2. In-situ investigation of particle removal;
3. Investigation of the flow conditions using numerical simulation.

The method of investigation has been tested and verified under real operating conditions on two project partners' large-scale stormwater tanks.

LIST OF PARTICIPANTS

Münster University of Applied Sciences, Laboratory for Hydraulic Engineering and Water Management, Prof. Mathias Uhl

FlowConcept GmbH, Hannover

Emschergenossenschaft, Essen

Ingenieurgesellschaft für Stadthydrologie, Hannover

Civil Engineering Office of the City of Münster

North Rhine-Westphalian State Agency for Nature, the Environment and Consumer Protection

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2005 – 2008

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The diagnostic procedure developed can be used in status analysis, for boosting efficiency in the case of reduced output and for checking the success of stormwater tanks following efficiency-boosting measures. The procedure for the implementation and assessment of tracer studies can be used for the integral analysis of flow conditions in tanks and other systems through which water flows.

The developed sedimentation system can be practically applied to the analysis of settling rate distributions. The system is particularly suitable for studies where immediate analysis after collecting samples is impossible. Results of the settling rate distribution and the simulation studies may provide important information for the selection and design of installations.

Germany possesses around 29,400 stormwater tanks and overflows representing a total investment of some 30 billion Euro.

Stormwater tanks are used to treat stormwater in combined or separate sewerage systems and in road drainage. MUAS (2)

Münster University of Applied Sciences

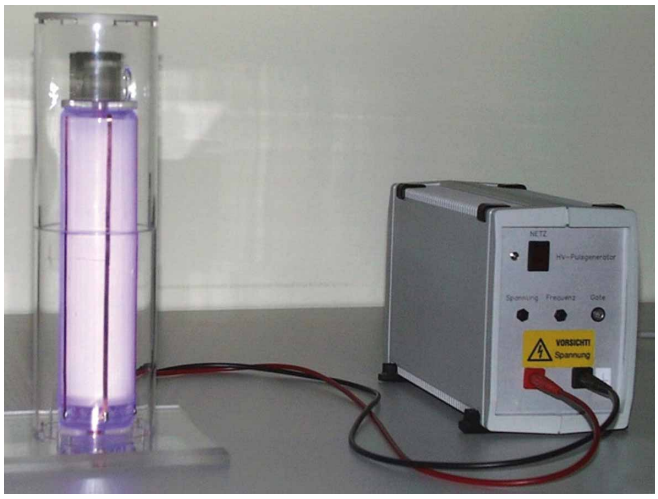
15.3 UV-C EMITTING VUV PHOSPHORS FOR DIELECTRIC BARRIER XE EXCIMER DISCHARGE LAMPS

ABSTRACT

The objective of this project is (1) to find suitable coatings for state-of-the-art UV-C phosphor YPO4:Bi in order to increase its stability and (2) to develop novel UV-C emitting phosphors that are suitable for disinfection devices, such as UV lamps applied to treatment of waste and process waters. Therefore, a good overlap with the Germicidal Action Curve (GAC) is needed, since the GAC shows the effect of radiation on DNA.

(1) Coating YPO4:Bi will adjust its chemical and physical properties to the conditions in a dielectric barrier Xe excimer discharge lamp. The protective nanoscale layer achieved by homogeneous precipitation consists of alkaline materials with a wide band gap increasing the lifetime of the phosphor (by restraining the plasma-phosphor interaction) but not affecting the luminescent performance.

(2) Alternative novel UV-C phosphors applicable to YPO4:Bi are also being developed. Special attention is paid to Pr3+ as an activator because of its tunable luminescent properties in the relevant spectral range.



UV lamps can be applied to treatment of waste and process waters. *MUAS*

LIST OF PARTICIPANTS

Münster University of Applied Sciences, Laboratory for Applied Material Sciences, Prof. Dr. Thomas Jüstel

Philips Lighting B.V., Eindhoven, Netherlands

Philips Research, Aachen

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2004 - 2011

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

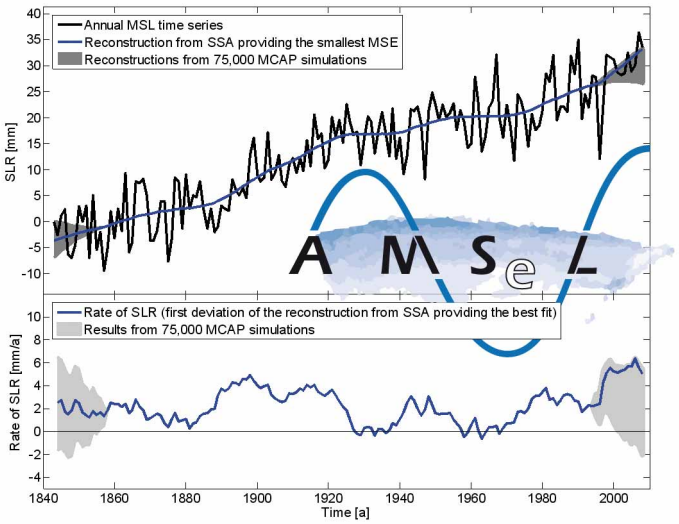
Based on a wide range of available UV phosphors and corresponding radiation sources, research in selective photochemistry – also referred to as 'green chemistry' – can be intensified. Therefore the development of tailored UV phosphors from the VUV via UV-C and UV-B to the UV-A can be expected to attract a great deal of attention. Furthermore UV-A and UV-B radiation is of great importance for healthcare in terms of skin treatment, vitamin D production or bilirubin reduction. Thus an increasing demand for suitable phosphors and radiation sources can be expected.

Münster University of Applied Sciences

16.1 MEAN SEA LEVEL AND TIDAL ANALYSIS ALONG THE GERMAN NORTH SEA COASTLINE

ABSTRACT

Sea level rise (SLR) is one of the major consequences of a warming climate. A higher sea level also influences the heights of storm surges and thus results in a higher risk of inundation for affected coastal areas. Regional and global sea level rise have been the subject of many recent scientific publications. In contrast, until now, the mean sea level (MSL) and its variability over the last centuries in the German North Sea area have not been analysed in detail. Although great progress has been made in predicting future developments, there is still considerable uncertainty in global and regional SLR projections and the quantification of the regional and global effects of e.g. sea level rise and its nonlinear behaviour. This is because most climate models currently seem to underestimate the observations. The AMSeL research project aims to make a detailed analysis of the huge quantity of available German North Sea tide gauge data focusing on the mean sea level (MSL) and its variability over the last centuries in the German North Sea area. It also analyses the tidal regime in terms of water residence times at different height levels or emersion curves, and chains of extreme tidal high and low waters.



Mean Sea Level (MSL) time series and rates of SLR in the German Bight

LIST OF PARTICIPANTS

University of Siegen, Research Institute for Water and Environment (fwu), Prof. Dr.-Ing. Jürgen Jensen

Federal Maritime and Hydrographic Agency (BSH), Hamburg

Federal Institute of Hydrology (BfG), Koblenz

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: October 2007 - June 2011

Costs: 309,000 Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The urgent need to derive reliable regional sea level projections for coastal planning strategies is highlighted. The study so far strongly indicates the necessity for further research in the field of sea level analysis and observation and highlights the urgent need to derive reliable regional sea level projections for coastal planning strategies. Uncertainties might be reduced by applying the results of GPS measurements to improve the rates of vertical land movements considered in sea level analyses. These approaches should be extended from the German Coastline to neighbouring EU Countries.

University of Siegen

16.2 XtremRisK – EXTREME STORM SURGES ALONG OPEN COASTS AND ESTUARINE AREAS RISK ASSESSMENT AND MITIGATION UNDER CLIMATE CHANGE ASPECTS

ABSTRACT

The anticipated effects of climate change with its associated increasing frequency of extreme storm surges may lead to larger storm surge hazards than previously observed. Therefore, the German XtremRisK-Project aims at improving our understanding of extreme storm surge predictions, including the joint occurrence of extreme water level and sea states. It will also provide tools to quantify the overall flood risk for an open coast (Sylt Island) and a megacity in an estuarine area (Hamburg). Following the Source-Pathway-Receptor-Concept, empirical and statistical storm surge analyses are conducted (source), failure mechanisms of the flood protection measures are modelled (pathway), and potential losses in the hinterland are estimated (receptor). In a last step, the overall results are brought together and the integrated risk analyses are performed.

LIST OF PARTICIPANTS

University of Siegen, Research Institute for Water and Environment (fwu), Prof. Dr.-Ing. Jürgen Jensen

Technical University Braunschweig, Leichtweiß-Institute for Hydraulic Engineering and Water Resources (LWI), Prof. Dr.-Ing. Hocine Oumeraci

Ministry of Urban Development and Environment, Agency of Roads, Bridges and Waters (LSBG), Dr. rer. nat. habil. Gabriele Gönnert, Hamburg

Hamburg University of Technology (TUHH), Department of River and Coastal Engineering, Prof. Dr.-Ing. Erik Pasche

Hamburg Port Authority (HPA), Sven Maudrich

Schleswig-Holstein Agency for Coastal Defence, National Park and Marine Conservation (LKN), Dirk van Riesen, Kiel

German Weather Service (DWD), Gudrun Rosenhagen, Offenbach

Federal Waterways and Engineering Research Institute, Elisabeth Rudolph, Hamburg

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

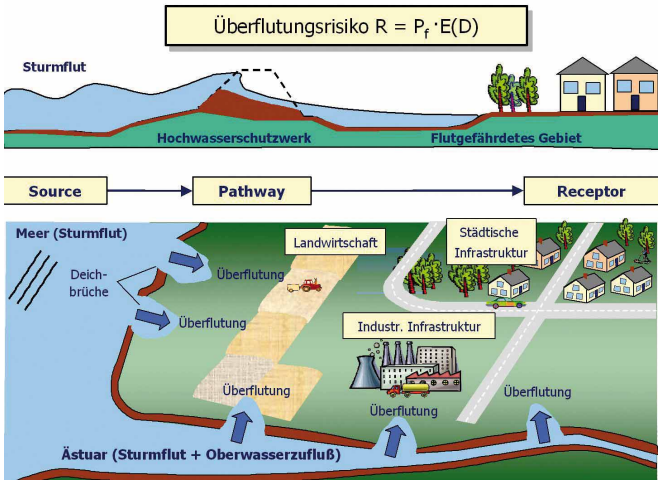
Project: October 2007 – June 2011

Costs: 1.2 million Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Innovative tools and methods will be developed which can be transferred to other open coasts and similar estuarine areas to perform risk analyses making it possible to achieve comparable results as a way of implementing uniform risk-based design methods.



Conception of the Source-Pathway-Receptor Model for determining coastal risk — *H. Oumeraci, TU Braunschweig*

University of Siegen

16.3 DEVELOPMENT OF SUSTAINABLE COASTAL PROTECTION AND MANAGEMENT STRATEGIES FOR HOLMS (HALLIGEN) UNDER DIFFERENT CLIMATE CHANGE SCENARIOS

ABSTRACT

The scope of this multidisciplinary joint research project is to develop sustainable coastal protection and management strategies for the holms (Halligen) within the Wadden Sea of the German Federal State of Schleswig-Holstein. The holms offer a unique landscape and therefore are of ecological significance. This is underlined by the fact that the Wadden Sea was added to the World Heritage list in June 2009. The low-lying areas of the holms are exposed, and at risk from rising sea levels and storm surges, which occur regularly. Climate change models suggest that these risks will increase. To maintain life on the holms, advanced climate adaptation methods will be needed.

The work plan is structured as follows:

1. Determination of coastal load parameters for present and future states;
2. Determination of impacts referring to ecosystem, housing and inhabitants;
3. Development of adaptation measures;
4. Investigation of acceptance of developed measures.

An inhabited mound on Hooge holm (German Wadden Sea). *Ch. Mudersbach, University of Siegen*

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PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: December 2010 - October 2013

Costs: 850,000 Euro

Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Holms are unique in the Wadden Sea, but as with other low-lying areas and islands worldwide, they are threatened by sea level rise and storm surges. Thus, methods and adaptation measures will be applicable to other regions.

University of Siegen

17.1 IMPACT OF CLIMATE CHANGE ON SOILS IN GERMANY

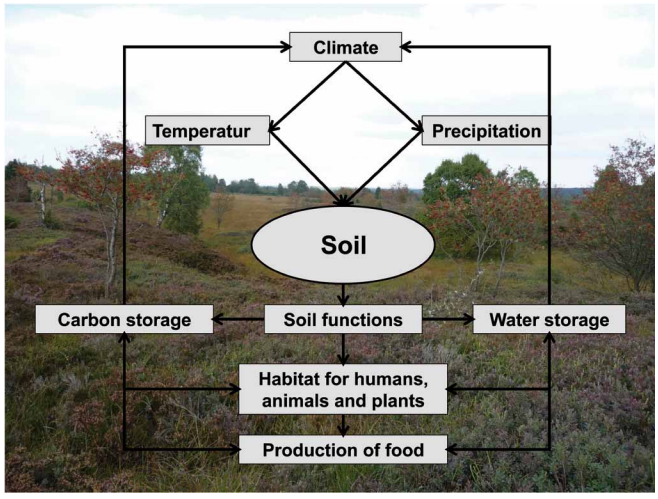
ABSTRACT

In 2008, the Federal Cabinet adopted the German Strategy for Adaptation to Climate Change, a framework for adapting to the impact of climate change in Germany. The Strategy lays the foundation for a medium-term, step-by-step process undertaken in cooperation with the federal regions and other civil groups.
It aims at assessing the risks of climate change, identifying the possible needs for action and defining appropriate goals for the development and implementation of adaptation measures.
Soil is one of the 15 action fields of the German Strategy for Adaptation to Climate Change because climate change has an impact on many soil processes, on soil development and soil properties. It influences soil biodiversity, nutrients, pollution, and the water cycle, together with other soil processes, such as matter fluxes, carbon storage, and erosion. Altogether, these can have a considerable impact on soil functions.
Adequate soil protection requires several management decisions, such as site-adapted plants as well as appropriate soil cover. Soil monitoring should be a major tool for observing possible changes or trends in soil properties. The overall objective of the project "Impacts of Climate Change on Soils in Germany" is to evaluate the data from currently available soil monitoring strategies. These datasets could be used more for future assessments of the impact of climate change on soils and their functions.

The goals of the project are:

- Evaluation of the use of soil data in climate research and adaptation strategies
- Improving the availability of data
- Development of suggestions for linking the different soil monitoring programs
- Support the continuous development of the German Adaptation Strategy (DAS)

Project homepage: http://www.boklim.de/boklimPublic/index.html



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PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: May 2009 – March 2011

Costs: approx. 160,000 Euro

Funding: Federal Environmental Agency (Umweltbundesamt UBA) (FKZ 3708 71 205)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

- EU-wide use of soil data for climate research and adaptation strategies
- Better assessment of the impacts of climate change on soils in the EU
- Harmonisation of different soil monitoring programs throughout Europe
- Improved availability of data

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NRW INNOVATION ALLIANCE –
KNOWLEDGE PROMOTES PROGRESS

North Rhine-Westphalia (NRW) aims to become Germany's number one Innovation State. Cooperation between science and industry is crucial in achieving this objective. Transfer processes contribute towards creating effective synergy, thereby fully exploiting existing potential - on both sides. The NRW Innovation Alliance offers companies and other institutions a platform linking R&D to the respective application so that an effective and purposeful knowledge transfer may be realised between research institutes and their partners.

The NRW Innovation Alliance, founded in January 2007, was initiated and is supported by its 29 member universities with a view to developing innovation transfer, as well as opening up more to cooperation and networking. A major objective is to give North Rhine-Westphalia's universities a clearly more important role within the framework of EU support programmes.

Universities in North Rhine-Westphalia have outstanding research competences. This enables the Alliance to provide the national and international partners with a broad spectrum of R&D services. The NRW Innovation Alliance pools the knowledge of its member universities.

Today, numerous exchange processes and activities are proof that good cooperation leads to sustainable and successful outcomes. Based on this experience, the NRW Innovation Alliance guarantees common quality standards, which are met by all universities.

These standards provide the framework for new projects emerging throughout the state of North Rhine-Westphalia, and encourage progress for a further development and professionalisation of transfer activities. At present and in future, companies and other institutions have and will continue to have a reliable partner providing certainty and building confidence among the parties involved.

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