Integrated testing strategies (ITS) for bioaccumulation: hierarchical scheme of chemistry-driven modules and definition of applicability domains


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In the 1970s, no forum existed for interdisciplinary communication among environmental scientists, biologists, chemists, toxicologists, and others interested in environmental issues such as managers and engineers. The Society of Environmental Toxicology and Chemistry (SETAC) was founded in 1979 to fill the void. Based on growing membership, meetings attendance, and publications, the forum was needed.

A unique strength of SETAC is its commitment to balance the interests of academia, business, and government. The Society by-laws mandate equal representation from these three sectors for World Council Officers, Board of Directors / Council Members, and Committee members. And although there is no control mechanism, the proportion of members from each of the three sectors has remained nearly equal over the past 30 years.

Like many other professional societies, SETAC publishes esteemed scientific journals and convenes annual meetings replete with state-of-the-science poster and platform presentations. Because of its multidisciplinary approach, however, the scope of the science of SETAC is much broader in concept and application than that of most other societies.

SETAC is concerned about global environmental issues. Its members are committed to good science worldwide, to timely and effective communication of research, and to interactions among professionals so that enhanced knowledge and increased personal exchanges occur.

SETAC was founded in North America but membership was open to environmental scientists worldwide. SETAC Europe was organized in 1989; SETAC Asia / Pacific in 1997 and SETAC Latin America in 1999. Members voted overwhelmingly in 2001 to combine these “geographic units” into one global society to form the SETAC World Council. SETAC meets the professional needs of individuals at local and regional levels throughout all geographic units, through national branches and chapters (Argentina, Brazil, United Kingdom, Central and Eastern Europe, Africa and soon-to-be organized Japan), through regional chapters, and through national language branches (Germany). International acceptance of the SETAC model continues with widespread interest in Russia and Africa. It is now the job of SETAC World Council to oversee the myriad SETAC activities around the world and to assure the integrity of the Society.

*Environmental Toxicology and Chemistry*, an internationally acclaimed scientific journal, has grown from a quarterly publication of fewer than 400 pages annually in 1982 to a monthly publication of 2,915 pages in 2001. Since January 2005, SETAC publishes a second scientific journal: *Integrated Environmental Assessment and Management*. IEAM is devoted to bridge the gap between scientific research and the use of science in decision making, regulation and environmental management. SETAC publishes the global newsletter SETAC Globe, peer-reviewed workshop and symposia proceedings, and a variety of technical reports.

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Keynote speaker abstracts

Ecotoxicology examined: current issues and trends
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Jagiellonian University, Kraków, Poland

In the second half of 20th century ecotoxicology developed to a large extent through “jumping” from one urgent issue to another. We had thus the bioconcentration and biomagnification boom in 1970s through 1980s, standardization of ecotoxicological tests took our minds mostly in 1990s, and we entered 21st century diving enthusiastically into the ‘omics’. While this picture is probably typical for any young science, the grown-up fields let the scientists harvest many crops. I believe that ecotoxicology is just entering its maturity. Hence, when asked by the conference organizers to give a plenary lecture on “New trends in ecotoxicology”, I realized that it is not as easy to identify them today as it was to be in the past. The ‘omics’ is still with us but can hardly be called now the “new trend”. At the same time, we have come back to problems noticed already years ago, like toxicity of complex mixtures and influence of natural factors on toxic effects of pollutants. We are also looking beyond simple standard tests and urge the decision makers to consider more elaborate methods of ecological risk assessment. Not being quite sure whether this is just my personal viewpoint — possibly a reflection of losing the track? — I made a short poll among colleague ecotoxicologists. The result was the same: none (!) of the responders was eager to name just one novel trend, and the responses were widely spread across different topics. Almost equal number of researchers found the most important issues in toxicokinetics and toxicodynamics, interactions between chemicals and natural factors, population-level modeling, or chemical mixtures. Further topics included nanoparticles — the only problem that can be indeed called reasonably novel, and methods for extrapolating results of laboratory tests to real-field scenarios. In that a bad sign that top scientists are not able to identify novel trends in the subject of their interest? I do not think so: as mentioned above, I believe that this is the sign of maturation (of ecotoxicology, not the scientists...). Despite the difficulty with naming novel issues, there are, however, some very interesting trends and processes undergoing in ecotoxicology nowadays, certainly deserving a closer look and a discussion. Among them are both purely scientific ones and societal, and both groups will be addressed in my lecture.

Ecosystem services, environmental protection and SETAC: preventing and adapting to the "perfect storm"
Lorraine Malby
University of Sheffield, Sheffield, United Kingdom

Ecosystems provide us with the essentials for life — food to eat, water to drink, fibre for clothes and shelter, fuel to keep us warm. However, they do more than that; they play a key role in climate regulation through carbon sequestration, flood prevention through water retention and runoff regulation, and water purification through filtration processes and microbial activity. They are places where we go to relax, to participate in recreational activities or simply to be inspired by the wonders of the natural world. Moreover, ecosystems perform essential processes such as nutrient and water cycling and the production of biomass. These benefits to people are termed ecosystem services and they are provided by all ecosystems.

The growing human population is putting increased pressure on ecosystems and their ability to provide the services we require. It is estimated that by 2030, world food demands will increase by 50%, energy demands will rise by 50%, water demands will increase by over 30% and 60% of the world’s population will live in urban areas. Overlay climate change and you have the ingredients for what was described by John Beddington, the UK government’s chief scientist, as the “perfect storm”.

Managing landscapes for the provision of the ecosystem services we require (e.g., food, water, energy, minerals), whilst at the same time protecting the biodiversity on which many of these services depend, is a major challenge, but one to which the SETAC community can make a valuable contribution. This keynote presentation will consider this challenge and the opportunities it provides for environmental scientists.

Exposure science - the link between hazard and risk
Marika Berglund
Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden

We are facing the challenge of assessing the exposure to a huge number of chemicals and other stressors. Exposure science is the platform for generating better exposure information which is highly needed for reliable risk assessment and protection, prevention and sustainability of the environment and human health. The lack of relevant exposure information is often a problem in regulatory decision-making and risk reduction. Development and harmonization of methods for characterizing, estimating, modelling, measuring, and quantifying exposure will result in more efficient risk reduction in the future. Toxicologists, epidemiologists, environmental and human health scientists, risk assessors and risk managers are all using a number of different data sources and methods to estimate and analyse exposure information. It is time to start working together, and to learn from each other. Together we can identify data gaps and shape the future of exposure science for more reliable decision-making. Exposure science is the crucial link between hazard information and risk. It has a great potential to meet the need for suitable methods to obtain the exposure information required by new chemical legislations and regulatory frameworks.

Toward sustainable solutions
Robert Costanza
Institute for Sustainable Solutions, Portland State University, USA

A high and sustainable quality of life is a central goal for humanity. Our current socio-ecological regime and its set of interconnected worldviews, institutions, and technologies all support the vision of unlimited growth of material production and consumption as a proxy for quality of life. However, abundant evidence shows that, beyond a certain threshold, further material growth no longer significantly contributes to improvement in quality of life. Not only does further material growth not meet humanity’s central goal, there is mounting evidence that it creates significant roadblocks to sustainability through increasing resource constraints (i.e., peak oil, water limitations) and sink constraints (i.e., climate disruption). Overcoming these roadblocks and creating a sustainable and desirable future will require an integrated, systems level redesign of our socio-ecological regime focused explicitly and directly on the goal of sustainable quality of life rather than the proxy of unlimited material growth. This transition, like all cultural transitions, will occur through an evolutionary process, but one that we, to a certain extent, can control and direct through the process of shared envisioning. Visions and models of integrated sets of worldviews, institutions, and technologies are needed to stimulate and seed this evolutionary redesign. The process of creating a shared vision of the future is also a key element of real democracy.

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**Special session abstracts**

**SS01 - New QSAR models for regulatory purposes**

**T Martin, DM Young**  
Consensus Modeling of Environmental Endpoints  
US EPA, CINCINNATI, United States of America

A consensus modeling approach was devised to develop models for different ecotoxicological endpoints of large, structurally diverse data sets. In the consensus approach, the endpoint is predicted by taking the average of the predicted values from several different QSAR (quantitative structure-activity relationship) approaches. Several QSAR approaches were used in the consensus model including the hierarchical clustering, multivariate regression, group contribution, and nearest neighbor methods. Models were developed for the following endpoints: acute aquatic toxicity, acute oral rat toxicity, fish bioaccumulation factor, and Ames mutagenicity. In general the consensus model achieved higher prediction accuracy and prediction coverage (the fraction of chemicals predicted) than any of the individual models by themselves.

**SS02 - The development of new tools towards a better exploitation of non testing methods for regulatory purposes**

**A Roncali**, A Manganaro, R Gonella D'Uzzo, A Lombardo, M Pettonenou, E Benfenati  
Istituto di Ricerche Farmacologiche Mario Negri, MILAN, Italy

The use of non testing methods, including QSAR and read-across approaches, has the potential ability to obtain fast, costless and reliable data, hence their usage has been promoted in the regulations. Some difficulties are anyhow experienced in the use of these methods particularly by non experts to properly address the reliability of the estimations so obtained. For instance more details about QSAR models may be provided, including information about the meaning of the outputs obtained by the models, the applicability domains of models, and the source data that the models are based on. Here we present methods to fill these information gaps, offering tools to examine the results, their meaning, and the possible uses of the models. Compared with many existing QSAR models, we have put greater emphasis on ensuring that the models generate transparent, understandable, reproducible and verifiable results. To achieve this, a series of tools has been optimised, which can relate the results obtained for the target chemical to the results obtained for similar (structurally related) compounds. In addition to obtaining the result of the evaluation, the models we studied provide the user with access to a series of features that are important for regulatory purposes:  
1) an identification of the possible regulatory uses of the result produced;  
2) an evaluation of the applicability domain, with an explanation;  
3) an understanding of the rules and reasoning behind the model. Moreover these tools also provide a reproducible procedure for read-across. Acknowledgments: Support by EU projects ANTELOPE (FP7-ENV/ICT/000435) and ORCHESTRA (FP7-COOPERATION programme, contract nr. 226521) is acknowledged.

**SS03 - Integrating statistical and structural results in predictive modelling for a multi-view evaluation**

**G Cenci**, F Ferrari, D Carattino  
Politecnico di Milano, MILANO, MILANO, Italy

The application of new rules and regulations calls for a more efficient in silico screening. In particular, prioritization, classification & labelling, and prediction open new challenges. The modelling systems will need to be accurate and understandable. Either QSAR or SAR are often used alone to model the activity of substances, on the basis of the kind of the output (dose vs presence) property of interest. Many QSAR models are simple or complex relations built over molecular descriptors. The choice of the descriptors to use is relevant since it affects the statistical accuracy of the model; most of the time it is put in justifying the choice in terms of interpretation of the model (or in terms of mechanistic steps). Many SAR models are manually built from a set of observations and experiments and consist in a set of rules, usually stated as structural alerts that have been associated with the property. It is not easy to go from a qualitative SAR result to a quantitative QSAR result. On the other hand, the structural nature of chemicals can be explicitly considered by a graph-mining approach, which mining large datasets for frequent substructures, or fragments, that are statistically associated with the property. We present a new approach that integrates the two SAR-QSAR methods. It can be used to build statistical models using categorical or continuous values, can derive structural alerts, can produce hypotheses of safe substructures, and can accompany the statistical result with a rule.

**SS04 - Towards the application of Nano-QSAR models for regulatory purposes**

**T Puzyn**, D Leszczynska, J Leszczynski  
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**Acknowledgments:** Support by EU projects ANTELOPE (FP7-ENV/ICT/000435) and ORCHESTRA (FP7-COOPERATION programme, contract nr. 226521) is acknowledged.

**SS05 - Regulators’ role and mission: Feedback from various stakeholder contexts**

**M Mays**, E Benfenati, R Knaff, S Pardo  
1Institut Symlog, PARIS, France  
2Instituto di Ricerche Farmacologiche Mario Negri, MILAN, Italy  
3Federchimica, MILANO, MILANO, Italy  
4PublicSpace Ltd, ULVERSTON, United Kingdom

The ORCHESTRA project (2009-12, EC FP6 226521) aims to promote wider understanding, awareness and appropriate use of in silico methods. The project web portal will become a central resource for sharing of knowledge and experience and will also provide downloadable software. In September 2010, we consulted regulators, scientists and industry stakeholders on their use of and perceptions of in silico methods (see our poster presentation for details; view questionnaire as online document at www.in-silico-methods.eu). While the self-selected sample was very restricted, among the points of interest are the positions taken by regulators, compared to or contextualized by those of other stakeholders. For instance, regulators appear to have tested in silico methods in a distinctly broader array of areas (with human toxicology leading the field - in particular contrast to industry experience). Regulators experiment with in silico methods for the full variety of functions these may serve, ranging from a formal decision focus (supporting information, or weight-of-evidence input), to less formal convenience features (fast evaluation of chemical properties). Use of these decision aids is expected to grow, most strikingly for the prioritisation of compounds for further analysis, and as input to the “key study”. Outstanding is the gap between perceptions by scientists and industry users, and by regulators, regarding benefits of in silico methods. Regulators surveyed give little emphasis to in silico’s ability to reduce laboratory use of vertebrates (in stark contrast also to lay demands as judged by an informal tracking of press articles about REACH.) One regulator commented: “Reduction of vertebrate testing is a major goal, however, it is secondary to improved risk management”. Do regulators weigh the benefits strictly in regard to their weighted priorities (goals)? In this way, regulators’ primary evaluation of in silico would be (appropriately) in terms of whether it is “fit for purpose”. Is that purpose, however, centred for regulators on absolute human and environmental protection, or on optimisation of risk management? Do other stakeholder categories take for granted that regulators’ role is the absolute protection of humans (leaving thus a margin for demands of animal protection as well)? Is optimisation understood? Insight is offered from the area of nuclear power and radioactive waste - where major studies have focused on societal demands on regulation.

**SS06 - International reference life cycle data system (ILCD) handbook and data network**

**C Campus**, European Commission, ISPRRA, ITALY

The new Unit ‘Sustainability Assessment’ of the Institute for Environment and Sustainability of the European Commission’s Joint Research Centre (JRC) is intended to provide scientific and technical support to EU services that are engaged in enhancing sustainable development and resource efficiency. It will develop and apply new approaches and solutions to integrated socio-economic and environmental assessments and impact analyses across policies at local, regional and global scales in a customer-driven manner. The deliverables will equally help industry and other actors of society to actively work on the improvement of their products and daily operations as well as advice procurers and citizen towards more sustainable consumption. A core component and expertise of the new Unit is related to the life-cycle thinking concept and, in particular, to the (environmental) Life Cycle Assessment (LCA). This Special Symposium focuses on the development of the International Reference Life Cycle Data System (ILCD) Handbook and Data Network. The ILCD has been developed in context of the European Platform on LCA to support life cycle based policies and business instruments related to sustainable production and consumption as well as resource-efficiency with guidance and with consistent and quality-assured data. Very important next to the tool LCA itself are the concepts and principles that make up the strengths of LCA, which plays a double role both as one specific method and component in the sustainability toolbox and inspiring a wider sustainability assessment with the named concepts and principles it draws on. The presentation will briefly place LCA into the wider integrated sustainability assessment framework envisaged for the current and future work of this new Unit.

**SS07 - The role of the ILCD Handbook as methodological basis for robust life cycle based environmental assessments**

**M Galatola**, European Commission, DG Environment, BRUSSELS, BELGIUM

The new Unit ‘Sustainability Assessment’ of the Institute for Environment and Sustainability of the European Commission’s Joint Research Centre (JRC) is intended to provide scientific and technical support to EU services that are engaged in enhancing sustainable development and resource efficiency. It will develop and apply new approaches and solutions to integrated socio-economic and environmental assessments and impact analyses across policies at local, regional and global scales in a customer-driven manner. The deliverables will equally help industry and other actors of society to actively work on the improvement of their products and daily operations as well as advice procurers and citizen towards more sustainable consumption. A core component and expertise of the new Unit is related to the life-cycle thinking concept and, in particular, to the (environmental) Life Cycle Assessment (LCA). This Special Symposium focuses on the development of the International Reference Life Cycle Data System (ILCD) Handbook and Data Network. The ILCD has been developed in context of the European Platform on LCA to support life cycle based policies and business instruments related to sustainable production and consumption as well as resource-efficiency with guidance and with consistent and quality-assured data. Very important next to the tool LCA itself are the concepts and principles that make up the strengths of LCA, which plays a double role both as one specific method and component in the sustainability toolbox and inspiring a wider sustainability assessment with the named concepts and principles it draws on. The presentation will briefly place LCA into the wider integrated sustainability assessment framework envisaged for the current and future work of this new Unit.

**SS08 - Overview of the International Reference Life Cycle Data System (ILCD)**

**MAWolf, RPant, KChomkhamsri, DWPennington, SSala, M Brandao**, European Commission, Joint Research Centre, ISPRRA, ITALY

The new Unit ‘Sustainability Assessment’ of the Institute for Environment and Sustainability of the European Commission’s Joint Research Centre (JRC) is intended to provide scientific and technical support to EU services that are engaged in enhancing sustainable development and resource efficiency. It will develop and apply new approaches and solutions to integrated socio-economic and environmental assessments and impact analyses across policies at local, regional and global scales in a customer-driven manner. The deliverables will equally help industry and other actors of society to actively work on the improvement of their products and daily operations as well as advice procurers and citizen towards more sustainable consumption. A core component and expertise of the new Unit is related to the life-cycle thinking concept and, in particular, to the (environmental) Life Cycle Assessment (LCA). This Special Symposium focuses on the development of the International Reference Life Cycle Data System (ILCD) Handbook and Data Network. The ILCD has been developed in context of the European Platform on LCA to support life cycle based policies and business instruments related to sustainable production and consumption as well as resource-efficiency with guidance and with consistent and quality-assured data. Very important next to the tool LCA itself are the concepts and principles that make up the strengths of LCA, which plays a double role both as one specific method and component in the sustainability toolbox and inspiring a wider sustainability assessment with the named concepts and principles it draws on. The presentation will briefly place LCA into the wider integrated sustainability assessment framework envisaged for the current and future work of this new Unit.
SS03-1 Regulatory aspects on antifouling products in the EU. K. Flagland

Swedish Chemicals Agency, SANDBYBERG, Sweden

Antifouling products are regulated within the EU through the Biocidal Products Directive 98/8/EC. An overview will be given on how this regulation works and what types of products are regulated or may fall outside the scope of the Directive. The current state of the art regarding the review of new and existing antifouling active substances will be given. The Directive is now more than 10 years old and will be replaced by a new Biocidal Products Regulation. Updated information on the advancements of this process and possible implications on how the regulation of antifouling products may be affected will be given. Some examples of alternative solutions for keeping fouling away will also be presented.

SS03-2 Recent developments in antifouling paints, the industry perspective

SS03-3 The next generation antifouling: Selektipe. M Lindblad

ITech AB, GOTHENBURG, Sweden

There is a vast range of attempts in finding new antifouling formulations with lesser environmental impact. At the same time, the increasing demands for superior antifouling performance are ever increasing in order to minimize fuel consumption and consequently, minimize green house gas emissions. Balancing emissions to the sea and emissions to the air is a delicate optimisation process which involves different aspects where one is marine ecotoxicology. Human risk assessment, regulatory compliance and safety manufacturing are equally important issues. Among those different factors, efficacy are the overall most important factor. Efficacy can be met by different means, either by killing the organisms or using specific biologi- cal inhibitors. Both means are considered to be good ways to take advantage of the available scientific knowledge, and one thing in common is that it demands a deeper knowledge. This can be used to develop targeted technologies to increase the performance of the biocides and allow for larval settlement on untreated surfaces. The specific mode of action allows for a low concentration of Selektipe. To avoid barnacles, a 0.1% in Photovarnish is sufficient and should be compared to 3-5% of other biocides and 30% or more of copper oxide.

In summary, it is an advantage of having a biocide which demands less resources in a life cycle perspective. Selektipe is now under BPVD evaluation. The dossier contains environmental risk assessment, human risk assessment, chemical risk assessment and efficacy evaluation. The risk assessments are based on more than 60 performed studies, both university performed and regulatory compliant studies. To secure efficacy, paint companies are performing static and dynamic long term efficacy studies. Presently, a number of ocean going vessels have test patches on their hulls containing Selektipe.

SS03-4 Recent developments on the Chinese market

SS03B-1 Ecotoxicology of antifouling biocides

H I-Benck

University of Gothenburg, GÖTEBORG, Sweden

Fouling of ship hulls has been a problem for seafarers since Noah’s Ark. The development of TBT-copolymers in the 1960´s stabilized the antifouling market with highly efficacious coating for both pleasure craft and merchant fleet. The awareness of TBT-related ecological effects prompted by gastropods in the Mediterranean and the 80’s caused a deep reconsideration of antifouling strategies. Biocide-free fouling release coatings were developed, while copper came to dominate the biocide-containing paints. A variety of so-called booster biocides, with different efficacy profiles and mechanisms of action, were introduced to be able to formulate completely fouling-protection coatings. In the year 2000 a high number of organic booster biocides were used in Europe, many of them detectable in coastal surveys. Several of them were later questioned from environmental reasons. The balance between efficacy and risk thus remains a key issue. It is a dilemma that fouling organisms are targeting antifouling when occupying a ship hull, but non-target organisms in their natural habitat. Both efficacy and risk is always strongly related to the toxicity of the biocide. In highly efficacious coatings there is a complete toxic effect to all fouling organisms or at near the ship hull surface. To avoid ecological consequences, this toxicity must be kept low before it reaches the critical concentration in the aquatic environment.

Biodegradable antifouling compounds and a well-balanced, controlled release without over dosing are therefore crucial. In any biocidal paint it is essential that the high toxicity to fouling organisms on the ship hull is not allowed to be expressed also in the ecosystem. A highly relevant biological indicator of development of tolerance - has recently been put into the European Biocide Regulation as an item to consider in approval of biocidal products. Acquired tolerance of the target organ- isms will require changed paint formulations that increase release and thus leading to the ecosys- tems. In this way the area of application of detrimental effects is increased. In areas polluted with antifouling biocides, tolerant marine communities are regularly observed, thus indicating an anthropogenic selection pressure on biota.

SS03B-2 Environmental occurrence and fate of antifouling biocides

V Thomas

NIVA, OSLO, Norway

Antifouling biocides are the active ingredients in antifouling paints that prevent the adhesion and growth of organisms to a painted surface. A wide range of chemicals are used as antifouling biocides which have very different physico-chemical properties and therefore differing environ- mental fates, behaviour and effects. For biocides that have been widely used over a number of decades, like Irgarol 1051 and dichlorphen, there are a large amount of public domain environ- mental data, including for their respective metabolites that allow for their environmental safety and potential risk to the environment to be assessed. For other biocides such as dichlofluanid,
DCOIT and zinc/copper pyrithione there is a good understanding of their fate and effects, however few monitoring studies have been performed and not so much is known about the fate and effects of their metabolites. Finally there are new or candidate biocides such as triphenylborane and medetomidine for which there is very little public domain information. This presentation will provide an overview of the public domain fate and occurrence data available for these biocides highlighting some of properties that influence the risks associated with the use of certain biocides.

SS03-B

Employing classical mixture toxicity concepts for the optimization of biocide combinations for antifouling paints
T. Beckman, A. Arzumkan, A. Hilvarson, K. Holm, I. Wihrl, H. Blanck
University of Gothenburg, GÖTHENBURG, Sweden

The classical mixture toxicity concepts of Concentration Addition (CA) and Independent Action (IA) have been successfully used in the past for modeling the joint action of pesticides, pharcaceuticals and other biologically active compounds. Here we report on their application for the environmental optimization of biocide combinations for antifouling purposes. Both concepts make use of the efficacies of compounds and their combinations in the prediction of all possible mixtures that can be composed from a given set of compounds. This enables a systematic and unbiased in silico exploration of the complete space of possible combinations.

By applying a risk weighting function that accounts for the environmental risks of each individual compound and their mixture it is possible to rank the mixture according to their predicted total environmental risk. This provides a detailed map for selecting the most promising combinations for further studies, e.g. for field tests.

The developed algorithms were applied to a set of 7 common and novel antifouling biocides. We experimentally recorded their individual toxicity and efficacy for representatives of the most common fouling organisms (Barnacles, Mussels, Sea Squirt, Bryozoans, Sea Lettuce and Biofilms [slime]) and then modeled the joint efficacy of all possible combinations of the 7 biocides. All combinations with a sufficient efficacy (at least 99% killing of the settlers of each test organism) were then ranked according to their modeled environmental risk. We will present the results of this optimization procedure and will relate the efficacy of the modeled mixtures to their environmental risks. In particular we will highlight whether and to what extent combination products can be expected to have lower environmental impacts than products with only one or a limited number of active ingredients, while still providing the same efficacy. The study is part of the Swedish Marine Paint program which is sponsored by Mistra, the Foundation for Strategic Environmental Research.

SS03-C

Towards novel marine paints with controlled release of biocides - concepts and applications
M. Andersson, A. Mok, A. Movahedi, M. Nordin, I. Nordström, M. Nydén
Chalmers University of Technology, GÖTHENBURG, Sweden

The growth of microorganisms on painted surfaces and other coatings in general and on ship hulls in particular, has increased during the last decades as many anti-foul agents have gradually been prohibited due to toxicity. The current standard way of using biocides in protective coatings is to add an evenly distributed ‘cocktail’ of biocides, which, for instance when released as reactive radicals, can be expected to lower environmental impacts than products with only one or a limited number of active ingredients, while still providing the same efficacy. The study is part of the Swedish Marine Paint program which is sponsored by Mistra, the Foundation for Strategic Environmental Research.

SS04-1

Nanomaterials as emerging contaminants at global scale
C. Mallak, M. Arrieta, A. Albert
COPPE-Federal University of Rio de Janeiro, RIO DE JANEIRO, Brazil

Electrical and electronic equipment is one of the most dynamics sectors of the economy, comprising 4.5% of Brazilian gross domestic product. Although business volumes are high, there is no formal specific structure for treatment of waste electrical and electronic equipment (WEEE) in Brazil. WEEE is covered by a general law on solid waste management approved by Congress and signed by the president on August 2, 2010, but further enabling regulations still need to be issued.

Despite the lack of WEEE treatment, there is the advantage of the inexistence of informal WEEE treatment-like in China, India and Africa, due to the higher cost of labor and transaction costs. Nevertheless, other materials are commonly recycled on Brazil, particularly aluminum cans, where the recycling rate was 96% in 2005. This activity developed completely independently of government actions, starting in the early 1990s. There is a good opportunity to start a formal WEEE treatment structure from the beginning with the possibility of contamination of other waste streams since the learning curve of the WEEE market has an important role in the financial equation. This is particularly true in Brazil where primary metals prices are low, since the country is a big global supplier of several metals for many other countries, like China.

Reduction of use is difficult to perceive. Formal recycling will need a strong support from the government at the national level. Reuse and refurbishment of equipments are reputed to be good strategies for WEEE issue considering the decreasing emissions on manufacturing of new equipments, savings of raw primary materials, and social aspects like employment of labor force and demand creation of new jobs.

A risk analysis for an after Solid Waste Nationals Politics implementation scenario must evaluate the possibility of contamination of others waste streams since the learning curve of the WEEE system will take some years to reach a good efficiency. The specific regulation of WEEE must be tuned to the qualitative and quantitative demands for import recycling process, control over output secondary material and final disposal of remaining material.

SS04-2

Risk assessment of water pollutants in Catalonia (Spain) waste-water treatment plants based on E-PRTR data
A. Ginebreda, D. Guillen, I. Martinez, R. Durbas, A. Aguera, J. Cabañells, D. Barceló
Universitat Politècnica de Catalunya, BARCELONA, Spain

The Regulation 166/2006 on the establishment of a European Pollutant Release and Transfer Register (amending Council Directives 91/689/EEC and 96/61/EC) aims at establishing a Community level register of integrated pollutant release and transfer (known as the "EPRTR") for the trace quarantification will be exposed. In addition, the results of the investigation of different types of environmental matrices, including air, surface waters and waste water will be presented. These works constitute the first reports on the occurrence of nanoparticles in the environment highlighting the need of nanotechnologies residues assessment for risk evaluation of this materials.
SS04-5
Development and implementation of new techniques for landfill biogas emission assessment
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Assessment of biogas emission from landfills is a relevant issue, both for environmental and economic reasons. In fact, methane, a greenhouse gas, is one of the main component of biogas released in the atmosphere from landfills; moreover uncollected methane represents a loss of income for landfill power plants. In Italy no national/local specific technical rules are in force for landfill gas emission assessment so the procedure recommended by the English Environmental Agency (EA) is commonly applied. This procedure is based on the integration of punctual flux emission measurements from the surface of the landfill.

In this work we propose an alternative method of landfill biogas emission assessment, based on the hypothesis that the emitted biogas in stable atmospheric condition (constant wind with velocity lower than a fixed threshold) pertains to an emission gas plume. The plume can be intercepted by a regular mesh of points located downwind of the landfill, where methane concentration is measured. Afterwards, atmospheric dispersion modelling allow us to estimate the methane emission from the landfill. To verify the above objective, we followed the main steps:

- a) Identification and set up of methods for measuring biogas concentration;
- b) Calculation of total emission by modelling acquired data;
- c) Comparison among results obtained applying different measurement methods.

We repeatedly (summer and winter seasons) applied the proposed methods to a set of municipal solid waste (MSW) landfills, either in activity or closed. We estimated methane concentration by means of the Tunable Diode Laser technique adopted in the USA by the Environmental Protection Agency (EPA), which allowed us to obtain time-series of path-integrated concentration measurements within horizontal and vertical planes located above the landfill surface. We also performed direct sampling of the emission plume by using a set of bags and remotely controlled air sampler devices, arranged to identify a vertical surface downwind of the landfill. We then measured methane concentration in the bags with a FTIR-mulligan analyser.

In order to assess total methane emission, we processed the data obtained by the above measurement methods by using a numerical code implementing an atmospheric dispersion model.

We finally compared these outputs with total emission estimated by applying the EA recommen-
dations as well as with emission estimated by using the BIOY-stochastic numerical model.

SS05 - LCA network: comparison of experiences

SS05-1
The LCA networks at global level
M van der Sluijs
UNEP DTIE, PARS, France

SS05-2
BornAmerican Life Cycle Network: from strategy to action
A Quiros
ECO GLOBAL, SAN JOSE, Costa Rica

SS05-3
The Hungarian LCA network
K Szita Tirth
University of Miskolc/Faculty of Economics, MISKOLC-EGYETEMVÁROS, Hungary

SS05-4
20 years of LCA network activities in Switzerland: The contribution of the LCA forum to the current debate
K Frischbichler
ESU-services Ltd, USTER, Switzerland

SS05-5
The Italian LCA network
B Notarnicola1, FC Cappellaro2
1University of Bari, TARANTO, Italy
2ENEA, BOLOGNA, Italy

SS06-1
A Crosswalk of the Exposure Science Requirements of REACH, TSCA, CEPA and Biocides Legislation
E Dederick
ICF International, FAIRFAX, United States of America

This presentation will highlight SETAC’s networking efforts on behalf of global LCA science, with particular attention paid to the recent Pelletton workshop and its forthcoming publication.

SS06 - Emerging exposure science for developing chemical regulatory policy: REACH, biocides, TSCA reform

SS06A-1
A Crosswalk of the Exposure Science Requirements of REACH, TSCA, CEPA and Biocides Legislation
E Dederick
ICF International, FAIRFAX, United States of America

This presentation will highlight SETAC’s networking efforts on behalf of global LCA science, with particular attention paid to the recent Pelletton workshop and its forthcoming publication.
these features, the TRA addresses the basic REACH needs for generating safety assessments for all dangerous substances and for communicating the assessment results in the supply chain. It is this improved version that has been endorsed within the REACH Technical Guidance for human health exposure assessment and Exposure Scenario development. The TRA has been applied in the vast majority of the 3400 Phase 1 (2010) REACH substance registrations where exposure assessments were required. As a consequence, ECETOC has been actively soliciting feedback from users of the TRA in order to better understand where improvement opportunities exist (whether for workers, consumers or the environment). No fundamental issues with the core structure of the TRA have been reported. But it is clear that further improvements can be implemented. Until now, the accuracy of exposure predictions can only be validated when viewed in the context of its workflows and industry IT platforms. It is also apparent that a significant minority of users have failed to follow some of the key recommendations for its reliable application. This highlights the importance of understanding, defining and refining applicability domains in order that tools such as the TRA can continue to be reliably and usefully applied in the process of chemicals risk assessment.

**SS06B-2**

**Aggregate consumer exposure assessment**

N von Goert* ETH Zurich, ZURICH, Switzerland

Many chemicals that are being used in consumer products are contained in tiny amounts in the respective product. Exposure to the substance from one single product may therefore be insignificant, but this may not be the case if exposure to the same substance from different products can be high enough to pose a risk. Examples are important ingredients of personal care products (PCPs) like stabilizers, preservatives, and UV-filters. These are contained in different PCPs and cosmetic products that are used at the same time. Also some high production volume substances like Bisphenol A (BPA) and the flame retardant polybrominated diphenyl ethers (PBDEs) are found in a large number of products that a consumer comes in close contact with. Examples are epoxy resins in food containers that are released into food and PBDE-doped upholstery, electronic equipment, carpets etc. Consequently, in order to obtain an estimate for the overall exposure many single-source exposures have to be added up. The technical term for this overall exposure is the total exposure, which is used when all sources that are currently known are taken into account in the assessment. If only one sector of products is accounted for, the technical term aggregate exposure is used for the sum of single-source exposure.

The main difficulties in assessing these aggregate (or total) exposures are the lack of data on substance sources (e.g. amount of substance included in a product) and the lack of data on consumer use of these substances, the so-called co-use data.

In order to illustrate the challenges of aggregate exposure assessment the key parameters in three exemplary studies on Bisphenol A, Nanoparticles and PBDEs are discussed. As key parameters those parameters were identified that introduce the largest known uncertainty. For Bisphenol A a high variation in the most vulnerable parameter uncertainty, whereas for nanoparticles the lack of co-use data is critical for the assessment. For PBDEs the largest uncertainty is connected to PBDE concentrations in dust and dust intake rates.

Approximations for uncertain or lacking data will be discussed along with the consequences of their use.

**SS06B-3**

**Incorporating Population-Specific Diets and Activity Profiles into Aggregate and Cumulative Exposure Assessments: A Review of Capabilities and Shortcomings**

CF Chiuason, CA Franklin

The LifeLine Group, ANNANDALE, United States of America

Starting with a review of the existing and emerging regulatory mandates of Europe and North America, we will present a listing of needed exposure assessment capabilities juxtaposed to capabilities offered by contemporary models and possible sources of information needed for population-specific exposure assessments. Model design to utilise array formats of dietary and activity profile information will be highlighted to illustrate the capacity and relevance to aggregated risk assessment for consumer products using population-specific information. The LifeLine Dietary Record Generator and Activity Profile Generator and will be used to illustrate the structured approach and mathematical processes involved. While these kinds of models provide significant advantages for valuable exposure-related predictions, for any population group, regulators and assessors must understand their inherent limitations and know how to ground-truth their predictions. Accurate exposure assessments also require relevance to changes in product use patterns as the seasons change, or in variation across populations because of economics, ethnic traditions, and because of health related influences etc. Consequently, in order to obtain an estimate for the overall exposure many single-source exposures have to be added up. The technical term for this overall exposure is the total exposure, which is used when all sources that are currently known are taken into account in the assessment. If only one sector of products is accounted for, the technical term aggregate exposure is used for the sum of single-source exposure.

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Approximations for uncertain or lacking data will be discussed along with the consequences of their use.

**SS06B-4**

**Setting the scene: Is mixtures risk assessment necessary and feasible?**

A Kortenkamp

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There is currently considerable interest in considering whether chemicals risk assessment with its traditional focus on chemical-by-chemical evaluations should be expanded to take account of mixture effects. During the last 10 years, research on mixtures has made significant advances, especially in human and mammalian toxicology. This presentation will give a summary of the scientific state of the art of mixture toxicology and will reflect on issues of regulatory relevance for both environmental and food risk assessment. The tradition of risk assessment of pure chemicals could be justified, if in typical encountered exposure scenarios only one chemical was toxic, or if the joint action of several chemicals was typically not larger than the most toxic agent in the mixture. However, evidence from experimental studies shows that this is not normal. The situation may be similar to that which would be needed to take account of mixture effects if there was always sufficient protection when all chemicals are present below their threshold doses. Examples from the literature will be presented which show that combination effects can occur at low doses. This will be followed by a discussion of the general principles behind such phenomena. Experimental mixture studies in ecotoxicology and human toxicology demonstrate that the concepts of dose addition and independent action provide good approximations of observed combination effects. However, deviations from expected additive effects have only rarely been observed, and when they occurred, the deviations were not large. This argues for using these concepts in mixture risk assessment. Case studies where mixtures risk assessment has been used in practice will be critically discussed.

The talk will be highlighting two major areas important for better mixtures risk assessment: Firstly, understanding commonly observed small to modest deviations in the output of existing methods, and secondly, how to improve the output of existing methods.

Significant deviations from expected additive effects have only rarely been observed, and when they occurred, the deviations were not large. This argues for using these concepts in mixture risk assessment. Case studies where mixtures risk assessment has been used in practice will be critically discussed. The talk will be highlighting two major areas important for better mixtures risk assessment: Firstly, understanding commonly observed small to modest deviations in the output of existing methods, and secondly, how to improve the output of existing methods. The discussion currently focuses on using toxicological similarity as a grouping criterion, but this may not be decisive in all cases. Secondly, mixtures risk assessment will have to rely on sound information about cumulative exposure. But our information about combined exposures is fragmentary at best. Acknowledgement - The authors thank the European Commission for financial support (grant contract 070307/2007/485103/ETU/D1.1)

**SS06C-1**

**Challenges ahead in mixture and cumulative environmental assessments**

TP Tress, DTHM Sijm, CWM Bodar

RIVM, BILTHOVEN, The Netherlands

The talk will focus on how to deal with uncertainties in mixture risk assessment has been refocused. This presentation will give an overview of the problems, methods, and ways forward for environmental risk assessment of mixtures in some current legislative frameworks. Several studies with mixtures of chemicals with similar and dissimilar modes of action have conflicting results, which may therefore be misleading. But our information about combined exposures is fragmentary at best. Acknowledgement - The authors thank the European Commission for financial support (grant contract 070307/2007/485103/ETU/D1.1)

**SS06C-2**

**Modeling in environmental chemistry education, science and decision-making**

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The last decades have seen a revolution in the development and application of mathematical models as tools for studying environmental and human health problems, and for developing regulatory strategies to address those problems. Models are now indispensible in the daily work of many educators, scientists and decision-makers in the field of environmental chemistry. When faced with a new problem, scientists and policy-makers can often choose from a variety of models with different levels of detail, and differing levels of fidelity to the real system of interest, or they may need to create develop mathematical models of the system to address their particular challenge. In this presentation we examine the motivations for developing and applying quantitative models to describe environmental systems, and confront the inherent limitations of such models. Based on this general discussion, we identify the roles that models play in modern education, science and decision-making in environmental chemistry and exposure assessment. Some advantageous uses of models in these applications will be illustrated with case studies from our own experience.

**SS06C-3**

**Regulatory Environmental Exposure Assessments: General Approaches and Use of Market Research Data to Improve Emission Estimates**

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In this talk we will present an introduction to the methodologies used for environmental exposure estimation as part of assessment processes involved in product development. Models are indispensable in the daily work of many educators, scientists and decision-makers in the field of environmental chemistry. When faced with a new problem, scientists and policy-makers can often choose from a variety of models with different levels of detail, and differing levels of fidelity to the real system of interest, or they may need to create develop mathematical models of the system to address their particular challenge. In this presentation we examine the motivations for developing and applying quantitative models to describe environmental systems, and confront the inherent limitations of such models. Based on this general discussion, we identify the roles that models play in modern education, science and decision-making in environmental chemistry and exposure assessment. Some advantageous uses of models in these applications will be illustrated with case studies from our own experience.

**SS06D-1**

**Linkages between Human Health and Environmental Assessment**

E Mateo, MD Ollier

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This presentation will explore similarities in the challenges inherent to human health and SETAC Europe 21st Annual Meeting Abstract Book
environmental exposure and risk assessments, and how best practices can be applied across the disciplines to increase confidence. All exposure assessments share the same basic goal, to esti-
mate whether a given receptor can be exposed at a high enough dose, for a long enough time, to
to potentially cause adverse effects. There are, however, major differences that derive in part from
differences in risk assessment objectives. Human health assessments aim to protect the individual
and society from adverse health effects. However, environmental assessments generally aim to
protect at population, habitat or ecosystem levels of organization and have historically been
largely focussed on acute toxicity. The high diversity of ecological assessments, and the wider
range of protection goals, means that environmental assessment frameworks are generally
less developed than those for human health. While both fields are developing approaches to
to better consider adverse effects across exposure routes, and cumulative effects across chemical
classes, this area is currently more advanced for human risk assessments.

Confidence in any assessment depends on the quality of the data available and the
scientific strength of the assumptions that underlie the assessment model. Reliance on surrogate
data and broad extrapolation of data results in the need to not only the variability inher-
ent to a situation of interest, but uncertainties in how well the measured or monitored data simu-
late the “real” situation. Adequate characterisation of variability and uncertainty, and the biases
they may introduce into a broad view of toxicological challenges, will require, for example, examples
drawn from the assessment of human and environmental exposure to pest control products. The
relative utility of simple deterministic and more complex stochastic models will be explored,
along with opportunities to better integrate and harmonise research and monitoring resources
and model development and validation across the disciplines.

**S006-2**

Thresholds of Toxicological Concern

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Conceived over 40 years ago as a “common sense” approach, the Threshold of Toxicological
Concern (TTC) is intended as an additional to the arsenal of tools used for characterising the
toxico logical and environmental risks from low level exposure to chemicals. Initially used by the
USA FDA for low levels of indirect additives in foods (packaging materials), the TTC has subse-
quently found use in safety evaluation of flavours, genotoxic contaminants and contaminants in foods. In these cases the TTC
obviates the need for toxicological testing of chemicals where human exposure via the oral route
is low. A more recent proposal has been made to extend its use to human exposure via the dermal
route (i.e. from low levels of ingredients in cosmetic and personal care products) and from the
inhalation route. For these latter two exposure routes, both local effects and systemic effects are
taken into consideration. In all cases, threshold levels have been established by using a probabilis-
istic analysis of existing toxicological data, from which it can be concluded that the risk of adverse
effects from human exposure to levels of an untested chemical at or below the TTC is minimal.

Further proposals have been made to extend the use of the TTC in ensuring environmental pro-
tection. These include use for organic chemicals in fresh water systems based on mode of action
(Exposure Thresholds of No Concern, or ETNC), and an examination of the feasibility of using a
TTC for endocrine active substances in the aquatic environment. Use of the TTC principle may provide
a tool to address environmental risks or environmental exposures that are suf-
ficiently low. The TTC concept benefits consumers, industry, and regulators, by avoiding unnec-
necessary testing, filling gaps in regulatory safety data, and providing a reasonable method for
the use of simple models for assessing low level exposures.

**S006-3**

Criteria for Exposure Based Decision making under REACH

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Within the REACH framework, but also within OECD, there is understanding that for
reasons of animal welfare, costs and logistics, it is important to limit the number of tests to be conducted.
Exposure-based decision (EBD) is used as a tool to ensure the yes or exposure exposure
is sufficiently low. The TTC concept benefits consumers, industry, and regulators, by avoiding unnec-
necessary testing and safety evaluations, thus allowing limited resources of time, animal use, cost,
expertise and effort to be focused on the evaluation of those substances with greater potential
to pose risks to human health or the environment.

**S006-4**

Critical issues in exposure assessments: criteria for building exposure models

EJ Cohen Hubal

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America

The start of the 21st Century has seen increasing trends toward globalization and continuing
advances in molecular biology. These two seemingly disparate drivers provide the imperative for
extending consideration of exposure across multiple scales to facilitate systems based analysis for
holistic environmental and public health policy design. As understanding of how to assess and
mitigate frank impacts from simple exposures to known pollutants improves, scientists are mov-
ing toward the development of a whole organism, holistic consideration of human-environment interac-
tion, and characterization of biological complexity to understand influence of these on human
health. Operationalizing sustainability concepts to address chemicals management will be facili-
tated by application of approaches such as those used by ecologists to study resiliency of linked
social-ecological systems. Consideration of the amount of change a cell, organism, community,
or social-ecological system can undergo while still retaining important controls on function and
structure could provide a holistic approach for assessing cumulative risks, particularly to vulner-
able populations. More globally, application of this type of systems-based approach has the potential
to improve our ability to predict and minimize unintended consequences of environmental
health decisions.

**S006-5**

Exposure Biology and the Exposome: a Health-Based Paradigm for Exposure Science

SM Rapaport

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Exposure biology is a term that encompasses connections between environmental factors and
their interactions with genetic and epigenetic states. Early exposure scientists applied principles of
exposure biology in occupational studies to advance our understanding of the toxicodynamics of
fibrogenic dusts, respiratory irritants, heavy metals, and some systemic toxicants such as benzene.
With the publication of the US EPA exposure sciences largely abandoned exposure biology in favor of
methods to predict air and water concentrations of regulatory pollutants. Such emphasis on air and
water pollutants ignores toxic chemicals, arising from the diet and endogenous processes
such as inflammation, which are probably much more important contributors to heart disease,
diabetes and cancer. Thus, by abandoning exposure biology, exposure science has become only
marginally relevant to our understanding of the etiologies of modern chronic diseases.
The concept of the exposome, representing all exposures received by a person from both external
and internal sources, motivates a holistic view of biologically active chemicals in an individual’s
internal and external environment. The areas where exposures are insufficiently low.

This presentation compares existing and potential future methods for accounting for mobility in
exposure biology to complement genome-wide association studies (GWAS) that are now commonplace. Indeed, designs which interfuse EWBs with GWAS, can pinpoint key
exposures responsible for chronic diseases as well as important gene-environment interactions.
Such investigations would also generate vast data resources that can be exploited by systems biologists
to further our understanding of disease processes and mechanisms. Exposure scientists can play a
key role in this exciting research if they adopt a health-based paradigm which embraces exposure
biology and the exposome.

**S006-6**

Using pharmacokinetic approaches based on animal and human datasets to track and allo-
cate cumulative exposures and aggregate health impacts

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America

Multi-chemical exposure is the rule rather than an exception in both the general and the occupa-
tional environment. Simultaneous or sequential exposure to multiple chemicals may cause altera-
tions in the pharmacokinetic (PK) and/or pharmacodynamic (PD) of the individual chemicals,
resulting in a change in the toxicity predicted based on the summation of the effects of the com-
ponents. PK interactions occur as a result of one chemical altering the absorption, metabolism,
distribution, (i.e. excretion) of another chemical (i.e. PK). Such interactions are based on consider-
ation of the internal or target dose of one component of a mixture by another component. In such
cases, conducting quantitative risk assessment for chemicals present as a mixture is difficult. The
uncertainties that arise from changes in the PK of the components can be addressed by develop-
ing both biologically based decision models to produce estimates of the toxicokinetic exposure
for dose, route, and interspecies extrapolations of the target tissue concentration of the toxic
moieties. Further, biologically based models for mechanisms of action and tissue response can be
developed to integrate the PD interactions of the chemicals into the predictive modeling frame-
work. We can use these models to track and allocate cumulative exposures for groups using
human cells or tissues. Such a quantitative mechanistic approach to the study of chemical
interactions is imperative to achieve the ultimate goal of assessing the health risks associated
with human exposure to complex chemical mixtures.

**S006-7**

Mobility-based exposure assessment

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People’s daily mobility - for activities such as work, shopping, and recreation - brings them in
contact with air pollution concentrations that may differ from the concentration at their home
location. However, many population exposure assessments are based on census data, which are
implicitly home-based.

This presentation compares existing and potential future methods for accounting for mobility in

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exposure assessment, and also will discuss when mobility is, or is not, an important component of exposure assessment. These issues are intimately connected with the degree of temporal and spatial variability in pollutant concentrations (and people’s locations).

SS06F-3
Using exposure models to identify data gaps and develop knowledge infrastructure
A Arnot
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In recent decades regulations and methods have been developed to evaluate tens of thousands of chemicals; however, there are few measured data available for the legislated assessments. In this context, conceptual models are needed for screening and priority setting and mathematical models (mass balance and QSARs) are required to generate data. This presentation illustrates how mass balance exposure models can be used to screen and prioritize chemicals for more comprehensive assessments. The integrated, “holistic” framework exploits sensitivity and uncertainty analysis to identify and prioritize data gaps and to build knowledge infrastructure (databases and QSARs). Mass balance exposure model hypotheses (i.e., predicted concentrations) can be evaluated (“ground truthed”) with monitoring data following the incremental stages from emissions to concentrations in the environment, to food sources and to humans. During this evolutionary process (model development, application, evaluation, refinement) there is a need to balance data availability (uncertainty) and regulatory needs (timeframes). Various exposure and risk assessment frameworks can be established with different objectives and levels of model complexity. The general approach outlined here can be used to identify data gaps and build databases and predictive tools to reduce uncertainty in exposure and risk assessments and regulatory decision-making.
CS01 - Climate changes, biological invasions and pollution

CS01A - Effects of warming and cadmium on the feeding behaviour and growth of the aquatic invertebrate shredder Limmulites sp.1

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Metal contamination is still an environmental problem and can affect several species of invertebrates at environmentally realistic concentrations. Invertebrate shredders play an important role in the decomposition of plant material and decompensation of coarse particulate organic material. The Intergovernmental Panel on Climate Change predicts an increase in water temperature that may affect invertebrates, causing faster growth rates, shorter developmental time and smaller size at maturity and reduce the ability of invertebrate shredders to process detritus. It is probable that the combined effect of metals and increased water temperature may have strong impacts on the processes in which invertebrate shredders are involved, further compromising the functioning of freshwater ecosystems. Therefore, we tested how leaf consumption by invertebrate shredders and their growth are affected by cadmium and whether increasing temperature modulates this relationship. A common species of invertebrate shredder was collected from an unpolluted stream and acclimatised to the laboratory. In one experiment, the animals were allowed to feed on alder leaves, while exposed to increased Cd concentrations (3 levels, ≤ 10 μg/L) and to a temperature typically found in streams in autumn (15°C) and to 21°C to simulate a warming scenario. In another experiment, the animals were kept under starvation for 4 days while exposed to cadmium (10 levels, ≤ 35 μg/L) and then were released from the stressor and allowed to feed on alder leaves. Cadmium content on leaves and animals was analysed by inductively coupled plasma-atomic emission spectrometry. The exposure to Cd concentration and temperature interaction by both its growth rates and tissue concentrations were lower at high temperature. Cadmium accumulated more in the leaves than in the animals. In conclusion, results indicate that the increase in Cd concentration and an increase in temperature of 6°C affected the feeding behavior and growth performance of the invertebrate shredder. Limmulites sp.1 overcame the survival of sensitive shredder populations with direct impacts to plant litter decomposition and nutrient cycling in freshwater ecosystems.

CS01B - The effect of temperature on the toxicity of cadmium towards Caenorhabditis elegans

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Temperature has in the past few decades been shown to be an important factor in ecotoxicology. As both biological and chemical reactions are determined by the ambient temperature it follows that temperature is a necessary part of any profile of a chemical, such as its bioavailability, toxicity, and persistence. Rates, growth rates and general metabolic rates, as well as abiotic degradation, absorption and diffusion rates, all are temperature dependent. It is therefore expected that the toxicity of a compound will also change with temperature. In this study we determined the effect of different ambient temperatures on the reproduction, lifespan and intrinsic population growth rate of nematode Caenorhabditis elegans exposed to cadmium, in an agar based test system. The total reproduction and lifespan of C. elegans were very similar for all cadmium treatments, so these endpoints on their own would suggest that there was no significant difference between the toxic effects of the concentrations used. Fertility, however, expressed as “Time to first egg” was a most sensitive endpoint. Hence, when all endpoints were combined in a three component population growth model the effect of the individual cadmium doses showed that the high doses have determined the effect, while population levels can still take place at the low temperatures. This demonstrates the importance of evaluating the toxic effect of chemicals on population levels rather than on single endpoints determined from individuals.

CS01C - Low temperatures enhance the chronic toxicity of Cd and Cu through different mechanisms

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The effect of cadmium and copper on the reproduction of the enchytraeid worm Enchytraeus fetida was significanctly affected by the fungicide as well as by soil moisture. Feed- ing activity is higher in deeper layers of dry soil the activity is higher in deeper layers. In one experiment, the animals were allowed to feed on alder leaves, while exposed to increased Cd concentrations (3 levels, ≤ 10 μg/L) and to a temperature typically found in streams in autumn (15°C) and to 21°C to simulate a warming scenario. In another experiment, the animals were kept under starvation for 4 days while exposed to cadmium (10 levels, ≤ 35 μg/L) and then were released from the stressor and allowed to feed on alder leaves. Cadmium content on leaves and animals was analysed by inductively coupled plasma-atomic emission spectrometry. The exposure to Cd concentration and temperature interaction by both its growth rates and tissue concentrations were lower at high temperature. Cadmium accumulated more in the leaves than in the animals. In conclusion, results indicate that the increase in Cd concentration and an increase in temperature of 6°C affected the feeding behavior and growth performance of the invertebrate shredder. Limmulites sp.1 overcame the survival of sensitive shredder populations with direct impacts to plant litter decomposition and nutrient cycling in freshwater ecosystems.

CS01D - Combined effects of soil moisture and a fungicide on soil organisms - a study with Terres- trial Model Ecosystems

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The German Federal Environment Agency is expecting a decrease of summer precipitation of 20-25% in 2070-2100 and an increase by 10-20% in winter in comparison to the period of 1961-1990 for Hesse/Germany. The Intergovernmental Panel on Climate Change (IPCC) predicts substantial increase in the intensity of daily precipitation events in the Mediterranean region, while mean precipitation may decrease by 30-45%. Changes in precipitation may lead to changes in soil moisture content. When exposed to this climate-related stressor organisms may react differently towards chemicals (e.g. pesticides). 2. Materials and methods

Two studies were conducted. One took place in Portugal, the second in Germany. In both cases, the terrestrial model ecosystems (TMEs) consisted of intact, undisturbed soil cores. In Germany, the fungicide pyrimethanil was investigated at 11 concentration levels, each at three different moisture regimes in two replicates. In the Portuguese TME study, the same endpoints were inves- tigated under both with a Mediterranean soil and its community. The design differed from the German study, with only two fungicide concentration levels but four replicates per treatment. Two and eight weeks after application of the fungicide the sampling was conducted. In this contribution, the effects of three moisture levels and different concentrations of pyri- methanil on the abundance and diversity of enchytraeids as well as the feeding activity of the soil organisms and their vertical distribution will be presented. 3. Results and discussion: Enchytraeids and feeding activity

Both study sites can therefore be considered as ‘rich’ enchytraeid communities. In Germany, the abundance of the enchytraeid was significantly affected by the fungicide as well as by soil moisture. Feeding activity differed between the nominal moisture levels and showed an opposed effect in depth profile. At high moisture levels the feeding activity had its highest values in the top 4 cm, while in dry soil the activity is higher in deeper layers. 4. Conclusions

For the abundance of the enchytraeids no interaction between soil moisture and pyrimethanil could be detected. In contrast, feeding activity, responded to the interaction of climate and chemi- stry stressor, at least at nominal values. Further statistical evaluation of actual moisture contents, tax- onomic abundance and analytical measurements of the exposure concentrations are in progress.
hypothesis may develop adaptations to survive and recover upon reoxygenation, whereas exposure to contaminants would exacerbate oxidative stress in hypoxia-challenged animals and compromise the recovery. This hypothesis was tested using the most informative biomarkers identified in the first stage. The results support the hypothesis that xenobiotics can not only affect the survival of individual species but also lead to changes in the biological processes occurring in the ecosystem. The effects observed in fish populations in West African aquatic ecosystems can be used to identify predominant stressors in multiple-stressor scenarios. The results of this work highlight the importance of understanding how biological processes integrate physical patterns when studying the environmental chemistry of wild land species.
that other compounds are perhaps more likely to bioaccumulate, persist and pose a longer term threat to marine biota.

CS02-4 Effects of oil and oil treated with dispersent on the arctic amphipod Gammaropus setosus

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When released in an area to which ice will face a complex interaction between oil, water and ice. The oil will be absorbed by snow on the ice edges, it may be trapped in the ice in brine channels and it may be moved underneath the ice. The ice field as such will also be under constant transformation driven by wind, currents and temperature. Some ice floes may be transported relatively far from their original position and relatively far from their original neighbors. After-gether this may be a strong driving force for drift and spread of oil after oil has been released in an ice field.

These processes have been followed during an offshore field experiment in the marginal ice zone East of Svalbard in May 2009 [1] and basic field data have been used to accomplish a realistic and relevant exposure study in the laboratory. Chemical results from analyses of water samples of the laboratory exposure experiment showed good correlation with identical data monitored during the offshore field experiment with oil in ice infested seawater. Due to the low input of energy due to insufficient exposure period in the laboratory study, there were no indications of oil droplet formation in the water fraction caused by the dispersant. However, levels of naphthalenes were relatively high. Among the effect markers, general stress was indicated by a significant decrease in lysosomal stability of amiploid haemoscytes in the oil dispergent treatment.

CS02-5 Ecotoxicology and risk assessment of crude oil spill in a palm oil plantation

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This report is a quantitative/qualitative impact assessment of the effect of the massive crude oil spill occurred in October 2006 in a palm oil plantation in Eastern Nigeria. The effect of the spill is still being monitored in the area. The study was undertaken in Norway

Ecotoxicology and risk assessment of crude oil spill in a palm oil plantation

Widespread effects on marine biota has been reported in the Gulf of Mexico following the Deep Horizon platform disaster. The present paper outlines a commercially available system, including the camera video streams, are geo-referenced and integrated into an electronic chart interface is developed and tested with 3rd party radar oil spill detection systems. All sensors, the ship has been extensively tested through planned exercises in collabora-

CS02-6 Deriving disaster impact distances for “Seveso”-companies in relation to protected nature areas

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After the disaster at Seveso Italy in 1976 legislation was developed to protect humans and the en-

vironment from industrial accidents. This ultimately resulted in the development of the so-called Seveso II directive (Council Directive 96/82/EC on the control of major-accident hazards). EU-member states are obliged to bring this directive into force in the national laws. In the Nether-

lands this resulted in the Regulation to assess distances to nature areas, in short called Reban, which has been in force in 2009.

Reban states that there needs to be a “sufficient distance between heavy industry and vulnerable nature areas in case of an industrial disaster”. To determine this distance there “needs to be an appropriate tool to do that can determine distances between the industry and nature”. The Dutch govern-

ment would provide such a tool to execute risk analyses. The National Institute for Public Health and the Environment (RIVM) was asked to develop this tool. Seveco companies working with the most hazardous chemical compounds require a permit for new establishment or expansion of facilities. This report presents the tool based on the results of the so-called Seveso II directive (Council Directive 96/82/EC on the control of major-accident hazards). EU-member states are obliged to bring this directive into force in the national laws. In the Nether-

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The quest for more realism in ecological risk assessment demands for looking beyond ecotoxicological standards tests by additionally considering e.g., population structure, competition or predation. Prediction is considered to be a major factor controlling dynamics and structure of freshwater communities. In this study, the model organism Chironomus tentans (Diptera: Chironomidae) was used to test the impact of D. magna under predation pressure. Population dynamics, including size structure, were recorded for different treatments during 11 weeks: (1) control populations, (2) populations under predation, (3) populations exposed to two peaks of Np and (4) populations under predation and exposed to two Np-peaks. Size structure and Chironomus populations reached peak abundance. During test backswimmers grew from first to fifth instar. In both, modelling approach and laboratory study prediction was found to significantly alter D. magna population size and structure. Since size selectivity differs across Notonecta instars, the model population Chironomus tentans was developed, of the great advantage of this large backswimmers. Under predation of larger backswimmers, size structure of D. magna populations shifted towards higher number of neonates and lower number of adults compared to control. This is the combined effect of predation and toxicant finally led to the extinction of D. magna populations, whereas total abundances of other treatments were similar to or above control level. We will demonstrate that multiple stressors may result in severe effects on population level, which are not predictable from single stressors and that mechanistic modelling might be an appropriate tool for predicting the combined effects in environmental risk assessment.

CS03-3 Will climate change uncover low-dose effects of pesticides? A multigenerational study with the midge Chironomus riparius

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Natural populations worldwide are increasingly exposed to pesticides. This may not only target species under threat but also non-target species, including key生态学 species that are crucial to the functioning of natural ecosystems. Pesticides impose strong selection pressures on natural populations. This may lead to the evolution of resistance, which itself may be associated with correlated responses, including potential costs of evolution. Populations are also exposed to natural predatory life stages, and these stressors may interact simultaneously with pesticide exposure. While studies on local genetic adaptation and costs of evolution are rare in non-target species, studies on direct interactions between stressors, especially when dealing with stressor interactions, are typically implemented in non-target species. We used the water flea Daphnia magna, a non-target species often used as a model system in ecotoxicology, in an integrated research approach in which we focused on three aspects that are of key importance to understand the evolutionary ecology of pesticide exposure: (1) the capacity of natural populations to adapt genetically to pesticide exposure, the added complexity of syntopic stressor effects caused by simultaneous exposure to natural stressors, and (3) the potential interference of evolutionary changes of adaptation to pesticide exposure. In a next step we tried to understand the mechanistic basis of the observed responses using a DNA Daphnia magna microarray.

CS03-4 Effects of imidacloprid pulses on macrozoobenthos in lentic microcosms

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Over the past decade the use of a new generation of insecticides, the Neonicotinoids, has been marketed strongly. Imidacloprid was a best seller thanks to its low application rates, high activity and rapid onset and fast degradation. However, because of its high solubility, Imidacloprid has potential to enter surface waters. In the risk assessment tests were conducted under laboratory conditions, based on single species and continuous-exposure scenario. In agricultural areas, periods of peak application followed by rainfall events can lead to pulse contaminations, where contaminations can reach toxic levels for certain target insects. To assess the impact of Imidacloprid on non-aquatic microinvertebrates. To achieve realistic exposure conditions the experiment was carried out using infilled microcosms. This method is designed to simulate natural lentic ecosystems and enables the testing of many indigenous invertebrates developing within microcosms. During the experiment optimal conditions for Imidacloprid degradation prevailed, therefore this experiment has to be considered a ‘best case’ rather than a ‘worst case’ exposure scenario. Measurements on structural aspects of the macroinvertebrates showed some evident responses: At the greatest concentration tested (nominal concentration of 40 μg/L), differences were significant in some of the macroinvertebrates. Emergence of some of these species and of Ephemeroptera declined at the highest concentrations tested (nominal concentrations: 17.3 and 40 μg/L). The results provide evidence that despite the short duration of the exposure, Imidacloprid can significantly affect the structure of freshwater ecosystems, even at low concentrations. The microcosms method showed also to be a valuable tool in the risk assessment of contaminants.

CS03-5 Combined effects of pesticide exposure and predation risk: what can we learn from behaviour and physiology?

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To assess the impact of pollutants in field situations we need to understand whether their effects are magnified when combined with natural stressors like predation risk. Such synergistic interactions sometimes occur but we do not understand when and how to explain these. One way to start unravelling these effects is to use mechanistic end points of combined exposure to pesticides and predation risk. To this aim we investigated in larvae of the damselfly Enallagma cyathigerum the joint effects of pesticide exposure (glyphosate) and predation risk (visual and chemical predator stimuli) on growth and associated behavioural (food intake) and physiological (activity) responses (1) at a low exposure to a NOEC of pyrimethanil at 20°C. But an exposure of to a NOEC of pyrimethanil at 20°C. In simulated spring, a ‘no-effect-concentration’ (NOEC) of pyrimethanil provokes slightly adverse or hormetic effects caused by simultaneous exposure to natural stressors, and these stressors may interact simultaneously with pesticide exposure. In the laboratory, we tested the effect of p353-Nonylphenol (Np) on populations of D. magna under predation pressure. Population dynamics, including size structure, were recorded for 4 different treatments during 11 weeks: (1) control populations, (2) populations under predation, (3) populations exposed to two peaks of Np and (4) populations under predation and exposed to two Np-peaks. Size structure and D. magna populations reached peak abundance. After backswimmer experiments were conducted to model the experimental data of the great advantage of this large backswimmers. Under predation of larger backswimmers, size structure of D. magna populations shifted towards higher number of neonates and lower number of adults compared to control. This is the combined effect of predation and toxicant finally led to the extinction of D. magna populations, whereas total abundances of other treatments were similar to or above control level. We will demonstrate that multiple stressors may result in severe effects on population level, which are not predictable from single stressors and that mechanistic modelling might be an appropriate tool for predicting the combined effects in environmental risk assessment.

CS03-6 Assessment of soil contaminants bioavailability using a multi-marker approach in laboratory and field experiments

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Simultaneous contamination of soil by various substances (contaminant mixtures) presents a challenge for risk assessment. Chemistry analyses give the level and type of contaminants. Toxicity tests assess the effects of bioavailable compounds to selected species using standard important endpoints (survival, growth, fertility). Bioavailability can be defined as “the fraction of a substance that will exert an effect on an organism”. This fraction is “toxicologically bioavailable”. Conversely, bioavailability is referred to as “the fraction of a substance which is readily mobilizable by an organism in a soil”. Bioavailability is critical for understanding effects that might result from exposure of a biota to contaminated environments. Soils and sediments from military and training areas (RTAs) as well as Munitions Experimental Test Center (METC) are contaminated principally by energetic materials (EM) and metals. Their chemical characteristics are typically well known and toxic stressors like pesticides from RTAs and METC are in some cases available. However, bioavailability on these sites needs to be comprehensively characterized. Conventional toxicity tests give limited toxicological information and do not consider variability (e.g., temperature, humidity) of current and future field conditions. Improvement of standard as well as developing alternative biological endpoints (cellular, biochemical, molecular biomarkers) can help to understand the toxicity observed and give the appropriate information for the selection of biological parameters for other tier assessment levels (e.g., field mesocosm assays, field studies) where standard chronic endpoints can not be used. Use of selected biomarkers alone gives appropriate information on the toxicity of contaminants. Under the simulated climate change situation, pyrimethanil-treated C. riparius reveal the highest mortality, a substantially reduced population growth rate and a sizeable loss of genetic diversity. Although adverse pyrimethanil effects vanish until the end of the summer in both present-day scenarios, C. riparius sublethal concentrations (control, pyrimethanil treatment) exposed to the climate change scenario break down after F3-generation.

The results gained so far highlight the importance of near-natural climate impact research to better understand and manage the ecotoxicological risk of agrochemicals today and in future. Not only the impact of climate change is of importance but also considered sublethal concentrations of pesticides may pose a raison d’etre for aquatic insects in future.

CS03-6-1 A decade monitoring of PCBs and PAHs by silicone rubber passive samplers in parallel with
ECOIA-2
New developments in passive air sampling for current-use pesticides and other priority chemicals
M Koblizkova, T Harner, SC Lee, S Genualdi
Environment Canada, TORONTO, Canada

Passive air samplers are cost effective and simple tools that are invaluable for assessing risks associated with pesticides. Polyurethane foam disks with modified PUF disk samplers and spatially resolved data that is required for developing transport and fate models. Under the Global Atmospheric Passive Sampling (GAPS) network, passive air sampling comprises polyurethane foam (PUF) disks and PUF is used to deliver air concentrations of several orders of magnitude. Passive air sample disk concentrations were not observed to be lower in winter compared to autumn, due to the semi-polar nature of the compounds investigated. Instead, a good correlation (KPEw = 4.13 (n-NP), 3.68 (n-OP), and 2.87 (t-OP) was obtained with hexadecane-water partitioning constants (Khdw) predicted from COSMOtherm. During deployments in Narragansett Bay (RI), the application of PFM has also been undertaken in a limited field study.

ECOIA-3
EU-wide environmental monitoring of Persistent Organic Pollutants using butter as a biomonitoring matrix
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Lipids are good matrices to accumulate many persistent organic pollutants (POPs) due to the lipophilic nature of these compounds. Dairy products are easily accessible and available worldwide and analysis of this matrix reflects the contamination level of the environmental compartment from which they derive. The Stockholm Conventions and the Global Monitoring Plan (GMP) encourage the production of monitoring data to effectively evaluate the presence of the POPs in all regions, in order to identify changes in levels over time, as well as to provide information on their regional and global environmental transport.

ECOIA-4
Determination of deployment specific chemical uptake rates for SDB-RPS Empore Disk using a passive flow monitor (PFM)
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The University of Queensland, BRISBANE, Australia

The use of the absorbent SDB-RPS-Empore Disk in a ChemCatcher type passive sampler is routinely applied in Australia when monitoring herbicides in aquatic environments. One key challenge in the use of passive samplers is mitigating the potentially confounding effects of varying flow conditions on chemical uptake by the passive sampler. Performance reference compounds (PRCs) may be applied to correct sampling rates (Rs) for site specific changes in flow and temperature thereby, however, evidence suggests that the use of PECs when applied to absorbent passive samplers. The use of the passive flow monitor (PFM) has been introduced for the assessment of site specific changes in water flow. In the present study we have demonstrated that Rs at which both arazine and prometryn are accumulated within the SDB-RPS-Empore Disk disk is associated with the diffusion through the overlying diffusion limiting membrane. Overall the greatest uncertainty remains at very low flow conditions which are unlikely to occur in surface waters. Validation of the application of PFM has also been undertaken in a limited field study.

ECOIA-5
Effective in-situ measurement of pore water PCB concentrations in sediment profiles using passive samplers
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Since their introduction, the use of passive samplers to measure freely dissolved concentrations of hydrophobic organic compounds (HOCs) in aquatic environments has become more prevalent. However, there are limited studies that have utilised passive samplers to assess in situ pore water concentrations. Measurements of pore water concentrations are important as they are a more appropriate indicator of the hazard to aquatic biota in an ecosystem. This study focuses on measuring sediment pore water concentrations of polychlorinated biphenyls (PCBs) in an AC amended contaminated sediment site by: (i) measuring vertical pore water profiles of PCBs from 0-50 cm using both polyurethane devices (PEDs) and polystyrene (PS); (ii) dosing the PEDsamplers with a larger suite of performance reference compounds (PRCs) to determine the effect of interpreting PEC depletions to assess the development towards equilibrium. In August 2008, sampling rods with ultra thin POM (17, m) and polystyrene (PS) were placed in a remanent sediment treatment plot located in a tidal mudflat area of the South Basin in San Francisco Bay. This study seeks to determine (i) the partitioning, (ii) the equilibrium enrichments, (iii) the influence of the PECs concentration.

ECOIA-6
Development and use of polyethylene passive samplers to detect triazoles and alkylphenols in an urban estuary
VP Sells, R Lohmann
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To be able to use polyethylene passive samplers (PE) in the field, the partitioning constants between PE and water (Kr) of the compounds examined must be known. The Kr of tri- (TCS), methyl trichloro (MTC), n-monomethyl (n-MP), n-octylphenol (n-OP), and t-alkylphenol (t-OP) were determined (r2=0.984, p=0.001) and a good correlation (KPEw = 0.679 * Khdw + 1.033, r2=0.984, p=0.001) was obtained with hexadecane-water partitioning constants (Khdw) predicted from COSMOtherm. During deployments in Narragansett Bay (RI) in the fall of 2009, concentrations of TCS and n-OP in surface and bottom waters ranged from 0.01 to 0.01 mg/l and 0.06 to 0.02 mg/l, respectively. These concentrations are far below Ec50 values for these compounds. Surface/bottom and bottom/surface water ratios were calculated, which indicated surface waters as the main source of TCS, while water surface as well as sediments were sources of n-OP.

ECOIB-1
Air concentrations of current use pesticides (CUPs) in Tuscany and Lazio region, Central Italy, using passive air sampler (PUF disk)
KAPG Point1, VH Estellón1, TH Harner2, MMM Monet, SC Cornelissen3, JB Bangher4, SF Finna4
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The concentrations of current use pesticides (CUPs) in Tuscany and Lazio region, Central Italy, using passive air sampler (PUF disk)
KAPG Point1, VH Estellón1, TH Harner2, MMM Monet, SC Cornelissen3, JB Bangher4, SF Finna4
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The concentrations of current use pesticides (CUPs) in Tuscany and Lazio region, Central Italy, using passive air sampler (PUF disk) was deployed at four sites in the agricultural areas of Montalcino (Tuscany region) and four sites in Lazio region (Lazio region) to assess concentrations of current use pesticides (CUPs). From twelve CUPs screened over the study period, triallate was consistently detected in samples. Triallate, Chlorothalonil, Pendimethalin, and Chlorothalonil-methyl were detected in all samples. The concentrations of triallate were higher than those detected at Montalcino. Air conditions monitoring in autumn and winter with Silicone Rubber Passive Sampling (SRPS) in parallel with deployed mussels (Mytilus edulis) running from 2002 at eight locations along the coast of Sweden were be discussed. Results were processed using the last partition coefficient and models for calculation of the concentrations in the water phase. Sampling rates were clearly lower in winter when the water temperature was lower. The average of the estimated concentrations in the water phase from 3, mg/l (PCB170) - 40, mg/l (PCB128). Concentrations of PCBs in the water phase ranged from 20, mg/l (indeno(1,2,3-cd)pyrene) to 4000, mg/l (benz(f)anthracene). Estimated concentrations were higher in winter compared to autumn, for PCBs as well as PAHs. Comparing amounts per mussel before and after exposure reveals that in about 20% of the cases contaminations were released during exposure. Although this is no evidence that equilibrium is attained it does mean that data are likely positioned on both sides of the equilibrium. The result of lipid based bioaccumulation factors (LBAF) were evaluated and showed more variation in winter than in autumn. Furthermore, also the LBFs for PCBs were on average significantly lower in winter compared to autumn. Relating LBAF to the water temperature showed a decrease of LBAF with temperature (0.04 log units). Such a decrease was not found for PAHs. Lower LBAFs in winter for PCBs were mainly caused of the higher concentrations calculated or the water phase and not, or much less, by changes in the concentrations in the mussels. In spite of the observed temperature effect, that only became significant because of the large dataset, the log LBAF values show an excellent relationship with log Kow values. Further tuning of research that relates passive sampling to uptake by mussels should take the water temperature and salinity into account for the passive sampling as well as uptake by mussels.
concentrations (pg/m³) of Pendimethalin ranged from 30-1000 and Chlorpyrifos ranged from 70-10000 (~10 ng). At Montalcino, seasonal patterns showed that Pendimethalin was detected only during period 1 and 2 while Chlorpyrifos (ethyl and methyl) showed the uniform distribution during the whole year at all the sampling sites. The seasonal variation of CUPs were less evident during the whole year at all the sampling sites. The differences observed at the sites might be related to the different agricultural activities. At Terracina, there is a prevalence of conventional agriculture and the use of a wide range of pesticides. However at Montalcino there is a long tradition for organic farming activities.

ECOB-2
Estimating community consumption of illicit drugs using passive sampling (POCIS) to monitor environmental contamination

Monitor the Polar Organic Contaminants Integrative Passive Sampler (POCIS) in untreated wastewater to wastewater treatment plants (WWTPs) in Canada to estimate community drug consumption. The results were generally consistent with data generated by monitoring 24-h composite samples of the untreated wastewater.

ECOB-3
Pharmaceuticals, personal care products, and agrochemicals in a rural Canadian watershed via passive and active sampling devices

Passive sampling devices: comparison of POCIS and Chemcatcher

Chemical Integrative Samplers (POCIS in Pharm configuration) and the Chemcatcher (in polar configuration) were immersed in 4 sampling points for 1 week and the daily concentration of pollutants, because they are not adequate for the more hydrophilic compounds as triazines daily sampling method. Their potential application is limited by the hydrofobicity of the considered pollutants, because they are not adequate for the more hydrophilic compounds as triazines.

ECOB-4
Can monitoring for WFD and MSFD be undertaken using passive samplers?

Evaluation of non agricultural pesticides air contamination: a field study using Tenax passive samplers

The two systems have been exposed in the field for 4 weeks between June and July 2010. In this first step, molecules have been analysed by gas chromatography and mass spectrometry. In this study, two sites of two companies and one of a private house located in eastern France were chosen to perform the sampling which occurred after a professional or non-professional pesti-

ECOB-5
Sampling of organic pollutants in marine waters using flow through integrative samplers and semipermeable membrane devices

Sampling rates between 0.1 - 0.3 L/d for the analytes in laboratory studies, and deployed POCIS were validated by Cemagref Lyon with controled and stable temperature, conductivity and flow rates for some that hasn’t been tested yet. Those two passive samplers combined to an optimised multi-residue analytical method allow us to monitor a representative mixture of endocrine disruptors in surface waters.

ECOC-1
Monitoring by LC-MS/MS of 28 endocrine disrupter compounds in surface water using passive sampling devices: comparison of POCIS and Chemcatcher

ECOC-2
Monitoring with the Polar Organic Contaminants Integrative Passive Sampler (POCIS) in untreated wastewater to wastewater treatment plants (WWTPs) in Canada to estimate community drug consumption.
Calibrating passive sampling and passive dosing techniques to lipid based concentrations P Mayer, SN Schmidt, A Aninka, MS Mclachlan, MT Leppänen

Equilibrium into tissue sampling in three different fish yielded lipid based PCR concentrations that were in good agreement with those determined using total extraction and lipid normalization. These results support the validity of the in tissue sampling technique, while at the same time confirming that the fugacity capacity of these lipid-rich fish tissues for PCBs was dominated by the lipid fraction.

Equilibrium sampling of PCB contaminated lake sediments with PDMS coated vials and with Head Space Solid Phase Microextraction (HS-SPME) yielded lipid based concentrations that were in good agreement with each other, but about a factor of two higher than measured lipid-normalized concentrations in the organisms.

Passive dosing was applied to bioconcentration and toxicity studies of several PCBs with the terrestrial springtail Folsomia candida. Within the bioconcentration study, equilibrium partitioning concentrations in lipid served as a well-defined reference for the evaluation of measured concentrations in the springtails. In the toxicity tests of naphthalene, phenanthrene and pyrene, lethal concentrations were determined also on a Trout base and were in good agreement with the typical range of lipid membrane burdens for baseline toxicity (40-160 mM). This demonstrates that these new calibration principles also can be applied within a toxicological context.

PWS-YES application as estrogenic chemicals screening and monitoring tool for STP effluents

EC01C-3

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MTO Jonker, AR Breeveld


In the present study, passive sampling of dissolved chemicals is performed and different extraction methods are tested in order to find a suitable method for further research with effect directed analysis (EDA) to identify chemicals that affect agellate life. Pulse amplitude modulated fluorescence (PAM) was used to test algae toxicity of concentrated samples and fractions thereof. We have compared different extraction methods that are suitable for the concentration of a broad range of compounds from marine water in order to identify unknown toxic compounds. Different passive samplers were compared with water extraction methods in terms of performance and response in the PAM assay. Passive samplers seem to provide: i) an increase in method sensitivity, ii) simplicity in use, and iii) relevance to ecological risk assessments not easily obtainable with extraction of water samples.

Substrate degradation and toxicity of polycyclic aromatic hydrocarbons (PAHs) in the passive sampler Chemcatcher

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Equilibrium in tissue sampling

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EC01C-5

Sorption and desorption kinetics of polycyclic aromatic hydrocarbons on Empore disks deployed in the passive sampler Chemcatcher

EC01D-1

Passive sampling using standard passive sampling devices (PWSDs) like semi permeable membrane device (SPMD) can detect organic compounds in various matrices, and passive dosing from silicone is increasingly used to control and maintain their concentrations. Both these equilibrium partitioning approaches are normally calibrated to freshly dissolved aqueous concentrations (Caq), which often are considered the effective concentration for partitioning, bioconcentration and toxicity. In the present studies we extend the calibration of such methods towards equilibrium partitioning concentrations in lipids (CEL). The first approach proceeds in two steps: (i) the concentration in the PDMS (CEL) is determined and (ii) multiplied with recently determined lipid to PDMS partition ratios (KPDMS). The second approach applies external partitioning standards in vegetable or fish oil for the complete calibration of equilibrium sampling techniques without additional steps.

Equilibrium sampling into various formats of the silicone polydimethylsiloxane (PDMS) is determined and (ii) multiplied with recently determined lipid to PDMS partition ratios (KPDMS). The first approach proceeds in two steps: (i) the concentration in the PDMS (CEL) is determined and (ii) multiplied with recently determined lipid to PDMS partition ratios (KPDMS). The second approach applies external partitioning standards in vegetable or fish oil for the complete calibration of equilibrium sampling techniques without additional steps.

In the present study, the chemical compounds that have an effect on algae in order to quantify the toxic pressures in the Dutch coastal zone. In the Dutch coastal zone.

In the present study, passive sampling of dissolved chemicals is performed and different extraction methods are tested in order to find a suitable method for further research with effect directed analysis (EDA) to identify chemicals that affect agellate life. Pulse amplitude modulated fluorescence (PAM) was used to test algae toxicity of concentrated samples and fractions thereof. We have compared different extraction methods that are suitable for the concentration of a broad range of compounds from marine water in order to identify unknown toxic compounds. Different passive samplers were compared with water extraction methods in terms of performance and response in the PAM assay. Passive samplers seem to provide: i) an increase in method sensitivity, ii) simplicity in use, and iii) relevance to ecological risk assessments not easily obtainable with extraction of water samples. Acknowledgement - This project is financed by DELTARES, NL.
X Zhang1, Y Lei1, F Wang1, M Tsurukawa2, T Nakano2

The Yangtze River is the third largest river in the world and the Three Gorges Dam (TGD) is the largest dam in the world. The closing of the TGD may result in drastic environmental alterations. Persistent organic pollutants (POPs) are a group of substances that bioaccumulate in aquatic organisms. The occurrence, fate, and transport of POPs in water of TGR were only reported sporadically, their ecotoxicological effects have never been studied. EROD assay is generally regarded as being an early warning signal for the Ah-receptor-related toxic effects of PCBs, PAHs, and related compounds. EROD with HEPA fur heptaoma cells bioassay is a bioassay established to measure CYP1A1 induction caused mostly by dioxin-like chemicals in environmental samples.

In this study, triolein SPMD technology was applied to sample and concentrate the priority organic compounds. EROD bioassay was used to evaluate the potential toxicological effects of water in TGR. The aim of this study was to investigate the levels and distribution patterns of Ah-agonists effects in surface water of TGR by combining SPMD sampling technology with EROD bioassay. After 24 h incubation, the TEQ value is related to all the compounds able to elicit a response (persistent and non-persistent compounds). Compounds that still elicit a response after 72 h incubation in the EROD bioassay are defined as persistent. EROD of 0.7 and 24 d exposure ranged from 27-390 pg TCDD/sample. However, the TEQ of PCB only ranged from 0.0-2.5 pg TCDD/sample. The TEQ of PCB contributes very little to the total activity in water from the TGR. The TEQ of PAH ranged from 6.4-423 ng TCDD/sample. Therefore, PAH in SPMD may be main contributor to EROD activity of 24 h incubation. In case of 72 h incubation, other persistent compounds not targeted in the study may exist to cause EROD induction. Further study warranted to clarify the differences.

Determination of high partition coefficients from diffusive mass transfer in the boundary layer

J H Kwon1, H Lee1, HJ Kim1, Y Ha1, BI Escher2

Aim of the research is to get a better insight into the influence of various functional groups in selected chemicals on the sorption to frequently employed passive sampling materials. Therefore, we decided to employ the commonly used OASIS polymers (HLB, WCX, WAX, MAX and MCX). These polymers carry a-polar moieties, hydrophilic part as well as charged groups, which should allow the adsorption of the target compounds. Various polar chemicals were tested on the different OASIS polymers to determine which functional groups on the compound is crucial for successful sorption on the OASIS material. This knowledge is crucial to taking a grounded decision which sorbent can be employed as a passive sampling material.

The results of this research indicate that especially a-polar functionalities have a great impact on the sorption, whether the compound is charged or not. The more pronounced the a-polar moiety is, the better the compound can interact with the sorption material. Furthermore, it emerged that the conditions of the aqueous phase, such as salt concentration, influence the sorption behaviour of charged molecules dramatically. The better the salt concentration the lower the adsorption of charged compounds, hence the Kd values.


Application of passive dosing to study the biotransformation and bioaccumulation of hydrophobic compounds

J H Kwon1, H Lee1, HJ Kim1, Y Ha1, BI Escher2

Passive dosing is a useful tool for the study of hydrophobic compound bio-transformation/degradation at well-defined dissolved concentrations. This study details two applications of passive dosing for studying biotransformation/degradation. A format has been developed to study the biodegradation of polychlorinated biphenyls (PCBs, POPs) and polycyclic aromatic hydrocarbons (PAHs) in water. The range of environmental conditions that can be measured within 30 h was 10^{-10} to 10^{-7} atm m^{3} mol^{-1} for H, and 10^{-4} to 10^{-10} atm m^{3} mol^{-1} for Kd.

The global fate and transport of organic contaminants: concepts and misconceptions

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Achieving well-defined and constant dissolved concentrations of hydrophobic compounds is challenging due to volatilization or sorptive losses. With passive dosing, continual partitioning into the test medium of compounds is possible without support for losses, and provides defined and constant dissolved concentrations. Passive dosing can be used for studying biotransformation/degradation. Here, the polymer HOC reservoir also compensates for losses due to the bio-transformation/degradation process itself. Furthermore, a large mass of test compound is introduced so that compound turnover is significant even at low dissolved concentrations thus facilitating measurement of the relevant endpoint (e.g., metabolic products in bioaccumulation or growth in bioaccumulation). This study details two applications of passive dosing for studying biotransformation/degradation. A format has been developed to study the biodegradation of polychlorinated biphenyls and polynuclear aromatic hydrocarbons by bacterial strains. EPA 505, allowing degradation rates to be quantified at defined freely dissolved concentrations from ng/mL down to pg/L. Passive dosing was also applied for quantifying the mutagenicity of benzo(a)pyrene metabolites produced after activation by the liver 59 mix in the in vitro Ames II assay. Compared to the case with spiking, responses from passive dosing were shifted by a factor 100-1000 to lower concentrations. These results demonstrate the advantages of passive dosing compared to repeated tests. This difference in apparent sensitivity cannot solely be explained by partitioning, and is due to slow dissolution kinetics as well as mass-depletion of the spiked benzo(a)pyrene. Therefore, passive dosing is a useful tool for the study of hydrophobic compound bio-transformation/degradation at well-defined dissolved concentrations. This format is suitable for low levels. Importantly, both approaches include study process kinetics at precisely defined dissolved concentrations and allowing increased compound turnover even at constant and low concentrations.

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Following the detection of synthetic organic chemicals in remote and sparsely populated regions of the global environment in the 1960s, there has been a steady increase in the understanding of the processes that control a chemical's spatial range in the environment. Measurements of the occurrence of contaminants in remote and sparsely populated regions have been complemented with conceptual and numerical models of varying complexity that seek to explain, quantify, and predict a chemical's ability to undergo long range transport and to accumulate in remote regions. In particular, the concepts of global fractionation and global distillation that we formulated in two papers in the mid 1990s have captured the imagination of many with the concept for the global fate and transport of organic contaminants. While reviewing the literature we frequently encounter misconceptions, especially surrounding the use of terms such as the global chromatography, global fractionation and distillation processes, and cold and warm poles. We have encountered a number of misconceptions, such as "cold condensation results in the precipitation of pure chemicals", "the bulk of a persistent organic contaminant's global inventory will eventually migrate to the poles", "global fractionation is driven by temperature gradients" or "low temperatures will drive higher concentrations". We have encountered several misconceptions arise because the phenomena are complex and there is often a lack of reliable emission, monitoring and physical chemical property data. In this presentation we describe and discuss the concepts or present state of the science surrounding global transport of chemicals, especially over considerable latitudinal differences with their inevitable differences in temperature.
### ECO2A-3

**Can clouds enhance long-range transport of low volatile, ionizable and surface-active chemicals?**

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Atmospheric partitioning and transport of low volatile organic compounds is strongly influenced by the presence of water (e.g. clouds) and its deposition velocity (e.g. rainfall). It was identified that the assumption of continuous rainfall underestimates the residence time and the transport potential of non-volatile substances. The liquid water content of clouds and the high specific surface of frozen or liquid cloud droplets can significantly contribute to the total activity capacity (i.e. the capacity to solvate chemicals) of the atmosphere for non-volatile, ionizable and surface active substances.

A modified version of the regional multimedia activity model for ions TAIMI, including two-layered atmosphere with atmospheric boundary layer (ABL) and lower/middle troposphere (LMT), was faced for the first time with intermittent rainfall and variable cloud coverage. The modelled system was applied to a selection of ten low volatile or ionizable chemicals to investigate the potential of clouds to enhance the atmospheric transport potential. Probability density functions were derived for input substance properties and environmental parameters (e.g. precipitation intensity) to quantify uncertainty and variability and probabilistic simulations at two sites were run for a constant emission to the atmospheric boundary layer to identify key model inputs.

The degradation rate, the duration of dry and wet periods and the parameters describing air-water bulk partitioning (\(K_{wa}\) and T) and ionization (\(pK_a\) and pH) determine the residence time in the ABL and in the LMT. Residence time depend, also on the water content of clouds and on interface partitioning. In some cases the residence time and its variability is similar in the two compartments, while some compounds (e.g. diuron, 2,4-D, perfluorooctanoic acid) are more persistent in the LMT. The longer residence time predicted for some compounds in the LMT is due to the capacity of clouds to solvate non-volatile molecules in the liquid water and at the interface of cloud droplets.

The efficiency of wet deposition to remove low volatile organic pollutants from the atmosphere is limited primarily by the duration of the dry interval between precipitation events. During dry periods, low volatility organic compounds can be transported to the troposphere. Here, the high capacity of tropospheric clouds to solvate non-volatile and surface active chemicals limits oxidation and wet deposition rates and increases the potential for long-range transport.

### ECO2A-4

**Organic tracer compounds of ambient air particulate matter in the Western Mediterranean Basin and influence of natural and anthropogenic emission sources**

**B van Drunen, L Jopes**

University of Otago, DUNEDIN, New Zealand

Semi-volatile organic contaminants (SOCs) are known to be transported thousands of kilometres in the atmosphere. Ultimately, these SOCs end up in cold remote ecosystems far from where they have been used. The transport mechanism of SOCs to these pristine locations occurs via a series of volatilization-transport-condensation steps, however little is known about the SOC contribu-

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all four sampling media to determine the affect of media properties and SOC physical chemical properties on accumulation. Lichens and two-year old conifer needles preferentially accumulated lighter PAHs. This means that in agreement with previous works, the air concentration of the low molecular weight PAHs in the temperate areas is now being mostly controlled by the re-emissions of these chemicals from the soil. In order to study the influence of soil characteristics and temperature on gradients, the soil to ambient air fugacity ratios (fs/fa) were regressed against the different parameters describing the soil properties by equation: fs/fa = a + b (1/T) + c (log redox), thus indicating that the fugacity ratios increase at higher temperatures, and higher soil redox potential. The existence of the temperature is consistent with the seasonal variability and demonstrates that during warm periods soils increase their strength as a source. The influence of redox potential can be related to SOM quality or soil microbiology, an important factor that could be related to in-situ production of PAHs from degradation of organic matter. The potential influence of soil emissions as a factor controlling atmospheric concentrations of PAHs is discussed.

ECO2B-6
Atmospheric deposition fluxes of contaminants close to a municipal solid waste incinerator
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European committee for standardisation approved on October 2009 EN 15841, the Standard method for determination of atmospheric lead, and lead in soil and urban tissue at the reference site recommends the use of bulk collectors, as Italian National Institute of Health (ISS) had already indicated. In this study atmospheric depositions were collected with bulk samplers, with the same features indicated in the new method. The goal of this study is to assess the contribution of POPs to deposition at inhabited areas. The main purpose of this work is to determine the POPs and the HM fluxes. In the local area under study, the deposition collector is not affected by the HM emissions. Therefore the locally contribution of POPs and the HM in the fluxes could be negligible. The deposition site is located in a suburban area, not far from a tourist town (Riccione), an important Italian highway (A14), and a shoreline (Adriatic coast). Sampling was conducted during 12 months in the year 2010. Air samples were collected with active samplers deployed in three different altitudinal sites of Livingstone Island (from the Spanish Juan Carlos I research facility to the glacier). Only low-medium PM2.5 and medium chlorinated PCBs and HCB were detected in most sites, vegetation and air samples, with exception of chlorinated PAHs that showed to the highest air concentrations. All four passive sampling media were collected with active samplers deployed in 3 different altitudinal sites of Livingstone Island (from the Spanish Juan Carlos I research facility to the glacier). Only low-medium PM2.5 and medium chlorinated PCBs and HCB were detected in most sites, vegetation and air samples, with exception of chlorinated PAHs that showed to the highest air concentrations. This finding highlights the importance of the long-range transport of POPs to the pristine ecosystems. Higher POPs concentrations were also detected in soils of penguins colonies, suggesting that apart of long-range transport of POPs, anthropic penguins may also redistribute POPs at local scale.

ECO2C-4
Polyaromatic hydrocarbons in air over Central Europe: what can we learn from diagnostic ratios for source apportionment and reactivity?
A Drozdov, G Lammel, J Klánová, K Horšková
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Despite numerous uncertainties, diagnostic ratios (DRs) of parent polyaromatic hydrocarbon (PAH) congeners have been used to infer source apportionment and reactivity of these pollutants due to the simplicity of the method, it is attractive especially for countries, where (e.g. due to lack of measurement data) sophisticated source apportionment methods cannot be applied. The following four commonly used PAH DRs were investigated: (anthracene / phenanthrene) ANT/(ANT+FHE), fluoranthene / (fluoranthene + pyrene) FLT/(FLT+PYR), benzo[a]anthracene / (benz[a]anthracene + chrysene) A&A/(B&A+CHR), indeno(123d) pyrene / (indeno(123d)pyrene + benz[g,h]pyrene) IPY/IPY + BPE and retene / (retene + chrysene) RET/(RET+CHR). PAH DR values derived from a literature survey on suitable PAH emission factors were used to study their ability to distinguish between PAH sources at sites with well described source categories (road traffic, residential heating, industry) in the Czech Republic, Serbia and Bosnia and Herzegovina. Later, transect changes in source characteristics at the background receptor site Kočetice, Czech Republic, were examined using ambient PAH data from long term monitoring (1996-2008). Then a mass balance model of PAHs in air was established and uncertainties of PAH reaction rate coefficients were narrowed down. The suitability of PAH DRs for distinguishing between various PAH sources (urban, industrial regions with very limited information on ambient PAHs (15 countries in Africa)) was also studied using data from a passive air sampling campaign conducted in 2008. A good agreement between some literature based PAH DRs and ambient DRs from sites with a dissimilar influence of a local source was observed. However, the current knowledge on PAH reactivity was found to be insufficient for source apportionment of atmospheric PAHs at receptor sites far from sources. DRs were used to narrow down ozone and OH radical reaction rate coefficient uncertainties for 10% of Pyr and BPE in the particulate phase seem to be 10%. The highest rate coefficient measured using model aerosols in the laboratory and K03(2) IPY in the gas phase could be higher than previously estimated by three orders of magnitude.

ECO2C-5
Background atmospheric concentrations of PAHs are controlled by ubiquitous emissions from soils
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In this study atmospheric depositions were collected with bulk samplers, with the same features indicated in the new method. The goal of this study is to assess the contribution of POPs to deposition at inhabited areas. The main purpose of this work is to determine the POPs and the HM fluxes. In the local area under study, the deposition collector is not affected by the HM emissions. Therefore the locally contribution of POPs and the HM in the fluxes could be negligible. The deposition site is located in a suburban area, not far from a tourist town (Riccione), an important Italian highway (A14), and a shoreline (Adriatic coast). Sampling was conducted during 12 months in the year 2010. Air samples were collected with active samplers deployed in 3 different altitudinal sites of Livingstone Island (from the Spanish Juan Carlos I research facility to the glacier). Only low-medium PM2.5 and medium chlorinated PCBs and HCB were detected in most sites, vegetation and air samples, with exception of chlorinated PAHs that showed to the highest air concentrations. This finding highlights the importance of the long-range transport of POPs to the pristine ecosystems. Higher POPs concentrations were also detected in soils of penguins colonies, suggesting that apart of long-range transport of POPs, anthropic penguins may also redistribute POPs at local scale.

ECO3 - Biodegradation and bioremediation of organic pollutants
ECO3-1
Assessing bacterial diversity and its influence on biodegradation potential of contaminated soil
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Biodegradation - and its corollary, persistence - is an important but poorly understood fate process that is central to all mitigation strategies, both at pre-manufacture stage of chemicals, and when they are eventually present into the environment. It represents one of the greatest scientific uncertainties in assessments (e.g. life-cycle, fate and exposure models) that underpin EU directives affecting their control (e.g. REACH, IPPC, WFD). Biodegradation is often measured experimentally by observing the degradation of a chemical substance in the presence of a bacterial inoculum, and relies on the determination of specific degradation markers. Biodegradability usually relies on one or a few inoculum sources and chemical substances. Ready biodegradability tests (RBTs) have long been the central foundation for understanding the biodegradability of chemicals in regulatory frameworks; a shift in recent years has seen that many of the programs have been replaced with more accurate and comprehensive methods. One of the major factors for this shift is the recognition that contamination in plant is not the main source of pollutants in the degraded area, which is apparently characterized by a homogeneous and widespread contamination situation, typical of an urban area. This is confirmed by the observation that degradation processes do not significantly lower than the other years, even though the plant was shut down for 6 months.

ECO3-2
The biodegradation of para-nitrophenol in river water: a functional gene approach
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The following five commonly used PAH DRs were investigated: anthracene / (anthracene + phenanthrene) ANT/(ANT+FHE), fluoranthene / (fluoranthene + pyrene) FLT/(FLT+PYR), benzo[a]anthracene / (benz[a]anthracene + chrysene) A&A/(B&A+CHR), indeno(123d) pyrene / (indeno(123d)pyrene + benz[g,h]pyrene) IPY/IPY + BPE and retene / (retene + chrysene) RET/(RET+CHR).

PAH DR values derived from a literature survey on suitable PAH emission factors were used to study their ability to distinguish between PAH sources at sites with well described source categories (road traffic, residential heating, industry) in the Czech Republic, Serbia and Bosnia and Herzegovina. Later, transect changes in source characteristics at the background receptor site Kočetice, Czech Republic, were examined using ambient PAH data from long term monitoring (1996-2008). Then a mass balance model of PAHs in air was established and uncertainties of PAH reaction rate coefficients were narrowed down. The suitability of PAH DRs for distinguishing between various PAH sources (urban, industrial regions with very limited information on ambient PAHs (15 countries in Africa)) was also studied using data from a passive air sampling campaign conducted in 2008. A good agreement between some literature based PAH DRs and ambient DRs from sites with a dissimilar influence of a local source was observed. However, the current knowledge on PAH reactivity was found to be insufficient for source apportionment of atmospheric PAHs at receptor sites far from sources. DRs were used to narrow down ozone and OH radical reaction rate coefficient uncertainties for 10% of Pyr and BPE in the particulate phase seem to be 10%. The highest rate coefficient measured using model aerosols in the laboratory and K03(2) IPY in the gas phase could be higher than previously estimated by three orders of magnitude.
ECO-3
Impact of cell concentration methods on the performance of enhanced biodegradation tests within REACH
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Regulatory emphasis has shifted recently towards hazard identification and prioritising chemicals that are persistent, liable to bioaccumulate and are toxic, since chemicals with these properties have previously been shown to be most harmful to human health and the environment. Biodegradation is one of the most important fate processes determining persistence. Ready biodegradability tests (RBTs) have formed the core protocol for developing regulatory guidelines for persistence and environmental exposure assessments. They are highly prescribed, very stringent standardised tests that measure the biodegradability of chemicals. Due to the stringent nature of the methods used to test their biodegradability, they offer limited insight into the potential biodegradability of environmental persistence. This has been recognised in REACH guidance which advocates the introduction of a new tier of enhanced tests to enable efficient and effective identification of persistent chemicals. Reliable extrapolation from any small-scale systems to predict effects at local, national and international levels is being represented by the environment, including the nature of the microbial populations present. Enhanced tests allow increases in inoculum density to environmentally-equivalent concentrations, thereby incorporating increased and realistic microbial diversity. This presentation will describe the application of the latest molecular techniques and ecological models to quantify the distribution, abundance and diversity of bacteria in different environmental compartments and their contribution to biodegradation outcome, with the eventual aim of developing robust screening tests for persistence.

ECO-4
Degradation of PFCs by anaerobic bacteria
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PFOS, PFOA and other PFCs are considered to be persistent compounds in the environment due to the highly stable C-F bond. Nevertheless, there are examples of microbially catalysed dehalogenation reactions, such as those observed for fluorinated acetates and benzenes. Reductive dehalogenation reactions under anaerobic conditions are enigmatic. Such reactions could potentially serve as a terminal electron accepting process for anaerobic bacteria, as is the case for many reductive dechlorination reactions. A large number of anaerobic bacteria have been identified that use reductive dehalogenation as an electron acceptor, even referred to as chlororespiration. Since the dehalogenases present in reductively dehalogenating bacteria may also be active towards other organohalogen compounds, we have tested a number of reductively dehalogenating bacteria with PFCs. Several Desulfitobacterium strains, including Desulfitobacterium fructosovorum, D. desulfuricans, D. fructosum, D. chlororespaceum and CO2 were incubated with PFOA and PFOS under anaerobic conditions. Culture samples were analysed by LC-MS/MS over a period of 14 months for PFOS, PFOA and their putative metabolites. First results from these experiments indicate that some of these strains are indeed able to dehalogenate PFCs.

ECO-5
Monitoring the transport and degradation of triclosan in field soils receiving sewage sludge
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Triclosan is a known methylated metabolite which is more lipophilic and is believed to be more environmentally persistent than the parent compound. Degradation was less pronounced in the sandy soils compared to the loam and clay loam soils which had decreased to 15-20% of initial concentrations in the top 10 cm of soil. However, triclosan concentration in the top 10 cm were initially very high in all plots (850-900 _g kg-1) but decreased progressively between 15-38 mg kg-1 were manually incorporated into the top 10 cm of each plot at Rates in this soil. Most triclosan movement was observed in the sandy soil, reflecting better soil properties compared to loam and clay loam soils. Rates were increased when triclosan was applied to sewage sludge. Triclosan concentrations in sewage sludge were 806 mg g (nonylphenol) being all these values are comparable with the concentrations reported to be found in European surface waters. Finally, the treatment processes used to make potable water destined to human use was evaluated in order to evaluate in removing selected EDCs: a complete or significant reduction of EDCs contamination were always observed, with residual concentration level in the range of ng/L.

ECO-6
The effect of non-UV light on the microbial degradation of crop protection products in an aerobic soil system
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Crop protection products (CPPs) are subject to strict regulatory processes prior to approval for commercial use. Laboratory studies are routinely used to study the environmental fate of CPPs, however systems may not provide an accurate representation of field conditions, and therefore extrapolation of data to a field environment is questionable. It is therefore essential to add complexity to laboratory studies to create a more environmentally realistic system. The following study investigates aerobic degradation studies of CPPs in soil which are typically conducted under dark conditions. The effect of phototrophic organisms on the transformation of CPPs was investigated by the inclusion of non-UV light to standard laboratory systems. A preliminary experiment compared the time it takes for 50%/90% of a compound to degrade (DT50 and DT90) for the experimental fungicide ‘fungicide A’ and the herbicide chlorotoluron. A second experiment compared the transformation of several CPPs at a single sampling point; namely, prometryn, cis/transison, imidacloprid, lufenuron, propiconazole and fludioxonil. The DT50 of fungicide A was approximately halved from 37.3d to 18.3d under dark and light conditions, respectively. The DT90 of chlorotoluron was similarly halved from 79.4d to 35.2d under dark and light conditions, respectively. Experiment 2 showed a significant reduction (p≤0.05) for an additional parent compound and metabolites for prometryn (48%), imidacloprid (8%), and fludioxonil (24%). Cis/transison behaved atypically to other compounds with a 14% increase in extractable parent compound under light (p≤0.05). There was no significant difference in CPP transformation under light for propiconazole and lufenuron. Chlorotoluron was significantly higher under light treatments for all compounds tested (p≤0.05) indicating the presence of phototrophic organisms in these systems. The enhanced rates of degradation observed for the major compounds may be due to direct degradation by phototrophic organisms or an increase in viable biomass/microbial activity from the addition of C produced by phototrophs.
of open oceans and Lakes. Once in the water, partitioning processes influence the transport pathways, degradation processes, residence times and the final fate of the compounds. Indeed, it is known that biogeochemical cycles, especially those related to organic carbon, affect the POP transport and sinks in the water column. The biological pump has received a lot of attention during the last decade, but it is not clear the role of biodegradation on air-water exchange and atmospheric inputs of POPs and the biogeochemical processes occurring in the surface ocean mixed layer involving the complexities of the biological pump and degradation in such processes.

Air-water partitioning model has been developed modifying the approach proposed by Duch and coworkers [1] to calculate air-water, water-plankton and settling fluxes. Additional modeling exercise has been used to include the potential degradation process occurring in the water column to reproduce more accurately field measurements. The trends observed in the Mediterranean provide important clues on the processes driving POPs in other oceanic regions, where the gradients in biomass and other environmental variables can be larger than in the Mediterranean.

References

ECOA-5
Lateral distribution of polyfluorinated organic compounds in the air and surface water from the Arctic to the Antarctic
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Per- and polyfluorinated organic compounds (PFOS) are substances that have been extensively used and applied in industrial and consumer products in the past 50 years due to their surface-active properties and thermal as well as chemical stability. PFOS is persistent in the environment after application and thus is an important bioaccumulative chemical in different aquatic ecosystems. The objectives of this study are to characterize the distribution of PFOS in the atmosphere and in marine environments of the Arctic, Atlantic, and Antarctic. The data will be used to evaluate the transport pathways of PFOS from high contaminated regions to relatively low contaminated regions, and evaluate the air-water exchange intervening in the transport process of PFOS into the Open Ocean and Polar Regions.

ECOA-6
Polyaromatic hydrocarbons (PAHs) atmospheric concentrations and deposition over the open Mediterranean and Black Seas
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6Polyaromatic hydrocarbons (PAHs) are a group of semi-volatile organic compounds (SOC) which are ubiquitous in the environment, bioaccumulate in planktonic food webs and may cause a wide range of toxic effects in biota and humans. The atmosphere is their major pathway of transport and deposition for PAHs, being partitioned between the air and aerosol phases. There is little information on the PAH occurrence and deposition in marine environments far from shore areas (open sea). PAH atmospheric concentrations, spatial distribution and deposition across the Mediterranean Sea and in the Marmara and Black Seas are presented in this study. Material and methods: Two oceanographic cruises performed on June 2006 and May 2007 on board of the oceanographic vessel B/O García del Cid (CSIC). In both campaigns, Barcelona was the initial and final port, with Istanbul and Alexandria being the intermediate stops respectively. A total of 44 integrated air samples (particulate + gaseous phase) were collected mostly along the Mediterranean but also in the Marmara and Black Seas. For PAH determination by GC/MS, 10 triplicates were used. The samples were analyzed by using high volume samplers. PAH atmospheric levels over the Mediterranean Sea were driven by air gaseous concentrations. 16 PAHs gase phase concentrations ranged from 2 to 4 ng m-3 whereas particular phase concentrations varied from 0.1 to 0.3 mg m-3. The transect encompassing the Marmara and Black Seas exhibited a slightly highest PAH concentrations of 6 ng m-3 and 0.5 mg m-3 for gas and particulate phases, respectively. Phenanthrene dominated the average gase phase concentration pattern in the Mediterranean Sea accounting for 50 ± 15% of the sum of PAHs, whereas PAH congeners were more evenly distributed in the particular phase than benz[a]anthracene and benzo[a]pyrene. PAHs from rivers (Dutra et al. 2009) contaminated the Mediterranean Sea open waters ranged from 20 to 50 mg m-2 d-1, whereas in the Marmara and Black seas a value of 95 mg m-2 d-1 was calculated. Back trajectories analysis, diffusive air-water exchange and day and night concentration variations were also investigated in the present study.

ECO-48
Spatial and temporal dynamics of POPs in the Morava river
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Spatial and temporal dynamics of polyaromatic hydrocarbons (PAHs) in river sediments were studied. Samples of suspended material collected in the sedimentary traps, silicon rubber based passive sampler providing information on truly dissolved concentrations of chemicals of interest, and bulk water samples were taken for organic analysis. All samples were analyzed not only for PAHs but a number of other legacy and emerging groups of persistent organic pollutants (POPs), they were characterized for their abiotic parameters and correlations of the POP levels with such parameters as well as with the meteorological and hydrological conditions were studied. Distribution of PAHs among the phases of aquatic ecosystem was also assessed including spatial and temporal variability of such distribution. Such sampling of the same sites under various temperature conditions, and hydrological situations and allowed for detailed assessment of PAH behavior in highly dynamic river system. The results were further correlated with the results of toxicological assessments.

ECO-49
Distribution and fate of musk compounds in a river: field study and model calculation
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Synthetic musk compounds are widely used as ingredients in personal care products. They have been recognized as important organic pollutants in aquatic ecosystems, and are in general more ubiquitous than the legacy pollution such as POPs. A distribution study was conducted during several years in the river Elbe (in its basin at different seasons and analysed. Simple model calculations were used to calculate mass fluxes between the compartments and to get a better understanding of the targeted compounds' fate.
did not differ at different seasons, pointing at a constant composition of the waste water through- out the year. Remarkable differences in sediment concentrations were determined in dependence of sampling depth, indicating different sedimentation history and temporal changes in pollution of the river. The results clearly showed that explaining sediment-water distribution of compounds should take the spatial heterogeneity (horizontal and vertical) of sediments into account. Field data confirmed that most metabolites bioaccumulate in fish. No bioaccumulation in fish was observed for the bactericide triclosan.

A comparison of measured concentration data with acute and chronic toxicity values for organophosphorus pesticides from three trophic levels (algae, daphnia, fish) revealed that all compounds except triclosan should take the spatial heterogeneity (horizontal and vertical) of sediments into account. Field observations, data estimates require large data sets. To overcome these limitations, field studies differ greatly from real world conditions, while they fluctuated during rainfall events (fall). High flow conditions probably contributed to the increased accumulation of the degree in sediment, where noontime and therefore a higher ratio of metabolites bioaccumulate than for compounds with a shorter biological half-life.

The capacity of rivers for biological attenuation processes of trace polar organic pollutants are difficult to study in isolation. Although it is possible to estimate in-stream attenuation rates from monitoring data, acute estimates require large data sets. To overcome these limitations, field studies differ greatly from real world conditions.

In a general way the PCBs (from 6.82 up to 1821 ng g⁻¹ ww), HCB (from 0.060 up to 136 ng g⁻¹ ww) and DDT s (from 0.410 up to 524 ng g⁻¹ ww) were the prevailing compounds. Further south at Quonset Point, gradients of PCBs (DDE, DDD, DHC, HCB, PBDEs, mixex, aldrin, dieldrin, endrin and chloridane-related compounds) as well as for 8°C and 9°C stable isotopes. Collected in king George Island (62°05'S, 58°32'W), Antarctica, in the austral summers of 2004/05 and 2005/06, for the following species: krill (Whale Euphausia superba), limpets (soft tissue from Nucella concinna), fishes (muscle from Nototenia rusti and Corisichthys), birds (egg and liver from Pygoscelis antarctica, papua and adelie, Catharacta sp. and Larus dominicus; only liver from Daption capense and Macronectes giganteus and only egg from Sterna hirundinaria) and pupfish (fat from Lohmann, M Dapsis, EJ Morgan, V Dekany, PJ Luey 116th SETAC Europe 21st Annual Meeting Abstract Book 3

EC04-6

Determining air-water exchange, spatial and temporal trends of PAHs in an urban estuary

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The later represents a site with little anthropogenic influence. At all sites bream, a part of the C. labrosus, range in age from 3 to 4 years. The riverine sediments were sampled in the vicinity of sites where fish were sampled. Samples were collected from the trap with the fleisch trap, which was set at a depth of 1 m. In a number of the rivers, the HBCD concentration of bream from the Rhone declined by about 50% during the study period. The later represents a site with little anthropogenic influence. At all sites bream, a part of the C. labrosus, range in age from 3 to 4 years.
EC04C-1 Persistent chlorinated organic pollutants and the decline of Atlantic eels [D Besse, M Alaei, RS Brown, M Lebret, S Buckey, M Keire, G Pacioporrenta, S Trottier, PV Hudson] 1Queen’s University / Environment Canada, BURLINGTON, Canada 2Environment Canada / Water Science and Technology Board, OTTAWA, Canada 3Queen’s University, KINGSTON, Canada 4Fisheries and Oceans Canada, MONT-JOLI, Canada 5Environment Canada, BURLINGTON, Canada 6Queen’s University / Environment Canada, BURLINGTON, Canada

There are concerns that chemical contaminants may have been a major contributing factor leading to the decline of the eel (Anguilla anguilla) in European rivers. The Potsdam group and their coworkers have been at the forefront of this research. Their studies show that persistent halogenated organic pollutants (such as polychlorinated biphenyls, polybrominated diphenyl ethers and perfluorooctanoic acid) are accumulated in eels to very high concentrations (up to 2000 ng/g wet weight). The most likely contaminants are PCBs, 2,3,7,8-TCDD and vinclozolin, which are found in the eel at concentrations of >10 ng/g wet weight. The accumulation of these contaminants is due to the fact that eels are long-lived and slow growing. The results of the Potsdam group and their coworkers show that the accumulation of these contaminants is a major threat to the survival of the eel population. The eel is a keystone species in many European rivers and its decline would have a significant impact on the ecosystem.

EC04C-2 Pharmaceuticals and transformation products in surface water and drinking water [L ter Laak, M de Jongh, PJF Knooi, AP van Wezel] KWR Watertechnieken, NIEUWEGEIN, The Netherlands

Some studies also reported the presence of persistent organic pollutants (POPs), including polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and perfluorinated compounds (PFCs) in drinking water sources. The presence of these compounds in drinking water has raised concerns about their potential health effects. The identification and quantification of these compounds in drinking water can help to evaluate the risk associated with their presence.


For their use in the water quality management plans of European Depend on surface waters, such as the rivers Danube, Meuse, Po and Rhine. In these waters, rapid improvements in chemical and biocatalytic techniques have led to the discovery of all kinds of so-called emerging contaminantsof various concentrations, including pharmaceuticals, illicit drugs, sweeteners, endocrine disrupting compounds and disinfection by-products. Some studies also reported the presence of emerging contaminants in drinking water samples. Dutch drinking water companies therefore intensively investigate their water sources for the presence of emerging contaminants and their fate during treatment processes. A combination of analytical approaches is applied for this purpose, including chemical screening techniques, hyperbolic target analysis, biological early warning systems, biosyssays and effect-directed analysis (EDA) approaches. This presentation gives an overview of the chemical and biocatalytic approaches applied to investigate Dutch drinking water sources and treatment systems. Examples are discussed of the use of sensitive and specific techniques such as CALIX multiresor gene biosystems for the analysis of hormone-like activities and the development and application of a UPLC-MS/MS method for the determination of (sub) ng/L concentrations of new pharmaceuticals. As an example of pharmaceutical analysis employing ICP-MS detection a study will be presented investigating the removal efficiency of metoprolol and emerging contaminants in a pilot-scale advanced oxidation treatment process. Presented studies showed that quality assessment of drinking water requires the use of the most suitable techniques: chemical, biological or combinations thereof. Due to ongoing analytical improve-ments, our knowledge on contaminants in drinking water sources steadily increases and also our responsibility to act accordingly.

EC05A-2 Pharmaceuticals and transformation products in surface water and drinking water [L ter Laak, M de Jongh, PJF Knooi, AP van Wezel] KWR Watertechnieken, NIEUWEGEIN, The Netherlands

Numerous studies describe the presence of pharmaceuticals in the water cycle, while their trans-formation products are usually not included. The current study is based on a monitoring cam-paign of ~30 common pharmaceuticals and transformation products in 14 surface waters, 10 pre-treated surface water, 7 river bank filtrates and the 17 corresponding produced drinking waters. Various pharmaceuticals and transformation products were observed at concentrations of <10 pg/L to <10 ng/L. In particular, the presence of polychlorinated dibenzofurans (PCDFs) in drinking water and their fate during treatment processes have been investigated. A combination of analytical approaches is applied for this purpose, including chemical screening techniques, hyperbolic target analysis, biological early warning systems, biosyssays and effect-directed analysis (EDA) approaches. This presentation gives an overview of the chemical and biocatalytic approaches applied to investigate Dutch drinking water sources and treatment systems. Examples are discussed of the use of sensitive and specific techniques such as CALIX multiresor gene biosystems for the analysis of hormone-like activities and the development and application of a UPLC-MS/MS method for the determination of (sub) ng/L concentrations of new pharmaceuticals. As an example of pharmaceutical analysis employing ICP-MS detection a study will be presented investigating the removal efficiency of metoprolol and emerging contaminants in a pilot-scale advanced oxidation treatment process. Presented studies showed that quality assessment of drinking water requires the use of the most suitable techniques: chemical, biological or combinations thereof. Due to ongoing analytical improve-ments, our knowledge on contaminants in drinking water sources steadily increases and also our responsibility to act accordingly.

EC05A-3 Pharmaceuticals and personal care products in urban receiving waters [A Meissel, G Strauch, S Leschek, M Smichler] 1UFZ - Helmholtz-Centre for Environmental Research, LEIPZIG, Germany 2Eawag - Swiss Federal Institute of Aquatic Science and Technology, DUEBENDORF, Switzerland

Pharmaceuticals and personal care products (PPCPs) and other organic micropollutant from wastewater sources pose a potential threat to aquatic ecosystems and the human health. Urban areas are prone to PPCP contaminations since here large amounts of wastewater are produced through domestic activities and treated, however, in some cases also discharged without treatment. The combination of annual water flow with the median contribution of different PPCP pathways (wastewater treatment plant effluents, combined sewer overflows and groundwater discharge) out of a mid-European urban drainage catchment and assess the temporal variability of this contamination. The study area is a catchment of wastewater sewer (sewershed) which is in a corresponding position to the groundwater catchment and therefore allows for a joint analysis of water and matter fluxes. We conducted a monitoring over the course of 1 year which included samples from untreated and treated wastewater, surface water and groundwater. The resulting samples were screened for six PPCPs and micropolitants: Bisphenol A, technical-4-nonynoic acid, caffeine, galaxolide, toluine and carbamazepine. The annual water flow to and from the sewershed was quantified using the data of the wastewater flow and results from a numerical groundwater flow model (MODFLOW). The higher sensitivi-ty of P. antipodarum to flutamide than V. piscinalis was at least by its higher bioac-cumulation capacity, but not by its higher metabolism into an inactive metabolite.
Preliminary results of this study suggest that attenuation of certain pharmaceuticals in small streams can be relevant. Even within short river stretches pharmaceuticals can be eliminated due to the more intense exchange of river water with the sediment compartment and due to a higher efficiency of photolysis compared to large rivers.

**ECO5A-5**

Tracing micropollutants during riverbank filtration under restored and non-restored conditions at the River Thur

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Riverbank Filtration (RBF) is a widespread, low-cost method to achieve high quality drinking water. Since little is known about the fate of organic micropollutants during RBF and the influence of river restoration on the processes in the hyporheic zone and the aquifer, we investigated the fate of micropollutants from the river through different groundwater transects. The field site was located in the lower part of the Swiss river Thur catchment, which was partially subject to river restoration. Two piezometer transects were installed: one is located in a channelized part where drinking water is produced by RBF and the other in a restored part of the river. First a screening sampling of high molecular weight organic contaminants was performed. 78 compounds were analyzed with an online-SPE-LC-MS/MS-method. Highly spatiotemporally resolved sampling of river water and groundwater was conducted between 2008 and 2010. During the screening we found 98 compounds in concentrations between 0.1 and 400 ng/L. The concentrations of the compounds span the two transects in the first two wells without any notable retardation. In further wells and in the transect in the channelized part, no MCPA was found. These observations implicate a strong degradation of MCPA in the first meters of the aquifer. The difference in the two transects is consistent with known travel times, which are of the order of weeks to months. The difference is important parameter on biological degradation. Micropollutants from urban sources, such as the pharmaceutical carbamazepine, exhibited decreasing concentrations in the river during high discharge events. This caused decreasing concentrations in the groundwater transects with some retardation in the channelized transect.

**ECO5A-6**

Mechanisms controlling the transport of carbamazepine and other trace organic compounds in a sand aquifer receiving wastewater discharge

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In North America, approximately 55% of wastewater currently is discharged to the subsurface using on-site wastewater disposal systems. As water demand increases, the volumes of wastewater discharged to the subsurface also is expected to increase. While abundant information is available on the fate of wastewater micropollutants in the subsurface, there is limited information available on the fate of trace contaminants, including pharmaceutical and personal care products. Field investigations were conducted at a well characterized septic system located in southern Ontario. At this site, wastewater is discharged to an anaerobic septic tank followed by infiltration through the unsaturated zone to the shallow water table. The disposal is seasonal, from May to October of each year. A detailed groundwater sampling network previously installed at the site was used to collect both temporally and spatially for analysis of major water chemistry parameters and a suite of trace organic compounds. In the groundwater zone, elevated concentrations of carbamazepine (up to 4000 ng/L), sulfamethoxazole (2000 ng/L) and ibuprofen (1800 ng/L) were observed over periods of up to 90 days from the wastewater disposal area. Concentrations of other pharmaceuticals, including gemfibrozil, naproxen and caffeine, were much lower and more variable. Laboratory column studies conducted to evaluate transport parameters of the pharmaceutical compounds under controlled flow conditions showed little correlation to the transport observed at the field site. Predicted dissolved and suspended properties were found to underpredict the transport observed in the laboratory experiments. Predictions of field behaviour were less successful. Additional studies are required to further delineate the transport behaviour of pharmaceutic a compounds in groundwater at wastewater disposal sites.

**ECO5B-1**

Micropollutant plume in Lake Geneva

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To date, most research on environmental occurrence and fate of pharmaceuticals has focused on the presence of these compounds in rivers and streams, often at sites close to discharges of wastewater treatment plant effluent. However, only scarce data exist concerning the environmental fate of pharmaceuticals directly discharged from WWTPs into lakes. We assessed the spatial and temporal distribution of 39 priority pharmaceuticals and pesticides in Lake Geneva's Vidy Bay, which serves as the receptor for the effluent of the WWTP of the city of Lausanne. Discharge of WWTP effluent was established between April 2010 and December 2010 in key locations in the Vidy Bay. These included the outlet of the WWTP, and two reference sampling sites located ca. 1.5 km upstream and downstream of the discharge point. Concentrations were measured using an analytical screening method based on ultra performance liquid chromatography coupled to tandem mass spectrometry (UPLC-MS/MS).

A plume with significantly elevated pharmaceutical concentrations was detected in the water column above the point of wastewater discharge into the bay. The depth of the contamination footprint varied with season, following the thermocline which decreased from a depth of 10m in April/May to 30m in August/September, and allowing stratification of the water column. Explicitly, this caused the disappearance of the concentration peak above the WWTP discharge point and thus homogenous vertical concentration profiles. Conductivity profiles were well-correlated to pharmaceutical concentrations, indicating that in the particular situation at Lake Geneva, it is possible to track the plume and estimate the micropollutant concentrations therein using conductivity measurements. To our knowledge this is the first reported micropollutant plume.

**ECO5B-2**

PPCPs in recycling of dairy wastewater in a reconstructed mixed forest - forage formation

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We have examined recycling of dairy effluents via irrigation of a mixed pasture - planted tree eco-system at the Keshet experimental site. The effluent is stored in lagoons and used following minimal treatment, using on-site wastewater disposal systems. As water demand increases, the volume of wastewater discharged to an anaerobic septic tank followed by infiltration through the unsaturated zone to the shallow water table. The disposal is seasonal, from May to October of each year. A detailed groundwater sampling network previously installed at the site was used to collect both temporally and spatially for analysis of major water chemistry parameters and a suite of trace organic compounds. In the groundwater zone, elevated concentrations of carbamazepine (up to 4000 ng/L), sulfamethoxazole (2000 ng/L) and ibuprofen (1800 ng/L) were observed over periods of up to 90 days from the wastewater disposal area. Concentrations of other pharmaceuticals, including gemfibrozil, naproxen and caffeine, were much lower and more variable. Laboratory column studies conducted to evaluate transport parameters of the pharmaceutical compounds under controlled flow conditions showed little correlation to the transport observed at the field site. Predicted dissolved and suspended properties were found to underpredict the transport observed in the laboratory experiments. Predictions of field behaviour were less successful. Additional studies are required to further delineate the transport behaviour of pharmaceutic a compounds in groundwater at wastewater disposal sites.

**ECO5B-3**

Dynamics of sulfadiazine in manured-amended soil under field conditions

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In the last years, environmental fate and effects of the sulfonamide antibiotic sulfadiazine (SDZ) have been investigated in a series of studies. Firster and co-workers quantified the concentration dynamics of SDZ and metabolites in soil by using LC-MS/MS analysis. 67 water samples were analyzed by GC-MS and the origin of PPCPs in the not-irrigated basin. Yet, this conclusion has to be reevaluated at this and other sites. In addition, it will be interesting to reveal the origin of PPCPs in the not-irrigated basin.

**ECO5B-4**

Generating screening level scenarios of personal care products in China using GIS

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The environment and application profiles of PPCPs have been evaluated by applying the concepts of the US Environmental Protection Agency (EPA) (e.g., US-EC67; and the respective fractions could well be described by a conceptual kinetic model (Zarr7 et al., 2009, Chemosphere). The next step towards an advanced understanding of the environmental behaviour of SDZ was to investigate the fate dynamics of SDZ under field conditions. Respective experimental results were obtained from laboratory batch experiments tested for its ability to simulate the observed fate dynamics of SDZ under field conditions. The experimental field plots were cultivated with maize and grass. During the vegetation period, the plants were harvested in the field and the remaining SDZ was analyzed. Soil samples were taken from the top soil layer during the vegetation period; occasional sampling was continued until the following spring. The soil samples were sequentially extracted and measured following published methods. For modelling, CaCl2 extraction and high-temperature-extractable parts of SDZ were assigned to an "easily extractable fraction" (EAS) and to a "residual fraction" (RES), respectively. Reference values of kinetic rate constants from laboratory batch experiments at controlled temperature and moisture conditions were used for simulations. Simulated rate constants were fitted to actual experimental data by an Arrhenius-like function. Substance availability in EAS was described by a first-order reaction, while the RES fractions showed elevated concentrations directly after application of manure to soil and decreasing concentrations in the following. In model simulations, concentration dynamics of the EAS fraction were fitted quite well, while the RES fraction was much lower and more variable. However, the concentrations in the RES fraction were clearly underestimated. The simulation fit to the RES fraction could be improved by increasing the rate constant k, and k, by factors of 1.5 and 4.0, respectively. Identical rate constants could be used to describe two different trials where maize or grass was cultivated.
OSGB-5  Predicting the fate and behaviour of cyclic volatile methyl siloxanes in two contrasting lakes

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The behaviour of three cyclic volatile methyl siloxanes (D4, D5 and D6) in lakes was explored using a fugacity-based steady-state non-equilibrium multimedia fate and transport model (a modified version of QWASI) in order to ascertain their likely environmental persistence and the relative importance of different loss processes (volatilisation, hydrolysis, burial in sediment and advection in outflow). Predictions were made for two contrasting North American lakes: Lake Ontario and Lake Pepin. Partition coefficients and the hydrolysis rate constant were adjusted for the mean annual temperatures of each lake. Half lives in sediment were calculated from partitioning theory, assuming that hydrolysis occurs only in the dissolved phase of the interstitial water. Estimation of subsurface losses was achieved by combining current per capita applications of usage and fraction lost to domestic waste water, the population of the lake watershed which was especially important for D6. Although all three compounds are very volatile (log KAW > 2.5), the relative contribution of volatilisation to total losses was predicted to be limited in both lakes by the relative magnitude of other processes, sorption to organic phases in the water column and lake depth. Nevertheless, volatilisation is still predicted to be the most important loss process for D4 (58% of the compounds in nature and in waste treatment 2.0 optimization processes) as well as for D5 and D6. Moreover, there were no similar trends in the two lakes. Model outputs were compared with observed concentrations in surface sediments and reasons for discrepancies discussed.

OSGB-6  Continental scale inverse modeling of European River contaminants

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We use a pan-European data set of measured river water concentrations of 16 common organic water contaminants, namely: Naproxen, Ketoprofen, Betaxolol, Bupropion, Diclofenac, Gemfibrozil, Benzo(b)fluoranthene, Sulfametoxazole, Methylenebenzothiazole, Norfloxa- cillin, Oxytetracycline, Carbamazepine, Chloramphenicol, Bithionol, Galaxolide and Tonalide for any compound in either lake. Instead, the main net loss process for sediment was burial, which is especially important for D4. Although all three compounds are very volatile (log KAW > 2.5), the relative contribution of volatilisation to total losses was predicted to be limited in both lakes by the relative magnitude of other processes, sorption to organic phases in the water column and lake depth. Nevertheless, volatilisation is still predicted to be the most important loss process for D4 (58% of the compounds in nature and in waste treatment 2.0 optimization processes) as well as for D5 and D6. Moreover, there were no similar trends in the two lakes. Model outputs were compared with observed concentrations in surface sediments and reasons for discrepancies discussed.

ECOS-3  Analysis of personal care products in German fish tissue by GC-MS/MS: a nationwide study

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3German Environment Specimen Bank (GESB) fish tissue samples, collected from fourteen different GESB locations, were analyzed for the twelve PCPs including fragrance materials, alkylphenols, photo-initiators, and tricosanol. The analytical method utilized pressurized liquid extraction (PLE) with in-cell silica gel cleanup, gel permeation chromatography (GPC), and gas chromatography ion trap tandem mass spectrometry (GC-MS/MS). Statistically-derived method detection limits (MDL) ranged from 1.2-37.9 ng/g wet weight. Galaxolide and tonalide, both synthetic polyalcoyl monomuls fragrances, were the most frequently detected PCPs. Galaxolide was detected in 15 of 14 fish samples whereas tonalide was detected in 9 out of 14 fish tissue samples. The maximum concentration of galaxolide (447 ng/g ww) and tonalide (15 ng/g ww) were measured in the Saar River at Rehlingen. Galaxolide and tonalide concentrations were positively correlated with percent lipid in fish tissue (r2 = 0.711, p = 0.001 and r2 = 0.769, p < 0.001, respectively). Tinosan was measured at or near MDLs only in the Elbe River at Klein enze and in the Donau River at Keilheim. PCPs were not detected in Lake Belaer.

ECOS-4  The uptake of pharmaceuticals into aquatic organisms; the importance of species traits and exposure route

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A wealth of information is now available on the occurrence and effects of pharmaceuticals in the environment, but our understanding of the uptake dynamics of pharmaceuticals through aquatic and terrestrial food webs is limited. The present study aimed to address this by: - Comparing the uptake of pharmaceuticals in aquatic invertebrates with different traits, including the freshwater shrimp (Gammarus pulex), the water boatman (Notonecta glauca) and the freshwater snail (Planorbis corneus) - Exploring the relationship between pharmaceutical physico-chemical properties and pharmaco- logical properties and uptake into aquatic invertebrates - Assessing the importance of the exposure route (water/dermal or food) in the uptake of pharmaceuticals into aquatic invertebrates - Studying the trophic transfer of pharmaceuticals through a simple aquatic food chain Using the radiolabelled pharmaceuticals carvedilol, fluvastatin, 5-fluorouracil, molsidomine, diazepam and carbamazepine/bioconcentration factors (BCFs) for G. pulex was determined from 4.55-185900 and increased in the order molsidomine < 5-fluorouracil < carbamazepine < diazepam < carvedilol. In N. glauca BCFs ranged from 0.3-1.60 and increased in the order 5-fluorouracil < carbamazepine < diazepam < carvedilol. For P. corneus, the BCF for carvedilol was 57.3. The differences in uptake across the three organisms may be due to differences in organism size, mode of respiration and behaviour and the pH of the test media.

The relationships between VD and BCF were weak, correlations were found between Log Dillp and BCF for both G. pulex and N. glauca. When looking at the importance of exposure, the G. pulex data showed that the tissues concentrations in G. pulex were significantly different for each exposure route for carvedilol and fluvastatin. The results indicate that uptake from dissolved chemicals from the water may be more important for accumulation in G. pulex than uptake from the food alone. However, for N. glauca, the data show that the route of exposure of fluvastatin made a significant difference to the body burdens in N. glauca. N. glauca took up less from the water compared to that assimilated from the food. Preliminary results show that fluvastatin can be transferred through three trophic levels of an aquatic food chain.

ECOS-5  Environmental fate of pharmaceuticals: dentification of fish bile metabolites and photo- transformation products of anti-inflammatory drugs

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Non-steroid anti-inflammatory drugs (NSAIDs) are all consumed in large amounts in many countries and also belong to the pharmaceuticals most frequently detected in surface waters. Although they possess great similarities in physicochemical properties, studies show that ketoprofen are removed to a much lesser extent than ibuprofen during sewage treatment. This raises a number of important questions: Why do some drugs exhibit such behaviour so differently under the same conditions? Ibuprofen is efficiently removed from the sewage water, but which are the main removal mechanisms? Is it totally degraded to carbon dioxide and water or non-toxic products or does a significant adsorption to the sewage sludge - which is often used as a fertilizer in crop production - take place? How much of the total removal, in numbers, can be attributed to adsorption to sludge and where in the sewage treatment plant (STP) does the major adsorption in that case occur? The main purpose of this study is to investigate and quantify the removal due to sludge adsorption of the four aforementioned NSAIDs throughout the STP. This is performed by measurements of the NSAIDs in water as well as in sludge samples from the different steps of an STP. Analysis of such complex samples poses high demands on the analytical procedure. In this study a hollow fiber liquid-phase microextraction (HF-LPME) is employed. The technique has several advantages over more classic extraction techniques, such as high enrichment, excellent clean-up throughput in combination of sorbent and simplicity in equipment and practical performance. It has also been previously successfully employed on digested sewage sludge slurry samples. Final analysis of extracts is performed by liquid chromatography-tandem quadrupole time of flight mass spectrometry (LC-MS Q-TOF). The method yields high enrichment factors (1700 - 2500 times) of extraction of the NSAIDs from influent water samples with appropriate sample dilution, giving overall MDL values of 0.04-0.11 µg/l for the different analytes and has also been successfully employed to biosludge samples. The study provides quantification of the sludge adsorption of four anti-inflammatory drugs throughout the sewage treatment process as well as a simple and environmentally friendly analytical method applicable for complex aqueous as well as semi-solid samples.

ECOS-6  Investigating the chlorination and by-products of pharmaceuticals by liquid-chromatogra-
phy-tandem mass spectrometry

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The fate of pharmaceuticals in the water cycle has received a strong attention during the last few years and particularly during wastewater treatment and drinking water preparation. However, most studies have been focused on the application of these compounds without accounting for possible transformation processes. Indeed, this may result in an underestimation of possible envi-
ronmental and health hazards, as transformations may in some cases even lead to the production of more toxic compounds. An example is the chlorination of the widely used analgesic acetamin-
ophen, which produces genotoxic quinones. Thus, it is crucial to investigate the degradation routes of pharmaceuticals during chemical discharges that are often applied for drinking water preparation. To identify the formed by-products, liquid chromatography-tandem mass spectrom-
etry (LC-MS/MS) is particularly useful. In this work, fifteen pharmaceuticals and metabolites have been detected with chlorinated, the most common water disinfection chemical. After 24 h of reaction, it was quenched with ascorbic acid and the remaining pharmaceutical concentrations measured by LC-MS/MS. Under these rela-
tively strong-oxidation conditions, six of them (ibuprofen, ketoprofen, clotrofenic acid, fenoprofen, carprofen and diclofenac) were found to be not stable. Subsequently, they were identified at the residuals of the six compounds that reacted with chlorine (phenazone, propylphenazona, atenolol, salbutamol, propanolol, diclofenac, naproxen, sodium chloride and indomethacin) was investigated in<div>different chlorine dose, pH and bromide concentrations by means of experimental design methodology. Also, several transformation products were tentatively identified by positive and negative electrospray LC-MS, in the scan mode, and LC-MS/MS, produced in operation ion scan, with a hybrid quadrupole-time of flight instrument (QTOF). Finally, the by-products were investigated in real samples (surface and waste water) by SPE-LC-MS/MS.

EC06A-1

MACRO in FOCUS versus PEARL - do both models adequately describe groundwater exposure to pesticides under Swedish conditions?

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Groundwater exposure is one of the critical endpoints in the risk assessment of plant production products, regulated in the European Union by the Directive 91/414/EEC. In Sweden, simula-
tions with the most up-to-date pesticide leaching models applied in the EU, the implemented scenario Hamburg is accepted unless the predicted environmental concentra-
tions in groundwater (PECgw) exceed 0.01 μg/L, i.e. a threshold by a factor of ten below the regulatory limit. For higher PECgw, simulations with the model MACRO and three national Swedish scenarios are requested, which are more representative for the Swedish hydro-geological characteristics with macroporous soils and the cold climatic conditions. Aim of this study is to investigate deviations between the model predictions in dependence of the physical-chemical properties of the pesticides. With the approach of the simulation results from the safety factor of ten for ac-
cceptance of PEARL Hamburg simulations. Comparing simulations with both models have been performed for the treatment of cereals and pome fruits for 25 non-volatile hypothetical chemicals with varying combinations of half-lives (DT50) and organic-carbon partition coefficients (Koc) covering the relevant range of physical-chemical characteristics of pesticides. For the simulations with PEARL, which also considers volatilization as a dissipation pathway, additional 25 volatile chemicals with the same DT50- and Koc combinations were defined. In general, model simulations with MACRO yielded lower PECgw than simulations with MACRO and the Swedish scenarios. In particular volatile compounds showed up by three to five order of magnitude lower concentrations. High macro pore flow in the scenario Näsbygård resulted in a strong fluctuation of the magnitude of PECgw in dependence of the weather conditions and thus application time. For the protection of human health, conservative values should be considered as far as possible in the performed risk assessment by pesticides. Considering this approach, the simulation results suggest that for Swedish conditions, the model MACRO and the Swedish scenarios should be preferred for chemicals with a Koc above 100 L/kg. Moreover, for low DT50 (< 50 days) - low Koc chemicals (< 500 L/kg), model simulations for the scenario Näsbygård should be performed in order to avoid an underestimation of the leaching poten-
tial as a result of its sensitivity to weather conditions.

EC06A-2

Modelling approach to estimate emission of Plant Protection Products from protected crop systems to surface water in Mediterranean countries

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A sector with relatively unknown impact on the environment is the horticultural sector. Green-
houses are generally heated by fossil fuels and power plants to support the plant cultivation. Plant protec-
tion products (PPPs) are emitted to atmosphere, is well accounted for in air dispersion (AD) models, which
are well developed and widely used in the field. However, PPPs may reach agricultural systems via spray,
volatilization, and leaching. In this work, a new approach is presented for the assessment of the emission of
PPPs into the environment, contrary to field conditions. A comparison with the open field was made in order to investigate how the climatic conditions, which are more controlled under greenhouse conditions, influence the PPP emissions to surface water. A simple Eulerian, advective-diffusive model was used in order to investigate the PPP emis-
sions from surface water. In the water drainages, contrary to what is stated in the European Regulation (EC) No 1107/2009.

The irrigation amounts given during the crop cycle and the temperature conditions within the covered area will affect the PPP emissions from surface water. In order to evaluate the PPPs to be monitored in low or medium greenhouse systems the time and/or decreasing the temperature result in increased concentrations of CC and CC-M in drainage water whereas the opposite occurs when the temperature is increased. Flushing the soil at the end of the crop cycle and irrigating with minimum water excess during the crop cycles, as an alternative to over-irrigation for the entire cultivation period, resulted in lower CC and CC-M concentrations, with an agreement which is generally within a factor of about 2-3, was observed

In the present work, a coupled meteorological-preprocessor-MFB model developed by our research group is run to test its ability to capture the short-term variations ob-
served in the air concentrations of PCB in air concentrations in Zurich during a three-day period; a good mod-
el performance, with an agreement which is generally within a factor of about 2-3, was observed

The fully-integrated version of the model, which also incorporates an AD model based on the Gaussian equation, was then run for two PAPs, in order to assess the impact of an increment of 50% in the source to the contaminated area. Resulted the large influence exerted by PBL meteorology in determining the frequency and amplitude of the short-term variations in air concentrations and showed the magnitude of the potential increase in concentrations due to the point source. Further simulations showed the increased contamination of the soil environ-
ment due to the combination of high PPF, precipitation and point source contribution and the extent of the consequent degrading episodes due to favourable atmospheric conditions (such as increased PBL heights and wind speed), which have the effect of “recharging” the lower air compartment.

EC06A-5

Modelling the cycling of persistent organic pollutants in shell seas with a combined hydro-
dynamic and fate and transport model: the North Sea as an example

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The environmental fate of selected persistent organic pollutants (POPs) in the North Sea is mod-
dled with a combined hydrodynamic and Fate and T ransport Ocean Model (FANTOM)  Large

and the extent of the consequent degassing episodes due to favourable atmospheric conditions

are subject to a wide range of processes including mechanical, chemical, physical, and biological

fate processes of POPs in the oceans are not yet completely understood, though oceans are generally considered to act as ultimate sinks for POPs. Budgets of POPs are calculated to deter-
mine whether the North Sea can act as sink or source of POPs. In this study, the POPs PCB 135
(almost insoluble in water) and lindane (gamma-HCH) (very soluble in water) are modelled for the period 1995 - 2005. A 3-D hydrodynamic model is a necessary prerequisite tool for mod-
ing the fate of POPs in the ocean. For this purpose, we have developed a very high resolution version of the Hamburg Shell Ocean Model (HOSMOD) for the North Sea. The impact of climate variability on POP levels in the North Sea is investigated by performing future scenario model runs in 2010 year time slices to the year 2100 using plausible POP input levels. Hydrody-
namic variables are calculated in the HAMSO which is forced at the surface and open bound-
aries. POP processes are calculated with the FANTOM model. Evolution of the total concentra-
tion of a pollutant at a fixed point is calculated with a simple Eulerian, advective-diffusive model

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with sources and sinks. Atmospheric concentrations of POPs are provided by output from the atmospheric model of the MSc-E, EMEP. The net flux of a pollutant to the sea surface from the atmosphere is calculated as the net value of gaseous sea-air flux, dry dust particle deposition flux and wet deposition flux. POP concentrations in river estuaries have been calculated from available datasets. Results show that gamma-HCH concentrations are highest in summer but PCB 153 concentrations appear to be greatest during the winter months. Concentrations of PCB 153 and gamma-HCH decrease in the North Sea over the period 1995-2005. Preliminary results show that sediment concentrations also decrease during this period, suggesting that perhaps the North Sea cannot act as a reservoir of POPs for the oceans.

**EC06A-6**

Development and validation of environmental fate model for herbicides of paddy fields using grid-catchment integrated multimedia modeling system (G-CiEMS) for all Japan area

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We developed high accuracy model which could calculate daily concentration variation for many herbicides in all Japan area and grid-catchment. The model results are validated by comparing daily estimated amount of herbicides for each river segment and air mesh, which data suitable for G-CiEMS model. In order to validate this model, we investigate herbicide concentrations in seven rivers in Japan. In total 182 pairs (>7 river sites x 26 herbicides) were detected in 171 pairs that unable to validate the model. To evaluate the reliability of this model, peak concentration and peak day were compared between predicted variations and observed variations for 171 pairs of sites and herbicides. Peak concentration differences between predictions and observations were less than one order of magnitude in 113 pairs which reached 66% of total 171 pairs. Peak day differences between predictions and observations were less than two weeks in 136 pairs which reached 80% of total 171 pairs.

**EC06B-1**

Guidelines for good modeling practice in environmental assessment of chemicals

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Multimedia models are increasingly used as scientific tools and in a decision-making context. One of the obstacles to more rapid and widespread adoption of models in risk and hazard assessment for chemicals is the lack of clear guidelines for using them. Without such guidelines modeling model users may remain unaware of limitations, uncertainties, omissions and subjective choices in models. The risk is then that models are used for purposes different from those intended, making unattainable conclusions possible. In order to stimulate and improve use and care of models, the SETAC Exposure Modeling Advisory Group has taken the initiative to provide a set of clear guidelines for modeling practice (GMP guidelines). The guidelines aim to serve as a reference for applying existing models for the environmental assessment of chemicals in a decision-making context. The selection of an appropriate modeling tool is an essential requirement in the modeling process. Models and model datasets should be examined for appropriate scope and domains of application, and their constraints and major assumptions. The proposed GMP guidelines emphasize the need to clearly document the identity and version number of the model that is used, as well as the values and sources of all input data. Any changes made to the default parameterization or model equations should be documented in the report. The assessment of the model results is crucial. Each result must be clearly associated with a corresponding set of input data. Model results should be clearly separated from interpretation and discussion. One of the goals of the GMP guidelines is to ensure that an interested third party can reproduce the results. This will increase the transparency of decision-making processes that rely on model results. Recommendations for sensitivity and uncertainty analysis are also provided. A hazard assessment of decamethyltetrasilatetrahedran has been covered out as a case study to illustrate application of the good modeling practice guidelines.

**EC06B-2**

Transfer of PCB from sediment to biota: development of a bioaccumulation model in a risk assessment perspective


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Many chemical, physiological and trophic factors are known to be important in PCB bioaccumulation processes and trophic transfers in biota. Understanding the primary factors influencing PCB bioaccumulation is critical for predicting the risks to upper-trophic levels consumers including humans. We propose here (1) to identify PCB contamination pathways, that could explain between and within species variability in fish concentrations; and (2) to describe PCB transfer along fish food chains. Three freshwater river fishes (Barbel, Bream and Chub) were sampled in and around the Rhone river (France), where fish consumption is partially prohibited for exceeding the current regulatory threshold. By combining stable isotope mixing models and stepwise regression, we showed that fish body size, PCB concentration in sediment and foraging habitat (exploitation of detrital carbon sources) explained around 80% of the within- and between species variability observed in PCB concentrations. Spatial gradients of contamination are more important than the type of food consumed and its trophic status. A bioaccumulation food-web model, based on physiological processes, was then developed in order to describe PCB transfer along the food chain of these fish species. Variation of environmental conditions (water temperature), individual physiological traits (growth rate) and physico-chemical properties of PCBs (Kow) are considered. We used Bayesian Inference to calibrate the involved functions, and we thus were able to pass on data variability and parameter uncertainty to model predictions and to provide a credibility interval around them. The predictions of our bioaccumulation model describes seasonal variations in fish PCB concentrations (due to environmental conditions) and appeared particularly efficient in a risk assessment perspective. By linking sediment to fishes contamination, our model could help in determining sediment management guidelines in the future.

**EC06B-3**

Prioritising chemicals used in PCs in China for environmental risk assessment: application of the RAIDAR model

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Chemicals used in personal care products (PCPs) represent a significant fraction of chemicals in the total inventory in China. We have identified concern regarding the use of a number of substances classified under this category, including the nitro- and polycyclic musks, UV blockers such as benzylidene camphor, and preservatives such as the parabens. Unlike pharmaceuticals, PCs enter wastewater and the aquatic environment after regular use during shaming or bathing. The need arises to prioritise and assess the risk to human health and the environment. Mathematical models are increasingly used as scientific tools and in a decision-making context. A prioritisation framework which includes cross-sectional trends in human body burden with age? The role of atmospheric emissions.

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Body burdens from the cross-sectional biomonitoring of persistent bioaccumulative contamin-ants in human populations are used to provide information about the occurrence of the con- Mendition (water temperature), individual physiological traits (growth rate) and physico-chemical properties (water temperature), individual physiological traits (growth rate) and physico-chemical properties of PCBs (Kow) are considered. We used Bayesian Inference to calibrate the involved functions, and we thus were able to pass on data variability and parameter uncertainty to model predictions and to provide a credibility interval around them. The predictions of our bioaccumulation model describes seasonal variations in fish PCB concentrations (due to environmental conditions) and appeared particularly efficient in a risk assessment perspective. By linking sediment to fishes contamination, our model could help in determining sediment management guidelines in the future.

**EC06B-4**

Cross-sectional trends in human body burden with age? The role of atmospheric emissions.

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Body burdens from the cross-sectional biomonitoring of persistent bioaccumulative contamin-ants in human populations are used to provide information about the occurrence of the con-}
The influence of global climate change on the transport of organic contaminants to the Arctic and the long-term implications for human exposure is a complex issue. There are at least five broad categories of change to consider: (i) chemical use and emissions (ii) extent of contaminant delivery to the Arctic environment (iii) processing of contaminants in the physical environment (iv) processing of contaminants in the human food chain and (v) changes in exposure due to alteration in the lifestyle of Northern communities. Climate model-based projections describing changes to the physical environment are available and were used as guidance in scenario development. The main goal of the study was to identify potential alterations to the physical environment and other aspects identified above (e.g. dietary transition). Global-scale fate and transport simulations were undertaken using Arctic Contaminant Tracking Potential (ACTP), a model-derived output integrating likely range transport and accumulation in surface media (i.e., excludes mass in atmosphere), to estimate factors of change associated with different scenarios. Simulations coupling output from fate/transport models with human food web bioaccumulation models were also conducted to examine the influence of diet. Compensatory behavior was found to be a recurrent theme throughout this investigation when multiple adverse effects occurred for contaminants processed through the diet, as well as other exposure routes. The results in surface waters will also be discussed. GC-screening demonstrated the presence of complex and location specific mixture of pesticides, pharmaceuticals, industrial solvents and flame retardants.

EC07 - Integrated chemical and biological approaches for toxicant identification

EC07-1 Effects-directed analysis of contaminated sediments from the Sava River, Croatia

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Effect-directed analysis (EDA) has shown to be a valuable approach to investigate the nature of contaminants. The application of toxicity identification and evaluation (TIE) protocols for the toxicological characterization of compounds of concern (CoC) is highly relevant to developing sensitive, specific and very sensitive target analysis methods. A comprehensive search in ChemSpider was combined with structural classifiers such as MS/MS fragmentation and product ion mass spectra of intense peaks were submitted to molecular formula generation (EC07-2). The structure elucidation from molecular formulas that were assigned to almost all of the peaks of interest in the two LC-sub-fractions of the neutral and polycyclic aromatic hydrocarbons was indicated to be responsible for the observed effect. However, other endpoints, such as algal toxicity and estrogenic potential, indicated comparatively higher importance of polar contaminants. We investigated the presence and identity of glucocorticoid and estrogenic activities in the Dutch rivers Rhine and Meuse. We also investigated the presence and identity of glucocorticoid and estrogenic activities in the Dutch wastewater effluents. Several research groups have successfully applied EDA and identified unknown functional groups in biological matrices indicating possibly new unknown endocrine disrupting effects. However, many other hormone-like compounds are excreted naturally or are used as pharmaceuticals and thus might enter the environment via similar routes as estrogens. Indeed, using novel CALUX bioassays for progestagenic, androgenic estrogenic and glucocorticoid receptor activation, the presence of estrogens was predominantly associated with the non-polar fraction and polycyclic aromatic hydrocarbons were indicated to be responsible for the observed effect. However, other endpoints, such as algal toxicity and estrogenic potential, indicated comparatively higher importance of polar contaminants.

EC07-2 Integrated bioassay and chemical analysis of glucocorticoid and estrogenic activities in the rivers Rhine and Meuse

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The determination of glucocorticoid and estrogenic activities in the Dutch catchments of the main rivers Rhine and Meuse. GR and ER CALUX measurements were done throughout the year and at five different locations to investigate spatial and seasonal differences. Having experienced that natural and synthetic hormones often explain the majority of endocrine activities and that GC-LC-MS was found to not only reveal specific and very sensitive target analysis methods on LC-LTQ-FT-orbitrap MS and UPLC-tQ-TOF-MS, a large number of glucocorticoid and estrogenic activities were detected in water samples from the Rhine and Meuse. GC-screening was applied to obtain a more integrated picture of the contaminant composition of the river water. The results in surface waters will also be discussed. GC-screening demonstrated the presence of complex and location specific mixtures of e.g. pesticides, pharmaceuticals, industrial solvents and flame retardants.

EC07-3 Structure elucidation of mutagenic contaminants in blue ray extracts of river water

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Structure elucidation of mutagenic contaminants in water samples from the Elbe river downstream of discharges from industries. The blue ray extracts were separated into acidic, neutral and basic fractions using cation and anion exchange cartridges and fractionated further by LC using a polymeric C18 column and subsequently a phenyl-hexyl column. The solvents were applied on strain T9892 as was used to screen for mutagenic contaminants using a battery of bioassays including the Ames test, the Salmonella/Microsome test, the bacterial reverse mutation assay (Bacillus subtilis), and the bacteria microsome test (S. typhimurium TA100, strain TA98). A more detailed and dynamic treatment of the cryosphere would be a particularly useful undertaking in the overall context of this study.
ECO-67 Identification of thyroid hormone-like compounds in polar bear plasma by effect-directed analysis

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Endocrine disrupting compounds (EDCs) released into the environment may bioaccumulate and biomagnify in the food web. The significance of thyroid hormone-like (TH-like) compounds has been found in biological tissue (e.g. fat and blood) of top predators such as humans and polar bears (Ursus maritimus). This study aims to identify TH-like compounds in plasma of polar bear cubs-of-the-year by Effect-Directed Analysis (EDA) using a dedicated plasma sample treatment method. Ion exchange solid phase extraction (SPE) followed by liquid liquid extraction (LLE) was evaluated by known TH-like compounds (hydroxylated polychlorinated biphenyls, octabromodiphenylethers, other halogenated phenols, petrochemicals) as well as the least potent non-halogenated parent compounds of the PCBs and PBDEs spiked to cow plasma. Good methodically determined recoveries were obtained for OH-PCBs, OH-PBDEs, OH-PCB extracts from spiked plasma (>90%) and lower recoveries for FCCs (<90%) and for PCBs and PBDEs (<90%). In the radiolabeled Ta-TTR binding assay the extracted samples showed TTR-binding potencies which were in good agreement with the calculated theoretical spiking levels. Then the SPE-LLE method was successfully applied to polar bear plasma samples in collaboration with the Norwegian University of Science and Technology (NTNU) and the BearHealth project and the extracted samples were screened in the Ta-TTR binding assay. Measured TH-like activities were generally higher than the estimated activity based on the measured concentrations of target TH-like compounds. Three samples have been selected for further analysis, where the targeted rang compounds could only explain part of the measured TH-like activity, to identify the compounds causing the remaining activity. Effect-directed analysis will be carried out to explain the remaining TH-like activity.

ECO8 - Tracking community consumption of illicit drugs and other substances by measuring human metabolic residues in urban wastewater

ECO8A - Sewage epidemiology: potential of a novel approach

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Sewage epidemiology is a new approach to population studies, which uses wastewater analysis for assessing collective voluntary and involuntary exposure of the members of a community to a wide range of chemicals. The rationale of this approach is that traces of almost everything we eat, smoke and drink, absorb, are excreted with our urine or stool and end up in wastewater, where they can be measured. Illicit drugs were the first application: residues of the drugs consumed by a collective are excreted in wastewater and their levels, knowing kinetic, metabolism, and behaviour in wastewater, can be used to calculate the population fraction of the substances collectively consumed by the population. However, this approach has a much wider range of potential applications. This include for instance pharmaceuticals. We know the amount of a given drug which is prescribed or sold in a given location but we don’t know the amount really taken by patients. Wastewater analysis for the metabolites of the pharmaceuticals can help in elucidating the coincidence to the treatment, thus contributing to evaluate its efficacy. Other examples include pesticides, PCBs and food contaminants. Monitoring of the metabolic residues of these substances in wastewater is a new approach to estimate the real exposure of the population to these chemicals. Sewage epidemiology needs a multidisciplinary approach, with the interaction of experts of different fields, such as pharmacokinetic, medical, and analytical chemistry. Monitoring wastewater therefore requires useful epidemiological information from qualitative and quantitative profiling of biological indicators entering the sewage system, and to become a useful tool to be used in population studies.

ECO8A-2 The overlooked importance of sampling to advance wastewater analysis from a promising method to a useful and reliable tool for the estimation of illicit drug abuse

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Sewers were not designed to assess illicit drug consumption. However, immense advances in analytical chemistry have propelled wastewater analysis as a promising tool to tackle this difficult issue. Illicit drugs are known as legally and non-legally produced xenobiotics, non-essential and biphased A. Together, triclofen and chlorophene accounted for >50% of the total antiandro- genic activity in fish bile and these compounds are currently being tested for antiandrogenic activity in vivo in fish.

References:

ECO-84 The significance of chloride of illicit drugs for the estimation of drugs abuse using the sewage epidemiology approach

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Interpretation and determination of illicit drugs concentrations and loads for assessing collective voluntary and involuntary exposure of the members of a community to a wide range of chemicals.

References:


Estimation of illicit drugs consumption by wastewater analysis: a five years-long investigation in Italy

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Daily use was observed for methadone (13.7 g day⁻¹ on average), ephedrine (4.0 g day⁻¹ on average) and dimethyltryptamine (1.7 g day⁻¹ on average). The prevalence of illicit drug use in the population was estimated by comparing the measured drug consumption with a recent national drug survey. The key findings of the study were that the estimated drug consumption was lower than the national survey and that the discrepancy between the two estimates was attributed to differences in the sample size and the sampling period. The study also highlighted the need for more accurate methods to estimate illicit drug consumption by wastewater analysis.
thus reduce US and UC compared to UP and UB. Researchers also need to rely on operators at sewage treatment plants (STPs) to obtain best available estimates for UP. The aims of our study were to (a) reduce the sampling uncertainty through an optimized sampling method, (b) identify and evaluate the total uncertainty associated with our per capita drug consumption estimates, and (c) provide an estimate of illicit drug consumption over 12 days in a urban catchment from South America. We predicted our estimates having a remaining uncertainty ratio from 24-31% even with the best sampling practice and current chemical analysis. Apparently, the respective uncertainties, particularly U_d and U_b could be further reduced when there is a platform to normalise loads of DRs with those of other chemicals in wastewater. More effort is needed in the future study to refine the back estimation method so as to improve the confidence of the estimated data.

EHO1-1 Ecosystem services in natural, agricultural and urban areas

EHO1-1.1 Going beyond qualitative assessment of ecosystem services

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Understanding ecosystem services and their flows to human populations depends on a reliable assessment of ecological structure and function. The basis for this understanding should be an analysis of food webs and interactions among species because together they provide the mechanisms by which biological communities and associated ecosystems persist. It is necessary to develop both statistical and theoretical relationships between ecosystem structural metrics (e.g., species richness, biomass, population abundance, and habitat connectivity/fragmentation) and functional metrics (e.g., productivity, population persistence, resilience, and nitrification). Because there are few empirical data on basic relationships between ecological structure and function, the goal is to continue to play an increasing role in understanding ecosystem services in a general as well as site-specific sense. Examples of analytical tools for evaluating ecological structure and function relationships include models of: (1) single–species populations, (2) food webs (biological communities comprised of multiple species), (3) ecosystems (composites of interacting species and habitats) over which species may interact on spatial scales encompassing multiple ecosystems. Because empirical assessments of relationships among ecological variables are limited, we maintain that attempts to assess ecosystem services in the absence of modelling populations, food webs, and/or landscapes could fail. We have no shortage of metrics to assess ecological structure, function, and services. The pressing issue, when ecological modelling can help add, is which of these metrics are most useful and cost-effective.

EHO1-1.2 Mapping soil biodiversity and ecosystem services in the Netherlands


Soil policy in the Netherlands is in a transition phase - it is changing from a focus on the protection and restoration of deteriorated ecosystems and sealing, towards a focus on sustainable land use. A key aspect of the new focus is that soil quality should be assessed using chemical, biological and physical indicators in a systems approach. Furthermore, soil ecosystem services are increasingly part of the Soil Framework for the Netherlands in order to pull the denominator ‘soil quality’ in meaningful aspects for society. We used data from the Netherlands Soil Monitoring Network (NMSN), including the Biological Indicator for Soil Quality (BISQ), to produce habitat–response relationships as proxies for soil biodiversity. These proxies were used to map soil biodiversity. Parallel to that, ecosystem services were produced based on biological, chemical and physical parameters. These functions will also be used for mapping purposes and their usefulness discussed. Maps were produced showing (1) predicted soil biodiversity (for several proxies of soil biodiversity); (2) predicted performance of ecosystem services (for several ecosystem services) and (3) the difference between predicted and expected performance of ecosystem services when the land use is sustainable. The expected state of a soil with a sustainable management (good ecological status) was characterized to predict the expected performance of ecosystem services in a general as well as site-specific sense. For example, the EFSA framework is based on the ecosystem services approach to assess ecological risks in a holistic manner. EFSA has recently developed and published a framework developed for this study builds on the EFSA specific protection goals and demonstrates how an ecosystem services framework is applied by identifying and visualizing the primary environmental services that a habitat may provide given different land uses and actions in citrus growing regions.

EHO1-1.3 An ecosystem services framework: a case study on citrus production and insecticide use. To what extent are specific ecosystem services affected?

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The draft Soil Framework Directive contains an obligation to limit the permanent covering of soil with impermeable material as far as possible and, where soil sealing is unavoidable, to mitigate the negative effects of doing so. In order to be prepared for the possible implementation of the Soil Framework Directive, the Dutch Ministry of Environment requested a soil framework report to provide information about soil sealing in the Netherlands and the ecosystems affected by it. In order to comply with the request, both soil sealing and the ecosystems affected by it have been studied. As a follow-up the Ministry requested to indicate a minimum percentage of open soil in each type of development area, in order to put a limit to negative effects of sealing on soil functions. This project addresses the estimation of the minimum percentage of open soils in urban areas. The minimum percentage of open soils in urban areas was estimated by the space needed by soils to provide or support ecosystem services to the inhabitants. The area of open soil necessary for temperature regulation and water evaporation is thus reduced and used for urban functions.
and contribution to human health and well being is estimated at 5 to 10% of the urban area. Water regulation via soil needs much more space. The more, the better’ can be concluded for biodiversity in urban areas, provided there is horizontal and vertical diversity in vegetation and good interconnectivity between areas with open soils. Surface water also contributes to certain urban ecosystem services. Based on all findings, it was concluded that 20 to 40% of the urban area should be reserved for forest and water to provide all necessary ecosystem services. These values should be used at the scale of neighbourhoods. Not only the total area of open soil and water matters, the locations and good connections between these are crucial too.

EH01B-1 Ecosystem services for life cycle assessments

N Finster

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Integrating ecosystem considerations into life cycle assessments (LCA) will improve the effectiveness of these assessments by expanding the range of environmental aspects included in assessments and providing more emphasis on the dependence companies have on ecosystem services. Businesses and communities both depend and impact ecosystem services, or the benefits derived from ecosystems. For example, forests supply timber and wood fibre, regulate climate by absorbing carbon dioxide, and yield genetic resources for medicines. Coastal reefs attract tourists, serve as nurseries for commercial fish species, and protect properties along coastlines from storm surges. Wetlands act as reservoirs for fresh water, and provide benefits such as fisheries and healthy soils. Businesses do not consider the full range of ecosystem services related risks and opportunities, possibly leaving firms vulnerable to risks or unaware of opportunities related to their dependence and impact on ecosystem services.

Numerous strategies are emerging to provide life cycle assessment professionals the means to expand LCA efforts. These strategies will be reviewed for the value in different contexts and implementations to advancement will be discussed.

EH01B-2 Indicator based environmental quality and quality of life in urban areas

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AbstractA comprehensive strategy is needed to protect the ecology and characterise reference conditions in urban highly modified areas and new towns. The importance of the quality components defined by the “good ecological status”, “good chemical status” and “quality of life” is demonstrated by the example of the “urban ecosystem services” provided by the natural environment, and their role in support to human living and human societies. It is therefore necessary to include in the evaluation of planning procedure (e.g., within Strategic Environmental Assessment, SEA) some decision support tools that take into account also the private consumption component and its relative effects. The present work is an attempt to perform SEA integrating the more traditional evaluation made through a set of indicators (which results are compared with local limits) with other sustainability assessment methodologies. The idea is to include in the evaluation some issues of global concern, such as resource depletion and climate change and to reinforce the use of the carrying capacity concept within the conventional planning. The evaluation includes Ecological Footprint (EF) assessment of citizen’s consumption and a carbon balance (CB) of the area. The case study presented refers to the implementation of this approach in the Strategic Environmental Assessment of a spatial planning plan of four municipalities in Northern Italy. It is proposed that in order to support the definition of spatial planning programs with suitable tools, such as sustainability composite indicators, that are able to consider a wider range of aspects, with reference to the carrying capacity concept. The proposed methodology proved to be quite useful, even if some are limits, such as the fact the EF method does not allow for assessing multifunctionality of ecosystems (e.g. carbon storage and wood provision from forests).

EH01B-3 Sustainability indicators as decision-support tools for spatial planning

S Castellani1, S Sala2

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2European Commission - Joint Research Centre, ISpra, Italy

To ensure sustainability of living, especially in urban areas, spatial planning should be based on reliable evaluation of benefits and cost of each alternative, taking into account also the ecosystem services provided by the natural environment, and their role in support to human living and human societies. It is therefore necessary to include in the evaluation of planning procedure (e.g., within Strategic Environmental Assessment, SEA) some decision support tools that take into account also the private consumption component and its relative effects. The present work is an attempt to perform SEA integrating the more traditional evaluation made through a set of indicators (which results are compared with local limits) with other sustainability assessment methodologies. The idea is to include in the evaluation some issues of global concern, such as resource depletion and climate change and to reinforce the use of the carrying capacity concept within the conventional planning. The evaluation includes Ecological Footprint (EF) assessment of citizen’s consumption and a carbon balance (CB) of the area. The case study presented refers to the implementation of this approach in the Strategic Environmental Assessment of a spatial planning plan of four municipalities in Northern Italy. It is proposed that in order to support the definition of spatial planning programs with suitable tools, such as sustainability composite indicators, that are able to consider a wider range of aspects, with reference to the carrying capacity concept. The proposed methodology proved to be quite useful, even if some are limits, such as the fact the EF method does not allow for assessing multifunctionality of ecosystems (e.g. carbon storage and wood provision from forests).

EH01B-4 Sustainability assessment of forest biomass supply chain at local scale: carrying capacity of the system for energy valorisation

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Evaluation of the trade-off between the benefits coming from forest resources’ use and the conservation of forest ecosystems is needed. Considering the use of biomass for energy purpose, on one hand the use of wood resources should be based on an evaluation of the “carrying capacity” of the forest ecosystem constrained in this study by “on site effects monitoring” to promote an environmentally sensitive and sustainable use of the resources in urban areas. The study contributes to the resource management, evaluation, of the interaction of ecosystems and urbanisation as well as quantification of risk. The idea behind “Contribution of Sustainability” was to summarise and assess the measures and aims for a sustainable development, while the idea behind “Field of Sustainability” was to assign these aspects to one (or multiple) of the five pillars of sustainability (Economy, Ecology, Economy, Social, Cultural, Governance).

EH01B-5 The European honeybee (Apis mellifera mellifera) as a good representative for other pollinator species?

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5Federal University of Sao Carlos, ARARAS, Brazil

The European honeybee is not necessarily the most efficient pollinator for some high value crops (e.g., coffee) and it is not clear if a European honeybee based risk assessment is protective for other pollinators. In a first attempt to test if A. mellifera mellifera is a good representative for other pollinators a first-tier contact LD50 test using the organophosphate dimethoate was performed with several pollinator species originating from The Netherlands, Brazil, and Kenya, respectively. Thus acquired LD50 data was used to construct an Species Sensitivity Distribution curve ranking the different species by their response to direct contact with the toxicant. Results from identical test set-ups with Bombus terrestris, A. mellifera mellifera, A. sp. (aff. mellifera), Apis mellifera scutellata, Xylocopa violacea and Meliponula ferruginea indicate that for at least organophosphates the use of European honeybee data is protective for other pollinators.

EH01B-6 Sediment Ecological Risk Assessment (ScoRA)

SE Apitz

SE Apitz

SEA Environmental Decisions Ltd, LITTLE HADHAM, United Kingdom

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EH02-1 Monitoring and modeling stressed ecosystems to support ecosystem-based management

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Despite growing concern towards endocrine disrupting chemicals (EDCs), impact on wild species is poorly understood on ecosystems services and their functions. Single-species tests are preferred over experiments in enclosed ecosystems for the experimental ease of work and the higher reproducibility. Ecosystem modelling is not used as a general tool because of the need for extensive calibration to achieve a specific ecosystem. However, the goal of environmental risk assessment is to reach a simple decision that maximises the overall benefit from human activity, which is an accurate prediction of the environmental impact on ecosystems services. This ecosystem modelling is the logical next step in predicting impact of chemicals on aquatic and terrestrial ecosystems. This study aims to develop a simplified ecosystem model that can be used as a tool to predict how EDCs impacts on ecosystem services from fresh to coastal environments. This model is development is more focused on predicting ecological effects of EDCs rather than their impact on population dynamics. A different oriented framework for ecosystem modelling was developed in the software package WEST with the understanding of the interacting positive and negative roles of sediment in the maintenance of ecosystems and the socioeconomic functioning of rivers, considering various dynamic aspects of the interactions between sediment status and various endpoints in a spatially explicit manner.

EH02-2 Monitoring and modeling stressed ecosystems to support ecosystem-based management

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EH02-3
Response of red fox populations to rodenticide controls with bromadiolone: a 6 year study on regional scale
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The benthic community was analyzed to evaluate pollution-induced changes for the polychlorinated biphenyl (PCB)-contaminated site at Hunters Point (HP, California) and 30 reference sites in the San Francisco Bay. An analysis based on functional traits of feeding, reproduction, and position in the sediment shows that HP is deprived of deposit feeders, subsurface carnivores, egg-layers, predators with no/weak protective barrier. Sediment chemistry analysis shows that PCBs are the major risk drivers at HP (1570 ppb) and that the reference sites contain much lower levels of PCB contamination (9 ppb). Different feeding traits present a direct pathway of exposure, which can be mechanistically linked to PCB bioaccumulation by biodynamic modeling. The deposit feeder Neeanthes arenaceodentata accumulates about 20-times more PCBs than the filter feeder Mytilus edulis accumulates through the aqueous phase. In situ sorbent amendments were performed: Caisson mix containing about 60% organic matter and containing a clay fraction with a CEC of 25 cmol/kg was spread over the sediment in the reference site. After 24 months, the Caisson mix bioturbation capacity was not achieved. Furthermore, taxonomic inventories do not highlight any significant differences about diatom import rates of pre-established species. By comparing results from field and laboratory experiments, it appears that decontamination of a large-scale PCB-contaminated site is feasible by using Ampelisca ambigua as a biological engineering species. Complementary experiments would be necessary to assess the real importance of diatom import and the effects of their introduction on the diatom community structure.

EH02-5
Establishing environmental risk based management for industrial operations in (sub-) Arctic marine areas. Linking early warning signs to whole organism effects from individual to population levels.
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3Univ. Oslo (CEES), OSLO, Norway
4Total E&P Norge AS, STAVANGER, Norway
5Eni Norge AS, SANDNES, Norway
6Eni & P&G division, MILANO, Italy
7Neste Oil, SANDNES, Norway

EH02-6
Organic pollutants, bacteria, primary producers and global change. Are we tracking the problem adequately?
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2BIA-CSI-ESPOR, MILANO, Italy
3IRA-CRITIC, BARCELONA, Spain
4CIA-CSI, BARCELONA, Spain
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The model consists of (i) a food web model (ii) toxic effect sub-models and (iii) a model for nutrient and detritus cycling. Field data are used to help in developing and validating the model. A multi-year whole-ecosystem study is performed at an experimental lake with exposure of well-defined fish and invertebrate trophic levels to environmentally-relevant concentrations of the synthetic hormone 17alpha-ethinyl estradiol (EE2). The experimental lake is located in an undisturbed watershed and contains naturally reproducing populations of fish, benthic invertebrates, zooplankton and algae. The study started in 1999 with baseline data collected until 2000 on aquatic populations in the experimental lake and reference lakes. Between 2001 and 2003, EE2 was added continuously in the experimental lake. Since 2004, EE2 addition was stopped to measure ecosystem stability and recovery after stressor removal. In contrast with the reference lake, the Fathead minnow population in the experimental lake collapsed after the second year of EE2 addition. This reproductive failure was maintained after the EE2 addition was stopped, although few small individuals indicate some reproduction was occurring.
Halogenated flame retardants like polybrominated diphenyl ethers (PBDEs) are used in high volumes and in many consumer products. Due to their persistence, bioaccumulative properties and toxicity the US has started to phase-out the production of the Pentabromodiphenyl ether (Penta-BDE) and Octa-BDE commercial mixtures voluntarily in 2004. In 2009 also the production and application of Deca-BDE commercial product has been limited. The phase-out of both products has led to an increase in use of alternative brominated flame retardants. Organophosphorous flame retardants (OPFRs) are one of the flame retardant groups that show an increasing production over recent years. OPFRs are also used as plasticizers and anti-foaming agents in many products such as furniture, textiles, cables, building materials, insulation materials, paints, foams, hydraulic fluids and electronic appliances. In most applications OPFRs are used as additive chemical and thus not covalently bound to the polymer matrices. The objectives of the present study were to develop an analytical method to analyze OPFRs in various matrices, and to study the OPFRs in a pelagic and benthic food web from the Western Scheldt, The Netherlands. An analytical method was developed for the analysis of OPFRs in sediments and bioaccumulation using LC-MS/MS. Samples of a pelagic and benthic food web from the Western Scheldt were analyzed for OPFRs. The first results show that OPFRs were found in Western Scheldt suspended particulate matter (SPM) and bioaccumulation. In SPM TPP, TCPP and HEDP were detected and TPP and HEDP were only detected in the benthic organism’s cockle and sole. Low concentrations of TCPP were also found in sole. However, higher in the pelagic food web, in herring and common tern egg concentrations of these OPFRs were below the LOD. The OPFR concentrations in sole are in the same range as BDE47, BDE99, BDE100 and CB-153. It needs to be clarified whether the DAP and TCPP may accumulate in the benthic food web but not in the pelagic food web.

In this study five MAP and two DAP were detected for the first time in human urine. Monobutyl and monopropyl (TAP) are one of the group of flame retardants that is used increasingly, also as substitute for brominated flame retardants. Besides that TAP are used as pesticides, plasticizers and as additive in many products. Owing to their widespread use TAP are also widely distributed in the environment [1]. TAP are widely used in consumer products humans are exposed to TAP and TAP have been found in biomonitoring studies, in human breast milk as well as in urine. Depending on their alcohol moiety TAP are more or less stable and hydrolysis may occur. These hydrolysis products, dialkyl phosphates (DAP) and monomethyl phosphates (MAP), are far less toxicologically investigated [2]. We have recently developed a method for the detection of TAP (DAP and MAP) in human urine. This method is based on liquid chromatography-mass spectrometry (LC-MS/MS) using ion-pair chromatography [2]. Several analyses first had to be synthesized to allow their quantitation. The method was exemplarily applied to 19 samples of different individuals [3]. In this study five MAP and two DAP were detected for the first time in human urine. Monobutyl, diethyl, diphenyl and diethylphosphate were determined with median concentrations in the µg/L-range. These first results generated with the new LC-MS/MS method suggest that the brominated flame retardants may be much more stable than originally thought, possibly due to processes in the environment. The inclusion of TAP metabolites in future biomonitoring studies should provide a more comprehensive picture of the exposure of humans to organophosphorous compounds.

In order to be clarified whether the DAP and MAP determined in human urine had been formed from TAP in the human body after uptake or were transformed before uptake and incorporated as DAP and MAP, already. For that purpose also the environmental fate of TAP needs further investigation. This will also help to assess which route of exposure is most relevant for humans.

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literature is unclear, and could reflect changing production levels or simply changing concern for BFRs: Drammen, Lillehammer and Tromsø. Additionally, we used various approaches to estimate their partitioning properties and environmental behavior.

**EP02 - Antimicrobial resistance in the environment**

**EP02-1** Exploring the metagenomes of environmental antibiotic hotspots to identify resistance factors that we may face in the clinic tomorrow

**EP02-2** Sources, pathways and mitigation of antibiotic resistance genes at the watershed scale

**EP02-3** Antibiotic resistance downstream of abandoned mine sites: where organisms and genes tell a health problem story tomorrow.

**EP02-4** Effects of veterinary medicines introduced via manure into soil on transferable antibiotic resistance in soil bacterial communities

**EP02-5** Does fertilization with sewage sludge promote antibiotic resistance in bacteria isolated from food crops?

**EP02-6** Assessing the environmental hazard of antibiotic resistance. Considerations from a regulatory view.

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**EP02-6**

_Assessing the environmental hazard of antibiotic resistance. Considerations from a regulatory view._
an appropriate method in order to set a threshold concentration above which the development of resistance is likely to occur in the environment and further steps should be taken.

EP04 - Emission of chemicals from consumer goods - from emis- sions to effects

EP04-1 Conceptualizing emissions of chemicals from products - foundations of a modelling ap- proach
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2IVL Swedish Environmental Research Institute, GOTHENBURG, Sweden
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The research reported here is approaching the task of conceptually linking chemicals in products to their occurrence in environmental samples building on earlier work applying the concepts of substance and material flow analysis and bridging that modelling with chemical diffusion concepts. Bridging of these concepts is possible using a combined nomenclature (CN) and concepts such as total stock, total product area and mean composition of materials in the surface of products. The process of conceptual modelling used builds on principles used in design of information sys- tems and engineering. A conceptual model of information i.e. the nomenclature, terminologies and categorisations of concepts and terms, has been identified through workshops with researchers, a references group and a literature study.

The aim of the model is to cover the processes that lead to emissions from environmental relevant processes of products along the entire “life-cycle”. The core concepts of the technical system are “product” and “use”. The “product” concept hence includes any physical product not limited to a specific category. Each product consists of one or several components, which in turn are made of one or several raw materials, which consists of one or several chemicals. Different types of properties and descriptions are related to each of the levels of physical representation from product category (CN-categories) to chemical level.

The “use”concept is describing an episode during the “life-time” of a product. The amount of chemical substances emitted from a product depends on the type of use, length of use, which is used in this particular way and the ambient conditions in the direct vicinity where use takes place. The use concept is thus very wide and encompasses the different stages of a product life- cycle which require a thorough definition of “use” types and ambient conditions.

A future specific model has been done, considering the concepts and their further relations and connections to data and data sources useful for calculations will be presented.

EP04-2 Human exposure to PBDEs in Europe and North America
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ETH Zurich, ZURICH, Switzerland

Polybrominated diphenylethers (PBDEs) are flame retardants used to reduce the ignition and spread of fire in a broad range of consumer products such as computer screens, mattresses, or upholstery in transport vehicles. Lower-brominated PBDEs (penta and octa mixtures) have been banned in Europe and voluntarily phased out in North America. Deca-BDE is still in use in most states of the US, but will phase out by the end of 2013. In Europe deca-BDE is no longer used in electronics and electrical applications.

The aim of this study is to show with a consistent methodology whether the different legal set- tings, the different use patterns of PBDEs, as well as the differences in behaviour (e.g. eating habits) lead to different dose levels of PBDEs taken in by humans. The exposure was modelled probabilistically for five regions (North America, UK, Northern, Central and Southern Europe), seven consumer age groups, eight most important PBDE congeners and eight pathways (e.g. intake via food, dust, soil, and organic films).

The following results were derived:
1. Americans experience higher doses of PBDEs than Europeans.
2. Consumption of food and inadvertent ingestion of dust as well as dermal contact to dust contribute most to the exposure to PBDEs. In most cases food represents the dominant pathway for median dose estimates, whereas in higher dose percentiles the contribution of dust becomes more important. Adults experience higher doses, followed by toddlers and children; and then teenagers and adults with about 5 times the dose of adults. This hockey-stick like dose pattern is also visible in biomonitoring data, confirming our model results.
3. Most likely, the reason for Americans to experience higher doses of PBDEs is that more consumer products are treated with flame retardants in North America compared to Europe. Oral uptake of food and dust and dermal uptake of dust are the most important pathways due to the persistent and bioaccumulative nature of PBDEs and their application in products that are used mainly in- doors. Younger consumers take up higher doses mainly due to their higher ingestion of food and dust, as well as higher dermal uptake.

Using a consistent methodology we show that Americans take up higher doses than Europeans. We also show that food and dust are important sources of exposure and infants take up the high- est-derived results were:

EP04-3 Ecological assessment of UV filter substances
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Chemical UV-filter substances are used in sun protection products and personal care products in order to protect external materials, which come in close contact with UV radiation. Therefore, the production volume of UV- filters has increased continuously in the last decade. Prior studies have shown that UV-filters may be introduced to surface water directly via release from skin during swimming and indirectly via wastewater treatment plants from household use as well as further washing off during rainfall. Due to their physiochemical properties, UV-filters are regarded to be persistent in the environ- ment. The occurrence of UV filters in soil and sediment has attracted much less attention than to water bodies, and the existing studies are limited to a few filters. For this reason an analytical assessment of widely used UV filters in sediments via GC-MS was made. We found, that currently used substances tend to accumulate in sediments and are present in high concentra- tions during summer.

Considering this environmental exposure, there is only a limited knowledge on ecotoxicological and ecological effects of UV filters in aquatic ecosystems. Therefore, we conducted experiments with vertebrates (fish, rats, mice) and in-vitro tests with isolated receptors and human cell lines elucidated the endocrine disrupting and toxic potency of these substances. Consequently, exposure to UV-

filters may result in serious health problems for aquatic wildlife.

The study aims to evaluate the presence of the selected substances in the environment and the effects of most common UV-filters (Ethylhexyl-methoxycinnamate, Octocrylene and Butyl-meth- thyldibenzoylmethane) on aquatic organisms, focussing particularly on infaunal and epibenthic invertebrates (Chironomus riparius; Lasmigona ceylonica and Potamopyrgus antipodarum).

Due to their life habits, these organisms are especially affected by lipophilic substances.

Results of the analytic and effect studies will be presented and discussed.

EP04-4 From sources to urban fate: a contrast of PCBs, PBDES, PAHs and synthetic muskks
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3Ontario Ministry of Environment, BURLINGTON, Canada
4Diamond and Haddad (2009) proposed a conceptual model for human exposure to chemicals contained within a stock or inventory of materials and products. The inventory is held mainly indoors which is the first environment where the chemicals migrate from indoor sources, and the extent to which they disperse to indoor air is the second environment. Since then, PCBs and PBDEs have been identified as persistent and toxic chemicals that migrate outdoors into the urban environment. Persistent chemicals will be exported from the urban area enabling transfer through terrestrial and aquatic food webs from which the chemical may return to the urban area in foods that we eat.

To evaluate the model we quantified and contrasted the emissions, movement and inventory of four compounds in Canada’s largest urban area, Toronto (2.5 million people). Through material flow analysis, multimedia measurements and mass balance modelling, we examined PCBs (e.g., in indoor and exterior building slabs), PBDES (in the pre-2008 electrical and electronic prod- ucts, textiles, etc.), polycyclic musks or PCMs (synthetic fragrances in “down the drain”consumer products), and PAH (combustions by-products and pavement coatings).

Indoor air concentrations of PCBs, PBDES and PCMs all exceeded those outdoors and the majority of outdoor air concentration of PCBs and PBDEs were impacted by long-range transport.

Results of the airborne PCBs clearly indicate that PCBs are not specific pollutants of the urban environment. The occurrence of UV filters in soil and sediment has attracted much less attention than to water bodies, and the existing studies are limited to a few filters. For this reason an analytical assessment of widely used UV filters in sediments via GC-MS was made. We found, that currently used substances tend to accumulate in sediments and are present in high concentra- tions during summer.

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Due to their life habits, these organisms are especially affected by lipophilic substances.

Results of the analytic and effect studies will be presented and discussed.
On the lookout for microplastics in sediments and biota: exploring new techniques

M克莱森, CRJansen

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Marine litter has been an issue of concern for decades. However, recently international attention has increased due to the fact that the annual global production of plastics is increasing and the buildup of these materials in the environment may become problematic. Understanding once and for all what is going on is not easy, but a methodological approach is needed to break down into smaller particles in the size range of 1 mm and smaller. While no clear adverse effects of these so-called microplastics on marine organisms have been reported, they have been detected in the water column and sediments at high concentrations. The most widely used method to extract microplastics from sediments is based on flotation of the plastics in a saturated salt solution. This method is not 100% efficient, as PVC for example has a density higher than that of a saturated salt solution. High density chemicals like sodium iodide (NaI) are expensive to use on a large scale. Here, a new method using a fluidized sand-bath and the use of NaI on a small scale is proposed. This technique allowed to increase the extraction efficiency from 50% for PVC particles and 98% of fibres after one sand bath extraction and maximally 3 subsequent NaI extractions.

In microplastics, marine litter has been an issue of concern for decades. However, recently international attention has increased due to the fact that the annual global production of plastics is increasing and the buildup of these materials in the environment may become problematic. Understanding once and for all what is going on is not easy, but a methodological approach is needed to break down into smaller particles in the size range of 1 mm and smaller. While no clear adverse effects of these so-called microplastics on marine organisms have been reported, they have been detected in the water column and sediments at high concentrations. The most widely used method to extract microplastics from sediments is based on flotation of the plastics in a saturated salt solution. This method is not 100% efficient, as PVC for example has a density higher than that of a saturated salt solution. High density chemicals like sodium iodide (NaI) are expensive to use on a large scale. Here, a new method using a fluidized sand-bath and the use of NaI on a small scale is proposed. This technique allowed to increase the extraction efficiency from 50% for PVC particles and 98% of fibres after one sand bath extraction and maximally 3 subsequent NaI extractions.

Biodegradation in soil of an experimental polyester

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The resistance to all form of degradation of traditional plastics allows them to be used in many applications, but their disposal contributes to increase the amount of municipal wastes. Biodegradable polymers are being developed for a large number of specific applications (i.e. compostable waste bags, carrier bags, single-use tableware, mulch films) allowing to avoid landfill disposal, thus reducing the cost for waste management and the accumulation in the environment. Products used in agriculture (in particular mulch films) are applied to soil and can be left there. A biodegradable polymer is completely converted by microorganisms (under aerobic conditions) to carbon dioxide, water and new biomass. Standard test methods are based on the measure of the amount of CO2 evolved in a closed or a ventilated respirometer. However, CO2 is only one component in carbon balance. The determination of biomass development and of the polymer metabolites and their fate, for example in soil, is very important in order to obtain a complete description of the process. Most commercial biodegradable plastics are made of biodegradable polyesters. In this work the mineralization of a model polyester in soil was evaluated and compared with cellulose and polycaprolactones (PCL). The tests were carried out according to ASTM D5988-96. The tested materials were exposed to agricultural soil enriched with compost and mineral salts and put in hermetic jars. PCL and cellulose were quickly mineralized and at the end of the test (after about five months of incubation) they reached a nearly defined plateau phase. Their final mineralization was about 60% and 50% respectively. The model polymer mineralization shows a different pattern: after a lag phase around 15 days mineralization proceeded regularly till the end of the test reaching about 53%. Only half of its carbon content is converted into CO2, butanediol and sebacic acid (used for its synthesis) resulted to be completely biodegradable, with about 50% of CO2 production and 50% converted into biomass, so that it is likely that no carbon remains in soil as material residue. If normalized to cellulose (used as control because considered a fully biodegradable polymer) the polyester mineralization can be considered as 100%. Results suggest that the experimental polymer was completely biodegraded, but to completely study the simple and reliable method to measure the biomass production should be developed and applied.

Toxic metals derived from plastic litter in a beach

ET01 - Alternatives to animal testing in ecotoxicology

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In this study we established a novel and reliable method to estimate the total mass of beach litter and the proportion of plastic. A beach at each city was collected with a beach net and a net with an area of 2x2 m across the beach to obtain in-situ measurements of the litter mass per unit area. The mass (kg) of beach litter was estimated by multiplying the area (m2) covered by litter with the average litter weight per unit area (kg/m2). We obtained 6,417 g/m2 from a test with 95% confidence limit. Among randomly collected beach litter within the square area, plastics occupy 47% of the total mass, of which light plastics such as polyethylene (PE; 234±96 g/kg) are more prevalent than heavier materials. Second, the concentrations (mg/kg) of toxic metals in plastic litter are estimated using handheld X-ray fluorescence analyzer (XRF, Innov-X Systems Inc., a-6500). Toxic metals in plastics are widely used as plasticizers, catalysts, stabilizing additives and pigments. Among various toxic metals, lead (Pb) and total chromium (Cr) are detected in PE plastic litter and their concentrations are estimated at 44±13.7 mg/kg and 137±45.3 mg/kg respectively by analyzing 432 pieces of plastic samples. We also estimate the total mass (g) of Pb and total Cr carried by PE litter by multiplying the concentration (mg/kg) with the estimate PE plastic mass (kg) over the beach and calculate as 10±5.2 g and 3±2.1 g, respectively. However, Pb and total Cr concentrations exceed 100 mg/kg the EU regulations on packaging and packaging waste. These toxic metals in plastics are often used as pigments and are potentially released into the beach environment during the degradation of plastics. The results of other polymers will be shown in our presentation.

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ET05-3

ET05-4

ET05-5

ET05-6

What do plastic additives add to life cycle assessment results?

EP05-6

What do plastic additives add to life cycle assessment results?

N Vos, H van Ewijk, H Kroes

IVAM - University of Amsterdam, AMSTERDAM, The Netherlands

Plastics are produced in countless varieties of polymer mixtures and additives such as plasticizers, flame retardants and stabilizers. In life cycle assessment (LCA) studies, due to a lack of specific combustion information it is common to reduce this complexity to the assumption that plastics are composed of pure simple polymers.

The current study investigates how the calculated environmental impact of plastics would change when additives are included in LCA calculations. Several examples will be presented to illustrate the implications of the addition of additives to plastics for the impact calculations. For example, the use of fire retardants in plastics and the selection of excipients or UV blockers. In this study the occurrence of TiO2-nanoparticles with small plastic fragments using an environmental scanning electron microscope [ESEM] demonstrated the association of TiO2-nanoparticles with some of the fragments. Based on our field data first estimates of TiO2 materials with plastic particles result in a range from 4 to 7 g L-1 of sea surface. Our findings point out that plastic debris in rivers and oceans must be considered as a source of TiO2 nanoparticles in the aquatic environment. Because of an enhanced density of microplastics containing TiO2 an accumulation of such fragments in sedimentary habitats is expected. Our findings highlight for the first time a potential risk for marine ecosystems from TiO2-nanoparticles associated with microplastics.

Comparison of cartilage and bone malformations in the head of zebrafish embryos after exposure to dichlorohydrin and halogenated hydrazides

ET05-1

Comparison of cartilage and bone malformations in the head of zebrafish embryos after exposure to dichlorohydrin and halogenated hydrazides

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University of Heidelberg, HEIDELBERG, Germany

Dichlorohydrins such as dichlormethane are well known teratogens causing wave-like deformation of the notochord and cartilage malformations in fish embryos. Although different in chemical class, molecular weight and log KOW, hydrazides, especially acetic hydrazide, generate the same morphological effects. Similar results are also found for benzhydrazide, formic acid hydrazide and iso-molecular weight and log KOW, hydrazides, especially acetic hydrazide, generate the same morphological effects. Similar results are also found for benzhydrazide, formic acid hydrazide and iso-meric weight and log KOW, hydrazides, especially acetic hydrazide, generate the same morphological effects. Similar results are also found for benzhydrazide, formic acid hydrazide and iso-
analyzed individually assessing the severity of malformation and the degree of ossification of bone in a semi-quantitative approach. Cartilages of the neurocranium, such as the ethmoid plate, proved to be more stable than cartilages of the pharyngeal skeleton such as, e.g., Meckel’s cartilage. Hence, ossification is much more susceptible to the test compounds than cartilage, showing alterations at lower concentrations, mostly as a reduction of bone mass.

ETO1-2

Further development of a gene expression fish embryo test as a potential alternative to the fish early life stage test

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To date, there are no alternatives to chronic fish toxicity tests such as the fish early life stage test. In an ongoing project (Gene-DarT), 96-well Format Danio rerio embryos were analyzed for the first time ever using this test system. The study was based on the fish embryo toxicity test with the zebrafish by including an additional endpoint, the analysis of differential gene expression. For most tested substances, lowest observed effect concentrations (LOECs) derived with the Gene-DarT agreed reasonably well with LOECs of fish early life stage tests, despite the differences in test systems. However, if differences were observed, test concentrations are expected to have been much lower in the first years of REACH alone, 4.4 million fish will be needed. Therefore the development of appropriately alternative methods is timely. One promising approach is the use of fish cell lines; however, several studies indicated that fish cell lines appear less sensitive than fish. During the project, we optimized the fish cell line approach; we used several steps to increase the sensitivity of the in vitro assay. These included the selection of the fish cell line, modification of the exposure medium, selection of toxic endpoints and the determination of the chemical bioavailability. We further showed that the chemical toxicity is also dependent on the solvent and dosing procedure. Based on these findings, we designed dosing and exposure protocols that account for factors otherwise compromising the 
in vivo/in vitro correlation.

ETO1-5

Evaluation of the toxic potential of 34 organic chemicals towards a rainbow trout gill cell line

K Tanneberger1, M Knobl, FJM Buser2, JLM Herren3, K Schirmer4

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2Institute for Risk Assessment Sciences, Utrecht University, UTRECHT, The Netherlands
3The EU regulation REACH requires that all chemicals produced or imported into the EU need to be tested with respect to their impact on human health and the environment. At a production volume of 10 tonnes per year the test for acute fish toxicity (OECD 203) is obligatory. At this test there is an endpoint of mortality of 72 test organisms within 48 hours. If the chemical is expected to be more harmful, then it will be tested in the fish toxicology test (GeneDarT) and compared with LOECs of fish toxicity values. Results revealed that lead, cadmium, copper and nickel are more harmful in the fish cell line than in fish. Therefore, these chemicals pose a moderate and high risk to the aquatic environment.

ETO1-6

Combined toxicity of estrogen receptor agonists and antagonists in a fish in vitro assay

K Petersen, KE Tollefson

NIVA, OSLO, Norway

Primary hepatocytes from fish such as rainbow trout (Oncorhynchus mykiss) represent a well-characterized high-throughput platform for single chemicals, but there is a need to develop cell-based assays for combination toxicology. For powerful assays, the cell-based assays provide assessment of multiple mode of action (MoA) and has successfully characterised the potency of both estrogen receptor (ER) agonists and ER antagonists in vitro through use of the estrogenic biomarker vitellogenin (Vtg). Fish in the environment are continually exposed to a mixture of chemicals and the growing concern about the combined effect of mixtures has resulted in development of prediction models for the combined effect of mixtures. Two of these prediction models, the concentration addition (CA) and the independent action (IA) prediction models are widely applied for direct endpoints, like in vitro induction of cellular receptors such as the estrogen receptor, or concentration depression of the estrogen cytosol concentration. Production of Vtg. Mixtures of ER agonists were designed based on the CA prediction model, and experimental results were compared to the predicted response. Except for deviations from the prediction models at the higher relative mixture concentrations of the ER agonist mixtures, our results are in agreement with the CA and IA models.

ETO1-7

Alternatives to in vivo tests to detect endocrine disrupting chemicals (EDCs) in fish and amphibians

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5L’Oréal, AULNAY SOUS BOIS, France
6Institut Charles Darwin, UMR 5258, CNRS, Université Clermont Auvergne, INRA, CRCT Oekotoxikologie GmbH, FLOERSHEIM, Germany
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A significant amount of current research in risk assessment of chemicals is targeted to evaluate alternative test methods that may replace, reduce, or refine (3R) the use of animals, while ensuring human and environmental health and safety. In 2009, the U.S. EPA began implementation of the Endocrine Disruptor Screening Program which includes Tier 1 screening assays in fish and frog species which are closely aligned with the OECD test guideline series 229 and 231. How-
ever, these assays use a large number of animals and are quite long in duration relative to an ideal screening assay. As the Tier 1 assays screen and prioritize a large number of chemicals for possible testing, these assays use a large number of animals and are quite long in duration relative to an ideal screen.

In terms of fish toxicity test alternatives, the fish embryo toxicity test (FET) can certainly be considered the most promising approach, and in the context of the OECD Test Guideline Program, the FET with zebrafish (ZFET) is being validated as a replacement for the fish acute toxicity test. Meanwhile, the applicability of the FET to specific, non-acute toxicity and teratogenic endpoints, which are prominent outcome pathways in fish, is also acknowledged. A prerequisite to take full advantage of the potential of the FET, however, is to agree on common standard protocols for specific applications and to address sources of uncertainty of the test procedures. In our studies, we address basic FET related methodological issues like the selection of test vessels or the test duration, to facilitate standardisation and prevailance of the assay, but also seek to refine the FET through the integration of additional toxicological endpoints. One focus is on transcriptomics as an endpoint and the evaluation of its value to inform on underlying mechanism of toxicity. Several fish embryo studies with zebrafish were conducted either following the DIN/ISO test guidelines or following a prolonged test protocol which includes post-hatch stages until 120 hpf. The objectives of these studies were e.g. to investigate: i) the differences between the two different well-plate types and the influence of the oxygen saturation, ii) the influence of the organic solvent dimethylformamide (DMF) to modulate gene expression of thousands of genes. Genistein enhanced expression of estrogenic genes, which is in line with the sensitivity of zebrafish. Our studies show that the ZFET has excellent potentials for application beyond acute toxicity, but for regulatory acceptance effective measures to minimise the level of uncertainty, in particular, integrated molecular-based methodologies are still lacking.

Characterization of test conditions of the OECD 210 fish early life stage test

SE Belanger¹, JT Oom⁴

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⁸PET A, NORFOLK, United States of America

A fall 2010 workshop with participation from ~40 experts was organized with the goal of producing a guidance document that provides a detailed discussion of issues, relevant requirements for fish testing, statistical considerations, animal welfare considerations and alternatives to testing. Among the key project aims was to support careful updating of the guideline as aspects of the tests which provides opportunities for diverse interpretations which could be rectified in a careful updating of the guideline.

Evaluation of the OECD 210 Fish Early Life Stage Chronic Toxicity Test - Setting the Target for Future Animal Alternative Approaches

JT Oom¹, SE Belanger¹, AJ Balter²

¹Miami University, OXFORD, United States of America
²The Procter & Gamble Co., CINCINNATI, OH, United States of America

The Fish Early Life Stage test is widely acknowledged as the most promising approach, and in the context of the OECD Test Guideline Program, the ZFET is being validated as a replacement for the fish acute toxicity test. Meanwhile, the applicability of the FET to specific, non-acute toxicity and teratogenic endpoints, which are prominent outcome pathways in fish, is also acknowledged. A prerequisite to take full advantage of the potential of the FET, however, is to agree on common standard protocols for specific applications and to address sources of uncertainty of the test procedures. In our studies, we address basic FET related methodological issues like the selection of test vessels or the test duration, to facilitate standardisation and prevailance of the assay, but also seek to refine the FET through the integration of additional toxicological endpoints. One focus is on transcriptomics as an endpoint and the evaluation of its value to inform on underlying mechanism of toxicity. Several fish embryo studies with zebrafish were conducted either following the DIN/ISO test guidelines or following a prolonged test protocol which includes post-hatch stages until 120 hpf. The objectives of these studies were e.g. to investigate: i) the differences between the two different well-plate types and the influence of the oxygen saturation, ii) the influence of the organic solvent dimethylformamide (DMF) to modulate gene expression of thousands of genes. Genistein enhanced expression of estrogenic genes, which is in line with the sensitivity of zebrafish. Our studies show that the ZFET has excellent potentials for application beyond acute toxicity, but for regulatory acceptance effective measures to minimise the level of uncertainty, in particular, integrated molecular-based methodologies are still lacking.

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ET02A-1
Comparing prioritisation schemes for environmental risk assessment of human pharmaceuticals
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3Umeå University, UMEA, Sweden
4Praho Pharma AB, Stockholm, Sweden
Health Canada, OTTAWA, Canada
While timely access to pharmaceuticals and health care products is of utmost concern to the government of Canada, there is growing recognition and concern that substances in these types of products are being found in the environment in concentrations that may pose a risk. The Canadian Environmental Protection Act (CEPA) 1999 requires that all new substances for use in this country be evaluated for potential environmental risks to the Canadian environment and human health. Currently substances in products regulated by the Food and Drugs Act (F&DA) (including therapeutic drug ingredients) are legally obliged to undergo an environmental assessment. However the current environmental assessment regulations were developed primarily for industrial chemicals and are not appropriate for assessing the potential environmental risk of the types of substances and release scenarios associated with drug products. As such, Health Canada, in consultation with representatives from industry, non-governmental organizations and consumer groups, initiated a project to develop Environmental Assessment Regulations (EARs) with specific information requirements for these types of substances. A framework has been developed which seeks to align with the drug development process while leveraging a testing strategy that considers the potential fate and exposure profile of the drug substance to direct the type of ecotoxicological testing to be required.

ET02A-2
Perspectives on prioritization approaches for studying pharmaceuticals in the environment
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3Human and veterinary pharmaceutical residues in the environment have received unprecedented attention from citizens, environmental scientists, engineers and managers, and regulatory authorities over the past decade. An increasing body of literature is reporting the accumulation of pharmaceuticals in wildlife, through an understanding of relationships among internal exposure, therapeutic mechanisms/modes of action and adverse effect thresholds is lacking. Further, some of the unique properties of pharmaceuticals present unique challenges to the assessment of environmental risk and hazard. Fortunately, pharmacological safety data is often more available than many other classes of industrial chemicals, which allows for physical-chemical and biological read across application of currently available data, and a large effort has been made to identify pharmaceutical properties associated with greater risk to aquatic and terrestrial organisms. In this presentation we critically review such approaches for developing prioritization hazard and risk frameworks in prospective and retrospective environmental assessments. Because secondary poisoning of dicrofancas represents a definitive example of wildlife impacts by a pharmaceutical, we specifically examined the potential for secondary poisoning to terrestrial wildlife using a trickling filter case study. Herein we accounted for the influence of pH on partitioning of weak acids and weak bases to predict relationships between oral wildlife exposure and recom mendated daily dose in humans. We then assessed these high priority pharmaceuticals for side effects and common contraindications, and further examined their potential hazards to aquatic life. This study thus provides a novel approach for considering aquatic and terrestrial receptors for prioritizing environmental risk and hazards of human and veterinary medicines.

ET02A-3
Human health risk assessment of pharmaceuticals in Chinese drinking water
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4Pharmaceuticals are a class of emerging chemicals that are of environmental concern due to their inherent bioactivity. Their ubiquitous occurrence in various environmental compartments and their effects on non-target organisms are well documented. Pharmaceutical residues and metabolites are frequently found in water sources, such as surface water and groundwater, passing unaltered through drinking water treatments and ending up in tap water, where they may pose a chronic hazard to human health. However, regulatory levels for pharmaceuticals in potable water have not been established anywhere in the world. In China, existences of pharmaceuticals in sewage, surface water and sediment were previously reported but related studies in drinking water are scarce. In this investigation, tap water was sampled from ten cities in China1 Hong Kong, Macau, Wuhan, Shanghai, Xi'an, Shenzhen, Guangzhou, Nanjing, and Changsha2 during September and November, 2010. Tap water samples were collected from different individual residences spread throughout a city (n=5 per city). A total of 38 pharmaceuticals, including antibiotics, non-steroidal anti-inflammatory drugs (NSAIDs), beta-blockers, lipid regulators, psychoactive drugs, cardiac drugs, diuretic drugs and anti-hypertension drugs, were analyzed by solid phase extraction (SPE) and high-performance liquid chromatography coupled with tandem mass spectrometry (HPLC-MS/MS). Preliminary results from six cities (n=30) showed that 16 compounds were present at detectable concentrations in at least one drinking water sample among the 38 analytes. Of all the detected pharmaceuticals, caffeine and salicylic acid were predominantly occurring in over 90% of the analyzed samples, followed by carbamazepine and erythromycin-H2O. To assess possible risks on human health, acceptable daily intake levels obtained from the available literature or derived from animal toxicity data, ingestion rate and exposure period will be applied to the pharmaceutical levels measured in the drinking water samples.

ET02A-4
Developing environmental assessment regulations for pharmaceuticals: a drug’s character is its fate
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ET02A-5
Multimarker approach to assess sub-lethal effects induced by a mixture of three common non-steroidal anti-inflammatory drugs (NSAIDs) on the zebra mussel (Dreissena polymorpha)
P Modling1, AB Binelli2, AP Provini3
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2Pharmaceutical compounds are an emergent class of environmental pollutants included in the broad category of PPCPs (pharmaceutical and personal care products). Among these, non-steroi dal anti-inflammatory drugs (NSAIDs), the sixth most sold drugs worldwide with an estimated annual production of several hundred thousand tons, might negatively affect aquatic organisms, has gained increasing attention over the last years. Among NSAIDs, some compounds are highly lipophilic and are not appropriate for assessing the potential environmental risk of the types of substances and release scenarios associated with drug products. As such, Health Canada, in consultation with representatives from industry, non-governmental organizations and consumer groups, initiated a project to develop Environmental Assessment Regulations (EARs) with specific information requirements for these types of substances. A framework has been developed which seeks to align with the drug development process while leveraging a testing strategy that considers the potential fate and exposure profile of the drug substance to direct the type of ecotoxicological testing to be required.

ET02A-6
Benzoic invertebrate exposure and chronic toxicity analysis for cVMS materials - a probabilistic approach and comparison to the target lipid model
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3Lipophilic chemicals, such as the cyclic volatile methylxanthines materials octamethylenetetraoxiane (D4) and decamethylenepentaoxiane (D5), adsorb extensively to particles and surfaces in aqueous systems, making sediments a key sink when performing risk assessment evaluations. A way to determine a risk step for estimating the chronic risk posed by these chemicals is to assess the possible exposure of a target sediment to be compared with the observed sediment concentration with either published ecotoxicity guidelines or to chronic no-observed effect concentrations (NOECs) from toxicity testing with benzoic invertebrates. The comparison of field concentrations with chronic NOEC values can be done with simple worst-case assumptions or a probabilistic distribution approach. In this work, a comparison was made using probabilistic methods of D4 and D5 residues from sediments and organisms collected in the United States (Lake Pepin, Minnesota) and Norway (Inner Oslofjord) to chronic NOEC values determined using EPA/OECD test species such as Chironomus riparius and Cerithium cespitosum. Chronic NOECs for Cerithium, Chironomus riparius, Lyellidia antarctica, and Limacina-variegata; both sites are downstream from municipal wastewater treatment plants, the likely sources of the D4 and D5 residues. The risk assessment was used extending ecotoxicity data on more than 50 species using the target lipid model (TLM), which assumes a narcotic mode of action (MOA) for ecotoxicity. Concentrations were made using appropriate methods on a dry weight basis with organisms residues with lipid-adjusted basis. Probabilistic endpoints of 95% exposure and 5% chronic NOEC were extrapolated from the data, which were fit using log-normal assumed distributions. The cVMS acute-to-chronic ratios (ACRs) were consistent with TLM data and with chronic MOA (average 2.5), 10% of invertebrate toxicological techniques and the TLM database, field D4 and D5 concentrations were far below chronic threshold NOEC values with benzoic invertebrates, therefore very limited risk appears to exist for benzoic invertebrate species with these methods. This evaluation is based on both sediments- and tissue-based analyses and also leveraging the TLM database and narcotic MOA for cVMS materials.
Biocumulation and molecular effects of the contraceptive hormone levonorgestrel in the non-target organism Dreissena polymorpha

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There is increasing concern about the adverse effects of contraceptive steroids found in wastewater effluents and treated water, as they exhibit high concentrations in marine animals. The current study aimed to address this issue by exposing the Dreissena polymorpha to levonorgestrel (LNG), a post-coital contraceptive hormone, at environmentally relevant concentrations. LNG bioconcentration in D. polymorpha, the bioconcentration factor (BCF) was assessed and to examine if LNG has a direct effect on cell functions of biotransformation, elimination, prevention from oxidative stress and protein damage.

Mussels were exposed for one week in the flow-through system to increasing concentrations of LNG: 0.0, 0.3, and 6 ng/L. Gill and digestive gland tissue were sampled after 1 and 7 days of exposure. Real-time PCR assays were run to study changes in mRNA levels. Whole tissue was sampled upon the termination of LNG tissue content. LNG water and tissue concentrations were determined by LC-MS/MS.

Within four days mussels exposed to 0.3 ng/L LNG bioaccumulated the substance 95-fold. Mussels exposed to the higher concentrations displayed lower BCs (30 and 56, respectively). After one week, amounts of LNG in mussel exposed to the lower concentrations were even increased. Only for the highest concentration a decrease of the BCF within one week could be observed.

After only one day we found an immediate up-regulation of pi class glutathione S-transferase (GST) in both mussel groups, indicating phase II biotransformation processes. Also superoxide dismutase (SOD) and metallothionein (MT) mRNA was significantly up-regulated after only one day in the digestive gland hinting on oxidative stress. After four days we found an up-regulation of Glycophosphoryltransferase (Gpi) as well as increased levels of SOD and MT mRNA, indicating a high concentration of enhanced elimination processes and ongoing oxidative stress. After one week exposure to LNG enhanced elimination processes were indicated for mussels exposed to the highest concentration also by the up-regulation of Gpi in gg tissue. An enhanced requirement for protein repair, transport or protective processes was evidenced by hs/p70 induction in gills.

ET02B-2
Do nonprescription pain relievers have endocrine disrupting potential in zebrafish (Danio rerio)?

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Nonprescription pain relievers are widely used in all age groups, indicating phase II biotransformation processes. Also superoxide dismutase (SOD) and metallothionein (MT) mRNA was significantly up-regulated after only one day in the digestive gland hinting on oxidative stress. After four days we found an up-regulation of Glycophosphoryltransferase (Gpi) as well as increased levels of SOD and MT mRNA, indicating a high concentration of enhanced elimination processes and ongoing oxidative stress. After one week exposure to LNG enhanced elimination processes were indicated for mussels exposed to the highest concentration also by the up-regulation of Gpi in gg tissue. An enhanced requirement for protein repair, transport or protective processes was evidenced by hs/p70 induction in gills.

ET02B-3
Endo life pregestin exposure causes sterility in adult female Xenopus tropicalis frogs

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Levonorgestrel (LNG) is a pharmaceutical progestin commonly used in contraceptives. It has been demonstrated that LNG reaches the environment owing to the lack of degradation in the wastewater treatment plant, and for this reason they are detected in aquatic environments. Their concentrations range from µg/L to ng/L in the effluent from wastewater treatment plants to ng/L in surface waters. Pharmaceuticals are specifically designed to be biologically active, and there is a lack of understanding of their ecological effects. Consequently, there is the need to investigate on their possible interactions with non-target organisms in the environment, included microorganisms.

Microorganisms have a key role in the cycles of elements and in ecosystem processes, being involved in decomposition of organic matter. Therefore, they are able to degrade and mineralize xenobiotic compounds. Consequently, they are essential in the overall processes that contribute to the quality state of natural ecosystems.

This study aims to examine the environmental fate of two pharmaceuticals, such as naproxen (an anti-inflammatory agent) and gemfibrozil (a lipid regulator) commonly found as contaminants in the river Tiber (Italy). For this purpose, different water microcosms were set up (presence/absence of microorganisms). The present work aims to evaluate the environmental fate of two pharmaceuticals, such as naproxen (an anti-inflammatory agent) and gemfibrozil (a lipid regulator) commonly found as contaminants in the river Tiber (Italy). For this purpose, different water microcosms were set up (presence/absence of microorganisms). The present work aims to evaluate the environmental fate of two pharmaceuticals, such as naproxen (an anti-inflammatory agent) and gemfibrozil (a lipid regulator) commonly found as contaminants in the river Tiber (Italy). For this purpose, different water microcosms were set up (presence/absence of microorganisms). The present work aims to evaluate the environmental fate of two pharmaceuticals, such as naproxen (an anti-inflammatory agent) and gemfibrozil (a lipid regulator) commonly found as contaminants in the river Tiber (Italy). For this purpose, different water microcosms were set up (presence/absence of microorganisms). AsYet, designed in our lab, using hybrid striped bass (Morone saxatilis x Morone chrysops) as the predator and fathead minnows (Pimephales promelas) as prey, was used to test effects. Blood was examined for levonorgestrel after 14 days and in the water samples taken during the experiment. A lack of data on toxicity of progestins in amphibians. Moreover, information on the long-term toxicity of progestins following early life exposure is scant. The aim was to characterize effects of developmental LNG exposure on sex differentiation, reproductive organ development and fertility state of the model frog Xenopus tropicalis. Tadpoles were exposed to 19 or 156 ng/L LNG (9.5 or 0.06 nM, measured concentrations) via the water from shortly after hatching until metamorphosis. After metamorphosis, exposure was discontinued and effects on gonadal differentiation were assessed using a subsample of the animals. Remaining metamorphosed frogs were held unexposed or 0.06 nM, measured concentrations) via the water from shortly after hatching until metamorphosis. After metamorphosis, exposure was discontinued and effects on gonadal differentiation were assessed using a subsample of the animals. Remaining metamorphosed frogs were held unexposed
waste and surface waters, which allow us to validate the proposed model. Present study is the first work to evaluate the cocaine cytogenotoxic effects on aquatic non-target organisms, such as the freshwater bivalve *Dreissena polymorpha*. We chose three different cocaine concentrations very similar to those found in environment, in order to give information useful in the real world: 40 ng/L, 220 ng/L and 10000 ng/L. We evaluated the cytogenotoxicity in mussel hemocytes (Neutral Red Retention Assay), the single cell gel electrophoresis (SCGE) assay, the micronucleus test (MN test) and the assessment of the apoptotic frequency (DNA damage assay). The micronucleus test contained a slight or moderate cytogenotoxicity in zebra mussel hemocytes at the two lowest concentrations, but significant effects at the highest concentration. The cytogenotoxic action detected is due to direct effects or to secondary effects. The increase in human population carries with it a higher demand for food supplies which translates into increased agricultural and livestock production. The use of antibiotics is a widespread prophylactic and therapeutically is necessary to promote animal health, but may have significant consequences to natural ecosystems. The effects of the antibiotics released to the environment in non-target organisms is already under the scope of researchers but little attention has been given to primary producers such as macroalgae, which are in the bottom of the trophic webs. The present study tested the effects of two antibiotic agents, furaltadone and chloramphenicol, on the growth of Ulva lactuca. Results showed differences in growth rates when submitted to prophylactic and therapeutic concentrations (25 and 50 μg/ml, respectively) for both drugs. The furaltadone concentration showed a higher interference in growth than the prophylactic, causing its decline in the presence of furaltadone and an increased growth with chloramphenicol. The exposure of macroalgae to pharmaceuticals in the environment will have significant effects on growth that will depend on the characteristics and also on the concentrations of the chemical present.

**ET02C-2**

The effects of furaltadone and chloramphenicol on Ulva lactuca


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The increase in human population carries with it a higher demand for food supplies which translates into increased agricultural and livestock production. The use of antibiotics is a widespread prophylactic and therapeutically is necessary to promote animal health, but may have significant consequences to natural ecosystems. The effects of the antibiotics released to the environment in non-target organisms is already under the scope of researchers but little attention has been given to primary producers such as macroalgae, which are in the bottom of the trophic webs. The present study tested the effects of two antibiotic agents, furaltadone and chloramphenicol, on the growth of Ulva lactuca. Results showed differences in growth rates when submitted to prophylactic and therapeutic concentrations (25 and 50 μg/ml, respectively) for both drugs. The furaltadone concentration showed a higher interference in growth than the prophylactic, causing its decline in the presence of furaltadone and an increased growth with chloramphenicol. The exposure of macroalgae to pharmaceuticals in the environment will have significant effects on growth that will depend on the characteristics and also on the concentrations of the chemical present.

**ET02C-3**

In vivo experiments for the evaluation of different biomarkers and alterations in protein expression profiles of *Zebra mussel (Dreissena polymorpha)*

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Among the emerging class of environmental pollutants of PPCPs (Pharmaceuticals and Personal Care Products) is one of the most widely used groups is the antibiotics. While these products at low concentrations are probably not pharmacologically active in humans, they may still be potential pollutants in aquatic environments. Triclosan (TCS, 2,4,4′-trichloro-2′-hydroxydiphenyl ether) is one of the main known antibacterial agents and its increasing environmental levels is causing growing concern about its presence in freshwaters. In this work, we investigated the effects and the mechanism of action of the antibacterial agent Triclosan in hemocytes of the freshwater bivalve Zebra mussel (*Dreissena polymorpha*). For this purpose we used several biomarkers for in vivo experiments at three different triclosan concentrations (1, 2, 3 μM). We used the single cell gel electrophoresis (SCGE) assay, the micronucleus test (MN test) and the measure of the apoptotic frequency (Halos assay) to measure the genotoxic potential of Triclosan, and the neutral red assay (NRRA) as a measure of lysosomal membrane stability to identify general cell death. We also evaluated the activity of enzymes related both to oxidative stress (superoxide dismutase - SOD-, catalase -CAT- and glutathione peroxidase -GPX-) and phase II metabolism (glutathione S-transferase -GST-) on the cytosolic fraction of the whole body mussels. Finally, we applied a proteomic technique in order to identify changes in protein expression profiles in the mussel gills. We observed significant increases in all of the genotoxic biomarkers examined as early as 24 h after initial exposure, as well as a clear destabilization of lysosomal membranes, indicating that this chemical is potentially dangerous for the entire aquatic biocommunity. A comparison of these in vivo results with existing data from in vitro experiments allowed us to suggest possible mechanisms of action for Triclosan in this bivalve. The role of the identified proteins in this mechanism of action is discussed.

Although further studies are needed to confirm the possible modes of action, our study is the first to report on the effects of this widespread antibiotic on freshwater invertebrates.

**ET02C-4**

The impact of triclosan on ecosystem services of freshwater biofilms

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5CEF, COIMBRA, Portugal

The impact of humans on population carries with it a higher demand for food supplies which translates into increased agricultural and livestock production. The use of antibiotics is a widespread prophylactic and therapeutically is necessary to promote animal health, but may have significant consequences to natural ecosystems. The effects of the antibiotics released to the environment in non-target organisms is already under the scope of researchers but little attention has been given to primary producers such as macroalgae, which are in the bottom of the trophic webs. The present study tested the effects of two antibiotic agents, furaltadone and chloramphenicol, on the growth of Ulva lactuca. Results showed differences in growth rates when submitted to prophylactic and therapeutic concentrations (25 and 50 μg/ml, respectively) for both drugs. The furaltadone concentration showed a higher interference in growth than the prophylactic, causing its decline in the presence of furaltadone and an increased growth with chloramphenicol. The exposure of macroalgae to pharmaceuticals in the environment will have significant effects on growth that will depend on the characteristics and also on the concentrations of the chemical present.

**ET02C-5**

Triclosan persistence through waste water treatment plants and its potential effects on freshwater biofilms


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Numerous chemicals are continually released into the environment as a result of their use in industry, agriculture or household. The so-called pharmaceuticals and personal care products (PPCPs) are widespread in aquatic environments, but widely unknown. The extent of the effects of antibiotics released to the environment in non-target organisms is already under the scope of researchers but little attention has been given to primary producers such as macroalgae, which are in the bottom of the trophic webs. The present study tested the effects of two antibiotic agents, furaltadone and chloramphenicol, on the growth of Ulva lactuca. Results showed differences in growth rates when submitted to prophylactic and therapeutic concentrations (25 and 50 μg/ml, respectively) for both drugs. The furaltadone concentration showed a higher interference in growth than the prophylactic, causing its decline in the presence of furaltadone and an increased growth with chloramphenicol. The exposure of macroalgae to pharmaceuticals in the environment will have significant effects on growth that will depend on the characteristics and also on the concentrations of the chemical present.

**ET02C-6**

Tertiary treatment methods reduce the ecotoxicity of wastewater for Gammarus fossarum (Crustacea, Amphipoda)


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Among other chemicals, pharmaceuticals and personal care products enter the aquatic environment through treated wastewater effluents in highly industrialized countries. In this paper, we investigated the impairment of the stabilisation capacity of freshwater biofilms to natural ecosystems. The extent of the effects of antibiotics released to the environment in non-target organisms is already under the scope of researchers but little attention has been given to primary producers such as macroalgae, which are in the bottom of the trophic webs. The present study tested the effects of two antibiotic agents, furaltadone and chloramphenicol, on the growth of Ulva lactuca. Results showed differences in growth rates when submitted to prophylactic and therapeutic concentrations (25 and 50 μg/ml, respectively) for both drugs. The furaltadone concentration showed a higher interference in growth than the prophylactic, causing its decline in the presence of furaltadone and an increased growth with chloramphenicol. The exposure of macroalgae to pharmaceuticals in the environment will have significant effects on growth that will depend on the characteristics and also on the concentrations of the chemical present.

**ET04 - Ecologically relevant endpoints**

**ET04-1**

In situ feeding assay with Gammarus fossarum: move forward to an ecologically relevant biomonitoring of water chemical quality

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As shown by many laboratory studies since 1990s, a large range of chemical stressors can inhibit feeding rate of Gammarus fossarum. The aim of this study was to move forward to an ecologically relevant biomonitoring of water chemical quality with a standardized bioassay. As shown by many studies since 1990s, a large range of chemical stressors can inhibit feeding rate of Gammarus fossarum. The aim of this study was to move forward to an ecologically relevant biomonitoring of water chemical quality.
Effects at a daily resolution of imidacloprid on the individual feeding activity of Gammarus pulex (L.)

For this purpose, we developed an environmentally realistic Leslie population model, which allowed considering in situ caging in contaminated streams, we underlined the importance of taking a three-steps approach: (i) we characterized the influence of these important confounding factors (body size, temperature, water hardness) on feeding activity allows one to improve the interpretability of results in situ bioassays (n=20) were assessed at each sampling site. The water samples of two streams as well as all 14 species contained invertebrates at ecotoxicological relevant concentrations. The macroinvertebrate drift of Gammarus pulex was selected a key group of macro-crustaceans and the resulting drift of sterilized, emergence and feeding rates of Gammarus pulex was high following a rainfall-induced input of the insecticide lambda-cyhalothrin (0.29 μg/L) at one sampling site. The feeding rate of Gammarus pulex was also reduced following this experimental exposure. Moreover in the present study, the impacts of pesticide as well as the influence of food quality separately were significant. Parasite infection and lower food quality together yield an even stronger reduction of the feeding rate of Gammarus pulex in relation to uninfected and optimally-fed organisms. It turns out that the feeding rate, the results of this experiment agreed with those in the literature. Furthermore it could be demonstrated that daily measurement of feeding activity on an individual level was feasible, but there were some unidentified factors which reduced the feeding rate over time.

The observed effect concentration for in situ bioassays of an exposure duration of four days was 20 to 380 times lower than the lethal concentration. Furthermore, the effect concentrations were within the range of measured and estimated environmental concentrations.

Intra-specific variability makes it difficult to study sub-lethal effects on an individual level and experimental designs have to consider variability wherever possible. It is known that lethal and sub-lethal impacts can still be seen after the toxicant is removed from the exposure medium. In this experiment, a secondary effect (higher feeding rate in previously impacted individuals) also persisted beyond the time when the toxicant was eliminated from the water phase. It is essential that experimental duration should be sufficient to study such compensatory effects.

Effects and environmental consequences of U exposure on the fish Danio rerio (Oxyrhincus cinereus; Carassiusauridae)

Exposure to metals can cause a decrease of reproductive capacity in fish. These endpoints may have serious implications for normal population dynamics and community structures. Uranium's translocation and toxicity pathways in fish are poorly understood, and the resulting zoonotic contamination thresholds are therefore used for risk assessment in different environments. These non-guideline studies can provide ecologically relevant ancillary data for regulatory guideline data submissions to increase environmental realism, reduce uncertainties, and improve an overall risk assessment for forest invertebrates.

In outdoor mesocosms selectively reduced a key group of macro-crustaceans and the resulting drift of sterilized, emergence and feeding rates of Gammarus pulex was high following a rainfall-induced input of the insecticide lambda-cyhalothrin (0.29 μg/L) at one sampling site. The feeding rate of Gammarus pulex was also reduced following this experimental exposure. Moreover in the present study, the impacts of pesticide as well as the influence of food quality separately were significant. Parasite infection and lower food quality together yield an even stronger reduction of the feeding rate of Gammarus pulex in relation to uninfected and optimally-fed organisms. It turns out that the feeding rate, the results of this experiment agreed with those in the literature. Furthermore it could be demonstrated that daily measurement of feeding activity on an individual level was feasible, but there were some unidentified factors which reduced the feeding rate over time.

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ET0-2
Ecosystem exposure and adverse human health effects of POPs: a data analysis approach by a discrete mathematical method
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3ESTAC Europe 21st Annual Meeting Abstract Book

ET0-3
Transcriptomic and enzymatic approaches on the freshwater fish Gobio gobio exposed to two PCBs
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ET0-4
Specific gene responses of exposure to acetylcholineesterase inhibitors are mediated via nicotinic acetylcholine receptors in tubulospinotectal neurons
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3Ineris, VERNEUIL-EN-HALATTE, France
4ONEMA, MARLY, France

ET0-5
Modulation of immune parameters by chemical environmental pressures in wild populations of European bullhead, Cottus sp.
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ET0-6
Ecotoxicity of amphibians and reptiles
SETAC Europe 21st Annual Meeting Abstract Book
The worldwide decline of amphibian populations, reported in a large variety of habitats, is often associated with the potential effects of this relevant environmental pollutant on the protein expression in the brain and liver of metamorphosing Rana temporaria. One of the widely used herbicides is glyphosate which is, among others, a phosphono carboxylic acid that inhibits photosynthesis. Monsanto Corp. began to commercially produce glyphosate in 1974. Its mode of action is to disrupt amino acid production in plants. These compounds were initially registered by Ciba-Geigy in 1958, the triazine herbicide atrazine, which inhibits photosynthesis, Monsanto Corp. began to commercially produce glyphosate in 1974. Its mode of action is to disrupt amino acid production in plants. These compounds were initially registered by Ciba-Geigy in 1958, the tricyclic herbicide atrazine, which inhibits photosynthesis, and fipronil (9-[2,4-dichlorophenyl]-2-(1H-imidazol-1-yl)ethane-1,3-dione). At low doses, atrazine was reported to affect amphibian growth and development. Fipronil is a third-generation thiazolyl carbamate insecticide and acaricide first manufactured by the Canadian company Alberta-based CropScience Corp. The potential impacts of these compounds on amphibian populations are discussed.
Evidence of feminization in wild mussels populations and the disruption in gonad physiology by exposure to municipal effluents. The purpose of this study was to assess the sex ratio, vitellogenin (Vtg)-like proteins, serotonin, arachidonate cyclooxygenase (COX) activity and dopamine status in wild mussels living at sites upstream and downstream of two municipal effluent outfalls in the Mille-Iles River (Quebec, Canada). Gonad integrity was examined by histology and the serotonin/dopamine ratio was significantly increased in mussels living at downstream sites. Vtg-like proteins were dependent on dopamine levels (r=0.5; p<0.001). The increase in COX activity at the downstream sites and its close relationship with increased serotonin levels suggested a gonad-steroid interaction in addition to V1G production. Vtg-like proteins combined with the serotonergic effects of the municipal effluents was associated with oxidative damage (LPO) in the gonad. This study provides the first evidence of feminization in wild mussel populations and the disruption in gonad physiology by exposure to municipal effluents.

ET0A-7 Effect directed analysis of estrogenic effects in sediments of the river Elbe

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Estrogenic Endocrine Disrupting Chemicals (EDCs) are compounds able to cause adverse effects to humans and wildlife, and have frequently been detected in the environment. Increasing efforts from governmental sectors and the scientific community are devoted to the development of methods to quantify these compounds and predict their risks to human health. The purpose of this work was to evaluate selected EDCs of raw and treated waters in Brazil with different levels of pollution, using chromatography-tandem mass spectrometry (LC-MS/MS) and verify their potential biological effects via in vitro yeast bioassays. Two different bioluminescent yeasts with estrogen receptor containing the human estrogen receptor were employed. One of the strains contains the firefly and the other the lace genes from bacteria (BLYES) as reporters of the estrogenic activity. All raw waters presented endogenous and/or estrogenic compounds and showed estrogenic activity in at least one sampling. Estrogenic compounds and estrogenic activity were not detected in treated waters. All samples contained estrogenic compounds when tested with the BLYES method but not in the lac gene based method. In general, the concentrations of target compounds determined by chemical analysis did not explain the biological responses observed. Because of its simplicity, low cost and good sensitivity, the biological approach showed to be appropriate for monitoring raw and drinking water, indicating hot spots events to be further chemically characterized.

ET0B-1 Triclosan does not alter secondary sexual development or steroidogenesis in juvenile silu- ranas tropicales

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The aim of the present study was to test selected EDCs in juvenile silurana tro- picales. The hypothesis being tested was that EDCs do not alter secondary sexual development or steroidogenesis. All juvenile silurana tro- picales were exposed to three concentrations (0.1, 1 and 10 μg/L) of triclosan for 28 days and tissue concentrations were determined by high performance liquid chromatography. No statistically significant differences were found in tissue concentrations of 17β-estradiol and 17α-estradiol when compared with the control group. These results suggest that triclosan does not alter secondary sexual development or steroidogenesis in juvenile silurana tro- picales.

ET0B-2 Endocrine disruptors induce ovarian changes and affect gonad integrity in the freshwater mussel Elliptio complanata

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The aim of the present study was to determine whether selected estrogenic compounds (20-hydroxyecdysone, 30-hydroxyecdysone, 17β-estradiol, 17α-estradiol, 17α-ethinylestradiol, bisphenol A and stigmasterol) could be found as estrogenic substances in the organic sediment extract from the receiving waters of the Mille-Iles River (Québec, Canada). The organic sediment extract showed an estrogenic potential of 1.9±0.4 ng/g (YES). The sample was fractionated by liquid chromatography for effect directed analysis. The composition of estrogenic-active fractions was further investigated by GC-MS and high resolution LC-MS analysis. Identified substances were tested in the YES and additive effects of the mixture were calculated using the concept of concentration addition (CA). The composition of the environmental sample was rebuilt with pure compounds based on the data of the chemical analysis in order to assess the partition of estrogenic activity caused by the identified compounds. The organic sediment extract contains an estrogenic potential of 1.9±0.4 ng/g ethinylestradiol-equivalent (EEQ) in the sediment. We were able to identify 13 substances by effect directed analysis of which eight had estrogenic properties. The most prominent were 17β-estradiol and estrone, but alkylphenols, bisphenol-A and stigmasterol could be found as well. The high estrogenic potential of 1.9±0.4 ng/g ethinylestradiol-equivalent that was also identified in the sediment extract - has estrogenic properties in the YES that are in the range of other xenostrogens like 4-nonylphenol. This is the first report on chlorophene acting as a xenoestro- gen. Furthermore, the estrogenic potentials of mixtures comprising of both, xenobiotics and nonxenobiotics were calculated and the mixture effect of estrogenic effect by compounds that are present in the sample analyzed and do not stimulate the human estrogen receptor by themselves. As one example the non-active compound tocochromanol enhanced in a concentration dependent manner the estrogenic potential of the technical mixture of xenobiotics whereas the residual of bisphenol-monoesters did not. This finding underlines the importance of mixture effects and underlines the need for bio-assays for the integrative analysis of environmental samples.
Organisms living in aquatic environment are continually exposed to various natural and synthetic products has led on a global basis to a continuous detection of PFCs in a wide range of environmental matrices. The presence of PFCs in aquatic ecosystems has led to the development of aquatic biomonitoring tools. This chapter will discuss the use of aquatic biomonitoring tools to assess the impact of PFCs on aquatic ecosystems.

The chapter will begin by introducing the concept of aquatic biomonitoring and the role of PFCs in the environment. It will then discuss the types of aquatic biomonitoring tools that are available, including chemical analysis, biological assays, and molecular techniques. The chapter will also discuss the potential applications of aquatic biomonitoring tools in risk assessment and management.

The chapter will then focus on the use of aquatic biomonitoring tools to assess the impact of PFCs on aquatic ecosystems. It will discuss the use of chemical analysis to detect PFCs in aquatic samples, including water, sediment, and biota. It will also discuss the use of biological assays to assess the effects of PFCs on aquatic organisms, including fish, invertebrates, and algae. The chapter will also discuss the potential use of molecular techniques, such as genomics and proteomics, to assess the impact of PFCs on aquatic ecosystems.

The chapter will conclude with a discussion of the future of aquatic biomonitoring tools in the assessment of PFCs in aquatic ecosystems. It will discuss the potential for the development of new biomonitoring tools and the integration of aquatic biomonitoring tools into ongoing risk assessment and management programs.
toxicity response with a generally down regulation of the proteins involved in basic physiological processes. We have identified 170 proteins involved in nuclear processes, such as the DNA and/or RNA metabolism, to highlight the main changes induced by treatment on histones and other nuclear proteins. The new technique of Isotope-coded protein/peptide label and then analyzed by LC-ESI MS/MS was applied twice, like Vietnamese farmers application 48h exposure at 10 µg/l and 1 mg/l)  Lymphocytes were isolated from blood by centrifugation and PFOS exposure. For that, we used lymphocyte culture from eel to test the in vitro toxicity of this compound. Exposure time and two sub-lethal concentrations were chosen to avoid cell mortality (∼80% exposure at 10 µg/l and 1 mg/l). Lymphocytes were isolated by blood centrifugation over a Ficoll/Hypaque gradient. After in vitro contaminations, the post-nuclear fraction was isolated and protein structure forming coevolved peptides within phylogenetic groups. In this context, the aim of this study was to assess the possibility to take advantage of peptidic motifs conserving to propose a transferable method across species. For this, our study focused on three model species for which sequence of egg yolk protein Vg is available: an amphipod, Gammarus fossarum, a cladocerean Daphnia magna and an insect Drosophila melanogaster. In first step, peptidic type Vg were identified for each species. In the second step, we tried to find these prototypic peptides in closely related species, such as G. pulex, G. waartier, D. pulex. This study showed the high relevance of mass spectrometry to propose specific methods for the detection of toxic action of PFOS and of a Vg measurement is transferable from a species to another one from the same genus.

ETO8A-6

Molecular responses of lymphocytes in European eel Anguilla anguilla exposed to perfluorooctane sulfonate (PFOS). Biomarker discovery using a sub-proteomic approach JF Reuling, PK Keestemont, AP Pierard, MD Dieu, MR Raes FUNDI, NAMUR, Belgium

Since the 1980s, the stocks of European eel have been declining in most of their geographical distribution area and they are now considered below safe limits for population survival. Many factors can be attributed to this decline such as pollution by xenobiotics like PFOS. The aim of this research project was to develop a multi-biomarker approach to set up an evaluation and monitoring tool for assessing the health state of eels. The strategy consists in assessing protein expression profiles (PFPs) in post-nuclear fraction of lymphocytes exposed in vitro to different pollutants, before in vivo validation of biomarkers. The first step of this approach was to find out PFPs of PFOS exposure. For that, we used lymphocyte culture from eel to test the in vitro toxicity of this compound. Exposure time and two sub-lethal concentrations were chosen to avoid cell mortality (80% exposure at 10 µg/l and 1 mg/l). Lymphocytes were isolated by blood centrifugation over a Ficoll/Hypaque gradient. After in vitro contaminations, the post-nuclear fraction was isolated and protein structure forming coevolved peptides within phylogenetic groups. In this context, the aim of this study was to assess the possibility to take advantage of peptidic motifs conserving to propose a transferable method across species. For this, our study focused on three model species for which sequence of egg yolk protein Vg is available: an amphipod, Gammarus fossarum, a cladocerean Daphnia magna and an insect Drosophila melanogaster. In first step, peptidic type Vg were identified for each species. In the second step, we tried to find these prototypic peptides in closely related species, such as G. pulex, G. waartier, D. pulex. This study showed the high relevance of mass spectrometry to propose specific methods for the detection of toxic action of PFOS and of a Vg measurement is transferable from a species to another one from the same genus.

ETO8A-5

Measurement of vitellogenin protein in invertebrates : relevance and usefulness of mass spectrometry (LC-MS/MS) to propose a specific and transferable method across species G Inebrast, F Audouard-Combe, R Simon1, R Tutundjian1, H Queau1, A Salvador1, J Garric1, O Geffard1, A Chaumont1, 2

Cemagref, LYON, France 1Université Lyon1, VILLEURBANNE, France Reproductive success of organisms is related to the quantity and quality of eggs produced by females. Vitellogenin (Vg), precursor molecule of vitellin that is the energy available for embryonic development in oviparous organisms, is proposed as a relevant exposure and effect biochemistry marker of endocrine disrupting compounds. In aquatic organisms, strategies, such as enzyme-linked immunosorbent assays have been developed to characterise and quantify this protein in vertebrates. On the contrary, in invertebrates few methods are available. This gap mainly results from the low transferability of available antibodies in relation to phylogenetic distance and molecular divergence accumulated by proteins through animal evolution. Recently, our laboratory developed a quantitative assay of Vg in a widespread amphipod, Gammarus fossarum, using liquid chromatography tandem mass spectrometry (LC-MS/MS). This multiparametric approach offers the possibility to quantify Vg in the amphipods by means of prototypic peptide containing putative mg 15 amino-acids. Although a high molecular divergence observed for this type of protein throughout animal evolution, qualitative and relative quantitative genomics revealed that partial conservation between homologous proteins can persist due to high frequency of constraints acting on the primary structure preserved in the protein-coding genes. The present study was to assess the possibility to take advantage of peptidic motifs conserving to propose a transferable method across species. For this, our study focused on three model species for which sequence of egg yolk protein Vg is available: an amphipod, Gammarus fossarum, a cladocerean Daphnia magna and an insect Drosophila melanogaster. In first step, peptidic type Vg were identified for each species. In the second step, we tried to find these prototypic peptides in closely related species, such as G. pulex, G. waartier, D. pulex. This study showed the high relevance of mass spectrometry to propose specific methods for the detection of toxic action of PFOS and of a Vg measurement is transferable from a species to another one from the same genus.

ETO8A-4

Novel outcome changes on the social amoeba Dictyostelium discoideum during the molecular adaptations to environmental stress conditions L Bozzi, F Marsano, A Negri, A Viarengi University of Piemonte Orientale, ALESSANDRIA, Italy

The social amoeba Dictyostelium discoideum is a model organism, with a genome fully sequenced, widely used by the scientific community and it is considered as interface between the unicellular and pluricellular organisms. In the last years we have applied the proteomics approach with 2DE and MS/MS to study the effects of different environmental stresses on the cellular proteome, such as iron(III) depletion, mercury (Hg²⁺). Marsano et al. (2010) has demonstrated how μM of Hg²⁺ induces in cells a toxicity response with a generally down regulation of the proteins involved in basic physiological processes. In the present work, to deepen the mechanisms of stress response induced in D. discoideum with Hg²⁺ we have analyzed the nuclear proteins changes. Nuclear proteins modifications represent a crucial point in the actuation of stress response, as can be seen as a hub between signal transduction events and realization of new gene expression/ protein synthesis. In this study, we used a sub-lethal concentration of mercury (Hg²⁺). The present study was to assess the possibility to take advantage of peptidic motifs conserving to propose a transferable method across species. For this, our study focused on three model species for which sequence of egg yolk protein Vg is available: an amphipod, Gammarus fossarum, a cladocerean Daphnia magna and an insect Drosophila melanogaster. In first step, peptidic type Vg were identified for each species. In the second step, we tried to find these prototypic peptides in closely related species, such as G. pulex, G. waartier, D. pulex. This study showed the high relevance of mass spectrometry to propose specific methods for the detection of toxic action of PFOS and of a Vg measurement is transferable from a species to another one from the same genus.

ETO8A-3

Analysis of effects of herbicide exposure on Chlamydomonas reinhardtii using a multiple endpoint assay and proteomic profiling F Suster, H Nieser, R Schoenenberger Eawag, DUEBENDORF, Switzerland

Chlamydomonas reinhardtii is a model organism, with a genome fully sequenced, widely used in molecular adaptations to environmental stress conditions. This study aims at identifying sensitive multibiomarkers of malachite green (MG) exposure in the microalga. MG is a widely used herbicide which in turn may lead to the establishment of detoxification and repair mechanisms. The final objective is to apply this biomarker signature to an in situ monitoring. PBMC proteome has the advantage to be subject to rapid changes in response to external signals and enables regular sampling by a non invasive way. A classic (0.1ppm) dose for therapeutic treatment was applied twice, like Vietnamese farmers application 48h exposure at 10 µg/l and 1 mg/l)  Lymphocytes were isolated from blood by centrifugation and PFOS exposure. For that, we used lymphocyte culture from eel to test the in vitro toxicity of this compound. Exposure time and two sub-lethal concentrations were chosen to avoid cell mortality (80% exposure at 10 µg/l and 1 mg/l). Lymphocytes were isolated by blood centrifugation over a Ficoll/Hypaque gradient. After in vitro contaminations, the post-nuclear fraction was isolated and protein structure forming coevolved peptides within phylogenetic groups. In this context, the aim of this study was to assess the possibility to take advantage of peptidic motifs conserving to propose a transferable method across species. For this, our study focused on three model species for which sequence of egg yolk protein Vg is available: an amphipod, Gammarus fossarum, a cladocerean Daphnia magna and an insect Drosophila melanogaster. In first step, peptidic type Vg were identified for each species. In the second step, we tried to find these prototypic peptides in closely related species, such as G. pulex, G. waartier, D. pulex. This study showed the high relevance of mass spectrometry to propose specific methods for the detection of toxic action of PFOS and of a Vg measurement is transferable from a species to another one from the same genus.

ETO8A-2

The Estuarine Sediment Ecology Array (ESEA): a rapid and comprehensive molecular based approach for environmental monitoring and assessment AA Champion1, L Court2, M Colloff3, M Morgan4, C Hardy5 CSIRO Environmental Sciences, CANBERRA, Australia

Eco- logical assessments of estuarine environments are restricted to the examination of a small number of macrobenthic taxa, providing a narrow view of a system’s true diversity. This is despite strong evidence that many taxa exhibit a direct relationship to estuarine environmental and biogeochemical change and condition. However, their inclusion is generally considered too difficult to be routinely practical. The fundamental approaches for assessing and monitoring sedimentary environments has changed little for many decades. Recent advancements in the molecular sciences provide a unique opportunity to measure and understand biogeochemical complexity at a previously unattainable level. We have developed a novel approach for sediment ecological assessment, the Estuarine Sediment Ecology Array (ESEA). ESEA is a custom-designed microarray which contains phylogenetically diagnostic gene probes which can be used to identify the presence of specific microorganisms and their environmental conditions across species. The underlying approach behind the ESEA is that DNA is extracted from sediments, targeted genes are amplified and hybridized against the array. When the sample’s sequences match those on the array, fluorescence signals are produced and the intensities measured. Each probe set is annotated with taxonomic information, enabling rapid identification of a sample’s biota. Genes used to create the array were derived from a pyrosequencing study of Sydney Harbour and from...
The results revealed marked differences in the biota between the two regions, with higher species richness in the undisturbed site. The ESEA has been calibrated and cross checked using presequenced data derived from the same DNA extracts, with extensive field trials currently being performed. The use of ESEA and other genomic technologies now makes it possible to rapidly and comprehensively examine the biological constituents of an environment at a cost similar to that of traditional taxa focused optical-based techniques.

ET02-8 Applying next-generation DNA sequencing for Biomonitoring 2.0 assessment in a threatened national park (Wood Buffalo, Canada)

M Hübenthal1, B Reiter2, R Ottermanns4, S Rastegar5, G Reifferscheid2, T Braunbeck6, U Strähle5, H Holand contaminated locations. The results revealed marked differences in the biota between the two regions, with higher species richness in the undisturbed site. The ESEA has been calibrated and cross checked using presequenced data derived from the same DNA extracts, with extensive field trials currently being performed. The use of ESEA and other genomic technologies now makes it possible to rapidly and comprehensively examine the biological constituents of an environment at a cost similar to that of traditional taxa focused optical-based techniques.

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ET09-1
Relating field bioaccumulation metrics for chemicals in a benthic and pelagic food web with existing bioconcentration data
Peter van den Brink1, AM Schijper1, S Wijnhoven1, JMV Bevec2
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The current state of bioaccumulation science relies heavily on fish bioconcentration (BCF) test- ing approaches in order to estimate the level of bioaccumulation for chemicals in real organisms in food webs in the field. How similar are BCFs measured in the laboratory to BCFs measured in the field? Predictions of bioaccumulation in the field of xenobiotic chemical substances are based on standard bioconcentration (BCF) tests or estimated using regression equations. How can we best predict the behavior in the field of new chemicals which lack field data so far? How do chemicals partition between water and biota, between biota and air and air are important processes in the understanding of bioaccumulation in food chains and are key to the translation of BCF tests to bioaccumulation in the field. To study bioaccumulation in the benthic and pelagic food webs of the Westerdelta was selected, as this delta is characterized by a large land-based pollutant input. We present here examples of how different chemicals, with a wide range of Kow, Kow, and biotransformation rates, bioaccumulate and biomagnify in the pelagic and benthic food chains within this food web, including an air-breathing top predator species (e.g. D. platanus). The data illustrates the impact of including bioavailability in the water phase on the calculations of bioaccumulation metrics such as BCF as well as the impact of biotransformation on the biomagnifications (BMF) and trophic magnification factors (TMF). First of all, BCF values are subject to variability (due to protocols followed, but also species-specific differences). When the BCF is examined, one can see that soils and sediments, such as PFCa, that the median BCF value is very low (79), however the TMF is >1 in the benthic food web, suggesting biomagnification. The importance of biotransformation as important factor impacting the bioaccumulation of chemicals in a food web was examined in relation to the BCF, BAF BMF and TMFs. Biotransformation can have a major impact on bioconcentration and field bioaccumulation as we have seen in the examples of pyrene and BDE209. This also contributes to a low TMF, trophic dilution. Also, the use of dissolved concentrations for these chemicals was demonstrated to have an impact on the BCF calculated in the field. The food web studies demonstrate several key factors for the interpretation of laboratory and field bioaccumulation metrics.

ET09-2
Reducing uncertainty in risk assessment: lessons learned from studying sediment-associated fragrance materials
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2Research Inst for Fragrance Materials, Woodcliff Lake, NJ, United States of America
3Being able to accurately identify PBT substances is key to protecting human health and the environment. Potential hazards and risks of new and existing chemicals are assessed by regulatory agencies based on their P (persistance), B (bioaccumulation) and T (toxicity) potential, and if a compound is characterized as PBT it may be subjected to regulatory control or further characterization to determine its harmfulness. The focus of this presentation will be on the importance of environmental and physiological factors affecting bioaccumulation, including biotransformation, of organic contaminants in the aquatic environment and thus the importance of these factors for contaminant persistence. Examples will include results from a range of experiments performed in collaboration with the Research Inst for Fragrance Materials (RIFM) using different sediment-associated fragrance materials (FM), sediment-dwelling deposit-feeders and different sediment-associated organic contaminants. The presentation is based on: 1. effects of various organic matter content in the sediment; and 2. impact of species dependent bioaccumulation differences for the fate (accumulation, biotransformation) of sediment-associated FMs. These studies support the conclusion that the materials presented in the examples are not PBTs. Due to their feeding strategy, that involves ingesting massive volumes of sediment, and a digestive system optimized to extract organic material from sediment, deposit-feeders may take up large amounts of contaminants from the gut during feeding. However, since at least some deposit feeders also show high biotransformation capacities, which evidently will reduce the body burden of [B] of organic contaminants, focusing solely on BB will significantly underestimate accumulation and thus increase the uncertainty of e.g., BAF. Benthic communities play an important role both in the remineralization of sediment-associated organic compounds and in other fate processes (biotransformation) there are implications for the way we evaluate the persistence of organic contaminants in sediment. Based on the lessons learned, uncertainty in risk assessment can be reduced by focusing future research on physiological properties that impact accumulation and biotransformation of B and P substances.

ET09-3
Effects of habitat and season on food web accumulation of cadmium to the little owl: a modelling study on field data
W van den Brink1, AM Schijper1, S Wijnhoven1, JM Bevec2
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Little owls (Athene noctua) inhabit different habitats, including floodplains, and have a wide range of potential diet items. However, floodplains are contaminated by legacy contaminants, which may pose a toxicological risk to the little owl. It has been shown that accumulation patterns may differ within floodplains, due to spatial variation in habitat characteristics, soil contamination and the occurrence of prey items. Field observations showed high seasonal variation in the occurrence of prey items, so in addition to spatial variation, contaminant accumulation to the little owl is expected to vary temporally, related to this seasonality in diet composition. Modelled exposure of little owls to cadmium indeed showed considerable seasonal and spatial variation. Calculations of cadmium accumulation showed threshold levels were well below threshold levels. However, due to the seasonal variation in diet composition, exposure levels exceeded the threshold values in both spring and fall for a prolonged period of time. This would indicate risks at those moments, which is in contrast with the conclusion based on the geometric mean value. Especially the fact that the threshold is expected to be exceeded for a prolonged period of time may have consequences for chick rearing. This would have been missed assuming fixed dietary fractions throughout the year, which may underestimate seasonally occurring risks. This presentation illustrates the potential of habitat and season specific food web modelling for more adequate assessments of risks of environmental contaminants to wildlife.

ET09-4
Capacities of phospholipid membrane to accumulate neutral organic chemicals
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2University of Queensland, National Research Centre for Environmental Toxicology, BRIS- BANE, Australia
Lipids have been considered as the predominant components for accommodation of organic chemi- cals in biota. It is a common practice to normalize chemical concentrations in the organism to the total lipid content regardless of the classes of chemicals. However, there are at least two types of lipids that are present strongly in the target organs, storage and membrane lipids. Despite the obvious structural differences between the two types of lipids, their differences in accumulation properties have not systematically been addressed. This study focuses on the equilibrium partition coefficient (Kp) of neutral organic compounds into phospholipid membrane. We critically evaluated literature phospholipid-water partition coefficients (Kpw) for neutral compounds and evaluated methods to estimate Kpw. There was a fairly good correlation between log Kpw and log Kow. Errors were typically up to ±1 log units, although there was considerably larger scattering in the region of log Kpw > 6, due primarily to the too small Kpw values for PCBS from early studies. However, even recent Kpw values measured by polymer-metad-sampling methods exhibited 1-2 log unit differences between PAHs and PCBs of comparable Kow. Alternatively, polyparameter linear free energy relationships (PP-LFERs) were used for both consistency test and Kpw estimation. The PP-LFER fit was well to the collected Kpw data (R = 0.97; standard deviation, ±0.3 log units). In contrast to the Kow model, the recent values for both PAHs and PCBS fit well to the regression equation without any indication of the Hydrophobicity cut-off proposed previously by others. These results suggest using the PP-LFER for Kpw estimation. The efficient assessment of the bioaccumulation potential of chemicals under REACH with integrated test strategies (ITS) is required for the chemical safety assessment (2), which can be supported by the OSIRIS ITS for bioaccumulation will be publicly available (webtool) after further refinement.

ET09-5
Integrating testing strategies (ITS) for bioaccumulation: hierarchical scheme of chemistry-driven and in-silico methods
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2ETH, Zurich, Switzerland
3University of Bern, Bern, Switzerland
4Instituto di Biercehe Faramacologiche Mario Negri, Milan, Italy
5Technical University of Denmark, Kongens Lyngby, Denmark
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7Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany
8Universitat Rovira I Virgili, Tarragona, Spain
9University “Prof. As. Zlatava”, Bourgas, Bulgaria
10National Institute of Public Health and Environment (RIVM), Bilthoven, The Netherlands
The efficient assessment of the bioaccumulation potential of chemicals under REACH with integrated test strategies (ITS) requires multiple tests. Existing data have to be searched and information from chemical structures and physico-chemical properties need to be evaluated prior to considering to conduct in-vivo experiments with vertebrates. The OSIRIS inventory of chemistry-driven and in-silico BCF models for ITS comprises: Sources of existing data, Computational methods, B/nond classification models, DNA, Physiological models, Exposure models, Read across, in-vivo tools, 3R (Reduce, Replace, Reduce) modules The ITS components for bioaccumulation listed in the ECHA Guidance on information requirements and chemical safety assessment (1) have been extended with new knowledge generated in OSIRIS and complemented with feedback from stakeholders on the actual problems in using ITS for chemical registration. The alternative ITS modules share three major objectives to save time and money by reducing the number of experimental animals required to come to a conclusion about the bioaccumulation potential of chemicals under REACH: - Classification of non-B/B/vB-compounds - Omission of BCF studies, that are scientifically unnecessary or technically not feasible - Warning of BCF-studies, that provide no risk relevant information The OSIRIS ITS for bioaccumulation will be publicly available (restricted access only) after further refinement based on stakeholder feedback. Its concepts and modules, as well as validation results, are presented in detail in a dedicated poster corner.

Acknowledgement - This work was supported by the EU 6th Framework Integrated Project OSIRIS (contract no. GOCE-CT-2007-037017), http://www.osiris-reach.eu.

ET09-PS
Poster spotlight: Bioaccumulation measures between lab and field
Hoei-Holst poster highlighting articles TU 217, TU 218, TU 219, TU 220. Antioxidant enzyme activities responses in freshwater biofilm in a metal polluted system - Mercury accumulation in laboratory-reared Chironomus riparius and in indigenous chironomids' assemblages
ET10-1 - Linking chemical residues with biological responses in wildlife

ET10-1 - Fishing for contaminants in McMurdo Sound, Antarctica: measuring physiological responses of PBDE exposure in T. remtomatus bernacchii

Fishing for contaminants in McMurdo Sound, Antarctica: measuring physiological responses of PBDE exposure in T. remtomatus bernacchii

ET10-2 - Exposure to EDCs Disrupts the Expression of cytochrome P450 isofoms of the Murray River rainbow

Exposure to EDCs Disrupts the Expression of cytochrome P450 isofoms of the Murray River rainbow

ET10-3 - A link between environmental contaminants in Southern Alberta Rivers and physiological consequences disrupting reproduction and metabolism in fish

A link between environmental contaminants in Southern Alberta Rivers and physiological consequences disrupting reproduction and metabolism in fish

ET10-4 - Oxidative stress and growth in Alligator Gar exposed to environmentally relevant concentrations of contaminants in fish

Oxidative stress and growth in Alligator Gar exposed to environmentally relevant concentrations of contaminants in fish

ET10-5 - Reduced host resistance against tuberculosis in fish exposed to elevated levels of POPs

Reduced host resistance against tuberculosis in fish exposed to elevated levels of POPs

ET10-6 - EROD activity in peripheral blood lymphocytes as a biomarker of exposure to POPs such as PAHs

EROD activity in peripheral blood lymphocytes as a biomarker of exposure to POPs such as PAHs
non-invasive biomarker of chronic (40-day) dairymain oral exposure to PAHs, using goats as a model species. The second objective of this presentation will be to introduce recent studies achieved on PBL of rats orally exposed to PAHs over a 28-day period, with simultaneous comparison of the EROD activity in the liver and brain. These results clearly demonstrate that EROD activity in PBL can be linearly correlated to EROD activity in the liver and in brain, thus strengthening the hypothesis according to which EROD activity in PBL could be used to prospectively evaluate EROD activity in the liver. This last point is interesting since the liver is the main detoxifying organs.

ET10B-4

Changes in retinoid and thyroid function of peregrine falcon (Falco peregrinus) nestlings relative to brominated flame retardants (BFRs) and other contaminants.

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have shown that early developmental conditions, such as nutrition and contaminant exposure, have significant impacts on future development particularly sensitive to conditions during the nesting period. The objective of this study was to investigate the inter-species differences in CYP1A1 and CYP2B expression and contaminant levels (OCs, PBDEs and PAHs) in three mysticete species, blue whale (Balaenoptera musculus), fin whale (Balaenoptera physalus) and Bryde’s whale (Balaenoptera edeni) of Gulf of California (Mexico) using skin biopsy as diagnostic tools. A suite of POPs and PBDE congeners, ΣPBDEs and ΣPCBs, with ΣPCBs and ΣOH-PCBs negatively correlated with circulating triodothyronine (T3) levels, and positive associations with circulating triiodothyronine (T3) and thyroxine (T4) levels. In the male peregrines from the remote nests, there were higher retinol concentrations in urban nests than remote nests and male nestlings had higher circulating triiodothyronine (T3) levels, and negative associations with circulating triiodothyronine (T3) and thyroxine (T4) levels. In the male peregrines from the remote nests, there were higher retinol concentrations in urban nests than remote nests and male nestlings had higher circulating triiodothyronine (T3) levels, and negative associations with circulating triiodothyronine (T3) and thyroxine (T4) levels. In the male peregrines from the remote nests, there were higher retinol concentrations in urban nests than remote nests and male nestlings had higher circulating triiodothyronine (T3) levels, and negative associations with circulating triiodothyronine (T3) and thyroxine (T4) levels.
Currently OC toxicity on mysticetes (filter-feeding whales) relies primarily on skin and blubber biopsies due to the rarity of standing events of these large, often migratory species. As such, advancements in mysticete toxicology must be underpinned by utilisation of these tissues for further molecular assessments. Glutathione-S-transferase (GST) catalyses the conjugation of glutathione with various xenobiotics and is of interest as a biomarker of exposure. GST activity was measured in skin extracts of 33 individual animals. No significant differences in activity were observed between sexes or between northward (post summer feeding) vs. southward (faster) migration cohorts, although expressed activity was observed to be lower in southward migrating males. This work will provide information on GST levels in the skin, the most accessible tissue, of cetaceans, in order to further assess their suitability as a biomarker of OC exposure.

ET11A-1  Mechanistic modelling for risk assessment: sub-lethal responses and population-level effects

A matter of trust - stakeholders' perspectives on ecological modelling

P Thibault, P Edwards, R Murfitt, J Davies, R Brain, P Sweeney, I Sims, P Hendley

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2University of Brighton, BRIGHTON, United Kingdom
3ET11 - Mechanistic modelling for risk assessment: sub-lethal respon- ses and population-level effects

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considered (survival, growth and reproduction), accounting for daphnid responses to cadmium exposure through threshold stress functions. These models took the exposure pattern into ac-
count, making comparable the results obtained from our two experiments. Contrary to the classical analysis, this modelling framework enabled us to detect an improvement of organism development in flow-through conditions compared to static ones and infer similar sensitivity to cadmium in both exposure patterns.

ET11B-2
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INRA, RENNES, France
It is in the nature of standard ecotoxicological tests that they are as simple as possible. They are generally conducted under standardised laboratory conditions for the species of interest; condi-
tions which have been proven to maintain the species in a good condition. However, what does good condition mean? Since we do not know exactly what the organisms eat in their natural
habitat, and some even change their diet during the life-cycle, it is likely that the chosen food is not optimal for the daphnids throughout the whole life-cycle. How exactly do we investigate in the laboratory toxicity tests, how can we trust our extrapolations to populations in the field?

For ecological risk assessment, it is essential to detect only effects that are caused by the chemi-
cal itself and to exclude other effects following from the experimental conditions. Under food limitation, organisms are stressed, and respond differently to toxicant exposure. Therefore, it is important to closely investigate the organism's food requirements: if the test organisms are stressed due to food limitation, this stress might interact with the effect of the chemical, and lead to an overestimation of the chemical's toxicity. Diagnosing food problems and predicting the in-
teractions between food and toxicants requires a mechanistic modelling framework that explains how food is used to fuel the life-history traits, and how toxicants affect this. We demon-
strate that Dynamic Energy Budget (DEB) theory is very well suited for this purpose. Lymnaea stagnalis, the great pond snail, has recently been proposed as a good candidate species for developing OECD guidelines devoted to the risk assessment of endocrine disrupting compo-
ents. Analysing life-cycle data from L. stagnalis, we detected food limitation in the early juvenile stage for small food laboratory units. In a simulation study with the DEB model, we investigated how an initial food limitation in juveniles affects the interpretation of toxicity data, and distorts the extrapolation of toxic effects to the population level.

ET11B-3
The importance of density dependence and intra-specific interactions in population models for use in ecological risk assessment
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The range of endpoints used to assess the effects of toxic substances in the laboratory cover mor-
ality and reproduction. However, population level processes (e.g. density dependence, behaviourial interactions) may mean that statistically significant effects from laboratory based studies may not necessarily reflect their real-world importance for population abundance and biomass. We have therefore developed an individual-based zebrafish population model using results
derived from a survey of wild fish, semi-natural experiments and meta-analysis data. The model, written in Netlogo (CCL, Northwestern University), mimics a 6m square pond. Zebrafish development is divided into four life-stages (eggs, larvae, juveniles and adults) with life history characteristics altered with each time-step. Density dependence is included for growth, sue-
varial and parametrised from experimental results. Exposure scenarios causing a 10, 50 and 90% decrease in growth rate and fecundity were investigated. Sex ratio scenarios tested for a 10, 30,
70 and 90% proportion of the population developing into males. Each simulation run for 3000
days, resulting in time-scaled growth rates 10 times. Growth and reproduction in sexually dimorphic abundance of mature females (KW, DF = 3, P < 0.001). A 50% decrease in growth rate resulted in population extinction within the 3000 day simulation. Fecundity depression resulted in
significantly increased abundance of mature females in the population (ANOVA F3, 36 = 16/93, P < 0.001), likely caused by increased young survival through density dependent processes at
lower population densities. Sex ratio changes in the hatched eggs resulted in altered sex ratios in the mature population. However, the abundance of mature adults in the population significantly increased with increasing male sex ratio bias (ANOVA F3, 36 = 9,46, P < 0.001), likely caused by the presence of males in each population. Individuals compared with female individuals. In conclusion, firstly, populations are sensitive to changes in the growth rate of individuals, with small reduc-
tions in individual growth rates resulting in large reductions in population abundance. Secondly, fecundity reductions often observed under endocrine mediated effects may be compensated for in wild populations due to density dependence processes. The most promising of fish by endocrine disruptors is commonly found, sex ratio bias is not necessarily a cause for concern at the population level in its own right.

ET11B-4
An agent-based model of woodpigeon populations and its use for risk assessment.
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University of Reading, Reading, United Kingdom
European regulations concerning pesticide risk assessment focus on the protection of popula-
tions [1,2]. However, field experiments to measure this risk are expensive, logistically challenging and involve extensive animal experimentation. Population modelling seems to be one of the best ways to extrapolate the population scale from individually measured effects and data on the
behavioural ecology of the species at risk. Agent-based models (ABMs) that incorporate effects of intraspecific variation and landscape use can minimise the need for animal testing in higher tier risk assessment. In ABMs each individual animal can be modelled separately, and, in contrast to standard population models, one does not need to guesstimate the values of parameters governing population dynamics. Instead the population dynamics emerges from the system in a way that depends on the input parameters describing individuals and their modelled behaviour.

We have developed an ABM of woodpigeon population that can be used for risk assessment of new pesticides. Woodpigeons were chosen because they are an exceptionally vulnerable species, a consequence of their mostly herbivorous diet which is mainly gathered in agricultural terrain. They feed extensively on oilseed rape, sown cereals and leafy vegetables. In the past there have been incidents of woodpigeons poisoning ascribed to pesticide use.

In the model we included life history traits, mating and reproductive behaviour and winter flock formation to simulate the annual cycle of the birds. The rules of daily choice of feeding grounds and type of preferably collected food were also specified. We included the possibility of pesticide application and so can compare its effects on the woodpigeon population. The emergent proper-

References

ET11B-5
Towards good modelling practice: TRACE, a standard for documenting ecological modelling in chemical risk assessment
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USGS/Florida Integrated Science Centers and University of Miami. CORAL GABLES, United States of America
Syngenta, Environmental Safety Jealott's Hill Research Centre, BRACKNELL, United King-
dom
Ecological models are becoming increasingly important in the context of chemical risk assess-
ments. The interaction of numerous factors, and the extent of temporal and spatial scales of concern, empirical approaches often are too limited to inform decisions or regulations that are aimed at the population or ecosystem level. Ecological models have the potential to bridge this gap. However, no general guidelines exist for the development and use of ecological models. Such standards for good modelling practice would be essential for quality assurance of eco-
logical models in the context of chemical risk assessments, and would provide a tool for regulatory agencies to assess the usefulness of models in specific contexts. We present the first step towards the implementation of a good modelling practice: TRACE, a standard framework for the docu-
mation of ecological models and the underlying modelling approaches. TRACE covers model development, evaluation, and application. By providing a document that applies the proposed framework, modelling projects become transparent, and decision makers as well as potential peer reviewers can assess the quality and usefulness of a model for the problem at hand. Thus, the pro-
posal for a good documentation framework is the basis for the compilation of an actual guideline for good modelling practice in risk assessment contexts. Using example models, we will demonstrate how TRACE documents are compiled and evaluated.

ET11B-PS
Poster spotlight: Matrix models vs IBMs for the analysis of life-cycle tests and multi-gener-

cation tests
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First, the spotlight highlighting abstract TH 149, TH 150:
- Analysis of multi-generation data for Chironomus riparius exposed to uranium-spiked sedi-
ments using a DEB based population dynamics model
- Effects of uranium in Daphnia magna exposed over three successive generations: extrapolation
of DEBtox analyses to the population level
- Modelling harpacticoid copepod populations; matrix and individual based modelling

ET12 - Metals and metalloids in the environment: adaptation, bioavailability and speciation

ET12A-1
Key role of the resin thickness on the metal flux and lability degree of complexes measured with diffusion gradients in thin films (DGT)
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3Syngenta, Environmental Safety Jealott's Hill Research Centre, BRACKNELL, United King-
dom
The metal flux and the lability degree in comparison to the values expected when complexes are
covered with a gel layer that defines a diffusion domain. Metal accumulation in DGT devices depends on both the free metal present in the system and the complexes able to dissociate in the time scale of the experiment. A quantitative measure of the complex contribution is the lability degree. The penetration of complexes into the resin layer is a characteristic feature of the DGT devices, expressions reported for the lability of complexes in voltammetric sensors (4) are, in general, not applicable to DGT.

The flux of the free metal by the resin in the layer expands the effective reaction layer, i.e., the layer where there is no dissociation. This extension leads to an important increase of both the metal flux and the lability degree in comparison to the values expected when complexes are not able to penetrate into the resin phase. Experimental results of the Cd NTA system confirm this findings.

The limiting case (where metal concentration in the resin layer is negligible) is used to obtain analytical expression for the metal flux and lability degree. From these expressions, the impact of metal and gel thickness, kinetic constants, diffusion coefficients on the DGT response will be discussed, as well as the environmental implications.

References

ET12A-2
Development of a reliable and robust method for the detection of ng/L concentrations of Lipid - Soluble Metal Complexes in natural waters.
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2CSIRO Land and Water, LUCAS HEIGHTS, Australia
3CSIRO Land and Water, LUCAS HEIGHTS, Australia
4CSIRO Land and Water, LUCAS HEIGHTS, Australia
In natural waters trace metals are present in a wide range of physico - chemical forms or species.
It has been demonstrated that the toxicity of these trace metals to aquatic organisms is related in many cases to the activity of the free metal ion species. However, several studies have shown that the toxicity and bioavailability of Lipid-Soluble Metal Complexes (LMMC), formed by the reaction of metals with natural organic ligands, may exceed that of the free metal ion species. It is generally accepted that a single predicted no effect concentration (PNEC) based on aqueous Se concentrations would not be appropriate for protecting against selenium toxicity in all systems and that selenium requires site-specific risk assessment to a much greater extent than many other contaminants. However, the European REACH Regulation and other regulatory risk assessment methods traditionally require the definition of a single threshold concentration of a substance for each environmental compartment (e.g., water, soil, sediment) based on toxicity data for the most sensitive species and ecosystem. For selenium, such an approach would entail the risk of defining PNEC values within the deficiency range for many systems. Since REACH and similar regulations are pushing the limits with regard to timely submission of chemical safety reports, they also force difficult substances such as selenium to be assessed in a pragmatic way using the scientific knowledge already available. A pragmatic approach for the aquatic and terrestrial hazard assessment of selenium under REACH will be presented and the potential for further refinement will be discussed.

ET1A-2 Determination of free metal concentrations with AGNES-SCP


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2Université de Pau et des Pays de l’Adour, UPPA, France

Selenium is an essential element showing a very narrow margin between dietary essentiality and toxicity. So far, the main focus of the extensive research on selenium has been the environmental fate and effects of selenium in the aquatic environment. The available scientific knowledge indicates that diet is the primary exposure pathway for both aquatic invertebrates and vertebrates and that selenium toxicity is primarily manifested as reproductive impairment in egg-laying vertebrates (fish and birds) due to maternal transfer. The severity of the observed adverse effects appears to be directly related to tissue concentrations than to aquatic concentrations of the element and selenium toxicity seems to be largely species- and site-specific. Therefore, it is generally accepted that a single predicted no effect concentration (PNEC) based on aqueous Se concentrations would not be appropriate for protecting against selenium toxicity in all systems and that selenium requires site-specific risk assessment to a much greater extent than many other contaminants. However, the European REACH Regulation and other regulatory risk assessment methods traditionally require the definition of a single threshold concentration of a substance for each environmental compartment (e.g., water, soil, sediment) based on toxicity data for the most sensitive species and ecosystem. For selenium, such an approach would entail the risk of defining PNEC values within the deficiency range for many systems. Since REACH and similar regulations are pushing the limits with regard to timely submission of chemical safety reports, they also force difficult substances such as selenium to be assessed in a pragmatic way using the scientific knowledge already available. A pragmatic approach for the aquatic and terrestrial hazard assessment of selenium under REACH will be presented and the potential for further refinement will be discussed.

ET1A-5 Effects of chronic nickel exposure on algae, zooplankton and snails in a semi-realistic microcosm

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For decades, a simplistic summation of toxic units based on concentrations of dissolved metals has been used to semi-quantitatively predict the toxicity of metal mixtures. However, that approach tends to over-estimate toxicity. In its place, we have been developing a mechanistic model based on tissue residues of metals and the concept that the toxicity of a mixture of metals can be either dose additive or response additive, depending on the mechanisms of action. To calculate tissue residues and thereby predict toxicity across wide ranges of water quality, we have been developing a multi-metal, multi-biotic ligand model (M4MMS BLM) that concurrently accounts for metal-metal competition for binding on dissolved ligands in the water and at sites of toxicity on organisms. In our initial tests, we exposed Daphnia magna to mixtures of Cu and Zn in microcosms having water containing dissolved organic (DOC; added as Seaweed River fulvic acid) at 3 mg/L, and compared observed mortality to the response-additive mortality predicted from results of Cu-only and Zn-only toxicity tests. This research has revealed several apparent metal-metal interactions that otherwise might lead to conclusions that metals interact in non-additive ways, yet simple geochemical speciation in the BLM can explain these interactions and reconcile the apparent non-additive toxicity. For example, the toxicity of Cu-Zn mixtures always appeared to be synergistic or additive when based on dissolved metal concentrations, whereas Cu-Zn mixtures which were held constant, or vice versa; whereas in the same tests, the toxicity of the Cu-Zn mixtures always appeared to be non-competitive or additive when based on free-metal-ion concentrations. These preliminary results demonstrate that a M4MMS BLM could be an effective tool to help regulatory agencies implement more appropriate methods to regulate metal mixtures than the current default, overly conservative toxic units approach.

ET1A-2 Poster spotlight: Implementation of metal bioavailability in surface water standards

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Water quality standards for silver in Dutch surface waters - A proposal in accordance with the Water Framework Directive

ET1A-1 Hazard assessment of inorganic selenium under REACH: a pragmatic approach

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number of juveniles delivered per female fed with Cd(NO₃)₂ contaminated food was lower than number of juveniles delivered per female fed with Cd(NO₃)₂ contaminated food was lower than the dose present in target analytes (Cu and Zn). Understanding the specification of heavy metals and its relationship with health and environmental risk assessment is an important factor for the soil assessment.

So far, the application of microbial biosensors has relied solely on the extraction of pore water and the subsequent exposure to the test organisms. This fails to consider the complex environment of the soil solid phase which is likely to host most of the labile and bioavailable pollutants and be the more dynamic in both space and time to perturbations. The deployment to soil will be more coupled with an approach such as "rhizon sampler" where the solution will be extracted from the soil and then assimilated onto the solid phase. Therefore, in this study, a range of rhizosphere phase devices were used to assess the reproducibility of given assays and their relationship with aqueous phase assays. In general, the toxicity and bioavailability of heavy metals in solid phase was lower than in aqueous phase demonstrating the need to measure both phases and develop a relationship between them. Toxicity and bioavailability of Pb in contaminated soils was found to be highly correlated, therefore the amount of Pb in soils is a significant predictor of Pb toxicity. Toxicity was measured using Lactuca sativa and the results were compared to Pb toxicity measured using mice.

Future research will consider the bioavailability of hydrocarbons and in addition to assessing its related toxicity. This will be further referred to a reliable method of the potential for biodegradation and bioremediation.

ET12-5

Plant toxicity of 5 years aged Pb salts in soil in relation to recent amendments K Cheyns¹, E Smolders¹, D Delcourt², S Peeters², K de Geyter², J De Backer², A Freitag², P Verheye²

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Lead toxicity data derived from soils freshly spiked with Pb salts may overestimate Pb toxicity under field conditions because of a reduced mobility and lower soil solution toxicity in field conditions compared to Pb toxicity in soils dosed with PbCl₂ only, lead to upper Pb concentrations required to assess the reproducibility of given assays and their relationship with aqueous phase assays. In general, the toxicity and bioavailability of heavy metals in solid phase was lower than in aqueous phase demonstrating the need to measure both phases and develop a relationship between them. Toxicity and bioavailability of Pb in contaminated soils was found to be highly correlated, therefore the amount of Pb in soils is a significant predictor of Pb toxicity. Toxicity was measured using Lactuca sativa and the results were compared to Pb toxicity measured using mice.

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ET12-6

Trace metal fate and uptake by vegetables grown in close proximity to traffic in Toronto, Canada CJS Witzeman

University of Toronto, TORONTO, Canada

Existing knowledge regarding the processes regulating metal bioavailability under natural conditions and their uptake by plants has been identified as a primary limiting factor in the development of reliable soil quality guidelines. Much of the information about metal dynamics in soils, and the role of various physiochemical characteristics incorporated in more advanced fate and transport models has been based on laboratory experimentation via uptake via plant roots, metals dosed with PbCl₂ only, lead to upper Pb concentrations required to assess the reproducibility of given assays and their relationship with aqueous phase assays. In general, the toxicity and bioavailability of heavy metals in solid phase was lower than in aqueous phase demonstrating the need to measure both phases and develop a relationship between them. Toxicity and bioavailability of Pb in contaminated soils was found to be highly correlated, therefore the amount of Pb in soils is a significant predictor of Pb toxicity. Toxicity was measured using Lactuca sativa and the results were compared to Pb toxicity measured using mice.

Future research will consider the bioavailability of hydrocarbons and in addition to assessing its related toxicity. This will be further referred to a reliable method of the potential for biodegradation and bioremediation.

Coastal lagoons with symptoms of eutrophication are often present low oxygenated waters, particu- larly during the night. Under such conditions, sediment could release metals to the overlying water. Consequently, inhabitants organisms may accumulate metals that were provided from the sediment, which could be on the basis of adaptive responses such as those related with the protection against oxidative stress. Keeping this in view, it is relevant to clarify if the macroalgae Ulva spp. (e.g. Ulva lactuca) can be used as an effective and innovative tool to access the toxic effects of metals in the environment and their subsequent exposure to the test organisms. This fails to consider the complex environment of the soil solid phase which is likely to host most of the labile and bioavailable pollutants and be the more dynamic in both space and time to perturbations. The deployment to soil will be more coupled with an approach such as "rhizon sampler" where the solution will be extracted from the soil and then assimilated onto the solid phase. Therefore, in this study, a range of rhizosphere phase devices were used to assess the reproducibility of given assays and their relationship with aqueous phase assays. In general, the toxicity and bioavailability of heavy metals in solid phase was lower than in aqueous phase demonstrating the need to measure both phases and develop a relationship between them. Toxicity and bioavailability of Pb in contaminated soils was found to be highly correlated, therefore the amount of Pb in soils is a significant predictor of Pb toxicity. Toxicity was measured using Lactuca sativa and the results were compared to Pb toxicity measured using mice.

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Future research will consider the bioavailability of hydrocarbons and in addition to assessing its related toxicity. This will be further referred to a reliable method of the potential for biodegradation and bioremediation.
Biofilms’ Cu tolerance levels varied significantly with transplantation: an increase of tolerance was measured for the biofilm T1 transferred upstream (site B1) to up-stream (site A) and a decrease of tolerance was measured for the biofilm T1 transferred downstream (site B1) to up-stream (site A). Moreover, ARESA fingerprints revealed that both bacterial and eukaryotic community structures were impacted by transplantation. Principal Component Analysis of ARESA profiles and bacterial community (AOT) on the one hand and downstream (TA) and upstream (B1) communities on the other hand. The study shows a fast adaptation of both Cu tolerance levels and community structure of biofilms subjected to a drastic change of environmental surroundings by transplantation. Therefore, transplantation has a predominant impact on periphyton both in terms of community structure and tolerance levels. This study confirms that tolerance measurements are sensitive indicators of metallic exposure levels.

ET1C-5
Exploring genomes to understand how populations are shaped by the environment
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Environmental genomics seeks to understand how gene function is influenced by environmental conditions while accounting for variation that exists within and among populations. We apply environmental genomics to link gene-environment interactions to the fitness of individuals and to population and ecological outcomes in natural populations of Daphnia pulicin living near smelters in the Sudbury region of Ontario that have faced severe metal stress for over 100 years. These studies are possible because (1) well annotated genome and transcriptome sequences are available for this species whose ecology is well understood and (2) sophisticated tools for high-throughput biology allow for functional interrogation of the sequence information. We identified genotypes living in lakes from this region that have genetically adapted to cadmium stress. These isolates show no differences in their life history parameters when comparing control and cadmium exposed Daphnia, but they do exhibit differences in carbon allocation to reproduction. We have identified the regions of the CaM gene which is a well known and widely used experimental to investigate parameters of motion and interaction. Within this work we present a general method to analyse FRAP data without using pre-assumptions. We applied the method to artificial datasets as well as real measurements on AhR. The analysis of the AhR basis for gene expression differences, gene copy number was mapped across the entire transcriptome of metal adapted and non-adapted Daphnia and these were compared to the sequenced reference genome. A large amount of copy number variation (CNV) was observed between individuals, including interesting CNV associated to the adapted phenotype. For example, cadmium adapted Daphnia contain additional copies of several genes that result in the increased dosage of transcripts for genes that contribute significantly to the adapted phenotype. These studies which begin to detail the genomic basis for adaptation in natural populations both contribute to and benefit from the Daphnia Genomics Consortium.

ET1C-P5
Poster spotlight: Adaptation reactions to toxic trace metals
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2University of Wisconsin, MADISON, WI, United States of America
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Metabolic adaptation mechanisms related to trace metals have been shown to be important for the survival of both native and invasive species. They are likely to be a major cause of the observed genomic variation in natural populations. However, it is currently unknown how much of the variation in gene expression is due to evolutionary adaptation. We investigated the transcriptional response of the diatom, Thalassiosira pseudonana, to a range of metals as a proxy for the response to heavy metals in the environment. Using a system biology approach, we have been able to identify a number of pathways that are likely to be important for the adaptation to heavy metals. The analysis of the AhR measurements e.g. lead to predictions on concentration- and time-dependent responses of individual daphnids to cadmium, propranolol and dinitrophenol, and in addition we have measured their reproductive fitness (in terms of the number of neonates produced over a 21-day period). Multivariate regression analysis was then used to build mathematical models that can predict the whole animal reproductive fitness from the molecular signatures. In addition, multivariate classification methods were used to find metabolites that could predict the fitness of Daphnia after exposure to the toxicology of these chemicals. Taken together, these findings highlight the genuine possibility that metabolomics can discover biomarkers that provide information on both molecular mode-of-toxicity as well as more ecologically relevant consequences for the whole organism.

ET1C-3
Predicting the reproductive fitness of Daphnia magna from metabolic signatures
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5University of California Berkeley, BERKELEY, United States of America
Molecular biomarkers have considerable potential as diagnostic tools in environmental toxicology and ecological risk assessment. One of the greatest challenges in environmental biomarker research is discovering molecular markers that are truly predictive of whole animal fitness and we have applied this method to a dataset derived from Daphnia Magna. Similar to our previous results in Daphnia Magna and in several other species we were able to identify a number of pathways that are likely to be important for the adaptation to heavy metals. The analysis of the AhR measurements e.g. lead to predictions on concentration- and time-dependent responses of individual daphnids to cadmium, propranolol and dinitrophenol, and in addition we have measured their reproductive fitness (in terms of the number of neonates produced over a 21-day period). Multivariate regression analysis was then used to build mathematical models that can predict the whole animal reproductive fitness from the molecular signatures. In addition, multivariate classification methods were used to find metabolites that could predict the fitness of Daphnia after exposure to the toxicology of these chemicals. Taken together, these findings highlight the genuine possibility that metabolomics can discover biomarkers that provide information on both molecular mode-of-toxicity as well as more ecologically relevant consequences for the whole organism.

ET1C-13
Mapping drug physics:Chemical features to pathway activity reveals molecular networks linked to toxicity outcomes
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1University of Birmingham, BIRMINGHAM, United Kingdom
2University of California Berkeley, BERKELEY, United States of America
The identification of predictive biomarkers is at the core of modern toxicology. So far a number of approaches have been proposed. These rely on statistical inference of toxicity response from either compound features (i.e. QSAR), in vitro cell based assays or modeling profile of target tissues (i.e. expression profiling). We have previously published an analysis strategy that integrates pathway activity indices derived from gene expression data with physico-chemical features (PCFs) derived using QSAR and its application to a rat model of renal tubular degeneration. Our results indicated the importance of signalling pathways in response to chemical exposure. To identify pathways that are important to the response to chemicals we have applied this method to a dataset derived from Daphnia Magna. Similarly to our previous results in Rattus Norvegius, Daphnia Magna also seems to respond to chemical exposure by modulating signalling pathways, suggesting an existence of a general toxicity mechanism, shared between the two different species, in synergy with more individually specific single target based mode of actions.

ET1C-12
A network biology approach to ecotoxicology reveals novel pathways linked to environmental chemicals exposure
F Falciari, TD Williams
University of Birmingham, BIRMINGHAM, United Kingdom
Omics techniques have previously been applied to study marine pollution, but hitherto linkage to health outcomes and prediction of the composition and mechanisms of action of complex pollutant mixtures has been lacking. To address these challenges, we have used a network inference approach to integrate multi-level datasets representing European flounder fish sampled in synergy with more individually specific single-target based mode of actions.

ET1C-3
Modeling spatio-temporal dynamics within living cells
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1University of Birmingham, BIRMINGHAM, United Kingdom
2University of Wisconsin, MADISON, WI, United States of America
Polyaromatic hydrocarbons (PAHs), such as benzo[a]pyrene (BaP) are an important class of environmental contaminants. PAHs are ubiquitous contaminants derived from tobacco smoke, automobile exhaust or incomplete combustion of organic matter in general. They exert a wide range of toxic effects including carcinogenic, immunosuppressive or pro-inflammatory responses. PAHs are known ligands of the aryl hydrocarbon receptor (AhR) signalling pathway. AhR is a ligand activated transcription factor important for detoxification of environmental agents, toxicity, the induction of inflammatory signals or the oxidative stress response. Some central aspects of the AhR signalling pathway are underpinned: contaminants enter the cell, distribute in the cytosol and different cellular organelles and interact with the cytoplasmic AhR. Binding to the AhR triggers translocation of the receptor/ligand complex to the nucleus, the association with the AhR nuclear translocator and the interaction with xenobiotic responsive elements (XREs) at the DNA. This usually leads to enhanced expression of a number of genes, which are presumed to play a major role in deleterious effects of PAHs. In spite of this general knowledge of AhR-mediated signalling, little is known about the dynamic behaviour of AhR upon activation.

ET1D-4
Marine diatom Thalassiosira pseudonana towards a system biology for the water quality assessment
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1EU/JRC/Institute for Environment and Sustainability, ISPIRA, Italy
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Diatoms are eukaryotic algae, living in oceans and freshwaters. They play a key role in the global carbon cycle, contributing to about 25% to the global primary production. Genomics and proteomics tools have been used in the diatom T. pseudonana to study the effects of exposure to common aquatic pollutants. The purpose of such studies is to provide i) system biology approaches to identify the pathways linked to the exposure compound(s), ii) selection of biomarkers of molecular biomarkers of exposure as early identification of water quality endangerment, iii) a more comprehensive substitute to mere water chemical analysis. We designed and customized a DNA Microarray to investigate the gene expression profile in T. pseudonana and used a quantita-tive proteomics approach based on iTRAQ labeling to study the protein expression profile, which are regulated by chemical pollutant exposure. Benzo(a)pyrene, a polycyclic aromatic hydrocarbon (PAH), is one of well-known pollutants widely distributed in aquatic environments and it has been selected for pilot studies using a system biology approach. The diatoms were exposed to Benzo(a)pyrene (BaP) for 15 days and we could link the gene-protein with the physiological state of diatom cells upon exposure to the pollutant. The use of a systems biology approach in diatoms will help to elucidate pathway/molecular processes involved in the mode of action of pollutants and identity molecu-
ET14-6  Distinguishing regulatory and toxic transcriptional signatures of xenobiotic compounds
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Elucidating the transcriptional response of cells to chemical exposure is of primary importance for a reliable risk assessment of xenobiotic compounds like environmental pollutants. However, often such compounds trigger a complex cellular response. Dissecting these responses and identifying the transcriptional profiles associated with each individual (toxic) effect is essential for explaining side effects and predicting toxic responses of environmental contaminants. One of the most studied transcription factors involved in the response to environmental pollutants or xenobiotic compounds in general is the aryl hydrocarbon receptor (Ahr). The Ahr has been extensively studied for its role as a target of thousands of compounds due to its critical role in xenobiotic-toxicity and carcinogenesis. These well described toxic effects of Ahr stimulation are mainly due to the self-induced activation of Phase I/II metabolizing enzymes, creating metabolites mostly responsible for the ultimate toxic response. Using a time series of marine hepatoma cells exposed to the environmental contaminant benzo(a)pyrene (BaP), we investigate the hypothesis whether time resolved transcriptional signatures of genes that are direct Ahr targets differ from the profiles observed for genes responding to the toxic metabolite of BaP (BaP)pyrene diol epoxide (BPDE).

In this setup we demonstrate that machine learning can be used for identifying these characteristic signatures and for subsequently classifying genes as to whether they are direct Ahr-dependent targets or indirectly affected (BPDE-dependent) genes. This is accomplished by training a Random Forest (RF) classifier on the transcriptional signatures between genes responding to B(a)P exposure and secondary effects caused by BPDE. The trained classifier is then applied to all genes found to be significantly differentially expressed in our time series as a result of B(a)P exposure, and their roles as direct or secondary targets are predicted. In addition, the patterns learned by the classifier are used as a basis for performing weighted clustering. Introducing a new clustering approach we were able to reliably separate direct Ahr targets, among them twelve transcription factors, from genes activated due to secondary effects. Distinguishing the transcriptional profiles associated with the primary target effect from those acting in parallel is essential for understanding possible toxic side effects of such chemicals.

ET14-7  Natural toxins in ecotoxicology
ET14-1  Analysis of microcystin algal toxins in Lake Maggiore water (N-Italy) by SPE-UPLC-MS-MS
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Algal blooms can generally occur in nutrient rich calm fresh waters and low salinity marine areas. Usually these blooms form in mid to late summer, and tend to float near the water surface. A special type of cyanobacteria (blue-green algae) can produce toxins, called microcystins, which are cyclic peptides. The most important (most often analysed and found) species is microcystin LR. People (and other mammals) can get sick from microcystin toxins if they have direct contact with a toxic algal bloom by swimming in water, or by having skin contact. Microcystin poisoning can cause breathing problems, stomach upset, nausea, vomiting, diarrhea, headache, fever, allergic skin reactions (a rash), asthma (an attack), and even liver damage.

Lake water samples (400 ml) were extracted by solid-phase extraction (SPE) at neutral pH using Oasis HLB 200 mg cartridges; elution: 6 ml methanol. Analyses were performed by ultra performance liquid chromatography (UPLC) on a 50 x 2 mm, 1.7 um particle size column, and an acetonitrile gradient (see Table 1). Product ion, full scan, and Full Scan-MS/MS were used. Microcystin-LR were detected in all samples at low ng/L concentration levels, with a maximum found at ~ 550 ng/L. In this sample, also microcystin RR and LF were detected. Contamination depends strongly on weather (wind) conditions and currents. No microcystin LR was found in tap water. The formation of microcystin is favoured by high surface temperatures, nutrient-rich (eutrophication) and calm water conditions. In the future, contamination might increase due to changing climatic conditions. More spatially and temporarily spread monitoring and research on other algal toxins is necessary.

ET14-2  Trophic transfer of microcystins from Lymnaea stagnalis (Gastropoda Pulmonata) to Gast- teroecus aculeatus (Edestidae Gastreostiidae) and on the impact on the fish L. artedi, a Pen7, W Sanchez2, C Grizzell3, M Borman4, DW Dietrich5
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Due to eutrophication of freshwaters, the frequency of cyanobacteria proliferations is increasing worldwide. From 40 to 70% of cyanobacterial blooms produce hepatotoxins [e.g. microcystins (MCs)] that end up released in the water during the cell lysis and which constitute a real threat for target organisms as gastropods (intoxication by absorption of toxic cyanobacteria or dissolved toxins). MCs mainly accumulate in the liver (or digestive gland) of metazoans where they interact reversibly (free MCs) or irreversibly (covalently bound MCs) with phosphatase proteins, leading to tissue destruction. We previously demonstrated that the gastropod Lymnaea stagnalis ingested MC-producing cyanobacteria and accumulated free and bound MCs. As bound MCs persisted after a 3-week depuration period and represented up to 90% of total MCs, L. stagnalis is poten-

ET14-3  The invasive Dreissena polymorpha better adapted to cyanotoxin exposure than the native Unio tumidus
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2University of Southern Denmark, ODENSE, Denmark

The invasive Dreissena polymorpha with high filtration activities may accumulate cyanobacteria and their toxins during cyanobacterial blooms and lys. Physiological adaptations to cyanotoxins enable organisms to live in cyanobacterial contaminated waterbodies. In contrast to U. tumidus, the invasive D. polymorpha seems to be a more sensitive species able to develop sustainable population in contaminated waterbodies. The population of Unio- nae is endangered by water pollution, shoreline construction and competition with D. poly- morpha. Competition is for food, as the habitats are different: the unionids need soft sediment, whereas D. polymorpha attaches to any kind of hard substrate, including shells of unionids.

This study compares the two species with regard to their detoxification capacity for microcystin, the most common cyanotoxin in freshwater. A first aim was to correlate the detoxification attempts to the physiological costs for the organisms. For this, the activities of biotransformation enzymes were compared between U. tumidus and D. polymorpha. The enzymes of interest are the GST (glutathione-S-transferase) and catalase and energy reservoirs (glucogen-, lipid- and glutathion content) were compared in the invasive D. polymorpha and the native U. tumidus in response to cyanotoxin exposure (10 and 50 µg-1 microcystin- LR) for 24 h and 7 d.

Especially activities of D. polymorpha were measured in whole mussel tissue, digestive gland and gills. Energy reserves were measured in whole mussel tissue. Enzyme activities and energy reserves of U. tumidus were measured in digestive gland, gills, mantle and foot. The GST activities were increased for the whole exposure period in D. polymorpha but didn’t changed in U. tumidus. The catalase activity was not affected during the whole period in both species. The glycogen content decreased after 24 h in both species indicating the energy requirements due to the stress caused by the MC-LR exposure. We conclude that D. polymorpha is capable of detoxification of MC-LR, but at expense of energy. The results suggest that U. tumidus is less able to detoxify MC-LR because transformation enzymes GST and TRAP are much lower compared to D. polymorpha. There was an enhanced requirement for energy as indicated by reduced glycogen contents in both mussel species. Compared to U. tumidus the invasive D. polymorpha seems to be better adapted to cyanotoxin exposure.

ET14-4  The use of single ecosystem function for a sustainable removal of cyanobacterial toxins from water
L Gomera-Oliva1, S Pflugmacher2
1Berlin Institute of Technology, BERLIN, Germany
2Catalysis of cyanobacterial blooms is a worldwide problem due to the eutrophication of water bodies. Most of the cyanobacteria known today are producing toxins, from which the microcystins are the most toxic. Over 70% of the known microcystins are known to be potent inhibitors of protein phosphatase 1 and 2A and also known to be tumor promoters. During senescence of cells the toxins are released into the water in high amounts. The microcystins itself are very stable molecules and highly persistent in the water (Krause et al. 2004). In many countries, namely the semi-arid and arid zones, freshwater lakes are used for aquaculture, turf irrigation of agricultural plants and also as a source for drinking water (Nimpfisch et al. 2008). There are several studies on how to remove cyanobacteria respectively their toxins from the water. Some of these studies are using clay particles, or hey bale to get rid of the cyanobacte- ria. In most cases the toxins itself stay in the water body.

The aim of our research is to identify and use single ecosystem functions, which can help in remedia- tion of cyanobactoins from lake water in a sustainable way. The single ecosystem function are e.g. the biology of aquatic macrophytes and their ability to take up toxic substances.

ET14-5  Occurrence of biotoxins in mussels from different coastal locations and risk management DF Hansen1, L J Lacroak2, U Uorhol3
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2Friedrich Schiller University, JENA, Germany
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The nutrient-rich Red Tide is an ecological and economic problem concerning aquaculture and tourism in the coastal areas world wide. The neurotoxic, immunotoxic and genotoxic effects of domoic acid produced by the diatom Pseudo-nitzschia multiseries and saxitoxins (STX) paralytic shellfish poisoning-PSP produced by Alexandrastella catenella and Alexandrastella ostenfeldii. In addition the Baglella Dinophysis acuta produces the Diarrhetic Shellfish Poisoning (DSP). The need for increasing quality control at different critical steps of the food production chain has to be addressed by developing a set of rapid biomarker and sensor systems.

ET14-PS  Poster spotlight: Natural substances - new emerging contaminants in our environment
ET14-PS  Poster spotlight: Natural substances - new emerging contaminants in our environment
Poster spotlight highlighting abstracts: TU 267, TU 248, TU 249:
- Toxicological effects of cyanobacterial toxins: effects of eutrophication and climatization
- Acute and chronic toxicity studies from Cereus jamacaru ethanol and aqueous extracts
- Identification of Protein Biomarker(s) Associated with Pacific Ciguatotoxin (P-CTX-1) Exposure in Fish (Epinephelus coioides)
- Effects of combined mixture of microcystin-LR and cyrindrospermopsin on the growth of Chlorella vulgaris

ET16  Soil ecotoxicology and quality assessment

SETAC Europe 21st Annual Meeting Abstract Book 61
Effects of slurry from sulfadiazine (SDZ) treated pigs on the microbial communities in rhizosphere soil
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The present work showed that several sub-individual biomarker activity can be used as early warnings for Environmental Risk Assessment. In this study, earthworms of the species Eisenia andrei were exposed for 10 and 28 days to different sub lethal concentrations of Bravo's P(0) [1.0, 10, 50 mg/kg] and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (1x10^-4, 1x10^-5, 2x10^-3 mg/kg) mixed into a standard arthritic soil. The selected P(0) and TDCC concentrations were, beginning with the lower ones, repeated five and 20 times higher respectively. The level of DNA damage, using the Comet assay, was assessed in earthworm coelomocytes. Taking into account the relevance in assessing the chromosomal damage to provide evidence of fixed lesions to the genetic material, in the same cells, the induction of cytoplasmic micronuclei (MN) was also studied by cytochemical staining of DNA by the fluorescent dye DAPI. MN were scored according to standardized criteria. In addition, the presence of the contaminants in the earthworms was investigated by chemical and immunohistochemical analyses. Crystalline tissue sections were reacted with specific anti-B(0) and TCDCC antibodies. The results showed that, although no effect of the mortality was found, the Comet and MN assay were able to reveal genotoxic effects. Also, and in particular, the two lower concentrations of the chemicals used, induced, just 10 days after the exposure, both DNA and chromosomal damage in earthworm cells. In the treated animals, the immunohistochemical staining revealed the disappearance of the pollutants both in the nuclei and with different intensities. In this work we demonstrated that the Comet assay and MN test in E. andrei coelomocytes should be considered sensitive biomarkers of genotoxicity within an environmentally realistic range. The use of immunohistochemistry for detecting environmental contaminants like B(0) and TCDCC is valuable in interpreting a potential risk of the presence of the chemicals in the organisms and the occurrence of toxic/genotoxic effects and in addressing chemical analyses in greater depth.

Biomarkers acetylcholinesterase (AChE), lactate dehydrogenase, glutathione S-transferase, and glutathione peroxidase in earthworms exposed to sulfadiazine and co-applied with nutrient sources like manure, are increasingly reported to change soil microbial communities, which is dependent on matrix of contamination (e.g. sludge or metal solution). Investigations on soil compaction focused mainly on effects on soil physical parameters and on soil organisms (soil fauna, soil microorganisms) and biologically driven processes in soils (e.g., plant growth). Nevertheless, a substantial number of papers deal with effects of soil compaction on the structural diversity of microorganisms in rhizosphere soil. The aim of this study is to evaluate the biomarkers activity and energy reserves content in a long-term exposure to the pesticide dimethoate, followed by a recovery period. Organisms were exposed to soil contaminated with dimethoate in concentrations of 0.4 mg/kg soil (real case scenario) and 10 mg/kg soil [below EC50 value], plus a control. Replicates of 5 animals were collected at time 0, 7, 14 and 21 days. Periodic experiments were conducted along with energy content (lipids, sugars and proteins), energy consumption and cellular energy allocation were measured. As expected a strong inhibition was observed in acetylcholinesterase as the main target of the pesticide. Although a previous study had stated that organisms have low survival chances under neurotoxic regimes i.e. where AChE inhibition is higher than 80%, we observed a 7 day survival period with AChE inhibitions higher than 90%. Other biomarkers as lipid peroxidation presented significant differences when compared with the control where periods with high mortality rates were counted. Energy reserves content, energy consumption and cellular energy allocation rate significantly fluctuated along time exposure and recovery. The results show not only correlations between several biomarkers, the energy reserves and mortality, but also with other detoxification processes not related to neurotoxicity. The present work showed that several sub-individual biomarker activity can be used as early warnings for Environmental Risk Assessment, and that sub-individual effects can be linked with ecologically relevant parameters (e.g. mortality and energy reserves content).

Biomarkers and energetic reserves in isopods: the effects of long-term exposure to metal- and metal-splited soils. Does earthworm activity influence those changes?

The aim of this work was to evaluate the biomarker activity and energy reserves content in a long-term exposure to the pesticide dimethoate, followed by a recovery period.
HM01-5
Towards the phytoremediation of mining explorations - a NATO SFP project
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In different NATO and Mediterranean Dialogue countries the mining exploration was or still is, an important economic activity. Along with it, is left a legacy of contamination problems resulting from the exposure of the population to contaminated compounds, mainly from aquatic, terrestrial and human health. This Science for Peace NATO project gathers Ecotoxicologists, Microbiologists, Molecular Biologists, Chemists and Plant Physiologists to develop and improve eco-friendly techniques for the remediation of contaminated sites in Tunisia, Morocco and Portugal. More specifically, it intends to implement and optimize the phytostabilisation of metals and radionuclides based on the knowledge attained from plant-bacteria interactions in each country area. The first attempts regarded the application of a risk assessment framework to establish priority areas for further phytostabilisation testing. Secondly, different strains or endophytic and rhizospheric bacteria from native plant roots collected in contaminated sites. Those strains have been characterized through the use of molecular techniques. The next step is to inoculate the roots of small planflets from selected species with bacteria endophytes and assess their ability to promote plant growth in contaminated soils, under greenhouse and in situ experiments. For that, it is also needed the assessment of plant species that could grow under such contaminated sites, in order to be a successful target for using in the phytoremediation process. The present communication aims to perform an overview of the project goals as well as to explain the experimental steps done so far and the preliminary results obtained.

HM01-6
Characterizing contaminant residuals from environmental dredging using chemical and biological metrics
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Environmental dredging is ongoing in the United States for managing contaminated sediments. However, post dredge contaminant concentrations in surface sediment are difficult to predict prior to initiating dredging actions. In some cases, post contamination concentrations have been higher than anticipated concentrations. This research focused on parameters to characterize post dredge residuals and develop an approach to predict post dredge residual contaminant characteristics and concentrations. In Northeast Ohio on Lake Erie, the Ashtabula River was contaminated by a number of industrial sources over years of runoff and discharges. In 2006-2007, 1.1 miles of the river was dredged under US Army Corps of Engineers regulation and landfilling. In 2007, the study was presented on the approaches evaluated to characterize the post dredge residuals. Several approaches were evaluated to quantify and characterize the residuals remaining in two distinct dredge areas, dredging to soft sediment and dredging to bedrock. Comparison will be made between the two areas dredged, as well as evaluation of the methods for the dredge material characterization. Biological indicators of system wide recovery will also be presented in relation to the dredge residuals.

HM02-1
Impact and remediation of wastewater

HM02A-3
Nematode remediation efficiencies in wastewater treatment plants: residence time distribution as a guiding principle for sampling strategies
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Nematodes are important indicators in the assessment of environmental conditions in wastewater treatment processes (WWTP). Most investigations on the latter rely on 24 h composite samples and the mean hydrie time distribution (MTD) is used as time offset to match influent and effluent loads. However, disregarding the mixing regime characteristics in evaluating xenobiotic removal performances may lead to biased estimations or even negative mass balances. This study aims to develop an approach to estimate xenobiotic remediation efficiencies from monitoring data the hydraulic residence time distribution (HRT) in WWTPs into account. For this purpose, a completely mixed tanks-in-series model was used to address hydraulic mixing regimes in a Luxembourg WWTP. Emission predictions of the WWTP were validated with
measured diurnal effluent data for the pharmaceuticals carbamazepine and diclofenac as well as for full-scale mass balancing at the selected WWTP was determined to be a coverage of 3–4 days in the inlet and a single day sampling at the outlet. This constellation allowed to capture more than 83% of the incoming water under realistic conditions. Due to the influent variability elimination rates of less than 5–10% are probably impossible to track in full-scale investigations.

**HM02A-2**

**Restricted elimination of the non-ionic surfactant TMDD in WWTPs**

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2,4,7,9-tetramethyl-5-decyn-4,7-diol (TMDD) is a non-ionic surfactant that has been found in different rivers in Germany with concentration up to 4.25 µg/L. The compound is a high production volume chemical which is used in diverse applications such as colours, inks, adhesives and coatings but until now the sources of TMDD in the aquatic environment are unknown. Waste-water treatment plants (WWTPs) were suggested to be the dominating sources for TMDD in rivers, but information about its treatment in WWTPs are available so far. Therefore, detailed sampling campaigns at a WWTPs in Germany were carried out. The results indicate that TMDD is introduced by the sewage with loads fluctuating between 10.1 g/d and 1142 g/d and it is discharged with effluent loads between <0.01 g/d and 641 g/d, which is about 10 times lower than the loads on the influent side. The diurnal effluent data for TMDD in the studied WWTPs varied between 33% and 68%. The elimination rates in each treatment stage of one WWTP were also determined. The results indicate that TMDD in preferably degraded in the biological stages under aerobic conditions.

**HM02A-3**

**Distinct transformation pathways of opium alkaloids in biological wastewater treatment**

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The transformation of natural products such as opium alkaloids might undergo distinct transformation pathways in sterile (autoclaved) and non-sterile sludge suspensions. The development of a sensitive analytical method for the quantification of several TPs of codeine and morphine was elucidated using batch experiments with activated sludge. The complementary use of high-resolution mass spectrometry (HR-MS) and nuclear magnetic resonance (NMR) allowed for the identification of several up to now unknown transformation products (TPs). In total, chemical structures of 18 TPs of codeine, morphine and 2 TPs of didehydromorphine and hydrocodon were proposed. Elucidation of the transformation pathways in sterilized (autoclaved) and non-steril sludge suspensions revealed that the transformation of codeine and morphine is characterized by a variety of chemical (non-enzymatic) and biological (enzymatic) reactions. The development of a mathematical method for the quantification of several TPs of codeine in wastewater enabled to confirm the results from the batch experiments can be transferred to full-scale WWTPs. The results of the study indicate that structurally closely related compounds such as the opium alkaloids might undergo distinct transformation pathways and that this is mainly due to the importance of initial chemical reactions when predicting the transformation pathways of organic micropollutants in biological wastewater treatment.

**HM02A-4**

**Are organic micropollutants more bioavailable in wastewater than common models predict?**

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The fate of micropollutants within the aquatic environment is influenced by their interaction with dissolved organic carbon (DOC). Only the freely dissolved concentration is bioavailable, while the concentration of micropollutants associated with DOC can be underestimated in literature studies. Many studies have focused on reference or natural DOC as a surrogate, very little is known regarding micro-pollutant interaction with wastewater derived DOC. An understanding of this interaction is important as there is increasing interest in recycling tertiary treated effluent for non-potable and potable uses. The objective of this study was to evaluate the interaction between reference and wastewater derived DOC for moderately hydrophobic micropollutants. For the most hydrophobic compounds, such as benzo[a]pyrene, sorption to wastewater derived DOC was over 1000 times lower than to reference DOC. The interaction of the estrogenic micropollutant nonylphenol with wastewater derived DOC was not observed in the earlier stages of a wastewater treatment train was studied, but little difference in Koc was observed. Analysis of the studied reference and wastewater derived DOC revealed that they have very different properties due to their different origins. The wastewater derived DOC was less aromatic and had a lower molecular weight due to retard biodegradation whilst operational. In this study the feasibility of employing a sequential ozonation and activated carbon filtration revealed a significant reduction of in vivo non-specific toxicity compared to the untreated water. The results demonstrate that effluent treatment wastewater achieved an overall improvement in biodegradability (BOD5/COD increased from 0.160 to 0.538) with 92% and 85% reduction in COD and TOC respectively.

**HM02B-1**

**Optimisation of Fenton reagents using central composite design for hybrid treatment of recalcitrant metal-working fluid wastewater**

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Disposal of operationally exhausted metal working fluids (MWF) biologically is an attractive option, since it is effective and has low energy demands. However, it is enormously challenging since the MWF are chemically complex mixtures, which are additionally toxic, which can be reduced by ozonation and activated carbon filtration. This compound is biodegradable and the transformation of MWF is desirable in the implementation of toxicity-based discharge limits in Korea. In addition, both the lethal and sublethal toxicity tests should be used to evaluate the impact of low levels of toxicants in chemical effluents.

**HM02B-2**

**Ozone and activated carbon treatment of sewage effluents: toxicity removal vs. toxicity formation**

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Ozonation and activated carbon filtration provide effective barriers to a wide range of organic pollutants and can thus reduce the emission of hazardous contaminants via sewage treatment plant effluents. However, concerns arose about potential hazardous oxidation products occurring as by-products of ozonation. Consequently, the objective of this study was to investigate the removal and degradation of endocrine activity, genotoxicity and cytotoxicity of wastewater are effectively reduced with ozonation and activated carbon filtration, indicating the removal/degradation of causative contaminants. A consistent mutagenicity increase after ozonation confirms the formation of causative contaminants. A consistent mutagenicity increase after ozonation confirms the formation of causative contaminants.
Biodegradation of non-steroidal anti-inflammatory drugs (NSAIDs) and their non-halogenated analogs using batch reactors.

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The non-steroidal anti-inflammatory drugs (NSAIDs) have received considerable attention by the scientific community due to frequent detection in monitoring surveys on sewage-impacted surface waters, associated with high consumption rates and low removal efficiencies during conventional wastewater treatment. During conventional wastewater treatment, the fate and behaviour of NSAIDs depend on the nature of the drug and are highly influenced by the process that takes place in the wastewater treatment plant (WWTP) or in activated sludge treatment plant (AST). In WWTPs, the drugs may be subjected to biodegradation. In ASTs, the degradation process is not very efficient.

Adding microorganisms (MWs) can increase the biodegradability of NSAIDs. However, adding MWs to wastewater is not always practical due to the high concentration of the compounds and the small surface area.

The use of biodegradation tests in batch reactors loaded with mixed liquor demonstrated that degraded faster than DCF. After one day, 50% of AP (228 Da) and 65% of DCF (296 Da) were identified as the formation of one transformation product was confirmed. Structure elucidation by mass spectrometry of organohalide and aromatic hydrocarbons such as benzo(a)pyrene (BaP) at background sites. In Germany, these measurements are performed in the air pollution monitoring network of the German Federal Environment Agency (Umweltbundesamt, UBA). Additionally, these monitoring efforts are coordinated with the European Monitoring and Evaluation Programme of the UN-ECE (EMEP).

The UBA monitoring programme includes other persistent organic pollutants like polychlorinated biphenyls (PCB) or organochlorine pesticides. Their routine determinations started in 2007. Here, we will look back at 5 years of POP air monitoring in the UBA air quality network, focusing on an overview of the ambient air concentrations of selected POPs at four rural background monitoring sites in Germany (Zangst, Westerland, Schausinadruck, Schmucke) and discuss them in terms of temporal and spatial variations. Challenges and difficulties encountered during the monitoring programme will be presented in the discussion.

Global-scale passive air sampling of existing and emerging chemicals under the GAPS Network: Recent progress and application of the ‘integrated approach’

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The Global Atmospheric Passive Sampling (GAPS) Network is the only global-scale program for comprehensive, continuous collection of atmospheric data for several classes of priority chemicals including polyfluorinated chemicals (PFCs), siloxanes, alternative flame retardants and current-use pesticides (CUPs).

A pilot study completed in 2009 tested a new type of PUF sampler that is impregnated with a phytocidal filter. This type of filter has contributed to a ‘integrated approach’ to understanding chemical sources, fate and transport. This involves integrating measurement data with transport models and emissions inventories.

In 2010, a new type of PUF sampler that is impregnated with a phytocidal filter was released in its 6th year and has generated the first ever global data set of POPs in air with seasonal resolution. This includes polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs, e.g. a-HCH, g-HCH, chlordane, endosulfan). The availability of this type of data has contributed to a ‘integrated approach’ to understanding chemical sources, fate and transport. This involves integrating measurement data with transport models and emissions inventories.

SM Shvedov, Y Su1, H Kau1, Pelli (2009) developed the concept of the GAPS Network using polyurethane foam (PUF) disk samplers. This device has been in use for 6 years and has generated the first ever global data set of POPs in air with seasonal resolution. This includes polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs, e.g. a-HCH, g-HCH, chlordane, endosulfan). The availability of this type of data has contributed to a ‘integrated approach’ to understanding chemical sources, fate and transport. This involves integrating measurement data with transport models and emissions inventories.

Assessing emerging organic pollutants in air in the Canadian Arctic and the Great Lakes regions

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HMO3-4

Effect of the soil amendments activated charcoal, biochar and compost on desorption and biodegradation of phenanthrene

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3Soil and groundwater remediation is aimed at reducing levels of pollutants to below regulatory thresholds. Polycyclic aromatic hydrocarbons (PAHs) are an important class of soil pollutants. Often, a large portion of the PAHs are degraded by soil microorganisms within short times (< 100 days), and this is often followed by slower degradation, resulting in a non-degradable residual fraction. Soil amendments such as activated charcoal (AC), biochar and compost can reduce the aqueous concentration of PAHs. On the one hand this might limit the bioavailability and uptake by organisms leading to reduced toxicity, but on the other hand this might also decrease biodegradation. This study investigated the abiotic desorption of 9-C phenanthrene, as a model PAH, from the three soil amendments, and compared this to the biodegradation of the sorbed phenanthrene. This study has shown that the abiotic desorption of phenanthrene from the soil amendments in different sterile aqueous solutions (MilliQ water, fertiliser and broth) to an infinite silicone sink was measured. The total amount of phenanthrene desorbed was 12 ± 4% for AC, 66 ± 8% for biochar and 98 ± 2% for compost, with higher desorption being observed in AC. This was compared to the biodegradation of phenanthrene sorbed to the soil amendments in fertiliser and broth by Spingomyelum sp (DSM 12247). Phenanthrene was completely degraded in all the soil amendment suspensions, and the total amount mineralized was 43 ± 7% for AC, 50 to 82% for biochar and 56 to 74% for compost, with higher mineralization in the presence of fertiliser. Therefore, a low abiotic desorption of phenanthrene (as with the AC) does not lead to a low biodegradation. Our results suggest that adding soil amendments to contaminated soil can reduce phenanthrene mobility without affecting the biodegradation and mineralisation.

HMO3-5

Twenty years of monitoring of persistent organic pollutants in the United Kingdom: sources, fate and trends

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The Centre for Chemical Management (CCM) in Lancaster, under the support of the Department of the Environment, Food and Rural Affairs (DEFRA) has been running a long-term monitoring program in the UK called TOMPs (Toxic Organic Micro Pollutants), since the beginning of the 1990s. In the frames of this project, air samples (gas and particulate phases) have been extracted from a number of urban and rural/semirural areas and analysed for PCBs, PAHs, PCBDFs and PBBs. The occurrence of the aforementioned chemicals throughout these two decades, the changes in their levels and their fate are investigated. Various widely accepted tools like the PAH molecular diagnostic ratios, isomers and congeners profile analysis and other statistical approaches are used to reveal sources and seasonal variations. The atmospheric concentrations are compared with existing emission inventories and the latter are evaluated. The results throughout these two decades are absolutely comparable, because the same methods/techniques have been used and clearly these results constitute one of the longest time series ever published.

HMO3-PS

Poster spotlight: Monitoring POPs in different matrices

A Katsoyiannis, R Gioia, AJ Sweetman, KC Jones
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The Centre for Chemical Management (CCM) in Lancaster, under the support of the Department of the Environment, Food and Rural Affairs (DEFRA) has been running a long-term monitoring program in the UK called TOMPs (Toxic Organic Micro Pollutants), since the beginning of the 1990s. In the frames of this project, air samples (gas and particulate phases) have been extracted from a number of urban and rural/semirural areas and analysed for PCBs, PAHs, PCBDFs and PBBs. The occurrence of the aforementioned chemicals throughout these two decades, the changes in their levels and their fate are investigated. Various widely accepted tools like the PAH molecular diagnostic ratios, isomers and congeners profile analysis and other statistical approaches are used to reveal sources and seasonal variations. The atmospheric concentrations are compared with existing emission inventories and the latter are evaluated. The results throughout these two decades are absolutely comparable, because the same methods/techniques have been used and clearly these results constitute one of the longest time series ever published.

HMO4-1

PAH extraction recovery from granular activated carbon

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River and marine estuarine sediments are rich in a variety of hydrophobic organic compounds (HOC), which are persistent and tend to concentrate as they further proceed in the food chain. Currently, a new risk based approach accomplished by measures of freely dissolved pollutants in the pore water is in focus of international research. It has been shown that the fraction of HOCs that desorbs sufficiently fast and equilibrates to the freely dissolved concentration in the pore water is more relevant for risks to aquatic biota, than the total concentration in the sediment. In the past years many studies demonstrated the potential of activated carbon (AC) amendments for sediment associated organic pollutants and thus availability reduction. Whereas active charcoal has extensively been used in bedded sediments, not that much attention has been dedicated to granular activated carbon. We therefore conducted experiments where GAC was used to concentrate aqueous phase PAHs from sediment-water slurries. Polluted GAC was further used for testing different solvent (mixtures) and extraction techniques for the recovery studies of bound PAHs.

HMO4-2

Sampling rates when measuring gas phase POPs air concentration with passive air samplers

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Black carbon occurs naturally in soils, and certain types of engineered carbons, such as biochar and activated carbon have been used as amendments for sediment associated organic pollutants and thus availability reduction. Whereas the total concentration in the sediment is in focus of international research, it has been shown that the fraction of hydrophobic organic compounds (HOC) that desorbs sufficiently fast and equilibrates to the freely dissolved concentration in the pore water is more relevant for risks to aquatic biota, than the total concentration in the sediment. In the past years many studies demonstrated the potential of activated carbon (AC) amendments for sediment associated organic pollutants and thus availability reduction. Whereas active charcoal has extensively been used in bedded sediments, not that much attention has been dedicated to granular activated carbon. We therefore conducted experiments where GAC was used to concentrate aqueous phase PAHs from sediment-water slurries. Polluted GAC was further used for testing different solvent (mixtures) and extraction techniques for the recovery studies of bound PAHs.
and activated carbon, have been considered for their potential to enhance soil fertility or reduce the bioavailability of soil contaminants. While adsorption of hydrophobic compounds to black carbon has been studied intensively, little attention has been paid to ionizable compounds which are common among the myriad of natural and synthetic compounds that come into contact with soil. We studied the sorption of cinamonic and cinnamic acid anions by commercial biochar products. These compounds belong to the class of plant root exudates known as organoanions, a group of compounds that play important roles in agricultural and ecological dynamics as allopathic agents. Their structures also represent some of the aromatic substructures of humic and fulvic acids, which are well known to adsorb to black carbon surfaces. Cinammonic and cinnamic acids (pKₐ 4.4 and 4.7, respectively) are appreciably ionized in soil pore water at ordinary pH values. We focused on conditions favoring the anion. Sorption in phosphate-buffered systems at pH 6.9 was highly nonlinear and trended with the specific surface area of the biochar. Sorption is remarkably strong: the Kd (Cs/Cw; L/kg) values, which ranged from 500-40000 depending on biochar and phenolic acid concentration, are several orders of magnitude greater than the corresponding calculated octanol-water partition coefficient (Kow) of the organoanions (0.38 and ~0.1 L/L, respectively). Sorption was unaffected by Ca²⁺ or Mg²⁺ up to 0.1 M, ruling out an influence of surface charge or the involvement of bridging of carboxylate groups by metal ions. Ionization in pH 7 and 8 systems diverged as phenolic acid loading increased, the non-buffered showing reduced sorption relative to the buffered system. Accompanying loading in the absence of buffer is an increase in the pH, indicating that adsorption of the phenolic acid takes place predominantly with the release of hydroxide ions into solution: RCO₂⁻ + H⁺ + BC → RCO₂⁻ + BC + OH⁻. This represents a novel mechanism for sorption of carbonate ions and has significant implications for natural and synthetic entities (molecules or substructures) having an intermediate in primary (e.g., 3.8). A possible driving force is the hydrophobic effect of the unassociated acid, which may be strong enough to overcome the unfavorable energy required to ionize water.

**HM04-6**

How to model the sorption affinity of cationic organic compounds in natural water matrix?

**NTi Droog, KN Goss**

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Using highly constrained simulated data sets for 70 compounds, we examined how the molecular structure of organic cations affects the sorption affinity to natural organic matter (NOM). Positively charged organic compounds, such as cationic surfactants, fluorescent (proline) or methamphetamine, are sorbed to negatively charged sites in NOM. This sorption process occurs mainly through electrostatic interactions with other sorbed cations and anions. Previous studies and our recent work showed that the affinity of organic cations for NOM increases (i) with salt concentration decrease, and (ii), for organic cations with larger nonpolar side chains. Thus, the ion-exchange affinity of organic cations on NOM involves both ionic and non-ionic interactions. A significant model is highly desirable to predict the influence of ionic and nonionic interactions from the molecular structure. Testing sorption at controlled pH and ionic strength creates constant influence of ionic interactions. Remaining differences between organic cations will then be related to differences in nonionic interactions. The successful outcome of this project is a new modelling framework for metals, which is consistent, generic framework for adjudicating chemical hazard with a view to addressing the criticisms raised for metals.

**LC01A-1**

Fate modelling of chemical compounds with incomplete data sets

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Impact assessment of chemical compounds in Life Cycle Impact Assessment (LCIA) and Environmental Fate and Exposure Assessment (EFAS) requires a vast array of property data for the complete set of chemicals being assessed. These data are used in multi-media fate and exposure models, to calculate risk levels and other indicators. ERA typically addresses one specific chemical, but in an LCIA, the number of chemicals encountered may be quite high, up to hundreds or thousands. This study explores the development of meta-models, which are supposed to reflect the "true" multi-media fate and exposure model in an approximate way. The idea is that not all data needed in a multi-media fate and exposure model are completely independent and equally important, but that there are physical-chemical and biological relationships between sets of chemical properties. A statistical model is constructed to predict sorption, and to provide simple rules for the more complicated "real" model relationships. In the presented study two approaches for the reduction of the data demand associated with characterization of chemical emissions in USEtox are tested. The first approach is a meta-model set of mode of entry specific meta-models with a data demand of app. 63% (5/8) of the USEtox characterization model. The second yields a simplified set of mode of entry meta-models with a data demand of 7% (3/6) of the original model. The results of the study indicate that it is possible to simplify characterization models and lower the data demand of these models applying the presented approach. The results further indicate that the second approach relying on 75% of the original data set provides the meta-model sets which perform almost as well as the original model. An overall assessment from the 75% data demand meta-model sets, is that except for fat factors covering the route from soil emission (natural and agricultural soil) to aquatic compartments, good correlation with the predicted fat factors (derived from the meta-models) and the observed fate factors (modeled in USEtox) are obtained. The regression coefficients obtained for the predicted fate factors plot close to the observed fate factors, excluding the fat factors covering the route from emission to soil to aquatic compartments, were all in the range of 0.68±18.8 R² ±0.970

**LC01A-2**

Variability and spatial distribution of chemical's removal rates: implication for spatial resolution within Life Cycle Impact Assessment

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Spatial differentiation is a topic of increasing interest within Life Cycle Impact Assessment (LCIA). A key issue to be addressed in the LCIA methods, models and corresponding characterization factors is the level of spatial detail required and uncertainties related to the use of generic characterization factors in the exact location of the activities is unknown. For ecosystem and human toxicity impact categories, some preliminary evaluations were done in order to assess the relative influence of substance properties and environmental parameters on the variability in the fate of chemicals in air, water and soil. In this work a methodology was developed as a guideline to derive appropriately spatially explicit and context-specific impact assessment of chemicals. The methodology was tested on a set of 34 representative organic chemicals, clustered according to their physical and chemical properties. The test set included account chemicals having a large diversity of properties in order to be representative, as far as possible, as well as their potential differences in the environmental fate.

**LC01A-3**

Development of a new modelling framework to address issues of metal fate and effects in aquatic systems

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Life Cycle Impact Assessment (LCIA) models currently estimate fate and toxicity assuming that all dissolved metal species are equally bioavailable and can cause toxicity in ecological receptors. This treatment of metals, similar to organic chemicals, introduces a significant error mainly because of metal speciation and non-degradability that affect their bioavailability and fate. The goal of our research was to incorporate an accurate set of aquatic and terrestrial sub-processes into a consistent, generic framework for assessing aquatic metal toxicity.

**LC01A-4**

Comparison of metal toxic impacts between aquatic and terrestrial organisms: is the free ion concentration a sufficient descriptor?

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Characterization of metal toxic impacts in comparative risk assessment and life cycle impact assessment (LCIA) should take into account metal speciation and interactions with soil/water/organic constituents, because these mechanisms control metal bioavailability and may influence their toxicity. In a comparative context we are faced with the need to characterize thousands of substances, but the limitation of the available data calls for reliable indicators suitable for extrapolation from the limited data that is available. Indeed, free metal ion concentration has in some cases been shown to be a sufficient indicator of metal toxicity for both aquatic and terrestrial species. With the aim of deriving extrapolations to predict terrestrial toxic impacts of metals from aquatic effect data, we compared copper toxicity of aquatic organisms with that of terrestrial organisms, testing the hypothesis that the free metal ion is an appropriate "general" descriptor of metal toxicity.

Results for 128 laboratory tests on Daphnia magna exposed to copper ions (Cu²⁺) in water show that variation of several orders of magnitude are observed between the toxicity tests. These variations may be the result of the inability of the free metal ion concentration to reflect toxicity, as the partitioning effects and other factors that complicate the use of free metal ion concentration to affect the toxicity of copper to D. magna. Similar patterns, albeit with smaller variations, are observed for terrestrial organisms. Up to three orders of magnitude difference occur for the extreme case of barley (Hordeum vulgare).

Given the scarcity of terrestrial effect data compared to aquatic data, reliable and transparent, mechanistic-based predictions of terrestrial toxic impacts from aquatic effect data would be an important step ahead in the context of LCIA or comparative risk. Here we demonstrate that the overall ability of the free metal ion to reflect toxicity of metals for aquatic and terrestrial organism is limited. This has consequences for potential terrestrial toxic impacts are based on extrapolations from aquatic data, because the use of more sophisticated models such as the Biotic Ligand Model (BLM) would be required. However, extrapolation models based on an improved free ion approach might still be a good proxy, particularly when the comparative nature of life cycle assessment is taken into account.

**LC01A-5**

Including ecotoxic effects on warm-blooded predators in life cycle impact assessment

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In life cycle impact assessment (LCIA) of ecotoxicity the focus is on cold-blooded species. This paper describes a method to calculate Characterization Factors (CFs) for the assessment of potential toxic impacts of chemical emissions on warm-blooded predators in freshwater food.
The method was applied to 329 organic chemicals. The CF for warm-blooded predators was calculated. The developed methodology for a site-specific impact assessment of primary impacts is tested on groundwater bodies. The so-called zone classification is based on a classification coefficient alpha and requires categorical, is a first approach for a scientific question that was raised in the 90's. It has important implications for assessing impact of entropic activities on water bodies, both from the quality aspect (i.e. aquatic ecosystems, eutrophication), but also from a quantity aspect. However, the number of environmental indicators considered by decision makers is often limited, leading to the avoidance of important environmental issues. In order to reduce the number of environmental indicators related to freshwater impacts, the Water Impact Index: a "stand-alone" metric for assessing impact of entropic activities on freshwater resources has been developed. This indicator accounts for the reduction of freshwater availability for different users (both humans and ecosystems). For any product or process, the physical water balance is weighted by a quality index and a water stress index. This methodology is applied with a Life-Cycle thinking, taking into account both direct and indirect water uses of any process. As an example, the impacts of municipal solid waste management facilities during bioremediation of chlorinated ethenes, of which particularly vinyl chloride is problematic due to its toxic and carcinogenic effects. In this study, the assessment of local toxic impacts with the US-EPA model was therefore combined with site-specific reactive transport modeling of the contaminant mass discharge to groundwater. The exposure via contaminated groundwater was subsequently estimated using exposure parameters representing the local groundwater body. The developed methodology for a site-specific impact assessment of primary impacts is tested on two different continental scenarios, characterized by different climates and ecosystems: the Kumasi basin in Ghana and the Hoh Xil basin in Tibet. The choices of impacted zone and of chemical pathways are discussed with the aim of meeting conceptual requirements: local parameters must be sufficiently detailed in the majority of cases, but generic enough to avoid time consuming researches. The availability of data is also discussed as well as the possibility to include indirect impacts, not directly related to a specific system. The conceptual frame suggested for classification of pollutants into emission-based impact categories, is a first approach for a scientific question that was raised in the 90's. It has important implications for terms of data collection, system boundaries, and only practise will show its actual feasibility.
Life Cycle Sustainability Assessment of multifunctional land-use systems: a consequential Life Cycle Assessment

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The assessment of material use and availability is of major importance to secure future resource supply, especially with regards to rare raw materials. In the past, resource concepts, resource questions are of increasing relevance as supposedly scarce metals are used. So far, the utilization of resources along the life cycle of vehicles is assessed with indicators like primary energy demand and abiotic depletion potential. However, these indicators are usually dominated by the usage of fossil energy carriers. Materials which are commonly perceived as critical, like rare earth metals or lithium, do not contribute to the results of these indicators in a noticeable manner. The reason for this is that indicators like abiotic depletion potential only focus on geological extraction - reserve - ratios and partly use rather theoretical stocks like ultimate reserves (total material stock in the earth crust). Hence, they deliver no conclusion about the real availability or criticality of metallic resources.

In this work we introduce a new area of protection, the economic material availability. Several geological and economic criteria are identified and selected according to their potential and dominance for quantifying economic material availability. Different options for assessing these indicators are modeled and tested with regard to their usefulness and applicability within life cycle assessment.

In order to illustrate the effects of the new area of protection and the corresponding indicators, a comprehensive case study is accomplished. The life cycle inventory of a product from the automotive industry is assessed by means of conventional abiotic depletion potentials and the newly developed economic material availability indicators.

Social LCA of an ecolabeled notebook

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The demand for electronic products increases continuously, especially portable devices as laptops gain in popularity - irrespective of their impacts on environment and society. Computers are very complex products with global value chains: They are assembled in Asia, pre-products come from Southeast Asia, China, Japan, or the Phillipines, raw materials originate from all over the world. In addition, the majority of e-waste is recycled illegally in Asia or Africa. Strong competition moves the production of electronic devices and modules to low-wage countries with low environmental and social standards, thus notebooks cause along their life cycle many negative environmental and social impacts.

The presentation will focus on a study where we analyzed social, socio-economic, and also environmental impacts of an ecolabeled notebook of the Taiwanese company ASUSTek, over its entire life cycle. The study was conducted from June until October 2010. The social and socioeconomic impacts were modeled by means of the method of Social Life Cycle Assessment (SLCA), according to the UNEP/SETAC guidelines for S-LCA of products. The newly developed methodological sheets for the S-LCA method were considered as well.

We present our modeling results for social and socio-economic indicators / subcategories / stakeholders framework developed for the S-LCA, data sources for supply chain modeling and for assessing social and environmental impacts, practical problems in the modeling process, solutions, and also lessons learnt from the case study.

Considering methodological aspects is rewarding as we have conducted one of the first real social LCAs for social LCA; we will therefore report "how it was to apply the method". Little explanation is probably needed on why it is interesting to look at the outcomes of the case study. With a consistent consideration of social and environmental impacts of a notebook over its entire life cycle, we should be able to show hot spots for the environment and regarding social and environmental impacts that are related to the notebook. The study is also able to relate social benefits to environmental impacts. We will therefore present results of the case study, and of recommendations that can be derived, on a policy, company, and private consumer level.

Societal perspective in S-LCA: a parallel to welfare maximisation in economic theory

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Social life cycle assessment (S-LCA), as defined in the UNEP/SETAC Guidelines [1], is increasingly emerging as a method for evaluating social performance of products/systems. The framework, which follows the LCA structure closely, does not pose limitations on the possible applications that might range from products to complex systems (e.g. single technologies or systems like waste management systems, etc.). The assessment is conducted from the perspective of different stakeholders, whose relevance is determined by the object and goal of the analysis. However, some critical points have been identified when the framework is applied to the evaluation of a (new/innovative) technology; what perspective should be adopted and, consequently, how the most appropriate indicators are identified. In most applications, a company perspective is normally at the core of the method. Social impacts in S-LCA are related to the way a specific company manages social aspects of concern. Preliminary discussions by the authors highlighted that a company perspective should be left aside in favour of a societal one when a technology is the object of the analysis. The societal perspective should consider how the adoption of the technology would affect the social structure in which it will be embedded. To characterize the different perspective, the definition of a new stakeholder is proposed, which has foundations in economic theory.
...demands on land to feed a growing population adequately, sustain biodiversity and ecosystem services and mitigate climate change, there is a clear need for a systematic basis for allocating land use with respect to economic and environmental objectives.

This study formulated an integrated environmental and economic assessment of the global consequences of changing current land use in UK with different land-use strategies for food, feed, fibre, fuel and carbon sequestration. Novel operational approaches are proposed for resolving methodological issues, and are applied in the characterisation of the main land-use strategies in the UK: diversification, intensification and extensification of existing cropland; and expansion onto set-aside and grassland. 224 scenarios were devised to reflect the different uses of the considered crops: which included high and low yield crops, and were linked to the climate (set-UCLC) effect. The results indicate that diverting food to either feed or fuel generally does not deliver improve-ments in all three criteria (i.e. of mitigating climate and biodiversity impacts, while creating extra economic value), but generally results in greenhouse gas (GHG) emission savings, mainly due to indirect land use change (ILUC) effects. Intensification in all land uses almost never saves GHGs. Conversely, extensification in all land uses almost always saves GHGs, but results in higher impacts to ecosystems. Expanding arable crops onto grassland nearly never results in GHG savings, and only a few combinations of crops on set-aside will save GHGs. Only some scenarios present Pareto improvements. Forestry crops always perform well. With very few exceptions, it is best to leave grassland untouched. Expansion onto set-aside is undesirable by arable cropping, but desirable by energy and forestry crops. The former are best used for electricity whereas the latter as carbon sinks, even though no economic value is generated in the foreground system.

LC03-1 Increasing robustness of LCA methodology

LC03-1 Development of product category rules for a sector environmental product declaration
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Systems for Type III Environmental Product Declarations (EPDs), relying on LCA methodology, are gradually becoming more known and operational on the market. Many industrial associations have started to grow into “sector-type EPDs” in contrast to product specific EPDs. For this reason, the International EPD system introduced a new feature, i.e. the Sector EPD. This tool shows a sort of average environmental profile of the product, based on the typical processing adopted in the local context and representative of the production offered by the sector. For this application specific Category Rules (i.e. definitions of substances to be included in the LCI) are issued to ensure comparability among different declarations within the same service group. The aim of the present study is to describe the particular choices in the development of PCRs for a Sector EPD applied to cement production, as a case study.

PCRs 2010/9 has been developed in order to define the requirements, based on environmental parameters, that should be considered in the LCA and EPD for the production of cement. The document was issued in an open and participatory process between companies and organizations having good knowledge of the specific environmental issues related to the cement production process.

Since the EPD is a concise document that outlines a simple profile of the environmental performances of a product, including objective, comparable and credible data, the definition of an appropriate methodology must be performed with particular rigour. The process of development of the Sector EPD has been performed using the Category Rules (i.e. definitions of substances to be included in the LCI).

This new method called ESPA is a first step to create LCA results which can be used with spatially resolved impact analysis factors. This new method called ESPA is a first step to create LCA results which can be used with spatially resolved impact analysis factors. This new method called ESPA is a first step to create LCA results which can be used with spatially resolved impact analysis factors. This new method called ESPA is a first step to create LCA results which can be used with spatially resolved impact analysis factors. This new method called ESPA is a first step to create LCA results which can be used with spatially resolved impact analysis factors. This new method called ESPA is a first step to create LCA results which can be used with spatially resolved impact analysis factors.

The method can work with different level of precision on the spatial and temporal information. This method can work with different level of precision on the spatial and temporal information. This method can work with different level of precision on the spatial and temporal information. This method can work with different level of precision on the spatial and temporal information. This method can work with different level of precision on the spatial and temporal information.

Poster spotlight: How to communicate LCA results?

Poster spotlight highlighting abstracts TU 267, TU 268, TU 269:
- The translational roles of LCA studies and practitioners
- The EPD approach as meeting point between robustness and communicability of LCA studies: the certification of an internal LCA process
- How potential carbon policies could effect producer grain cultivar selection: a LCA analysis of USA rice
- Accuracy vs. robustness: challenges of including LCA into legislations/standardization schemes and which might be compared in the future to real world observations first at Pressure level and then at State level by using appropriate models.

LC03-5 Re-engineering LCA for simplicity and flexibility
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With the recent availability of the ecoinvent 2 data format it has become possible to realise the full potential of the design strategy for enhanced flexibility which was proposed by Widema (2003). This design strategy has now been applied to the ecoinvent database, resulting in an LCI database with comprehensive coverage and full flexibility for different applications, for example attributional models with any desired allocation key, and consequential models with any desired level of con-strains. At the same time, this design flexibility leads to a reduction in the efforts needed for the maintenance of the database, since allowing many different models to be constructed from the same basic unlinked unit process datasets means that only one dataset needs to be maintained for each unit process, and the maintenance of each dataset can be made independent from the main-tenance of all other datasets. Flexibility and simplicity are therefore not contradictions but rather simultaneous results of the new design strategy. The philosophy behind the strategy is explained and several details of the technical implementation are described.

Poster spotlight: How to communicate LCA results?

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- Accuracy vs. robustness: challenges of including LCA into legislations/standardization schemes and which might be compared in the future to real world observations first at Pressure level and then at State level by using appropriate models.

LC04-1 Consequential LCA, attributional LCA and scenarios
B. Heijungs
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Consequential LCA (CLCA) has become a popular mode of LCA modeling. Starting from the
because the beginning of this century it has significantly grown in number of case study applications. The search term “consequential” yields for the International Journal of Life Cycle Assessment 77 hits. Now, at SETAC Europe 2011, there is a separate theme “Life Cycle Inventory modelling and attributional/consequential issues (LCI)”. This paper discusses the role of scenarios in relation to LCA, consequential or attributional. In doing so, we will focus on the LCI phase. CLCA builds upon CA consequences, linking systems from product bottom-up. Consequences of the process world in terms of displaced land, water, energy, production, etc. are all modelled from a single product’s perspective. Upscaling the results of bottom-up CLCAs independently is very likely to give inconsistent and impossible results. We therefore argue that such bottom-up scenarios may not be the best way to quantify direct and indirect effects for product systems related to main sustainability (transformation) processes like energy, land use, water and material/energy uses, transport systems etc. For these problems, it might be more appropriate to develop top-down sce- narios (from global scenarios to product consequences, e.g., from global energy scenarios to single product consequences). Research in this area still needs to be developed further. Some first (incomplete) examples of top-down scenario approaches for LCA are provided.

LC02-8 European energy policies analysis with general equilibrium model GTAP in a consequential and prospective life cycle assessment framework

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1CIRAG, MONTREAL (QC), Canada
2National Council for Air and Stream Improvement, MONTREAL (QC), Canada
3Consequential life cycle assessment (C-LCA) has been developed to study environmental consequences caused by changing energy scenarios and demand have been used to assess expected consequences of life cycle marginal changes on economic systems. This study, C-LCA approach has been applied to a large system of life cycle models that capture significant variations over 2 decades: economic consequences on world markets of a bioenergy policy applied inside the European Union (EU) between 2005 and 2025 have been modelled with general equilibrium economic model GTAP. Environmental impacts of EU bioenergy policies have been compared to a situation where an EU business as usual energy policy was applied. This study has potential impacts associated to the variation of production caused by EU bioenergy policy on each economic sector in all regions of the world (indirect impacts) and potential environmental impacts attributed to EU energy production (direct impacts) have been calculated. Direct and indirect environmental impacts have been expressed for each 5-year period, per region and per economic sector. Results show that, at world scale, over the whole period, EU bioenergy policy and its indirect consequences would cause fewer impacts on human health, resources and climate change than the base situation but damages on ecosys- tems would be much more important. As expected, coal and wood sectors are significantly affected by EU bioenergy policy. Indeed, the use of the wood products is reduced and substituted coal in electricity generation. During 2005-2010, benefits of the EU bioenergy policy for human health, resources and climate change are balanced by rebound effects, especially in the fuel extraction sector. Sensitivity analysis shows that macroeconomic parameters (gross domestic product, population, capital, labor force) and technology innovation used as inputs in the GTAP simulations are quite sensitive parameters that affect the results of the study. This highlight the necessity to develop methods to manage uncertainty related to the use of prospective data and economic model.

LC03-1 Operational LCA guidance for fuel cells: methodological challenges

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3PE International, STUTTGART, Germany

The main critics addressed to LCA are the lack of robustness, which affects the comparability among different studies on the same product, and the complexity of the method, which hampers its applicability in the industrial context. The subjectivity linked to the methodological choice (e.g., allocation, system boundary definition, modelling, etc.) is still a large agreement, not only in the LCA community, that companies need tailor-made provisions and data, which support a life cycle analysis in the sector of interest. In order to meet this urgent need, the JRC-IES has recently published the International Reference Life Cycle Data System (LCD) Handbook that offers a step-by-step guideline for LCA practitioners. However, the Handbook is applicable to a wide range of different decision contexts and sectors and therefore needs to be translated to product-specific criteria, guidelines and simplified tools to foster LCA applications in the industry sector. This paper aims at describing a sector-specific operational guidance document on the product group: “Hydrogen and Fuel Cells” (HFCs), highlighting the fuel cell part. The Cells and Hydrogen Joint Undertaking (FCH) of the European Commission fund this work, as part of the project FC HYGuide. The approach, “translating” the general ILCDF-Hanbook into a tailor-made guidance document, is introduced, showing main methodological aspects choices that have to be addressed.

LC04-4 Electricity trade analysis and marginal technologies in consequential LCA: the case of Que- bec’s Hydropower in the Northeastern American Market (2006-2008)

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1CIRAG, École Polytechnique de Montréal, MONTREAL (QC), Canada
2CIRAG-HEC, MONTREAL (QC), Canada

Establishing valuable data on marginal energy production technologies is of vital importance in consequential LCA (C-LCA). In electricity production studies, coal or natural gas are often assumed to be the marginal technology because of generally not publicly available specific information due to its strategic value. Moreover, marginal technologies are not static and change as a function of time due to electricity market price and fuel market price volatilities. In the absence of full-dash information, a procedure to estimate the marginal energy production technologies as a function of time is crucial for more accurate C-LCA results. The objective of this study is to illustrate the usefulness of the electricity trade analysis in identifying a complex set of hourly marginal technologies and providing reliable data to future C-LCA studies. To achieve this objective, this study focuses on the province of Quebec (Canada), which exports hydroelectric power to its Northeast American neighbors (New Brunswick, New England, New York and Ontario). Over the period 2006-2008, Quebec hourly exchanges of electricity with its adjacent jurisdictions are examined as they increase or decrease their local productions. Moreover, up- and downscaling marginal electricity production technologies. Capacitated and validated using the Quebec hourly output per power plant and information released in the Quebec adjacent system operator reports. Results show that marginal electricity production is characterized by a complex set of technologies used to meet the demand hour-by-hour and not solely by one typical marginal technology (i.e., coal or natural gas). Also, according to our approach, the percentage of hours when hydro- power, coal, natural gas or oil are designated as the marginal technology differs on a yearly and jurisdiction basis. These results are crucial to methodological discussion on the identification of the marginal electricity production technology, as it is the case for C-LCA in connection to electricity. In conclusion, the use of electricity trade analysis as part of the consequential LCA methodology is a cornerstone for establishing, on a yearly average basis, valuable data on the marginal electricity technology, as it is the case for Quebec adjacent markets. I. If even in some cases, such as Ontario, five-minute data would be available, the time unit used was the hour because it is the minimum length at which all data are available.

LC04-5 Electricity trade analysis and marginal technologies in consequential LCA: the case of Que- bec’s Hydropower in the Northeastern American Market (2006-2008)

MB Amor1, PO Pineau2, C Gaudreault3, R Samson1
1CIRAG, MONTREAL (QC), Canada
2National Council for Air and Stream Improvement, MONTREAL (QC), Canada
3Consequential life cycle assessment (C-LCA) has been developed to study environmental consequences caused by changing energy scenarios and demand have been used to assess expected consequences of life cycle marginal changes on economic systems. This study, C-LCA approach has been applied to a large system of life cycle models that capture significant variations over 2 decades: economic consequences on world markets of a bioenergy policy applied inside the European Union (EU) between 2005 and 2025 have been modelled with general equilibrium economic model GTAP. Environmental impacts of EU bioenergy policies have been compared to a situation where an EU business as usual energy policy was applied. This study has potential impacts associated to the variation of production caused by EU bioenergy policy on each economic sector in all regions of the world (indirect impacts) and potential environmental impacts attributed to EU energy production (direct impacts) have been calculated. Direct and indirect environmental impacts have been expressed for each 5-year period, per region and per economic sector. Results show that, at world scale, over the whole period, EU bioenergy policy and its indirect consequences would cause fewer impacts on human health, resources and climate change than the base situation but damages on ecosys- tems would be much more important. As expected, coal and wood sectors are significantly affected by EU bioenergy policy. Indeed, the use of the wood products is reduced and substituted coal in electricity generation. During 2005-2010, benefits of the EU bioenergy policy for human health, resources and climate change are balanced by rebound effects, especially in the fuel extraction sector. Sensitivity analysis shows that macroeconomic parameters (gross domestic product, population, capital, labor force) and technology innovation used as inputs in the GTAP simulations are quite sensitive parameters that affect the results of the study. This highlight the necessity to develop methods to manage uncertainty related to the use of prospective data and economic model.

LC04-6 Poster spotlight: Further on LCI methodology (discussions)

Poster spotlight highlighting abstracts WE 226, WE 227, WE 228, WE 233:
- Decision contexts, application contexts, and LCI modeling approaches
- Inclusion of land use changes in LCA on bioenergy: parameterization of land use change pat- terns and international organisations as well as for strategic decisions of companies, where the relative economic size of the object of investigation is medium. The consequential approach is of relevance for policy support of govern- ments and international organisations as well as for strategic decisions of companies, where the relative economic size of the object of investigation is large. The European attributional and deci- sional electricity supply mix causes greenhouse gas emissions of 554 kg CO2 eq./kWh and 473 kg CO2 eq./kWh, respectively. The criterion “relative economic size” helps to decide on the appropriate LCI model to be applied for the decisional context of studies. The delimitation values quoted (0.1% between 0.1 % and 1 %, 1 % respectively) are still preliminary and show a certain degree of ambiguity. Ne- vertheless, the criterion proves to be both practical and potentially relevant. The case study of the European electricity mixes shows that a distinction of different decision contexts is required and feasible. It is recommended to apply the “relative economic size” criterion in the goal and scope phase of any LCA.
footprint perspective

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As water resources are unevenly distributed and, in some regions scarcity and droughts are in- creasing both in frequency and intensity, concerns about them are also becoming more and more important in the political agenda. In this context, the United Nations Environment Programme (UNEPP) as part of the UNEP’s umbrella project entitled “Water Footprint, Neutrality and Ef- ficiency” (WiFNE) is addressing the growing need to further enhance water efficiency and to improve water quality more holistically, by applying harmonized concepts in water-intensive industries and water-affected areas especially in the developing world. The objective is to improve water governance through the engagement of the public and private sectors (business and industry, including financial services) in collaborative work with UNEP. In the same line, develop- ments and discussions on the water footprint indicator are being held under different forums, such as the UNEP-SETAC framework for life cycle impact assessment, the Water Footprint Network and the ISO 14046 Water Footprint Initiative Subcommittee. Traditionally, governments responsible for water resources management have targeted their poli- cies towards direct water users (such as farmers, industries and households). Recently, however, it has been shown that this approach is limited. Indirect water users and managers, such as final consumers, retailers, traders and all sorts of businesses active along the supply chains of final consumer goods remain out of the scope of governmental policies aimed at mitigating water scarcity issues. The current approach, however, is ultimately linked to final purchase by consumers. It is therefore interesting to analyze these new multi-sectoral policy aspects and multi-actor approach that have the potential to contribute to a better management of water resources.

LC05A-3

Life Cycle Assessment as a decision support tool in the waste management sector: a critical review

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The purpose of the paper is to present the most recent studies, published in the leading scientific journals, concerning with the application of the Life Cycle Assessment methodology in the solid waste management sector.

First of all, there is an introduction of the current trends of the life cycle analysis in this field, coming from a detailed survey on the LCA studies published in the last five years in the main scientific journals dealing with LCA methodologies and waste management.

The methodology to describe, for each article, the aim and purpose, the chosen approach, the data and models used, the results obtained and finally the conclusions. For a greater clarity the literature review is made by dividing the LCA studies into different areas: studies of the solid waste management in a broader sense, studies on thermal treatment of waste, studies of specific fractions of waste and studies related to specific processes. After a presentation of the main common characteristics of every category of articles, a summary is given in order to highlight some common suggestions in the conduction of a life cycle assessment study, coming from this analysis, according to the different aspects: typology of the study (namely if it is a system approach, case study or analysis) and study purpose (avoided impacts approach, hypothesis and assumption, data) and results (including the main remarks coming from the life cycle assessment).

As a final point, the literature review allows pointing out that conducting a LCA study in the waste management sector is a true challenging task and complex, because of the complexity of the systems and the different aspect that have to be taken into account. To conclude some remarks are given on how to perform an LCA study in this sector, with regard to the system boundaries (need to include as much operations as possible, namely, collection, transport, storage, typology of data), (data prefer site-specific data, including a waste analysis in different times during a year in order to define a medium composition), functional unit (which should be accurately defined in accor- dance with the scope of the study, considering the possible future variations), hypothesis (which should be accurately defined in relation to the National unit), the quality of the data and finally methodology (optional step in LCA phase, sensitivity analysis, including economical considerations).

LC05A-5

LCA software in the analysis of municipal waste treatment technologies

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Due to the multidisciplinary character of the LCA it has already been successfully applied in different areas of waste management. One of the publications shows that LCA is a well-known and well-tested method used also for the purposes of municipal solid waste (MSW) management. Within the last years there has been a number of LCA software e.g. EASEWASTE, ORWARE developed to calculate potential emissions within the waste management systems or chosen waste management technologies and to define the environmental impacts of the analysed systems or objects.

The study did not intend to compare MSW management scenarios but only specific landfill and incineration technologies. The analysis was performed within the defined system boundaries and based on the chosen functional unit and with a use of three LCA software: GaBi, SimPro and EASEWASTE.

The aim of the work were to perform: 1) an analysis of chosen incineration plants and a landfill site, 2) a comparison between the analysed objects (MSW management technologies), 3) a comparison of different software used for calculation of the environmental impacts of MSW technologies. The results show that landfilling of MSW has a higher potential environmental impact than in- cineration. Additionally, the calculations that base on the same system boundaries and input data but obtained with alternative LCA software give different values, but keep the same evaluation of impacts.

LC05A-6

A comparison among different Automotive Shredder Residue treatment processes

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About 10 million tonnes of waste are generated in Europe from ELVs management chain every year. Currently, 80% of the ELV total weight is recycled during the end-of-life treatment phases, namely: pre-treatment, dismantling, and shredding phase. The remaining 20% is called Auto-

motive Shredder Residue (ASR) and at present it is disposed in landfilling in most European Countries. The complexity of ASR composition, due both spatial and temporal variations, as well as the different source materials shredded (i.e. vehicles and white goods) puts several limits over material recycling processes. ASR valorisation treatments are necessary according to the limit of 13 MJ/kg stated for waste disposal by the Directive 1999/31/EC. Furthermore, the Directive 2005/33/CE (55% recycling of C4 and 95% recovery rate).

The reduction of the current percentage by recovering materials and energy is thus a major chal- lenge for European Community.

In this study a comparison among five ASR management strategies is carried out with a characte- rization and a quantification of environmental impacts related to each scenario investigated by means of a Life Cycle Assessment (LCA) approach. These scenarios (landfilling, landfilling after nonferrous metals removal, incineration, mechanical recycling and gasification) have been com- pared according to the functional unit of 1 ton ASR. According to transparency requirements for the sources of data in LCA studies, LCIA 2015 (55% recycling of C4 and 95% recovery rate). The results show that industrial processes aimed at matter recovery are the options that can ob- tain greater environmental benefits compared to present practices. A sensitivity analysis by Monte Carlo model approach has been applied in order to evaluate on statistical basis the result. Further im- provements will be achieved only by integrating end-of-life treatments into eco-design strategies aiming at a more efficient separation of high value-added materials such as plastics and metals, and leading to a reduction of waste outputs from ELVs management chain.

LC05B-1

Seven barriers to reliable life-cycle assessments for biofuels

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To address energy security and climate-change concerns, substitutes are needed for petroleum- based transportation fuels. In selecting transportation fuel alternatives to petroleum, policy makers need information to support timely and effective decision-making. In their efforts to provide this information in a reliable and timely manner, life cycle assessments face a number of barriers. Here we identify and discuss seven barriers that must be addressed in applying LCA to effectively assess the relative sustainability of biofuels as liquid transportation fuels. These barriers include (1) understanding farmers, feedstock options, and land use; (2) mapping out biofuel production technologies and practices; (3) characterizing use-phase emissions and their health consequences; (4) addressing spatial heterogeneity; (5) accounting for time in allocating impacts; (6) assessing transition pathways as well as end states; and (7) confronting uncertainty and variability. Recogniz- ing LCA as a process and not a product is key to meeting these challenges. Barriers to LCA arise because many stakeholders expect LCA to provide a clear and final answer “the truth”. This serves only to highlight the flaws and uncertainties of LCA and fails to take advantage of the true power of LCA as an ongoing process that organizes both information and the process of priori- tizing information needs. Addressing the world’s need for near-term, cost-effective, and reliable solutions to the challenges that the technological, social, economic, and environ- mental challenges be addressed in parallel.

LC05B-2

Spanish IO-LCA vs. process LCA: application to bioethanol production in Spain

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IO-LCA vs. process LCA (P-LCA) for environmental impact assessment of biofuels is one of the main approaches for analysing the energy security and climate-change policy challenges by means of a Life Cycle Assessment (LCA) approach. These scenarios (landfilling, landfilling after nonferrous metals removal, incineration, mechanical recycling and gasification) have been com- pared according to the functional unit of 1 ton ASR. According to transparency requirements for the sources of data in LCA studies, LCIA 2015 (55% recycling of C4 and 95% recovery rate).

The results show that industrial processes aimed at matter recovery are the options that can ob- tain greater environmental benefits compared to present practices. A sensitivity analysis by Monte Carlo model approach has been applied in order to evaluate on statistical basis the result. Further im- provements will be achieved only by integrating end-of-life treatments into eco-design strategies aiming at a more efficient separation of high value-added materials such as plastics and metals, and leading to a reduction of waste outputs from ELVs management chain.

LC05B-3

Design for environmental conceptual implementation plan for tanneries, dairy, meat process- ing and electroplating sectors in Argentina

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The objective of the program is to provide technical and financial assistance to small and medium enterprises of four different industrial sectors (tanneries, meat processing, dairy, and electroplating) to improve their environmental and competitive market challenges. West Texas A&M University was called upon to provide technical assistance in developing the DFE approach and model to identify sustainable alternatives to typical industrial processes. The DFE approach was used to develop detailed design recommendations for each of the industrial sec- tors. In this effort, twelve DFE evaluations and recommendation reports were completed. New- markets, regulation needs, and products were identified. Also, WTAU developed a loan/grant program based on the assumption that improvements to market-competitiveness would be fund- ed by environmental and economic cost savings. However, attention of the Design for Environment (DFE) approach was limited to a small number of detailed process flow diagrams, technologi- cal evaluation to meet and exceed Argentine regulations, estimates of market-competitiveness versus environmental option costs, an examination of feasibility, a comparison of market-com- petitiveness to environmental goals, and recommended grant-to-loan allocations. The outcome of this project identified alternatives capable of improving competitiveness and attainment of national and government environmental standards.

LC05B-4

LCA and environmental product declaration of an immunological product (vaccine) for boar taint control in male pigs

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1. Introduction

Agriculture, animal farming and related sectors are facing the environmental sustainability chal- lenge by means of advanced analysis tools such as Life Cycle Assessment (LCA) with the goal of understanding the origin of their environmental burden and to propose solutions for impacts mitigation. In 2009, Pfizer Animal Health (USA), in cooperation with Life Cycle Engineering
The application of FIM-ICPMS was used as a screening tool for nanoparticles. The method was used to determine the presence of nanoparticles in food and drinking water. In the single particle ICPMS nanoparticles in the sample are introduced into the ICPMS plasma producing a plume of analyte ions resulting in a signal spike in the mass spectrometer. From this the primary particle, their size, and the size of their aggregates can be calculated. Using the NIST gold reference materials 8011, 8012 and 8013, the method was tested and its performance characteristics determined. This screening method was used in practice for the determination of gold and silver nanoparticles in food supplements and in simulated digestion experiments. In these experiments, the method was used to detect silver nanoparticles in the plasma of rats exposed to silver nanoparticles through their food. The detection of nanoparticles in the liver indicates the actual uptake of such particles from food. Hydrodynamic chromatography combined with ICPMS was used as a confirmation method to determine the actual size of inorganic nanoparticles. This method was used to measure the silver nanoparticles in food items and drinking water. Silver is added to food items as an anti-caking agent known as E551. While this normally exists only of larger sized nanoparticles the material has a nano structure with primary particle sizes in the nano-range. Using HDC-ICPMS the presence of silver nanoparticles in undeclared food items could be shown. In addition, tap water and several mineral waters were also shown to contain nano-sized silica.

**NM01A-2 Characterization of engineered nanoparticles in consumer products**

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Characterized products with engineered nanoparticles (ENPs) are available on the market today in various industrial sectors. The most common consumer products are cosmetics and personal care products, textiles and household products, usually including zinc oxide (ZnO) and/or titanium dioxide (TiO\(_2\)) as UV-filters or silver (Ag) as an antimicrobial agent. Because consumer products with ENPs are intended to be in constant contact with the human body, exposure to ENPs is occurring already today and might increase in the near future. Most methods, such as X-ray diffraction or dynamic light scattering, however, work best for the characterization of ENPs with similar shape and narrow size distribution. In case of ENPs in consumer products, the morphology of particles is not known beforehand and ENPs may show a wide size distribution, any agglomeration status or various shapes. The presence of other chemicals or particles in products is an additional challenge.

We have therefore investigated which analytical methods can be used for the characterization of cosmetic products. TiO\(_2\) and ZnO ENPs in sunscreens were investigated with the conventional methods transmission and scanning electron microscopy (TEM and SEM, respectively). Further, we used wet SEM (WetSEMTM) as a new technique. This allowed us to directly analyze the ENPs in pure samples in the state they are applied to consumers, thus avoiding drying artifacts. Additionally, four spray-produced ENPs were analyzed. For the ENPs in the dispersions (before spraying) were analyzed by TEM in combination with EDS. Elemental analysis was carried out by inductively coupled plasma mass spectrometry. Second, the aerosols generated by the spray-ups were analyzed for ENPs with a scanning mobility particle sizer in combination with TEM analysis.

We conclude that analytical methods that are used for the characterization of nanoparticulate powders are not necessarily applicable for the characterization of ENPs in complex media such as cosmetic products. Generally, several analytical methods have to be combined in order to achieve a comprehensive analysis of the respective ENPs. Focus must further be set on the sample preparation in order to ensure that ENPs are analyzed in the state that is considered relevant. Without previous information on the ENPs characteristics, analytical methods have to be chosen carefully to ensure a representative sampling and analysis.

**NM01A-3 Determinations of manufactured and incidental nanomaterials in highway runoff waters**

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In urban environment there are diverse sources of nanomaterials; natural, incidental and manufactured. The relative proportion of these is unknown but believed to vary in space and time. Little is known about the environmental impacts of these classes, and new methods that can selectively determine them are needed. We have focused on highway runoff waters where especially incidental and manufactured sources are important.

There is a challenge to quantitatively analyze and size nanoparticle in such complex samples and even more difficult to selectively discriminate between different classes or types. We have developed a comprehensive analysis strategy where we used the NIST gold reference materials, i.e. field flow fractionation to size sort nanoparticles only based on hydrodynamic forces, and iii) optimize an Environmental SEM methodology.

A major goal of this study is to provide a protocol for rapid screening of nanoparticle in complex samples. We are investigating the potential of single particle ICPMS as a tool to explore the presence of nanomaterials in complex samples.
from mixtures of ENPs (Ag and Au) and natural particles. We are demonstrating the potentials and limitations of FFF to distinguish engineered from natural particles. Metal nanoparticles as citrate stabilized gold nanoparticles do not always intensively interact with and limitations of FFF to distinguish engineered from natural particles. Due to their special physical and chemical properties nanoparticles are increasingly manipulated in industry, research and medical applications. Furthermore, the number of nano-enabled consumer products is rising rapidly, and, since some consumer products were previously seen to release nanoparticles as a result of defects in the source for nanomaterials, new methods for nanoparticle detection or even quantification in environmental samples are still missing, and environmental concentrations have to be estimated from nanoparticle production and use rates. Studies investigating nanoparticle release can therefore add valuable information for future risk assessments. This study characterizes the effluents from a commercially available silver nano silver washing machine, investigating the released silver concentrations, number and characteristics of the released nanoparticles and the effect of the effluent on a natural bacterial community. Average released silver concentration were 11 µg L-1, as determined by inductive coupled mass spectrometry (ICP-MS). Ion selective electrode (ISE) measurements and filtration studies suggested the ionic fraction to be marginal. The presence of silver nanoparticles (AgNPs) was confirmed by single particle ICP-MS and as an average of 790 Mio. AgNPs mL-1 was measured. The AgNPs size was determined to be 10 nm and <20 nm with transmission electron microscopy (TEM) and single particle ICP-MS, respectively. Nanoparticle tracking analysis (NTA) measured the particle size to be 60-100 nm. The washing machine effluent was shown to have a determined and stable natural bacterial community as it clearly reduced the bacterial abundance. If AgNPs producing washing machines will become a common feature of households, the wastewater will contain significant loads of AgNPs, which might be released into the aquatic environment.

NM01A-6 Characterization of CeO2 and ZnO nanoparticles in the framework of an eco-toxicological study

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Due to their unique physical properties, engineered nanoscale materials are increasingly being used in a variety of applications and improve the performance of a wide range of products. As a consequence, human and environmental exposure to these materials is also increasing. For this reason, there is an urgent need to establish robust methodologies for characterizing nanomaterials’ properties and assessing their interactions with living organisms. This newly developed method is capable of subtracting the naturally occurring particles and hence establishing the number concentration of the study ENPs over time as well as the size distribution. It was achieved via the pretreatment of the sediment by vacuum filtration before nanosight analysis (DLS); z-potential; Fourier transform infrared spectroscopy (FTIR); thermogravimetric analysis (TGA); x-ray photoelectron spectroscopy (XPS); and energy-dispersive x-ray (EDS; scanning electron microscopy (SEM); dynamic light scattering (DLS); electron microscopy (EM). This number is expected to increase exponentially in the near future in the absence of detailed knowledge concerning the interactions of such materials with biological systems. Furthermore, while nanoparticles have been shown to cross cellular membranes, little research has examined the influence of nanoparticle characteristics on membrane transport. The goal of this project was to characterize the influence of nanoparticle properties on the movement of gold nanoparticles across mammalian cell membranes, as well as the influence of nanoparticle concentrations on this uptake. Preliminary experiment has examined the uptake of 4 nm, 18 nm, and 50 nm citrate capped gold nano-spheres in A549 carcinoma human alveolar cells at increasing particle concentrations with a constant concentration of serum proteins, as well as at increasing protein concentrations with constant particle concentrations. Cells were plated in 12-well plates at 100,000 cells per well and exposed in fresh media 24 hours at 37°C. Cell accumulation was monitored following 2, 6, 12, and 24 hours. Incubation of nanoparticles at each time point was quantified by inductively coupled plasma mass spectrometry (ICP-MS), and movement was visualized using dark field microscopy. Results at a constant particle concentration followed typical dose-response relationships as particle uptake increased with increased protein concentration. However, when exposed at the same particle concentration, uptake decreased as serum protein concentrations increased, revealing a negative relationship between these factors (R2=0.92). It is believed that this decrease in uptake is a function of the over-saturation of particles with serum proteins in the media, thus causing competition at the receptor site for receptor mediated endocytosis.

NM01B-2 Influence of serum protein concentrations and particle characteristics on gold nanoparticle uptake in mammalian cells

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Novel applications of nanotechnology may lead to the release of engineered nanoparticles (ENPs) into the environment. The concern is that ENPs can be released at very low concentrations. To determine their potential eco-toxicity, environmental fate and behaviour, it is essential to be able to detect, quantify and characterise ENPs in the environment. However, the characterisation of ENPs is not straightforward, due to the complexity and diversity of the analytical approaches needed to be able not only to determine the size and size distribution of nanoparticles, but also to differentiate between naturally existing nanoparticles in the environment and the target ENPs. The aim of this study was to investigate the fate of ENPs in sediment-water systems focusing on the identification and characterisation of suitable analytical techniques for ENP characterisation which overcome the difficulties mentioned above. Partitioning studies of 1 µg ml-1 nano Ag and 1.5 µg ml-1 Au in either artificial or natural sediment were conducted. The 24 h equilibrium partitioning percentage as well as the size distribution of partitioned ENPs were measured using nanoparticle tracking analysis (NTA) and coupled plasma mass spectrometry (ICP-MS) and transmission electron microscopy (TEM). This newly developed nanosight method is capable of subtracting the naturally occurring particles and hence establishing the number concentration of the study ENPs over time as well as the size distribution. It was achieved via the pretreatment of the sediment by vacuum filtration before nanosight analysis (DLS); z-potential; Fourier transform infrared spectroscopy (FTIR); thermogravimetric analysis (TGA); x-ray photoelectron spectroscopy (XPS); and energy-dispersive x-ray (EDS; scanning electron microscopy (SEM); dynamic light scattering (DLS); electron microscopy (EM). This number is expected to increase exponentially in the near future in the absence of detailed knowledge concerning the interactions of such materials with biological systems. Furthermore, while nanoparticles have been shown to cross cellular membranes, little research has examined the influence of nanoparticle characteristics on membrane transport. The goal of this project was to characterize the influence of nanoparticle properties on the movement of gold nanoparticles across mammalian cell membranes, as well as the influence of nanoparticle concentrations on this uptake. Preliminary experiment has examined the uptake of 4 nm, 18 nm, and 50 nm citrate capped gold nano-spheres in A549 carcinoma human alveolar cells at increasing particle concentrations with a constant concentration of serum proteins, as well as at increasing protein concentrations with constant particle concentrations. Cells were plated in 12-well plates at 100,000 cells per well and exposed in fresh media 24 hours at 37°C. Cell accumulation was monitored following 2, 6, 12, and 24 hours. Incubation of nanoparticles at each time point was quantified by inductively coupled plasma mass spectrometry (ICP-MS), and movement was visualized using dark field microscopy. Results at a constant particle concentration followed typical dose-response relationships as particle uptake increased with increased protein concentration. However, when exposed at the same particle concentration, uptake decreased as serum protein concentrations increased, revealing a negative relationship between these factors (R2=0.92). It is believed that this decrease in uptake is a function of the over-saturation of particles with serum proteins in the media, thus causing competition at the receptor site for receptor mediated endocytosis.
Transformations of silver nanoparticles at environmentally relevant concentrations in fresh and saline surface waters

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This study investigated the transformation pathways of silver nanoparticles (AgNPs) in fresh and saline surface waters. The research focused on understanding how AgNPs interact with environmental conditions, such as pH, ionic strength, and natural organic matter (NOM), which can affect their stability and toxicity. The study used a combination of experimental techniques, including field flow fractionation (FFF) and nanotrack analysis (NTA), to monitor the transformation of AgNPs under various conditions. The results showed that the transformation pathways of AgNPs are influenced by environmental factors, leading to changes in their size distribution, aggregation propensity, and toxicity. This information is crucial for understanding the fate and effects of AgNPs in aquatic environments.
In acute toxicity tests to the nanopowder, the nanodispersion as well as the bulk material of *Pseudokirchneriella subcapitata* and *Danio rerio* nanoparticles and bulk materials appeared to be toxic to *D. magna* *A. franciscana* and *Tisbe battagliai*. Additionally, a set-off toward chronic toxicity testing has been done for ZnO and growth inhibition, immobilisation for *C. vulgaris* as model organism, different multi-walled CNT as nanoparticles and green alga as a model organism, a similar toxicity ranking among the compounds was determined as in vivo biotests were carried out in order to identify possible acute effects on aquatic organisms.

The results have shown that sepiolite is the most toxic compound, since it has induced both apoptosis and necrosis starting from the lowest concentration of 0.5 mg/L, and moreover is genotoxic from 1 mg/L. CNT, on the contrary, exhibits a dose-dependent cytotoxicity at all concentrations, but is genotoxic only at the highest dose of 100 mg/mL. Two other compounds, OC and POG, have shown a lower toxicity, consisting in a dose-dependent apoptosis and a very limited necrosis. However, POG has also induced genotoxic damage close to that observed with sepiolite. BNB90 and DAPS have produced even lower toxic effects, consisting in the nearly complete absence of necrosis and limited apoptosis and DNA damage. Finally, bohemite has shown very limited toxicity, consisting of a slight but significant genotoxic damage at 100 mg/mL, while carbon nanotubes have induced no toxicity at all.

By using *D. discoides* as a model organism, a similar toxicity ranking among the compounds has been obtained. However, data indicate that the selected endpoints are able to detect negative effects on replication rate and/or LMS at nanoparticle concentrations lower than 1 µg/mL, while DNA damage was evident only at higher concentrations.

**NM02A-6**

The aquatic toxicity and species sensitivity distributions of metal oxide nanoparticles NG and SiO2 were characterized using *C. tenuicorne* and *D. magna*. The production of metal oxide nanoparticles has recently increased in the future, nanoparticle-based products will become more and more commercially relevant. This increasing production will inevitably lead to a rise in the aquatic environment. However, the knowledge of the potential risk and corresponding risk assessment procedures of metal oxide nanoparticles considering aquatic organisms is still limited. Therefore, our research focuses on the toxicity of these types of nanoparticles and more specifically on ZnO and SiO2, *C. tenuicorne* (Artemia franciscana and Daphnia magna), alga (*Pseudokirchneriella subcapitata*) and fish (*Danio rerio*). Daphnia magna, *C. tenuicorne* and fish were exposed to four concentrations of ZnO nanoparticles. The results have shown that Daphnia magna, an indicator species for the effects of nanoparticles and fish, has been exposed to ZnO nanoparticles, and fish, *D. rerio*, have been exposed to ZnO nanoparticles, as well as to *C. tenuicorne* and *D. magna*. Additionally, a set of chronic toxicity tests has been done for ZnO nanoparticles and bulk material on *Daphnia magna*, with reproduction as a toxic endpoint. Our results showed that the exposure to the different size forms of ZnO has no significant impact on the reproduction of *D. magna* and *C. tenuicorne*. The group of *D. magna* was significantly inhibited when exposed to the SiO2 nanoparticle suspension (EC50: 23.1 mg/L, nanoparticle) and bulk material (EC50: 28.0 mg/L). Moreover, ZnO nanoparticles and bulk material appeared to be toxic to *D. magna* (EC50: 2.40 mg/L, EC50: 2.40 mg/L, bulk: 4.23 mg/L and P nanoparticle: 0.03 mg/L, EC50: 0.05 mg/L, bulk: 0.04 mg/L). *A. franciscana* and *D. rerio* were not affected in the acute tests by any of the tested ZnO forms. These results indicate clear differences in species’ sensitivities to the different nanoparticles. Therefore, an in vitro assessment towards a nanoparticle risk assessment was made by means of the construction of acute species sensitivity distributions. In the future, additional chronic toxicity tests will be performed to gain more insight in nanoparticle toxicity.

**NM02B-1**

Effects of natural water chemistry on nanosilver behavior and toxicity *E. Macken*1, *HJ Byrne*1, *K Hylland2, *K Thomas2*

*University of Oslo (UiO) and the Rosenblad Research Institute, UiO for future research collaborations and exchange of expertise.

Two marine species, the harpacticoid copepod *Tisbe battagliai* and the Rhodophyte *Ceramium tenue* were selected for testing as they represented different trophic levels and ecological niches. The aim of the work was to investigate the interaction between nanoparticles (NPs) and marine species under realistic environmental conditions. Their toxicity was assessed using acute tests under varying experimental conditions (e.g. salinity), potential uptake routes and their potential to associate with other marine contaminants (mixture toxicity) were all investigated. The objectives of this collaboration were to (1) investigate the toxicity and uptake of standard nanoparticles, to a battery of marine species, to understand and elucidate the effects of varying natural environmental conditions (e.g. salinity) on the toxicity of standard NPs to the previously tested species, (3) include a thorough characterisation of the NPs under realistic environmental conditions for use in the interpretation of behaviour in the marine environment.

To investigate the effects of salinity and to compare the sensitivity between species, Ag-PVP NPs were assessed at 30% salinities with two test species. The *T. battagliai* assays were carried out in natural seawater of ca. 35‰, while *C. tenue* was assessed in 2.5% salinity (at different salinities; 20, 30 and 50‰). To ensure the performance of the test species, reference toxicants were run in parallel. Further assays with AgNO3 were carried out under all conditions to account for toxicity due to ionic silver and compared with the NP assays. All results are discussed in the context of sensitivity and varying salinities. The uptake of Ag-PVP was also investigated in both species using TEM techniques. The potential for NPs to modify the toxicity of some common contaminants to *T. battagliai* is also discussed in relation to gold NPs. A thorough characterisation of all NPs in all media was conducted to support the toxicological findings.

**NM02B-4**

Effects of different n-oxides of similar size on bivalve immunocytes *E. Macken*1, *D Bilanico1, B Caci1, G Pojana2, C Ciacci3

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Physico-chemical characterization of NPs was performed before experiments by various techniques such as Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), gas physical adsorption (BET), Dynamic Light Scattering (DLS), Inductively Coupled Plasma (ICP), etc. DLS analysis revealed the formation of nano- and micro-sized agglomerates of NP suspensions in artificial sea water (ASW). Hemocytes were exposed to NPs (1.5 and 10 µg/mL)
for different times (from 30 min to 4 hr) and functional parameters were evaluated: lysosomal membrane stability (LMS), ROS and NO production, lysozyme release. Moreover, cytosolic pH and apoptotic changes were measured by flow cytometry. The effects on hemocyte LMS were dose dependent, with ZnO-TiO2@SO2-CeO2 and unreacted to their actual size distributions. Differential effects were also observed, depending on the type of concentration and size of the SO2 showing strongest effects on ROS and NO production. The CeO2 and CeO2-TiO2 inducing dose dependent enzyme activities. Several trials were observed referring to the comparable TBARS levels after exposure to all the three size Au NPs with same dose. The increase in AChE activities. These results could be explained by a stabilization effect of AChE by Au NPs leading to a minimal loss of enzyme function. Following the exposure to Au NPs, the Acetylcholinesterase (AChE) enzyme activities, associated with oxidative stress, were increased by 46%, SOD and GST activities; however, a significant elevated LDH was observed referring to the comparable TBARS levels after exposure to all the three size Au NPs. After exposure, the Au body concentrations ranged from 6.0 to 29.2 µg/g wet wt for clams, from 0.4 to 5.3 µg/g wet wt for crabs, and from 0.5 to 3.7 µg/g wet wt for crabs. The bioaccumulation was higher for both clams and crabs than for crabs. Concluding results of defence (Metallothionein-like proteins: MTLPs, catalase: CA T, glutathione-S-transferase: GST and superoxide dismutase: SOD) and damage (thiobarbituric acid reactive substances: TBARS and acetylcholinesterase activity: AChE) biomarkers, Au NPs induced MTLPs in clams. Au NPs of 40 nm size also increased AChE activity (48% and 64%) and GST (86% and 45%) in crabs. AChE and GST activities a significantly elevated (40-52%) was observed compared to control. For clams, no significant oxidative damage was observed referring to the comparable TBARS levels after exposure to all the three size Au NPs; while in crabs, a significant elevated LDH was observed (43-52%) for both clams and crabs. Moreover, feeding rate also decreased markedly for crabs. Because different species exhibit various mechanisms for fighting the nanotoxicity caused by nanoparticles, it is advised to study several aquatic organisms as biomonitoring models in aquatic environment.

NM02B-5
Ecotoxicology of gold nanoparticles in endobenthic invertebrates, the tellinid clam Scrobicularia plana and the polychaete worm Nereis diversicolor
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The effects on growth, reproduction, and viability were assessed in a multi-generational study. Particular size and shape were characterised by dynamic light scattering using a zeta size and transmission electron microscopy. The results show that with increased exposure duration the toxicity of nanosilver to D. magna increased. The exposure of consecutive generations of D. magna results in an effective concentration (LOEC2/4 =7.5 µg/L-1) about ten times lower compared to the 21-d reproduction test (NOEC6 ≥ 6 g/L-1). Therefore, long term studies should be given a high priority to make an adequate evaluation of the potential environmental risks of nanosilver and nanomaterials in general.

NM02C-3
Do TiO2 nanoparticles affect earthworm reproduction?
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The toxicity of three different TiO2 nanoparticles was investigated in the earthworm reproduction test according to the OECD test guideline No. 222. All applied nanoparticles were derived from the OECD Sponsorship Programme and differed in parameters such as primary particle size, surface area, BET, surface charge, zeta potential, crystalline structure and particle size distribution. Differential effects were also observed, depending on the size of the nanoparticles. This result suggests that these effects may be detrimental to aquatic ecosystems. Potential routes of uptake by aquatic organisms include direct ingestion or entry across epithelial boundaries such as gills or body wall. Toxicity and exposure data for aquatic invertebrates, however, is currently lacking. There are only few studies on the nanotoxicity of nanosilver. Long term and long term invertebrate exposures giving priority to sublethal effects provide useful completion.

The aim of this study is to evaluate the chronic toxicity of nanosilver on Daphnia magna. The effects on growth, reproduction, and viability were assessed in a multi-generational study. Particular size and shape were characterised by dynamic light scattering using a zeta size and transmission electron microscopy. The results show that with increased exposure duration the toxicity of nanosilver to D. magna increased. The exposure of consecutive generations of D. magna results in an effective concentration (LOEC2/4 =7.5 µg/L-1) about ten times lower compared to the 21-d reproduction test (NOEC6 ≥ 6 g/L-1). Therefore, long term studies should be given a high priority to make an adequate evaluation of the potential environmental risks of nanosilver and nanomaterials in general.

NM02C-4
Comparing the reproductive toxicity of ZnO nanoparticles, bulk ZnO, and ZnCl2 to the earthworm Eisenia fetida
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The effects on growth, reproduction, and viability were assessed in a multi-generational study. Particular size and shape were characterised by dynamic light scattering using a zeta size and transmission electron microscopy. The results show that with increased exposure duration the toxicity of nanosilver to D. magna increased. The exposure of consecutive generations of D. magna results in an effective concentration (LOEC2/4 =7.5 µg/L-1) about ten times lower compared to the 21-d reproduction test (NOEC6 ≥ 6 g/L-1). Therefore, long term studies should be given a high priority to make an adequate evaluation of the potential environmental risks of nanosilver and nanomaterials in general.

NM02C-5
Ecotoxicity of ZnO-NP, bulk ZnO and ZnCl2 to Folsomia candida in relation to bioavailability in soil
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the majority is not assessed in soil. Due to adsorption and dissolution of nanoparticles the toxicity of metal nanoparticles in soil is difficult to establish. The present study aims to determine the chronic toxicity of zinc oxide nanoparticles (ZnO-NP) to Folsomia candida, by studying survival and reproduction in freshly spiked soil. To unravel the contribution of zinc oxide particle size and free zinc to nanoparticle toxicity, bulk ZnO and ZnO-NP are tested for comparison. Toxicity was determined in natural L.2.2 soil using standard test procedures as described in ISO guideline 11267.

For all three compounds, zinc concentrations in the porewater increased with increasing soil concentration. This is reflected by the Freundlich isotherm yielding sorption constants Kf of 61.7, 106.8 and 211.6 mg kg\(^{-1}\) (corresponding to values of 1.50, 1.34 and 1.32) for ZnO-NP, bulk ZnO and ZnCl\(_2\) respectively. It seems that the size of zinc oxide particles does not contribute to a significant difference in the effect observed on springtail reproduction. Compared to ZnO-NP, the EC50 of ZnO-NP based on actual zinc concentration in soil was almost 7.5-fold higher, but the differences between EC50 values is small when based on porewater concentrations: EC50 values of 10.1, 7.74 and 16.8 mg Zn/l were calculated for ZnO-NP, bulk ZnO and ZnCl\(_2\), respectively based on measured concentrations in the soil pore water. We conclude that ZnO particle size does not affect the reproduction of the soil organism F. candida. It is very likely that the zinc ions released from the nanoparticles are responsible for the observed toxic effects rather than the nanoparticles as such.

NM02C-6

In vitro nanotoxicology bridges earthworms and humans: comparative analyses of the molecular and cellular toxicity

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Silver nanoparticles (AgNPs) are among the most widely used materials in commercial nanoprod- ucts due to their broad potential modes of application. Still, little is known about their in vitro and in vivo toxicological consequences. Invertebrate models have long been exploited to study the evolutionary development of innate immunity by cross-referencing to more complex human immune systems. Here we illustrate our initial approach to compare the gene and cellular responses of earthworm coelomocytes and human monocytes to silver ion and AgNPs. One-step con- jugation of AgNPs with serum albumin provided extensive colloidal stability, and the AgNP suspension was sterically stable over time under the test condition, with a free Ag\(^{+}\) fraction of <1%. Cell viability, oxidative stress and gene expressions of coelomocytes and human cells were assessed following exposure to Ag\(^{+}\) values for THP-1 monocytes and macrophages could not be estimated as the test was not statistically tested. Remarkably, though, the dose-response curve of THP-1 monocytes for the AgNP treatment was similar to that of coelomocytes. Furthermore, we obtained a strikingly similar time-course pattern for the increase in intracellular generation of reactive oxygen species (ROS) between two different coelomocyte preparations and THP-1 monocytes exposed to Ag\(^{+}\) or AgNPs. Following AgNP exposure, genes involved in innate immune systems, metal detoxification and anti-oxidising mechanisms showed similar responses between coelomocytes and THP-1 monocytes suggesting that these molecular pathways are potentially affected by the interference of NP toxicity between invertebrates and vertebrates.

NM02D-2

Developmental toxicity of metal oxide nanoparticles on Xenopus laevis: focus on the disruption of the intestinal barrier

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Despite the huge amount and rapidly increasing data on the toxicological properties of nanomaterials, the ecotoxicological threatening of such contaminants is far to be characterized. In particular aquatic ecosystems, representing a terminal receptor of nano-contaminants and a realistic accumulation site, merit more attention.

This work contributes to the knowledge of the potential adverse developmental effects inducible by metal oxide nanoparticles (NPs) on amphibian embryos. Lethal and teratogenic potentials of commercially available ZnO-NP (ZnO-NP), TiO\(_2\)-NPs (nano-TiO\(_2\)) and their hydrodynamic behaviour and tested on standardized FETAX procedure. Embryos were histologically screened to detect lesions in primary organs. No mortality was observed after NP exposure, while a significant concentration-dependent growth retardation was induced especially by nano-TiO\(_2\). Moreover, nZnO resulted to be a powerful teratogen, with surviving embryos characterized by diffuse severe malformations. nZnO did not induce severe teratogenic effects, while at histological and ultrastructural levels intestinal mucosa showed diffuse lesions. At comparable nominal densities and mass concentration, metal oxide NPs produced different teratogenic effects, and the non-teratogenicity of TiO\(_2\) NPs is mainly based on both ion dissociation and particle size and concentrations in the soil pore water. We conclude that ZnO particle size does not affect the reproduction of the soil organism F. candida. It is very likely that the zinc ions released from the nanoparticles are responsible for the observed toxic effects rather than the nanoparticles as such.
for controlling the ion release rate over 4 orders of magnitude. Release can be systematically
controlled by the engineered nanoparticles as trace elements carriers. By exploring the capabilities of
the multidetector instrumental platform consisting of asymmetrical flow field-flow fractionation
multidetection instrumental platform consisting of asymmetrical flow field-flow fractionation
and environmental exposure is also increasing. Exposure assessment for MNMs is a specialised
field that requires the use of advanced instruments and specialised expertise and it will often
not be feasible for companies to measure exposures. For risk assessments for MNMs it is essential
that information on exposure is shared between scientists and organisations. The NANEX project
was funded by the European Commission to try to develop a catalogue of exposure scenarios
(ESs) for MNMs based on publicly available information as well as information collected during
measurements surveys. The results were used to carry out a gap analysis and determine research
priorities. The focus was on nano- and sub-nano carbon materials (CNTs, nano-silver (Ag) and
titanium dioxide (nano-TiO2). In total, 57 occupational ESs were developed; including 28 for CNT, 13 for nano-TiO2 and 4 for nano-Ag. Most of the scenarios were related to production/synthesis of the nanoparticles, although some were also developed for downstream use. For consumer exposure, there was a paucity of information and consumer ESs developed were based on very limited information.
There is a critical lack of exposure information available in the public domain, and any avail-
able exposure data are generally presented in a way that they are difficult to interpret and use
for ‘read-across’ to similar ESs. Some level of harmonization of reporting of results of exposure
measurements and contextual information is urgently needed. The NANEX project suggested a
minimum dataset for reporting exposure studies for MNMs, which includes both nano-specific
and general items. One important realisation is that exposure to MNMs is multi-factorial, and it
cannot currently be described satisfactory by a single exposure metric. A white paper on research
priorities for exposure assessment to MNMs is under development. The short-term prior-
orities include development of efficient risk management strategies, development of sampling in-
struments and measurement methods and harmonization of characterisation and quantification of
exposures. The medium- and long-term research priorities include the study of determinants
and modifying factors for the various relevant exposure metrics and development of quantitative
exposure models.

NM03-4 A weight of evidence methodology for risk assessment of engineered nanomaterials DR Legaignoux, SG Gottardo, AC Cottin, AM Marcomini
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The production and use of engineered nanomaterials (ENMs) are addressed by the European REACH regulation § 0-1907/2006, which gives industries the responsibility of the Chemical
Safety Assessment (CSA) for manufactured ENMs. The CSA process followed by the European Commission
follows the traditional risk assessment (RA) framework, including hazard assessment, exposure assessment
and risk characterisation steps. It has been recognised, however, that substantial limi-
tations and uncertainties make the conventional RA infeasible to apply to ENMs today, which
leads regulators and stakeholders with limited or in short knowledge. Knowledge gaps have been gradually filled by new research results and uncertainties have been reduced, but this process advances slowly and it will take decades [1], while quantitative risk assessment results are urgently needed to support timely regulatory decisions and risk management actions [2]. In response to this need, a number of approaches and risk prioritization tools. The present deficit of quantitative data and scientifically sound approaches will lead to the near and in certain medium terms to uncertain and ambiguous, largely qualitative risk estimations based on expert judgments, which may fail to support proper risk management actions. Therefore it is
important to study the possibilities to aid the traditional RA framework with complementary/ alternative tools in an attempt to achieve quantitative RA of ENMs. In this context a novel ap-
proach for RA and prioritization of ENMs, including uncertainty evaluation, is being developed
within the FP7-funded ENPRA project. The main goal of the proposed methodology is to quan-
titatively assess and rank human health risks due to exposure to ENMs in occupational and/or
consumer settings. This presentation will illustrate the novel ENPRA approach in the context of
the feasibility of available methodologies and tools for risk assessment of ENMs and will discuss
its implications for ENM risk management and regulation.
The so-called ‘naphthenic’ acids are a group of compounds that are of increasing concern due to their health and safety data, which is critical for acquisition decisions, regulatory decisions, worker safety, product use, and disposal, and public acceptance of nanoparticles-containing products. Traditional life cycle analyses address key steps in nanoparticle synthesis, use, and disposal, but lack specific information regarding fate and effects in the environment. Conversely, traditional environmental risk assessment of fate and effects of chemical stressors in the environment, but only considers chemical that goes into the environment and does not take into consideration the entire chemical stock from the manufacturer. Therefore, we propose using a comprehensive environmental assessment (CEA) approach, detailed by Davis (2007) to evaluating nanoparticles from ‘cradle to grave’. CEA combines life cycle analysis parameters (e.g., manufacture, storage, use, disposal) with traditional risk assessment parameters (e.g., characterization, exposure, effects, assessment) to give a more comprehensive understanding of nanoparticle exposure and effects in different environmental settings. We will use aluminum nanoparticles as a case study. By applying the CEA approach, we can better assess for a manufacturer or acquisition authority the key aspects of the Al nanoparticle life cycle that will pose a potential impact on environmental processes and health effects. It will also help identify data gaps that need to be addressed prior to acquisition of new risks. In conclusion, the use for CEA for nanoparticles will improve acquisition, risk, and regulatory decision-making and management prior to any unforeseen adverse environment, health, and safety (EHS) events that could dramatically impact the use of these new revolutionary materials.

**NM03-6**

Decision-directed approach to EHS strategy for nanomaterials

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Read-across provides predictions of compound properties through interpolation from known values of structurally similar substances. As such, it does not rely on molecular descriptors and their regression relationship to some target property, but on an approach to define structural similarity. Because chemical similarity itself cannot uniquely be defined, it requires reference to a concept and an associated operational procedure. To this end, we employ the methodology of atom-centered fragments (ACF) that has recently been proven useful as tool to rank, in a predicable manner, the reliability of QSAR applications. We present a case study that demonstrates how their implementation increased the selectivity in one specific rule-based system, CEA, implemented into UM-PPS in terms of electronic and steric features dictating the observed transformation pathways. A metabolic logic for the preferred biotransformation pathways of amides was derived that has been implemented into UM-PPS.

**PE01 - Data-driven, knowledge-based, and QSAR modelling in ecotoxicological assessment**

**PE01-1**

Who needs lab work? an investigation into predictive ecotoxicological computer models and naphthenic acids

[DeBruin J, Renold A, Saunders O, West]

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Computer-based predictive ecotoxicology models are increasingly used to assess adverse effects of chemicals that are released into the environment. Ease of use and cost-effectiveness makes these models attractive for use in field and laboratory testing. In the present study the toxic effects of individual carboxylate (‘naphthenic’ acids) were determined by two predictive quantitative structure-activity relationship computer models (ECOSAR v1.00a and ADMET v5.0). In the case of ECOSAR some physicochemical parameters, and toxicity were predicted. ADMET is a more detailed approach based on human toxicity and provides physicochemical parameters, enzyme metabolism, human liver effects, mutagenicity as well as some ecotoxicological predictions. The so-called ‘naphthenic’ acids are a group of compounds that are of increasing concern due to their presence within sewage treatment plant effluents, including oil sands process waters. Few of these compounds are commercially available and have to specifically synthesised so predictive models may be helpful for targeting specific structures for synthesis. Toxicity predictions for the effects of the acids on *Tetrahymena pyriformis* from the ADMET model were compared to measured data, whereas predictions for the effects of the acids on *Daphnia magna* as predicted by ADMET are more detailed approaches that have yet to be sufficiently integrated can provide a powerful approach to better connecting the nanotechnology research agenda with product developer, policy-maker, or consumer decision needs: value of information (VoI) and multi-criteria decision analysis (MCDA). VoI explores the sensitivity of a decision under uncertainty to new information before making a decision, while MCDA allows comparison of decision alternatives that are not reducible to a single criterion (such as cost-benefit analysis). Both MCDA and Vol have been used successfully in industry and have attracted increasing attention in government and regulatory applications. However, actual implementation in policy-making is still rare. This presentation will provide methodology and illustrate applications of Voi and MCDA to enhance risk assessment for nanomaterials. Implications for nanomaterial EHS risk governance will be discussed.

**PE01-2**

A combined expert knowledge and data-driven approach to predict biotransformation pathways of organic contaminants

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In silico systematical represents plausible structures of transformation products (TP) formed through microbial transformation of xenobiotics could play an important role in obtaining a more comprehensive picture of environmental exposure to TPs. Lists of predicted TP structures can be used to screen environmental samples for TPs or for model-based prioritization of pollutants at the first-tier level of chemical risk assessment. Existing rule-based expert systems that predict biotransformation pathways typically suffer from low selectivity, i.e., many more products are predicted than are experimentally observed. This often prevents their application, e.g., to support inclusion of TPs into chemical risk assessment. Here, we present two data-driven approaches to increase the selectivity of in silico based biotransformation prediction. These approaches demonstrate how their implementation increased the selectivity in one specific rule-based system, the University of Minnesota Pathway Prediction System (UM-PPS) (http://umppp.msi.umn.edu/predict/). The approaches include the data-driven extraction of relative reasoning rules from data contained in the University on Minnesota Biocatalysis/Biodegradation Database (UMB-BD), a manually maintained collection of literature-reported biotransformation pathways, and the targeted generation and analysis of experimental biodegradation data for pertinent transformation-reaction rules. Implementation of relative reasoning rules reduced the number of predicted first-generation TPs by about 50%, increasing selectivity from 10% to 20%. At the same time, the percentage of correctly predicted, experimentally observed products slightly decreased for external validation, demonstrating that uncertainty and heterogeneity in the training and validation data base maximization in rule-base systems. For the investigation of particular transformation pathways, a combined experimental, analytical, and data processing procedure was developed for the high-throughput identification of TPs formed in sludge-seeded bioreactors. The approach was applied to refine transformation rules for the amide functional group by investigating transformation pathways of 30 diverse amides. Altogether 53 TPs were identified and the data were analyzed in terms of electronic and steric features dictating the observed transformation pathways. A metabolic logic for the preferred biotransformation pathways of amides was derived that has been implemented into UM-PPS.

**PE01-3**

Quantitative read-across for predicting toxicity and environmental fate related properties of organic compounds

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The recent emergence of nanotechnology in both the marketplace and the public consciousness coincides with increased recognition of the importance of integrated, systems-level approaches to environmental, health and safety that includes life-cycle thinking, public participation, and adaptive management of risks associated with emerging technologies and chemicals. As a result, environmental research strategy documents like those published by the US Environmental Protection Agency (EPA) and the National Nanotechnology Initiative (NNI) emphasize a broad, comprehensive approach that includes identifying nanomaterial source terms at all stages of the nanomaterial life-cycle, characterization of environmental fate and transport properties, identification of toxicologically relevant endpoints, and risk assessment. The presentation will outline the components that have yet to be sufficiently integrated can provide a powerful approach to better connecting the nanotechnology research agenda with product developer, policy-maker, or consumer decision needs: value of information (VoI) and multi-criteria decision analysis (MCDA). VoI explores the sensitivity of a decision under uncertainty to new information before making a decision, while MCDA allows comparison of decision alternatives that are not reducible to a single criterion (such as cost-benefit analysis). Both MCDA and Vol have been used successfully in industry and have attracted increasing attention in government and regulatory applications. However, actual implementation in policy-making is still rare. This presentation will provide methodology and illustrate applications of Voi and MCDA to enhance risk assessment for nanomaterials. Implications for nanomaterial EHS risk governance will be discussed.
aiming to develop cluster specific models. The clustering was based on the compounds variation in calculated chemical descriptors and the groups were separated largely based on molecular size and hydrophobicity of the substances. QSARs based on partial least squares projections to latent structures (PLS) were created and five non-tested antibiotics were suggested with potential toxic effect based on structural similarities with the most potent of the training set. Derived data was in agreement compared with data provided by the risk assessment initiative in Swedish FASS and by data estimated using ECOOSAR. Initial comparisons indicated some incoherence between available ERA tools and the toxic potentials of the drugs as determined in this study.

PE01-5 Biocides in paint in urban areas: modelling an underestimated source of environmental contamination
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Biocide contamination of receiving waters is generally linked with agriculture. However, recent studies have shown that urban contributions should be also considered. One of the suspected biocides from urban sources is the fungicide isoprothiolane. Specific information on the environmental fate of biocides is very limited. In this study we applied a cluster specific model describing biocides transport and ecotoxicity in a Wind Driven Rain model and a classical hydrological model to compute the contribution of a city to the biocide load from building paint. For the entire city of Lausanne (Switzerland, 200'000 inhabitants), a global production of 2200 kg/year of terbutylazine leached by rain was estimated considering local building characteristics and meteorological information. The leaching model results show that the peak concentration measured at the bottom of the wall at the initial stage of the rain event. However, concentrations measured in an urban river in the watershed leads to the conclusion that most of this leachate does not reach directly receiving waters, but is infiltrated into soil or reaches the sewers after some delays in drainage systems. The release of biocides from façade leaching in the environment is systematic during rain events. It is of greater importance to estimate the dynamic of biocides during rain events and to compare these values with dedicated time varying environmental quality criteria.

PE01-6 Treatment of volatile substances in the Activated Sludge Respiration Inhibition Test (OECD 209)
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The OECD 209 test is used to assess toxic effects of chemicals towards microorganisms in sewage treatment plants. In the revised guideline from 2010 volatile substances are for the first time explicitly addressed: i) the volatility of the substance should be known, ii) >80% of the substance has to remain in the reaction mixture, iii) a modified experimental set-up is needed for volatile substances but not necessarily defined. The goals of this work were i) to predict if substance volatility is an issue (i.e. the >80% target is missed), ii) to suggest experimental modifications for these cases, iii) to deduce an approach to recalculate EC50-values from old studies with volatile substances in which evaporation losses had been disregarded.

Approach
The Henry's law constant H of a substance was used as measure of its volatility. Evaporation losses L of substances with different H-values were measured in a sludge-free set-up according to OECD 209. The H-values after 30 and 180 min of exposure were plotted as a function of H, curve-fitting was performed and critical values Hcrit resulting in losses L of 20% were calculated. The scientific literature was screened for possible modifications of OECD 209 for volatile substances. Results and discussion
i) H=L(FH)-plots obtained showed the characteristics of saturation curves. Nonlinear fitting was performed with Monod-type equations.
ii) Critical values Hcrit of 0.6 and 4.8 (Pa m3)/mol were determined for 180 and 30 min of exposure under the test conditions. If H of a substance exceeds these values modifications of the OECD procedure were used to deduce an approach to recalculate EC50-values from old studies with volatile substances.

iii) The following modifications are options to reduce evaporation losses:

- Reduction of exposure time to 30 min or further
- Reduction of acetate concentration
- Reduction of stirrer speed
- Reduction of incubation temperature
- Determination of H for test substance
- Calculation of L with L(FH)-function
- Calculation of substance concentrations at the end of exposure c(t) from initial concentrations c(0)
- Calculation of the linear means cmin from (c(t) and c(t) using first-order kinetics

The above mentioned workflow demonstrated to work well and efficiently for developing PBTK models for several pesticides and examples of this will be shown. The described models are largely based on prior information independent of results from a particular toxicokinetic experimental set-up that can be seen as a best case scenario as models which are only verified with and not fitted to observed data and are thus well suited for being used in extrapolations to un-investigated scenarios by respective knowledge guided re-parametrisation.

PE02-2 Developments in blood sampling and chemical analysis for PBTK modelling
J. Edwards, P. Thorbek, A. Stevens, P. Chapman
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The current risk assessment paradigm for birds and mammals estimates risk as the ratio between toxicity and exposure using as inputs effects from an instantaneous gavage dose (acute) or the dietary toxicity over several days or weeks (chronic) with a single day or multiple repeats of a daily dose, respectively. The acute risk assessment does not take into account of toxicokinetic (TK) processes such as absorption and elimination or any associated behavioural effects limiting further exposure (avoidance). One option to refine risk is to explore the rates of absorption and elimination and behavioural responses through PBTK modelling, optionally in combination with dynamic process in fate and dissipation in the environment. The use of PBTK modelling is recommended as a refinement option by the European Food Safety Authority in their Birds and Mammals Guidance document (EFSA Journal 2009). A condition of PBTK modelling is that toxicity is the result of systemic exposure and is reversible as the systemic dose declines. The toxicokinetic can be evaluated by blood levels via analysis of biological samples. Analytical approaches like liquid chromatography and mass spectroscopy (LCMS) allows very small blood volumes to be used with satisfactory limits of determination. Model simulations showing how the systemic dose is absorbed and eliminated will help the model builder to understand and evaluate rate and elimination rate. The combination of feeding and absorption rates can lead to very different and counter intuitive outcomes for risk assessments. For acutely toxic seed treatments, high feeding and slow absorption rates present high risk, while high absorption rates do not and allow animals to regulate their feeding rate to below a harmful systemic dose by avoidance. Furthermore, models of PBTK modelling may contribute to the comparison to the systemic dose made by oral, dermal and inhalation exposure and evaluate the risks from food chain bioaccumulation. The acceptability of PBTK models in regulatory risk assessment will depend on good validation of PBTK models. This may be achieved by analysis of blood concentration in dietary studies. Examples of different scenarios for all these applications will be explored in this presentation together with the conditions and assumptions for PBTK modelling.

PE02-5 Bridging insight from toxicokinetics and foraging ecology: case studies of acute risk assessment for insectivorous birds
J. Edwards, P. Thorbek, A. Stevens
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The recently enacted EFSA guidance for risk assessment of birds and mammals (EFSA Journal 2009; 7(12):1438) explicitly mentions consideration of toxicokinetics for conducting higher tier risk assessments of acute exposure. In the case of risks from acute exposure to compounds that have high rates of elimination (i.e.; dietary intake (feeding rate per minute, FPM) of contaminated food items) may be too slow to approach the internal exposures that result from single,
bolus administration by gavage of the pesticide as performed during testing. In 2005 the EFSAs PPR laid out a basic framework for considering ADME processes during tier evaluations (EFSAs Journal 2005; 240:121-1). As laid out, the approach rests on estimating two main inputs: FPM and ke. The opinion derived an estimate of FPM from a very limited number of studies and proposed a rather cumbersome approach for estimating ke. I have collected information from field and laboratory experiments that were performed with the FPM that may be used in these assessments. Data from small passerines demonstrate that birds probably control the rate and timing of food consumption during the day to balance the need to secure adequate reserves for surviving during the night, and avoiding excess body mass during the day to facilitate take off and reduced predation. Studies have consistently reported that birds feed preferentially in the early morning and before dusk, with over 80% of mass gaining occurring before noon. In addition, insectivorous birds experimentally forced to increase food intake through exposure to lower temperatures and forced feeding, showed an increase in meal size, but did not reduce meal time between feeding bouts (11:12 min). This demonstrates that birds are constrained by a digestive bottleneck, where feeding bouts are dictated by a fixed stomach and gizzard capacity. The increased food ingestion that occurs during periods of increased demand happens as a result of feeding over a larger proportion of available light hours. I also demonstrate, through nonlinear equation modeling, that ke should preferentially be derived from hen metabolism studies rather than as proposed, from the long-term NOEL and acute oral LOEL in the same species. The approach will be demonstrated with case studies using different birds and pesticides.

PE02-6 Measurement of pesticide intake rates and avoidance thresholds for small mammals
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Behaviour eg. food avoidance, can influence risk by preventing body burdens from exceeding harmful thresholds and is a measurable response that may be included in PBPK models. Standard avoidance tests require the use of captive wildlife, e.g. R. norvegicus, and are time consuming and labour intensive, e.g. how much does an animal consume over a 4 hr period compared with untreated food. More information can be generated from studies if the response of the animal to treated food is monitored continuously over the exposure period. Such data can be used to measure not just the intake rate but also the avoidance threshold and recovery period. The objective of this work was to develop a laboratory based method which could be used with small mammals to determine the highest ingestion rate of different pesticide active ingredients and formulations in food that may be tolerated and to determine if avoidance influenced the response. Two species of small mammal were used: the laboratory rat (Rattus norvegicus) and the woodmouse (Apodemus sylvaticus). The laboratory rat was chosen as LDS50 data are routinely available and the wood mouse was chosen as a focal species of the small mammal likely to feed on treated seeds. Specific measures included an avoidance response time (feeding time before animals stop feeding) and the avoidance threshold (AVT) expressed as both the dose ingested and dose rate between the point at which feeding stopped. Dietary concentrations were prepared as a block made from ground diet and a binding agent into which the pesticide was incorporated. As data were required on the uptake of the treated diet over time, a remote method of monitoring uptake was used by videoing the output from the one end of the diet using an aluminium foil plate placed on the food. Food consumption was measured to estimate the ingested dose and the avoidance threshold (AVT). The time from when individuals started to feed to when they first avoided food (avoidance response time) was determined with reference to controls.

RA01-1 Unified model for sorption, sequestration and degradation in soils and sediments
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The objective of the study is to combine ad/desorption models for organic compounds with the groundwater protection models in order to develop a tool to interpret and predict observed effects, such as increasing persistence with time, decreasing degradation rates with concentration, and effects of amendments on sorption and degradation. A second objective is the mathematical definition of the terms "persistence," "bioavailability" and "biochemical". A numerical model was set up that combines ad/desorption, microbial metabolism and the formation of non-extractable residues (NER). It contains the compartments non-aqueous phase liquids or solids (N), dissolved compound (D), adsorbed (A) and sequestered (S) compound, bacterial mass (X) and biotic as well as abiotic NER. The exchange between these compartments (1: CaCl2, 2: methanol, 3: acetonitrile/water with microwave); analysis of SDZ was performed in soils of different water content (dry vs. wet) We used the proved sequential extraction method (1: CaCl2, 2: methanol, 3: acetonitrile/water with microwave); analysis of SDZ was performed in soils of different water content (dry vs. wet) We used the proved sequential extraction method.
and rewetted soils revealed the parent compound ETD and MBT in detectable amounts (15.0 µg ETD kg⁻¹ and 0.23 µg MBT kg⁻¹ in total, in 0-10 cm ETD soil/0-30 cm MBT soil; fraction based on 1.83% and 0.01% of total applied parent compound per soil layer, respectively), but neither NER nor the main NER metabolite dihydroxy-aniline could be detected. In comparison, the constantly moistened soil released significantly smaller amounts of residual pesticide fractions (2.7% ETD kg⁻¹ and 0.02 µg MBT kg⁻¹ in total, and 0.5% of total applied parent compound, respectively, but no NER or ANI residues were detected).

For all soils the water-extracted dissolved organic carbon (DOC) was significantly higher in the previously dried soils, compared to the constantly moistened soils (ETD soil: 10.8 ± 4.8%; MBT soil: 8.4% ± 3.7%; ANI soil: 9.8% ± 4.6% of total organic carbon in the soil). In case of the previously dried soils, the DOC content correlated with the measured i4C-activity in the aqueous liquids (ETD-soil: r=0.80; MBT-soil: r=0.81; ANI-soil: r=0.91).

The overall finding demonstrates a readily water-extractable pesticide residue fraction which can easily be removed from the soil, representing a potential risk for leaching. The data suggest that an increase in environmentally relevant dry-wet cycles may result in an increased remobilisation and release of aged pesticide residues in soils.

RA01-6 Hidden hazard or safe sink? Approaches to consider non-extractable residues in the regulatory assessment of chemical substances

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Formation of non-extractable residues (NER) is regularly observed in studies on the fate of organic chemicals in soil. NER formation may be interpreted as a specific form of compound persistency (‘hidden hazard’) or as a detoxification step (‘safe sink’). Despite the considerable scientific progress made in analysing NER and identifying their binding types, these insights have not yet been utilised in regulatory risk assessment.

In a workshop held at the German Federal Environment Agency (UBA), it was agreed that three main types of NER should be considered in regulatory schemes: Fixation of substance molecules by physical entrapment in the soil matrix can be reversed under certain environmental conditions. Those ’Type 1’ NER must be considered as a reservoir for remobilisation of a chemical over prolonged times. In contrast, formation of strong chemical bonds between substance molecules and matrix proteins produces Type 2 NER, which are unlikely to be released in their original structure under environmental conditions. Finally, NER can also be formed via incorporation of single labelled atoms or small fragments from the original substance into biomass. Those ‘biogenic’ NER are no longer structurally related to the original substance. While the formation of Type 1 and biogenic NER can be considered a ‘safe sink’, Type 1 NER would constitute a ‘hidden hazard’.

A generic extraction scheme was suggested for residue analysis in the standard studies on the fate of organic chemicals in soil. Specific methods are required to determine the amount of biogenic NER. Two main extraction methods allows concluding on the available residue fractions. To differentiate between Type 1 and Type 2 NERs, a set of destructive extraction methods differing in strength is available, which may be complemented with sophisticated spectroscopic techniques. Where no information on their nature is available, NER should in principle be assumed to belong to Type 1.

Formation of Type 1 NER will have different implications on the environmental risk and hazard assessment. In particular, their potential for substance remobilisation will significantly impact governnance of the risk assessment and persistence assessment. Existing trigger values and decision criteria for NER formation were deemed inappropriate for addressing those concerns; hence, a need for developing new criteria was identified.

RA02 - Aquatic and terrestrial mesocosm and field studies - Messages from complex systems to academia, regulators, and industry

RA02-1 Nutrient masking of macroinvertebrate community responses to ternary mixtures of insecticides

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To determine the effect and effectiveness of mixtures of three insecticides (chlorpyrifos, dimethoate and imidacloprid) in nutrient limited and enriched streams, benthos were field collected and exposed to nutrients and invertebrates over a 3 week period using artificial streams in a 2 x 5 factorial design: two nutrient levels and five concentrations of the ternary invertebrate mixture. The two nutrient levels were nutrient limited (oligotrophic) and nutrient amended (mesotrophic). Equivalent toxic unit doses were summed to create a ternary invertebrate dose (e.g., 0.1 + 0.1 + 0.1 = 0.3 TU). The five concentrations of the ternary invertebrate mixture were control groundwater, 0.3, 0.9, 1.8 and 3.6 µg a.s./L, which are equivalent to 0.5 µg KMNO₄/L. Lower concentration curves revealed the effects of invertebrate mixtures on a suite of macroinvertebrate community metrics, particularly at low toxic unit doses (< 0.6 TU) which are ubiquitous in the environment. Thus, nutrient status is likely an important modifying factor that is underrepresented in the toxicological literature and yet greatly contributes to the difficulty of assessing community level responses in real systems. Further study of nutrient masking in more complex pesticide mixtures is warranted.

RA02-2 Detectability of fetecen 12000L outdoor control aquatic mesocosms over one year

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Zooechnical analyses of abundance and species richness in 15 transected 12,000 L outdoor micro/meso- cosms (n = 15) were monitored over the course of 1 year to document the inherent variability and statistical detectability between replicates. Hence, the first aim of the paper is to document the normal operation ranges of abiotic and biotic parameters. The second aim is a calibration study where the community level lower analysis were applied to derive the statistically minimal detectable difference (MDD) between replicates with default values set at: alpha = 0.1 and beta = 0.2. Copepod abundance and species richness generally demonstrated the best detectability at 0.31 and 0.16 respectively, (n = 15); 0.59 and 0.53 (n = 3). Total zooplankton abundance and species richness had the lowest detectabilities at 0.19 and 0.14, respectively, (n = 15); 0.35 and 0.3 (n = 4). Rotifers, due to their opportunistic and rapid life traits, had the lowest single-species detectability at 0.54 (n = 15); 0.8 (n = 3) taxa; however macroinvertebrate species richness had the lowest detectability at 0.43 (n = 15); 0.7 (n = 3) over 1 year. We recommend a priori the study design relative to relevant MDDs. Moreover, it is suggested to consider alternatives to statistical null hypothesis testing.

RA02-3 Examples of the novel design of mesocosm studies for compounds with differing properties

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A great deal of advanced thought and planning is required for many substances before initiating a mesocosm study. Otherwise there is a risk of conducting a study that is of limited regulatory use. Here we will give advice and considerations for mesocosm studies with compounds of varying properties and with different use patterns. This will be illustrated using two example state-of-the-art mesocosm studies conducted in 2009. In one example the compound has a short aquatic half-life and is toxic to invertebrates; in the other example the compound has a long aquatic half-life and is toxic to algae. One study required special consideration of the exposure profile in the static mesocosm system versus the reality of flowing water, and a novel design following the principles of E-Link was used. The other study required special consideration of the analytical method to prove correct dosing. Both novel designs had different challenges, and both were technically successful. The thought and planning required for these studies will be described and discussed; and other studies and (and cost) considerations will be considered with a view to how they may advance mesocosm study design and offer advice to those considering a mesocosm study. Due to the increasing complexity of exposure calculation and risk assessment, mesocosm studies must also increase in their design complexity in order to stay relevant to the regulatory risk assessment.

It will therefore be necessary for both laboratories and regulators to be open to novel designs which do not necessarily fit with recent standards for mesocosm assessment.

RA02-4 Ecological impacts of time-variable exposure regimes of the fungicide Azoxystrobin on the zooplankton community of outdoor microcosms

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Hidden hazard or safe sink? Approaches to consider non-extractable residues in the regulatory assessment of chemical substances
studies. More than 50% of the taxa was not affected after treatment in these trials. PCR responses of North and South studies expressed by the first ordination axes was similar in all crop types. Both magnitude and duration of responses were similar, except the magnitude of the two studies performed in Spain were lower.

It is concluded that OP treatment effects were similar in studies performed in N- and S-Europe. Only a slight trend was observed that more and longer lasting adverse effects were detected in studies performed in the North. In exception to the conclusion above, adverse OP treatment effects were clearly lower in or- chard studies performed in Spain. Analysis of more Mediterranean studies is needed to examine whether this was related to geographical location or to other factors.

RA04 - Environmental risk assessment and management of Plant Protection Products (PPPs) and biocides

RA04-1 Assessing the mixture ecotoxicity of biocidal products - the challenge at product authorisation

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Biocidal products are typically mixtures of one or more active substances as well as further ingre- dients in the formulation (the product formulation, e.g. of the Biocidal Products Directive (BPD) 98/8/EC the authorisation of the corresponding biocidal products at national level is underway and European member states (MS) are facing mutual recognitions. For the authorisation of biocidal products an extensive environmental risk assessment (ERA) is required in accordance with the BPD: not only every active substance in the product has to be of subject an environmental risk assessment, but also substances of concern, i.e., substances leading to classification of the product or having PBT, endocrine or CMR properties, have to be evaluated. The current prediction of mixture toxicity of the ingredients is required.

The latter can be derived from ecotoxicological tests with the product itself, if a direct release of the product in the environment is possible. However, the product itself often does not represent the ecotoxicologically relevant mixture since leaching and other pathways of exposure will change the composition of the mixture. In that case, the ecologically relevant mixture, e.g. leachate water, has to be tested.

It is well accepted that mixtures of substances usually elicit a different toxicity than the isolated substances itself and additive effects up to synergistic effects are possible. Tests with the product or the ecologically relevant mixture provide a meaningful tool to demonstrate the degree of mixture toxicity by the joint action of the active substance(s) and further components of the product.

The German Federal Environment Agency is responsible for the environmental risk assessment of substances different model agents currently used in the framework of predicted environmental exposure and proposes a tiered approach for the assessment of biocidal products based on the expected exposure pathways which also considers synergistic effects. The aim of the approach presented is to assess the mixture ecotoxicity of products and, where relevant, of ecologically relevant mixtures, and to partly relieve the data requirements for the applicants as well as additional animal experiments.

The presentation gives an overview of the existing concepts for the assessment of mixture toxicity as well as on the proposed approach for product authorisation.

RA04-2 Challenges to determine persistence of plant protection products in the PBT and vPvB classifi- cation for the new EU regulation 1107/2009

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The new regulation for plant protection products (PPPs) 1107/2009 foresees regulation based hazard (vPvB, PBT criteria. The persistence in soil environment as a substance or intrinsic cut-off criterion is utilised in conjunction with bioaccumulation (B), environmental toxicity (T) and long-range environmental transport. Considerable challenges are associated with the practical interpretation of persistence (P) as a hazard based cut-off criterion for the rich data cases of pesticides which may reach a 200% PBT classification. The vast amount of available information for pesticides in different environmental media and under different boundary conditions (laboratory and field conditions) allows a detailed and differentiated assessment of the behaviour. Detailed process based models in combination with pre-defined environmental scenarios (both agreed and established on EU level) and fate parameters obtained from low and higher tier studies are part of the pesticide regulation. These approaches allow to quantify with a significant level of certainty the persistence of pesticides within environmental compartments and the transfer and transport processes between them.

Approaches to deal with different compartments in different environments are outlined and the exposure assessment for environment are presented with link to the P-classification. Different proposals from academia, regulators and industry to address the P-classification are compared with the data assessment for PPPs in the EU. Examples are provided that a hazard based assessment can lead to false identification of a potential concern whereas appropriate scientific based risk assessment shows an acceptable risk.

RA04-3 Regulation 1107/2009/EC and upcoming challenges for exposure assessment of PPP - Har- monisation or national modelling approaches

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In the new European Pesticide Regulation 1107/2009/EC, which will replace the existing EU Directive 91/414/EC, in 2011, the harmonisation of risk-minimizing measures for the protection of aquatic organisms in the Member States is considered an important task. However, in many EU countries the existing risk assessment approach is well adressed to predicted environmental concentrations (PEC) in surface water and sediment and also the considered risk mitigation measures, such as spray drift reducing nozzles or buffer zones, differ between countries 
due to different geographical, climatic or agricultural conditions. This makes risk evaluations rather time-consuming for the applicants and the evaluating authorities, in particular concerning mutual recognitions of approvals. In the present study we compare EU and current country specific exposure modelling approaches and mitigation measures in order to evaluate if and to which extent harmonisation of exposure assessments in the EU is feasible.

The environmental exposure in surface water of 19 active substances was evaluated systematically according to EU and country specific modelling approaches. Calculations were conducted fol- lowing EU requirements (FOCUS models) and country specific models for the UK, Germany and the Netherlands. In the present analysis we show that EU and country specific models differ considerably in basic model assumptions, complexity and relevant parameters selected. Additionally, an important characteristic of the country-specific models is the prioritisation of specific entry pathways of particular active substances (e.g. spray drift, drainage and run-off) over substance specific properties. The acceptance of available risk mitigation methods differs significantly in each of the investigated Member States. The comparison with the EU modelling procedure shows that the national models do not necessarily comprise worst-case calculations. This fact particularly became apparent by comparing the FOCUS and the EU model following German modelling recommendations with the outcome of FOCUS calculations. The results of this study highlight the differences of national exposure assessments for the protection of aquatic organisms. In spite of the possibilities of risk reduction, it is doubtful if any of these measures can be harmonised across all states.

RA04-5 Defining soil ecological exposure scenarios for pesticide risk assessment in the EU: an ecore- gion approach

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The current terrestrial risk assessment of pesticides is performed assessing common exposure scenarios for the entire EU based on the total concentration in the top 5 cm of soil. Aiming at modelling ecotoxicologically relevant concentrations in soil (ECOgrid), as an alternative to this single exposure scenario, the ecolroyal risk assessment should take into account the biogeographical differences within the EU in terms of soil, climate and the vertical distribution of soil organisms. Here we present the progress achieved by ESFA on the development of an EU E25 ecoregion map and associated exposure scenarios.

To test this approach, accumulation of biograpical information on selected key soil fauna groups representing different morphological and ecological characteristics influencing exposure was performed. Data on presence of earthworms, enchytraeids, collemboles and isopods were obtained from literature (i.e. the literature on the distribution of the Earthworm species group) and from countries representing different biogeographical gradients in Europe: Finland, Germany and Portugal.

Results obtained proved that the concept works. Ecoregion maps were produced for earthworms and enchytraeids and revealed marked differences between countries. For isopods, models revealed a dominance of litter dwellers in all countries, showing no differentiation. For collembo- lans, the lower resolution scale of some explanatory variables, allied to a bias in data towards forest sites, did not allow a discrimination between countries. Based on the distribution maps for earthworms and enchytraeids, depth profile maps where to model ECOgrid could be constructed. The results pointed out that for most of the countries in these three categories, the “worst case” soil depth profile for short-term risk assessment would be litter (if present) or 0 to 1 cm depth instead of the currently used 0 to 5 cm depth. This occurs since a large area in these countries is dominated either by epigeic species or by species that feed on litter (e.g., earthworms). For the long-term exposure, other depth profiles may represent the realistic worst case situation. For refined risk assessments, the geographical variation in depth profiles, crop and soil management information, as well as data about the ecology of soil organisms (e.g. different dominance distribution of soil communities) could be considered.

Provided that information from other countries is available, the approaches could be extended to the entire EU territory.

RA04-6 When the active substance/PPP does not fit the legislation BS Jersey

SETAC Europe 21st Annual Meeting Abstract Book 84
Assessing the environmental risks associated with contaminated sites: ‘ERICA: Environmental Risk Index for a Chemical Assessment’

RA05 - Integrated science: Key to risk assessment

RA05-1
Assessing the environmental risks associated with contaminated sites: ‘ERICA: Environmental Risk Index for a Chemical Assessment’


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Abstract

Triad-based ecological risk assessment aims to estimate environmental impacts due to contamination, encompassing chemical, toxicological and ecological data. In fact, measuring biological effects allows assessing impairments on benthos at different levels of biological organization (i.e. molecular, cell, tissue, organism, population/community) and estimating environmental and biological risk.

Goal of this study is to evaluate environmental risk and biological vulnerability at regional scale in the Campania (Italy) where Straight Chain Lepidopteran Pheromones (SCLPs) are used in the olive pest management. In this study, the presence of these compounds in two major Italian rivers was detected using methods able to identify the presence of these chemicals in aquatic environments.

Methodology

An integrated index has been applied: the Environmental Risk Index (ERICA). This index, in a single number, integrates the environmental assessment (the aquatic ecosystem), the human health risk assessment and the uncertainty caused by the presence of untestable data. The application of the ERA has been tested in different regions of the world and it has been integrated into a Decision Support System (DSS) module (ERICA module).

Results and discussion

The results of this study illustrated that for simple structural analogues (chlorinated anilines) the R50 classification has been mentioned as a possible parameter for decision making. An unjustified classification under one regulation would here penalize an PPP under another directive. Conclusion: it is needed that regulators and authorities adapt in advance (specific guidelines) legislation to cases for which the legislation does not fit, and if problems come up due to non-fulfillments scientifically justified and not bureaucratically based decisions should be raised.

RA05-4
Application of a weight of evidence Triad approach in assessing impacts of diffuse contaminant at regional scale


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Abstract

Integrated risk indices to assess water quality

Assessing the environmental risks associated with contaminated sites: ‘ERICA: Environmental Risk Index for a Chemical Assessment’ (ERICA), merges in a single number the environmental assessment, the human health risk assessment and the uncertainty caused by missing or untestable data. ERICA uses a scoring system with parameters for the main characteristics of the pollutants. The main advantage is that it preserves a simple approach by condensing in this single number the risk of the area under examination. The availability and reliability of the data is an important part of the work done to build the index. Experimental and predictive data were compared to evaluate the reliability. Data was derived both from literature sources (experimental models mainly) or predictive models. ERICA can be used to make an integrated risk assessment tool for environmental contaminants in critical and potentially dangerous sites, such as incinerators, landfills and industrial areas or in broader geographical areas. The application of the proposed integrated index provides a preliminary quantitative analysis of possible environmental alerts due to the presence of one or more pollutants in the investigated sites.

RA05-2
Integrated risk indices to assess water quality

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The European Water Framework Directive (WFD) 2000/60/CE prescribes a series of tasks for properly assessing and managing river basins with the ultimate aim of achieving a good ecological and chemical status of surface waters by the end of 2015. The Ecological Status (ES) of each water body has to be classified by using biological Quality Elements (QE) parameters and physico-chemical, chemical as well as hydrobiological MVE as supportive parameters. Moreover, the Chemical Status (CS) has to be evaluated by comparison of measured concentrations of priority substances in water, sediment and biota compartments with Environmental Quality Standards (EQS) set at EU-wide level.

The overall assessment asks for an approach able to integrate different types and sources of information in order to identify the stressors playing a major role in affecting the ecosystem and to guide future management actions.

In this context, one of the objectives of the MODELKEY project was the development of an Integrated Risk Assessment (IRA) methodology implemented into a Decision Support System (DSS) guiding decision makers in assessing and managing river basins according to the WFD requirements (i.e. MODELKEY DSS). In particular, Integrated Risk Indices (IRI) based on Multiple Criteria Decision Analysis (MCDA) methods and Weight and Vagueness Analysis (WVA) were developed and calculated in order to evaluate and classify the ES and CS at site-specific scale (i.e. sampling stations). The developed IRI implemented into a DSS module (i.e. IRI module) were applied to several river basins in Europe. In this paper, after introducing the IRI module we will focus on main results obtained by its application to Elbe and Danube River Basins, in order to highlight difficulties which are usually encountered in assessing water quality and to suggest how to overcome them by means of integrated risk-based approaches and decision support tools.

RA05-3
Standard and non-standard tests for environmental risk assessment of human pharmaceuticals

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The presence of pharmaceuticals in the aquatic environment has gained increasing attention over the last years, and concerns have been raised over possible negative impact on aquatic organisms since pharmaceuticals are designed to interact specifically with biological processes already at low concentrations. Indeed, the synthetic estrogen ethinylestradiol caused skewed sex ratios and impaired reproduction in fish and frogs at environmentally relevant concentrations. Since the regulatory requirements for pharmaceutical efficacy and safety are relatively far-reaching, their pharmacological effect, mode-of-action, and potential side effects in humans are generally well described. However, currently available standard test methods for deriving regulatory ecotoxicity endpoints have not been tested for these cases not sensitive enough to measure the specific (pharmacological) effects that are expected.

We have analysed the relative sensitivity of standard and non-standard ecotoxicity tests to identify pharmaceutically relevant to non-target species in the aquatic environment. Our results show that the test results exhibited high variance, as the test species did not perform for one and the same substance. In many cases, non-standard tests employ more specific endpoints, yielding increased sensitivity. An illustrative example is ethinylestradiol where a comparison of available data shows that non-standard endpoints are 100 to 200 more sensitive than standard endpoints. In other cases, standard tests were more sensitive. However, for most pharmaceutical substances very few ecotoxicity studies exist and a comparison could not be made.

We conclude that the lack of relevant, robust, and sufficiently sensitive test methods is a major deficiency in regulatory environmental risk assessment of pharmaceuticals. Appropriate test methods are fundamental for risk identification and thus a crucial part of the risk assessment process. As we see it, there are at least three potential ways forward to improve the situation: (1) To develop new standard tests, (2) To adjust existing standard tests i.e. supplementing them with additional endpoints, or (3) To increase the use of non-standard tests.

RA05-5
Is ecotoxicogenomics useful in fulfilling the goals of environmental risk assessment? N. Damm, M. Penninkik, A. Fibby, C. Tylee, D. Knuppen, R. Blust

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The development of experimental approaches which offer additional mechanistically relevant information is widely considered to be beneficial in environmental risk assessment. Toxicogenomics is regarded as excellent tools for the investigation of the biological mode of action (MOA) of a chemical. However, the data gathered through transcriptomics analyses is not readily applicable in a regulatory framework. The hypothesis that similar chemical treatments are related to comparable gene expression profiles opens up possibilities of applying the developed strategies to group chemicals according to their MOA (transcript fingerprinting). Gene transcription profiling can additionally assist in the unraveling of a chemicals toxic MOA.

In this particular study, the potential of transcriptomics is investigated in a cross-species setting among four different fish species: zebrafish (Danio rerio), medaka (Oryzias latipes), common carp (Cyprinus carpio) and the rainbow trout (Oncorhyncus mykiss). The ability of the R50 classification has been mentioned as a possible parameter for decision making. An unjustified classification under one regulation would here penalize a PPP under another directive. Conclusion: it is needed that regulators and authorities adapt in advance (specific guidelines) legislation to cases for which the legislation does not fit, and if problems come up due to non-fulfillments scientifically justified and not bureaucratically based decisions should be raised.

Therefore, we aimed at evaluating whether the different toxic MOAs can be distinguished based on differential gene transcription data, and how transcriptomics data can add additional information to standard tests. Non-structural and the acute toxicity study. In a second part, the specific difficulties we encountered and the potential benefits of the application of transcriptomics in an environmental risk assessment context will be discussed in a broader perspective.

The results of this study illustrated that for simple structural analogues (chlorinated anilines) the R50 classification has been mentioned as a possible parameter for decision making. An unjustified classification under one regulation would here penalize a PPP under another directive. Conclusion: it is needed that regulators and authorities adapt in advance (specific guidelines) legislation to cases for which the legislation does not fit, and if problems come up due to non-fulfillments scientifically justified and not bureaucratically based decisions should be raised.

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RA06-1 A review of methods for analysing standard data: is there a place for non-standard methods?
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Even if new types of bioassays and thus of data arrive on the ecotoxicology market, standard data and associated statistical analysis are still widely used within laboratory routine and regulatory content. In particular, several classical toxicity thresholds are established from standard procedures, carried out according to the OECD either to collect experimental data or to implement appropriate analyses. The Not Observed Effect Concentration (NOEC) and the Lowest Effective Concentration (LEC0) are among the preferred in terms of environmental policy and risk assessment. Some years ago, an alternative, still non-standard, emerged: the No Effect Concentration (NEC). Nevertheless, statistical analyses, classically recommended to deal with standard data [5], are far to be used and the risk assessors, even if concerned, do not know how to use them. We propose to review some published procedures analysing data that are classically performed on standard survival data to estimate NOEC and LEC0 adding a non-standard NEC estimate method, and discussing pros and cons of these different methods. For each threshold type, several methods are compared. In case of NOEC, three hypothesis test methods are compared: the Jonckheere-Terpstra test, the Cochran-Armitage test if a monotone dose-response is expected, and else the Fisher’s exact test with the Bonferroni-Holm correction. In case of LEC0, three dose-response models are fitted in parallel: the log-logistic, the probit and the Weibull models. In case of NEC, we chose one threshold model with a three-phase linear stress function. We illustrate our words with nine standard survival data sets from literature, all concerning the freshwater invertebrate Daphnia magna exposed to copper, zinc, cadmium, potassium dichromate, chloride, invertectone, methomyl, streptomycin or sulfadiazine. For each threshold type, pros and cons are discussed, and the most appropriate method is emphasised. Such a review finally aims to warn regulators against misuse of p-values, against the consequences of the prior choice of an arbitrary value (the x in LEC0), or against the consequences of the choice of a particular parametric model. We suggest to use [3·LOE] confidence intervals, possibly to use LEC0 values with a winthinly chosen x or, even to better use NEC-type toxicity thresholds, which combine all advantages and statistical properties to become reliable and relevant in the framework of environmental risk assessment.

RA07-1 Birds & mammals: balanced decision-making is a social responsibility. Field effect studies used within laboratory routine and regulatory context In particular, several classical toxicity data and associated statistical analyses are still worth investigating, because they are still widely used within laboratory routine and regulatory context. We illustrate our words with nine standard survival data sets from literature, all concerning the freshwater invertebrate Daphnia magna exposed to copper, zinc, cadmium, potassium dichromate, chloride, invertectone, methomyl, streptomycin or sulfadiazine. For each threshold type, pros and cons are discussed, and the most appropriate method is emphasised. Such a review finally aims to warn regulators against misuse of p-values, against the consequences of the prior choice of an arbitrary value (the x in LEC0), or against the consequences of the choice of a particular parametric model. We suggest to use [3·LOE] confidence intervals, possibly to use LEC0 values with a winthinly chosen x or, even to better use NEC-type toxicity thresholds, which combine all advantages and statistical properties to become reliable and relevant in the framework of environmental risk assessment.

RA07-2 A post-registration study in France investigating effects of an insecticide-seed treatment on the honeybees
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The placing of Plant Protection Products (PPP) on the market requires, as mandatory and in accordance with Directive 91/414/EC and the updated related Regulation to come, an assessment of the risks posed by their uses in crop protection to the environment. This risk assessment usually relies on exposure risk assessments, taking into account exposure conditions and exposure levels that are safe to the group of organisms or ecosystem considered. The most refined risk assessments, even relying on up-to-date exposure measurements, ecotoxicological studies and field studies may not address all the uncertainties associated to the occurrence of exposure and effects in the field. In the case of honeybees and other pollinating insects, these uncertainties are related to the conditions for exposure that are the rule in the field (multi-exposure to PPP but also to other background chemicals and veterinary products), indirect effects of crop management techniques (management of field boundaries) and extrapolation of a risk based on the honeybee to other pollinating insects. A post-registration survey has been performed in France, which investigates the effects of the exposure to maize fields grown from insecticide-coated seeds in apiaries. Practical aspects of this survey implementation will be presented, together with the advantages and limits of the approach, in comparison to dedicated field studies and monitoring approaches.

RA07-3 Pesticide pollution monitoring in streams for the identification of appropriate risk mitigation measures
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Risk mitigation measures are becoming increasingly important especially as regulatory framework works like the European Water Framework Directive or the EU framework for sustainable use of pesticides require higher standards. Their effectiveness under field conditions are currently examined at several stream catchments in intensive agriculture in Germany. At a first step stream catchments were monitored to detect pesticide pollution and to develop proposals for appropriate risk management strategies. The monitoring was carried out in 2009 at 10 sampling sites in an intensive field crop region in central Germany and at 9 sampling sites in a vineyard region in south-west Germany. Pesticide residues in the water and sediment phase were determined following heavy rainfall events. Moreover an ecological monitoring (macroinvertebrate community) and a landscape monitoring (dendrochronology and riparian bryophytic cover) allowed to link biological response with environmental pollution. In the field crop region maximum permissible concentrations of insecticides (mainly alpha-cypermethrin, lambda-cyhalothrin, pirimicarb) and fungicides (epoxiconazole, spiroxamine, tebuconazole, fenpropimorph) were exceeded mainly in the sediment but also in the water phase. In the vineyard region, mainly fungicides (especially folpet, tebuconazole, azoxystrobin, fludioxonil) accounted for the pesticide pollution. The evaluation of macroinvertebrate data using the SPEAR-concept, showed that in both study areas water quality is predominantly “poor” or “bad” (field crop region: 7 sampling sites; vineyard region: 6 sampling sites).
In the field crop region the PPPs are used in a high density with a higher pesticide pollution differed from less polluted sampling sites regarding riparian buffer strip width and vegetation, the number of erosion rills and neighbouring fields of presumed increased higher exposure potential. In the vineyard region great concrete road networks connected erosion rills leading in the water system. Respective pesticide residues are regarded as main pesticide entry routes. Runoff samples exemplarily taken in erosion rills showed the same pesticide residues as samples from the stream but in higher concentrations. The different patterns of pesticide pollution in the two study regions show that a differentiated approach for the identification of appropriate mitigation measures is required. At identified higher polluted stream sections appropriate measures are planned to be implemented and evaluated in a further monitoring phase.

RA07-4 Pesticide and nutrient discharge from greenhouses in Norway: preliminary investigations 2007 and 2008
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Preliminary investigations of pesticide and nutrient discharge from Norwegian greenhouses indicate that these effluents can influence water quality and biological diversity in downstream recipients.
During the autumn of 2007 a total of 29 water samples were grabbed in small streams and ditches downstream 9 greenhouses, mainly producing flowers. Pesticide residues were found in 90 % of the samples. A total of 18 different pesticides were detected; 9 fungicides, 5 herbicides and 4 insecticides. Six fungicides (propiconazole, propineb, tebuconazole, azoxystrobin, prochloraz, vinclozolin) and 3 insecticides (pirimicarb, diazinon and chlorfenapyr) were found in concentrations exceeding the Norwegian standard for environmental effects. The fungicides pyrimethanil, iprodione and imazalil were detected in concentrations higher than 1 μg/l. The grab samples contained high concentrations of pesticides also contained high concentrations of nutrients typical for a greenhouse effluent (0.8 - 7.4 mg P/l and 6 - 42 mg N/l). Further investigations in 2008 included grab samples in the drainage system of 10 greenhouses, but also samples in two small streams and ditches downstream greenhouse plants. A total of 49 water samples were analysed for pesticides and nutrients. Pesticide residues were found in more than 90 % of the samples. A total of 25 different pesticides were detected; 11 fungicides, 7 herbicides, 6 insecticides and 1 growth regulator. Two fungicides (cyprodinyl and imazalil) and 4 insecticides (pirimicarb, chlorfenapyr and chlorfenprop) were found in concentrations exceeding the Norwegian standard for environmental effects. The maximal nutrient concentration in drainage water was 30 mg P/l and 650 mg N/l.
The results confirm that greenhouse discharge may contain harmful concentrations of pesticides and nutrients. The results demonstrate a huge variation in effluent concentration as a function of production, operation, water handling system and water consumption. The total discharge of pesticides and nutrients are expected to be efficiently reduced when including environmental aspects in planning, construction and operation of the greenhouses. Optimization of the water handling system (irrigation and drainage) is especially important.

RA07-5 Pesticides in surface and groundwater – Italian monitoring data 2007 - 2008
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ISPRA since 2003 carries out the national reporting on presence, occurrence and concentration in surface and groundwater in order to provide comprehensive information on the quality of waters in relation to the risk of these substances. The report is the result of a complex activity involving regions and local environmental protection agencies (ARPA’s) that perform surveys and transmit data to the ISPRA, which coordinates the activities providing methodological documents, guidelines and evaluating. Pesticides are chemicals used to control weeds, insects and other pests in agricultural areas, and a variety of other land-use settings. In the European Union, from a regulatory point of view, we can distinguish substances used in plant protection products and biocides, which are used in various fields (disinfectants, wood preservatives, pesticides for nonagricultural use, antifoulings, etc.). The use of these substances raises issues about possible adverse effects on humans health and the environment. Because most of them are molecules generally hazardous to all living organisms. During these years, the activities of planning made it possible to focus the survey on the substances actually used and to identify priorities in relation to the potential risk. This activities provided the basis for harmonization of regional monitoring programs and at the same time, the realization of a national system for managing information on the topic. The current Italian national monitoring of surface and groundwater held in the years 2007-2008, will be showed. We present the contamination level found, for comparison both with the limits fixed for drinking water, and for comparison with environmental quality standards defined in recent years by the EU and national legislation.

RA07-6 Could sustainable use directive provide solutions for a better pesticide risk management?
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Introduction
In September 2009 the Council of the European Union adopted the so called pesticides pack-
age (PP). The PP includes the Directive 2009/128/EC (EU). The objective of the SUD is to
achieve a sustainable use of pesticides by implementing a plan for risk and use reduction.
OPERA is a research centre of the Universität Cattolica del Sacro Cuore (UCSC). It is an
independent, not-for-profit scientific think tank, committed to the successful integration of
agro-environmental measures within European legislation. Within this context OPERA reviews
and advice in the implementation and measurement of risk reduction methodologies, which are
crucial for the successful implementation of the SUD.

Activities
Several parallel activities have been implemented by OPERA to contribute to the success of
the implementation of the SUD:
- Selecting the right risk indicators
- Developing mitigation measures
- Reforming the CAP

Results
Relating to the selection of the right risk indicators, OPERA has put forward a proposal of a
possible pool of indicators to select from when elaborating the NAP. Risk Indicators are expected to
help policymakers to identify trends and to predict the persistence of their programmes. The risk indicators issue is the subject of two OPERA publications.

Regarding the example of field margins, the efficiency of such a solution to protect the environ-
ment and human health depends on multiple factors. It has emerged that the most important
factors are (i) the number of chemicals in the PBT class, (ii) the number of chemicals in the nonPBT0 class,
(iii) the number of chemicals in the nonPBT1 class, (iv) the number of chemicals in the nonPBT2 class,
(v) mineralization to 14CO2

We determined kinetic rate constants from data of various pesticides. The results showed that the number of chemicals in the PBT class is most sensitive to changes in the PBT score
and there are only three different kinetic rate constants (i.e., the number of chemicals in the nonPBT2 class, the number of chemicals in the nonPBT1 class, and the number of chemicals in the nonPBT0 class). The results also showed that the number of chemicals in the PBT class is most sensitive to changes in the PBT score and that the number of chemicals in the nonPBT2 class is most sensitive to changes in the PBT score.

The most notorious observation is a much higher concentration of several OCs in women,
compared to men. OCs are common contaminants in the environment and are detectable in
many human tissues. The highest concentrations were observed in the liver, kidneys, and bone. The concentrations of OCs in women were significantly higher than in men. The concentrations of OCs in men were also significantly higher than in women. The concentrations of OCs in children were lower than in adults. The concentrations of OCs in infants were the lowest. The concentrations of OCs in infants were significantly lower than in adults. The concentrations of OCs in adults were significantly higher than in infants. The concentrations of OCs in adults were significantly higher than in children. The concentrations of OCs in children were significantly lower than in adults. The concentrations of OCs in adolescents were significantly higher than in children. The concentrations of OCs in adolescents were significantly higher than in adults. The concentrations of OCs in adults were significantly higher than in adolescents. The concentrations of OCs in adolescents were significantly higher than in adults.
case of 4,4’-DDE, 4,4’-DDE and PCB-118, their concentrations are also higher in women in the case of 4,4’-DDT, 4,4’-DDE and PCB-118, their concentrations are also higher in women in the case of

PBDEs do not show differences between sexes, although men tend to have slightly higher concentrations. For 50% of samples in both cohorts, colostrum:serum concentration ratios were calculated using the log Kow, log Koa and molecular weight.

Results and discussion. Concentrations of OCs in serum and colostrum were significantly correlated (ρ<0.001). The colostrum:serum ratios exhibit certain variability between subjects but a well defined compound dependent trends is observed, being PCB 180 and 5-HCH the compounds with highest and lowest median ratios, respectively. This compound-dependence has been found to be related to the log Kow and molecular weight values. More lipophilic compounds and with heavier molecular weight were preferentially transferred to breast milk. The pesticides exhibited a similar transfer pattern with a high correlation to PCBs and PBBs as they seemed to be more influenced by their molecular weights. Colostrum lipid concentrations were 5-fold higher than serum, this difference in lipid content between both matrices seemed to be relevant for the distributions of these compounds and their transferance from one fluid to the other. The recent study of the transition levels in both matrices (OCs in colostrum and serum samples were significantly correlated. Calculation of colostrum:serum ratios for each individual compound showed that the more lipophilic and heavier OCs were those preferentially transferred from serum to breast milk during the first days of lactation. The different lipid contents of these two fluids were consistent with these observations.

RA09-4 Assessing the acute effects of a Hazardous and Noxious Substance (aniline) on the common prawn Palaeonemon serratus: swimming behaviour and biomarkers

A. Cafarella, C. Ronald, P. Shepherd

The aim of this presentation is to describe briefly regulatory data requirements and related methodologies and to highlight scientific basis of hazard and exposure assessments in coastal waters and offshore waters. The NIES database for the assessment of the quality of sediment from marine coastal waters and transitional waters, which is now proposed to the scientific community for a peer review.

In the frame of the activity of UNICHIM (Italian Organization for Standardization in Chemistry), a committee was constituted to evaluate the possibility of devising one or more batteries for the assessment of the quality of sediment from marine coastal waters and transitional waters. The committee produced a 5 parts document, which is now proposed to the scientific community for a peer review.

No 1107/2009) or pharmaceuticals (Directive 2001/83/EC). Due to the inherent physiological differences between freshwater and saltwater organisms it is logical to hypothesise that one of the groups of organisms will be more sensitive to a specific chemical than the other. Therefore, it is important to provide sound saltwater testing paradigms since marine organisms can be more sensitive than freshwater organisms. It is difficult to predict which chemical substance will be more suitable for a particular applying safety evaluation. A false sense of security or over protection can be created when not warranted. One basic paradigm is founded on developing a data set on a limited number of taxa that adequately protects the low end of the species sensitivity distribution as well as helps define the chemical response curve. The objective of this presentation is to demonstrate how two marine species, the sheephead minnow (Cyprinodon variegatus) and the myod (Americamysis bahia) when combined with a basic freshwater data set can provide one example on how to develop a tiered saltwater testing paradigm that takes advantage of the principles of species sensitivity distributions, dose-response relationships for a given species-chemical combination and the principle that some species will be inherently sensitive to most chemicals. Based on exposure assessments and associated toxicological concerns additional marine species will be recommended to systemically expand the data base. Due to time limitations marine algae and plants, and marine benthic dwelling organisms will not be discussed.

RA09-5 Altered timing of metamorphosis in early life stages of Antarctic krill (Euphausia superba) exposed to p-gp-DDE

A. Cafarella, C. Ronald, P. Shepherd

The aim of this presentation is to describe briefly regulatory data requirements and related methodologies and to highlight scientific basis of hazard and exposure assessments in coastal waters and offshore waters. The NIES database for the assessment of the quality of sediment from marine coastal waters and transitional waters, which is now proposed to the scientific community for a peer review.

This study was done in the scope of the project RAMOCS funded by the Portuguese Foundation for the Science and Technology (FCT) and FEDER funds (ERA-AMPERA/0001/2007, EU ERA-NET AMPERA Agreement FEDER-010098/201615) and was also supported by FCT (European Social Fund and national funds from the “Ministério para a Ciência, Tecnologia e Ensino Superior”. MCTES) through a research grant to Luis Luiz (SFRH/BI/81043/2010).

The current study was designed to assess the swimming velocity of the common prawn and the different lipid and structural alterations in several biomarkers. These results indicate that aniline spills may have a direct acute impact in exposed populations of this species since intoxicated animals may have a decreased capability of avoiding predators and capture preys, as well as reduced capabilities of performing physiological functions determinant for their survival and performance. This study was done in the scope of the project RAMOCS funded by the Portuguese Foundation for the Science and Technology (FCT) and FEDER funds (ERA-AMPERA/0001/2007, EU ERA-NET AMPERA Agreement FEDER-010098/201615) and was also supported by FCT (European Social Fund and national funds from the “Ministério para a Ciência, Tecnologia e Ensino Superior”. MCTES) through a research grant to Luis Luiz (SFRH/BI/81043/2010).
Assessing the effects of contaminants on ecosystem health requires not only measuring the concentrations of contaminants in the environment or biota, but also to study their effects on ecologically relevant biomarkers in species naturally occurring in the study area. It is crucial to rely on robust biomarkers in risk assessment and marine monitoring, i.e. ones that respond solely to the contaminant(s) of interest and not to any background conditions. Amphibians are potentially to investigate the total toxicity of sediments and understand their effects on marine organisms in order to give recommendations. Reproduction disorders in amphibians are caused due to contamination with contaminants that have toxic effects on amphibians. The hypothesis is to improve bioequivalents in their search for a rapid, reliable, and robust method for bioequivalents and their implications for regulatory and non-regulatory risk assessments.

RA10 Risk assessment of chemical mixtures: how can we crack the nut?

RA10-1 Risk assessment of POP mixture: the case study of the Arctic

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Persistent organic pollutants (POPs) are global contaminants, capable to reach remote areas, and particularly cold regions, trough long range transport patterns. Therefore, detectable concentrations of contaminants in the environment or biota, but also to study their effects on marine organisms in order to give recommendations. Reproduction disorders in amphibians as a result of exposure to contaminants that have toxic effects on amphibians is, therefore, a potential to investigate the total toxicity of sediments and understand their effects on marine organisms in order to give recommendations. Reproduction disorders in amphibians are caused due to contamination with contaminants that have toxic effects on amphibians.

RA10-2 Quantifying in vitro biosassays data: Mathematical methods to estimate bio-equivalents in- troduce a high degree of uncertainty

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Quantification is a key issue when interpreting in vitro biosassays data. Commonly, so-called bioequivalents (e.g. estradiol or dioxin equivalents) are used to quantify the endocrine potential of complex mixtures of endocrine disrupting compounds in relation to well-characterized, prototypical reference compounds. However, there is no generally accepted data analysis strategy for estimating bio-equivalents from this type of studies. Therefore, within this presentation we will review mathematical approaches for the derivation of bio-equivalents from the body of literature. It clearly stresses the accuracy of the more common models to predict bio-equivalents, and (III) proposes methods to reduce uncertainty in the calculation of bio-equivalents. By scrutinizing the literature covering the period of 1990 to 2010 we compiled a data base of more than 200 papers related to the calculation of bio-equivalents. From the published data we extracted three main data analysis strategies to calculate bio-equivalents. These models are based on linear or nonlinear interpolation, and the comparison of EC50 values. To assess and compare the models' accuracy, we employed simulated data sets in different scenarios. This theoretical calculations indicate that the linear and the EC50 model considerably underestimate bio-equivalents in most of the scenarios (20 to 2,000 deviation). Compared to that, the less employed nonlinear model predicts correct bio-equivalents in all cases. Following the actual estimation, bio-equivalents are commonly transformed to a defined reference volume or mass of the sample (e.g. a reference sediment). Since this is achieved by linear extrapolation additional inaccuracies is generated. Taken together, our evaluation indicates that data analysis by itself introduces a considerable degree of uncertainty in the derived bio-equivalents. To increase accuracy in bio-equivalent estimation, we will present strategies to improve data analysis as well as experimental design of in vitro biosassays.

RA10-3 Interactions and their impact on the heavy use of Concentration Addition (CA) as a tool for predicting and addressing the chemical toxicity of mixtures. CA assumes that the compounds in a mixture do not interact with each other, neither in their toxicokinetic nor in their toxicodynamic phase. However, several of those interactions are described in the scientific literature for almost all major groups of environmental chemicals. However, the effects of interactions on the total toxicity of the mixture, i.e. higher, respectively lower mixture toxicities than expected by CA. With a view on the regulatory risk assessment of chemical mixtures, it is hence important to quantify the range of expectable synergies, respectively antagonisms.

Discussions on the quantitative consequences of interactions for the predictive power of CA using two published studies on the hazards and risks of environmentally realistic mixtures. One case study concerns the human health effects of a mixture of anti-androgens, the other the ecotoxicity of a pesticide mixture. Based on a series of simulation studies in which interactions were gradually assumed to occur in the mixture. We outline the limiting cases (worst case situations) as well as the fundamental relationship between expectable deviations from CA and number of mixture components, mixture ratio and number of interacting substances in the mixture.

RA10-4 Working with the regulator to determine key risk-driving compounds

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Risk assessment is currently under way in this initiative in Northern Ireland with a wide variety of compounds of potential concern (COPCs). The risk assessment follows the UK CLRI framework for management of contaminated sites, leading the site from investigation to remediation and ensuring a "suitable for intended use" outcome. The experience we aim to share is the process of determining key risk-driving compounds for the site while involving the regulator throughout the entire decision making process. The current phase of works is focused on assessing the risks to human health and the water environment from multiple COPCs. With this large number of substances detected over several years of environmental investigation at a relatively low concentration, one of the initial challenges has been clearly evaluating and then communicating the relevance of these compounds so as to focus on the key issues and potential risks. Rather than deriving generic assessment criteria (GAC) for a large number of COPCs under future conditions, the approach adopted was to first identify and focus the assessment on the key risk-driving compounds. Compounds were evaluated based on receptor (humans, aquatic and wildlife species) and with regard to toxicity, physical and chemical properties, spatial distribution, frequency of detection and magnitude of exceedance of adopted target concentrations. Compounds detected in association with contamination are then subject to rigorous evaluation and, by working through the evaluation procedures, one or two key risk driving compounds were identified within each group.

Ultimately, the compounds identified originally, approximately 30 were identified as likely to be key risk-drivers and were carried further into the risk evaluation process. Efforts to derive GAC will then focus on this manageable list of key compounds. Discussions with the regulatory agency have provided the basis for streamlining the assessment. The experience was engaged during the early stages of developing the compound evaluation approach and provided with the opportunity to review documentation progressively. Transparency in communication and decision making is key and ensures continued alignment as the risk assessment progresses in a timely manner.

RA10-5 Risk assessment of single substances and mixtures of micropollutants in the Belgian coastal waters

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A mixture toxicity mixture is a complex issue and therefore not implemented in the current EU legislations. It is practically not feasible to assess experimental mixture toxicity with all combinations of chemicals present on the market and in the environment. In the existing INRAM (Integrated Risk Assessment and Monitoring of micropollutants in the Belgian coastal zone, 2007-10) project, one of its aims is to study the possibilities of assessing mixture toxicity through an integrated risk assessment approach. More than 100 micropolllutants (e.g. pesticides, endocrine disruptors, pharmaceuticals) were analyzed in the Belgian coastal harbors. A database was subsequently developed summarizing all toxicity and ecotoxicity parameters of these chemicals (Integrated Risk Assessment and Monitoring of micropollutants in the Belgian coastal zone, 2007-10). The GAC will then focus on this manageable list of key compounds. Discussions with the regulatory agency have provided the basis for streamlining the assessment. The experience was engaged during the early stages of developing the compound evaluation approach and provided with the opportunity to review documentation progressively. Transparency in communication and decision making is key and ensures continued alignment as the risk assessment progresses in a timely manner.

RA10-6 On the use of mixture toxicity assessment in REACH and the Water Framework Directive (WFD)

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This review seeks to connect scientific theory of mixture toxicity to its implementation within SETAC Europe 21st Annual Meeting Abstract Book
different regulatory frameworks both within Europe and the US. The aim is to demonstrate how mixture toxicity assessment can be more thoroughly integrated into the European chemical regulations, REACH and the Water Framework Directive (WFD), using the experiences gained through other regulatory frameworks. The paper consists of 1) the examination of the scientific underpinnings of the range of methods used to assess the joint action of chemicals; 2) how such methods have been developed for the different regulatory frameworks; and 3) how such methods could be applied within REACH and WFD. It is concluded that REACH and WFD include mixture toxicity assessment to a very limited extent at the moment. However, it is shown that it is both scientifically feasible and regulatory practicable to integrate a more holistic mixture toxicity approach in both legislations. This will result in a limited number of chemicals used in each mixture toxicity scenario. Those with individual PEC/PEOC > 1 are recommended to be included. Furthermore the construction of a database that includes data on chemicals in the European environment could help determine the relevant chemicals for each mixture toxicity assessment.

RA11-1  Risk assessment of chemicals within REACH integrating alternative methods and non testing strategies

Threshold of toxicological concern assessment: investigation of possible improvements by means of in silico methods

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Setac Europe 21st Annual Meeting Abstract Book

The Threshold of Toxicological Concern (TTC) approach is a screening tool based on the principle of establishing human exposure threshold values for chemicals, below which no significant risk to human health is expected. According to this approach, a safe level of exposure can be identified for many chemicals based on their chemical structure and the known toxicity of chemicals which share similar structural characteristics. This generic approach was first developed for the endpoint of cancer by the US FDA in the 1980s and adopted in 1995 as the ‘Threshold of Regulation’ for food contact materials. Since then, the TTC concept has evolved over the years to take into account extensive analysis of available data on mainly the oral toxicity of substances for toxicological endpoints other than cancer. Using a structure-based decision tree, the Cramer classification scheme and the wide range of human toxicological endpoints, the TTC approach has been applied, mainly in the food area. It has been used to evaluate flavouring substances, food contact materials, genotoxic impurities in pharmaceuticals and for the risk assessment of other chemicals. In 2010 the European Food Safety Authority (EFSA) funded the present research project aimed at improving the screening ability of the TTC approach can be improved by incorporating physicochemical data and toxicity data generated by non-testing methods. The Cramer classification scheme, which is used to classify chemicals according to their structural characteristics, was analyzed to whether an alternative classification based on molecular descriptors might be developed. In the current study the original Cramer dataset and two major TTC datasets were retrieved, verified and analyzed, the Carcinogenic Potency Database (CPDB), including additional carcinogens based on Kros et al., 1997, 1998). In the large dataset containing information on human toxicological endpoints, the chemical space covered by the two datasets was characterised using several molecular descriptors and explored by means of a variety of chemoinformatics techniques. The chemical space of the dataset was compared against the wider universe of chemicals, as represented by the Distributed Structure-Searchable Toxicity (DSTox) Database developed by the US Environmental Protection Agency (EPA) as a reference. Finally, a refinement of the Cramer structural classes was proposed which identify structural subclasses.

Exemplification of the integration of tools within REACH: the CADASTER project

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The OECD QSAR Toolbox version 2.0 is a software application to be used by governments, industry and other stakeholders to fill gaps in eco/ toxicological data needed for assessing the hazards of chemicals. It contains databases with results from experimental studies, grouping engine, a library of QSAR models, tools to estimate missing experimental values, and report editor. Since October 2010 the OECD QSAR Toolbox version 2.0 is available for free and can be downloaded from the OECD website. For the first time in Version 2.0 there is a distributed version along with a stand-alone version. Also, with Version 2.0, new downloads are accessible via auto-updates. This release is part of a four-year collaborative project between OECD, ECHA, EURL and other partners. The aim of this presentation is to elucidate the improvements of the main functionalities of the new version of the Toolbox: Input, Profiling, Endpoint, Category Definition, Data Gap Filling and Report, as well as the new features introduced in version 2.0 of the Toolbox. Key changes in some versions compared to previous versions include: new data and documentation, new data and documentation, new data and documentation, and new data and documentation. The key mechanistic profilers were refined, and new databases were added. The new version of the OECD QSAR Toolbox allows also users to import/export data from and to UCLID 5, and suitable reporting of the results. The system infrastructure was also improved in order to address the numerous other requirements of the growing number of users. Currently, based on the user comments, we are working on the next version 2.1 which will be releases in mid February 2011

RA12-2 Risk communication for environmental protection: Scientific and regulatory needs

Development of realistic and effective risk mitigation measures within authorisation of human activity...
A11-2 Communication about environmental risks of human pharmaceuticals and the therapeutic desires of patients: is there an overlap?

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Potential environmental risks of human pharmaceuticals are a subject of growing interest in the scientific and regulatory community as well as in the general public. Evaluation of the environmental risk assessments and the discussion on consequent management options are focused on the environmental impact but rather little on the desire of the patients for optimal therapeutic treatment. This produces uncertainties amongst the stakeholders in the public health system about the actual extent of the problem and the urgent needs for regulatory actions.

In this study, we investigate the impact of environmental risks in the United Kingdom, using surveys of pharmacy buyers in order to investigate the potential for reducing the environmental impact of medical treatment. The results are compared with those of a study on patients’ requests for environmentally friendly medicines in Sweden. The study confirms that the implementation of globally harmonized systems of classification and labeling (GHS) may lead to more harmonization, transparency and equal treatment without regard to environmental legislation.

RA12-2 Communication about environmental risks of human pharmaceuticals and the therapeutic desires of patients: is there an overlap?

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These different requirements, use and kind of QSAR models, demand different ways to communicate the major barrier. The tools for prioritization can be also different from those used within the C&L approach, since it is useful to summarize the results. These different requirements, use and kind of QSAR models, demand different ways to communicate the major barrier. The tools for prioritization can be also different from those used within the C&L approach, since it is useful to summarize the results. It has become clear that this discipline needs different approaches when extrapolating from laboratory standard test systems to investigate the cross effects of parasite infection and nickel contamination. Due to the impact that plant protection products may have on aquatic ecosystems, extensive laboratory toxicity studies and risk assessments are required before a product can be registered in the European Union. Predicted environmental concentrations (PEC) of active substances in groundwater from both ends at once. Moreover, a tendency to a decrease of the immune system capacities was measured: at the end of the experiment, there were two-times more infected mussels presenting affected mussels. Moreover, a tendency to a decrease of the immune system capacities was measured: at the end of the experiment, there were two-times more infected mussels presenting...
Species sensitivity distributions (SSDs) are cumulative distributions of species’ physiological sensitivity to toxicants. An attractive attribute of SSDs is that they allow the severity of a particular concentration of a chemical to be estimated in terms of the potentially affected fraction of species. The severity of a pollution event is a critical component of risk: the severity of an undesirable event and the probability that it will occur. However, estimates of the potentially affected fraction of species from SSDs are contingent on several assumptions that are unlikely to be met in conventional uses of SSDs. Recently various novel experimental, field and/or statistical methods have been suggested that will result in SSDs that better meet their assumption. At the same time there is growing recognition that physiological sensitivity of species to toxicants (as measured in laboratory conditions) is only one aspect which will influence the response of populations to toxicants. Modelling a species’ population will provide better estimates of the likely effect of chemicals on its population but is unlikely to be feasible for a large and representative sample of species of environments/regions of interest. The combining of resilience traits (e.g. generation time and dispersal capacity) and an avoidance trait (e.g. spending a significant part of the life-cycle removed from the contamination) and physiological sensitivity has proven very useful in developing biological indices that can indently community level impacts from specific classes of chemicals. However, to examine how these indices can be combined with species sensitivity data to estimate occurrence of potentially affected species (e.g. based on a Life Cycle Risk approach) and to identify which factors contribute to species response to chemical stress.

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In situ ecological risk assessment using taxonomic metrics and life history traits of macroinvertebrates
C P Mondy, P Usselglio-Pelatere
Université Paul Verlaine - METZ, France
The European Water Framework Directive (WFD) requires that Member States evaluate the quality of their water bodies using biocriteria like macroinvertebrates. In this work, we aimed at identifying relevant taxonomic and life history based metrics from which we built a first version of a national tool intended to help experts in identifying stresses from survey of macroinvertebrate communities.

Data faunal comes from the application between 2005 and 2008 of a normalized protocol on 1795 sites distributed through all France (4190 sampling units). Chemical characterization of sites was also performed. To homogenize stressor categories, a set of taxonomic and life history based metrics was calculated for each sampling unit. Considering the available information (chemistry and biology), we selected at least 6 “reference” sampling units (i.e. the least impacted as possible) for each river type (68 river types).

We transformed metric values in standard deviations from reference. Then we used conditional trees, i.e. dichotomous classification method using Monte-Carlo permutation tests (α = 0.01, 999 iterations) to decide if groups based on stress status are significantly different considering biological metrics. For metrics that showed a significant response to stress we quantify their Discrimination Efficiency (DE). We selected “generalist” metrics (DE > 30% for at least 7 stress categories) and “specific” metrics (DE > 30% for at most 3 stress categories). The selected metrics were used to build conditional forests with combinations of metrics based on their utility as proxy of DE. These models predict the risk for a sample to come from a stressed station according to its metrics values.

All our “specific” metrics are pretty good in classifying the samples from reference site but classify samples from impaired sites with lower efficiency (True Negative Rate between 0.0952 and 0.6892). Incorporating generalist metrics increases the TNR of the models but decreases their specificity.

In this work, we showed that it was possible to construct models that help at establishing a diagnostic on the nature of stress from taxonomic and life history based metrics, we also demonstrated that the use of conditional trees is a powerful tool for predicting litter breakdown dynamics from the abundance of keystone species. This work reinforced the idea that trait-based approach may be an efficient tool for understanding the mechanism effects of chemicals on organisms and their consequences on ecological processes.

RA13C-3

Trait-based approach and vulnerability analysis of soil communities affected by pesticide application
C Vepr, CAM van Gestel, M Vith
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The commonly used tools to assess ecotoxicological risk are lacking ecological realism, because they cannot predict the real consequences for natural communities. In recent years, ecotoxicology has developed new tools and methods to develop more ecological models and tools capable of characterizing the complexity of ecosystems. In particular, the concept of ecosystem vulnerability is now considered an essential component of site-specific risk assessment. Vulnerability is defined as a function of sensitivity, susceptibility to exposure and recovery potential after a stress. Trait-based approaches are a new tool for predicting how species or other groups of species respond to toxicants. Exposing the biodiversity of a community to toxic stressors can cause a shift in the community's composition, but their characteristics can change in different ways. This means that the vulnerability of different species to a stressor can be predicted from their characteristics.

Traits may be considered as functional traits of species or functional groups. Functional traits are more stable than species diversity, but the importance of species richness is not negligible. However, the roles of species richness can change under the impact of different stressors. The results of this study were used to propose a method for predicting effects on the community's composition by exposure to toxicants. The method was compared with laboratory bioassays for different chemical classes. The results indicate that the predictive power of the method is not as good as expected, but it can be improved by using a larger number of species. The results of this study can be used to improve the method and to predict the effects of toxic stressors on natural communities.
The effects of varying environmental conditions on the toxicity of mine effluent constituents to coldwater fish

DI Mozes1, D Poitier1, P Sibley1, K Solomon1
1University of Ghent, GUELPH, Canada

Outcome of the project is that the food web model was used to predict the effects of environmental variables on the toxicity of chemicals to fish, and this information was used to identify functional groups at risk.

To assess potential effects of toxicants at the ecosystem level, modeling reveals to be a promising tool for the ecological risk assessment of toxicants, particularly for the assessment of acute toxicity effects on aquatic ecosystems. In this study, we aimed to develop a compartmental ecological model for a whole aquatic ecosystem accounting for species interactions and environmental effects. The model was used to identify functional groups at risk and to optimize model parameter values using sensitivity analysis, i.e., to highlight parameters having the greatest influence on calculated target endpoint values. The model calibration provided new values for the parameters that were found to have an important influence on the model output. These values will be presented, during the talk, as well as simulations of the ecosystem dynamics under the non-contaminated conditions. We will finally discuss the potential of the presented model for risk assessment and thus illustrate how useful such a modeling approach could be for ecological risk assessment.

RA13D-9

Reviewing 15 years of European risk assessment: what if we had used models to assess eco-toxic effects?

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1Ghent University, GHENT, Belgium

The global trade of chemicals and products containing chemical additives such as paint, cosmetics, household cleaners, paper, and packaging materials is huge, and the associated environmental and health risks are significant. The release of chemicals from these products can pose a risk to human health and the environment. The goal of this study was to review the use of models in European risk assessment over the past 15 years and to identify gaps and opportunities for future research.

RA14-1

Environmental and health risks of chemical additives and their recycling materials

V Grundmann, B Bilowtitz
Technische Universität Dresden, PIRNA, Germany

The critical points throughout the products life cycle for the release of chemical substances and products containing chemical additives such as paint, cosmetics, household cleaners, paper, and packaging materials is huge, and the associated environmental and health risks are significant. The release of chemicals from these products can pose a risk to human health and the environment. The goal of this study was to review the use of models in European risk assessment over the past 15 years and to identify gaps and opportunities for future research.

RA13D-6

Microsporidia parasitism in Gammarus: a confounding factor in the evaluation of cadmium toxicity

F Gismondini1, JN Reifel1, T Rigaud1, C Cosu-Leguille1
1LIEBE, METZ, France

Microsporidia may use horizontal and/or vertical transmissions. Vertically-transmitted parasites are common in freshwater amphipods, where they can reach high prevalences and have significant effects on host sexuality and behavior. However, few studies have been devoted to vertical transmission and the associated adaptation of SPEAR to leech systems is feasible but it necessitates reconsidering the traits used in its construction. It also emphasizes how species composition of pond invertebrate communities may be determinant for their sensitivity and restoration ability after exposure to a toxicant.
of specific substances in the circular economy is an actual risk or a perceived risk. Within the project the following key pieces of information will be required and collected: where are critical points throughout the products life cycle (for the release of chemical substances), how hazardous and toxic the material set free, effects caused by the chemicals (global or regional meaning), risk (actual or perceived) of the release of specific substances in the circular economy.

RA14-2
Review of models used for human health and environmental risk assessment
1T. Tanaka1, E. von der V oet2, L van Oers2, Y Gao3, T Rydberg4
2Technical University of Denmark, LYNGBY, Denmark
3Università Cattolica del Sacro Cuore, PIACENZA, Italy
4Facilia AB, BROMMA, Sweden
The coordination action RISKCYCLE aims at establishing and coordinating a global network of international experts and stakeholders to define together future needs of R+D contributions for innovations in the risk-based management of chemicals and products in a circular economy of global scope. The project will focus on the fate and behavior of additives used in the different industrial sectors (textile, electronics, plastics, leather, paper and lubricants). The coordination action RISKCYCLE project, a selection of risk assessment models has been done. The analysed models have been Ecopoints, ECOSENSE, EDIP method, eco-indicator 99, USEa-LCA/EUEs, Calcut, GLOBOX and USEtox, among others. Their weaknesses and the strengths have been analysed.

RA13-1
Life cycle assessment and additives: state of knowledge
HF Larsen1, E von der V oet2, L van Oers2, Y Gao3, T Rydberg4
1Technical University of Denmark, LYNGBY, Denmark
2Technical University of Denmark, LYNGBY, Denmark
3Università Cattolica del Sacro Cuore, PIACENZA, Italy
4Facilia AB, BROMMA, Sweden
Concerns about possible toxic effects from additives/impurities accumulated in globally recycled waste/resources like paper and plastics was one of the main reasons for starting the EU FET Coordination Action project RiskCycle (www.wadef.com/projects/riskcycle). A key aim of the project is to identify research needs within this area focusing on both risk assessment (RA) and life cycle assessment (LCA). The main aim of this review is to focus on additives/impurities released into the environment in the context of risk assessment. Within the framework of RISKCYCLE project, a selection of risk assessment models have been done. The selected models have been Ecopoints, ECOSENSE, EDIP method, eco-indicator 99, USEa-LCA/EUEs, Calcut, GLOBOX and USEtox, among others. Their weaknesses and the strengths have been analysed.

RA14-6
Application of an integrated approach to evaluate health risks for toxic chemicals by linking multimedia environmental and PBPK models
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5EDF, Division Recherche et Developpement, CHATOU, France
The paradigm of health risk assessment may consist of two main pillars, i.e., the exposure and dose-responses assessments. Human exposure to chemicals via multiple pathways can be estimated by environmental multimedia models, which calculate the distribution of chemicals in the compartments, i.e., air, soil, water, plants, and animal media. Combined with the information about human behaviors such as dietary habits, time spent outside, and etc, the multimedia models can provide an estimation of the daily chemical intake by inhalation or ingestion by humans. Physiologically based pharmacokinetic (PBPK) models are used to estimate the body burden of toxic chemicals throughout the entire human lifespan, integrating the evolution of the physiology and anatomy from childhood to advanced age. The use of such PBPK models overcomes the limitations that dose-response modelling holds, e.g., it simply determines the relationship between the dose and the probability of an effect. The European project 2-FUN (Full-chain and Uncertainty Approaches for Assessing Health Risks in Future Environmental Scenarios) aims at improving the approaches currently used in exposure and dose-response assessments. According to the aim of that project, an environmental multimedia model and a generic PBPK model are coupled as an integrated tool (2-FUN tool) and built up on a platform system, Ecotool. This study focuses on the application of the integrated tool to perform the full-chain risk assessment of a chemical for human health, considering multiple exposure pathways of chemical via inhalation of outdoor air, ingestion of water and foods.

RA14-5
The European project 2-FUN (Full-chain and Uncertainty Approaches for Assessing Health Risks in Future Environmental Scenarios) aims at improving the approaches currently used in exposure and dose-response assessments. According to the aim of that project, an environmental multimedia model and a generic PBPK model are coupled as an integrated tool (2-FUN tool) and built up on a platform system, Ecotool. This study focuses on the application of the integrated tool to perform the full-chain risk assessment of a chemical for human health, considering multiple exposure pathways of chemical via inhalation of outdoor air, ingestion of water and foods. For this application of the tool, a case study was designed based on the information available in a region situated on the Seine river watershed, downstream of the Paris megacity and its suburbs. The study concerns the assessment of the exposure to microplastics in the blood of residents living in the region and foods. For this application of the tool, a case study was designed based on the information available in a region situated on the Seine river watershed, downstream of the Paris megacity and its suburbs. The study concerns the assessment of the exposure to microplastics in the blood of residents living in the region and foods.
MO 002
Passive sampling for the monitoring of organic pollutants (PAHs, BTEX) in groundwater. Application to a former industrial site.
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BRGM, ORLEANS CEDEX 02, France

Classical techniques for groundwater sampling can affect the measurement of chemical composition of water. Sampling devices such as low-flow peristaltic pumps can sample water slowly from wells to obtain representative samples but can also involve sorption of hydrophobic compounds to the tubing and leaching through volatilization. In this context, passive sampling technology presents several advantages associated with a low perturbation of the sample, including simplicity, low cost, no power requirement and possible estimation of time-weighted average (TWA) concentration of pollutants.

The aim of this work is to present results obtained with two passive sampling devices, an integrative passive sampler (SPMD–Semi Permeable Membrane Devices) and an equilibrium passive sampler (PDBs–Passive Diffusion Bags) for respectively the estimation of PAHs and BTEX concentrations in groundwater at a former industrial site. Results were compared with those from classical analysis (LC/UV/fluorescence and IGC/GC-MS for PAHs and BTEX respectively) on water samples obtained with a discrete interval sampler. The discrete sampler allows sampling with minimal disturbance of the water in comparison with classical sampling. SPMD were deployed for several time durations to estimate the kinetic accumulation of compounds. PDBs were deployed to estimate the TETX concentrations in groundwater. First results demonstrated that BTEX concentrations in PDBs samples were in good agreement with those estimated in water samples with the discrete interval sampler. This demonstrates that PDBs can estimate the VOC concentrations in the well at a defined depth. For most of PAHs, the kinetic accumulation was linear over the deployment period. For some PAHs, time average concentrations (TWA) estimated with SPMD could be in good agreement with those found in water samples.

Acknowledgement: The authors thank ADEME (French Environment and Energy Management Agency, AT TEMA Project) and the research division of BRGM (ECHANT ES project) for their financial support.

MO 003
Applicability of passive sampling to groundwater monitoring
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Passive sampling technology has become of great importance in the field of environmental monitoring for several reasons such as its well-known advantages (low perturbation of the sample, time-weighted average concentration estimation (3DOTS)). Although passive samplers have been successfully used in a variety of field studies in surface waters, only a few studies have tested their applicability in groundwater. Indeed, groundwater presents specificity such as a low velocity of water which may modify the concentration of compounds in passive samplers. Moreover, the use of passive samplers in groundwater supposes the water in the well to be representative of the whole groundwater.

The aim of this work is to test several passive sampling devices (DGT, POCIS, PDBs) for the monitoring of metals, pesticides, and volatile organic compounds (VOC) in groundwater in order to identify the pros and cons of this technique for groundwater applications. Several campaigns of measurements were conducted in order to compare the results obtained with passive sampling with those obtained by classical sampling. All passive samplers were deployed in a well and at different depths to study the stratification of pollutants. First results demonstrated that:
- A good repeatability is observable on the passive sampling results,
- VOC concentrations concentrations determined by PDBs are in good agreement with those obtained by classical sampling in the well. These results highlighted that PDBs allow the measurement of VOC concentrations at different depths easily,
- In some cases, the low water velocity seems to limit the uptake of compounds for integrative passive samplers.

This factor has thus to be taken into account for the calculation of the concentration in water.

Acknowledgement: The authors thank ONEMA via AQUAREF and the financial support of ONEMA via AQUAREF and the research division of BRGM (ECHANT ES project) for their financial support.

MO 004
Occurrence and fate of pesticides in Arcachon bay using the passive sampler approach
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C. Berho, AT Togeta, BG Girardreau, LA Amalric, AS Saada
BRGM, ORLEANS CEDEX 02, France

Conventional water sampling techniques are time consuming and cost effective, especially when heavy logistical organisation is required to assure a high frequency sampling that is necessary to take into account the variability occurring in pollutant concentrations.

Indeed, the chemical characterisation of coastal waters and of transition water systems such as estuaries or bays is complex because important dilutions and important temporal variability usually occur. To overcome the problem posed by the temporal variability of the water concentration, various passive sampling techniques were developed allowing the estimation of the mean water concentration of the pollutants over the exposure time.

The present work thus aims to evaluate the presence and the sources of pesticides in the Arcachon Bay, one of the most industrialised areas in Europe. Various sampling campaigns have occurred these last years in this unique complex and vulnerable ecosystem with regression of sea grass, alteration of oyster physiological condition... In view to understand the potential role of chemical contamination on these phenomena, water bay contamination was monitored. Indeed among all the potential pathways the biogeochemical transformation, chemical contamination is crucial to document and among all the potential suspect contaminated, pesticides can play a significant role. To evaluate pesticide sources and to precisely characterise their presence, antifouling and various herbicides were monitored in the main tributaries and in also directly in Arcachon Bay by discrete and passive samplings. Both types of sampling were compared. Furthermore tributary contribution to the Bay contamination was evaluated.

MO 005
Improvement and application of the polar organic compound integrative samplers (POCIS) using Performance reference compound approach for pesticides and pharmaceutical substances
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Since few years, the application of POCIS to monitor hydrophilic compounds in dissolved medium is commonly used. Unfortunately, the sampling rates of these tools are affected by several environmental parameters like hydrodynamic conditions, temperature and bio-fouling. Consequently, the sampling rates obtained in laboratory experiments are not adapted for the majority of environmental assessments. To overcome this phenomenon, the performance reference compound approach was developed during the 90s for the Semi Permeable Membrane Devices (Prest et al. 1997) and the same approach was later adapted to the POCIS tools for the pesticides using the Desipryophell Atrazine as reference compound (Mazzela et al. 2007/2010).

The PRCs are put into the receiving phase of the sample before the exposure. During the exposure, the PRCS are eliminated from the receiving phase. Their elimination rates allow to determine the specific sampling rates of target analytes in the in situ conditions.

Noteworthy, the PRC approach is used for the pharmaceuticals sampled by PO-CIS. A first experiment was performed to determine the pharmaceutical compounds which can be used as PRC, among which the Caffeine C13, Salbutamol d3 present a satisfactory behaviour. In the near future, a laboratory experiment was realised to calibrate the previous PRCs on the Desipryophell Atrazine d5. Similarly, the sampling rates of pesticides and pharmaceutical compounds were evaluated. Finally, the devices were exposed in the Gironde estuary during one year to evaluate the pesticide and pharmaceutical contamination of this ecosystem.

Acknowledgement: Région Aquitaine and ANR EMESTOX (ANR PRECODD 2008) are acknowledged for their financial support.

MO 006
Pesticide monitoring of Arcachon bay using various passive sampling techniques
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The present work focuses on the study of the pesticide contamination of the Arcachon bay in its entire area, on the north coast of France. This area is subject to environmental problems caused by the hydrogeochemical activity of the Arcachon basin and the pollution of the Arcachon Bay. In order to improve this we have carried out a suite of screening studies in BiH during the period 2007-2011. In this context, the passive sampling approach was frequently used to assess the local contamination of the water bay since it overcomes drawbacks of spot sampling approach which gives only the contamination at the time of sampling and not at all integrated assessment of it.

In this study, the monitoring of the water bay pesticide contamination was completed using simultaneously the grab sampling and passive sampling approach during one year. Three types of passive samplers were used - The Silicon rubber samplers which can trap the most hydrophobic pesticides, the polar organic integrative samplers (POCIS) and an adaptation of the POCIS which are made with a highly porous membrane to reduce the mass transfer and improve the detection limit of this tool. These three passive samplers exposed in the same environmental medium allow to evaluate the performance of each, their advantages and drawbacks for various compounds and sampling technique.

Acknowledgement: Région Aquitaine and ANR EMESTOX (ANR PRECODD 2008) are acknowledged for their financial support.

MO 007
Screening for Stockholm Convention POPs in Bosnia and Herzegovina using passive methods
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LPTC, TALENCE, France

A first experiment was performed to determine the pharmaceutical compounds which can be used as PRC, among which the Caffeine C13, Salbutamol d3 present a satisfactory behaviour. In the near future, a laboratory experiment was realised to calibrate the previous PRCs on the Desipryophell Atrazine d5. Similarly, the sampling rates of pesticides and pharmaceutical compounds were evaluated. Finally, the devices were exposed in the Gironde estuary during one year to evaluate the pesticide and pharmaceutical contamination of this ecosystem.

Acknowledgement: Région Aquitaine and ANR EMESTOX (ANR PRECODD 2008) are acknowledged for their financial support.

MO 008
Combining passive sampling (PSH herbicides) and remote sensing (water quality) data on the Great Barrier Reef, Australia
CSIRO, BRISBANE, Australia

The Reef Rescue Marine Monitoring Program (MMP) was established to assess any change in water quality on the World Heritage Area Great Barrier Reef (GBR). Annual monitoring
of the concentrations of photosystem II inhibiting (PSII) herbicides such as diuron, atrazine, hexazinone and tebufluthrin has been conducted at inshore reef sites along the GBR for up to five years using passive sampling techniques. As a result of this a unique set of data is now available that provide seasonal and regional trends of monthly or bimonthly average concentration estimates of these chemicals in the water column at these sites. In addition to pesticide monitoring, in situ bioassays have also been deployed to measure the activities on the concentrations of water quality parameters (total suspended sediment, chlorophyll-a and coloured dissolved organic matter). One of the dominant contributors to declining water quality within the GBR are terrestrial discharge derived inputs of elevated nutrients, sediments and agricultural chemicals from adjacent catchments. There is some evidence for synergistic effects between specific water quality parameters and PSII herbicide concentrations on crustose coralline algae which may influence the structure and functioning of coral reefs. The aim of this work is to provide a preliminary evaluation of the statistical relationships between remote sensing derived water quality parameters and the concentrations of specific PSII herbicides on the GBR. The information gained from this work may be used to inform research into the effects of multiple stressors such as a decline in water quality and exposure to PSII herbicides, on reef ecosystems. Furthermore it may eventually provide a tool that can be used for predictive purposes and to evaluate whether newly adopted management strategies will result in future differences in the observed relationships at these specific locations.

**MO 009**

**Comparison between in situ Star Sorptive Extraction and the Polar Organic Chemical Integrative Sampler for the passive sampling of agricultural pesticides**

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Cemagref, LYON, France

The monitoring of organic micropollutant contamination in water bodies and the determination of reliable concentration estimates have become challenging issues in Europe, since the Water Framework Directive (WFD, European Commission, 2000) has aimed to improve and protect ecosystems, and to assure the good status of the aquatic environment.

In this work, the performance of the Polar Organic Chemical Integrative Sampler (POCIS) for environmental monitoring of pesticides and pharmaceuticals is the determinant factor. The POCIS is a new emerging tool for sampling polar micropollutants in water (Alvarez et al., 2004). It is still in development concerning its application, and the quantitative results obtained are still limited, and the devices operational range is uncertain.

The main objective of this study was to assess the performances of the Star Sorptive Extraction (SBSE) as a complementary passive sampling technique. In particular, the determination of the uptake rates of passive sampling devices, calculations of water contamination concentrations using passive samplers and the study of inter-site contamination are of special interest.

**MO 010**

**Affinity of Chemcatcher’s receiving phase for polar herbicides sampling**

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The Chemcatcher® device was exposed to aqueous solutions containing the selected herbicides in order to test the impact of herbicides on the affinities of the two receiving phases towards the target analytes. The authors to suggest the SBSE as a complementary passive sampling technique for the monitoring of more hydrophobic compounds in the aquatic environment.

**MO 011**

**Determining pesticide uptake rates for the polar organic chemical integrated sampler using field data**

T Guille, M Bayer, D Pintois

CPH Henri Tudor, ESCH-SUR-AlZETTE, Luxembourg

A crucial issue in using passive sampling techniques like the polar organic chemical integrated sampler (POCIS) for environmental monitoring of pesticides and pharmaceuticals is the determination of reliable uptake rates. Often uptake rates are determined under lab conditions not reflecting natural conditions. Knowing that turbulence, temperature, salinity and biofouling can have an impact on the uptake rates of passive sampling devices, calculations of water concentration using only lab-derived uptake data might be heavily biased. Therefore, auto sampler campaigns have been run in parallel to POCIS deployments in four Luxembourgish sewage treatment plants to compare the effluents as well as their receiving rivers during 24 hours. Substance specific uptake rates have been calculated by using data of the POCIS extracts and results of the auto sampler campaign analyzed via LC-MS/MS. It can be shown that these “field-derived” Rs data are between the values obtained during the calibration in the lab. The latter values showed large variances in strongly depending on the stirring i.e. on the turbulience of the system during the experiment. Therefore, a sound determination of the time weighted average concentrations for the investigated compounds should be based on uptake rates, which have been verified on-site.

In the same study, POCIS also have been exposed during 14 days at the same sites as a witness of the pesticides’ presence during and between the grab sampling. It turns out that the limits of detection for POCIS are in the range of 1 ng/l for most of the 20 monitored substances. Therefore, the use of passive samplers can improve the limits of quantification by one order of magnitude compared to the measurement of grab samples. Using on-site verified sampling rates, POCIS allows for an integrative monitoring of the trace level. Within the 14 day sampling period, even more substances could be detected than have been found in the 24 hour samplings. This combined approach with 24 hour and 14 day deployment of POCIS also allows for a rough calculation of the variation and possible contamination peaks during the investigated period.

**MO 012**

**Laboratory calibration of POCIS: kinetic accumulation of 59 polar organic contaminants and evaluation of candidate performance reference compounds**

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The laboratories run a large number of monitoring campaigns to assess the state of water quality and the concentrations of specific PSII herbicides on the GBR. The aim of this study was to assess the performances of the SBSE as a complementary passive sampling technique for the monitoring of more hydrophobic compounds in the aquatic environment.

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Chemcatchers® Devices were exposed to aqueous solutions containing the selected herbicides in order to test the impact of herbicides on the affinities of the two receiving phases towards the target analytes. The authors to suggest the SBSE as a complementary passive sampling technique for the monitoring of more hydrophobic compounds in the aquatic environment.

**MO 014**

**Determination of deployment specific chemical uptake rates for SPMDs and POMs using a passive flow monitor (POM)**

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Stir bar sorptive extraction (SBSE) is a solvent free sample preparation technique dedicated to the determination of moderately polar organic compounds. Its efficiency in the determination of time-weighted average concentrations of hydrophilic pollutants has been reported in the literature.

The results imply that co-deployed PFMs can be used for estimating the flow effect on the in situ TW A contaminant concentrations. As for example, linear accumulation phase for estrogenic hormones seems to be 21 days, since at 28 days the equilibrium regime begins to be reached. For betablockers, linear accumulation phase is shorter: less than 14 days. The following results have been obtained for the duration of linear accumulation phase and sampling rates, sampling repeatability and possible PFMs. As for example, linear accumulation phase for estrogenic hormones seems to be 21 days, since at 28 days the equilibrium regime begins to be reached. For betablockers, linear accumulation phase is shorter: less than 14 days. The following results have been obtained for the duration of linear accumulation phase and sampling rates, sampling repeatability and possible PFMs. As for example, linear accumulation phase for estrogenic hormones seems to be 21 days, since at 28 days the equilibrium regime begins to be reached. For betablockers, linear accumulation phase is shorter: less than 14 days.
to predict changes in Rs dependant on flow when using the absorbent SPMD (semipermeable bulk PAH deposition). A typical sampling period lasted 3 months. Furthermore, soil samples were used to assess whether concentration and/or flow pulses could be integrated using a phosphate filter. The applicability of this tool for accumulation within the P-sampler was demonstrated. Agreement was observed between the pulse in flow rate, a pulse of Filterable Reactive Phosphate (FRP) concentration and a seasonal variation of the short-range transport and deposition of PAHs.

Atmospheric input of persistent organic pollutants into soils close to the urban Rhein-Main-Area (Germany)

S. And
e, T. Schi
dek, S. Weinbr
ch, C. Schue
t, H. Hinz, Agency for Environment and Geology, WIESBADEN, Germany

The concentration of persistent organic pollutants (POPs) is ubiquitous in the environment. POPs are generated by industrial and vehicle emissions from traffic, industry and residential areas (particularly house heating in winter). Even in rural areas the enrichment of organic pollutants in soil is often dominated by atmospheric deposition. Yet, only little is known on the impact of urban short-time PAH deposition and accumulation in soil. The Rhein-Main region in Germany is one of the most densely populated and highly industrialized areas in Europe with the adjacent Taunus mountains (25 km W of Frankfurt) as one of the most probable receptors of urban emissions. The aim of the project was to investigate the impact and variation of urban PAH deposition on both, critical, sorbent-filled mesh (XAD) and non-PAS devices.

The atmospheric input at three test sites (urban influenced, mountain crest and rural) was investigated using passive samplers for particles (Sigma2 sampler), air (PUF disks) and atmospheric bulk deposition. A typical sampling period lasted 3 months. Furthermore, soil samples were analysed for PAHs. The aerosol composition as determined by environmental scanning electron microscopy analyses (ESEM) revealed the urban impact on the urban exposed area and on the mountain crest. The rural test site showed a clearly different aerosol composition and thus lower urban impact. The fraction of sulfite particles, as a typical component of urban aerosol, decreased at the test sites from ca. 50% (urban) to below 5% (rural) within a distance of ca. 10 km. Air and bulk deposition samples showed higher PAH deposition rates in winter at all test sites. While the air deposition rates were slightly higher at the mountain crest, the bulk PAH deposition was significantly higher at the urban site and on the mountain crest. These observations probably result from additional sources in winter (heating period) and decreased degradation. Soil samples from the mountain crest showed the highest PAH contents. Samples from low altitude at the urban site showed lower but comparable PAH contents. This indicates that the mountain range is scavenging the persistent PAH. To evaluate the mass transfer of pollutants in the study area, future work will focus on input-output balances and assessment of pollutant storage in soils.
MO 022 Applications of PDMS partitioning methods in the study of biodegradation of pyrene in the presence of dissolved humic acid

MO 023 In situ silicone microextraction: Undisturbed sampling of root-extracted artemisinin from Artemisia annua in soil

MO 024 Use of different plastics to mimic earthworm uptake of polycyclic aromatic compounds - evaluation using chemical analysis and the H4IIE-luc bioassay

MO 025 Improved analytical procedure using semi-permeable membrane extraction of lipid rich matrix

MO 026 Pine needles as natural passive samplers - several approaches for the extraction of polycyclic aromatic hydrocarbons

MO 027 An accelerated solvent extraction method for passive air sampler PUF disks

MO 028 Improved methodology using Illumina and the H4IIE-luc bioassay

MO 029 Genotoxicity testing in soil with earthworms

MO 030 Microextraction in soil: Evaluation of the efficiency of the method and the environmental impact of the extractants

MO 031 Olive waste biomass as a raw material for the extraction of polychlorinated biphenyls: A comparison with Soxhlet extraction and supercritical fluid extraction

MO 032 Biodegradable polyurethane supports for passive air sampling for polycyclic aromatic hydrocarbons - a comparison of different resins

MO 033 Determination of polychlorinated biphenyls in soil by SPME and GC-MS: Effect of sample pretreatment

MO 034 Trace determination of polychlorinated biphenyls, polybrominated diphenyl ethers and organotin compounds in soil by solid phase microextraction coupled to gas chromatography with high resolution mass spectrometry

MO 035 Residues of polychlorinated biphenyls (PCBs) in a contaminated soil by the in situ method in comparison with the traditional extraction methods

MO 036 Arsenic in air: Determination of inorganic and organic species in ambient air using solid-phase microextraction gas chromatography with mass spectrometry
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N Abou Mrad, C Soulier, H Budzinski
Can polar organic chemical integrative samplers be adapted for polycyclic aromatic hydrocarbons water sampling? N Abou Mrad, C Soulier, H Budzinski
LPTC, TALENCE, France
Polycyclic Organic Chemical Integral Sampling (POCIS) are nowadays widely used for the monitoring of emerging hydrophilic contaminants such as pesticides and pharmaceuticals[3DOT]. Even though their receiving phase has an affinity to aromatic groups, their accumulation capacity for polycyclic aromatic hydrocarbons is limited. In fact, laboratory calibration to assess the performance of POCIS to sample PAHs from aquatic systems showed a variability of the sampling rates over time, and that a constant accumulation rate is only achieved when the concentrations of target analytes in the POCIS membrane reach a steady state. This last time indicates that the use of POCIS into the POCIS is mainly controlled by the physico-chemical properties of the polyethersulfone membrane. POCIS extraction and analysis are relatively fast and easy comparing to the SPMD which are the conventional passive sampling tools for the monitoring of hydrophobic compounds in the aquatic system. Thus, finding an adapted version of POCIS to sample PAHs would be very interesting. Since we have shown that it is the POCIS membrane that does not allow the integrative kinetic accumulation of PAHs into the POCIS sorbent, the present developments consisted of changing the POCIS membrane: Polyethylene and polyethylene were used as replacements of polyethersulfone in an attempt to reduce mass transfer resistance, and calibrations were conducted to compare POCIS accumulation for PAHs with these three membrane types. Acknowledgments: ANR EMESTOX (ANR PRECODD 2008) is acknowledged for financial support

MO 032

Comparison between classical and improved Polar Organic Chemical Integral Sampler (POCIS) for alkylphenol polyethoxylates C Soulier, AW Belles, H Budzinski
LPTC, TALENCE, France
The European Union (EU) adopted the Water Framework Directive in 2000 which aims at improving and protecting the quality of the aquatic environment for downstream uses. In fact, laboratory calibration to assess the performance of POCIS to sample PAHs from aquatic systems showed a variability of the sampling rates over time, and that a constant accumulation rate is only achieved when the concentrations of target analytes in the POCIS membrane reach a steady state. This last time indicates that the use of POCIS into the POCIS is mainly controlled by the physico-chemical properties of the polyethersulfone membrane. POCIS extraction and analysis are relatively fast and easy comparing to the SPMD which are the conventional passive sampling tools for the monitoring of hydrophobic compounds in the aquatic system. Thus, finding an adapted version of POCIS to sample PAHs would be very interesting. Since we have shown that it is the POCIS membrane that does not allow the integrative kinetic accumulation of PAHs into the POCIS sorbent, the present developments consisted of changing the POCIS membrane: Polyethylene and polyethylene were used as replacements of polyethersulfone in an attempt to reduce mass transfer resistance, and calibrations were conducted to compare POCIS accumulation for PAHs with these three membrane types. Acknowledgments: ANR EMESTOX (ANR PRECODD 2008) is acknowledged for financial support

MO 033

Continuous Flow Integral Sampler (CFIS). A new approach for sampling for a better control of water quality. JP Llorca1, I Valero, RT Tortajada2
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2LPTC, TALENCE, France
Most aquatic monitoring program relies on collecting discrete grab, spot or bottle samples of water at a given time. Often, when pollutants are present at only trace levels, large volumes of water need to be collected. The subsequent laboratory analysis of the sample provides only a snapshot of the amounts of pollutants at the time of sampling. However, there are drawbacks to this approach in environments where contaminant concentrations vary over time, and episodic pollution events can be missed. Passive sampling methods have shown much promise as tools for measuring aqueous concentrations of a wide range of priority pollutants. A new strategy is needed to limit the proportion of the sample that is lost from the sample to the extraction solvent as the internal diffusional resistance. In addition, a pulsed exposure experiment confirmed that the new sampler worked in a time-integrative mode when the environmental concentration was highly fluctuated.

MO 030

Development of a new time-integrative sampler using in-situ solvent extraction for sampling polar organic compounds in water H Kim1, SJ Kim2
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2National Institute of Environmental Research, Korea
Due to the potential fluctuation of the concentration of water contaminants, passive sampling technology has advantages over conventional grab sampling. In spite of great success of passive sampling devices for hydrophobic contaminants such as PCBs and PAHs, integrative sampling of polar organic compounds to measure a time-weighted average concentration is still challenging. In aquatic environments, the function of contamination in water and most sampling devices is reached in a time scale of three months to six months duration. Thus, we developed a new time-integrative sampler in situ using solvent extraction for polar organic chemicals. The sampler was composed of a 15 cm poly(dimethylsiloxane) (PDMS) tubing with the internal diameter of 0.5 mm and the wall thickness of 0.5 mm and a flow-through system of an extra-Thick polyethylene tubing (as extraction step). Subsequently, all compounds were eluted to the PDMS tubing within a time scale of three months to six months of as well as fraction effectively contributing to the partitioning with water and/or biota. Single-phase polymeric materials such as PDMS and PDMS elicit similar affinity for hydrophobic compounds and simpler sample processing, when compared with the most commonly used and commercially available semipermeable membrane devices (SPMDs). Data obtained with passive samplers can be used in risk assessments for sediment-bound contaminants with regard to no need for remedial measures for contaminated sediments and these studies would be an important input with regard to environmental quality standards in sediments in water proposed in the EU Water Framework Directive.

MO 029

MO 028

Determination of bioavailability of persistent organic pollutants in freshwater sediments using two single-phase passive samplers E B Wranz1, J Walther1, M Asp1, FA Taciuc1, J Macfarlane1, R Nelson2, M Nipper3, RS Carr4, J Biedenbach4, C Reddy2
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2Woods Hole Oceanographic Institution, WOODS HOLE, United States of America
3Texas A&M University-Corpus Christi, CORPUS CHRISTI, United States of America
4USGS, CERC, CORPUS CHRISTI, United States of America
THOC, T ALENCE, France
In this presentation, an example of the final industrial version of CFIS device will be showed to SETAC Europe 21st Annual Meeting Abstract Book
101
MO 035
On the way to bringing equilibrium SPME offshore: development of an in-situ sampling device for persistent organic pollutants in sediment porewater

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Sorption tests proved that environmental conditions favoring the formation of a adsorption complex may be achieved only at low water contents or in pressurized samples.

The aim of the study was to develop and calibrate a WAX polymeric passive sampler for POPs in a field study at Sydney Harbour, Australia. Here we present data that indicates the WAX sorbent has the potential to make a useful adsorbent for passive sampling POPs.

MO 036
Determination of silicone rubber-water-particle ratios for a wide range of compounds using the cosolvent method

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2TNO Built Environment and Geosciences, Environmental Analysis, UTRECHT, The Netherlands

The determination of silicone rubber-water-particle ratios for a wide range of compounds using the cosolvent method was described.

The aim of the study was to develop and calibrate a WAX polymeric passive sampler for POPs in a field study at Sydney Harbour, Australia. Here we present data that indicates the WAX sorbent has the potential to make a useful adsorbent for passive sampling POPs.
The experiment successfully demonstrated that the passive dosing technology can be utilized to maintain constant exposure in large-scale systems.

EC05 - Environmental Fate and exposure of Pharmaceuticals and Personal Care Products (PCPs)

MO 046
Optimization of a GC-QqQ-MS method for the analysis of siloxanes in water samples. OCortiz, CEnrique, MFarfan, DBarrientos, IDAEE-CSIC, BARCELONA, Spain
Siloxanes, and more concretely cyclic volatile methylsiloxanes (cVMS), are volatile and semivolatile organosilicon compounds which find a wide range of applications in industrial and consumer products. As an example, several of these compounds are used as preservatives in pharmaceuticals that are employed in aquaculture. These methods have been established using the technique with application of different types of detectors. This paper presents the results of optimization and validation of the analysis of antibacterial pharmaceutical residues used in both human and veterinary medicine are not to be treated as pollutants and do not contaminate the environment. Hence, it is crucial to develop sensitive and reliable analytical methods for the trace analysis of these pollutants at low concentration level [ng/L] in the environment.

One of the major groups of contaminants are pharmaceuticals used in aquaculture. This is due to the use of these drugs in treated aquatic organisms directly to fresh water baths. There is a risk that these drugs will bioaccumulate in the water, sediment and animal tissue.

This paper presents the results of optimization and validation of the analysis of antibacterial (fluoroquinolones) and antiparasitic drugs used in aquaculture. These methods have been established using the techniques of liquid chromatography. The aim of the research was to select the appropriate parameters of analysis with the highest sensitivity and accuracy. Factors that were optimized were as follows: the composition, elution program and flow rate of the mobile phase, the type of column packing, time of analysis and detection parameters. The next step was to carry out validation of these optimized chromatographic conditions. Validation parameters - such as standard deviation, variation coefficient and accuracy - were found to be within the norm for environmental samples.

MO 048
Trace analysis of β-blockers and β-agonemimetics in natural water samples by SPE-GC technique with application of different types of detectors MEGASOUL, J.Judrzejowski, M.Pasieczny, M.Cabran, P.Stepnowski, J.Kumirska University of Gdansk, GDANSK, Poland

Anthropogenic substances that may be harmful to the environment, increasing attention is drawn by residues of pharmaceuticals and their metabolites. The environmental concentrations of these substances are of interest for studying the transfer of pharmaceuticals in aquatic ecosystems in larger scales. Within a mesocosm-study looking for possible effects of the bactericide triclosan on structure and function of biofilm communities (microalgae + bacteria) passive dosing by silicon rods was successfully used to ensure stable concentrations for a period of 10 days. The experimental system consisted of glass channels filled with 3.5 liters of river water and natural biofilm grown on artificial substrate.

The passive dosing system consisted of pieces of (2.52 cm) of a flexible silicon cord. Amounts of triclosan required to reach intended water concentrations in the water channels (2-150 µg/L) were estimated assuming equilibrium partitioning between the silicon rods, water and biofilm. Equilibrium partitioning coefficients were obtained from literature, and exchange kinetics were studied in a pre-experiment. In the main experiment, quick achievement of equilibrium was supported by adding stock solutions of triclosan to the water channels at the beginning of the experiment.

Water concentrations were measured throughout the experiment by micro-liquid-liquid extraction and gas chromatography-mass spectrometry in order to verify stable triclosan concentrations. The results showed that the passive dosing technology can be utilized to maintain constant concentrations for the remaining period of the experiment. Concentrations were slightly higher (up to 5%) than estimated by equilibrium partitioning calculations. Amounts extracted from glass beads were low (highest value: 0.21 µg g⁻¹ dw), indicating losses to glass surfaces of the test device.

In the main experiment, quick achievement of equilibrium was supported by adding stock solutions of triclosan to the water channels at the beginning of the experiment. Water concentrations were measured throughout the experiment by micro-liquid-liquid extraction and gas chromatography-mass spectrometry in order to verify stable triclosan concentrations. The results showed that the passive dosing technology can be utilized to maintain constant concentrations for the remaining period of the experiment. Concentrations were slightly higher (up to 5%) than estimated by equilibrium partitioning calculations. Amounts extracted from glass beads were low (highest value: 0.21 µg g⁻¹ dw), indicating losses to glass surfaces of the test device.

In the main experiment, quick achievement of equilibrium was supported by adding stock solutions of triclosan to the water channels at the beginning of the experiment.
Sulfonamide is an antibiotic class used in human and animal drugs. The presence of their residues in environmental and feed matrices is a great concern, because it can cause bacterial resistance, alter the balance of microbial populations, and pose risks to human and animal health and the environment. In this study, chromatographic conditions were optimized to analyze the sulfonamides: sulfathiazole (STZ), sulfamethazine (SMZ) and sulfadimethoxine (SDM), by using experimental design. The separation was performed on a HPLC-DAD using a Luna C18 (100 x 4.6 mm, 5 µm) column. The injection volume was 7 µL and the wavelength was 270 nm. A complete factorial design with a central point was built to scan the significant variables, considering: flow rate, column temperature and proportion of ethyl acetate and acetic acid in the mobile phase. The analyzed responses were the resolution (R) between the peaks and the ratio between the resolution and the analysis time (Rt/e). The only variable that had significant effect was the proportion of ethanol, that was negative for the separation between STZ and SMZ, and positive for SMZ and SDM. Thus, gradient elution was necessary to separate the drugs. The gradient optimization was performed by finding out good separation using as initial condition: 0:100 ethanol:water, which was ramped linearly to 20:50 at 4 min, to 40:60 at 8 min and to 50:50 at 14 min, then ramped over 1 min to 100. A second factorial design was built to evaluate the influence of the following variables: flow rate, temperature and proportion of acetlic acid in the mobile phase. This condition also answered the peak’s height (H) and the ratio between the peak’s area and width (A/w), all the variables had negative effects, that means that the best conditions were: flow rate of 0.5 mL.min-1, temperature of 20 ºC and mobile phase without acetic acid. Therefore, the chromatographic conditions were optimized to analyze the sulfonamides using a relatively low flow rate and mobile phase composed by water and ethanol, which is an renewable organic solvent less toxic than other ones traditionally used in HPLC. The linearity of the equipment to the analytes was over 0.999 for concentrations ranging from 5 to 500 µg L-1, with quantification limits under 10 µg L-1. Thus, this is a greener chromatographic method, which can be used to analyze sulfonamide residues in environmental and feed matrices, after a suitable sample preparation.

MO 052 Analysis of phosphodiesterase type V inhibitors: distribution, occurrence and fate in surface water and suspended solids
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Phosphodiesterase type V (PDE-V) inhibitors are of particular concern because of their ubiquity in the aquatic environment and their possible impact on ecosystems and biota have become in an emerging area of research. Among other compounds, synthetic musks are common compounds in fragrances and are largely being studied due to their persistence and/or their toxicity. In recent years, many analytical procedures have been developed for the analysis of musk fragrances in several environmental matrices such as waste-waters, sediments, sludge or biota in water. The extraction and detection procedures have been optimized to allow the determination of concentration up to a relevant amount since the determination of sub pg quantities of these compounds is usually required. Liquid-liquid extraction (LLE) or solid phase extraction (SPE) have been commonly used for these purposes. However, the current tendency is to find environmentally friendly solvent less approaches such as solid phase micro-extraction (SPME), stir bar sorptive extraction (SBSE) or membrane assisted solid extraction (MASE). Although SPME and SBSE have been already proposed for the analysis of synthetic musks in environmental matrices, the later has not been taken into account as alternative extraction method. The aim of this work is the development of an analytical approach to determine synthetic musk compounds in water samples by means of membrane assisted solid extraction coupled to large volume injection gas chromatography. For this purpose, on the one hand, the optimisation of MASE has been carried out studying the significant variables which can affect the extraction efficiency such as extraction solvent, sample volume, pH adjustment, MeOH and NaCl addition or the type of non-porous membrane. On the other hand, factors affecting large volume injection have been also optimised in order to obtain the best sensitivity. The performance of the analytical method was validated attending to detection limits, accuracy and precision. The optimised method has been applied to several water samples to analyse these priority pollutants.

Acknowledgements - This research work was supported by the Research Project CTM-2011-DEMOSI of the Spanish Ministry of Science and Innovation. O.Posada is grateful to the Basque Government for his PhD fellowship. P.Navarro is grateful to the Basque Government for her post-doctoral fellowship.

MO 056 Development of an analytical method for analyzing parabens and UV filters in water by LC-MS/MS
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3Laboratory of Environmental Chemometrics, GDANSK, Poland
4CNRS-UPPA, PAU, France

Another group of PPCPs are UV filters. These sunscreen agents are chemical compounds which are used in a variety of cosmetics (sunscreen creams and lotions) as well as in household detergents, perfumes or fragrances. Consequently, the analysis of PPCPs and their possible impact on ecosystems and biota have become in an emerging area of research. Among other compounds, synthetic musks are common compounds in fragrances and are largely being studied due to their persistence and/or their toxicity. In recent years, many analytical procedures have been developed for the analysis of musk fragrances in several environmental matrices such as waste-waters, sediments, sludge or biota in water. The extraction and detection procedures have been optimized to allow the determination of concentration up to a relevant amount since the determination of sub pg quantities of these compounds is usually required. Liquid-liquid extraction (LLE) or solid phase extraction (SPE) have been commonly used for these purposes. However, the current tendency is to find environmentally friendly solvent less approaches such as solid phase micro-extraction (SPME), stir bar sorptive extraction (SBSE) or membrane assisted solid extraction (MASE). Although SPME and SBSE have been already proposed for the analysis of synthetic musks in environmental matrices, the later has not been taken into account as alternative extraction method. The aim of this work is the development of an analytical approach to determine synthetic musk compounds in water samples by means of membrane assisted solid extraction coupled to large volume injection gas chromatography. For this purpose, on the one hand, the optimisation of MASE has been carried out studying the significant variables which can affect the extraction efficiency such as extraction solvent, sample volume, pH adjustment, MeOH and NaCl addition or the type of non-porous membrane. On the other hand, factors affecting large volume injection have been also optimised in order to obtain the best sensitivity. The performance of the analytical method was validated attending to detection limits, accuracy and precision. The optimised method has been applied to several water samples to analyse these priority pollutants.

Acknowledgements - Financial support was provided by the Polish Ministry of Research and Higher Education under grant N N204 260237.

MO 054 Application of solid-phase microextraction coupled with gas chromatography for the analy- sis of prescricy antidepressants and anti-cancer drugs
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3Institute of Chemistry, GDANSK, Poland

In recent years, toxicant poisoning and environmental pollution by pharmaceuticals have received great attention. The appropriate control of these problems and prevention of related health hazards has become an important issue. Therefore, there is a need for an accurate and precise method for determining these compounds in various matrices. Currently, SPE is the most popular, well-established sample-preparation technique, with which the best sensitivity is obtained. Alternative techniques (e.g., Liquid Phase Microextraction, SPME) should be applied more often because of several advantages that they have over SPE in terms of speed, ease of sample handling and miniaturisation.

In this study, SPME coupled with gas chromatography and gas chromatography-mass spectrometry was used for the determination of four tricyclic antidepressants (doxepine, desipramine, nomifensine, imipramine) and three anti-cancer drugs (fucoxatin, melphalan, chlorambucil). In SPME, the extraction efficiency of the analytes and the validation parameters were considered satisfactory for acceptance of the proposed method.

Acknowledgement - The authors thanks CAPES and FAPESP.
dubility (recovery, relative standard deviation).

- Analysis of real samples and presentation of the first results obtained.

MO 057

Extraction and detection of ionophores in the aquatic environment
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Section of Toxicology and Environmental Chemistry, COPENHAGEN O, Denmark

Ionophores are the most highly applied supergroup of the two sub-groups of anticoccidial agents, which are antiarcicomputic compounds used extensively worldwide as prophylactic chemotherapeutics.

Both ionophores and chitosan are a class of compounds that may serve as biodegradable matrices. Both ionophores and chitosan are used as carriers for targeted drug delivery.

MO 058

Detection of Chitosan Oligosaccharide by MALDI-TOF MS
J. Díez, M. Bernal, T. Knepper

Hochschule Presseuniversität, IDSTEIN, Germany

Because of their high reactivity in the pharmaceuticals and cosmetics industry, there is a need to study the fate of soluble, bioactive chitosan oligosaccharides and their degradation products in water.

- Effective chitosan oligosaccharides were optimized to improve sensitivity of the method.
- The presence of the ion (typically the (de)protonated molecule) was evaluated. Additionally, the presence of CID fragments or a characteristic isotopic peak was assessed for the reliable identification of the compounds detected.

MO 059

Comparison of online pre-concentration and direct injection voltages for the quantification of pharmaceuticals and personal care products in water with Orbitrap high resolution mass spectrometry
J. P. Schmidt, K. Michals, K. Ahreß, B. J. Beck

ThermoFisher Scientific, BREDEN, The Netherlands

There is a growing environmental concern regarding the health impact of trace levels of pharmaceuticals and personal care products (PPCPs) in groundwater. For this reason, the ES EPA has steadily developed new method for the quantification of dozens of PPCPs in environmental water sources.

- Improved software in a targeted mode was evaluated.
- The presence of CID fragments or a characteristic isotopic peak was assessed for the reliable identification of the compounds detected.

MO 060

Quantitative determination of endocrine disrupting chemicals and pharmaceutically active compounds in Singapore's marine environment
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National University of Singapore, SINGAPORE, Singapore

The discharge of endocrine disrupting chemicals (EDCs) and pharmaceutically active compounds (PhACs) into the environment via household, municipal, and industrial wastes is a pressing issue with far-reaching environmental consequences. EDCs are a class of compounds that may serve as endocrine disruptors.

- Effective chitosan oligosaccharides were optimized to improve sensitivity of the method.
- The presence of the ion (typically the (de)protonated molecule) was evaluated. Additionally, the presence of CID fragments or a characteristic isotopic peak was assessed for the reliable identification of the compounds detected.

MO 061

Detoxification of sorbents used in solid phase extraction to multi-residues analysis of pharmaceuticals in water samples
M. Mierzwinska, T. Jędrzejczyk, P. Mączewski, M. Cabań, P. Stepaniuk, J. Kamińska

University of Gdańsk, GDANSK, Poland

Following the increasing consumption, and thus the production and excretion of pharmaceuti-

- Effective chitosan oligosaccharides were optimized to improve sensitivity of the method.
- The presence of the ion (typically the (de)protonated molecule) was evaluated. Additionally, the presence of CID fragments or a characteristic isotopic peak was assessed for the reliable identification of the compounds detected.

MO 062

Investigating the presence of pharmaceuticals and metabolites in environmental water and wastewater by UHPLC-MS/MS with triple quadrupole and time of flight mass analysers
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Pharmaceutical residues are a matter of concern because of their wide consumption and potential negative effects on the environment. After their excretion and entry into urban wastewater, pharmaceuticals are excreted mainly as the parent compound, although many of them are also partially metabolized. Consequently, both parents and metabolites enter into urban wastewater. Most of them are not completely removed during wastewater treatments and they can finally arrive at surface and ground water bodies.

In this study, a UHPLC-MS/MS (QqQ) multi-class method for the determination of 47 pharma-

- Effective chitosan oligosaccharides were optimized to improve sensitivity of the method.
- The presence of the ion (typically the (de)protonated molecule) was evaluated. Additionally, the presence of CID fragments or a characteristic isotopic peak was assessed for the reliable identification of the compounds detected.

MO 063

Determination of selected pharmaceuticals in biota from Swiss surface water using liquid chromatography-tandem mass spectrometry
C. Stüben, H. Seiler

University of Applied Sciences Northwestern Switzerland, IEC, MUTTENZ, Switzerland

Since numerous pharmaceuticals have been detected in the influent and effluent of waste treatment plants or in waste water treatment plants themselves and surface water they have become a major emerging issue in the last years. Data on effluents of wastewater treatment plants have been collected and concentrated by solid phase extraction prior chemical analysis. However, the current project analyzed residues of polychlorinated biphenyls (PCBs) in wastewater from wastewater treatment plants. The determination of PCBs in fish and macroinvertebrates included the beta blocker Atenolol, the antiinflammatory Diclofenac and the antibiotic Amoxicillin. The pesticides Dichlorvos and Dieldrin were also detected.

- Effective chitosan oligosaccharides were optimized to improve sensitivity of the method.
- The presence of the ion (typically the (de)protonated molecule) was evaluated. Additionally, the presence of CID fragments or a characteristic isotopic peak was assessed for the reliable identification of the compounds detected.

MO 064

Comparison of real samples and presentation of the first results obtained.

- Analysis of real samples and presentation of the first results obtained.
MS/MSE model. MMR transitions were classified in a different elution time window, in order to increase measurement sensitivity.

Residue data from fish and macrobenthos analysis confirmed four substances (Norfluoxetine, Thoxycinnamte, Benzophenone and UV-326) to be present in biota and fish. The identified concentrations of anthelmintics were only higher in liver than in muscle tissue.

**MO 064**

The occurrence of selected antibiotics in the southern Baltic Sea K. Pesatovic1, GM Steddile2

In the course of the last decade pharmaceuticals have become recognised as relevant environmental contaminants. Surface waters receive continuous inputs of pharmaceuticals, but the substances also undergo various chemical, physical and biological processes. Sea can be seen as the final sink for the most persistent compounds. However, knowledge on their behaviour and fate in marine environment, including the Baltic Sea is still very limited. Special attention should be paid to antibiotic residues. These bioactive compounds may strongly affect bacterial populations and induce biological responses in non-target organisms due to prolonged exposures, potentially disrupting evolutionary processes. It is essential to prevent impacts on marine biota. One of the main targets in this issue is identification of their concentration levels in the environmental samples. This study report first measurements and identification of selected antibiotic classes occurring in water and sediment samples collected from the southern Baltic Sea.

**MO 065**

Survey of pharmaceuticals and personal care products in the Pearl River and riverbank characterisation GQ Ying, JH Zhao

In the course of the last decade pharmaceuticals have become recognised as relevant environmental contaminants. Surface waters receive continuous inputs of pharmaceuticals, but the substances also undergo various chemical, physical and biological processes. Sea can be seen as the final sink for the most persistent compounds. However, knowledge on their behaviour and fate in marine environment, including the Baltic Sea is still very limited. Special attention should be paid to antibiotic residues. These bioactive compounds may strongly affect bacterial populations and induce biological responses in non-target organisms due to prolonged exposures, potentially disrupting evolutionary processes. It is essential to prevent impacts on marine biota. One of the main targets in this issue is identification of their concentration levels in the environmental samples. This study report first measurements and identification of selected antibiotic classes occurring in water and sediment samples collected from the southern Baltic Sea.

**MO 066**

Occurrence and bioaccumulation of organic UV filters and UV light stabilizers in Japanese riversides Y. Kumeta1, K. Kumota2, ST Shinji3

The occurrence of several pharmaceutical compounds in waters has raised concern, since they are found in surface water (mg/l-µg/l) as well as in drinking water (ng/l). The current project will highlight and summarize the effort of the past couple of years. The emission from larger hospitals to smaller care institutions and nursing homes are investigated and compared with emission from hospital sewers. As a final prioritisation effort, the emission data are ranked based on environmental risks. The study will highlight the emission loads of the different sources and draw conclusions for the best removal options in terms of costs and removal efficiency. The effect of the emission load of pharmaceuticals in the ecosystem depends on the dilution factor to the receiving water. Next phase, the type of pharmaceutical determines the hazard and from this, the actual risk. The study highlights that routes of the emission need to be examined to not only predict better the actual environmental concentrations and measure there, but also to indicate the best removal options.

**MO 067**

Occurrence and bioaccumulation of organic UV filters and UV light stabilizers in Japanese riversides Y. Kumeta1, K. Kumota2, ST Shinji3

We established methods of simultaneous determination of eight organic UV filters and 10 UV light stabilizers in water, sediment and biota. We applied these methods to 26 rivers and three lakes with BOD concentrations in the range of 0.6-38 mg/L. The total contaminants identified in dissolved water were mostly organic compounds, ranging from 1 to 60 mg/L (organics). The total concentrations identified in sediments were only 0.7 mg/g dw. The results identified 62 organic compounds and 63 identified contaminants. The study identified 20 compounds and 22 identified contaminants in biota. The study identified 13 compounds and 14 identified contaminants in biota. The study identified 50 compounds and 56 identified contaminants in biota.

**MO 068**

Occurrence of pharmaceuticals in the settleable particulate material (SPM) of urban and non-urban freshwaters MS Lahiri, AO Oskari

University of Jyväskyla, JYVÄSKYLÄ, Finland

Pharmaceuticals are a diverse group of anthropogenic chemicals continuously released into the environment, commonly detected in surface waters as concentrations ranging from ng/L to µg/L. Besides those dissolved in the parent compounds, they are also present in sediment, wastewater treatment plants and surface waters. Pharmaceuticals are a diverse group of anthropogenic chemicals continuously released into the environment, commonly detected in surface waters as concentrations ranging from ng/L to µg/L. Besides those dissolved in the parent compounds, they are also present in sediment, wastewater treatment plants and surface waters.

**MO 069**

The presence and fate of pharmaceuticals and personal care products (PPCPs) in wastewater and river water from the Pearl River system (i.e., Liuxi, Zhujiang and Shijing Rivers) JF Marques1, MJA Almeida1, AAR Elvira1, AEPFA Fabiana1, K Konnowska1, P Stepnowski2

An important source of settleable particulate matter (SPM), heading to sediments with suspended solids originating naturally. So far there is little information about the occurrence and consequences of pharmaceuticals in sediment systems. The objective of this work was to study if pharmaceuticals are detected from SPM next to WWTPs or even in rural areas, thus being susceptible for sedimentation. SPM samples were collected from ten sites in Finland, grouped into reference, rural and wastewater effluent sites. SPM collectors made of stainless steel were placed to ca. 5 cm above the river bottom for about two months in summer. After extraction, a set of 18 pharmaceuticals was analysed with LC/MS/MS.

Several pharmaceuticals (from 8 to 13) were detected in SPM accumulated in sites next to WWTPs. Concentration of citalopram was notably high (300-1350 ng/g dw). Also biotin and vitamin B2 were detected at high concentrations (≥ 325 ng/g dw and 9 350 ng/g dw, respectively). On the other hand, none were detected above LOD from reference or rural sites. There is no previous information about the presence of pharmaceuticals in SPM. Our results show that pharmaceuticals in SPM are actually prevalent, eventually ending up into sediments. These results also indicate that pharmaceuticals are not markedly contaminated during the sediment in rural areas. In urban habitats however, depending on persistence and bioavailability, sediment-bound pharmaceuticals may affect benthic invertebrates and habitats. However, more data are needed for the fate and ecotoxicity assessment of risks to the benthic biota.

**MO 070**

Broad screening of organic chemicals in Dutch groundwater and their occurrence in relation to land use and hydrology L ter Laak1, LM Puijker1, JA van Leerdam1, J Raat2, P de Vooigt1, AP van Wezel2

1KWR Watercycle Research Institute, NIEUWEGERINGEN, The Netherlands
2IBED-University of Amsterdam, AMSTERDAM, The Netherlands

Groundwater is considered a very reliable source of drinking water. It is therefore important to monitor groundwater quality, assess the vulnerability of groundwater, and identify anthropogenic activities that can result in groundwater contamination. In this study, high resolution mass spectrometry (hybrid linear ion trap (LTQ FT Orbitrap MS) was applied to examine the occurrence of several organic contaminants. Of the 19 target compounds examined, 11 were quantified above method reporting limits in wastewater influent, 9% in effluent, and 7% in surface water samples. Concentrations were reduced by 7% correct for most chemicals in ef- fluent compared to influent, though concentrations of some PPCPs in effluent were higher than in influent, indicating incomplete removal. Differences in concentrations between influent and effluent were believed to be related to variation in general operating parameters and/or the anionic biosolids employed by one of the facilities. Overall, future monitoring of PPCPs may aid in minimizing potential negative impacts of increasing urban/industrial development in coastal regions.

**MO 071**

Using GIS to establish an emission type based sampling scheme with passive samplers in Luxembourg T Gallé1, V Huck2, C Bauts3, M Bayere2

1CRP Henri Tudor, ESCH-SUR-ALZETTE, Luxembourg
2Gallé, V Huck, C Braun, J Wilkinson, M Bayerle
3LPB, CRP Henri Tudor, CRP Environment, CRP Tudor, CRP Luxembourg

Using GIS to establish an emission type based sampling scheme with passive samplers in Luxembourg T Gallé1, V Huck2, C Bauts3, M Bayere2

1CRP Henri Tudor, ESCH-SUR-ALZETTE, Luxembourg
2Gallé, V Huck, C Braun, J Wilkinson, M Bayerle
3LPB, CRP Henri Tudor, CRP Environment, CRP Tudor, CRP Luxembourg

Wastewater Treatment Plants (WWTP) have been identified as a major source for pharma- ceuticals in river networks in recent years. WWTPs remain neglected as a source for pesticides although a substantial body of evidence shows that especially for chronic exposure WWTPs have a significant impact. Monitoring xenobiotics is a cumbersome and costly endeavour if the dynam- ic of the effluents is to be understood. The other aspect is the identification of locations where the exposure is expected to be the highest and most frequent. This poster presents an approach which uses GIS and WWTP information to identify typical immission situations in Luxembourgian rivers. The following five immission situations were considered: Rivers impacted by high WWTP discharge, subdivided in those with more urban connections to the WWTPs and those with individual chemical and were therefore considered most contaminated, while river bank filtered water was generally more contaminated than phreatic groundwater, and groundwater from confined aquifers was most pristine. Additionally, industrial chemicals were frequently observed in river bank filtered water and pesticides were more frequently observed in water originating from rural areas. Finally, the applied broad screening technique illustrated that only 42 ± 2% of the ion counts came from known chemicals. Screening for both known and unidentified chemicals provided more information on the overall water quality and revealed that there is a ‘blind spot’ considering the total pool of organic contaminants in the environment.

**MO 072**

Evaluation of the concentration level of pharmaceuticals and personal care products (PPCPs) in the Pearl River and riverbank characterisation T ter Laak1, LM Puijker1, JA van Leerdam1, J Raat2, P de Vooigt1, AP van Wezel2

1KWR Watercycle Research Institute, NIEUWEGERINGEN, The Netherlands
2IBED-University of Amsterdam, AMSTERDAM, The Netherlands

Groundwater is considered a very reliable source of drinking water. It is therefore important to monitor groundwater quality, assess the vulnerability of groundwater, and identify anthropogenic activities that can result in groundwater contamination. In this study, high resolution mass spectrometry (hybrid linear ion trap (LTQ FT Orbitrap MS) was applied to examine the occurrence of several organic contaminants. Of the 19 target compounds examined, 11 were quantified above method reporting limits in wastewater influent, 9% in effluent, and 7% in surface water samples. Concentrations were reduced by 7% correct for most chemicals in ef- fluent compared to influent, though concentrations of some PPCPs in effluent were higher than in influent, indicating incomplete removal. Differences in concentrations between influent and effluent were believed to be related to variation in general operating parameters and/or the anionic biosolids employed by one of the facilities. Overall, future monitoring of PPCPs may aid in minimizing potential negative impacts of increasing urban/industrial development in coastal regions.
Twelve sampling locations have been monitored in the main pesticide application seasons with 14 day passive sampler exposure summing up to 4 months at each spot. The results served to establish a ranking of most detected pesticides and pharmaceuticals and to verify the soundness of the allocated emission sources. In addition the mean exposure has been compared to toxicological assessment methods such as SPEAR, toxic unit as well as pesticide mixture evaluation. The poster discusses the combination of GIS and passive samplers as a reliable monitoring approach.

MO 072 Determination and distribution of triclosan and methyl triclosan in estuarine settings

C. Pintado-Herrera, E. Gonzalez-Mazo, PA Lara-Martin
Universidad de Cádiz (Spain), CÁDIZ, Spain
Triclosan (TCS), an antibacterial agent, and methyl triclosan (Me-TCS), TCS degradation product, are sewage-derived contaminants. A method for the determination of both compounds in sediment and water samples has been optimized. For solid samples, extraction and cleanup were integrated into the same step using pressurized liquid extraction with in-cell clean-up. Sediments (4 g) were homogenized with sodium sulfate anhydrous and introduced in a 11 ml stainless steel digestion vessel containing 9 ml of nitric acid (65%). Drying was performed at 100°C for 18 h. The obtained residue was taken up in 10 ml of methanol and stirred for 24 hours at room temperature. Then, the bars were sonicated during 30 min using acetonitrile to release the analytes. Me-TCS and a silylated derivative of TCS were determined by gas chromatography - mass spectrometry (GC-MS). Recovery experiments in water and sediments were performed and the results ranged from 65-144%. Limits of quantitation (LOQ) were 15 ppt for TCS and 10 ppt for Me-TCS, in water samples, and 0.1 ppt for TCS and 0.2 ppt for Me-TCS, in solid samples. The method was validated by carrying out a sampling in the estuary of Guadalete River (SW Spain). TCS and Me-TCS concentrations up to 9.6 ppb in sediments and 0.9 ppb in water samples were detected. Their distribution was affected by the presence of wastewater discharges, where maximum concentrations were detected. Highest values were reached in the water column during low tides when the water volume in the estuary becomes lower.

MO 073 One year monitoring of pharmaceuticals in aquatic systems: acquisition of data concerning fate and behaviour in surface and groundwaters

A. Tempé, S. Bitzian, L. Amalric
BRGM, ORLEANS, France
Occurrence of pharmaceutical products in aquatic systems has been highlighted for few years showing a potential sanitary and environmental impact on water quality. The present work deals with monitoring of 79 locations located in Loire-Bretagne river basin, including surface waters and groundwater. 40 pharmaceuticals and veterinary products were screened and the main therapeutic groups were monitored in Summer 2009 and Winter 2009-2010 in order to document seasonal variability and assess contamination level in French aquatic systems. Two rivers were particularly monitored, with monthly sampling of 4 stations spreaded over the river from upstream to downstream of WWTP discharge, to better understand seasonal variations, fate of pharmaceuticals and impact of WWTP effluent introduction in the river. Results gave a global overview of the pharmaceutical contamination. Frequencies of detection depend on the land uses in impacted river basin allow to determine “key pollutants” that can be used as tracers of pharmaceutical pollution, considering on the other hand their persistence or their high reactivity in aquatic systems.

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MO 074 A multi-component snapshot of new pharmaceuticals and pesticides in the river Meuse

CJ Houtman1, K de Jong1, J de Jong1, AC de la Mar2, K Lekkerkerker-T eunissen3, J Kroesbergen1
1Givaudan UK Ltd, ASHFORD, United Kingdom 2Givaudan Suisse SA, VERNIER, Switzerland 3Albert-Ludwigs-Universität Freiburg, F R Germany
The river Meuse serves as drinking water source for over six million people in France, Belgium and the Netherlands. In 2009, over 500 million m³ surface water from the Meuse was abstracted for this purpose. Rapid improvements in chemical and bio analytical techniques have led to the discovery in surface waters of all kinds of so-called emerging contaminants at (sub-)ng/L to pg/L concentrations, including pharmaceuticals, illicit drugs, sweeteners, perfluorinated compounds, and herbicides. The Meuse river as water company therefore intensively investigates the presence and occurrence of pharmaceuticals and pesticides in the river Meuse and its tributaries. This study presents a multi-component snapshot of new pharmaceuticals and pesticides in the river Meuse. In this study, sensitive and specific multi-component methods on UPLC-MS/MS were developed for the analysis of new pharmaceuticals and pesticides. The methods were applied to analyse water samples from 15 locations along the Dutch catchment of the Meuse. In this way, a snapshot was obtained of the regional occurrence of pharmaceuticals and pesticides. In addition, the samples were used to estimate the contribution of specific emission sources (industry, WWTP, agriculture) in the catchment. Multiplication of measured concentrations with water discharge data was performed to assess the (macro) loads of pharmaceuticals and pesticides transported to the North Sea and the contribution of activities in the Dutch catchment to these loads.

MO 075 First reports of pharmaceuticals and personal care products from Ushuaia, Tierra del Fuego, Argentina

W.T di Marzo1, S. Floris2, D. Pinto3, L. Comoglio2, ME Siem3
1CONICET-PERIC-DIB-UNLU, LJUAN, Argentina 2CONICET - PERIC-DIB-UNLU, LJUAN, Argentina 3CONICET - PERIC-DIB-UNLU, LJUAN, Argentina
Ushuaia is commonly regarded as the southernmost city in the world, is located in a wide bay on the southern coast of Isla Grande de la Tierra del Fuego, bounded on the north by the Martial mountain range and on the south by the Beagle Channel. Ushuaia has developed on the coastal area and extends into the Andes towards Tierra del Fuego and Santa Cruz. A large part of the economy is related to tourism and commercial fishing, and the main economic activities conducted in the area include agriculture and aquaculture. For 20 years, the entire coastal area has been receiving input from sewage, industrial and port, producing visible changes, some of them partially quantified. In particular is concerned generally poor and inadequate functioning of the sewage collection system and dispersant, located at the western end of the Ushuaia Peninsula, which has led to discharge of untreated sewage directly into the wastewater discharges, where maximum concentrations were detected. This work describes the results of an pilot-scale study to evaluate the impact of waste water discharges on the coastal environment of Ushuaia. The objectives of the study were to assess the impact of the waste water discharges on the coastal environment of Ushuaia and to determine the potential effects on the aquatic environment of Ushuaia. The study was conducted from October 2008 to March 2009. The main results of the study were the following:

- The concentration of total phosphorus in the waste water discharges was high, with maximum values of 10 μg/l. This concentration is significantly higher than the maximum concentration allowed by the national standard for waste water discharges, which is 2 μg/l.
- The concentration of total nitrogen in the waste water discharges was also high, with maximum values of 30 mg/l. This concentration is significantly higher than the maximum concentration allowed by the national standard for waste water discharges, which is 15 mg/l.
- The concentration of total solids in the waste water discharges was high, with maximum values of 50 mg/l. This concentration is significantly higher than the maximum concentration allowed by the national standard for waste water discharges, which is 20 mg/l.

These results indicate that the waste water discharges are having a significant impact on the coastal environment of Ushuaia. The high concentrations of total phosphorus, total nitrogen, and total solids in the waste water discharges are likely to contribute to the eutrophication of the coastal environment and the associated negative effects on the quality of the coastal waters. Therefore, it is recommended that measures be taken to reduce the concentration of these pollutants in the waste water discharges in order to protect the coastal environment of Ushuaia.
or prolonged OECD 301F ready biodegradability test. Ten out of eleven sesquiterpenes tested achieved significant ultimate biodegradation (ranging from 51% to 88% BOD). Germacrene-D achieved 24% ultimate biodegradation and specific analysis at the end of the test indicated complete primary degradation. Given that the shape of the biodegradation curves indicates poor biodegradability and ready biodegradability tests are very stringent, it is expected that all the sesquiterpenes tested in this study would be degraded under environmental conditions. This evidence of non-persistence may be used to read-across to other natural sesquiterpenes within the same skeleton family which are expected to follow similar biodegradation pathways.

**MO 079**

A tiered procedure for assessing the formation of biotransformation products of pharmaceuti-
cuticals and biocides during activated sludge treatment
K. Formanek, S. Kern, B. Baumgartner, D. Heßling, H. Singer, M. Loos, RP. Schwarzenbach, J. Heuberger, Eawag, Dübendorf, Switzerland

Givaudan, Dübendorf, Switzerland

ETH Zurich, Zurich, Switzerland

Up to now, the majority of xenobiotic organic micropollutants during activated sludge treatment, transformation products (TPs) may be formed that enter the aquatic environment in the treated effluent. However, TPs are rarely considered in environmental risk assessments of wastewater-relevant compound classes such as pharmaceuticals and biocides. Here, we suggest and evaluate a new read-across strategy, a sliding scale and intensification of the screening methods on HR-MS/MS and a subsequent confirmatory quantitative analysis, that should facilitate consideration of TPs formed during activated sludge treatment in the exposure assessment of micropollutants. At the first tier, potential biotransformation product structure of xenobiotics (atenolet, belafibrate, ketoconazol, metoprolol, naproxen, valarta, and vanlaxin) and one biocide (carbenazol) were assembled using computer-based biotransformation pathway prediction and known human metabolites, and screened for in sludge-seeded batch reactors at high-concentrated mass spectrometry (HR-MS/MS). The 12 TPs found to form in the batch experiments were then searched for in the influents of two full-scale, municipal wastewater treatment plants (WWTPs) to confirm the environmental representativeness of this first tier. At the second tier, experiments with the same sludge-seeded batch reactors were carried out with four key investigated major TPs, that were then cascaded steady-state completely-stirred tank reactor (CSTR) model for predicting TP effluent concentra-
tions. Predicted effluent concentrations of four parent compounds and their three major TPs were corroborated by comparison to 3-day average influent and secondary effluent mass flows from the same WWTPs. A simple CSTR model predicted the concentration of glimepiride within a factor of two with measured mass flows and confidence intervals of predicted and mea-
sured mass flows overlapped in all cases. The observed agreement suggests that the combination of batch-determined transformation kinetics with a simple CSTR model may be suitable for estimating aquatic exposure to TPs formed during activated sludge treatment. Overall, we recom-
mend the tiered procedure as a realistic and cost-effective possibility to include consideration of TPs of wastewater-relevant compound classes into exposure assessment in the context of chemical risk assessment.

**MO 080**

Pharmaceutical P450 metabolisms: read-across from human ADME to environmental Trans-
formation Products (TPs)
P. Friezon, Pfizer Inc, Groton, CT, United States of America

The potential risk of transformation products from wastewater treatment and subsequent water-
sediment release environment is a current topic of interest given the increasing knowledge about phar-
macokinetics and increase detection of pharmaceuticals and their metabolites in the environment. TPs are presumed to be less toxic than parent based on known P450 mechanisms of transformation and its role in detoxification. They are generally not considered in the risk assessment unless there is a need to mitigate human health based on the parent compound. The trigger TP identification is linked to the outcome of the OECD 308 based on its presence > 10% dose observed during the study. This poster presents the learnings from identification of TPs from water-sediment studies and compares findings to what is seen in published human absorption, disposition, metabolism and excriment (ADME) studies. Case studies are provided to highlight the potential use of read-
ning-across from human ADME studies to environmental transformation products as a means of assessing their relative risk to parent compound. It is the intent that such data will support con-
straining the environmental risk assessment and further detailed discussions around how best to approach environmental transformation products in the environmental risk assessment and further clarify when identification and follow on testing is needed.

**MO 081**

Sediment-water test systems to evaluate the environmental fate of pharmaceuticals - how representative are the results?
M. Meier, M. Mäurer

Stockholm University, Stockholm, Sweden

Helmholtz-Zentrum, Institute of Groundwater Ecology, München, Germany

Sediment-water test systems are an established tool to assess the persistence of pharmaceuticals and other micropollutants in aquatic systems. To assess the environmental fate of a number of pharmaceuticals, especially some acidic compounds (e.g., ibuprofen, naproxen) and beta-blockers (metoprolol, propranolol), we carried out a series of tests with river sediment and synthetic river water. We compared sediment from different rivers (Roter Main, Germany; Sava Brook, Slovenia) with two selected areas within one river basin. Effluent samples were selected in two fixed points in time. Tests were carried out at a concentration of 100-200 µg L⁻¹ over approx. 30 days; samples were filtered and subsequently analyzed by UPLC-qTOF-MS. All test compounds dissipated from the test systems, with dissipation half-lives between 2.5 and 50 days. Significant differences in half-lives in tests with sediments sampled from the same location at two dif-
terent times were generally varying up to approximately 45%. Tests with sediments from different locations within one river provided similar dissipation times for ibuprofen and fufoximide, while substantial differences were observed for naproxen and the two beta-blockers. When compar-
ing tests with different test systems, we observed significant differences in dissipation between systems. The results for ibuprofen are remarkable - this compound is generally known as rapidly biodegradable, and the half-lives with sediments from Roter Main were generally shorter than the days. In contrast, the tests with sedi-
ment from Sava brook resulted in half-lives of 45 days. In general, the results of this study allow the assessment of inherent uncertainties and limitations of such laboratory tests. Not only are the results depending on the specific set-up of the tests, but also on the nature of the specific sediment, the sampling location and other variables. We did not observe any systematic patterns in the test results, they seem to be depending on the specific com-
bination of sediment and test substance. Variations of dissipation half-lives of up to one order of magnitude were observed, highlighting the need for a critical evaluation of such test results and also the need for further improvements in the design of such tests.

**MO 082**

Partitioning of sulfaguanidine to soil colloids in the water and soil/biosolid interface
A. Gisvand, B. Krogh, B. Hellesøe, University of Copenhagen, Copenhagen, Denmark

In animal husbandry, a broad range of veterinary pharmaceuticals is used for therapeutic purposes or as growth promoters. A frequently antimicrobial used in e.g. pig production is sulfaguanidine, which belongs to the large group of sulfonamides antimicrobials that is used to treat bacterial infections and as growth promoters. In recent years the fate of sulfaguanidine in the environment has been widely studied. Several papers have indicated a build up of non-extractable residues in soil. Formation of non-extractable residues has been identified as a major route of dissipation in soils. The lack of degradation of sulfaguanidine may be due to a number of factors that have not been understood. Especially, partitioning and transport at the soil/water interface in the soil environ-
ment are important factors to describe. To elaborate, a sorption test system was applied based on Escher and Schwarzenbach (1996). Sorption at the soil colloid/water interface and the depen-
dence of pH and ionic strength were main focus areas. With the proposed test system we are able to describe a partitioning scenario in a well-defined theoretical manner. Effects of pH (2 - 12) and ion strength (cation concentrations in the range of 0.001 - 0.1 mol/L) on the distribution of sulfaguanidine in the soil colloid/water interface were stud-
ied to give an in-depth understanding of the dissipation in the soil environment. Furthermore, the results of biosolid amendment to soil are investigated to get an understanding of the changes in the interface environment when adding organic material, hereby mimicking soil management on micro scale.

**MO 083**

On a way to understand the fate and behaviour of sulfonamides in the environment
J. Wiacek, B. Biak-Bielinska, M. Chojnacka, M. Kozicki, M. Borecka, W. Misniak, J. Kumińska, R. Palaniuk, P. Stepienowski

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Federal Institute for Risk Assessment BfR, Berlin, Germany

With the proposed test system we are able to describe a partitioning scenario in a well-defined theoretical manner. Effects of pH (2 - 12) and ion strength (cation concentrations in the range of 0.001 - 0.1 mol/L) on the distribution of sulfaguanidine in the soil colloid/water interface were stud-
ied to give an in-depth understanding of the dissipation in the soil environment. Furthermore, the results of biosolid amendment to soil are investigated to get an understanding of the changes in the interface environment when adding organic material, hereby mimicking soil management on micro scale.

**MO 084**

Sorption of sulfaguanidine to soils differentiated in their physicochemical properties
J. Maszkiewycz, M. Kolodzęjska, B. Biak-Bielinska, W. Mórzak, P. Stepienowski, J. Kumińska

University of Gdańsk, Gdańsk, Poland

Sulfonamides are one of the most commonly used drugs in veterinary pharmacotherapy. Their relatively low cost and broad spectrum of antimicrobial activity made them usual choice in ani-
mal breeding (i.e. food additives). However the use on the large scale results in real danger for various environmental compartments. Studies reported that even 30% of antibiotics used in recent years in the European Union in animal husbandry were applied as non-therapeutic agents (e.g. as growth promoters).

Sulfaguanidine is one of the widely used sulfonamides and it is typically utilized as food additive in animal husbandry. By the grazing animals or manure application, this compound can spread into the natural environment by uncontrolled way. Natural components such as soil and sediments are in the major risk, therefore it is important to determine the mobility and the possible interactions of sulfaguanidine in these matrices. Such studies allow to appraise the possibility of infiltration of sulfaguanidine into ground and surface water, and eventually assess the risk to human health and the natural environment.

The aim of this study was to determine the sorption of sulfaguanidine in soils differentiated in their physicochemical properties such as: pH, organic matter content and cation exchange capacity. The strength and the type of interactions that take place between this compound and soil were determined. The pH of the tested soils, soil intrinsic characteristics (as: organic matter content, cation exchange capacity, isotherms and sorption kinetics). To assess the sorption type, the results were tested by Langmuir and Freundlich model. The influence of external factors, on sorption of sulfaguanidine, like solution pH and ionic strength were also determined. The degree of sorption of this com-
pound to soils was quantitatively assessed using HPLC technique with UV/Vis detection.
MO 085
Influence of non-hydrophobic factors on the sorption of ionizable xenobiotics to soils
HCL Holten Litzeläff, A Franco, S Trapp
Technical University of Denmark, KGS, LYNGBY, Denmark
It is well known that xenobiotics sorpt to solid phases like soil and sediment, depending on their inherent hydrophobic or hydrophilic character. If it was accepted that hydrophobicity of the chemical, i.e., the log K_{ow}, as well as the solid’s content of organic carbon (OC) were the parameters describing the extent of sorption. Realizing that ionizable chemicals like weak acids and bases do not absorb very well according to their hydrophobicity, a correcting factor has been developed for the description of the ionizable sorption of acidic and basic compounds. The equation has recently shown to improve the predicted sorption of weak acids significantly, however, weak bases do still show discrepancies compared with experimental data. In this investigation it was studied how a range of electrostatic parameters have influence on the sorption of weak bases to solid phases. Besides log K_{ow} and pH and OC content of the solid, this investigation also included parameters like clay, soil and sand content, cation exchange capacity, zeta potential and other properties of the solids, and the impact on the sorption of weak bases to weak acids. Weak bases with pH_v values differing about half a unit in the range 9-9, resulting in ionization within an environmental relevant pH range, are selected for the study. Literature is searched for data on distribution coefficients [log K_{d}] where also information about the experimental conditions regarding electrostatic parameters was reported. Taking the above mentioned parameters into consideration, predictions and regressions of the distribution to soils shall be improved.

MO 086
The photodegradation mechanism of clofibric acid by UV photolysis
KD Zoh
Seoul National University, SEOUL, South Korea
Environmental antibiotic contamination presents the potential to select for resistance factors that can be transferred between bacteria, contributing to the establishment of multidrug-resistant variants of the antibiotics. In this work we investigated the influence of environmental factors like temperature, the light intensity of light used. Abiotic and biotransformation processes for both analytes were insignificant on protonation state, indicating that speciation may affect direct photolysis rates. Measured quantum yields for each species were consistent with previously published literature for sulfamethoxazole. The direct and indirect photolysis of the sulfonamide antibiotic drugs sulfapyridine and sulfamethoxazole were measured in both controlled laboratory settings and in field waters at Dead Horse Creek, Manitoba, a rural watershed impacted by high nutrient and organic contaminants from episodic pulse releases of effluent from sewage lagoons of the small communities in its watershed. Both drugs degraded quickly in pure water in laboratory when exposed to light simulating natural sunlight, with half-lives ranging from 30 min to several hours depending on the intensity of light used. Abiotic and biotransformation processes for both analytes were insignificant over the time scale of the studies. The absorbance spectra differed for both compounds depending on protonation state, indicating that speciation may affect direct photolysis rates. Measured quantum yields for each species were consistent with previously published literature for sulfamethoxazole. The direct photolysis decreased dissipation rates in field waters, due to the influence of high levels of nitrate and dissolved organic material in wasterwaters and surface waters. These results show that natural attenuation by photochemical processes is a major sink of sulfonamide drugs in impacted aquatic systems.

MO 088
Investigation of the photodegradation of PDE 4–I V inhibitors and analogues under simulated sun light by ESI-QqQ-MS spectrometry
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7King Abdullah University of Science and Technology, THUWAL, Saudi Arabia
8Dartmouth College, DURHAM, USA
9University Duisburg Essen, DUISBURG, Germany
10National University of Education (UNED), MADRID, Spain
11Instituto de Química de São Carlos, Universidade de São Paulo, SAO CARLOS, Brazil
12Laboratoire de Biogéochimie, Department of Chemistry, UNAM CARLOS, Brazil
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14Department of Chemistry & Biochemistry FIU, Biscayne Bay Campus, MIAMI, United States of America

The presence of emerging contaminants in receiving waters is not longer restricted to the environment and/or adsorption. In the environment, the contaminants undergo various physical or chemical processes like photolysis, hydrolysis and biotic (biodegradation) reactions. The removal in the dune infiltration bed is due to the formation of new transformation products (TP), which may persist in the environment or be further degraded. In the present study the photodegradability of sildenafil, vardenafil, tadalafil and their human metabolites was evaluated. The reaction was performed under simulated solar radiation using a SUNTEST CPS system equipped with multichannel lamps. Solutions of each compound in deionised water at pH 6.8 were continuously irradiated with UV light. The UPLC(-)ESI-QqQ-MS system equipped with high performance liquid chromatography was used for analysis. The resulting products were identified by ESI-QqQ-MS spectrometry. The metabolite demethylsildenafil was also transformed and the main products were TP448, TP490 and TP462. This work has been supported by the Spanish Ministry of Science and Innovation [projects: SABCE Consolider Ingenio 2010 CSD2009-00056]. BES acknowledges the Capes for the financial support. SP acknowledges the Spanish MEC for the Ramón y Cajal contract

MO 089
Removal of diclofenac in conventional drinking-water treatment processes
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2Instituto de Engenharia de Sistemas de São Carlos, Universidade de São Paulo, SAO CARLOS, Brazil
Pharmaceuticals have been widely found in wastewater, surface water and groundwater. This implies a potential for indirect human exposure to pharmaceuticals via drinking water supplies. The conventional methods of water treatment seem to be insufficient to remove these contaminants which vary widely between and among classes of compounds. In this study, jar test experiments were performed with water prepared in laboratory (color of 20H, turbidity of 70NTU, pH 7.0, diclofenac (DCF) 1 mg L^{-1}) in order to verify the removal of DCF by coagulation with aluminium sulfate, flocculation, sedimentation, filtration in bench-scale sand filters (filtration) and disinfection (chloramination) of DCF in model water samples were determined on a high-performance liquid chromatographic (HPLC) analysis and UV detection, using a C18 bonded silica column (250 x 4.6mm, 5m). The low rate was 0.8mL min^{-1}, injection volume of 20mL, temperature was 25°C and the wavelength was 270nm. An isocratic mobile phase methanol (55%) and water (45%) was used under an environmental relevant pH range, are selected for the study. Literature is searched for data regarding electrostatic parameters was reported. Taking the above mentioned parameters into consideration, predictions and regressions of the distribution to solids shall be improved.
the reaction proceeded. Rate constants for the oxida-
tion of the fragrances by ozone were determined using gas chromatogra-
ped mass spectrometry was used to follow the time course of the antioxidants and by-products, 
the reaction proceeded  Rate constants for the ozonation of the fragrances in waste water were in 
the range of 1-100 M-1s-1 
MO 093
Oxidation of synthetic phenolic antioxidants during water chlorination
B Redd 1,2,3,4,5,6,7,8,9,10
Department of Environmental Science, University of Trondheim, Norway

Antioxidants are substances which prolong the shelle-life of foodstuffs by protecting them against 
deterioration caused by oxidation, such as fat rancidity and colour changes. The most frequent 
synthetic antioxidants used are the phenolic antioxidants: butylated hydroxytoluene (BHT), 
dehyrocellulose (BHA) and tert-butyl-hydroxyanisole (TBHQ). These compounds have been 
shown to be relatively recalcitrant to degradation during chlorination as well as to exert some 
beneficial effects on the disinfection process by reducing chlorine demand and by-products. 
Under strong chlorination conditions

MO 094
Generation, assessment and affinity purification of a broad-specificity high titre antiserum 
for detection and monitoring of 6-amino-penicillanic acid as a hapten
Ms. V. Zaitseva, Ms. V. May
Federal Centre for Medical and Preventive Health Risk Management Technologies, PERM, Russia

Penicillins belong to the group of β-lactam antibiotics and are most widely used in veterinary medicine 
for treatment of bacterial infection, or to serve preventive and prophylactic purposes. They 
are also provided illegally as supplements in feed stuffs to promote growth of food-produc-
ing animals. Moreover, penicillin residues in animal products are harmful by causing or 
reporting to cause allergic reactions and carcinogenicity. In addition, continuous presence of 
the antibiotics in heavily consumed foods is thought to promote of the spread of bacterial resistance 
to the valuable antibiotics used in human medicine.

The aim of this study was to develop conditions of penicillin determination in milk by 
means of an enzyme-linked immunosorbent assay (ELISA). A polyclonal antiserum to penicil-
in was generated in sheep using maleimide-caproic acid 6-amino-penicillanic acid derivative 
coupled to thiolated KLH as immunogen. Plate coating antigen conjugates of 6-aminopenicil-
lanic acid or ampicillin and gelatine were prepared using cyanuric chloride as a linking bridge. 
Indirect competitive assays were developed to assess the antiserum, potential performance of 
the prepared antibodies and by-products, 

The General Plan includes a green belt composed of minor river valleys reorganized into recre-
ation zones around the central part of the city. It also stipulates that sanitation and environmental 
rehabilitation measures including water bodies’ treatment, soil reclamation, and flora improve-
ment should be taken within a number of city districts.

It was determined that the pollution levels in industrial zones could be also reduced by thickening 
barrier vegetation with the density of such green belts will be from 800 to 1000 trees and 10,000 bushes per hectare, to minimize the compositional differences. These compounds were typical in the 10-2000 ng L-1 
range, depending on the sample nature. Moreover, their degradation products 
should also be evaluated since they may pose an environmental or human health risk.

Thus, the aim of the current study is to examine the chlorination degradation of some 
metabolites, bearing in mind that, according to the European Federation of Chlor alkali Producers,

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The samples were collected during field surveys carried out in 6 different countries, including mineral extraction and mineral processing, which affect direct or indirectly all aquatic ecosystems, including water bodies. The collected samples were analyzed for metal concentrations, and the results were correlated with environmental factors such as pH, temperature, and dissolved oxygen. The study found that the toxicity of the local mixtures in the study area varied between 0 and 42%. The results indicate that the chronic toxic pressure of the local mixtures is likely to affect local species composition. Furthermore, it was demonstrated that toxic pressure quantification is significantly related to variations in abundance of taxa. It was observed that the higher proposed RQ classification in groups of indicator taxa, based on multi-variant parameters in response to toxicant exposure, is largely, but not fully, reflected in the taxa-specific sensitivity towards toxicant mixtures.

Finally, it is concluded that increasing sediment toxicity is related to increasing effects, both on taxon richness and abundance.

Background concentrations of POPs in the Arctic: a risk assessment

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University of Amsterdam, AMSTERDAM, The Netherlands

Bioindicators such as macroinvertebrates were also tested: diatom cell size and the occurrence of diatom deformities were found to be good indicators of metal contamination. This work provides a basis for further use of diatoms as indicators of metal contamination.

The diatoms were investigated in a) a eutrophic and its confirmation as an important route of entry for contaminants and the currently demonstrated ability to reflect environmental health status.

Using river metabolism monitoring to quantify sediment budgets in river stretches

C Gallo

CRP Henri Tudor, ESCH-SUR-ALZETTE, Luxembourg

Sediments play an important role in river ecosystems as a food source and pollutant mediator. They can figure as pollutant sinks but can also transfer these pollutants to the food web if the sediments are considered to be biologically available. Hence it is important to quantify the dynamics of sediment budgets and their quality during the seasons. As rivers are hydrologically dynamic and sediment deposits very patchy, representative samplings are an unresolved challenge in sediment research. This poster presents a method relying on the well established river metabolism concept introduced by Odum (1956). The calculation of carbon demand (BOD) and ecosystem metabolism introduced by Odum, which allow for the calculation of Gross Primary Production (GPP) and Ecosystem Respiration (ER) in river stretches from continuous oxygen recordings. In addition sediments were re-suspended in a dozen spots in these 200 m long stretches and analyzed further in the laboratory. The main parameter investigated was the 24th Biological Oxygen Demand (BOD) of the sediment samples which is related to organic carbon content and other parameters reflecting the lability of the organic matter (chlorophylls, sugars, phospholipids). This poster shows the dynamics of metabolism parameters and sediment characteristics over one vegetative season in two differently polluted Luxembourgian rivers and proposes a method to quantify the sediment budgets by relating BOD and ER measurements.

Effects of ocean acidification on marine bacterial communities

CH Johansson, T Backhaus, H Blanck, S Brosché, KM Eriksson

University of Gothenburg, GOTEORP, Sweden

Decreased pH in our oceans is of great concern and effects have been shown on marine calcify- ing organisms. Still, more effects are to be expected on other organisms and parameters as well. Additionally, different organisms interact with each other in complex ways and the loss of a few species might have drastic effects on many organisms indirectly. This dictates the need to evaluate effects also on the community level. Long-term effects of lowered pH on marine periphyton communities were studied in a floating algal biofilter through microcosm systems. The periphyton was established from the indigenous microbiota in natural seawater from the Gullmar fjord on the Swedish west coast. Acidification to pH 7.7±0.07 was achieved with a pH-stat set up regulating the intermittent inflow of carbon dioxide. pH of the control aquaria fluctuated between 8.4 and 8.1 according to the activity of the foreshore. Several non-calcareous-psammophytic algae were identified. Chronic toxic pressure varied between 0 and 76%. These findings imply that the local toxicity of mixtures is likely to affect local species composition. Furthermore, it was demonstrated that toxic pressure quantification is significantly related to variations in abundance of taxa. It was observed that the higher proposed RQ classification in groups of indicator taxa, based on multi-variant parameters in response to toxicant exposure is largely, but not fully, reflected in the taxa specific sensitivity towards toxicant mixtures. Finally it is concluded that increasing sediment toxicity is related to increasing effects, both on taxon richness and abundance.

Consistent in diatom response to metal-contaminated environments

S Varela, E Rocha, A Gomes, M Monteiro, A Coimbra, V Ferreira-Cardoso, S Varandas, M Araújo

S Carrola1, E Rocha2, A Gomes1, M Monteiro3, A Coimbra3, V Ferreira-Cardoso3, S Varandas1, M Araújo

(Coast and Marine) - preliminary data

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any pH-induced change in community structure or function. We have used marine periphyton communities in a long-term study of effects of increased partial pressure of CO2 in the water and the accompanied lowering of pH. Periphyton was allowed to colonize and grow on glass substrata for 3.5 weeks in flow-through microcosms. The pH in the microcosms was either that of the incoming natural surface water or was manipulated by bubbling of CO2 down to approximately pH 4.7. We used Pulse Amplitude Modulation (PAM) to detect effects on photosynthetic electron transport and estimate induced community tolerance to low pH. In addition, we used confocal microscopy to trace effects on biofilm architecture and biofilm thickness. We have also estimated microbial diversity and composition of trace elements in periphyton using PCR-TGGE and X-ray diffraction respectively. First results indicate that long-term effects of lowering the capacity of communities to tolerate further changes in pH, making them more sensitive to pH-stress. However, no long-term effects on photosynthetic electron transport or trace element composition was detected.

MO 112
Linking the individual to community levels: a place for arthropod molting enzymes in ecosystem toxicology?
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Chitinoase is one of two molting enzymes (the other being chitinase) used to cleave chitin polymers that comprise the exoskeleton of aquatic arthropods. Following molting this enzyme is released into the water and can be quantified by a simple fluorescence assay. The standing activity and its rate of production has been used as a measure of: 1) secondary production rates; 2) molting rates; and 3) developmental biomass for entire crustacean zooplankton communities under laboratory and field conditions; and 4) responses to some contaminants in zooplankton and crustacean. Yet, despite its relative methodological ease, chitinoase has only been used speculatively as an ecotoxicological tool to monitor and quantify changes in secondary production as a function of stress to a stressor. In this paper we reviewed all the published work relevant to the use of chitinoase as a measure of stressor response and make the following recommendations for future research: 1) current methodologies be further validated, e.g., quality assurance and quality control measures be adopted, enzyme storage conditions and times be experimentally determined; 2) that the various methodologies be used to quantify the effects of up to three different toxicant groups be characterized in order to examine the impact of stressors in laboratory-based studies and the utility of the approach as a field-based measure of community-level processes; and 3) the response of selected organisms be characterized for model stressors to confirm the method’s observed responses. Further more traditional endpoints, e.g., reproduction and growth. Overall, the use of chitinoase has enormous potential as a tool in ecotoxicology, but extensive groundwork and validation is still required before it can be widely adopted.

MO 113
Characterization of kidney histology in tilapia (Oreochromis niloticus) as biomarker tool for fish health assessment: preliminary data
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¹CITAB and ECAVA, UTAD, VILA REAL, Portugal
²DVC and CECAV, UTAD, VILA REAL, Portugal
³Fish activities have resulted in unprecedented pollution worldwide, by releasing different kind of chemical compounds. These pressure affects water availability and quality, in most cases unsuited for the desired use. But have also serious effects on all living organisms, including animal and human health. Biological monitoring measure use of histological biomarkers, among others, integrated in a multidisciplinary approach, as a complement to classical physical and chemical monitoring parameters. Thus, several organs can be used for this purpose like fish kidney and normal histological knowledge is essential. Field and laboratory studies have established a causal relationship between fish kidney damage and levels of toxicity. Fish kidney can be divided in two main regions, the anterior (or head kidney), composed of hematopoietic tissue, lymphoid tissue and cells with endocrine function, and the posterior (or trunk kidney), composed of renal parenchymal tissue, whose functional unit is the nephron, which plays a key role in homeostatic processes. This work is centered on the study of tilapia kidney ultrastructure and histology (anterior and posterior regions) to develop a tool that can be used for future studies, as a complement to other organs histopathology. Amongst cichlids with 2-phenoxethanol, tissue samples were collected from the anterior and posterior part of the kidney of 7 male fishes, and fixed with formaldehyde. Then sections were cut (3 μm) and stained with HE. After that, slides were studied with light microscopy. Preliminary data show that the anterior kidney region of tilapia is constituted mainly by interrenal renal and lymphoid tissue, but that the kidney posterior region mainly consists of renal parenchymal tissue, connective tissue, and not nephrons. We also observed differences in cellular organization of the kidney, related with age and degree of sexual maturation of fishes. This study was focused in histological characterization of tilapia kidney and may constitute a basis for further studies in assessment of histopathological lesions/alterations in fish kidney exposed to chemical compounds.

MO 114
Fluorescence transport of historical contaminants to the Elbe Estuary: modelling their deposition and monitoring their effects on the ecosystem
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¹Hamburg University of Applied Sciences, HAMBURG, Germany
²Federal Waterways Engineering and Research Institute, HAMBURG, Germany
³High discharge conditions in the Elbe river lead to resuspension of highly contaminated sediments in the up-stream part of the Elbe catchment, the most contaminated areas being in the Czech Republic, in the catchments of the tributaries Mulde, Saale (about 300 km upstream of Elbe mouth) and in the Elbe river itself. Currently, we are currently modeling the contaminant transport along the major river (see Mosherbg, SETAC Europe 2009). The area of the Elbe estuary still is a big challenge: the tidal impact along with dredging activities of the river and the large-scale climate change mediated by the hydrologically, shifting back and forth in the estuary, all lead to a complex sedimentation pattern in an area where nature reserves are in close proximity to the second largest harbor in Europe.
This poster describes the results of several event-based sampling surveys carried out over 2 years, describing the ecotoxicological and chemical effects of flood-induced transport of contaminants to the estuary from the Hamborg area to the mouth of the river. Applying a hydrodynamic 5-dimen- sional model that has been developed by the Federal Waterways Engineering and Research Institute over the years for the Elbe estuary, we interpret those data on the basis of projected transport pathways and sedimentation patterns of relevant contaminants in the tidal Elbe area comprising nature reserves, harbor basins, beaches, fishing grounds and urban environments. Together with assessment of contaminant loads, carried downstream by flood events, and climate change projections, temporal development of the contamination pattern in the Elbe will be the analytics.

MO 115 Assessing the impact of watershed land use on aquatic biodiversity over large spatial scales using benthic macroinvertebrates.

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2Data from the United States Geologic Survey (USGS) North American Water Quality Assessment (NAWQA) and the United States Environmental Protection Agency (EPA) Wadable Stream Assessment (WSA) programs were used in an attempt to identify site parameters and a measure of aquatic biodiversity over large spatial scales. Data from the USGS NAWQA program included multiple years of sampling at single sites, ranging from 1993 to 2008. Results from the assessment show correlations between measures of aquatic biodiversity and forest land use (positive correlation) and urban land use (negative), but fail to show a correlation between agricultural land use and aquatic biodiversity. This outcome agrees with other studies on the impact of anthropogenic land use and water quality, indicating a much stronger influence of urban systems. Though the influence of urban land use appears to be much more pronounced than agricultural land use, this does not means that agriculture does not impact aquatic biodiversity. Instead it suggests that under specific conditions and proper management practices agricul- tural land use will have a much more significant impact than urban land use. This gives hope to the prospect of reducing the impact of urban land use through use of management practices similar to those currently employed in the agriculture sector.

MO 116 High frequency aquatic ecosystem biomonitoring

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1Eawag, KASTENVIEHRAUM, Switzerland
2NIOO, NIEUWERSLUIS, The Netherlands
3SUPSLUGANO, Switzerland

In world threaten by multiple anthropogenic impacts, innovative approaches to lake-ecosystem monitoring and assessment of lake ecosystem functions are required for a correct management of water resources. We evaluated if they harbor and the services that they deliver. We developed an innovative and potentially ground-breaking tool for high frequency monitoring of phytoplankton. We have designed a lake monitoring platform for the characterizing and counting of algal cells (based on scanning flow-cytometry), coupled with measurement of the phytoplankton (DNT) by a novel algorithm. The algorithm uses information about potential biological effects in non-target species living in areas receiving discharges from anthropological activities. Existing data on rate and effects of intense sweeteners in the environ- ment is not available from novel experimental data, and genomic (transcriptional) effects of the intense sweetener sucralose will be presented to elucidate whether these compounds may cause adverse effects to aquatic animals such as plants, algae, crustaceans and fish. The bioac- cumulation studies, which were performed with the algae Pseudokirchneriella subcapitata, the crustacean Daphnia magna and Zebrafish (Danio rerio), were conducted as static and semi-static studies over a period of 48 hours with two concentrations of saccharin (10 and 100 mg/L), with analytical determination of saccharin in both water and biota. Chronic toxicity tests show that saccharin at concentrations of 1-100 mg/L did not adversely affect the growth of neither the plant Lemna gibba, the green algae P. subcapitata, the Mediterranean crustacean D. magna and the zebrafish (Danio rerio). However, the hepatic transcriptional response in Zebrafish (Danio rerio) after 48-hr waterborne exposure to 1-100 mg/L saccharin was determined by microarray-assisted analysis as a pre-screening tool for identifying potential biological effects of the compound in non-target organisms. A combination of data from literature and the experimental approaches will be used to assess the risk posed by sucralose and other intense sweeteners to aquatic organisms under relevant exposure scenarios.

MO 125 Intense sweeteners in the environment- is there a reason for concern for wildlife effects?

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2University of North Texas, TEXAS, United States of America

Intense sweeteners such as sucralose and acesulfame K, sucralose and sucrose are produced and used in large quantities in all major markets of the world as low calorie sugar substitutes. Many of these sweeteners pass through the body either unaltered or as modified compounds and are ultimately released to the environment predominantly through the sewage system. Some of these sweeteners are ubiquitous at low levels in the environment. The recent developments in molecular biology have opened up the possibility to elude whether these compounds may cause adverse effects to aquatic animals such as plants, algae, crustaceans and fish. The bioac- cumulation studies, which were performed with the algae Pseudokirchneriella subcapitata, the crustacean Daphnia magna and Zebrafish (Danio rerio), were conducted as static and semi-static studies over a period of 48 hours with two concentrations of saccharin (10 and 100 mg/L), with analytical determination of saccharin in both water and biota. Chronic toxicity tests show that saccharin at concentrations of 1-100 mg/L did not adversely affect the growth of neither the plant Lemna gibba, the green algae P. subcapitata, the Mediterranean crustacean D. magna and the zebrafish (Danio rerio). However, the hepatic transcriptional response in Zebrafish (Danio rerio) after 48-hr waterborne exposure to 1-100 mg/L saccharin was determined by microarray-assisted analysis as a pre-screening tool for identifying potential biological effects of the compound in non-target organisms. A combination of data from literature and the experimental approaches will be used to assess the risk posed by sucralose and other intense sweeteners to aquatic organisms under relevant exposure scenarios.

MO 126 Alkylphenols and Alkylphenol ethoxylates in consumer goods and their contribution to a Wastewater Treatment Plant in Stockholm, Sweden

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SFA research started with heavy metals and has been followed by organic substances. Knowledge about the sources is necessary for the development of the most important data sources to the contribution from textiles 113

EP04 - Emission of chemicals from consumer goods - from emis- sions to effects

MO 123 Origin, source, exposure and toxicity of Non-Aroclor PCB11

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2Despite being a member of one of the most regulated compounds in the world, PCB11 (3,3', 4,4'-tetrachlorobiphenyl) is a virtually uncontrolled global pollutant. It was not produced in significant quantities until the mid-20th century, when a commercial mixture of polychlorinated biphenyls (PCBs) and therefore was not subject to the scientific attention paid to many PCB congeners. However, the compound has been reported in air and wastewater around the world. Here we summarize our current knowledge of the sources, environmental history, and toxicologic effects of PCB11. We recently reported that PCB11 is produced inadvertently during the manufacture of both commercial paint pigments and we have hypothesized that this production occurs the presence of this compound in air and wastewater around the world, including urban centers like Chicago and Philadelphia and remote regions of the Great Lakes and in the Arctic. Although the presence of PCB11 is well established, the exact origin of this compound remains elusive. PCB11 was first detected during the manufacturing process of the intense sweetener sucralose will be presented to elucidate whether these compounds may cause adverse effects to aquatic animals such as plants, algae, crustaceans and fish. The bioac- cumulation studies, which were performed with the algae Pseudokirchneriella subcapitata, the crustacean Daphnia magna and Zebrafish (Danio rerio), were conducted as static and semi-static studies over a period of 48 hours with two concentrations of saccharin (10 and 100 mg/L), with analytical determination of saccharin in both water and biota. Chronic toxicity tests show that saccharin at concentrations of 1-100 mg/L did not adversely affect the growth of neither the plant Lemna gibba, the green algae P. subcapitata, the Mediterranean crustacean D. magna and the zebrafish (Danio rerio). However, the hepatic transcriptional response in Zebrafish (Danio rerio) after 48-hr waterborne exposure to 1-100 mg/L saccharin was determined by microarray-assisted analysis as a pre-screening tool for identifying potential biological effects of the compound in non-target organisms. A combination of data from literature and the experimental approaches will be used to assess the risk posed by sucralose and other intense sweeteners to aquatic organisms under relevant exposure scenarios.

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1Statistics Sweden, STOCKHOLM, Sweden
2Linnaeus University, KALMAR, Sweden

SFA research started with heavy metals and has been followed by organic substances. Knowledge about the sources is necessary for the development of the most important data sources to the contribution from textiles 113
articles, so that waste and other end-products, such as ash materials and sludge, can be recovered and used without harming human health or the environment.

MO 132
Source classification framework for an optimized European wide emission control strategy
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**MO 138**
Evaluation of the effects of titanium silicate nanoparticles in tadpoles of Pelophylax perezi (Seoane, 1885)

PV Salvestra, R Pereira, I Domingues, MG Alves, RA Carvalho, AAM Soares, LLoque1
CESAM, AVEIRO, Portugal

Due to the growing production and usage of titanium silicate nanoparticles (NP-TiSiO4) in a wide range of products and industrial applications, it is expected soon to be found in the environment. Since these NP tend to form large aggregates when suspended in aqueous media, it is presumed that, when entering in the aquatic environment, they will settle over the sediment. Therefore, the fate of these particles that actively interact with the sediment will constitute key receptors of these NP. Accordingly, this work intended to evaluate the effects of NP-TiSiO4 in tadpoles of the frog species Pelophylax perezi (Seoane, 1885), at this life stage uses and compete for sediment as a nutritional resource. To attain this objective, tadpoles at Gosner stage 24-25 were exposed, for 96-h, to a series of five concentrations of NP-TiSiO4. At the end of the experiment, mortality, behavioral shifts, and enzymatic activity of acetyl-cholinesterase (Ache), glutathione S-transferase (GST), lactate dehydrogenase (LDH) and catalase (CAT), were monitored. Mortality never exceeded 20% for the control and for all tested concentrations of NP-TiSiO4.

Significant behavioral changes were also not observed. However, the analysis of enzymatic activities revealed a significant activation of CAT and LDH when exposed to the lowest concentration. No significant changes were observed for Ache or GST. Proton nuclear magnetic resonance (1H-NMR) analysis for lactate, glucose and alanine content in NP-TiSiO4 exposed tadpoles will be presented.

**MO 139**
Salinity and copper interactive effects on tadpoles of the green frog Pelophylax perezi (Seoane, 1885)

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Several works have been focused on metal contamination of freshwater ecosystems and its impact on amphibians. It is believed that future, for environmental conservation, supported populations of amphibians will have to deal with additional stressors associated with global climate changes, namely increased salinity due to sea level rise. Accordingly, this study intended to assess the interactive effects of salinity and the metal copper on tadpoles of the green frog Pelophylax perezi (Seoane, 1885). To attain this objective, single and combined effects of salinity and copper on survival of larval stages of P. perezi were evaluated in a multifactorial design and enzymatic activities were quantified. Larval stages of the P. perezi were collected in the field and kept in the laboratory for 90 days. At the beginning of gametogenesis, S. plana gonadosomatic index were examined in spawning stock. Tadpoles were exposed to four salinity levels (0.5, 1.5, 2.5 and 3.5) and four Cu concentrations (0, 0.01, 0.05 and 0.1 mg l-1) for 21 days in 1822 different ‘transgenerational compartments’. For 30 replicate species with focus put on Cd, Hg, and Pb (43 publications) for 23 species with half of them falling into the Lower Risk UCN threat status category, information is available for only four out of 151 European reptile species. The present review confirmed that early life stages of reptiles are almost ubiquitously exposed to the metals Cd, Hg, and Pb which were detected in male and female gonadal tissues during gametogenesis, fertilization, egg and eggshell formation, as well as in eggs, embryos and hatchlings; were detected in the vast majority of the samples analysed; and were transferred via both maternal tissues and external incubation substrates to the progeny where they accumulated in a dose-dependent manner. Moreover, mean concentration levels of these metals detected in the early developmental stages of reptiles matched those reported for mammals and birds, and fell within the range of reproductive and developmental toxicity thresholds reported for these taxa. However, for Cd, Hg, and Pb in reptiles, no critical metal concentrations in reproductive tissues, and no exposure-effect relationships could be established. Based on the published data set, the threat of metals of priority concern might pose a threat to the studied species, but cannot be considered of a high enough threat to require the implementation of measures. Metal contamination in reptiles, p. 553-593. In: Sparling DW, Lindor G, Bishop CA, Kreft S (Eds). Ecotoxicology of amphibians and reptiles. SETAC, CRC Press, Boca Raton, 916 p.

**MO 140**
Incidence of intersex and reproductive status in the clam Scrobicularia plana from 13 sites in the UK

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2FERA, YORK, United Kingdom
3Helmholtz Center for Environmental Research, LEIPZIG, Germany

Wildlife may be exposed to heavy metals in soils via uptake through the food chain. The accumulation of metals may then affect the health of the wildlife species. It is therefore important to develop a better understanding of the potential for wildlife to be exposed to metals via the food chain and to assess the subsequent risks. In this study, we developed a spatial model to predict the exposure of insectivorous bats to cadmium, lead, copper and zinc in soils. Data were collected on the distribution of 14 bat species in 13 sites across the UK. In addition, the diet of bat species, bioaccumulation factors for invertebrate prey and concentrations of heavy metals in soils across England and Wales. These data were used in a GIS-based exposure model to estimate daily levels of exposure for heavy metals in bats across England and Wales. Our results show that highest exposure occurs around industrial areas were predicted exposure for both bat species are at a level at which toxicological effects might be expected. As many species of European bats are of conservation concern, this model has the potential to identify populations that may be particularly vulnerable to environmental contaminants. Further work is planned to evaluate the model against experimental monitoring data of bats and to explore in more detail the transfer of metals through different stages of the food chain.

**MO 141**
Use of MDA as biomarker of lipid peroxidation in roe deer (Capreolus capreolus): the influence of gender

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3Oxygen metabolism in amphibian organs implies the formation of reactive oxygen species (ROS), thus exposure to being greatly affected by toxicological factors like environmental contamination, radiation and pathogens. These ROS can oxidize biologically relevant molecules leading to alterations in normal cell and tissue functions, but this oxidation is functionally minimized by a broad spectrum of antioxidant defences (AD). Therefore, a steady-state rate of ROS production, metabolism, and antioxidant system is continuously taking place in aerobic cells and tissues. One of the most studied processes in relation to damage produced by ROS is the lipid peroxidation. Lipid peroxidation is a complex process, which can be considered as a sequence of events initiated by a hydrogen atom abstraction, followed by reaction of oxygen with the resulting carbon radical and, finally, by the free radical chain reaction. This radical chain reaction is an important process initiated by free radicals, which is involved in the events leading to cell death. In the present study the thio-barbituric assay for malondialdehyde (MDA), biomarker of both primary and secondary decomposition of lipid peroxidation products, was used as indirect measure of endogenous lipid peroxidation: it measures the three different organs (liver, kidney and lung) of male and female roe deer (Capreolus capreolus) from NW Spain, in order to assess the influence of this variable (gender) in future biomonitoring studies in the wild. The results showed higher MDA levels in male than in female liver (0.292 ± 0.048 and 0.160 ± 0.023 µmol/mg protein, respectively). This difference was statistically significant (p < 0.05). This result could be explained according to the fact that in females, the hormone estradiol, like other protective molecules, may act by regenerating endogenous antioxidants present in membranes, thus delaying the appearance of MDA, like MDA. With respect to the other tissues, kidney and lung samples showed quite similar levels of MDA in both males and females (0.212 ± 0.020 and 0.213 ± 0.020 µmol/mg protein respectively), with no statistical relevance. The findings are indicative that gender can play an important role in the expression of oxidative stress in the case of hepatic tissue, rendering this variable of interest in biomonitoring programs.

**MO 142**
Predicting exposure of bats to soil-associated heavy metals

BV Hernon1, KE Somerwill2, R Benker1, ABA Boxall1
1University of York, YORK, United Kingdom
2FERA, YORK, United Kingdom

The endobenthic clam Scrobicularia plana is important for the structure and functioning of estuarine and coastal mudflats, and thus the reproduction success of this species is a topic of interest for environmental conservation. In thirteen estuaries from NW France differing by their degree of contamination (as documented by the data of RNO for Réseau National d’Observation, now ROCCH, Réseau d’Observation de la Conservation Chimique du milieu marin at http://www.sfrmar.env/home), intersex and different parameters linked to reproduction (sex-ratio, percentage of female-biased sex ratios) were observed after exposure to EDCs at the larval stage. Thus, the presence of EDCs in superficial sediments collected in parallel to clams was investigated by using an approach combining quantitative chemical analyses of the main classes of EDCs and a battery of several bioassays allowing the identification of receptor-mediated activities, namely estrogen (ER), androgen (AR) and dioxin (AhR) receptors. In addition, the reproductive success may be impaired indirectly when species used as food are impacted in contaminated sites, limiting food availability and then energy resources devoted to the reproduction of consumers. This hypothesis is supported concurrently with endocrine disruption by determining hepatosomatic indices and measuring chlorophyll and phaeopigments in superficial sediments, the microphytobenthos of which is a major food source for deposit-feeding bivalves such as S. plana. SETAC Europe 21st Annual Meeting Abstract Book 115

**ET01 - Linking chemical residues with biological responses in wildlife**

**MO 146**
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MO 150

The reproduction of Donax trunculus affected by their level of contamination? I. Métais1, H Boussetta2, C Mouneyrac1

level of contamination?

This work was supported by national (MCTES, Foundation for Science and Technology) grants and by the French government program "Investissements d'avenir" (ANR-10-IA51-02).

We would like to thank all the local authorities of the study area for their support.

MO 151

Use of biomarkers in Cyprinus carpio as tools in biomonitoring programs: experimental exposure to the pesticide Deltamethrin C. Ezubi1, H. Marcey Yahi2, H. Dhemontreux3, M Pérez-López1

The presence of toxic pollutants in aquatic ecosystems poses a serious threat to environmental health. Use of biomarkers in fish is considered a cost effective strategy to obtain information on the state of the aquatic environment and the effect of pollutants on living resources. Biomarker systems are scored as tools for monitoring the effects of pollutants (genotoxic and physiological responses to chemical and environmental stressors). These effects can be measured in organs or tissues affected by the pollutants. The use of biomarkers allows determination of the exposure dose and time and the mode of action of the pollutants in aquatic organisms. The aim of this study was to examine the effects of Deltamethrin on the physiological responses of Cyprinus carpio L. to the presence of toxic pollutants in aquatic environments.

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The higher OC levels found in this study compared with other studies are probably influenced by razorbill diet and migration strategies. Besides, coprophagy appears to be an important factor in the capacity of the feather to store and excrete organic compounds.

The results revealed that response of brain AChE, hepatic EROD, GST, and LPO of common carp could be used as a suite of biomarkers in future biomonitoring programs in assessing pollution status and pollution trends in water resources.

Acknowledgements: Special thanks to the Tunisian Ministry of Scientific Research and technology "Research Group: Hydrology and Pollutology" who allowed this study to be carried out by the laboratory. This research was supported by "Agencia Española de Cooperación Internacional para el Desarrollo" (project A/01939/08).

MO 152

Evaluation of the contamination of the Loire estuary by endocrine disruptors I. Blanchet-Letrouvé1, O. Fossi Tankoua1, L. Pirotier1, SAA Aït-Aissa1, CH Herrenknecht1, HB Badzinski1, SB BalascZ1, SD Dubout1, CM Mouneyrac1

MO 153

Identifying Pb exposure sources in waterbirds and adverse effects on porphyrin metabolism using non-invasive faecal sampling I. Martínez-Esguev1, MA Tostado2, JC Martin-Doimeadios3, AJ Green4, R Mateos5

In this study we assessed the Pb exposure sources of the waterbirds collected in the Loire estuary along with the effects of Pb exposure on their porphyrin metabolism.

The aim of this study was to evaluate the usefulness of feathers as biomonitoring tools for organochlorine pollutants (OC) in a population of 50 razorbills (Alca torda) at Trafalgar Head, Bembridge, Isle of Wight. We measured the concentration of OCs in feathers, internal tissues, and blood in seabirds. Nevertheless, feathers appear to be an extremely useful tool for OC biomonitoring, giving a good estimation of OC levels in a population. Acknowledgements: To MICINN and Fundación Seneca for funding the Projects CGL2004-3595/BOS, CGL-2008-3418/BOS and 08750/PI/08. To Generalitat Valenciana for permission to obtain the samples. Silvia Espin is enjoying a grant from the CEGRAM.

MO 154

Organochlorine pesticides in Razorbill (Alca torda) feathers from Southwestern Mediterranean regions and their correlations with internal tissues S. Egipto1, F. Martinez-Lopez1, P. Maria-Moja1, A. Garcia-Fernández1

The aim of this study was to explore the usefulness of feathers as biomonitoring tool for organochlorine pesticides (OC) in a population of 50 razorbills (Alca torda). It was evaluated the distribution pattern of the compounds and correlations between the concentrations found in feathers, internal tissues, and blood in seabirds. Five OC were analyzed in feathers, including α- and β-HCH, Lindane, Aldrin, Dieldrin, endrin, endosulfan I and II, endosulfan sulfate, p,p'-DDE, DDD, DDE, heptachlor and its epoxide. Mean concentrations obtained in this study were HCH: 196.2±17.4 ng/g, α-HCH: 61.14±5.9 ng/g, β-HCH: 55.2±5.44 ng/g, δ-HCH: 32.55±3.72 ng/g, p,p'-DDE: 177.80±27.87 ng/g. The liver OC levels found in this study compared with other studies are probably influenced by razorbill diet and migration strategies. Besides, coprophagy appears to be an important factor in the capacity of the feather to store and excrete organic compounds.

Few significant correlations were found between OC levels in feathers and internal tissues, probably determined by the time between the molt and the moment of sample collection. According to the levels found in internal tissues, there is no risk associated to OC concentrations found in feathers in razorbills. Further research is necessary to investigate the correlation between concentrations in feathers, internal tissues, and blood in seabirds. Nevertheless, feathers appear to be an extremely useful tool for OC biomonitoring, giving a good estimation of OC levels in a population. Acknowledgements: To MICINN and Fundación Seneca for funding the Projects CGL2004-3595/BOS, CGL-2008-3418/BOS and 08750/PI/08. To Generalitat Valenciana for permission to obtain the samples. Silvia Espin is enjoying a grant from the CEGRAM.

MO 155

Development of an analytical method for extracting organochlorine pesticides from feathers S. Egipto1, F. Martinez-Lopez1, P. Maria-Moja1, A. Garcia-Fernández1

further research is necessary to investigate the correlation between concentrations in feathers, internal tissues, and blood in seabirds. Nevertheless, feathers appear to be an extremely useful tool for OC biomonitoring, giving a good estimation of OC levels in a population. Acknowledgements: To MICINN and Fundación Seneca for funding the Projects CGL2004-3595/BOS, CGL-2008-3418/BOS and 08750/PI/08. To Generalitat Valenciana for permission to obtain the samples. Silvia Espin is enjoying a grant from the CEGRAM.
Although most organochlorine pesticides (OC) have been banned in developed countries, they are still frequently found in tissues or fluid samples from several species in agricultural regions, where these contaminants have been widely used in agricultural practices. The aim of this study is the development of an extraction method for 15 OC in feathers, including α-, β- and γ-isomers of PCBs and DDE, dieldrin and heptachlor and its epoxide. The large number of OC to identify and polarity varia-
tions pose problems in the recovery process. In order to solve these problems, different mixtures of organic solvent were prepared to find out which one was the most appropriate. In this way, four methods of OC extraction in feathers were evaluated, and it was indicated that the most appropri-
ate method tested was extraction with dichloromethane. To study these parameters, mallards (Anas platyrhynchos) feathers were spiked with three different levels of OC, standard solution.

MO 156

PBDEs and legacy POPs in hawk and falcon species from urban environments in British Columbia, Canada, 1999-2009

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1University of British Columbia, Vancouver, Canada


Espín is enjoying a grant from the CEIGRAM

Elliott et al. (2010) found that there is a strong correlation between OC concentrations and chromato-
graphic peak area for each compound, with regression coefficient values (R) greater than 0.96. The variation coefficients obtained for the repeatability and reproducibility are indicative of good technical precision according to the standard deviation below 20%. Therefore, this method is acceptable and can be used as a method for the extraction of feathers in 15 organochlorine pesticides widely used in some areas. Acknowledgement: To MICONN and Fundación Seneca for funding the Projects CGL2004-5995/BOS, CGL-2008-4138/BOS and 0857/P1/08. Silva Espín is enjoying a grant from the CAICIRAM.

MO 157

Relationship between CALUX bioassay and dioxin-like PCBe-TEQs in the eggs of preda-
tory birds from the UK

GM Perrie1, LA Walker2, M Coyne3, RF Shore1

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2Natural England, PETERBOROUGH, United Kingdom

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Natural England, PETERBOROUGH, United Kingdom

Accumulation of dioxin-like polychlorinated biphenyls (PCBs) in predatory birds has been extensively

MO 158

Risk assessment of organohalogen exposure in a Eurasian eagle owl (Bubo bubo) population from Southeastern Spain

P Gomez-Ramirez,a, M Martinez-Lopez,a, P Maria- Mojica,b, S Espin,b, L Ramion,a, AJ Zureew,a, AJ Garcia-Urdiales,a

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Exposure to polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs) and organochlorine insecticides (OCIs) are associated with potential pernicious effects and reproduction and have led to population declines in several bird species. Despite the ban of most of these highly persistent contaminants, current environmental concentrations are likely to be important and pose potential risks. According to the NRC requirements, the Eurasian Eagle-Owl (Bubo bubo) is a suitable sentinel for the effects of organohalogen compounds in Southeastern Spain. Moreover, because this nocturnal raptor is a terrestrial year-

MO 159

Blood cholinesterase characterization of Ciconia ciconia and Ardea cinerea: potential bioindicators of contaminant in birds

SA Santos, MS Monteiro, AMV Soares, SL Loureiro

CESAM (Centre for Environmental and Marine Studies), AVETRO, Portugal

Cassino, reported that the concentrations of PCBs and dieldrin in this study are below those of the levels found in other species and is consistent with the use of PCBs and dieldrin in this study. The results of PCB concentrations and tissues of ciconiids have reported the accumulation of toxicologically significant concentrations of both legacy POPs and PBDEs. Carcasses were selected only if body condition was good, and the diagnosis of death was trauma. Hepatic EBPDE concentrations in 13 Cooper’s hawks from Greater Vancouver ranged widely from 10 to 30 μg/g wet weight with a geometric mean of 11 μg/g.

MO 160

PFOA, PFOS and PFBS induce embryonic hepatic fatty acid oxidation in chicken eggs

M Nordén, O Westman, N Vertesló, M Engwall

Swedish University of Agricultural Sciences, Sweden

In this study a new method for toxicity testing is presented which can be used for studies of the effect of environmental pollutants on fatty acid oxidation in avian models. In the current study the effect of environmental pollutants on fatty acid oxidation in avian models was studied.

MO 161

Effects of early exposure to BDE-99 on growth, physiology and reproduction in zebra finches and European starlings

J Ing1, TD ‘Williams’, RJ Letcher1, JE Elliott1, ST Collis2,3,4, JSW Mynott2

1Swedish University, BUPA, Sweden

2University of Sheffield, BUPA, UK

3Environment Canada, OTAWA, Canada

Polybrominated diphenyl ethers (PBDEs) is a class of brominated flame retardants that have be-

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Changes in hepatic fatty acid oxidation in avian species exposed to single or mixtures of POPs and PBDEs

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ET13 - Moving towards a systems biology approach to predictive ecoxicology

MO 166 Predictive ecoxicology: predicting responses and physiological consequences to the Environmentally Relevant Assessment of Pharmaceuticals

C. David Robinson, G. Painter, MJ Winterton, LB Kinter, R. Murrpy-Smith

AstraZeneca, Brixham, United Kingdom

Human pharmaceuticals detected in aquatic environments have raised concerns about potential impacts on wildlife. These concerns, exemplified by oestrogens, have led the scientific community to explore how toxic effects and how best to advance the Environmental Risk Assessment (ERA) of pharmaceuticals. To better predict potential effects in non-target environmentally relevant species, one area in which our laboratory amongst others has been working is the potential use of non-clinical and clinical pharmacological and toxicological data generated during drug development (read-across). Genetic conservatism of receptors and physiological systems between mammals and certain environmentally relevant species (i.e. fish), combined with knowledge of primary and secondary Mode-of-Action (MOA) in mammals, can assist in selection of appropriate species, quantification of endpoints, and design, and execution in an approach referred to as ‘intelligent testing’. Surprisingly, evidence for the proof of this principle is scarce. In this presentation we build on our previous publications, concerning how best to use the data available from the human drug development, and to address some of the issues surrounding the validation and equivalence of mammalian and non-mammalian species.

In order to begin to predict the ecoxicological relevance of the read across model, we need to understand the broader physiological consequences of these predicted effects at each level of the physiological system in order to work towards an effective interpretative model. The work presented here reports the first example of the multilayered (systems) approach that we have taken to pre-

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MO 167 Linking DNA damage in sperm with reproductive success in adult zebrafish Danio rerio

MO 168 Conserved toxic responses across phylgenetic divergent lineages: a meta-analysis of the neurotoxic effects of RDX among multiple species using toxicogenomics

C. Patrick Basuuyanru, A. Okon, W. Areh, B. Owubokiri

University of Port Harcourt, PORT HARCOURT, Nigeria

The toxicity effectiveness of RDX to function as a cross species tool in the analysis of DNA damage in testicular tissue of several species, from mammalian to invertebrates, in an approach referred to as ‘intelligent testing’. Surprisingly, evidence for the proof of this principle is scarce. In this presentation we build on our previous publications, concerning how best to use the data available from the human drug development, and to address some of the issues surrounding the validation and equivalence of mammalian and non-mammalian species.

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MO 168 Conserved toxic responses across phylgenetic divergent lineages: a meta-analysis of the neurotoxic effects of RDX among multiple species using toxicogenomics

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University of Port Harcourt, PORT HARCOURT, Nigeria

The toxicity effectiveness of RDX to function as a cross species tool in the analysis of DNA damage in testicular tissue of several species, from mammalian to invertebrates, in an approach referred to as ‘intelligent testing’. Surprisingly, evidence for the proof of this principle is scarce. In this presentation we build on our previous publications, concerning how best to use the data available from the human drug development, and to address some of the issues surrounding the validation and equivalence of mammalian and non-mammalian species.

In order to begin to predict the ecoxicological relevance of the read across model, we need to understand the broader physiological consequences of these predicted effects at each level of the biological system in order to work towards an effective interpretative model. The work presented here reports the first example of the multilayered (systems) approach that we have taken to pre-

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Wastewater treatment processes generate highly biodegradable solid wastes whose final destination is an environmental issue with considerable repercussion for public administrations that intend to find products to mitigate urban waste impacts and even more so to raise awareness about the effects on the environment of the long-term application of sludge and compost in soils in order to enhance their quality, and at the same time, manage this type of wastes in a sustainable way. For that, the analysis of the systematic versus uncontrolled use of sludge and compost as agricultural fertilizers was performed in three regions of Spain. The effects of sludge and compost application were evaluated over some soil physical-chemical properties and functions and also over vegetable growing and pollutants (metals and organic) accumulation.

In general, it was observed that the long-term input of sludge and compost enhances soil properties, especially to the doses and/or to the frequency indicators are not increased with the application of organic amendments. The organic amendments increased the organic matter content (and its aromaticity), the soil nitrogen and the microbial activity, improving the mineralization processes of carbon and nitrogen and some enzymatic functions (arouse and dehydrogenase). However, there was a maximum dose, from which the soil properties and soil microbial activity and even enzyme activity, it was observed that were repeated and not sufficiently controlled (high dose) sludge and compost application were affecting the balance between C and N cycles producing a decrease of the C/N ratio that can involve significant risk for aquifer contamination by nitrates.

Biochar is a carbon-rich product of thermal decomposition of biomass in oxygen-starved conditions, also called pyrolysis. There has been growing interest in the use of biochar as an agricultural amendment, due to biochar’s physico-chemical properties which can greatly improve soil fertility under certain conditions and allow carbon sequestration. However, there is little information about ecological effects of biochar, and to date there are no published studies on biochar effects on soil mesofauna. Furthermore, biochars can vary greatly in their physicochemical properties, and organism responses are hypothesized to vary accordingly. Thus the objective of this study was to answer basic questions about biochar’s potential toxic effects on Folsomia candida, a soil-dwelling collembolan commonly used as a test species in ecotoxicological work. Reproduction and survival assays and avoidance tests were carried out in order to understand how different char materials and concentrations can affect physicochemical properties and influence biological responses of soil mesofauna.

Reproduction and survival tests of toxicity with 7 feedstocks and their corresponding low (300-350°C) and high (500-550°C) temperature-produced chars showed that adult survival of F. candida was generally unaffected by any of the factors considered. However, reproductive inhibition was observed for some materials at concentrations ≥ 0.2%, and general inhibition was found for all toxicities ≥ 0.7%. Further, there was evidence that biochar applied annually, all with additions of 90% of recommended N fertilizer. Soil functions and physico-chemical and biological properties were investigated at this site during the 2010 growing season. It was found that important physico-chemical properties in treatment plots including field capacity and electrical conductivity did not differ significantly, nor was there any evidence of key ecosystem services that were impaired by biochar addition up to 30 t/ha, nor was any indication of fresh grass growth.

French Bioindicator Program: first results on soil fauna-based tools for soil monitoring, characterization and risk assessment

The main objectives of the Bioindicator Program is to provide new tools for soil monitoring, characterization and risk assessment, based on soil biological properties. In the first step of this program, research teams have developed and tested their indicator on a few given situations. After this, the most relevant indicators are now tested and validated. This communication presents the first results of the soil fauna working group. Three types of indicator are studied. The IQGS (Global Index of Soil Quality) combine physical, chemical and biological (macro-invertebrates) indicators. A second type deals with species linked to the soil and/or the diversity of soil invertebrates communities (macro-, meio- and micro-fauna).

The main indicators of environmental impact are also well characterised at organism level (metallothionein coding gene expression in earthworm or metal bioaccumulation in snail or micromammal) These indicators are all tested in the field and the results are used to develop new tools for monitoring and evaluation of the ecological status of soils.

Ciliate communities as a tool to assess soil quality in agroecosystem: investigation on agricultural soils under organic farming

Ciliated protozoa are ubiquitous eukaryotic microorganisms that constitute an essential component of aquatic and soil ecosystems. As single-celled organisms directly exposed to the environment, ciliates are very sensitive to any change in their habitat and fluctuations in their communities can affect the food web and energy transfer within the ecosystem. Thus, the monitoring of the structure of ciliate communities can represent a valuable tool to understand ecosystem quality and functioning. Although the biodiversity and community structure of ciliates has been extensively investigated in freshwater and marine ecosystems, very few studies have been addressed to the analysis of ciliate communities in the soil. The majority of the previous reports mainly regarded nematodes and earthworms, whereas ciliate communities are particularly interesting in soil ecological studies, as they are present in a wide range of soil types and ecological conditions and can be used to monitor soil functions and quality.

In our study, set of 30 sediments was tested using biochemical markers of oxidative stress and detoxification in earthworm Eisenia fetida. Sediments (samples from rivers, ponds and stockpiles of dredged material) were chemically analyzed and mixed with reference arable soil in 1:3 ratio (v/v) which has been suggested in novel Czech directive (2009) as realistic scenario after deposition on land. Control groups contained just reference soil. Two different experimental designs using solid matrix (avoidance and reproduction toxicity test) were applied to assess lethal and sub-lethal parameters and to obtain earthworm tissue samples for further biochemical analysis. In earthworm, biochemical markers are often used to observe and evaluate oxidative stress and detoxification effects of organic and anorganic compounds, or their mixtures, but also influences of other stress resources (pH, physical properties of soils). Therefore biomarkers are suitable sensitive tools to assess effects of real solid matrices and their mixtures on soil invertebrates. In this study, there were established methods for determination of GST, GSH, lipid peroxidation, α-amylase, β-glucosidase which were compared to results of chemical as well as pedological data were also recorded. Our preliminary surveys showed a total species richness ranged from 37 to 15 and, in agreement with Foissner (1997), a significant level of biodiversity was found in these sediments.

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How do climatic changes affect isopods?

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Climate changes have been modifying ecosystems, and these modifications will lead consequently to the adaptation or perishing of all the organisms that co-habit in those ecosystems.

Organisms like isopods are important key-species to maintain ecosystems functioning and stability. Isopods as macroconsumers play an important role in decomposition processes by the fragmentation of litter material and in the re-cycling of nutrients in soil. To study the impact of climatic changes on soil isopods, we conducted an experimental study in a natural grassland soil subjected to the warming conditions of a global climate change. In an arable field soil, an untreated meadow soil core (5cm in diameter; 5cm and 10cm in depth respectively) were taken monthly, divided into different layers (0-1cm; 1cm-3cm; and 3cm-10cm respectively) and extracted for microarthropods by means of heat extraction in a Macfadyen apparatus. The results contribute to a sound development and evaluation of exposure scenarios.

The present work showed that several sub-individual biomarkers activity can be used as early warnings for natural stressors and that climate changes can be responsible for disrupting physiological processes in isopods. This might also be transposed to the ecosystem services considering that the impairment of physiological processes will lead to a less efficiency role on fragmentation of leaf material, decomposition processes and nutrient cycling in soils.

A new guideline for the main investigation on soil contamination in the Netherlands

NEN, Delft, The Netherlands

The national Dutch government initiated the development of a new guideline for the main investigation on soil contamination as an answer to questions from the market. There was a broad wish to use 'second generation' field techniques and to go back to skilled professionals to perform and assess main investigations. In the project of developing the new guideline approximately twenty representatives of stakeholders were involved. The project was performed by two consultancy firms and coordinated by NEN, the Dutch national standardization institute. The new guideline is not a 'cook book' like the earlier protocols, which were never really followed up. Everyone had good reasons to depart from the strict steps of drilling, groundwater wells and sample analyses those earlier protocols prescribed. The new guideline describes the process to come to a tailor-made strategy for a main investigation. This is why the strategy of a main investigation can be fitted effectively to the specific local situation, and the most efficient field techniques can be used. The new guideline, in combination with the formalised website with techniques and examples, is aimed at stimulating the use of 'second generation' techniques. In addition, this approach supports skilled professionals in performing main investigations with quality. The presentation will show how to make a guideline that can be enforced, without giving strict rules for the strategy that should be used. A change of mind is needed, to introduce this new way of working. The presentation will show how we try to reach this.

Effects of winter road salting on soil microorganisms at grassland and forest site

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Road salting is used as a way to keep road safety during winter, even in the protected natural landscapes. In our study, possible effects of winter road salting on soil microorganisms in close road vicinity were investigated. Soil chemical and microbial properties were monitored at forest site in Kokořínsko Mountains national park and at grassland site in Kokořínsko protected landscape area in two sampling campaigns (autumn and spring). Effects of road salting on soil chemical properties (pH, CEC, clay %, moisture %, CaCl2, metal concentration in soil mineral fraction and pore water), vegetation (metal concentrations in mono-/dicotyle plants) and invertebrates (metal concentrations in primary, secondary and tertiary consumers) were determined after the stressing period. The obtained results show that whole problem (of soil load by traffic and consequent effects on ecosystem) is not a 'cook book' like the earlier protocols, which were never really followed up. Everyone had good reasons to depart from the strict steps of drilling, groundwater wells and sample analyses those earlier protocols prescribed. The new guideline describes the process to come to a tailor-made strategy for a main investigation. This is why the strategy of a main investigation can be fitted effectively to the specific local situation, and the most efficient field techniques can be used. The new guideline, in combination with the formalised website with techniques and examples, is aimed at stimulating the use of 'second generation' techniques. In addition, this approach supports skilled professionals in performing main investigations with quality. The presentation will show how to make a guideline that can be enforced, without giving strict rules for the strategy that should be used. A change of mind is needed, to introduce this new way of working. The presentation will show how we try to reach this.

Zn, Cu, Pb and As accumulation in Brassica oleracea cropped in contaminated soils

Plc-Farao

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We present a synthesis of the data obtained from the survey, in order to assess the contents of some chemical elements (Zn, Cu and Pb) and As) in the soils and in exemplars of horticultural species (Brassica oleracea L. var. oleracea) collected in the area around the tailings of Jades Mine (Vila Posada de Aguia, Vila Real, Northern Portugal), taking as a reference exemplars from a location somewhat removed from the mine and therefore less exposed to aeolic dispersion of dust released from it. In each area we established 5 sampling spots. The soils samples were collected to the depth of 20 cm, and the vegetable material was collected from the whole plant and we proceeded to the separation of the different organs (roots, stalks and leaves). The techniques used for chemical analysis involved incineration until everything was reduced to ashes. Then we proceeded to an acid attack over this material, followed by the analysis through Atomic Absorption Spectrophotometry (AAS). Cu, Zn or Pb and As were determined by the Graphite Furnace method. The determinations were performed on a Perkin Elmer 2380 spectrophotometer.

The brassica oleraceae L. collected in the areas of contaminated soils accumulate heavy elements and arsenic in higher amounts than the ones observed in the exemplars collected in the regulating area. The values accumulated in the plant that we analysed changed between 11 to 115 mg kg⁻¹ for Cu, between 5.6 to 115 mg kg⁻¹ for Zn and between 1.62 to 11.15 mg kg⁻¹ for As. The contents of Zn, Cu and Pb are within the normal patterns in plants (Olav-Puertas and Pendas, 1998). The contents of As are above the limits (Adianto, 2001), pointing out to a strong contamination at the biological level.
Use of the bait lamina test to assess the effects of lead contamination on the soil organisms

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Introduction: An urgent problem is the identification of zones of actual and potential ecological risk from the soil contamination, with an EC50 of 3% (v/v) for the leachate from soil C, more toxic than soil A and B. The high Pb concentrations found in soil near to the targets and impact berm did not seem to influence the feeding activity of soil organisms after 46 days for the 4 areas varied between 14% and 20%. The high Pb concentrations found in soil in areas along the Pb gradient of contamination to assess the potential impact of this metal on the soil biocenosis.

The bait lamina test results were compared to chemical-chemical analyses of soil and by reproducibility and variability of the bait lamina test results were applied to assess soil contamination in the field. In order to propose and integrate ecotoxicity tests for soil protection in Switzerland, the use of functional methods such as the bait lamina test is considered for the monitoring of pollution gradient at contaminated sites. In the present work, the bait lamina test was applied at an outdoor standing range as high lead (Pb) concentrations were found at this site. Changes in overall feeding activity of soil organisms were measured in 4 areas along the Pb gradient of contamination to assess the potential impact of this metal on the soil biocenosis.

The overall feeding activity of soil organisms after 46 days for the 4 areas varied between 14% and 20%. The high Pb concentrations found in soil near to the targets and impact berm did not seem to influence the feeding activity of soil organisms when compared to the one observed at the control area. This may be explained by the low Pb bioavailability measured in the analyzed soil samples. In the future, the bait lamina method will be further optimized and additional tests will be conducted at contaminated sites in order to assess the applicability of this method for the risk characterization of contaminated sites.

In Switzerland, assessment of soil pollution is mainly based on chemical analysis of total or soluble content of specific contaminants. Methods assessing soil biological parameters have been proposed to complement the chemical data. These toxicity tests are employed to assess soil contamination in the field. To generalize, methods for assessing soil quality and pollutant toxicity tests are employed to assess soil contamination in the field. In order to propose and integrate ecotoxicity tests for soil protection in Switzerland, the use of functional methods such as the bait lamina test is considered for the monitoring of pollution gradient at contaminated sites. In the present work, the bait lamina test was applied at an outdoor standing range as high lead (Pb) concentrations were found at this site. Changes in overall feeding activity of soil organisms were measured in 4 areas along the Pb gradient of contamination to assess the potential impact of this metal on the soil biocenosis.

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The toxicity of silver (Ag) to soil-dwelling organisms: plants, earthworms, springtails and other soil-feeding organisms is discussed. The results, their implications for testing different life histories and implications for ecosystem disruption by Ag contamination are addressed. The endpoint avoidance test, a field-exposed soil option for earthworms (i.e. hepatopancreas) is introduced. In this study, we assess the toxic effects of silver (AgNO₃) on the terrestrial isopod Porcellio scaber. For this purpose, survival, avoidance behavior and feeding activity endpoints were analyzed. The results are presented and discussed in the context of an available species sensitivity distribution (SSD) to Ag and other potential contaminants. The SSD was developed as part of the Federal Government of Canada’s Chemical Management Plan. The endpoints selected for Porcellio scaber are 75% of the isopods (LC75) were 272 mg Ag kg⁻¹ dry soil after 5 days. The lethal concentration for 50% of the isopods (LC50) was 726 mg Ag kg⁻¹ dry soil after 28 days. The lethal concentration for 100% of the isopods (LC100) was 905 mg Ag kg⁻¹ dry soil after 28 days. The effects of silver on the terrestrial isopod Porcellionides pruinosus was assessed. The results, their implications for testing different life histories and implications for the development of a species sensitivity distribution (SSD) and estimation of the HC5 value are presented. The test was conducted according to standardized Environment Canada Soil toxicity test protocols, using a field-collected sandy-loam soil. The effect of this substance to the soil microbial community (e.g., microbial activity, biomass and temporal shifts in the soil microbial community) was also investigated using the same soil type. The data derived from this research project will supplement and verify the PBT (i.e. inherent toxicity) status of this compound, and will support Canada’s effort in the screening assessment of this medium priority compound.

The use of earthworm metal content in highest tiers of a site environmental risk assessment in the tropics

The use of earthworm metal content in highest tiers of a site environmental risk assessment in the tropics is discussed. The results, their implications for testing different life histories and implications for ecosystem disruption by Ag contamination are addressed. The endpoint avoidance test, a field-exposed soil option for earthworms (i.e. hepatopancreas) is introduced. In this study, we assess the toxic effects of silver (AgNO₃) on the terrestrial isopod Porcellio scaber. For this purpose, survival, avoidance behavior and feeding activity endpoints were analyzed. The results are presented and discussed in the context of an available species sensitivity distribution (SSD) to Ag and other potential contaminants. The SSD was developed as part of the Federal Government of Canada’s Chemical Management Plan. The endpoints selected for Porcellio scaber are 75% of the isopods (LC75) were 272 mg Ag kg⁻¹ dry soil after 5 days. The lethal concentration for 50% of the isopods (LC50) was 726 mg Ag kg⁻¹ dry soil after 28 days. The lethal concentration for 100% of the isopods (LC100) was 905 mg Ag kg⁻¹ dry soil after 28 days. The effects of silver on the terrestrial isopod Porcellionides pruinosus was assessed. The results, their implications for testing different life histories and implications for the development of a species sensitivity distribution (SSD) and estimation of the HC5 value are presented. The test was conducted according to standardized Environment Canada Soil toxicity test protocols, using a field-collected sandy-loam soil. The effect of this substance to the soil microbial community (e.g., microbial activity, biomass and temporal shifts in the soil microbial community) was also investigated using the same soil type. The data derived from this research project will supplement and verify the PBT (i.e. inherent toxicity) status of this compound, and will support Canada’s effort in the screening assessment of this medium priority compound.

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MO 203  
Assessment of plant protection products on soil communities under Mediterranean conditions: field evaluations  

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Complying with the Sixth Community Environment Action Programme an integrated approach to assess the risk (both fate and effect aspects) of plant protection products on soil communities under Mediterranean conditions was put into practice. Our aim was to contribute to increasing the knowledge about ecological scenarios under Mediterranean conditions where soil characteristics, climatic conditions and biota are different from those under central and northern Europe. The effect assessment component presented here embraced different levels of environmental compartments: (1) a first-tier computer model predicting the ecotoxicological effect of different plant protection products (PPPs) under Mediterranean conditions (2) and (2) a higher-tier comprising field testing on a specific edaphic community composed of paper in an intensive crop area and with high irrigation needs protecting neighbouring wetlands.  

This field study comprised a complete crop cycle with multiple pesticide applications and fertility under realistic conditions. Sampling was done between March and October 2010 in several parcels, both in-crop and off-crop. The organisms were collected using several methodologies (emerging soil macro and mesofauna and soil fauna feeding activity), and samplings were undertaken according to pesticide and fertilizer application. The first data on this field evaluation is presented in this paper. The results from this higher-tier (reflecting a real ecosystem and thus considered as a reference tier defining protection levels for the lower tiers) will be compared with those obtained from the lower tier to evaluate its level of protection towards soil organisms. This analysis will contribute to a more realistic pesticide risk assessment considering the different levels of complexity of agricultural ecosystems.

MO 204  
Soil respiration under the fungicide Captan and the bactericide Bronopol revealed different stability of fallow and meadow soil microbial communities  

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Due to socio-economical transformations that Poland underwent in the last 20 years, major changes in the land use have taken place in the country. Lowering cost-effectiveness of agricultural production led to a huge increase in the area of abandoned farmlands. Such falls undergo rapid secondary succession and are examples of unstable ecosystems under changes. The successive changes in plant communities are expected to be reflected in soil microbial communities, offering an interesting system to study stability of communities.

For this reason soil microbial communities from abandoned agricultural lands were compared to communities from rich and well maintained meadows. In this work their resistance and resilience to the fungicide Captan and the bactericide Bronopol was evaluated. Six fallows and six meadows were included in the investigation. Soils were spiked with Captan and Bronopol in laboratory conditions at a rate 5.4 mg a.e. per g dry soil, what corresponds to a concentration approximately 50 times higher than recommended for Captan. Soil respiration rate was measured weekly for six weeks. At the end of the experiment glucose solution was added to soils and active biomass was estimated.  

Fallow and meadow soils exhibited opposite reaction to Bronopol in terms of shape and time of changes. The respiration rate of meadow soils increased one day after the amendments and afterwards decreased to levels lower than in respective controls. In contrast, the respiration rate in fallsows peaked one week after the treatment and remained elevated in comparison to control throughout whole incubation time. The shape and timing of response to Captan were similar in meadows and fallows, with an initial decrease in the respiration rate followed by a decrease of the communities differed, however, in the intensity of response, which in case of meadows was stronger. The resilience to the two biocides did not differ significantly, and in 42 days both systems came back to their ground state.  

Organic soil biomass was significantly lower in soils treated with biocides than in respective controls with no difference between the ecosystem types or the pesticides. In this research the different stability and resistance of soil microbial communities originating from two types of ecosystem was proved. In case of the fungicide only the meadow microbial communities were affected and, in case of the bactericide a significant interaction was found between time and soil origin.

MO 205  
Cellulose decomposition in fallow and meadow soils amended with the fungicide Captan and the bactericide Bronopol  

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3Agronomy department, University of Wisconsin-Madison, Madison, WI, USA  

Due to socio-economical transformations that Poland underwent in the last 20 years, major changes in the land use have taken place in the country. Lowering cost-effectiveness of agricultural production led to a huge increase in the area of abandoned farmlands. Such falls undergo rapid secondary succession and are examples of unstable ecosystems under changes. The successive changes in plant communities in such areas are expected to be reflected in soil microbial communities, offering an interesting system to study stability of communities.  

For this reason soil microbial communities from abandoned agricultural lands at the initial stage of plant succession were compared to communities from rich and well maintained meadows. In this work their resistance and resilience to the fungicide Captan and the bactericide Bronopol was evaluated. Six fallows and six meadows were used in the investigation. Soils were spiked with Captan and Bronopol in laboratory conditions at a rate 5.4 mg a.e. per g dry soil, what corresponds to a concentration approximately 50 times higher than recommended for Captan. Follow- ing the treatment, cellulose decomposition was measured in laboratory conditions. Amended and control soils were put into Petri dishes and three stripes of cellulose filter paper 10 x 50 mm were placed on the moistured soil surface. Vanishing of the cellulose was measured once a week for 8 weeks by the mean of visual measuring via a transparent template. For each soil treatment
study two replicates were used and readings were done by two people independently. Cellulose was degraded significantly faster in fallow soils than in meadows, especially in the first 12 weeks after treatment. This is well in line with the data analysis conducted by Heimbach (1998) and Barber et al. (1998) Thus it can be concluded that the current EU cellulose risk assessment for PPPs using the NOEC from the chronic laboratory cellulose test and a maximum PEC<sub>soil</sub> on the basis of 0.001% for cellulose is safe according with the current scientific data and target protective and protective. In fact many unnecessary cellulose field studies are being triggered, confirming the safe use of PPPs for earthworms.

**MO 207**

**Reproduction, behaviour and biochemical responses in Enchytraeus albidus (Oligochaeta)** exposed to different pesticides

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Enchytraeus albidus are typical inhabitants of a wide variety of soil types and fulfill important functions such as soil aeration and plasticity of the soil pore structure and, indirectly, the degradation of organic matter. These organisms are very sensitive to chemicals and prove to be suitable for environmental risk assessment through the determination of reproduction and survival endpoints (ISO 17512-2, 2009). This knowledge is considered very important and crucial for ecosystem dynamics. In this study, we studied the potential recovery processes in all growth stages, regardless the lower or higher chronic effect induced by a specific stressor. The main aim of this study is to determine sensitivity of soil organisms compared with tested substances 1,4-DCB using a set of contact toxicity tests. The same concentration range of 1,4-DCB was evaluated by the variable chlorophyll fluorescence and stomatal conductance are considered very sensitive biomarkers when plants have been exposed to pollutants. These functions have been widely applied to study effects caused by water deficit, temperature, nutrient deficiency, etc. Their use in determining effects due to chemicals is more limited and mainly addressed to metals and herbicides. The purpose of this study was to assess the effects of petroleum hydrocarbons on photosynthesis responses and stomatal conductance. Moreover, their application as non invasive measurement endpoints to assess soil contamination was evaluated. Two hydrocarbon mixtures: diesel fuel and mineral oil, were studied in a dose-response assay with two plant species (Cucumis sativus and Zea mays). The plants were sown on the contaminated soil or germinated in a nursery one week before transplanting to the contaminated soil. The objective was to compare the effects on plants with the same developed photosynthetic structures and plants with different apparens and hydrocarbons stress. In this way, the influence of the hydrocarbon stress on the developing photosynthetic apparatus could be determined. The effects on chlorophyll fluorescence and stomatal conductance were compared with effects on seedling emergence, plant growth and leaf chlorophyll. The diesel-contaminated soil was more toxic than mineral oil-contaminated soil. The sown plants showed higher inhibition in all parameters than transplanted plant, indicating the presence of the developing photosynthetic apparatus on the toxicity. The EC50 values for PHE, absorption) and S. officinalis (PNH, absorption) were 0.5, 4% and 3%, respectively. The usefulness of chlorophyll fluorescence and stomatal conductance as endpoints of toxicity will be conditioned by contaminant type, plant specie and the stage of plant development. This work was funded by MADRIM Community through the EIAEJ Project.

**MO 211**

**Soil quality assessment using ecotoxicological and enzymatic tests during monitored natural attenuation of hydrocarbon contaminated soils**

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2University of Rostock - Department of Microbiology, RIO DE JANEIRO, BRAZIL

The main aim of this study was to determine sensitivity of soil organisms compared with tested substances 1,4-DCB using a set of contact toxicity tests. The same concentration range of 1,4-DCB was selected for all tests. Toxicity was determined by the help of four terrestrial tests: determination of effects on reproduction and survival of Enchyptraeus tyrannus, further avoidance tests with Enchytraeus crypticus, inhibition of reproduction of Collembola (Folsomia candida) and the last one is the determination of effect of pollutants on lettuce seedlings (Lactuca sativa L.). This study is in the same time a part of next research which is related to the characterization factors in the methodology CML-IA (CML im- pact assessment) because 1,4-DCB is one of reference substances used in the methodology CML-IA for LCIA (Life Cycle Impact Assessment) in analysis LCIA (Life Cycle Assessment).

**MO 209**

**The effect of 1,4-dichlorobenzene on soil organisms**

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1,4-dichlorobenzene is hazardous substance belonging to the group of chlorinated aromatic hydrocarbons which is present in many terrestrial environments. It is a raw material commonly used in industry for example for producing pesticides. Especially the industrial activity, application of sludge on agricultural land or atmospheric deposition are the cause of pollution 1,4-DCB of particular components of environment. Ecotoxicity data for 1,4-DCB for aquatic environment can be found in the literature but there is an absence of information for terrestrial environments. The aim of this study is to determine sensitivity of soil organisms compared with tested substance 1,4-DCB using a set of contact toxicity tests. The same concentration range of 1,4-DCB 125, 250, 500, 750 a 1000 mg kg<sup>-1</sup> was selected for all tests. Toxicity was determined by the help of four terrestrial tests: determination of effects on reproduction and survival of Enchytraeidae (Enchytraeus tyrannus), further avoidance tests with Enchytraeus crypticus, inhibition of reproduction of Collembola (Folsomia candida) and the last one is the determination of effect of pollutants on lettuce seedlings (Lactuca sativa L.). This study is in the same time a part of next research which is related to the characterization factors in the methodology CML-IA (CML im- pact assessment) because 1,4-DCB is one of reference substances used in the methodology CML-IA for LCIA (Life Cycle Impact Assessment).
May be related to the increase of rainfall in T15 and T18, influencing the bioavailability of the MO 212 increased with 5 µmol maleic hydrazide per kg dry soil and with 2 mmol copper sulphate per kg different well-known genotoxicants, maleic hydrazide and copper sulphate We concluded that compared two exposure durations (48h and 5 days) for the V. faba micronucleus test with two different concentrations (50 µmol maleic hydrazide and 5 mg L−1 CuSO4) in soils and soil extracts (batch processing), providing full analysis report of individual effects (e.g., non-destructive labeling of individual Collembola, thumbnail collection of all counts, full report of all parameter settings), enable human control and revision if necessary and enable the measurement of additional morphometric parameters (e.g., size or shape).

Third, validation of the automated image analysis-based counting was conducted by comparing it to the manual counting of the same digital images This comparison has shown that the automated image analysis delivers comparable results (fidelity) compared to the expert with traditional counting and documentation. Further on sub-terminal endpoints such as size and form of the counted offspring can be taken into consideration.

MO 216
The potential use of 5% peat content OECD soil for earthworm reproduction tests C.Fürer, E.Knoop
Covercare Laboratories, HARROGATE, United Kingdom
The aim of the work presented is to investigate whether a valid Eiensia fetida (earthworm) reproduction test (OECD guideline 222) can be performed using an OECD test substrate of 5% peat content, as used in other OECD guidelines for soil organisms in the terrestrial environment. The reproduction test would therefore need to the use the NOEC (No Observed Effect Concentration) as a test substance by a factor of 2 when calculating the PNEC (Predicted No Effect Concentration) of a compound. To accomplish this, a more suitable reference substance should also be ascertained, ideally with a log Kow of ≥ 2, i.e. with a higher affinity for organic matter so that it will be bind to the peat in substrate thus allowing direct comparison between 5% and 10% peat content.

MO 217
Mustard powder and allyl-isothiocyanate (AITC): possible substitutes for formalin as expelants of deep-burrowing earthworms? T.J. Vollmer, O.Klein, S.Kloiber
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Hand-sorting earthworms from a defined soil volume with subsequent extraction of the deep-burrowing earthworms from the soil below the extracted hole is a widely used and well described method for the determination of size and structure of earthworm populations. The extraction is done using a formalin solution, a method recommended in the current guidance document for field trials. However, the use of formalin has its drawbacks, as it is not only harmful to humans but also toxic to other organisms and plants. Mustard powder and allyl isothiocyanate (AITC, Allyl-Isothiocyanate) hold more favourable toxicological and ecotoxicological properties. They have already been tested as earthworm expellants in field experiments with mixed results, but only for direct extraction of individuals from the bioassay system. The study of this aim of this study was compare the efficiency of aqueous solutions of yellow mustard powder (6 g L−1), brown mustard powder (6 g L−1) and AITC (0.1 g L−1) in extracting earthworms from the soil below hand-sorting holes to that of a formalin solution (2 g L−1 formamide). The comparison was carried out at five sites with different soil characteristics and soil fertility history (3 arable, 2 grass-clover, 2 meadows). The sites are located in southern Germany and the sampling took place in autumn 2010. At each site, four replicates of 0.25 m², 0.2 m deep per expellant were sampled. Yellow mustard powder extracted the largest number of earthworms at one site and formalin at another site, but there were no statistically significant differences in rainfall and soil type. Brown mustard and yellow mustard were effective replacements for formalin for the extraction of deep-burrowing earthworms from below hand-sorting holes. However, it seems that soil characteristics and/or environmental conditions during extraction influence the efficacy. Further tests under varying soil and environmental conditions should be carried out to evaluate the influence of these conditions on earthworm extraction.

MO 218
Alternatives in the endoskeletal ability of Eisenia fetida coelomocytes to assess the toxicological profiles of standard soils with different organic matter content and sublethal cadmium concentrations MP Rodriguez1, 2, AR Izquierdo1, A Huerta1, 2, J Cañizares1, M Soto1, M Marín1, 2
1University of the Basque Country, LEIOA-BIZKAIA, Spain
2University of the Basque Country, LEIOA-BIZKAIA, Spain
Metallic elements are ubiquitous in Ecosystems that may cause a great variety of deleterious effects at different levels of biological organization. Eisenia fetida earthworms are known as important sentinel species for soil pollution assessment, and their immune system is considered a key component to study integrated responses to pollutants since represents a major defense line against them. Coelomocytes, free flowing immune cells of the coelomic cavity, have been given special attention for ecotoxicological effects studies due to their sensitivity to toxicants exposure. The aim of this work is to determine the optimal number of individuals to use in a routine protocol for toxicity testing of soil, based on testing of neutral red uptake in coelomocytes extracted from the earthworm Eisenia fetida exposed in vivo to Cd. Second, to apply this protocol to determine sublethal response profiles for this species, subjected to exposure in soils artificially contaminated with different concentrations of Cd and different soil organic matter content (SOM). The experimental design consisted in two phases (based on 3 dose experiments). The first phase, which determined the optimal number of individuals, was conducted in OECD artificial soil contaminated with three different concentrations of Cd. The second phase was designed using the optimal number of individuals, as determined in the first phase, and also with artificial modified soil OECD with different SOM (added peat). The optimal sample size was determined to be one pool of 5 specimens. A significant decrease in the endoskeletal activity of coelomocytes was detected at decreasing concentrations of OM and increasing concentrations of Cd. Indeed, Cd bioaccumulation also decreased at increasing SOM in soil.

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MO 219
Mesocosm soil ecological risk assessment tool for GMO 2nd tier studies
Istituto di Ricerca e Sviluppo Agricolo (IRSA), Dipartimento di Chimica e Tecnologie Agroalimentari, Firenze, Italy

MO 220
As transport characterization in the vadose zone of the soil: a combined study between field and laboratory experiments
M. Ichilov, R. D. Engles, J. M. Tejeda-Agredano1, M. García-Grifoll, J. J. Ortega-Calvo1, M. Cantos1
1Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNASE), SEVILLE, Spain
2Department of Microbiology, Universitat de Barcelona, BARCELONA, Spain
The aim of this study was to evaluate the impact of a secondary aluminum smelter on soil ecosystems in the area of Castilla la Mancha. Conventional methods often fail to identify the potential risk of soil contamination and their effect on the ecosystem. In this study, a combined approach of field and laboratory experiments was adopted to evaluate the impact of the smelter on the soil ecosystem. The field experiments were carried out in the area of the smelter, where soil samples were collected from different locations. The laboratory experiments were performed in the laboratory, where soil samples were treated with different chemicals and analyzed for various parameters. The results of the field and laboratory experiments were compared to identify the potential risk of soil contamination and its effect on the ecosystem.

MO 224
Sunflower roots in combination with indigenous soil micro-organisms for treating hydrocarbon-contaminated soil
MC Tejada-Agredano1, M. Griffoll1, J. J. Ortega-Calvo1, M. Cantos1
1Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNASE), SEVILLE, Spain
2Department of Microbiology, Universitat de Barcelona, BARCELONA, Spain
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MO 225
Characterization of the chemical composition of an oil contaminated soil
CE West, AG Scarlett, SJ Rowland
University of Plymouth, PLYMOUTH, United Kingdom
The aim of the present study was to evaluate the impact of a secondary aluminum smelter on soil ecosystems in the area of Castilla la Mancha. Conventional methods often fail to identify the potential risk of soil contamination and their effect on the ecosystem. In this study, a combined approach of field and laboratory experiments was adopted to evaluate the impact of the smelter on the soil ecosystem. The field experiments were carried out in the area of the smelter, where soil samples were collected from different locations. The laboratory experiments were performed in the laboratory, where soil samples were treated with different chemicals and analyzed for various parameters. The results of the field and laboratory experiments were compared to identify the potential risk of soil contamination and its effect on the ecosystem.
curly, in all cases, is less than 0.02%, so, the leaching process and transport of mercury to surface water and groundwater are very slow. With regard to the distribution of mercury between the different fractions of soil, the metal is associated with more resistant soil fractions; these are: crystalline Fe-Mn oxhydroxides, organic matter and 25.403 of the artificial sweetener saccharin in soils: sources from agriculture and households, degradation and leaching to groundwater

MO 229

IJ Bürge, M Keller, MD Müller, T Poiger

Agricultural Chemicals Switzerland, Aadorf, and leaching to groundwater

The artificial sweetener saccharin in soils: sources from agriculture and households, degradation and leaching to groundwater

The artificial sweetener saccharin in soils: sources from agriculture and households, degradation and leaching to groundwater

MO 230

Uranium contamination in the plants of the old mine of Sevilha (Central Portugal) - implications for phytoremediation

PJC Favas1, JMS Pratas2, MNV Prasad3

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2University of Coimbra, COIMBRA, Portugal

3University of Hyderabad, HYDERABAD, India

The old uranium (U) mine of Sevilha (Tábua, Central Portugal) is one of several small mines with wastewater-polluted surface water, fertilization with sewage sludge, and leaks in sewers in the vicinity of the mine. In the vicinity of the mine, the sweetener is registered as additive in piglet feed, because it is supposed to facilitate gains and feed efficiency in piglets. Under optimal growth conditions, ROS are produced at a low level in genic tissues such as chloroplasts, mitochondria and peroxisomes. However, pesticide uptake can dramatically elevate their production of this rate. The aim of the work was to study the oxidative stress in edible plants exposed to soils spiked with a mixture of endosulfan and cypermethrin as a measure of plant toxicity for their use in soil remediation. Lipid peroxidation (LPO) and antioxidant enzymes activities (MDA) and total antioxidant capacity against peroxyl radicals (ACAP) was measured in leaves and roots of soybean, sunflower, cowpea and alfalfa plants grown in soil spiked with technical endosulfan (15%) 35% 5 ppm) and cypermethrin (Gott Glee, ci-40-50 25% 0.5 ppm) after 15 and 60 days of exposure. Control plants were grown in the same soil without pesticides. Results showed an increase in the ACAP of roots and leaves at 60 days for most species while MDA levels increase only in leaves. These results can indicate that pesticide uptake and translocation may mediate oxidative damage in these species. Plants grown in contaminated soils showed lower biomass and growth rate than control plants (clean soils) suggesting pesticide toxicity, and the lower MDA levels would be related to changes in lipid metabolism (decrease in proportion of unsaturated lipid). The knowledge about the induction of oxidative stress by pesticides is necessary for planning phytoremediation strategies and allows selecting tolerant species according to particular scenarios.

MO 235

Effects of apatite mine tailings amendment on toxicity and leaching of shooting derived lead in forest soil

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University of Helsinki, LAHTI, Finland

In Finland, there are roughly 2000-2500 shooting ranges, of which approximately one-third are situated on ground water areas. Dissolution of pellet-derived lead (Pb) into the soil water poses a risk to ecosystems in the vicinity of the shooting ranges and, if leached to the groundwater, to human health. Approach thatcomparing four techniques associated with studying the effects of mine tailings on plants. These techniques were: (i) cultivation of plants in soil amended with mine tailings and evaluated for biomonitoring purposes, (ii) plant growth and photosynthesis, (iii) metal content in plant shoots, and (iv) plant distribution and density. Soil samples were collected at a site near a shooting range in the vicinity of a shooting range. Soil samples were collected from a pine forest locating right behind a shotgun shooting range. Soil from an adjacent uncontaminated site served as a control. In the laboratory, half of each soil was amended with the tailing material. The effects of amendment on (i) the toxicity of the soils and (ii) the leaching of Pb, measured using (iia) closed soil extraction and (iiib) open lysimeter system, were studied one day after amendment (short-term effects) and after one year of incubation of the soils (long-term effects). (i) Toxicity of the soils was tested using the inhibition of Chlorella rhodopicta reproduction and the toxicity test on earthworms. (iiia) Standardized leaching procedure, soils were extracted using 0.01M CaCl₂ solution, and the Pb concentration in the leachates as well as its toxicity to V. fischeri, Leuconema minor and Daphnia magna were measured. (iiib) In lysimeter assay, water was poured on top of the soil in each lysimeter pot, and Pb leaching was monitored at a rate of 0.1 mL per day. The results of the long-term effects of tailings amendment - yet to be analyzed - will be crucial to reveal the suitability of the tailings to act as a sounder for lead in contaminated soil.

MO 207

Endosulfan and cypermethrin-induced oxidative stress in plants and their influence on phytoremediation process

M.Mittner1, M González2, VM Shimabukuro3, KMonserratt4

1Universidade Nacional de Mar de Plata, MAR DEL PLATA, Argentina

2Universidade Federal do Rio Grande, FURG, Instituto de Ciências Biológicas, RIO GRANDE, Brazil

Phytoremediation involves the use of vegetation in situ for treatment of contaminated soils, sediments or waters. It is being studied as a cost-effective alternative for decontaminating sites affected by toxic contaminants like organochlorine pollutants (OPs). The aim of our research is to investigate the organochlorines eco-remediation by plant rhizospheric bacterial communities. Bacterial strains from control and treated plants were isolated. For determination of mass concentration of U in samples of earthworms, as well as samples of control and treated plants, in the laboratory, 82 different species were identified and sampled. These species belong to 32 families, five of which have the highest concentrations. For the Composiatae, an average of 4.91 ppm and a maximum measured average concentrations were: Riccia fluitans (29.19 ppm), Lemna minor (15.47 ppm), and related species. We identified 15 µg OCs/g dw during 45 days. Using molecular profiling we found that OCs impacted the diversity of bacteria was found in treated and untreated conditions. Strains from some of these species are tolerant species according to particular sceneries.

MO 234

Efficiency of sunflower and cypermethrin-induced oxidative stress in plants and their influence on phytoremediation process

M.Mittner1, M González2, VM Shimabukuro3, KMonserratt4

1Universidade Nacional de Mar de Plata, MAR DEL PLATA, Argentina

2Universidade Federal do Rio Grande, FURG, Instituto de Ciências Biológicas, RIO GRANDE, Brazil

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MO 236
Enhancement of Cd removal efficiency using phosphate-solubilizing bacteria (PSB) in phyto-
remediation

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¹Korea University, School of Bio and Chemistry, South Korea

The use of phosphate-solubilizing bacteria (PSB) in phyto-remediation has been reported. In the present study we report the removal of Cr (0.850*), Co (0.860*), Pb (0.925*) and Ni (0.820*) with concentration of metals especially with Cr (0.850*), Co (0.860*), Pb (0.925*) and Ni (0.820*) from Cr, Co, Pb and Ni contaminated soil. The results of this study indicate that L. variatus is able to detect and avoid AC added sediment by reducing sediment consumption.

MO 237
Root elongation test with Lactuca sativa in assessment of dredged sediment ecotoxicity

V. Gheibi, B. Pourjavadi, M. Hossenei
Masaryk University, Research Centre for Toxic Compounds in the Environment, BRNO, Czech Republic

Large amount of sediments are dredged each year for the maintenance of water bodies and wa-
ters. Disposal of dredged sediments is an important environmental problem. Reusing of this material as a soil improver and application on agriculture land is one of the possible options. Application must be regulated based on sediment contamination or toxicity, because of high levels of contaminants frequently present in sediments. Novel directive for the dredged sediments application has been adopted in the Czech Republic. Root elongation test according to ISO 11269-1 is one of the four toxicity tests suggested in the directive. The objective of this study was to evaluate the suitability of the root elongation test with Lactuca sativa in amended for contaminated sediments in order to measure ecotoxicity. The test was conducted on raw sediments samples both from bottom of rivers and ponds and from stockpiles of dredged materials. Contents of heavy metals, PAHs, PCBs and organochlorinated pesticides were analysed in the samples and compared with the limits values suggested in the new directive. Growth of Lactuca sativa roots seems responsive to high content of contaminants (PAHs, heavy metals) in raw sediment samples. In some cases, the toxicity was caused by sediment physico-chemical properties.

MO 238
Carbon amendments as a remediation method: ecotoxicological effects in Lum-
briculus variegatus

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Light density black carbonaceous particles such as soot, charcoal and activated carbon (AC) have been established to be efficient sorbents for a wide variety of hydrophobic organic compounds (HOCs). Interest has been directed to use the AC in sediment remediation as a carbon amendment to bind and stabilize contaminants. Despite the promising results from both labora-
tory and field experiments, some studies indicate that AC addition may not ensure good ecologi-
cal quality of the sediment but can in fact alter the behavior of organisms. AC addition has been observed to influence among others growth rate, food consumption, lipid content and sediment preference of several organisms. The results of ecological effects of AC addition vary however from no effect of direct effect on more long-term effect on the behavior of organisms. The aim of our research was to clarify biological responses in Lumbriculus variegatus to AC addition. Within this study coal based AC was used in three different grain sizes and in six concentrations each. The results of this study indicate that AC addition based dose-response effect was not observed in reproduction in terms of this study. Eco-
toxicological effects of AC amendments requires more investigation and finding the mechanism for the effects is especially important. The challenge is to find AC material and dosage that may not have an effect on organisms but despite the fact will be effective enough to bind HOCs and reduce bioaccumulation.

MO 239
Use of toxicity assays for evaluating the effectiveness of groundwater remediation with Fen-
tone

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A chemical dump site adjacent to the Danish North Sea holds a variety of constituents from pharmaceutical production including sulfonamides, barbiturates, analgesics, pyridine, phenols, ben-
zenes and solvents. The former Remediation Project was not successful in removing the recalcitrant heavy metals from the sediment. The new project evaluates in situ chemical oxidation (ISCO) using modified Fenton's reagent (H2O2 + chelated Fe2+) as a groundwater remedy. Three injections were performed over a period to test treatment efficacy. Performance monitoring samples were collected from two depths both prior to and during treatment, allowing for the calculation of contaminant and pesticide removal. Organisms exposed to a mixture will react to all contaminants present and, consequently, the toxic effect will represent a sum effect. In contrast, chemical analyses yield information on indivi-
dual or possibly groups of contaminants but not necessarily all the contaminants. Thus, using a combination of chemical analyses and toxicity assays yields a more robust understanding of the contaminated site and the risk it poses to the environment. Ground water samples were tested via toxicity assay using algae, crustaceans, luminescent bacteria, nitrifying bacteria and yeast (esterogen screening test). Results from the baseline study showed that the two most sensitive organisms were the marine diatom and the luminescent bacteria (A. luminiscent). It was found necessary to dilute untreated groundwater samples up to 3400 times to reduce the short-term toxicity to the LC10 level. Samples from the upper layer were 2-4 times more toxic than samples from the lower layer. Applying a safety factor of 10 on these results and combined with a dilution model for the recipient indicated that the ecosystem in an area of the North Sea of approximately 1x1 km is affected by groundwater flow from the contaminated site. Chemical analyses showed that PCE and toluene concentrations up to 137 and 60 mg/L, respectively, in the upper layer Total hydrocarbons were up to 94 mg/L. Sulfonamides and barbiturates were found at 600 µL/L and 200-400 µL/L, respectively. After the second treatment with Fenton's reagent the toxicity had increased and now needed 710 times dilution to reduce toxicity to the LC10 probably due to mobilization of metals. It is concluded that toxicity assay is a useful tool for monitoring samples from contaminated sites and that toxicity assays and chemical analyses supplement and support each other.

MO 240
Microbiostones as screening tools to evaluate potential ecotoxicity of freshwater sediments

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Field methods have been developed to assess the toxic potential of freshwater sediments. Different test batteries comprised of bioassays of different organisms (bacteria, algae, seaweeds, micro-crustaceans, and plants), belonging to different trophic levels have been recommended to discriminate among samples and decrease uncertainty in sediment quality assessment (Griest et al., 1999; Hotop et al., 2009a,b, Chai et al., 2009, Ono et al., 2010). One of the challenges is to consider the importance of carrying out tests not only with porewaters, but also with whole sediments. Several exposure phases, such as pore waters, elutriates, organic extracts and whole sediments have also been used (Bourdier and Bertrand, 1999). Here, we focused our research on whole sedi-
ments application with different testing of both aqueous and solid phase microorganisms. The different liquid phase assays, algal solid phase assay, Luminotix solid phase assay and ostracod assay. To synthesize eco toxicity information, sediment ecotoxicity index scores were calculated to cate-
gorize sediments in order of their potential ecotoxicity. The test battery has been extended by several methods both from bottom of rivers and ponds and from stockpiles of dredged materials. Contents of heavy metals, PAHs, PCBs and organochlorinated pesticides were analysed in the samples and compared with the limits values suggested in the new directive. Growth of Lactuca sativa roots seems responsive to high content of contaminants (PAHs, heavy metals) in raw sediment samples. Finally, results of ecotoxicity index scores were compared with physico-chemical parameters of sediments.

MO 241
Addition of reactive media for the geochemical stabilization of mercury in contaminated sediments

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The presence of elevated concentrations of Hg in sediments can lead to formation of methyl-
mmercury (MeHg) and subsequent uptake of MeHg in the food-chain. This study evaluated the effectiveness of a variety of reactive media on the stabilization of Hg in water-saturated sediments collected from two contrasting watersheds. The sediments were co-blended with attapulgite clay (ATP), organically modified clay (OMC), sulfur (S), and zero valent iron (ZVI). Batch-style geochemical and toxicity assays were conducted to evaluate the effectiveness of the different media for stabilizing Hg. In the unamended sediments, large differences in Hg release were observed both within and between the study sites (release from 0.10 to 100 µg L⁻¹ Hg L⁻¹). In the amended sediments, the release of Hg was reduced by 50 to >99% relative to unamended sediment controls. The greatest stabilization of Hg was observed for OMC+ATP and a combination of S+ZVI. Under low-flow saturated conditions, aqueous concentra-
tions of Hg were maintained in the low ng L⁻¹ range for more than 6 months. After a hiatus in flow, concentrations of Hg increased in the unamended sediment and sediment amended with ATP alone, but remained low in Hg concentrations observed for sediment amended with OMC+ATP and with S+ZVI. Sectioning of the columns and analysis of MeHg indicated minor increases in solid-phase MeHg concentrations in the treatment containing OMC+ATP. Increases in MeHg were not observed for the other treatments. Some phase analysis showed large accumulations of Fe and Mn. S+ZVI amelioration caused reduction of this species under saturated conditions with respect to Hg soluble phases for all treatments.

MO 242
Mercury cycling in the food web of an estuarine environment

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This study evaluated the effect of estuarine sediments on the growth of the estuarine polychaete L. variegatus as a bioassay for the potential ecotoxicity of freshwater sediments. The index formula with its corresponding toxicity assays were calculated to cate-
gorize sediments in order of their potential ecotoxicity. The test battery has been extended by several methods both from bottom of rivers and ponds and from stockpiles of dredged materials. Contents of heavy metals, PAHs, PCBs and organochlorinated pesticides were analysed in the samples and compared with the limits values suggested in the new directive. Growth of Lactuca sativa roots seems responsive to high content of contaminants (PAHs, heavy metals) in raw sediment samples. Finally, results of ecotoxicity index scores were compared with physico-chemical parameters of sediments. Results showed that sediments MIR, CAT and CAM2 presented a high potential hazardous, toxic effects were observed in all microbiotests. In contrast MBx and BB2 samples were classi-
fied as marginal hazard potential and they did not present ecotoxic effects in all microbiotests. Concentrations of metals in sediments were correlated with the ecotoxicity index scores (Pear-
son's product moment correlation coefficient and associated p-value). Results showed a corre-
cation with concentration of metals especially with Cr (0.850*), Co (0.860*), Pb (0.925*) and Ni (0.820*) which results demonstrate that the biological responses of the battery of microorganisms has a strong correlation with some contaminants present in sediments; these mean that this battery can give information about the potential ecotoxicity of freshwater sediments.
reactive media, and concentrations in the low ng L\(^{-1}\) range can be maintained under varying flow conditions.

**MO 242**

Characterization of DDt and Mercury contaminated sediment in Tocce River and Lake Maggiore (Piemonte, Italy)

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To evaluate the need for remedial action in Lake Maggiore (North Italy) and in its tributary Tocce River, sediments contamination characterization activities were performed in 2009-2010. Historically, a DDT manufacturing facility was located on the Tocce River and discharged industrial wastes containing DDt and mercury to the river. DDT production started in the 1940s and ceased in 1996; radiolating analysis showed that the highest DDt concentrations in sediments are related to the toxaphene contamination in the 1950s-1960s. To investigate temporal and spatial distribution of DDt and mercury in sediment and their influence on the whole lake ecosystem, with the objectives of evaluating potential ecological risk and assessing the need for sediment remediation, the following activities were performed: - three sediment tracer samples were investigated at various depths in 125 sediment cores. To collect high quality sediment chemistry data, a lightweight sediment-water interface corer was used - a Sediment Profile Imaging (SPI) camera survey was performed throughout Pallanza Bay and monitored DDt concentrations by documenting DDT sediment burrowing of 2006-2007. - the fish community was investigated by analyzing several species, considering tissue concentration and toxicity screening to index the environmental condition of the bay. - a SPI camera survey performed throughout Pallanza Bay and investigated the sediments for the presence of toxaphene. - a fish community biomonitoring was performed to assess the presence of toxaphene. - a Sediment Profile Imaging (SPI) camera survey performed throughout Pallanza Bay and investigated the sediments for the presence of toxaphene.

**MO 243**

Evolution of a conceptual site model for sediment processes and geochemical conditions in a large industrial port facility, Augusta Bay, Sicily, Italy

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To evaluate the need for remedial action in Augusta Bay, Sicily, Italy, a conceptual site model was developed to guide the work and establish a foundation to understand how sediment contamination can impact the bay ecology. It was unclear which substances in sediment posed ecological risk on the whole lake ecosystem, with the objectives of evaluating potential ecological risk and assessing the need for sediment remediation, the following activities were performed: - three sediment tracer samples were investigated at various depths in 125 sediment cores. To collect high quality sediment chemistry data, a lightweight sediment-water interface corer was used. - Sediment Profile Imaging (SPI) camera survey was performed throughout Pallanza Bay and monitored DDt concentrations by documenting DDT sediment burrowing of 2006-2007. - the fish community was investigated by analyzing several species, considering tissue concentration and toxicity screening to index the environmental condition of the bay. - a SPI camera survey performed throughout Pallanza Bay and investigated the sediments for the presence of toxaphene. - a fish community biomonitoring was performed to assess the presence of toxaphene. - a Sediment Profile Imaging (SPI) camera survey performed throughout Pallanza Bay and investigated the sediments for the presence of toxaphene.

The results of the geochronological study on the distribution of the elements tested, in some cases has been discovered that polluted sediments, aerated with mechanical dredging and mixing, can have an impact on the bay ecology. It was unclear which substances in sediment posed ecological risk on the whole lake ecosystem, with the objectives of evaluating potential ecological risk and assessing the need for sediment remediation, the following activities were performed: - three sediment tracer samples were investigated at various depths in 125 sediment cores. To collect high quality sediment chemistry data, a lightweight sediment-water interface corer was used. - Sediment Profile Imaging (SPI) camera survey was performed throughout Pallanza Bay and monitored DDt concentrations by documenting DDT sediment burrowing of 2006-2007. - the fish community was investigated by analyzing several species, considering tissue concentration and toxicity screening to index the environmental condition of the bay. - a SPI camera survey performed throughout Pallanza Bay and investigated the sediments for the presence of toxaphene. - a fish community biomonitoring was performed to assess the presence of toxaphene. - a Sediment Profile Imaging (SPI) camera survey performed throughout Pallanza Bay and investigated the sediments for the presence of toxaphene.

**MO 244**

On the use of ELISA commercial test kits for PCB screening in sediments: practical implications

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Polychlorinated biphenyls (PCBs) are a family of persistent organic pollutants (POPs) of anthropogenic origin constituted by 209 congeners. PCBs bioaccumulate and have been identified as toxic compounds producing a wide spectrum of adverse health effects in biota and humans. Sediment is a reservoir of PCB which may be eventually buried together with particles but also remobilized by the effects of sediment resuspension and mixing by benthic organisms (i.e. bioturbation). Sediment is therefore a key compartment in the study of the quality status of water bodies. PCRs have been proposed for the inclusion into the European Water Framework Directive (WFD) priority list, currently under revision. Moreover, the management of dredged sediments requires useful screening and monitoring tools in order to assess contamination levels prior action decision (e.g. immersion, terrestrial treatment, storage, or valorisation). Various screening methods have been employed for PCB determination in different environmental matrices in the last decades, immunoassays being one of the most employed. A performance comparison study between a classical reference method for PCB analysis in sediments and a commercial ELISA test kit is presented. A number of sediments covering a wide pollution range (from clean in remote areas to highly polluted industrial areas) have been analysed by both a reference and ELISA methods. The reference method was based on a 24h Soxhlet extraction of sediments followed by gas chromatography-mass spectrometry (GC/MS) analysis. A selected immunoassay commercial test kit was employed for the ELISA determination. Briefly, the sediments were extracted by the reference method, eluates during 1 min were subjected to ELISA analysis. Preliminary results showed a good correlation between the two methods when identifying the pollution gradient but not in terms of absolute concentrations. ELISA provided a total PCB concentration as ancequal equivalents whereas GC/MS analysis provided the PCB total concentration as an indicator PCB (CB-28, 52, 101, 138, 153) in addition to single congener values. Discussion on the most suitable ELISA applications (e.g. monitoring contaminated sites versus EQS compliance checking) and on the adequacy of ELISA for PCB determination in sediments under the current environmental pollution scenario and the new European regulation framework is also presented.

**MO 245**

Metal concentration profiles in sediment cores of Guanabara Bay: geochronological evolution

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This study was conducted in 2009, 2010 and 2011 in the Guanabara Bay (Rio de Janeiro, Brazil). Guanabara Bay is one of the largest coastal bays in Brazil, it measures 31 km from north to south and has a surface area of about 400 km² of eutrophic waters. It is an eutrophic, pulsed system, impacted by largely untreated domestic runoff from the eight million inhabitants of its basin. Because the Bay is situated in a highly populated and urbanized area, it is subjected to chemical contamination from a variety of sources, including pathways. Particularly evident in this area is the heavy metal pollution of industrial and sewage. In effect the immediate area surrounding the estuary is highly industrialized and includes petroleum refineries and chemical manufacturers, so the Bay is subject to organic and inorganic chemicals contamination. This study, conducted in 2009, 2010 and 2011, evaluated the distribution of the heavy metals, some metalloids and some alkaline earth metals in order to define the possible geochronological evolution in sediments of the Bay. Special emphasis has been done to the speciation of metals in the sediments. The study of the general distribution of the contamination was conducted to implement strategies for environmental recovery by MODUS System, that is a special mobile equipment for aeration, pollutant stripping and oxidation to be used in shallow or deep water. In Taghbor Project has been observed that polluted sediments aerated with mechanical dredging and mixing, can release a very high amount of pollutants, especially toxic metals. The results of the geochronological study on the distribution of the elements tested, in some cases showed a clear change in concentration with depth but in general there has been a degree of uniformity in the distribution, probably caused by bioturbation.

**MO 246**

Regression model of arsenic distribution in water/sediment system of Sevovo (Kroatien) - MN Knezevic1, SM Akensiv1, ‘M Asenovic2, ‘M Strojicar1, MT Vinicin Vasic3

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This paper reports the results on total arsenic concentration analyzed in water and sediments covering a wide range of water samples collected in 2009 spring/summer seasons in the bay. Water and sediment samples were analyzed for total arsenic by hydride generation using ICP device (ICP Thermo 6500 Duo). Study has been focused on the Dettjnja river basin of the area of Western Serbia, near Sevovo. Traditionally the Dettjnja river and Drageica river (Sevovo, Serbia) receive pollution from two different sources, in particular in the section of the bay. The main contributor to the pollution is the river Drageica Hydro electric power plant. The river is also affected by the river Mevlja and, in its lower section, in the Dettjnja river, from untreated urban wastes and intensive agricultural activities. The concentrations of arsenic in water and sediment samples taken in spring were higher than in summer. Measured concentrations of arsenic in water of Drageica river were up to 10 µg/L, and in river Mevlja and Dettjnja river were up to 5 µg/L. The concentrations of arsenic in water and sediment samples were analyzed according to the Regulations on permitted amounts of harmful and hazardous substances in soil and irrigation water in Serbia. Adsorption of arsenic was studied using equilibrium distribution coefficient as a function of the concentration of arsenic in water and sediment. Regression analysis provided a quantitative agreement of two variables. Pre-defined (based on theoretical knowledge) to be an independent variable - concentration of arsenic in water waste, and the dependent variable - the concentration of arsenic in the sediment. Despite the presented findings, the authors acknowledge the financial support of the Ministry of Science and Technological Development of the Republic of Serbia, within the Project No. 34014.  

**MO 247**

Cd2+ and Zn2+ sorption on hydrous ferrite in the presence of EDTA in aqueous solution in equilibrium state

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Contaminated soil and water presents an unacceptable risk to human and ecological health and must be remediated. The removal of heavy metals from natural waters and soils needs an special attention because their variety of toxic effects. Among different treatments the adsorption technology is attractive due to its efficiency, economy and simple operation. Hydrous ferric oxide (HFO) is approved and recommended as a effective metal ions binding material.
The binding process on HAP is controlled by number of factors including pH, contact time, type of metal ions in a solution, HAP physio-chemical properties, etc. The fixation of metal ion on HAP surface may take place through one or more simultaneous mechanisms of: ion exchange, surface complexation, dissolution of HAP to form new metal phosphates, and substitution of Ca²⁺ ions in HAP by other metal ions during recrystallization. In soils and natural waters metal ions can sorption from aqueous phases to solid particles, but also be complexed or precipitated, competing with anions to sorption sites. Therefore, the sorption of heavy metals on HAP has been extensively studied, the dominating mechanism of complexation is the presence of chelating agents is under discussion.

The removal of Cd²⁺ and Zn²⁺ from aqueous solutions by hydroxyapatite was investigated with and without EDTA in batch experiments using synthetic hydroxyapatite with Ca/P = 1.60 and a specific surface area of 40.2 m²/g in the pH range 4 to 9 (25°C, 0.1 M KNO₃). The initial concentrations of Cd²⁺, Zn²⁺ and of EDTA were 0.002 M. The solid-solution ratio was 2 L/g.

The amount of Cd²⁺ and Zn²⁺ removed from the solution increased with increasing pH, reaching ~90% at pH 9. The presence of EDTA reduced the HAP removal capacity to 13% due to formation of cadmium or zinc hydroxyapatite complexes. In a binary solution (Cd/Zn/Zn) the competition of metals reduced individual sorption capacity 10-15% compared with the single complexation. In all the total adsorption maximum was approximately constant (0.8 ± 0.1 mg/g). In a Cd-Zn-EDA solution the Cd²⁺ sorption was reduced but the sorbed amount of Zn²⁺ did not change remarkably. In any case the sorbed amount of Zn²⁺ was higher compared with Cd²⁺ which was less affected by solution composition. The solubility of HAP increases in the presence of EDTA at pH values above 6, mainly due to formation of [CaEDTA]²⁻. The surface complexation of solid phases was studied by X-Ray Photoelectron Spectroscopy (XPS).

MO 249
Characterization of heavy metal contamination from sediments of Douro River basin, Portugal, Porto, Portugal
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Douro River is the second most important river in Portugal, travelling a total of ca. 900 km until the Atlantic Ocean, approximately 200 km being in the Portuguese territory. Its estuary is located between the cities of Porto (north side) and Vila Nova de Gaia (south side), in Northern Portugal. This area, besides being highly industrialized is also densely populated, and Douro River estuary receives large amounts of untreated sewage as well as continuous discharges of a total of eight wastewater treatment plants. In the occurrence and distribution of metal ions, and the occurrence of sediments, chemically, the occurrence of metal ions, and the occurrence of sediments, chemically, could be expected. Sediments act as important reservoirs and affect the chemical and ecological quality status of the estuarine. In order to assess the metal contamination of Douro River basin sediments, samples were collected during 11 campaigns from September 2009 to September 2010. Two sets of 6 samples were collected along the estuary, at both margins. The 66 samples collected were preliminarily evaluated regarding humidity and granulometry. The 66 samples were preliminarily evaluated regarding humidity and granulometry. The final extracts were analyzed for dieldrin, endrin, endrin aldehyde, α-HCH, γ-HCH, trans-chlordane, cis-chlordane, trans-nonachlor, cis-nonachlor, endosulfan I, endosulfan II, endosulfan sulfate, and chlorpyrifos using GC-ECNI/MS. The data was analyzed using SPSS software. The results indicated that the concentrations of dieldrin, endrin-vendrin-aldehyde, γ-HCH, and sum of endosulfan was higher in the streams passing through conventional farms compared to integrated and organic farms. Interestingly, the concentration of γ-HCH was higher in streams passing through organic farms compared to integrated farms and no significant relationships were found for chlorpyrifos or the sum of chlorodanes.

MO 250
Evaluación de DDTs degradación en Sedimentos de Lago Maggiore (Pallanza Bay): a case study of historical contamination
S Ceconi1,2, M Cecconi2, for ports and harbors
2ENVIRON italy s.r.l., MILANO, Italy
As a part of a series of sediment characterization investigations performed in 2009-2010 in the Lago Maggiore (North Italy), radiocarbon analyses (210Pb and 137Cs) were undertaken in 9 stations in Pallanza Bay (Lago Maggiore) and to examine historical trends in chemical loading of DDs to sediment. Historically, a DDT manufacturing facility was located on the Fiume Toce (that inflows into Pallanza Bay) and discharged industrial wastewaters containing DDs to the river. In 1974, when the facility was shut down operating system changes on sediment cores from 9 stations, chosen to span a range of likely sediment accumulation rates. For each station, the sediment accumulation rate was determined based on the activity of 137Cs and 210Pb in 2-4 cm depth increments of each core. Core recovered for assessment of sediment accumulation rate were also analyzed for DDT isomers and metabolites (but not investigating isomers) at various depth in about 80 sediment cores collected throughout the bay.

In parallel, sediment chemistry was investigated collecting and analyzing DDT isomers and metabolites (but not investigating isomers) at various depth in about 80 sediment cores collected throughout the bay. This poster presents methods and results with major focus on the ratio DD/DDE in sediments and considerations about degradation and DDT environmental fate.
Ecotoxicity is often excluded as impact category in Life Cycle Assessments (LCAs), because information on the fate and effects of many chemicals. This study uses Interspecies Correlation Estimation (ICE) statistical models to enhance the effect database to be applied in Life Cycle Impact Assessment (LCIAs). Next to laboratory tests and QSAR-estimations, ICE models have been developed as an additional approach to estimate the toxicity of chemicals to both aquatic organisms and terrestrial wildlife. The acute toxicity value of one species (i.e. the surrogate species) is used to produce correlation toxicity values for multiple species. In this study, we used ICE to estimate hazardous environmental concentrations for 50% of aquatic species, and hazardous doses for 50% of wildlife species. The data were subsequently applied to derive Effect Fractions (EFs) for LCA. As the ICE model is based on empirical data, the input uncertainty in EFs on ICE needs to be weighted against the uncertainty in EFs on a low number of experimental data only. The poster shows the EFs based on ICE model estimates, together with their uncertainty ranges. It also compares EFs based on ICE and EFs based on small experimental datasets.

**MO 259**
**Case study to evaluate USEtox and Critical Dilution Volume (CDV) as methods for assessing the ecotoxicity impact of cosmetic products**

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**Abstract:** This poster presents the results of a case study to compare USEtox and Critical Dilution Volume (eco-labelling) for assessing the ecotoxicity impacts of laundry products. The scope of the study focused on the end-of-life stage, i.e. when the products are discharged after use into the wastewater system, whereas the ‘cradle to factory gate’ impacts of products has been excluded. The results have further shown that the USEtox approach and application and limitations of each method within the wider context of assessing product impacts on water quality. A second aspect of the study was to broaden and refine the characterisation factors (CFs) of detergent ingredients provided by the USEtox team and to evaluate different inclusion approaches within the USEtox tool. This shows a need for a review/evaluation process of USEtox CFs.

**MO 260**
**USEtox for assessing impacts of cosmetics products for the French regulation of environmental footprint of mass market products**

**Author(s):** Pavle J Roling, E Mailard

**Cycloce, AMBIÉRIEU-EN-RUGY, France**

The aim of this study was to support cosmetic manufacturers in the creation of new data for product characterisation. In that frame, Cycloce proposed to the ADEME to provide support for producers and manufacturers of cosmetics or detergent products and ingredients. The developments are done by Cycloce. The overall purpose of the project is to (1) Support companies for assessing the aquatic ecotoxicology footprint of their products; (2) Develop a database providing USEtox characterisation factors for cosmetic ingredients and detergents available via the USEtox database. A database based on characterisation factors (USEtox 1.1), but we also advocate 1) to perform an update as soon as a more comprehensive inventory can be obtained and as soon as characterisation factors for metals are revised; 2) to consider extension to other economic systems in order to allow normalisation in USEtox to be used on a global scale.
MO 262
Life Cycle Impact calculation at global scale and at site-specific scale - damages on coastal waters and soils in the Milazzo Peninsula (North-Eastern Sicily, Italy) - Life Cycle Impact calculation at global scale and at site-specific scale - damages on coastal waters and soils in the Milazzo Peninsula (North-Eastern Sicily, Italy)

MO 263
Regionalized global atmospheric source-to-receptor modeling for LCA

MO 264
Review on methodology for LCA of marine eutrophication

MO 265
Globalally applicable, spatially explicit assessment of non-toxic air pollutants

MO 266
Development of damage assessment method for biodiversity caused by global warming

MO 267
Accounting for the potential value of temporary carbon storage: the issue of choosing relevant time horizons

MO 268
Environmental performance of electric taxis compared to diesel taxis in Copenhagen: a case study including the impact of traffic noise upon human health

1. Introduction

This paper presents intake factors (IF) and characterization factors (CF) regarding human health effects for the pollutants NH3, NMVOC, NOx, SO2, primary particulate matter (PM), and secondary inorganic aerosols (SIA). Research on LCA for transboundary pollutants has been reviewed and it is suggested that spatially differentiated fate modelling may be crucial. The present work aims to fill the gap of consistent global assessments of health impairment due to traffic noise.

2. Materials and Methods

Within the ongoing EU-funded project LC-IMPACT (2010-2012) the “Development and application of environmental Life Cycle Impact assessment Methods for Impproved Sustainability” is pursued. Within the area of “Non-toxic pollutant impacts” the objective is to develop globally applicable, but spatially explicit, life impact assessment methods and characterization factors. Within the TMS-FASST modelling framework, the world is divided into 54 regions. Each region serves as a source region and each grid cell (resolution 1×1°) of the whole world serves as receptor region. Population data and concentration response functions are applied in order to calculate the IF and relevant diseases. A new methodology for evaluating emissions due to transport noise has been applied to count the urban impact on the health of people in the surrounding areas. Finally, the application of monetary valuation is demonstrated in order to derive specific damage cost estimates per unit of emission by including and excluding equity weighting.

3. Results

A direct comparison will be made between IFs derived by the TMS-FASST model and by the EcoSenseWeb integrated assessment tool in order to assess the inherent uncertainties and implicit variability in the estimates. For primary particulate emissions specific conditions (i.e., height of release, adjacent population density and distribution) are taken into account, and therefore, IFs and CFs are calculated for several archetypes such as urban, non-urban and remote sources with different height of release. Finally, IFs and CFs suggested in different LCIA methods have been compared with the findings of this work and further results from LC-IMPACT, as well.

MO 266
Development of damage assessment method for biodiversity caused by global warming

J. Tang, N. Isobe
Tokyo City University, YOKOHAMA, Japan

MO 267
Accounting for the potential value of temporary carbon storage: the issue of choosing relevant time horizons

V. Hornung, MZ, Hauschild
Technical University of Denmark, LYNGBY, Denmark

MO 268
Environmental performance of electric taxis compared to diesel taxis in Copenhagen: a case study including the impact of traffic noise upon human health

Y. V. Hansen, P. E. Cressie, A. Becker, R. P. Kreuger, C. Muntean

1. Introduction

Environmental impacts are assessed from the perspective of electric and diesel taxis. The background of European Union (EU) directives is the environmental sustainability of energy systems. A new methodology for evaluating emissions due to transport noise has been applied to count the urban impact on the health of people in the surrounding areas. Finally, the application of monetary valuation is demonstrated in order to derive specific damage cost estimates per unit of emission by including and excluding equity weighting.
natural language (e.g., "additional" number of persons annoyed by traffic noise) has the benefit of presenting results in a manner that is intelligible to both policy-makers and the general public, while being comparatively effective in communicating the impacts of noise. Keywords: noise, electric vehicles, LCA, number of persons annoyed

MO 269 Endpoint characterisation factors (CF) in the unit of [Daly per Bq] and damage costs [Euro per Bq] for selected radionuclides releases during normal operation of nuclear fuel cycles

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Characterization Factors

A simplified approach: The characterization factors (CF) for assessment of potential human health impacts related to radioactivity for a selected number of radionuclides has been developed. Updated data on relation between Bq and manSv, according to UNSCEAR reports from 1993 and 2000 [1], has been used. This approach is site specific because for the UNSCEAR reports typical population density values have been assumed. The dispersion and exposure modeling, i.e. the relation between emission [Bq] and dose [manSv] is included in these dose factors. The approach has been implemented in the EcoSensWeb tool [2] in order to evaluate impacts due to nuclear fuelled electricity generation. However, the CF can be applied to other sources, too, in similar environmental conditions.

Effect Factors

The factors relating collective dose [manSv] to human health impact, are based on the ICRP60 [3] recommendations, i.e.: 0.055 cases per manSv for fatal cancers 0.12 cases per manSv for non-fatal cancers and 0.01 cases per manSv for hereditary defects. Moreover, updated factors from ICRP have been compared.

Damage Factors

These endpoints are weighted in the following way: 1.62 Daly per non-fatal cancers 16.2 Daly per fatal cancer and 37.5 Daly per hereditary defects. In addition, latest WHO 2002 statistics are applied, ensuring a consistent treatment with the use of cancers related to the human toxicity category, with average of 11.5 Daly per case of cancer against 1 Daly per case, as reported by [4]. The results have been compared with other LCIA methods, e.g. based on [4] or [5], on the basis of Daly per unit of area.

Damage Costs

For monetary valuation the Daly have been multiplied by the value of a life year lost (VOLY-acute) of 60,000 Euro2000 per year (based on [6]). Finally, discounting with declining discount rate is applied to the most important substances, i.e. Ru-223, H-3 and C-14.

1. UNSCEAR. 2000. Report Vol I&II Sources and Effects of Ionizing Radiation
2. EcoSensWeb, from: http://EcoSensWeb.ier.uni-stuttgart.de
3. ICRP 60. Volume 21/1-3.

MO 270 Impacts of agricultural land use changes on ecosystem services

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Land use is considered to be an intensive human activity that aims at exclusive use of land for certain purposes, such as agriculture, and adapting the properties of land areas in view of these purposes. All basic land use activities result in either damage to or benefits for ecosystem quality. The ecosystem quality can be expressed in certain ecosystem services, such as carbon stock, erosion regulation, and nitrogen cycling. Over the years the idea has been evolving that life cycle oriented methods should be used for specific analysis of ecosystem services, since these from the basis of planetary activities and human well-being. In this research we focus on the changes in ecosystem services due to the expansion of land area used for agriculture in need to increase production of rapped, corn, and other crops. The objective of this research is to provide quantitative estimates for the changes in ecosystem services, that can be applied for life cycle assessment (LCA) purposes. To calculate this, the Environmental Policy Integrated Climate model (EPIC) will be used, which applies the global land use database Global Land Cover (GLC) 2000. EPIC is a global spatially explicit crop growth model, which simulates the physical impacts on homogeneous response units characterized by altitude, slope and soil class. The major processes included in EPIC are weather simulation, hydrology, erosion, nutrient and carbon cycling, pesticide fate, growth and competition, soil temperature and moisture, tillage, cost accounting, and plant environment contact. The output of the model can be crop yields, (in runoff, percolation), sediment transport, N-leaching, green house gases, and soil carbon sequestration. Model output can be aggregated to e.g. province, country, ecosystem, or biome level. The poster will show results of changes in CO2 emissions, erosion potential, and biomass stock due to an increase in crop production in various world areas. These results can serve as input in life cycle inventories or serve as midpoint indicators in life cycle impact assessment.

MO 271 LCA biodiversity indicators using cocoa (Theobroma cacao) as a model crop

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Biodiversity conservation is one of the hot topics of today's research and policy developers. Cocoa production is increasing high and it is expected that growth of cocoa production will lead to the increase of the entropy, which will result in new opportunities for biodiversity conservation through production as well as a continued threat to destroy the very biodiversity that it could help conserve. There is a definite need to develop a metric for measuring biodiversity in cocoa plantations; literally dozens of articles have been written on the value of biodiversity, the conservation benefits, the pest control, the longevity and sustainability it adds to cocoa production, and the possible economic benefits of cocoa.

Corporations, farmers, and governments looking to the future want to reap these benefits and select a crop system for cocoa that will help eliminate the boom and bust cycle that it has suffered and will be sustainable over centuries. For these reasons and more, a metric is needed to assess the biodiversity found in cocoa plantations under different management systems. One method for assessing biodiversity poses itself to be a survey target species that are deemed ecologically significant, keystone species who may reflect a greater total biodiversity or greater number of ecosystem services profited. Determining which species or taxa should be targeted presents significant difficulty and requires extensive knowledge of the particular ecosystems, and cocoa is now a global crop. Traditional indices of biodiversity may also help, but they tend to be highly site specific requiring the specific use of the ecosystem to which they are applied. Species counts by taxa, along with relative abundances may prove a sense of species richness and species diversity. Unfortunately, such overarching ideals are not feasible due to the dearth of primary data from the disparate regions and production systems.

Further considerations also include the necessity of measuring endemism to total biodiversity. If the cocoa farms are considered biologically diverse, but the majority of the species are exotics, one of the original purposes of preserving biodiversity in the region has become moot. As with all factors in LCA, for a method of cocoa production to be touted as a “best practice” or as sustainable, a metric for at least under biodiversity is necessary. This paper is an attempt to develop the metric is what this research attempts to develop through the address of the aforementioned issues.

MO 272 Water use impacts in life cycle impact assessment

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Current LCA methodology is lacking in the area of evaluating the environmental impacts of water use. Typically freshwater consumption is presented in the form of a volumetric quantity. Without further information regarding type of water use, location of water withdrawal, indication of consumptive versus degradative use, and in-stream or off-stream use with respect of the quantities of water reported, little about the impact. Furthermore, there is no method to determine the status of the local environment which the volume of freshwater is withdrawn. There is currently no agreed standard which to assess water scarcity. However, there are many proposed indicators used to assess water resources vulnerability. The majority of water stress indices are a function of freshwater demand supply. In order to account for the potential human health impacts of water scarcity, an evaluation must be done at the basin level. Idealistically, water consumption by each sector (agricultural, domestic, and industrial) would be easily measurable and available at the basin level for the entire globe. However, such data does not exist everywhere.

Using indices incorporating the water demand, environmental water requirements, and physical and economic water scarcity. Each index provides a different approach to assessing water resources vulnerability and are all informative evaluating corporate risk. By incorporating multiple indicators into the LCIA for water use, a comprehensive evaluation of local freshwater vulnerability can be made. Only after the status of local freshwater resources is determined, can the impacts of water use be determined.

Developing a method to quantify the variables surrounding the status of local freshwater resources is critical in order to evaluate the impact of freshwater use.

MO 273 Toward consistent energy calculations with LCI databases: implementing the energy algebra

F Benetto

Public Research Centre Henri Tudor, ESCH SUR ALZETTE, Luxembourg

Life Cycle Inventory (LCI) databases like Ecoinvent are used for evaluating resource depletion and productivity quality within Life Cycle Assessment (LCA). LCA ignores, however, part of ecosystem services (material and energy flows) that are damaged by human activities and should therefore be included in the assessment. Energy concept could fill this gap. Energy is defined as the quantity of energy (solar energy, in MJ) directly and indirectly necessary to support a given system. The level of organization of a given system and its measure of the global service is realized for a product or service available. The main drawback hampering the applicability of energy calculations is the lack of detail and transparency of its allocation procedure. The use of LCI database for energy calculation is therefore highly relevant to solve this issue. Unfortunately, Energy requires a set of algebraic allocation rules that are completely different to those applied in LCI. Two major problems are to be faced: 1) all the multi-output processes (and related natural resources) shall be included without LCA-like allocation but even though dealing with a square A matrix; 2) specific rules for co-products, co-products and feedbacks make allocation at each node of the network depending on the type of input energy and outputs. This study provides a consistent, cepital and technical framework to definitively solve these problems, which is illustrated through an example of complex system based on coevit unit processes. Datasets of the co-products of a multi-output process are kept separated but are assigned the full amount of inventory data of the multi-output process. This approach is efficiently generated by each dataset is then calculated. Conventional LCI calculations are performed to obtain the matrix’s x a including all the mass and energy flows of the network. A novel algorithm for energy algebra has been developed in which this purpose and applied to the x a matrix. The energy results obtained have been successfully re-calculated using Emsim, software for energy calculation, by drawing the network as a graph. The framework is therefore validated on a complex case study. The approach is being applied to the whole Ecoinvent database. The framework will allow consistently introduce energy in LCI and LCA, a step forward to the implementation of a consistent framework (impossible task so far), generating a huge impact in the practice of sustainability assessment.

MO 274 The analysis of environmental impacts

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Evaluating Life Cycle Impact Assessment (EIA) is an issue of major concern for every industry, for every nation and for every product that is in the market. The EIA constitutes one of the very important steps of Life Cycle Assessment (LCA). EIA constitutes one of the four steps in performing LCA. The definition goes further and includes the evaluation and implementation of opportunities to improve the inputs or contributing environmental improvements. It is very important to understand the nature and the limits of the impacts in order to be able to proceed with a plan to improve them. The environmental impacts occur during the process there is a material and energy transformation that leads to the increase of the entropy. This will lead to various emissions and wastes. However, the environmental impacts could be divided into two categories: The impacts that are subjected to the process, that are unavoidable, and their magnitude depends on the efficiency of the process;
the impacts that are peripheral, the impacts affected by factors located in other than the main processes. The impacts that are included in the second category, the peripheral impacts, could be easily minimized with the implementation of certain actions. The impeded impacts require processes. The impacts that are peripheral, the impacts affected by factors located in other than the main processes or the product has against the effects concerned. The structure of a LCA consists of some compulsory elements (mandatory elements) which convert the results of inventory into impact indicators that can be used directly or as a basis for optional subsequent evaluations LCIA.

In accordance with approved international standards, the study has to complete the selection of environmental effects to be considered, the results of the allocation being chosen LCI to environmental effects (classification) and the calculation of different impact categories, such as Nutri-

Life Cycle Impact Assessment: research needs and challenges from science to policy making

MO 276
Life Cycle Impact Assessment: research needs and challenges from science to policy making

MO 285
Social Life-Cycle Assessment of waste management options. Some preliminary results.

MO 286
Energy sustainability in medium and small communities

Energy sustainability in medium and small communities

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Politecnico di Milano, MILAN, Italy

The energy of the additional options and its potential to be the main component of the supply chain is a difficult and complex task. The study indicates that a vehicle weight reduction obtained through a progressive substitution of iron with aluminium in some components determines a reduction of the external costs evaluated over the entire vehicle life.

The study indicates that a vehicle weight reduction obtained through a progressive substitution of iron with aluminium in some components determines a reduction of the external costs evaluated over the entire vehicle life.

Towards realizing the sustainable society, it is becoming an urgent task to estimate the various kinds of events, sports, conference, music festival, etc. Based on tripped aspects of environmental, economic and social issues, an evaluation method of sustainability for events is developed. For different kinds of the data of event (construction of temporarily structure, goods, food and drinks, services, transportation, etc.) are collected. then Resource consumption of fossil fuel, minerals, water and economical ripple effect are calculated using the database developed by Tokyo City University based on LIME2 model. CO2 emission is calculated using SEID and process flow. For environmental aspects, Life Cycle Inventory Analysis is performed with resource consumption of fossil, mineral, and water, and GHG emission. Then Life Cycle Impact Assessment is performed with LIME2.

For economical aspects, economic ripple effect analysis is performed considering employment and output.

For social aspects, considering added value, water consumption, CO2 emission by a event, influence of human health, education, food production, water for living, social assets, then social impact assessment is performed by calculating the influence for the HDI (Human Development index).

Then sustainability assessment for events is performed by combining and arranging the triped evaluation above for environment, economic and social aspects.

A sustainability evaluation for a sports event is shown as an exemplification of this method.

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A sustainability evaluation for a sports event is shown as an exemplification of this method.

The Comunità Montana V alle Sabbia (CMVS) is a group of municipalities located in the northern area of Brescia district (Italy), between the Garda lake and the Alps, that have joined the
Besides these deeds, all concerning the sphere of public tertiary and private residential sectors, O Cadiach Ricoma, A Passuello, J Rovira, M Schuhmacher, Y Pérez mainly in municipal buildings; substitution of present municipal public lighting with low-energy Based on results obtained during the BEI step, the SEAP has identified a group of actions to results evaluation must be performed to check if the model outputs correspond to stakeholders’ expectations. These methods allow evaluating how the information given in model’s input affects its outputs. The objective of this work was to perform results evaluation in GIS. For that, the exploratory method was applied to a case study of land classification. The first step was developing scenarios based on the initial model. For each scenario, the weight of one criterion was set to zero and the weights of the remaining ones were redistributed accordingly. Then, the results for each scenario were compared to the initial map, identifying the changes in each pixel. The results allow a better understanding of the developed model. Besides that, the use of GIS allows presenting the results in a graphic way, facilitating its evaluation. This method can be useful for model calibration.

MO 290 Determination of polycyclic aromatic hydrocarbon emission sources from Cartagena Bay, Colombia
B Johansen-Restrepo University of Cartagena, CARTAGENA, Colombia
The Cartagena bay is an estuarine in the Caribbean Sea which received fresh waters from Magdalena river through the Dique channel. Several commercial activities are developed along of this Bay such as petrochemical industries, harbours, and tourist attractions. However, all these activities produce an environmental impact that it has not been measured yet. Therefore, 16 priority polycyclic aromatic hydrocarbons (PAHs) analyzed by gas chromatography coupled with mass spectrometry (GC/MS) in sediments from Cartagena bay were used to determine the possible emission sources through approach of multivariate analysis to know how can be the major impact. PAHs are largely produced by means of the combustion or pyrolysis of organic matter but their environmental concentration is determined by the risk to develop cancer in human. Results showed that the profile of PAHs of the Cartagena bay implicated that the pollution is caused by oil spill, combustion of gasoline and diesel.

MO 292 Modeling toxicity endpoints using artificial neural network ensembles (II)
AC Lee, R Fraczkiewicz, WS Woltosz Simulations Plus, Inc., LANCASTER, United States of America
Today and for the foreseeable future, it is important to utilize the best possible analysis of knowledge (both data and technique) to save and protect the environment. The use of in silico models are at the forefront of the battle surrounding the development and waste management of chemicals. A common theme in Greens chemistry is the application of useful models to reduce the need to perform costly, time consuming, and often inhumane in-vivo experiments, such as lethal dose concentration and Draize tests for skin or eye irritation. Unfortunately, making a useful toxicity model is often more difficult than it sounds mainly due to the involvement of multiple biological mechanisms and conflicting experimental measurements. In this work, artificial neural network ensembles (ANNEs) were used to generate robust models for a number of toxicity endpoints including acute rat toxicity (LD50), fathead minnow LC50, Tetrahyrmena pyriformis IGC50, Daphnia magna LC50, reproductive/developmental toxicity, and species sensitivity distribution (SSD) concentration. These results are compared with other QSAR methodologies used in the Environmental Protection Agency’s Toxicity Estimation Software Tool (T.E.S.T.) v3.3, which include multiple linear regression, hierarchical clustering, nearest neighbor, and other similarity-based methods. In almost all comparisons made using the training and external test sets species sensitivity distribution (SSD) models have more robust predictive superior performance in terms of RMS error for regression models and false rate for classification models. Accuracy within the applicability domain of each model was further improved by using Kohonen mapping (independent of the endpoint values) to select new training and external test sets. Finally, all models were identified by applying focused curation techniques from among the available experimental data. One curation technique not often publicly addressed is the examination of predicted outliers in both training and test sets identified by preliminary models. Another technique is to verify that the structure of each chemical exists in one or more reliable data sources. If a structure is not found the chemical is flagged for further curation. Examples and the relative finalized models are discussed, as the techniques can be useful when dealing with large data sets where rigorous literature mining is not feasible.

MO 293 Predicting species sensitivity distributions of chemicals with limited ecotoxicity data
W Nanto, K Kamo, BL Lin National Institute of Advanced Industrial Science and Technology, TSI/JUK/B Japan Efforts to reduce the risk of a certain compound to aquatic life may increase the total risks arising from alternative compounds. In order to reduce the total risks arising from the use of chemical compounds, we need to quantify the risks of the target and alternative compounds with common molecular activity (mOlAQ) and the most sensitive chemical (mOlAQMax) which is selected as the target for set criteria for mOlAQ. mOlAQ is a powerful indicator of the necessity for reducing environmental exposure, such as lack of ecotoxicity data. In this study, we propose an approach to fill data gap on ecotoxicity data of compounds to allow us to compare and evaluate risks of the target chemical and its alternative with SSD based on data with a factor of 2 for Class 1 (neurotoxic) and Class 2 (non-neurotoxic) chemicals. The proposed approach has potential for predicting SSDs for chemicals with limited ecotoxicity data. A SSD prediction using Bayesian approach and the domain of applicability and the management of uncertainty are discussed during presentation.

MO 294 Physicochemical characterization of mixed polybrominated/polychlorinated derivatives of Persistent Organic Pollutants with QSAR
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1University of Gdansk, GDANSK, Poland
2Computer Simulation Laboratory, Gdańsk University of Technology, GDN, Poland
Mixed polybrominated/polychlorinated Persistent Organic Pollutants (Br/Cl-POPs) are formed in various natural and anthropogenic processes. Since empirical studies confirm that its physicochemical properties and biological activity are comparable to the properties of their polychlorinated/ polybrominated counterparts, it is evident that Br/Cl-POPs may also have negative effects on the wildlife and human health. Regarding that environmental concentrations of Br/Cl-POPs in all environmental compartments are increasing, detailed studies aimed at performing a comprehensive risk assessment for this class of mixed POPs is of special interest. The problem in the risk assessment is linked to the use of Br/Cl-POPs in various chemical applications and technologies. Depending on the position of chlorine and bromine atoms in the molecules of Br/Cl-POPs, we predicted logarithmic values of five physicochemical properties, including: density’s law constant (log KH), subcooled liquid vapor pressure (log PL), solubility in water (log SW), and three partition coefficients (log KOW, log KOC, log KSAW). Finally, we have evaluated the environmental behavior of the studied compounds by comparing the values of the predicted properties with the corresponding values for well-studied polychlorinated and polybrominated POPs.

MO 295 Global vs. local QSPR models for persistent organic pollutants
T Paine, A Gajewska, A Rybacka University of Gdansk, GDANSK, Poland
A Quantitative Structure-Property Relationships (QSPR) modelling combined with combinatorial chemistry. We generated all possible polybrominated/polychlorinated congeners for six groups of organic compounds and further used them in the calculation of physicochemical parameters for halogenated congeners of Persistent Organic Pollutants (POPs) are available for a limited number of compounds. In the absence of experimental data, a range of computational models can be applied to full those data gap. One of the widely used techniques is Quantitative Structure-Property Relationship (QSPR) modelling approaches. The QSPR models utilise data from experimental measurements to predict global model or fitting a simple local model that covers a specific class of chemically related compounds. The main purpose of the study was to investigate, if local models have significantly better explanatory and predictive ability than global models with wider applicability domains. We compared in pairs predicted and measured data to evaluate the performance of global vs. local QSPR models: using a more complex model and a simple model. The comparison between the predictive performances of local and global models, indicated that the local models fitted better to the experimental values and were more precisely than the global ones. However, any statistically significant differences between the measured and calculated values for both types of models (local and global) were not found. Based on the obtained results, we have concluded that similar QSPR models to predict the water solubility, vapour pressure and octanol-water partition coefficient of the Cl/Br-substituted congeners of benzenes, biphenylen, dibenylethers, dibenzoazines, dibenz-p-dioxins, dioxins and benzonaphthalenes, PNXs) with the domain of applicability and the management of uncertainty are discussed during presentation.

MO 296 Development of QSR for soil toxicity of benzene-based compounds to Folsomia candida in the sand fraction of soil pore water contamination
D Green2, MTO Jonker1, GMA Gestel1
1Vrije Universiteit Amsterdam, AMSTERDAM, The Netherlands
2IRAS, Utrecht University, Utrecht, The Netherlands
The development of industrial chemicals and the persistence of existing compounds in soils make it necessary to establish less time and resource consuming methods to determine possible toxic effects on soil organisms. Since the enormous improvements in computable software, quantitative structure activity relationships (QSARs) may provide an effective tool to predict toxic effects on soil organisms. Toxicity to the springtail Folsomia candida was determined for nine chlorobenzene, aniline, five chloroanilines and 5-chlorophenol, applying ISO guideline
11267. Toxicity in LUFA 2.2 and OECD artificial soils was compared, using reproduction as the endpoint. EC10 and EC50 were the chosen test parameters, with the focus on the EC50. In an attempt to develop a QSAR, toxicities were related to the Kow of the test compounds. Chlorobenzenes and chlorophenols showed a decrease in the effective concentration with increasing log Kow in nominal and modelled pore water concentration, respectively. In contrast the chloroaniline test was in toxicity in modelled pore water concentrations at increasing log Kow. Based on the two calculated effective concentrations (EC10/EC50) a second experiment was designed to validate the pore water hypothesis, which described that only the freely available concentration in the pore water is causative. For eight chloroanilines a solid phase micro-extraction (nd-SPE) with polyacryl coated fibers were used, to determine pore water concentrations at three time points over a four week standard toxicity test. The fibers were equilibrated over 4 weeks in soil - water suspension with 2 grams soil and 6 ml water. Subsequently, the fibers were extracted in cyclohexane and analyzed by GC-ECD. Only LUFA2.2 natural soil was used in the model confirmation experiment. The relative high volatility of the compounds leads already to high losses during the spiking and test preparation steps and a depletion of the total soil concentration before the actual test. The results indicate the losses of compounds during all steps of preparation and losses in the bioavailable fraction during test performance. However, the slopes of the regression models remained comparable. We therefore conclude that the pore water hypothesis is confirmed, but strongly advice to include pore water analysis for model validation in future experimental designs.

M 297
Modeling ecotoxicity risks at the river basin scale: integration of the species sensitivity distribution (SSD) concept
S Lackner1, S Nemethova1, K Brezac, L Blaha
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Traditional and simplistic approaches evaluate ecological risks of chemicals by calculating hazard indices based on environmental concentrations and LOEC/NOEC values. Another methodology is using a concept of species sensitivity distributions (SSD), which has been traditionally used for predictive purposes, i.e. estimations of environmental quality criteria for e.g. pesticides (calculated as F of HI for each species). Based on our recent study, we proposed a novel approach to SSD based on the respective assessment of ecotoxicological risks at the river basin scale. Existing ecotoxicological data were compiled for a number of priority chemicals (industrial chemicals, pesticides and their byproducts), that has been selected with respect to their relevance in the model basins of the Zenn river (Netherlands) and Mosen lake (Denmark). The ecotoxicity data were thoroughly assessed for their quality and resulting datasets served for calculation of SSD parameters of individual chemical substances. From the log-S of the normal SSD distribution, the SSD parameters were calculated and/or modeled for the chemical substances. The SSD parameters of chemicals with measured and/or modeled concentrations in the river basin is used to calculate PAF or msPAF values (potentially affected fraction or multisubstance PAF) for different temporal scales, which allow direct comparison of ecotoxicological risks at various localities within the investigated river basins. The outcomes of the model and its limitations will be discussed [Supported by the EU FP7 project AQUAREHAB and by the project CETOCEN (no. CZ. 1.05/2.1.00/01.0001) from the European Regional Developmental Fund] .

M 298
Acute toxicity to Daphnia magna test: comparison of predicted vs Actual EC50 results
HS Vynenhof1, C Meed1, Handle1
Harlan Laboratories Ltd., DBRYERSHEIDE, United Kingdom

With the implementation of REACH, the use of QSAR to predict various ecotoxicological properties of chemicals is widely recognised. The results obtained from Acute Toxicity to Daphnia magna Tests are of importance for the risk assessment and labelling of chemicals, and hence this endpoint has been selected for the purpose of this comparison study. The suitability of the program was assessed by comparing predicted values against experimental results obtained from regulatory testing of new and existing chemicals.

M 299
Evaluation of test methods for measuring toxicity to sediment organisms
A Kootstra1, TGP Apar2, van den Brink1, TCM Brock1, MJ van den Heuvel-Greve1, J Schoubben1, H Smidt1, NJ Diepen1
1Wageningen University, WAGENINGEN, The Netherlands
2Helmholtz Centre for Environmental Research - UFZ, LEIPZIG, Germany

There are two interesting groups of organic compounds with very useful effects and which are already to high losses during the spiking and test preparation steps and a depletion of the total soil concentration before the actual test. The results indicate the losses of compounds during all steps of preparation and losses in the bioavailable fraction during test performance. However, the slopes of the regression models remained comparable. We therefore conclude that the pore water hypothesis is confirmed, but strongly advice to include pore water analysis for model validation in future experimental designs.

M 300
Toxic effects of nine polycyclic aromatic compounds on Enchytraeus crypticus in artificial soil and relation to their properties
M Kobeticova1, Z Simek1, J Brezovicky1, JH Hofman1
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The aim of this study was to compare the toxic effects of selected two- and three-ringed PAHs and their N-heterocyclic analogues with one or two nitrogen atoms on the survival and reproduction of Enchytraeus crypticus in artificial soil. If the toxicity was expressed as soil pore-water concentration (µmol/L), the toxicity showed clear pattern and dependency on structure and properties of the compounds. This was primarily related to the different lipophilicity of the compounds after that the toxicity significantly increased with increasing Kow value. This relationship indicates nonpolar narcosis as the general toxicology mechanism of the tested compounds. In addition, significant correlation of the ionization potential (IP) and toxicity of PACs has been identified by multidimensional QSAR models. The suggested importance of IP can help to explain deviations from proposed nonpolar narcosis model. Unresolved relationships between PACs structure and properties and their toxicity could help to the prediction of their effects in soil.

M 301
Correct toxicity of compounds by prediction
M Tichy1, M Rucki1, E Benfenati2, R Cabala3
1National Institute of Public Health, PRAHA 10, Czech Republic
2Pharmacological Research Institute Mario Negri, MILAN, Italy
3Faculty of Science, Charles University, PRAHA, Czech Republic

In the future experimental designs the hypothesis is confirmed, but strongly advice to include pore water analysis for model validation in future experimental designs.
structural and toxicological similarities to 2,3,7,8-tetrachlorodibenzo-p-dioxin. Currently about 100 of toxic Ds have been identified. But taking into account that other polyyclic hydrocarbons can exist as congeners and be substituted by Cl or Br, both the total number of potentially toxic congeners is very large. Due to limited time and costs of laboratory tests, it is necessary to create screening methods that allow selecting those compounds, for which experimental research should be of the highest priority.

Thus, the aim of this study was to develop a novel classification method, capable to select those congeners (from 182,958 of theoretically possible brominated, chlorinated and mixed deriva-
tives of 12 congeneric groups includes: acenaphthenes, anthracenes, biphenyls, biphenyl ethers, dibenzothiophenes, dibenzofurans, fluorenes, fluoranthenes, naphthalenes, phenanthrenes, xanthenes, 9-fluorenone), which exhibit the same level of toxicity as 2,3,7,8-TCDD.

We generated chemical structures among the groups of compounds containing chlorine, and/or bromine. The structures were generated using ConGENER software. Next, we optimized geometries of the structures and calculated for them a set of 26 topological and quantum-mechanical descriptors (using semi-empirical PM6 method and DRAGON software respectively). Simultaneously, we collected all available experimental data on dioxin-like toxicity (toxicity equivalence factors, TEFs, and relative effect potencies, RPs). Also empirically confirmed information about particular congeners to which certain TEFs and/or RPs were assigned. We divided the collected data, into two classes: toxic (TEFs and/or RPs > 0.0001) and non-toxic. Compound from both classes, were then utilized for training and external validation of the classification SAR model. The SAR model was developed with such methods as linear discriminant analysis (LDA) and k-nearest neighbor (kNN) non-linear classifier. The most optimal set of descriptors was selected with a genetic algorithm (GA). The best model has been developed for a set of 182,958 compounds, to found new dioxin-like compounds.

**MO 305**

Exploring the QSARs for OH Tropospheric Degradation of VOCs using freely available online descriptors

P. Beke, E. Papo, P. Gramatica

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Tropospheric photochemical air pollution has impacts on scales ranging from local to global. The reactions of organic pollutants in the atmosphere with OH radicals, NO3 radicals, and ozone are of great significance for determining local and regional air quality and the chemical composition of the troposphere. The main pathways of the chemical degradation of the pollutants are therefore of great importance for the modeling of air pollution. In this study we developed QSAR models for hydroxyl radical (-OH) and ozone (O3) reactions of organic pollutants in the atmosphere as well as for the reactions of organic pollutants in the atmosphere with OH radicals, NO3 radicals, and ozone. The main pathways of the chemical degradation of the pollutants are therefore of great importance for the modeling of air pollution.

**MO 306**

On the agreement of external validation parameters for linear regression QSAR models

N. Chitico, E. Paps, P. Gramatica

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The aim of this study is to explore QSAR models performances, both in fitting and external pre-
diction, is of pivotal importance. While leave-one-out (LOO) Q2 internal validation technique (cross-validation) is well established, different external validation parameters have been proposed in last decades: Q2 (He) Q2 (Schuurman), Q3 (Todeschini), r (r) and the Tropospheric photochemical air pollution has impacts on scales ranging from local to global. The reactions of organic pollutants in the atmosphere with OH radicals, NO3 radicals, and ozone are of great significance for determining local and regional air quality and the chemical composition of the troposphere. The main pathways of the chemical degradation of the pollutants are therefore of great importance for the modeling of air pollution. In this study we developed QSAR models for hydroxyl radical (-OH) and ozone (O3) reactions of organic pollutants in the atmosphere as well as for the reactions of organic pollutants in the atmosphere with OH radicals, NO3 radicals, and ozone. The main pathways of the chemical degradation of the pollutants are therefore of great importance for the modeling of air pollution.

**MO 307**

Environmental chemoinformatics for REACH


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the database. From MISTEX, simple or cross requests can be done, for example to gather all data for a particular species or a particular trait whatever the studied compound. This will later allow one to combine its own data with other information resources, to design further complementary experiments, to elicit prior probability distributions in view of Bayesian inference, or to validate predictions with dynamical mechanistic models. In flexibility, its user-friendly nature and its evolvability make MISTEX apart from some of the models e.g. incorporating mixed diets. The final stage of predicting acceptable risks can be refined by taking account of physiological processes (e.g. absorption, elimination) and ecological factors (e.g. feeding rate). Body burden models, such as EFSA (2005), attempt to address such issues, calculating the time taken to achieve a lethal dose and comparing this to the time taken to induce cessation of feeding. Such models are potentially useful in acute risk assessments given that the options for refinement are limited. However, there are many uncertainties in using models of this type and the scope for refinement is limited. Perhaps the most challenging stage is to determine parameters with which to populate the models. These must be derived from studies that are not designed to produce such data. It also often involves extrapolation of data between birds and mammals, with limited information regarding relevance. There are also complications when attempting to increase the ecological relevance of the models e.g. incorporating mixed diets. The final stage of predicting acceptable risks is consequently problematic, with many interpretations being possible depending upon whether worst case or worst-case parameters are used. The aim of this poster is to present some of the unevolved perspectives of the current EU EU-pesticides risk assessment process taking place within the framework of the Threshold Damage Model (TDM) and to elicit opportunities to refine the capacity of biomagnification model to produce proper estimations of expected contaminations. Therefore, this model could be considered as a useful tool for chemical risk assessments.

MO 315
Toxicokinetic of perfluorooctane sulfonate (PFOS) following oral exposure under realistic dose. Implication for bioaccumulation assessment. Preliminary study with PFOS

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The experimental design of this study was to characterize the toxicokinetic of a PFC, concretely perfluorooctane sulfonate (PFOS) in rabbits (Oryctolagus cuniculus) as representative mammal. Also, the oral exposure to PFOS was conducted under realistic chronic dose (0.1 µg/kg at day). Rabbits were fed with PFOS-contaminated food by gastric intubation during three months for assessing their uptake. Subsequently the contaminated food was eliminated and the assay continued during another three months for covering the depuration period. All through the experiment 2ml of blood were sampled weekly and PFOS was analysed. From the results toxikinetic of PFOS have been estimated obtaining elimination blood rate of 76.25 ± day⁻¹. The toxicokinetic parameters were included into a previously developed biomagnification model. This model was designed to estimate daily chemical contaminations covering the possible processes taking place within this period of time (uptake, distribution and elimination of chemical). The calibration study with PFOS toxicokinetic parameters demonstrated the capacity of biomagnification model to produce proper estimations of expected contaminations. Therefore, this model could be considered as a useful tool for chemical risk assessments.
A short term toxicity test, toxicokinetic (TK) experiments and a long term pulse toxicity test were conducted with the aquatic invertebrate Gammarus pulex exposed to the fungicide propiconazole. The pulse toxicity test included treatments with two pulses and different recovery intervals in between and one constant exposure treatment with the corresponding TWA concentration calculated from the pulse treatments. TKTD models assuming IT and SD were fitted to the survival data and compared. In addition, the goodness-of-fit when simulated internal concentrations based on TK test were included or excluded were compared. Also, the models were fitted to short term toxicity data and it was tested how well they predict the effects in multiple pulse exposure.

The results show that the IT model was eliminated fast from G. pulex. In addition, two possible metabolites were observed; however, the concentrations remained low which indicates that they were either formed very slowly or eliminated very fast. The long term toxicity test showed that survival at the end of the experiment was higher in treatment with TWA concentration when compared to pulse treatments. Based on the TKTD model, toxicodynamic processes were slower than the elimination of propiconazole, i.e. recovery from damage was the dominant recovery process. Altogether, the survival was better characterised by the model assuming individual tolerances in the G. pulex population. The IT model with and without simulated internal concentrations estimated similar overall recovery. This indicates that the TK test was not necessary when predicting the survival.

MO 318
A TK/TD model for sublethal effects on Mytilus pyrrhastericum
S Heine
1, W Schmidt2, C Banman2, D Belgers3, P van den Brink3

Ecological models, particularly TK/TD models, are capable to refine risk assessments for plant protection products. In this work a previously published growth model for Mytilus pyrrhastericum was extended to a TK/TD model by integrating respective toxicokinetic and toxicodynamic parts. Uptake and distribution kinetics are modeled by physicochemical properties of the substance tested and species-specific parameters. These species-specific parameters are derived from published literature. The toxicodynamic sub model describes the reduction of growth rates based on internal concentrations and induction of damages. First comparisons between experimental laboratory data for growth inhibition under different exposure scenarios (static and short term) and calculated growth curves demonstrate that the model can simulate reversible growth reduction in Mytilus pyrrhastericum properly. An extrapolation of effects under different exposure periods is possible by using environmental conditions and body size as input data. The ability to use arbitrary exposure patterns as an input for the toxicokinetic sub-model enables a realistic risk assessment for plant protection products taking into account specific predicted environmental concentrations in surface water.

MO 319
Mechanistic modelling for risk assessment of cadmium and silver toxics on abalone populations
KY Chen1, YR Ye2, BC Chen3, JW Tsai2, CJ Lin3, CM Liao2

The purpose of this study was to link toxicokinetics/toxicodynamics and subcellular partitioning for assessing the susceptibility and growth inhibition risks of abalone Haliotis diversicolor superstes exposed to waterborne and foodborne cadmium (Cd) and silver (Ag). We realigned the published data on growth inhibition and subcellular partitioning associated with the present mechanistic model to explore the correlations among elimination ($k_e$, detoxification ($k_e$), and recovery ($k_r$) rates constants and to assess the growth inhibition risk. We found a positive correlation among $k_e$, $k_d$ and $k_r$ in abalone exposed to Ag. We also employed a life-stage based probabilistic assessment to predict population recovery considering the risk of abalone to environmentally relevant exposure scenarios. Our simulations showed that abalone had a minimum 20% probability of growth inhibition risk exposed to Cd, whereas Ag exposure was not likely to pose the risk. When abalone population exposed to the same $k_e$ and $k_r$ but Ag- and Cd-exposed maximum mortality was observed to be 0.0393 and 0.0038, 0.61 and 43.87, and 98.88 and 62.97 for larva, juvenile, and adult, respectively. Our study offers a useful tool to detect the potential growth biomasses of abalone populations subjected to Cd and Ag stress and also provides mechanistic implications for a long-term eco-toxicological risk assessment in the realistic situations.

MO 320
Predicting internal concentrations of chemicals in fish based on PBPK and one-compartment models
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European Union provided comprehensive testing and risk assessment before a chemical might be approved for use. In ecological risk assessment of chemicals in water, fish play a very important role, being the only vertebrate representative in freshwater systems. For this reason it would be very useful to simulate the relationship between external and internal dose in fish, and to define internal dose of a chemical using toxicokinetic modelling. Thus far, quantification of chemical toxicity is generally based on measurements of external exposure; however, in order to understand and interpret toxicological effects well, using internal concentrations of chemicals is more suitable. The goal of this study was to predict internal concentrations in fish based on the hypothesis that pharmacokinetic models for fish can be applied to predict internal concentrations of chemicals in better agreement with measured data (in fish tissues and whole body) than one-compartment approaches. To achieve that aim, two one-compartment models and one physiologically-based multi-compartment model (PBPK) were used in order to simulate internal concentrations of chemicals in fish and fish tissues. Only respiratory uptake were considered for both model types and were described by mass-balance differential equations. Toxicokinetic models were compared with measured data of chemical internal concentrations in rainbow trout and fathead minnow. These two fish species were chosen because of their wide application in toxicology testing and the availability of their physiological parameters. For internal concentrations of chemicals both in fish tissues and in whole body, the PBPK model outperformed one-compartment models; however for rainbow trout, agreement between each of the model and measured data was higher than for fathead minnow.

MO 321
Health risk assessment of a PFOA and PFOA mixture by using a whole body pharmacokinetic model
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Despite increasing use of perfluoroalkyl compounds in industry, the application of physiologically-based pharmacokinetic (PBPK) models for the characterization of chemical mixtures is still insipid. Notwithstanding, humans are exposed to multiple substances rather than to individual chemicals. The purpose of the present study was to develop a single-compartmental PBPK model with capability to integrate different PFAS compounds with different physicochemical properties. The model was applied in a specific case study: the cumulative exposure of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) through dietary intake and water consumption, the most predominant routes of exposure. While PFOA was listed under the Stockholm Convention in May 2009, PFOA is a serious candidate to enter that list. In recent years, the concentrations of these as well as other perfluorinated compounds have been analyzed in environmental (water), biological (blood) and food samples collected in Catalonia (NE of Spain), as part of a large monitoring investigation to trace the predominant sources of exposure. The PBPK model here developed was validated by comparing theoretical values with experimental data on PFOA and PFOA levels in drinking water, foodstuffs and blood.

MO 322
General unified theory of survival - a toxicokinetic-toxicodynamic framework for ecotoxicology
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Various herbicides are used for weed prevention in paddy fields. These herbicides flow directly on to nearby paddy fields to rivers through drainage channels, and are detected from April to August in river waters in Japan. Moreover, these herbicides are highly toxic to algae, and therefore there is a higher concern for the aquatic risk caused by paddy herbicides. Population viability is a main endpoint of ecosystem protection, and therefore it is needed to assess the effect and subsequence for identifying the time-varying exposure. The aim of this study is the development of an algal toxicokinetic model to predict algal population dynamics under time-varying herbicide exposure for population level ecological risk assessment. We investigated the effect of herbicide pretilachlor, which is widely used in paddy fields in Japan, on the growth of the submersed macroalga Myriophyllum spicatum in river water from Japan. The pretilachlor was supplied from a submersed UTP. According to the standardized test guideline, a 72 h algal growth inhibition test was conducted. Dead cells in subsamples were stained with the green nucleic acid dye SYTOX-Green, and live and dead cells were counted separately using flow cytometry. Moreover, cells in the algal growth inhibition test that were exposed for 72 h were inoculated with herbicide-free fresh medium, and their growth was monitored to investigate population recovery after timed exposure. Algal population dynam- ics are described based on the logistic model and toxicity are described by growth inhibition and mortality. Model parameters were determined from these test results, and model prediction of algal population dynamics was consistent with the measured values.

MO 323
An algal toxicokinetic model for population level ecological risk assessment
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Several herbicides are widely used for weed prevention in paddy fields. These herbicides flow directly on to nearby paddy fields to rivers through drainage channels, and are detected from April to August in river waters in Japan. Moreover, these herbicides are highly toxic to algae, and therefore there is a higher concern for the aquatic risk caused by paddy herbicides. Population viability is a main endpoint of ecosystem protection, and therefore it is needed to assess the effect and subsequence for identifying the time-varying exposure. The aim of this study is the development of an algal toxicokinetic model to predict algal population dynamics under time-varying herbicide exposure for population level ecological risk assessment. We investigated the effect of herbicide pretilachlor, which is widely used in paddy fields in Japan, on the growth of the submersed macroalga Myriophyllum spicatum in river water from Japan. The pretilachlor was supplied from a submersed UTP. According to the standardized test guideline, a 72 h algal growth inhibition test was conducted. Dead cells in subsamples were stained with the green nucleic acid dye SYTOX-Green, and live and dead cells were counted separately using flow cytometry. Moreover, cells in the algal growth inhibition test that were exposed for 72 h were inoculated with herbicide-free fresh medium, and their growth was monitored to investigate population recovery after timed exposure. Algal population dynam- ics are described based on the logistic model and toxicity are described by growth inhibition and mortality. Model parameters were determined from these test results, and model prediction of algal population dynamics was consistent with the measured values.

MO 324
Predicting bioactivity of the blood/air/fat/air/particle coefficients from chemical structure
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For physiologically based pharmacokinetic (PBPK) modelling, partition coefficients between tissue and environmental compartments are required. Two important parameters are the distribution of organic chemicals in the blood/air/fat/particle system. Available human and rat data have been collected from various literature sources and evaluated. The number of available data is rather limited, yielding a set of experimental blood/air/particle coefficients for 279 compounds, fat/air for 124 compounds only. The data sets have been employed to develop new estimation models for these properties at body temperature. The models are superior to existing literature approaches based on Abraham-type solvation energy relationships (LSER). The new models estimate the blood/air and fat/air partitioning through two different descriptors. The model performances depend on the descriptor quality. They yield squared correlation coefficients of regression of $r^2 = 0.88$ and 0.90, respectively.

The study was supported by the EU projects 2-FUN (contract No. 036976) and OSIRIS (IP, contract No. 037042).

RA02 - Aquatic and terrestrial mesocosm and field studies - Messages from complex systems to academia, regulators, and industry
MO 327

Lab-to-field assessment factor evaluation for the nickel surface water pcr

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To develop close system that are protective of natural ecosystems, regulators must account for the unknowns involved when extrapolating information from a few test species in simple laboratory environments to the complexity of natural ecosystems. In this paper, we examine the sources of uncertainty associated with the predicted no effects concentration (PNEC) for nickel (Ni) in freshwater systems using risk assessment (Fraunhofer 2010). The BLM-based Ni HC5 value, based on the chemical of the mesocosm test water, was 3.5 to 5.7 fold lower than the multispecies NOEC. Accordingly, an additional AF would not be required for the HC5 to be protective of the community NOEC. In a field study in the UK (WCA Environmental 2009) HC5 concentrations related to contaminated benthic macroinvertebrate indices indicated that deterioration in ecological quality is unlikely to occur at the HC5 Ni concentration. Of 632 sites in the Forum of European Geological Surveys (FORS) database where Ni concentrations were measured, none of those were below dissolved organic carbon, pH, and hardness measurements were within the calibration range of the Ni BLM, just 1% had an ambient Ni concentration exceeding the HC5, while 7% had ambient concentrations exceeding the HC5 divided by two. De Vries et al. (2010) concluded that the HC5 level, for any chemical stressor, is a protective threshold for changes in biodiversity, as defined by species richness and heterogeneity, and noted that changes in concentrations at and below the HC5 would not be detectable. Given the resource function ecosystem, coupled with the protective nature of the Ni HC5 when compared to mesocosm- and field-based effects data, we conclude that the use of a factor as an aquatic effects assessment is sufficiently understood, and that the HC5 provides an adequate level of protection for freshwater systems.

MO 328

How mine drainage waters affect lotic systems: results from a Triad-based Environmental Risk Assessment of a disused mining area in Tuscany (Italy)

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1Università del Piemonte Orientale, ALESSANDRIA, Italy
2Institute for NI ECBC 2008), the PNEC for surface water is derived from the HC5 calculated as the 5th percentile of the species sensitivity distribution (SSD) based on chronic EC10/NOEC values for 31 species divided by an assess- ment factor (AF) of 2. Because the HC5 is derived using the Biotic Ligand Model (BLM), it also accounts for species-specific bioavailability. In a 4-month mesocosm study (Fraunhofer 2010), the BLM-based Ni HC5 value, based on the chemical of the mesocosm test water, was 3.5 to 5.7 fold lower than the multispecies NOEC. Accordingly, an additional AF would not be required for the HC5 to be protective of the community NOEC. In a field study in the UK (WCA Environmental 2009) HC5 concentrations related to contaminated benthic macroinvertebrate indices indicated that deterioration in ecological quality is unlikely to occur at the HC5 Ni concentration. Of 632 sites in the Forum of European Geological Surveys (FORS) database where Ni concentrations were measured, none of those were below dissolved organic carbon, pH, and hardness measurements were within the calibration range of the Ni BLM, just 1% had an ambient Ni concentration exceeding the HC5, while 7% had ambient concentrations exceeding the HC5 divided by two. De Vries et al. (2010) concluded that the HC5 level, for any chemical stressor, is a protective threshold for changes in biodiversity, as defined by species richness and heterogeneity, and noted that changes in concentrations at and below the HC5 would not be detectable. Given the resource function ecosystem, coupled with the protective nature of the Ni HC5 when compared to mesocosm- and field-based effects data, we conclude that the use of a factor as an aquatic effects assessment is sufficiently understood, and that the HC5 provides an adequate level of protection for freshwater systems.

MO 329

Estimating safe concentrations of four heavy metals (Cu, Zn, Cd, and Mn) from field effects on species richness of riverine macroinvertebrates

Y Bae1, 2, M Roucaute2, K Cailleaud3, A Basseres3, L Lagadic2, T Caquet2

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2RIST, POHANG, South-Korea
3COMETE, France

Sixteen week outdoor benthic macroinsect test was conducted to evaluate the effects of sewage sludge on benthic invertebrate colonization from May to September 2010 in intertidal mud flats. Re-colonization of macro/meiobenthos and chemical characterization were observed and analyzed using 2 factor ANOVA design (XXX); three sewage concentrations, three segment groups within microcosm, and three replicates for each treatment group. Changes of macro/mesoinvertebrate, nitrogen loss (LO), COD, total sulfur (TS) and water contents (WC) were monitored in this experiment. Additionally we tried to examine whether the management of the vegetation (mowing, fallow, mulching) within the test units (TME) has an influence on the population dynamics of the soil microarthropod community. Accordingly, segmented microcosm (small plastic basket) can be a useful tool for toxicity estimation at ecosystem level. This research was funded by Ministry of Land, Transport, and Maritime Affairs, Korea.

MO 330

Comparative sensitivity and recovery of structural and functional endpoints to fungicide chronic exposure in artificial streams

Y Bayona1, M Roucaute2, K Cailleaud3, A Basseres3, L Lagadic2, T Caquet2

1INRA UMR 985 (Total Petrochemicals, LRE, Rennes, France
2INRA, UMR 8958 Eco-toxicology et Qualité des Milieux Aquatiques, Rennes, France
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ECological risk assessment on aquatic ecosystems is a major concern worldwide. Ecological risk assessment is thus necessary for effective risk management. In this context, the estimation of the safe concentrations (SCs), such as predicted no effect concentra- tion (PNEC) and the no observed adverse effects concentration (NOAEC), is likely to be avoided, is critical. Although these concentrations are usually determined from labora- tory toxicity tests to assess effects on individual-level traits, the real goals of ecological risk man- agement are to protect populations, communities, and ecosystems in the natural environment. Information on our model induced effect can therefore provide useful insights into the SCs in the natural systems. Despite previous studies evaluating the effects of heavy metals on aquatic organisms, knowledge useful for estimating the safe concentrations is limited. We estimated SCs of heavy metals (copper, zinc, cadmium, and manganese) from macroin- vertebrate tests performed over 400 days in the laboratory. Results were used to determine the PNEC, a sensitive and widely used tool in risk assessment. While the PNEC for surface water is derived from the HC5 calculated as the 5th percentile of the species sensitivity distribution (SSD) based on chronic EC10/NOEC values for 31 species divided by an assess- ment factor (AF) of 2. Because the HC5 is derived using the Biotic Ligand Model (BLM), it also accounts for species-specific bioavailability. In a 4-month mesocosm study (Fraunhofer 2010), the BLM-based Ni HC5 value, based on the chemical of the mesocosm test water, was 3.5 to 5.7 fold lower than the multispecies NOEC. Accordingly, an additional AF would not be required for the HC5 to be protective of the community NOEC. In a field study in the UK (WCA Environmental 2009) HC5 concentrations related to contaminated benthic macroinvertebrate indices indicated that deterioration in ecological quality is unlikely to occur at the HC5 Ni concentration. Of 632 sites in the Forum of European Geological Surveys (FORS) database where Ni concentrations were measured, none of those were below dissolved organic carbon, pH, and hardness measurements were within the calibration range of the Ni BLM, just 1% had an ambient Ni concentration exceeding the HC5, while 7% had ambient concentrations exceeding the HC5 divided by two. De Vries et al. (2010) concluded that the HC5 level, for any chemical stressor, is a protective threshold for changes in biodiversity, as defined by species richness and heterogeneity, and noted that changes in concentrations at and below the HC5 would not be detectable. Given the resource function ecosystem, coupled with the protective nature of the Ni HC5 when compared to mesocosm- and field-based effects data, we conclude that the use of a factor as an aquatic effects assessment is sufficiently understood, and that the HC5 provides an adequate level of protection for freshwater systems.

MO 331

Benthic microcosms: tool for toxicity estimation on ecosystem level

MO 333

Ecotoxicology study of new butachlor CS formulation in Korean rice paddy field

Dongja Han et al., South Korea

Acute toxicity study was performed by test guidelines of Rural Development Administration, Korea. Butachlor is an herbicide which is widely used to control rice weeds which was divided to 3 plots(each plot 2.5 x 40 m). Each plot contains 5 cages with 20 oriental weedhopper. Mortality and abnor- mal behaviour were under the criteria of observation for 23 days after the application of butachlor CS formulation. During the experiment, paddy water and soil were sampled and analyzed. Agri- cultural field study was performed at the conventional rice cultivation conditions. The paddy field(1500m2) was divided to 3 plot(500m2), sprayed butachlor CS formulation and Harvarded from laboratory toxicity tests, most of these laboratory-based SCs overlapped with our estimates. To our knowledge, this is the first study to estimate the SCs from geographically widespread field data on macroinvertebrate surveys.
were 10 cages with 10 weatherfish, and 900 out of cages. Bird netting was set to protecting from
at the same time, and then planted rice. Each test plot contained 1000 oriental weatherfish which
after the treatment of butachlor CS formulation. During the experiment, paddy water and soil
were sampled and analyzed. According to results of the acute toxicity study, butachlor CS formu-
lization was less toxic as compared to already-in-use product. Cumulative mortality of butachlor CS formulation in semi-field study was resulted in significantly lowered to 5% com-
pared to that of 64 ~ 97% of already-in-use product. In agricultural field study, the cumulative
mortality of oriental weatherfish was 0% in the case of butachlor CS formulation. In conclusion,
new developed butachlor CS formulation was very low ecological risk to the oriental weatherfish.

MO 335
Ecological diagnosis of pollution impacts by weight of evidence
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A recent survey of sediment quality in Melbourne and the Yarra Valley found elevated concentra-
tions of a range of contaminants. Because contamination occurs in a mixture of chemicals and
guideline concentrations exist for few of the detected pesticides, predicting the ecological impact
of contaminated sediment is a complex issue. We applied a weight of evidence approach to three
complementary sediment toxicity bioassays to diagnose both the severity and type of ecological
impact. We measured community compositional change in a field dataset by comparing 47 species
rates in wild Chironomus spp, and growth, emergence and survival in laboratory-reared C. tep-
peri. The field microcosm bioassay provided an ecologically relevant benchmark by estimating the
impact of sediment pollution on invertebrate community composition. Pesticides and heavy met-
als were linked with two distinct types of microcosm community change. In wild Chironomus spp, heavy metals were specifically associated with mummified deformities, while pesticides were as-
associated with deformities of the pectin epipharanges. Sites where impacts were identified by both
laboratory C. tepperi bioassay and wild Chironomus spp deformity rates tended to also display concentra-
tions of other contaminants. The results of the bioassay appear consistent with the hypothesis that the
most sensitive of the three bioassays, deformities suggested more severe toxicity, and microcosm
community change indicated the most severe toxicity. The combined bioassays provide useful
evidence regarding the type of contamination responsible for the observed toxicity.

MO 336
Characterizing off-field vegetation for NTA terrestrial mesocosm studies
S Allender1
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In contrast to in-crop environments, the habitat for studies with non target arthropods in natural
off-field environments can as a matter of fact not be standardized. Because the composition of
the arthropod fauna is closely linked to the local flora there is a clear need to characterize the vegeta-
tion of off-field areas. The field monitoring program is based on the study variation in habitat
characteristics as a basis for blocking, but also to enable a future classification/comparison of off-
field studies. Here we present a simplified standard method to assess plant diversity and relative
abundance of grassland vegetation. The method involves relevés of units consisting of eight small
squares of 1 m x 1 m, representing a regular grid imposed over the study site. The data analysis uses Twin Span and correspondence analysis to quantify similarities in vegeta-
tion structure within the study site.

MO 339
Is the composition of the small mammal prey guild a factor that influences the risk to preda-
tors from anticoagulant rodenticides?
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2Queen’s University, BELFAST, United Kingdom
3The Food and Environment Research Agency, YORK, United Kingdom
4The Agri-Food and Biosciences Institute, OMAGH, United Kingdom
The small mammal prey guild in Ireland is restricted compared with that in Britain but still includes a number of species most likely to consume anticoagulant rodenticides (AR) baits, the biocides that are the most widely used globally to control rodents. We hypothesise this restricted prey guild will enhance secondary exposure of predators and the associated risk of secondary poisoning. We determined, from the presence of liver residues, the exposure of 115 voles (Vulpes vulpes) to ARs (secondarily) and a test population of anticoagulant rodenticides) that were shot or killed by
traffic in Northern Ireland (NI). Exposure to the more toxic ARs, Bocouamen and brodifacoum, was more prevalent than in foxes elsewhere in the UK and reflect greater use of these com-
pounds by farmers in NI. Exposure to ARs generally was greater (% of animals exposed and/or
magnitude of residues) in lowland than upland animals, probably due to greater availability and
consumption of AR-contaminated small mammals in lowland habitats. Overall, 84% of the foxes
tested had detectable liver residues and exposure was greater or similar to that in samples of foxes
from Scotland and from England and Wales, despite the British samples being biased towards
smaller, more anticoagulant poisoned animals. High AR exposure in NI is most likely explained by greater predation
of commensal rodents and those non-target species most likely to take AR baits. Our data are
consistent with the hypothesis that the reliance of small mammal predators in Ireland on a
restricted prey guild enhances their exposure to ARs. We argue that Ireland may be a sentinel for
the UK in terms of likelihood of AR-mediated effects on predator populations.

MO 541
Harmonising the exposure assessments for rodenticides: finalising the revision of the Emis-
sion Scenario Document for PT14
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The first active substances for biocidal products of the first priority list (product types 8 and 14)
have been included in Annex I of the Biocidal Product Directive in order to be assessed for their potential
ecotoxicological effects. The Directive, which aims at minimising the risk to human and animal health
and the environment, has been evaluated for only a small number of active substances. In addition,
the evaluation methodology requires the determination of: leaching rates from treated wood, exposure rates,
and environmental effects. The aim of this study is to refine the exposure assessment methodology
for the first active substances for product types 8 and 14 as far as possible. The exposure assess-
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ment methodology requires the determination of: leaching rates from treated wood, exposure rates,
Furthermore, we also tested one substance, triclosan, on a natural microbial community, which had significant reduction in the consumption rate of Gammarus pales when fed tebuconazole-exposed leaf material.

**MO 344**

**Fungal community structure and functioning in arable and non-arable streams**

S. Kosol, L. Maltby

1Roskilde University, ROSKILDE, Denmark
2Department of Environmental, Social and Spatial Change, ROSKILDE, Denmark
3University of Zagreb, ZAGREB, Croatia

Due to their high commercial value exotic freshwater crayfish have been introduced to many freshwater ecosystems. Being very mobile and able to escape designated water bodies over land contact, crayfish are spread far beyond their original point of introduction. Today almost every country harbors at least one species of exotic crayfish.

**MO 345**

The effects of three pesticides on the growth of Euglypha rotunda (Rhizaria; Euglymphila): is this species a good bioindicator?**

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In this study we investigated the effects of pesticides on a common soil testate amoeba species (Euglypha rotunda). E. rotunda and other free-living Euglypha soil protists play important ecological roles in the soil microbial loop as bacterial predator and in the cycling of silica. However, the consumption of leaf material by shredders was increased when leaf material was conditioned in arable streams.

**MO 346**

The length of the interval between repeated pulses influence the effect of the pesticide permethrin on Hyalella azteca?**

S. Richardson, V. Poulsen

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3Department of Environmental, Social and Spatial Change, ROSKILDE, Denmark

Exposure of non-target aquatic organisms to pesticides is likely to occur in short pulses following periods of slow run-off, spray drift, or pesticide application. The effects test for acute effects assessment are primarily based on continuous and maintained exposure periods of 24 to 96 hours, there is a mismatch between laboratory and field exposure design. This has potential implications for standard risk assessments and could result in over- or underestimation of risk.

**MO 347**

Invasive freshwater crayfish: a new ecosystem component and its challenge to risk assessment**

J. Rothschild, N. Galic, S. Hudina

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2Alterra, Wageningen UR, WAGENINGEN, The Netherlands
3University of Zagreb, ZAGREB, Croatia

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**MO 348**

Population-level effects of spinoad and Bacillus thuringiensis israelensis in Daphnia magna: comparison of laboratory and field microcosm exposure conditions**

C. Duchet, MAC Coutelle, E. Fabre, Arx, C. Lagnague, L. Lagadic

1EID Méditerranée, MONTPELLIER CEDEX 4, France
2INRA, RENNES, France
3INP, MARSEILLE, France

Although being hardy creatures, its large size and aggressive territorial behavior make most crayfish challenging test subjects in the laboratory. In this poster we present several tried techniques used in crayfish testing and provide solutions covering the challenges crayfish pose to risk assessment.

**MO 350**

Database compilation on pesticide ecotoxicological tier 1 study endpoints using IUCLID 5.2 as data entry software**

K.M Niemietz, J. Richardson, V. Croce, S. Barmaz, S. Marconcini, C. Neri, S. Bompas

1EFSA European Food Safety Authority, PARMA, Italy
2INPE, SEB, Bopp, K. Niemietz, S. Suci
3ChemService S.r.l, NOVATE MILANESI (MI), Italy

In 2009, EFSA PPR Panel has been responsible for the update and development of EU Guidance Document (GD) for risk assessment of plant protection products. Since 2010, the PPR Panel has been responsible for the update of the GD on Terrestrial Ecotoxicology. An update on the ongoing work, as well as an outlook of ongoing activities in the PPR Panel, will be given:

- Revision of the GD on Persistence in Soil, New gd on Emission from Protected crop system (Greenhouses and Covered crops), Revision of the GD on Aquatic Ecotoxicology and the Revise the GD on Terrestrial Ecotoxicology.

Besides the update and expected time-frames for the ongoing activities, an outlook for upcoming requests for revision or new GdD and Opinions will be presented.

**MO 351**

Status of guidance documents for environmental risk assessment of plant protection products at EFSA**

E. Mogema, S. Bopp, K. Niemietz, S. Suci

European Food Safety Authority, PARMA, Italy

Since 2006, EFSA PPR Panel has been responsible for the update and development of EU Guidance Documents (GDs) for risk assessment of Plant Protection Products. Since October 2008, the EFSA Pesticide Steering Committee (consisting of Member States, the Commission and EFSA representatives) has been responsible for setting priorities for needs of new Guidance or updating existing GDs for risk assessment of Plant Protection Products (PPPs).

A status update on ongoing work, as well as an outlook of ongoing activities in the PPR Panel, will be given:

- Revision of the GD on Soil Persistence, New gd on Emission from Protected crop system (Greenhouses and Covered crops), Revision of the GD on Aquatic Ecotoxicology and the Revision of the GD on Terrestrial Ecotoxicology.

The database contains all available tier 1 study endpoints for aquatic organisms, bees, non target arthropods, non target plants and soil organisms, for the datasets where higher tier ecotoxicology data for any of these taxa is available. The datasets deal with 272 datasets corresponding to 104 active ingredients and 123 PPPs. The data has been collated using IUCLID 5.2 software which has a data structure based on the OECD harmonised template for reporting chemical test summaries. This option was selected since the harmonised template is an international standard which is extensively used as a test organism and is generally sensitive to contaminants.

H. azteca was exposed to two repeated pulses of one hour each with different intervals between the two pulses. The nominal exposure concentrations were 0, 0.3 or 0.9 µg/L, and the intervals between the pulses were 0, 6, 24, 48 or 144 hours. After each pulse the organisms were transferred to clean water. Survival was recorded immediately after the pulses and again after 10 days from the start of the experiment.

The implications of having different intervals between pulses will be discussed.

**MO 352**

Are HC₅ values derived from toxicity tests with fish, invertebrates and primary producers protective concentrations for fungicides and bacteriocides?**

S. Kosol, R. Wijngaarden, MR Dimitrov, TCM Brock, L. Maltby

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2Alterra, Wageningen University and Research Centre, WAGENINGEN, The Netherlands
3University of Zagreb, ZAGREB, Croatia

Due to their high commercial value exotic freshwater crayfish have been introduced to many freshwater ecosystems. Being very mobile and able to escape designated water bodies over land contact, crayfish are spread far beyond their original point of introduction. Today almost every country harbors at least one species of exotic crayfish.

**MO 353**

Fungal community structure and functioning in arable and non-arable streams**

Fungal community structure and functioning in arable and non-arable streams**

S. Kosol, L. Maltby

1The University of Sheffield, SHEFFIELD, United Kingdom
2Department of Environmental, Social and Spatial Change, ROSKILDE, Denmark
3University of Zagreb, ZAGREB, Croatia

Through North America and is a common food source for birds, fish and large invertebrates. As a requisite for this, it was decided to create a database on ecotoxicological properties of many pesticides being fungicides. Here we investigate the impact of arable farming, including pesticide application, on the structure and functioning of aquatic hyphomycetes, a key group of many animals and plants are well studied, but little is known about the risk posed to fungi; despite many pesticides being fungicides. Here we investigate the impact of arable farming, including pesticide application, on the structure and functioning of aquatic hyphomycetes, a key group of organisms in ecotoxicology could potentially cause erroneous assessment of true environmental impact of pesticides and pollutants on soil biodiversity and ecosystem function. We therefore evaluated the effect of three pesticides, the herbicide glyphosate (Roundup active ingredient), the fungicide carbendazim (Carbendazim SA 60 FL active ingredient) and the insecticide thiacloprid (Alphamite active ingredient) on the growth and population dynamics of E. rotunda after exposure at following concentrations ranges: 0.1 - 10 mg/L glyphosate, 0.1 - 2 mg/L carbendazim and 10 - 1000 mg/L thiacloprid cultured in NCL 0.1% media during 21 days of incubation. The results showed that both the fungicide and the insecticide decreased the growth of E. rotunda and the herbicide increased it in all the range of concentration tested. Carbendazim caused a total growth inhibition at a concentration of 1 mg/L, and a partial growth inhibition at a concentration of 0.1 mg/L. By contrast, glyphosate, thiacloprid and carbendazim at 0.10 mg/L were not detected at 1 mg/L. These results show that E. rotunda reacts differently when exposed to different pesticides and is highly sensitive to some such as thiacloprid. We therefore suggest that it could be a good bioindicator to be tested to evaluate the effects of pesticides.
MO 351 Risk mitigation measures in the framework of the council Directive 91/414 EU

M Foudoulakis1, D Tzakos1, N Kostouros1, E Kaniastas2

MO 352 Hellenic scenarios for bird focal species: the case of the cotton fields

M Foudoulakis1, D Tzakos1, N Kostouros1, E Kaniastas1

MO 353 Foraging habitat of hedgerow bird species in arable land and its relevance to in-crop exposure to plant protection products

M Foudoulakis, N Kostouros, D Tzakos

Agricultural University of Athens, ATHENS, Greece

Hellenic Ornithological Society, ATHENS, Greece

In Europe, the risk to birds from plant protection products (PPP) needs to be evaluated under the provision of Council Directive 91/414/EEC and associated documents. In many cases, a refined risk assessment is necessary, for which the identification of actual bird species more likely to be exposed to a PPP is often a pre-requisite. While several studies have been conducted in typical crops of central temperate Europe, less information is available for crops specific for Mediterranean countries, like cotton.

In this study, we present information about bird species observed in cotton fields in two regions of Hellas (Kopaida and Larisa) in two field seasons in spring and summer using two bird survey methods (‘line transects’ and ‘point counts’).

The most frequent and abundant species found in cotton fields in the two regions were the house sparrow and the barn swallow. The crested lark was often observed in Larisa but much less frequently in Kopaida. Other candidates for focal species were yellow wagtail, European bee-eater and greater short-toed lark. Among the larger species, common kestrel and lesser kestrel (Falcoidea), carrion crow, corvidae, and Eurasian collared dove were identified as the most common species.

The selection of bird focal species for the refined risk assessment of plant protection products used in cotton is further discussed.

MO 354 Probabilistic ecological risk assessment of eleven paddy herbicides

T Zhang

National Institute for Agro-Environmental Sciences, TSUKUBA, Japan

Probabilistic ecological risk assessment of 11 herbicides, commonly used in Japanese paddy fields was conducted. The effect assessment was based on species sensitivity distribution (SSD). The assessment was performed for aquatic primary producers were collected from available literatures and then fitted into lognormal distributions. Predicted environmental concentration (PEC) was calculated using an environmental model defined by the Ministry of Environment, Japan. The regional variations of PEC were quantified using Monte Carlo analysis. A joint probability curve was derived by comparing SSD and PEC distribution, and the area under the curve was defined as expected potentially affected fraction (EPAF) for quantitative risk index. The highest EPAF was 6.2% forbensulfuron-methyl.

MO 355 Higher-tier surface water risk assessment according to ELINK

B Sur, B Koch, C Kley, E Bruns

Bayer CropScience AG, MONHEIM AM RHEIN, Germany

For a herbicide a higher-tier aquatic risk assessment was performed. One pillar was a mesocosm study. A lower-tier exposure calculation only provides a single worst-case drainage/run-off entry peak and does not take into account the duration of the exposure. It was challenged by authorities whether the exposure pattern in the mesocosm study covers the real environmental exposure situation for run-off and drainage entries with respect to peak height, duration, and area under the curve. Based on the recommendations of the ELINK workshop and using representative FOCUS surface water scenarios the suitability of the mesocosm study was demonstrated. For that purpose the exposure pattern curve was applied comparing exposure concentrations observed in the mesocosm and time-resolved PECs originating from FOCUS Surface Water Step 3 calculations. By this procedure it was shown that the exposure pattern used in the mesocosm study covers the run-off and drainage exposure patterns at any time with a safety factor of at least 4.

MO 356 New strategies in the risk assessment of plant protection products in soils

S Pinarg4, B Scholz-Staake4, JP Soussi4, S Jaeck4, J Romnik4, C Lejeune4, M Bielasik-Rosinska4, D Maciaszek4

European Commission, Joint Research Centre, SURHYSE, ISpra, Italy

3Dept. Zoology, COIMBRA, Portugal

4ECT, FLÖRSHEIM, Germany

The risk for soil organisms arising from the exposure to plant protection products (PPP) is assessed by relating the effect concentration to the calculated predicted environmental concentration in the soil matrix (PECsoil). Currently, the PECsoil calculations are based on simple assumptions, e.g. on an homogeneous distribution of the substance in the first 5 cm of the soil profile. However, since neither the distribution of PPP nor the habitat preferences of the soil organisms are taken into account, the appropriateness of this approach in the risk assessment (RA) of PPP has been questioned. The German Federal Environment Agency (UBA) is currently working on the improvement of the risk assessment procedure for soil organisms as part of the national authorisation process of PPP. In this context, a re-evaluation of literature data and of earthworm field studies has been undertaken, with the aim of corroborating the key hypotheses on which the newly developed strategy is based and to assess the implications that will arise from the implementation of the new procedure for the outcome of the risk assessment of plant protection products in soils. The methodology chosen followed these steps:

- Functional characterization of life forms of Central European soil invertebrates (e.g. oligochaetes, mesoarthropods) at crop sites regarding their exposure to PPPs - with particular regard to different exposure pathways

- Identification of “focal communities” of soil organisms regarding the exposure to PPP for combinations of crop types and tillage operations as indicators for the soil biocenosis.

- Analysis of the results of earthworm field studies with PPPs which were performed in the context of the registration of PPPs, in particular regarding of the representativeness of the respective community on the control plots, the physico-chemical properties of the test substances as well as the sensitivity of the individual life forms types.

- Indication of parameters for the derivation of the ecological relevant concentration distributions of PPPs for soil organisms based on their life form types and exposure scenarios

- Discussion of possible effects of modified exposure calculations on the interpretation of the results of ecotoxicological standard tests with soil invertebrates, including the question whether existing test designs are still appropriate or should in future be modified.

MO 357 Plant protection products authorization in Poland. Actual and future requirements.

JH Herranz, DA Auteri, FS Streissl

Institutiove of Environmental Protection National Research Institute, WARSZAW, Poland

The submitted dossiers for plant protection products should contain study reports and calculation data for active substances and their metabolites according to requirements.

MO 358 Indication of parameters for the derivation of ecological relevant exposure concentrations of active substances and their metabolites according to requirements

M Bielasik-Rosinska, D Maciaszek

Plant protection products authorization in Poland. Actual and future requirements.

Institute of Environmental Protection National Research Institute, WARSZAW, Poland

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MO 359 Regions and their implications for the regulatory risk assessment of PPPs in Europe is further discussed.

MO 356 New strategies in the risk assessment of plant protection products in soils

S Pinarg4, B Scholz-Staake4, JP Soussi4, S Jaeck4, J Romnik4, C Lejeune4, M Bielasik-Rosinska4, D Maciaszek4

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Physical and chemical properties of releasers and metabolites of their hydrolysis are essential for the risk assessment.

Assessment of predicted environmental concentration (PEC) for soil (PECSo) and surface water (PECWG) and surface water including sediments (PECWSW and PECSED) should be based on proposed use of plant protection product (GAP) and European guidelines - FOCUS Working Group Guidance Documents. According for actual requirements, for Poland there are particular requirements for ground and surface water. The calculation for PECSWG and PECSED are realized for STEP 1-2, STEP 3 and STEP 4.

For the ground water - all European scenarios are required, for the surface water - D3, D4 and R1 scenarios are obligatory. For some crops there is no scenario for D3 or D4 or R1. In that case the worst scenarios is used as representative for Poland.

In future - Poland will be treated as Central Region State and according to such requirements all information should be submitted.

If metabolites properties confirm potential hazard for environment, then additional calculations for them are necessary and required. Evaluation of submitted reports and data for each active substance and its metabolites are considered for risk assessment. The final risk assessment and decision should include all available study results and information and should be compared with proposed GAP.
MO 358

Lack of an understanding in correlating various legislations in an effort to harmonize a strategie solution to environmental risk assessment and management - The Indian experience

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The Insecticides Act, 1968 and Rules, 1971 is the major legislation which deals with the regulation of PPP’s and biosicides. However, there are other legislations which are remotely associated with this Act, but with a poor understanding of their implications in making regulation harmonized among all enacted legislations in an effort to have a more effective risk management strategy.

At present, there is an absence of risk management strategies in the country. The proposed Pesticide Management Bill 2008 too fails to address such concerns, which is still pending approval from the Lok Sabha (Parliament of India.). The paper attempts to highlight the lack of a national commitment towards a harmonized approach to evaluating risk management in the country.

MO 359


B Gollas, J Strassemeyer, V Gutsche

Julius Kühn Institute [JKI], Federal Research Centre for Cultivated Plants, KLEINMACHNOW, Germany

New EU legislation on the sustainable use of pesticides requires member states to produce ‘national action plans’ (NAP) on pesticides. The German NAP is designed to provide incentives for further risk reduction with the overall goal to reduce the risk potential by 25% until the year 2020 in relation to the risk potentials calculated for a reference period from 1996 to 2005. A core component of the NAP is the management of hot-spots. They are defined as temporally and spatially defined fields of action with increased risk associated with plant protection products. Hot spots can occur due to specific environmental conditions (e.g. high water body density, high rainfall), due to sequential use of a few specific pesticides in a specific area, high-frequent use of specific pesticides, high-frequent use of specific crop and pests-related use of a specific plant protection product over a single area in connection with other conditions, such as frequent rainfall. Hot spot detection & management follows a stepwise approach: the target of step one is a ranking of regions according to their risk potential using the indicator model SYNOPS-GIS and a subsequent in depth analysis at stream segment level for TOP regions. These in depth analysis apply probabilistic and spatial methods for more realistic exposure analysis linking critical source areas to receiving stream segments. The method requires recent regional pesticide use data, large scale soil data (1: 50 000), weather data and explicit crop locations from the land parcel identification system (LPIS) [EC No 796/2004]. Results are aggregated to watershed units recognized also by the water framework directive (WFD). This common regional backdrop assures the link between activities of the WFD with the NAP. Monitoring data collected within WFD activities are used in the second step. The activities aims at providing regional “tool box”of RMM measures in order to strengthen the voluntary cooperation of farmers in water protection at local level. As the first step a model of success is performed as the number of the selected RMM before putting those into practice. This step is a partial run through step 1. First results of the implementation of this methodological framework are collected in North Rhine-Westphalia.

MO 360

Hot-spot identification & management for surface waters in context of the German national action plan for sustainable use of pesticides: first results

J Strassemeyer, B Gollas, J Kraupme, V Gutsche

Julius Kühn-Institut, KLEINMACHNOW, Germany

Within the National Action Plan the indicator model SYNOPS is applied for the analysis and determination of hot spot areas (hot spots) associated with plant protection products. This can occur due to specific environmental conditions (e.g. high water body density, high soil porosity, steep slope), due to widespread and frequent use of a few plant protection products or due to high frequency, crop and pests-related use of a specific plant protection product over a single area in connection with other conditions, such as frequent rainfall. In this study the provisional detection of such hot spots was conducted with SYNOPS-GIS in North Rhine-Westphalia on the basis of surveys on pesticide use and weather data from 2009 and extended GIS datasets such as the ‘Land Parcel Identification System (LPIS)’. Three watersheds with hot spots were identified. Here an in depth risk analysis was conducted at the level of stream segments. The time varying concentration of the selected stream segments was analysed over the whole vegetation period considering the exposure pathways drift and run-off. A GIS evaluation on the exposure pathways and run-off pathways from critical source areas was conducted. In combination with a run-off model the initial load of the stream segments by run-off was evaluated. Drift loads were assessed with a probabilistic approach. Stream segments which exceed a certain trigger concentration were used to describe the load of the selected RMM before putting those into practice. This step is a partial run through step 1. First results of the implementation of this methodological framework are collected in North Rhine-Westphalia.

MO 361

Derivation of environmental quality standards for plant protection products: factors influencing the outcome

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4Eawag, DUEBENDORF, Switzerland
5BMG Engineering AG, SCHLIEREN, Switzerland

This study aimed to clarify the technical aspects of environmental quality standards (EQS) derived for active substances of plant protection products. In case studies using six compounds relevant for Swiss surface waters, EQS were derived according to the three guidance documents, the Lepper guidance document (Lepper 2005), the Dutch guidance document for deriving EQS (van Vlaardingen and Verbeugten 2007) and the EU draft TGD for EQS (EU 2010). The active substances were: the herbicides Diuron, Mecoprop and Terbutylazine; the fungicide Carbendazim; and the insecticides Diazinon and Imidacloprid. The EQS derivation consisted of three steps: (i) ecotoxicity data were compiled by database and literature search, (ii) the data were assessed separately for their reliability and relevance according to the guidance given in each of the three guidance documents, and (iii) EQS were derived separately according to each of the three guidance documents. Although a review of the methods showed that the guidance documents are very similar, a few modifications were derived for small different parameters in the case studies. However, the differences never exceeded a factor of 3, when the same set of data was assessed by the same hazard assessor. In contrast, the so-called “expert judgment” had a stronger influence on the EQS derivation. By comparing the derived values for different active substances it could be shown, that the results were controlled by up to a factor of 20 due to different weighting of the data or due to the choice of a different assessment factor. Finally, the data validation was identified as a very critical step in the EQS derivation. The assessment of data reliability in all three guidance documents is performed according to the Klimisch scoring system, which allows extensive expert judgment. It is therefore recommended to revise or amend the Klimisch scoring system, since it does not seem to guarantee consistent validation between hazard assessors. It should also be mentioned, that the available data was insufficient for the derivation of an EQS based on the SSD approach for all active substances considered here. This is astonishing for such relatively well-studied PPP, and raises questions regarding the future relevance of the SSD approach in EQS derivation.

MO 362

Introducing the ECOTOXTOOLS Project: ecotoxological tools for assessing agriculture associated environmental risks in Southern Europe big man-made freshwater reservoirs

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6CESAM & Instituto de Estudos Farmacêuticos, Faculdade de Farmácia, Universidade de Coimbra, COIMBRA, Portugal

The prior objectives of the Water Framework Directive for 2015 concerned on the need for implementation of risk management processes to achieve environmental quality objectives, i.e., the good ecological potential, in the so strongly modified locations from the land parcel identification system (LISP) [EC No 796/2004]. Results are aggregated to watershed units recognized also by the water framework directive (WFD). This common regional backdrop assures the link between activities of the WFD with the NAP. Monitoring data collected within WFD activities are used in the second step. The activities aims at providing regional “tool box”of RMM measures in order to strengthen the voluntary cooperation of farmers in water protection at local level. As the first step a model of success is performed as the number of the selected RMM before putting those into practice. This step is a partial run through step 1. First results of the implementation of this methodological framework are collected in North Rhine-Westphalia.

MO 363

Development of regulatory testing procedures to study the metabolism of farmed fish

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Information provided for the authorisation of a plant protection product (PPP) must be sufficient to permit the evaluation of the risks for man and (food) producing animals arising from residues of the active substance and relevant metabolites remaining in food and feed. Metabolism studies for food producing animals provide an estimate of PPP residues in edible products and help to predict when PPP is used in crops from which parts or products are fed to livestock. Metabolism studies on ruminants and poultry are a current regulatory requirement. However, due to the increasing proportion of plant derived materials in aquaculture diets, metabolism studies on freshwater fish (bream, trout or carp) will also be required when PPP of type I or II are used in crops fed to farmed fish. Metabolism studies are normally conducted with a suitable radiolabelled form of the active substance to identify the major components of the total residue and to show the efficiency of extraction procedures for these components. Following this initial assessment of the nature of the residues in food commodities, such as meat, milk and eggs, further livestock feeding studies are usually required. This use non-radiolabelled test material and a larger group of animals to provide the necessary to establish maximum residue levels for food products of animal origin. Available guidance documents on metabolism and feeding studies for fish, poultry or ruminants, usually refer to the EMMA approach for fish due to the differences in the animals’ environment and husbandry conditions. More specific guidance documents for fish are therefore necessary.

A concept for fish metabolism is described and compared with the established guidance documents for other food producing animals. The results of a study on rainbow trout, designed to assess the practicality of the experimental design and to identify further technical challenges, are presented. The methodology used in the study is anticipated to meet the needs of new regulatory guidelines, which will require an understanding of metabolism and residues in fish farmed for human consumption.

RA07 - Monitoring data and post-registration studies for PPPs: generation, compilation and use in the environmental risk assessment management
MO 367

Randomized controlled trial: effects on stock sustainability of pesticides and provision of biocontrol agents in Kenya


Objective

The objective of this study was to determine the impact of the provision of biocontrol on the sustainability of pesticides use in Kenya.

Methodology

The study was conducted in 24 villages in three districts of Kenya: Bungoma, Siaya, and Vihiga. The villages were divided into three groups: one group received pesticides only, one group received biocontrol only, and one group received both pesticides and biocontrol. The impact of the intervention was assessed by measuring the number of applications of pesticides and the number of days between applications.

Results

The results showed that the group that received both pesticides and biocontrol had the lowest number of applications and the longest interval between applications compared to the other two groups.

Conclusion

The provision of biocontrol agents can significantly reduce the sustainability of pesticides use in Kenya.

Limitation

The study was conducted in only three districts and the results may not be generalizable to other regions of Kenya.

Funding

This study was funded by the Kenya Agricultural Research Institute (KARI).

MO 370

Constraining environmental monitoring and health risk management studies - Post-regulation in INDIA

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M/s Pesticide Regulatory Affairs - INDIA, FARIBADAB [HARYANA], India

Pesticides and certain other chemicals classified as dual-use chemicals are primarily regulated by the Insecticides Act, 1968. Registration process of such chemicals are granted after adhering to a tiered evaluation process involving three stages. In the case of dual-use pesticides and particularly, once a product has been granted registration, post-registration monitoring is practically missing. Review of such chemicals take place depending upon its use pattern and subject to any international concern. However, a well planned scientific and regular post-registration is not mandatory, neither at the national or state level. This is primarily due to lack of enforcement of legislations and proper timely coordination. Communication of decisions and its implications are generally waived by various departments on the pretext of their own dedicated authority. Risk assessment in a broad sense is missing due to lack of responsibility and an commitment towards the society and nation as a whole. This issue is being faced by all the regulatory bodies and case studies will be revealed in this paper and make an attempt to give an overview of the issues involved in country where legislations are in the plentiful but enforcement and implementation are lacking.

MO 571

ASTERisk, a tool to assess the pesticide risk

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The protection of human health from exposure to pesticides is a critical issue since they are extensively used worldwide, and their potential human health risk can be evaluated through a tiered model, focusing in a first step on the intrinsic properties of the pesticides and their potential impact on the human health. The model is called ASTERisk (the acronym stands for a Tool to ASsessment the pEsticide Risk) and involves a set of toxicity and fate data, as well as ecological and landscape considerations. The tool is implemented in the Geographic Information System (GIS) and provides a spatially distributed output which can be used to support decision-making processes. The tool has been validated in the Lombardy Region, and its application has shown that it can be a valuable tool for the assessment of the potential impact of pesticides on human health and the environment.

MO 572

Assessment of lambda-cyhalothrin in vegetables: case study of Nairobi City, Kenya

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Vegetables are essential in the diet for they provide, fibre, trace minerals, vitamins, folic acid, carotenoids and protein. However, vegetable pesticide residues in vegetable products and the ingestion of vegetables can cause a number of health problems, such as allergic reactions and poisoning. The study was conducted in the Nairobi City, Kenya, and the samples included tomatoes, lettuce, and cabbage. The levels of lambda-cyhalothrin in the vegetables were analyzed by high performance liquid chromatography (HPLC). The results showed that the levels of lambda-cyhalothrin in the vegetables were below the maximum residue levels (MRLs) of 0.2 mg/kg, except in tomatoes, where the levels were above the MRLs. The study concluded that the use of lambda-cyhalothrin in vegetables is safe and does not pose a health risk to consumers.
Salute” was undertaken. It deals with activities and news related to REACH, other Regulations concerning chemicals and risk mitigation measures. The aim is to provide through a simple language adequate information for the public on risks and safe use of chemicals, dealing with specific items in each e-bulletin.

In addition to the main topic of the e-bulletin it has been prepared:

- an “Events” section about meetings, seminars, workshops on technical legal issues to chemicals;

- a News from ECHA section containing details of the main procedures of public consultation launched by ECHA (European Chemicals Agency); about proposals for and/or inclusions in the "Candidate List of Substances of Very High Concern”;

- a "Link" section.

To manage the registration and sending the newsletter a dedicated mailbox is created. The address is sostanzechimiche@miasmambiente.it.

An e-mail with the first issue of the bulletin and the registration form to receive future issues was sent to:

- Environmental organizations;
- Consumer organizations;
- Regional Environmental Protection Agencies;
- Regions (Environment and Health Departments);
- National Technical Committee for the REACH implementation;
- Regional authorities.

The Ministry should also promote activities to ensure public access to information on chemicals through the creation of databases that allow easy access to information on hazardous properties of substances.

For this purpose the database DESC (Database Ecotoxicologico sulle Sostanze Chimiche) was created. It contains the main ecotoxicological and environmental information of more than 650 chemicals manufactured and/or imported into the European market. The database is structured to be implemented and to contain an unlimited number of substances. Moreover it’s in Italian language, to facilitate consultation by not expert public.

MO 376 Magnifying Perceived Risk: how misconceptions about the importance of ethynyl estradiol (EE2) in the overall endocrine disruptor issue is driving misguided risk management decisions

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"Selective" reporting and exaggeration have resulted in undue concern over environmental presence of EE2. Inaccurate or snapshot field measurements used as ‘environmentally-relevant’ test concentrations in laboratory studies, biomarker detection (i.e., vitellogenin in male fish) incorrectly reported as effect, and field experiments using confined exposure (i.e., lake) being inappropriately extrapolated to surface water (river) risk assessments have all contributed to the misconception that EE2 exposure is of great consequence to wildlife and humans.

With the media always placing contraceptives at the top of the list when discussing the endocrine issue, the regulatory community is being swayed to take unwarranted risk management actions with potentially costly consequence. A detailed review of monitoring and effect data show that fish populations are predominantly sensitive predicted no effect concentrations and that human exposures are miniscule when compared to other estrogens in the diet. All of which support the contention that undue attention is being paid to EE2 and that overall estrogenic exposure is the appropriate determinant when considering this aspect of endocrine disruption.


Mastrocco, C Smith

Pfizer Inc., New York, United States of America

Through the application of a database structure designed to organize information in a highly accessible, parsed format and an automated reporting generating protocol capable of gathering, filtering, and presenting the information in a detailed, site- and substance-specific report describing inherent hazard, PBT profile, estrogenic potential, and risk-based MADLs for manufacturing facility consideration. The MADL incorporates site characteristics to transform the traditional PEC/PNEC assessment into a mass loss below which no adverse impacts are expected. Separate MADL calculations are conducted for downstream receiving waters, focusing on indigenous or representative organisms. In addition, a ‘stoplight’ risk analysis matrix is supplied to point out the parameter(s) driving the risk so that informed decisions can be made for future testing strategies.

The MADL report can be used to support site selection, WWT enhancements, or waste stream diversion. While useful for understanding individual compounds, future enhancements will consider coexisting substances to report combined risk.

MO 378 Challenges of the EU REACH regulation: a perspective from British American Tobacco (BAT)

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This poster presentation describes some of the challenges faced by BAT, in interpreting the new EU REACH regulation. Ingredients are added to the tobacco depending upon the product type and one of the main considerations is the required identity of each ingredient. To achieve this BAT is an importer and a downstream user (DSU), and not a manufacturer of such substances.

A cigarette is a “preparation in a container” with the container considered to be an “article” under the scope of REACH. “Articles” include tobacco materials such as cigarette papers and filters, manufactured in (or imported into) the EU for use of end users (i.e., consumers). The requirement to define preparations or packaging may require registration depending on the criteria defined in the regulation for example if they are present in quantities exceeding one tonne per producer or importer per year. REACH also identifies specific exemptions as defined in Article 2, Annex IV and Annex V.

A REACH evaluation process has been developed within the REACH Research & Development (GR&D) as a simple and effective method for identifying REACH compliance requirements for tobacco ingredients. Key elements of the REACH screen include: 1) Annex IV exemption 2) Annex V exemption 3) Tonnage and 4) Registration and Pre-registration status. This process has been documented as a flow chart with decision codes and outcomes. Key learnings and experiences of implementing the REACH screen are presented in this poster.

MO 379 Environmental risk assessment outputs for socio-economic analysis under REACH

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The outputs from environmental risk assessments (ERAs) are not the same as the “impact information” required for socio-economic analysis (SEA), making it difficult to develop and optimise the processes and Authorisations under REACH. ERA outputs are usually in the form of Risk Characterisation Ranges (RCRs), in which a PEC is divided by a PNEC. If the RCR > 1 then a presumptive risk is assumed. Here we explore the translation of an RCR into a ‘stoplight’ value into a “value”. Translating RCRs into an assessment of impact requires further, ideally quantative, information on how severe and extensive any effects are likely to be in the real world, our level of certainty about these effects, and how different risk management measures might alter this risk. ECHA has identified the following additional problems in translating ERA outputs into SEA impacts: 1) a chemical’s persistence is a key reason for concern about its presence in the environment, but this persistence makes it difficult to quantify any changes in impacts over time; 2) chemical persistence gives rise to trans-boundary issues, complicating both the quantification of effects and any attempts to value such effects (“whose values should be assumed?”); 3) an absence of environmental monitoring data (together with transport, fate and behaviour data in some cases) to establish the geographic extent of environmental concentrations above the no effect level; 4) difficulties in deriving toxicity data for sensitive species to other species or ecosystem effects; 5) combinations of sources contributing to environmental concentrations, leading to difficulties in determining how restrictions on some uses would affect concentrations in water; and 6) significant variations across the EU in the processes used, the continuous or sporadic nature of use and emissions, and in existing levels of treatment. This poster presents examples of potential ways to translate ERAs into environmental impacts which can be practically used to inform SEA and eventual decision making under REACH. These approaches include: 1) exposure-based ‘protrix’ of effect, such as changes in volumes of exposed media, as generated by potential use of USES modelling; 2) use of species sensitivity distributions (SSD) for environmental concentrations above the no effect level; 3) translation of an RCR into a ‘stoplight’ value; 4) read-across from similar substances for which there is more information; and 5) life-cycle impact assessment. This approach provides a tool to reduce the exposure of pharmaceuticals in the environment! N Amann, n Götz, n Deffner, n Rechenberg

Federal Environment Agency, Germany, DESAU-ROSSLAU, Germany

"German Society for Social-Ecological Research (UBA) and the Institute for Social-Ecological Research (ISOE) prepared recommendations for a communication strategy. The current knowledge of the specific target groups and factors, affecting the handling of pharmaceuticals has been identified, revealing that the problem of pharmaceutical residues in the environment is widely unknown. Therefore the first objective was to create profound knowledge. This sensibilisation is the basis for implementing further strategies leading to an increased awareness and better behavioural changes. Modifications will affect daily routines concerning medication such as prescription, compliance, non-medication prevention as well as patient-doctor-interaction. Moreover the results of the project clearly reveal that the knowledge, the handling and the reflection of the subject pharmaceuticals in the environment varies only between, but also within the individual groups. This means that a promising communication strategy has to be tailored to the individual needs in the specific target groups. This strategy also contains the communication of a proper medication disposal and is intended to promote the return of all unused medication by implementing a feasible take-back scheme. The study is expected to emphasise that under any circumstances pharmaceuticals should not be flushed down the toilet or the sink and by this get into the water circle. Based on an analysis of typical shortcomings in available publications, the project compiled recommendations for conceptualizing information material.

MO 381 Chemical risk communication from the ecospheres perspective: legislative preconditions and needs for more information according to law

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Ecodesign or design for the environment is a systematic approach to reduce environmental impacts of products and to achieve higher protection standards than set by law. The chemicals legislation of the European Union is seen as one of the most advanced in the world regarding protection of human health and environment. REACH – Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals enhances risk communication, as supply chain and manufacturer have to generate all chemicals safety informations (e.g., feeds, the information needed for communicating chemicals’ risks down the supply stream including classification, labeling and safety data sheets as required by the regulation on CLP (Classification - Labelling - Packaging) according to GHS (Globally Harmonized System of Classification). The main responsibility about chemicals’ safety is placed on the industry; however, the most dangerous chemicals are restricted and banned in a transparent and systematic way. Are the risk assessment measures upstream sufficient for the ecospheres? It is needed to judge upon chemical risks of the non-chemical products during design phase to achieve higher standards for the environmental and human health protection?

This study indicates the benefits from the REACH system for the ecospheres, as well as highlights the needs for an enhanced risk communication on the supply chain compared to the current legislative requirements, especially regarding the materials: intended content of chemicals and risks of impurities. For example, in order to demonstrate compliance with environmental labeling criteria, very detailed information about the chemicals contained in materials is required.

MO 382 A scheme for the analysis of the results and dissemination and exploitation activities of in silico models

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ORCHESTRA (Organising dissemination on results of projects on Chemical evaluation and prediction, including risk assessment) is a project funded by the European Commission,
aimed to discover and exploit the European research activities dealing with computer models for the environment. Nine EC funded projects have been done as case studies to develop and apply a dissemination/exploitation strategy for in silico models promotion. Each of these projects produced (or is producing) results and developed a dissemination and exploitation plan. In order to improve the dissemination and exploitation strategies, the selected projects have been analysed, from the point of view of the goodness and importance of the results produced and then how they have disseminated these results. Then, the outcome of this analysis has been used to try to evaluate and explain the impact obtained by the considered research activities. Thus, the target of this is not to identify a winner project, regarding results or dissemination strategy. On the contrary, the target is to identify good results and, on the basis of these examples, learn from success stories, but also on not optimal experience done within these nine projects. The lesson we will get will be obtained on the basis of the comparison of what has been achieved. The overall, improved, strategy for dissemination is the final goal. On the basis of this analysis, the ways which are more suitable to achieve a broad dissemination and use of in silico models will be identified. This involves suitable communication ways and strategies, and also evaluation of the user’s need. We will describe the in silico tools which appeared more promising for this, and the reasons which produced the higher possibility of dissemination.

MO 383
Stakeholder perceptions of opportunities and challenges for the use of in silico methods in Europe
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In assessing the impact of biocides on the environment, specific measures to reduce a risk to the environmental compartments may be required. The evaluation of biocidal active substances up to now showed that the Rapporteur Member States have followed different approaches of risk mitigation measures (RMM). For the environmental risk assessment a harmonisation of possible RMM is missing. This research project contributes to establish RMM required for a harmonised assessment of biocidal products in the EU and compiles appropriate solutions to prevent/reduce the identified risks to the environment. This is elaborated exemplarily for two used as food preservatives and for the control of insects. Therefore RMM proposed by producers, industrial/ professional users, and authorities are collected and critically evaluated in terms of practicability and efficiency. This project focuses on the mitigation of environmental risks. This project is performed in cooperation with stakeholders and authorities. The Inclusion Directives are based on the intended uses and a representative biocidal product, which might not cover all applications. Product integrated RMM implemented during product development, design, and distribution are immediately practicable while those referring to the use of biocidal products mainly depend on the communication of risks, risk awareness, education, specific training and on the information availability. However, apart from RMM being addressed in regulatory decisions, a broader strategy of sustainable use of biocides is required. Further, little information is available on the efficiency of RRM since e.g. only few monitoring data for active substances in the receiving environmental compartments exist. More specific RMM may be included in the authorisations of biocidal products when full information on the formulation and the conditions of use are available.

RA 14 - Waste fluxes around the world and the associated risks

MO 389
Assessing the potential for the upstream control of contaminants present in materials spread to land
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The Food and Environment Research Agency (Fera), YORK, United Kingdom
In silico tests are used to model the in vitro tests are used to model the ways in which a chemical behaves in the body and in the environment. The toxicity of a particular chemical used in a particular setting can be predicted and assessed without further tests on animals or living cells.

Development of in silico models may generate a more sophisticated and more reliable understand ing in the future of how a chemical may affect humans and the environment. In silico methods inevitably have limitations as well as potential. The limitations must be clarified in order to ensure that these are used wisely and are adequately supervised and regulated.

The EU has funded the ORCHESTRA project (2009-12) to promote wider understanding, awareness and appropriate use of in silico methods. ORCHESTRA will support good practice and regulation by bringing together EU research on in silico methods and practical feedback from industry. The project will become a central repository for sharing the knowledge and experience between professionals who are developing and using in silico models. For industry users and regulators, it will also provide downloadable software for in silico models reviewed by the project.

The experience of applying in silico methods to respond to regulatory requirements is built up on a case-by-case basis. Both industry and regulators are learning by doing. Dialogue is needed between researchers, stakeholders and regulators to identify zones of uncertainty and success. ORCHESTRA will be a platform for stakeholders to share best practice and experiences.

MO 384
IFRA environmental standards: risk and hazard assessment update for 2011
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In 2010, the International Fragrance Association expanded the fragrance industry’s self-regulatory program with the development of IFRA Environmental Standards for both risk and hazard in 2008. Fragrance material risk assessments for these Standards are incorporated in the Research Institute for Fragrance Materials’ (RIFM) testing program coordination with its Expert Panel. The development of this program was reported previously at SETAC (Seville, 2010). To identify materials for risk assessment refinement, fragrance materials were screened using the RIFM Environmental framework and 2008 IFRA volume of use survey as reported for both Europe and North America. The project included the following:

1. Identification of specific substances in the circular economy is an actual risk or a perceived risk.
2. Barriers to the use of in silico methods
3. Professional and policy needs
4. Stakeholders’ sound information on methods in toxicology.

The poster reports and analyzes responses received until April 2011, and highlights responsive actions taken in the context of ORCHESTRA.

MO 385
Complexity of regulatory enforcement under various legislations and effective communication of possible environmental impact and hindrances in addressing public awareness
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The characterization and quantification of uncertainty and variability in health risk assessment are important to prevent erroneous inferences in multimedia modelling and exposure assessment, which may lead to major environmental policy implications. Health risk assessment calculations require a better understanding of exposure variables and uncertainty associated with them. Although there are many sources of uncertainty in system models, two basic kinds of parametric uncertainty are fundamentally different from each other: natural/stochastic and epistemic uncertainty. Natural uncertainty is defined as the variability that is inherent to the system, and that cannot be influenced by the modeler. Stochastic uncertainty is defined as the variability that is introduced by the modeler as a result of imperfect knowledge or lack of data. In the current paper, the potential of applying Latin Hypercube Sampling (FLHS), a hybrid approach for incorporating epistemic and stochastic uncertainties separately. An important property of this technique is its ability to merge inexact generated data of the LHS approach to increase the quality of information. The FLHS technique ensures that the entire range of each variable is sampled with proper incorporation of uncertainty and variability. A fuzzified statistical summary of the model results produces a detailed sensitivity analysis, which relates the effects of variability and uncertainty of input variables to model predic-
tions. The feasibility of the method has been tested with a case study, analyzing total variance in the calculation of incremental lifetime risks due to polychlorinated dibenzo-p-dioxins and dibenzo furans (PCDD/Fs) for the residents living in the surrounding of a municipal solid waste incinerator (MSWt) in Spain. The results showed that FLHS clearly separates controllable and uncontrollable uncertainty associated with models, which helps the models and decision makers to identify the priority area in order to improve the result.

MO 393
Local laboratory reagent exchange network
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The experimental work performed in laboratories use many chemicals with different characteristics. Some of them presents several dangers that can affect people that work in the laboratory and also the environment if they are not carefully used and managed. The wastes produced can also be dangerous and demand careful attention.

In many laboratories there are reagents that are rarely used and that become out of date and create a problem of waste management since they must be correctly disposed. In order to prevent these problems we develop a computational application (website) for promoting the exchange of reagents between laboratories.

This Local Laboratory Reactant Exchange Network is useful to perform a sustainable management of a laboratory since it allows the adoption of suitable strategies to deal with reagents and waste from its original location, which can be transferred to the same laboratory or to waste to the social and environmental advantages. In spite of the quantities are relatively small the risk associated with some of the reagents/wastes raises the problem of its correct management. A good management will contribute to the ecosystems protection. In this way it will be possible to maintain or increase the quality of life since it decreases with the degradation of the ecosystems.

The development and implementation of this computational application is important to achieve a sustainable management of laboratories since it improves the laboratory operational, economical, social and safety performance. It will allow a better use of resources and will contribute to the prevention of chemical waste generation.

MO 394
Panorama of the lubricating oil sector and recycling in Brazil
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Federal University of Rio de Janeiro, RIO DE JANEIRO, Brazil
The Brazilian market for basic lubricants oils is the worlds sixth largest. The present paper analyzes sector and presents its current panorama, identifies some of the main trends and evaluate the main problems related to lubricants recycling. The lubricating oils sector analyzes this sector and succinctly presents its current panorama, identifying the market structure, productive chain, actors and balance of production versus recycling. The feedstock oils in the sector come from three streams: the basic oil produced at three of the refineries operated by Petrobras, the state-controlled oil company; the bio-lubricant derived from the biodiesel, and the bio-based oils from vegetable oils.

A good advance had been made in this respect in Brazil, there is still room for further improvement, particularly regarding quantitative and qualitative monitoring of the lubricant market. There is a need to provide consolidated official data representing the entire market. In this sense, it is necessary to invest in research to develop a life cycle assessment of lubricants, to allow obtaining consistent and reproducible results.

MO 395
Methane-bearing rock waste
V Poliduk
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Waste rock in coal mining is the overburden material that is excavated and disposed of in order to access valuable reserves of combustible mineral fuel. Rock waste as natural stone (sandstone and limestone) is used as building material and, therefore, it can be exported to other countries. The sandstone and limestone are applied as aggregates, ornamental and dimension stones. Some sandstones and limestones are methane-bearing. After methane-bearing waste rock has been excavated from its original location, it is important to evaluate the methane but also from the waste to the atmosphere. Methane is greenhouse gas that remains in the atmosphere and is over 20 times more effective in trapping heat in the atmosphere than carbon dioxide. Methane poisoning, fire and explosion can occur when methane concentration on the ground surface reaches a potentially dangerous value. In this study, duration of methane release of a waste rock pile, (i) from a 21-day fathead minnow fecundity study using a mixture of an EDC, ethynodiol diacetate (EDA) and a chlorinated PAH, naphthalene, and (ii) to apply it in two-factor experiments with both stressors

In the present work a small-scale terrestrial ecosystem (“STEM”) containing a Mediterranean agricultural soil was used to survey the effects of the combination of the herbicide glyphosate and the insecticide dimethoate, mimicking realistic scenarios of exposure. Earthworms (Eisenia andrei), isopods (Porcellionides pruinatus), turnip seeds (Brassica rapa) and bair-lamina strips were placed in the STEM. The results showed that the recommended field dose (10 kg ha-1) of both pesticides did not damage the plant, at least under the conditions of life and growth, and the presence of reagent exchange networks in local laboratories can be a problem of waste management since they must be correctly disposed. In order to prevent these problems we develop a computational application (website) for promoting the exchange of reagents between laboratories. This Local Laboratory Reactant Exchange Network is useful to perform a sustainable management of a laboratory since it allows the adoption of suitable strategies to deal with reagents and waste from its original location, which can be transferred to the same laboratory or to waste to the social and environmental advantages. In spite of the quantities are relatively small the risk associated with some of the reagents/wastes raises the problem of its correct management. A good management will contribute to the ecosystems protection. In this way it will be possible to maintain or increase the quality of life since it decreases with the degradation of the ecosystems.

The development and implementation of this computational application is important to achieve a sustainable management of laboratories since it improves the laboratory operational, economical, social and safety performance. It will allow a better use of resources and will contribute to the prevention of chemical waste generation.

TU 003
Evaluation of the joint effect of glyphosate and dime-thoate using a small-scale terrestrial ecosystem
M-Sampaio, R-Morgado, NGG-Ferreira, AMVM-Soures, S-Loureiro
TU 003
In the present work a small-scale terrestrial ecosystem (“STEM”) containing a Mediterranean agricultural soil was used to survey the effects of the combination of the herbicide glyphosate and the insecticide dimethoate, mimicking realistic scenarios of exposure. Earthworms (Eisenia andrei), isopods (Porcellionides pruinatus), turnip seeds (Brassica rapa) and bair-lamina strips were placed in the STEM. The results showed that the recommended field dose (10 kg ha-1) of both pesticides did not damage the plant, at least under the conditions of life and growth.

The mixture performed showed that according to the independent action model antagonism (smaller effect than expected from the single exposures) was observed in both the shoot length and fresh weight of B. rapa. There was a decrease in the earthworm’s weight in all concentrations tested, although no statistical differences were observed in any of the treatments made. Regarding the isopods, a distribution of the field dose and initial weight of the field dose of two pesticides, antagonism was observed whereas in the highest concentrations tested (10 times the field dose of both pesticides) synergism took place (worst escape more than predicted from the single exposures made). In all the binary mixtures performed a decrease in feeding activity (baia-lamina consumption) of the soil fauna was observed. Biomarkers (Catalase, ACETG) assessed in the isopod led to a decrease in the enzymatic activity in the animals exposed to the highest concentrations of dimethoate and to the binary mixtures performed.

TU 004
Applying a novel experimental system for the independent control of chemical and drought stress
M Schmidt, M-Holmstrup, KEC-Smith, P Mayer
National Environmental Research Institute, Aarhus University, ROSKILDE, Denmark
In their natural habitat, soil organisms are not only exposed to different contaminants but also to a wide range of physical, chemical and biological stressors. The physical and chemical conditions in the soil greatly affect the activity of the contaminants present, and new experimental systems are required in order to be able to test effects caused by multiple stressors. The aims of this study were (i) to develop a novel experimental system for the independent control of both chemical and drought stress and (ii) to apply it in two-factor experiments with both stressors. This study used two single stressors (i) the insecticide imidacloprid was carried out in the indoor stream mesocosms of the Federal Environment Agency, BERLIN, Germany
TU 006 Effects of ultraviolet radiation on terrestrial isopod Porcellio scaber (Crustacea, Isopoda) in three simulated environments
RGC Morego, NGC Ferrere, FA Ribeiro, AMMV Soares, NLoureiro
University of Aveiro, AVEIRO, Portugal
Nowadays climate changes are introducing extra stress to the environment. UV radiation reaching ecosystems is increasing due to ozone depletion and deleterious effects are expected to happen to organisms. In this work, the effects of high doses of ultraviolet (UV) radiation to the terrestrial isopod Porcellio scaber were investigated in three simulated environments. Organisms were exposed to two hours of visible light followed by eight hours of UV radiation and another four hours of visible light. After that, they were kept for recovery in a climatic chamber at natural light and temperature conditions. To evaluate isopod stress levels, the activity of the biomarkers acetylcholinesterase (AChE), glutathione S-transferases (GST), catalase (CAT), glutathione peroxidase (GPx), lactate dehydrogenase (LDH), lipid peroxidation (LPO), oxidized glutathione and reduced glutathione (GSH/GSSG) ratio was analyzed at the end of exposure, and after 24, 96th, and 7 days. Despite the behavioral responses observed during the exposure, no significant mortality was registered. Significant differences in biomarkers results were observed mainly on those related with oxidative stress (e.g. LPO increased during the recovery time). The results obtained highlight the value of biomarkers to assess the levels of stress on sub-lethal exposure to UV radiation.

TU 007 Potential of the European bullhead (Cottus sp.) to assess the effects of pollution using a set of biomarkers
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1LABERCA - ONIRIS, NANTES, France
2CEPB - Centre for Pharmacological Studies, COIMBRA, Portugal
The European bullheads were sampled, in the North of France, between September and October 2008 at seven estuaries. The aim of this study is to characterize the potential of the European bullhead (Cottus sp.) as sentinel fish species to monitor pollution. In order to measure multiple biomarkers response in freshwater ecosystems, numerous wild fish species have been used. However, the geographical distribution of these extensively characterized fish species did not allow a large sampling for ecotoxicological application and justifies the research of novel sentinel species for biomonitoring. The aim of this study is to show the potentiality of the European bullhead (Cottus sp.) as sentinel fish species to assess the effects of pollution using a set of biochemical biomarkers. This fish is widespread throughout Europe, and it is sedentary fish that allows assessing local disturbances conveniently to migrate from the polluted area to a better localized area or to die. This fish is characterized by the presence of enzymes involved in biotransformation pathways (i.e. 7-ethoxyresorufin-O-deethylase, EROD), oxidative stress (i.e glutathione peroxidase, GPx and lipoperoxidation, TBARS) and neurotoxic parameters (i.e acetylcholinesterase, AChE). To evaluate the potential of European bullhead for biomonitoring, laboratory and field experiments exposed to β-naphtoflavone (BNF), fenitrothion and copper in order to evaluate respectively EROD, AChE and GPx activities as well as TBARS data. BNF generated a rapid induction of liver EROD activity in bullhead. Feinitrothion had no effect on the AChE activities. In field, wild bullheads were sampled, in the North of France, between September and October 2008 at seven sites considered as a benchmark by the Water Framework Directive, and five contaminated sites. The selected set of biomarkers was measured in fish from sites exhibiting various contamination levels to evaluate discriminant power of this tool and to characterize response profiles in a multi-contamination context. The response profile of AChE allowed a good discrimination between reference area exhibiting low AChE levels and contaminated sites with high AChE levels.

TU 011 Occurrence of antifouling biocides in two Italian marine systems and comparison with previous monitoring surveys
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Occurrence of antifouling (AF) paints are used to prevent the attachment of living organisms to submerged surfaces of ships, boats and aquatic structures, usually by release of biocides. The serious environmental problems caused in aquatic ecosystems by extensive use of organotin compounds (e.g. tributyltin, TBT) drove to a global ban of TBT based paints for all vessels. Alternative products were developed by paint manufacturers and usually contain Cu(II) compounds as main biocide, but this component was ineffective against some algae and diatoms; hence AF properties were enhanced by the addition of “booster” biocides. Recently in some European countries (UK, Denmark, Sweden and the Netherlands) legislative restrictions have been introduced concerning use of two popular biocides iargol 1051 and diazon in vessel paints, due to the adverse environmental persistence and toxicity. This measure did show a positive effect in decreasing levels of these antifoulants found in sensitive UK coastal ar- eas. However, in the Mediterranean, regulations about the use of AF paints have not been enforced. As a result, the effect of these control measures on Italian market of AF paints cannot be ruled out because of the production at multinational level. This work was designed to strike clarifications previously investigated inside the Gulf of Napoli to determine whether environmental concentrations of four common booster biocides (iargol 1951, diuron, dichlofluanid and chlorothalonid) had significantly altered over a five year period. Analytical results showed that actual concentrations of diuron declined substantially on average to 10% compared with those recorded during 2005 monitoring survey, on the other hand the concentrations of iargol 1051 were found similar to those detected in the previous survey. Monitor- ing data were based on the interpretation of active ingredients contained in the paints on sale in Italy. Spatial and temporal patterns of these compounds in seawater were investigated. Other booster biocides screened for (diuron, dichlofluanid and chlorothalonid) were below level of detection in all samples and this concurs with their environmental fate. The presence of organotin compounds in the aquatic environment of Gulf of Napoli were also investigated, and the low concentrations we found suggested that these banned compounds were not detected is used for vessel hull protection. Moreover a parallel survey on alternative biocides and TBT was carried out in a different marine system that is Gulf of La Spezia.

TU 012 PCBs in the Mondego Estuary (Portugal): a preliminary survey
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The Mondego River flows along 227 km, draining the largest hydrological basin entirely comprised in the Portuguese territory. During its course, it runs through rural as well as highly urbanized areas. The river basin is home to 1,600 ha of estuarine area. The Mondego River basin supports over half a million inhabitants and as a result the estuary has consequently been subjected to a strong anthropogenic pressure. Over the last 15 years, applied research has been conducted in the Mondego Estuary, preparing a Scientific and Research Dataset on several areas and an insight into the pollution levels of the ecosystem. However, in spite of the environmental persistence and toxicity of PCBs, the information available on their levels in the estuary is scarce and limited to sediment samples. Therefore, the present study aimed to report the occurrence of the twelve PCB congeners designated as toxic by the World Health Organization (non-ortho PCBs 77, 81, 126, 169; mono-ortho PCBs 105, 114, 118, 123, 156, 157, 167, 189) and the six indicator congeners (PCBs 28, 102, 110, 138, 153, 180) in sediment and biota from the Mondego Estuary. PCB levels were measured by a high resolution chromatograph - high resolution mass spec- trometry (HRGC/HRMS) in samples collected in November 2009 from the Mondego Estuary. Concentration in sediment on a dry weight basis was 199.23 µg g-1 dw for the sum of diisoe-thyl PCBs (Σ2-PCBs) and 1127.25 µg g-1 dw for the sum of indicator PCBs (Σ2-PCBs). Regarding biota, Σ2-PCBs concentration on a wet weight basis ranged from 6.15 to 2807.97 µg g-1 dw in invertebrates (Paracentrotus lividus and Scrobicularia plana) and 1.25-132.86 µg g-1 dw in fishes (Anguilla anguilla, labrax). Fish samples (A. anguilla, labrax and common sole Solea solea) presented higher lipoidal normalised PCBs levels than those of benthic invertebrates (sculpis Cottidae, oyster Crassostrea edule, clam Scrobicularia plana and ragworm Nereis diversicolor). In general, the Σ2-PCBs profiles of the different matrices showed a predominance of the mono-ortho PCBs 118 and PCB 105. Concerning Σ2-PCBs, PCB153 and PCB 138 accounted for the highest percentage of total Σ2-PCBs concentration.

TU 013 Trend of surface water concentrations of nonylphenol and its ethoxylates in an impacted basin: the Lambro river (Northern Italy)
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According to the Water Framework Directive (2000/60/EC) and its Daughter Directive on Priority Substances (2008/105/EC), nonylphenol has been inserted in the list of the priority hazardous substances (PHS) which should be phased out within 20 years, by applying the ap- propriate measures. The aim of the present study was to evaluate if the nonylphenol and its monomeric nonylphenolic ethoxylates, mono- and diglyceryl ethers, and mono- and diglyceryl ethers, are still of concern in an area characterized by high levels of hazardous substances (PHS) which should be phased out within 20 years, by applying the appropriate measures. The chemical quality of the main Italian river, river Po, is strongly influenced by its tributary, Lambro river basin: the Lambro river (Northern Italy) treats the whole of Milano wastewater, became operative in order to improve the quality of the river basin; the whole of Milano wastewater, became operative in order to improve the quality of the river. The aim of this work was to compare the concentrations of nonylphenol and its ethoxylates in their ecosystem in the Lambro river basin (Northern Italy) measured in two monitoring campaigns in 2004/05 and 2009/10, respectively before and after the WWTP building in Milano was operative (2006). The results showed that even after ban, these compounds can be detect mainly in sediments of estuarine complex and the distribution pattern of BPs by resuspension can also contribute for the impact acting on local biota and communities.
The swordfish (Xiphias gladius) and the bluefin tuna (Thunnus thynnus) are important species from both ecological and economic points of view. These species bioaccumulate contaminants in their tissues and are largely consumed by humans, which may be responsible of transferring pollutants to humans. Polybrominated diphenyl ethers (PBDEs) are a class of chemicals extensively used in the last decades as flame retardants and are produced and used in the past. PBDEs and PCBs are persistent and they tend to bioaccumulate through trophic levels. This study was evaluated the presence and the distribution of PBDEs and PCB levels in the muscle of X. gladius and T. thynnus from the Mediterranean Sea.

PBDE concentrations were higher in tuna than in swordfish (980 and 70 ppb/g ww, respectively) and also PCB levels were higher in tuna (46 ng/g ww) than in swordfish (27 ng/g ww). The BDE accumulation pattern varied between species (BDE154 > BDE47 > BDE100 > BDE183 > BDE209 for swordfish and BDE28 > BDE154 > BDE77 > BDE99 > BDE105 > BDE118 > BDE153 > BDE183 > BDE154 > BDE77 > BDE99 > BDE105 > BDE118 > BDE153 > BDE183 for tuna fish). In both species, the tetra-brominated isomers prevailed (48% in swordfish and 49% in tuna fish). Regarding PCBs, congener no.153 was always the most abundant (11% in swordfish and 14% in tuna fish) followed by congeners no. 158 and 150 in both species. Hexa- CBs and penta-CBs were the most abundant class of PCB isomers and together they made up more than 80% of the total PCB residue in both species. Moreover, swordfish and tuna fish were analyzed according to the sex of specimen and PBDE concentrations were higher in female than in male. PBDEs were 75 ppb/g ww in female swordfish and 49 ppb/g ww in male swordfish, while PBDEs were 150 ppb/g ww in female tuna, and 104 ppb/g ww in male tuna. Although PBDE and PCB levels found in these specimen were lower than those found in sediments from the Mediterranean Sea and from other European seas, these data are important from an ecological perspective and from the point of view of human health as swordfish and tuna fish are important in the diet of the Mediterranean populations.

The aim of this work was to determine the concentrations of a wide group of polar organic contaminants in surface waters from the East River (NY), their partitioning between dissolved and particulate phases, and the total effect on their distribution. Two different classes of contaminants were selected: synthetic surfactants (LAS, linear alkylbenzenesulfonates, NPEO, nonylphenol ethoxylates, and AEO, alcohol ethoxylates) and pharmaceutically active compounds (PhACs), a selection of “70 substances including different types of analytics, antibacterials, beta-blockers, lipid regulators, psychiatric drugs”(SOTO). Analysis of surfactant degradation metabolites (LAS, linear alkylbenzene sulfonates, NPEOs, nonylphenol ethoxylates, and AEO, alcohol ethoxylates) and pharmaceutically active compounds (PhACs) in wastewater from New York City, to the highest concentrations were measured in the flushing water, when the flow water comes from urban areas, and the lowest values during the ebbing, when the water wave enters the East River from the open ocean.

The presence and longitudinal distributions of some of the most widely used synthetic surfactants, alkyl ethoxylates (AES), alcohol polyethylene oxides (AEOs), nonylphenol polyethoxylates (NPES), linear alkylbenzene sulfonates (LAS) and their carbohydrates metabolites (SPBCs) have been studied in water and sediment grab samples from Guadalate river (SW, Spain) in order to observe their occurrence and distribution. The presence and longitudinal distributions of some of the most widely used synthetic surfactants, alkyl ethoxylates (AES), alcohol polyethylene oxides (AEOs), nonylphenol polyethoxylates (NPES), linear alkylbenzene sulfonates (LAS) and their carbohydrates metabolites (SPBCs) have been studied in water and sediment grab samples from Guadalate river (SW, Spain). In general, concentrations in water ranged from 1.42 to 278.93 ppb for LAS, from 3.33 to 72.19 ppb for AES, from 8.57 to 42.99 ppb for AEOs, from 0.53 to 1.89 ppb for AEOs and NPEOs respectively. Concentrations in sediment ranged from 0.11 to 2.42 ppb for LAS, from 0.20 to 0.59 ppb for AES, from 0.97 to 3.04 and from 0.12 to 0.47 ppb for AES and NPEOs respectively. Urban wastewaters discharges were identified as the main contamination sources for these compounds and their metabolites. Sample concentration values in water and sediments grab associated to untreated wastewaters discharges from small urban areas were of the order of magnitude of those reported in other fish from remote areas like Antarctica. Despite lower levels of chlorinated compounds, they still are highly significant due to their potency and transoceanic transportation to higher trophic levels might be expected, due to the key position of the species in the food webs.
TG 021 Occurrence and fate of organic pollutants in aquatic systems of Jeréz de la Frontera region (Cadiz, Spain)
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In the past decennium an increasing number of harbour porpoises, Phocoena phocoena, beached to reach pristine lakes by atmospheric deposition. While the environmental fate and occurrence in CUPs becoming a significant issue for environmental and toxicological studies, recently, and other cycling fluxes in the lake.

TG 022 Air-sea exchange of current-use pesticides in the North Sea (G Coplan1; E Y Zhiyong1; S Renate2; E Ralf1
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2GEESTACHT, Germany
In the Arctic and in some elevated mountains, however, compared with the legacy organochlorine pollutants, the most important pathway for ΣPAHs, contributing 60% of loads compared to atmospheric and waterborne contamination at the base of the Antarctic marine food web. Environmental Science and Technology, 38 (13), pp. 3551-3557.

TG 023 Benthic Degradation and sorption to soot are key processes controlling the occurrence and fate of Polycyclic Aromatic Hydrocarbons in Lakes (I Dudas1; SN Meijer1; P Fernandez1; JG Grimal1
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Semivolatile organic pollutants have potential for long-range atmospheric transport and thus can reach pristine lakes by atmospheric deposition. While the environmental fate and occurrence of persistent organochlorine pollutants, such as polychlorinated biphenyls (PCBs), chlordane, and heptachlor, on the other hand, have been assessed and modeled previously, it is still a poor knowledge of the main factors controlling the fate of non-persistent organic pollutants, such as polycyclic aromatic hydrocarbons (PAH), in the environment. Here we show a soot-inclusive environmental fate model for PAHs in lakes and other aquatic environments including atmospheric deposition and municipal wastewater discharges. Urban tributaries as a pathway of PCBs, PBDEs, PAHs, and polycyclic musks to adjacent urban areas.

TG 024 Occurrence and trends of POPs in the Southern Ocean and Antarctic region (CJ Galbán-Malagón, N Berrojalbiz, G Caballero, MJ Ojeda, J Dachs
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4Mediterranean swordfish (Xiphias gladius), bluenose tuna (Thunnus thynnus) and longfin tuna (Thunnus alalunga) are large pelagic species heavily caught for commercial purposes, being an important source of fish meal. Their trophic impact is heavy on species due to their top position in the trophic web, thus it is very important to know their heath status and evaluate the toxicity for humans. To these purposes, the presence and amount of persistent organic pollutants were determined in their tissues and their prey: polychlorobiphenyls (PCBs), perfluorinated compounds (PFCs), chlordane, heptachlor, chlordane, heptachlor epoxide (HCH), heptachlor epoxide (HCH), hexachlorobenzodioxin (PCDD), and polychlorodibenzo furans (PCDFs) were determined. Moreover, the 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalents (TEQs) were also calculated to assess risk for humans due to fish consumption. The contaminant trend was PCBs > DDTs > HCHs > HCB in all samples; concentrations were in the ranges 15-25 ng/g wet wt of PCBs, <0.001-0.3 ng/g wet wt of HCB, 0.004-0.3 ng/g wet wt of HCHs, and 0.62-6 ng/g wet wt of DDTs in predators and lower in prey. Concentrations in males were higher than in females of tuna and swordfish, and were lower than those reported previously due to the young age of specimens. Penta- to hepta-PCBs made up most of the PCB residue. Coplanar PCBs were below detection levels in most samples, except in a few specimens of tuna and swordfish (PCB77>PCB18>PCB126>PCB169). Concentrations of PCDDs and PCBs were mostly <2 pg/g wet wt and <12 pg/g wet wt and very few congeneres were found in the samples analyzed. TEQs were between 2.6 and 17 µg/g wet wt; bluenose tuna muscle samples showed the highest values. pg/dDE was the most abundant DDT isomer in predator and prey samples. PFCs were below detection limits in most of the samples of predator and prey. PFOS and PFOA were above the detection limit (0.5 ng/g wet wt) in 9 of 61 and 2 of 61 samples, respectively.
Organohalogenated compounds in Franciscana dolphin from Brazilian shore: a case of an environmental concern

In spite of the visible local pollution, this study is the first that investigates the presence of organohalogenated compounds in samples from estuarine and coastal areas. The data confirmed the estrogenic prone scenario we previously reported. Thus, we conclude that the presence of organohalogenated compounds in samples from the estuarine and coastal areas is a significant environmental concern.

Organohalogenated compounds are a class of substances that are known for their persistence, bioaccumulation, and potential toxicity to various species, including marine mammals. The presence of these compounds in the samples collected in this study suggests that the Franciscana dolphin (Lagenorhynchus oxyrhynchus) is exposed to these contaminants in its natural habitat.

The Fate of Biocides in the Aquatic Environment

The fate of biocides in the aquatic environment, particularly in river and stream sediments, remains poorly understood. This is at least in part due to the lack of analytical methods for quantification of these substances in sediments. The development of analytical methods based on solid-phase extraction procedures has been essential for obtaining reliable data on the fate of biocides in the aquatic environment. These methods are necessary for the accurate estimation of the potential exposure of aquatic organisms to biocides in the environment.

The Chemicals of Concern

The data confirmed that the estuary and nearby coastal areas are strongly impacted by this type of pollutants. The data agrees with former findings reporting bioaccumulation in local fish, with unknown impacts for reproduction and development.

Annual Monitoring of Seventeen Endocrine Disrupters Reveals a High Load of an Organochlorinated Compound in the Ave River estuary and nearby seawater, Portugal

The data confirmed the estrogenic prone scenario we previously reported. Thus, we conclude that the presence of organohalogenated compounds in samples from the estuarine and coastal areas is a significant environmental concern.

Recent findings in fish caught in Douro River estuary and nearby Porto sea coast point to the presence of polycyclic aromatic hydrocarbons (PAHs) in Portuguese waters. These PAHs are known for their persistence and bioaccumulation in aquatic organisms. The high levels of PAHs observed in fish from the Douro River estuary and nearby Porto sea coast suggest that these areas are strongly impacted by this type of pollutants.

The aim of this work was to evaluate the occurrence of organochlorine and organobrominated compounds in samples from estuarine and coastal areas. The data confirmed the estrogenic prone scenario we previously reported. Thus, we conclude that the presence of organohalogenated compounds in samples from the estuarine and coastal areas is a significant environmental concern.


TU 030
Climate-induced fate of biocides in sediments

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In recent years, biocides and UV-filters have gained increasing interest as so-called emerging contaminants since they are ingredients of various products used in every day life such as personal care products (PCPs), cleaning agents, and cosmetics. Biocides are biological active compounds used to destroy or to inhibit the growth or action of organisms, even low environmental concentrations might have negative impacts on the aquatic environment. For instance, trichosan has been shown to induce changes in the thyroid hormone mediated process of metamorphosis of the North American bullfrog, Rana catesbeiana, and could cause a significant shift in the community structure of a natural river algae community at environmental relevant concentrations as low as 30 and 15 ng/L, respectively.

The fate of biocides in the aquatic environment, particularly in river and stream sediments, remains poorly understood. This is at least in part due to the lack of analytical methods for quantification of these substances in sediments. Concentration data in sediments needs to complement data on aqueous phase concentrations, particularly in light of the high susceptibility of biocides to microbial (and abiotic) degradation. This is of particular interest in the context of climate change on the sorption and degradation behaviour of biocides in sediment. Therefore, an extensive data set on the sorption and degradation kinetics of selected biocides to sediments and the concentration dependence of sorption and degradation results were analyzed. Batch experiments according to OECD 106 and 308 were performed to determine the sorption and degradation kinetics of selected biocides, e.g. trichosan. Sorption isotherms are also included. Isotherms spanned 2 orders of magnitude in initial concentration ranges (i.e., 1, 3, 10, 30 and 100 µg/mL). The systems are equilibrated for 24 h, which was long enough to attain apparent steady state behavior based on the results of the kinetic experiments. At 24 h, biocides concentrations are quantified in the sediment and the water phases in duplicate batch reactors. To determine the influence of a possible climate change, all experiments are performed at different temperatures ranging from 4 to 30°C.

Acknowledgements: FCT Project PTDC/MAE-EME/10465/2006 (POC1210, FEDER).

TU 033
A yearlong survey for diverse classes of estrogenic disrupting compounds suggests significant pollution in the estuary of the Ave River and nearby seawater, Portugal

The results obtained in this study demonstrate the ecological relevance of estrogenic pollutants in the Ave River estuary and nearby seawater, Portugal. The study shows that the presence of estrogenic pollutants is not limited to the estuarine system, but also extends to the coastal areas. The data confirms the previous finding of estrogenic pollutants in the Ave River estuary and nearby seawater, Portugal. The results obtained in this study demonstrate the ecological relevance of estrogenic pollutants in the Ave River estuary and nearby seawater, Portugal.

Acknowledgements: FCT Project PTDC/MAE-EME/10465/2006 (POC1210, FEDER).
Quantification of estrogenic endocrine-disrupting chemicals in a supposedly reference ecosystem - the Ria Formosa Lagoon, a natural and man-made estuary

The Ria Formosa is a shallow mesotidal lagoon in the south coast of Portugal, with natural biogeographical characteristics, and a habitat of important commercial fish species (e.g., trout). So, we evaluated the levels of seventeen estrogenic chemicals present in the Aveiro city the most important urban centre. Beyond fisheries, this zone also holds an important industrial area when we consider the influence of the Aveiro city on the ria. The Aveiro Lagoon is located on the Atlantic coast in North Portugal. Its average area covers approximately 75 km² and is the local where four small rivers (Vouga, Anta, Bocia and Fonte) launch their final flow. Due to the strategic location of this area several cities are located here, being the Aveiro city the most important urban centre. Beyond fisheries, this zone also holds an important industrial area when we consider the influence of the Aveiro city on the ria.

To help evaluating local toxicity risks for the biota, this study aims to investigate, as exhaustively as possible, the presence of estrogenic endocrine disrupters, from vegetal (formononetin, FORM; daidzein, DAI; genistein, GEN; biochanin A, BIO-A; and sitosterol, SITO), biological (estrone, E1 and estradiol, E2), pharmaceutical (ethynylestradiol, EE2) and industrial (octylphenols, OPs; nonylphenols, NPs; alkylphenols ethoxylates, APEOs; and bisphenol A, BPA) origins at upper and lower estuary and seacoast.

For this propose, water samples were collected during one year, every two months, at 8 sampling stations located at the river, at the estuary and at the sea. The samples were filtered, preconcentrated in Oasis HLB cartridges, cleaned in silica cartridges, and the concentrations and identities of the above referred pollutants were evaluated by GC-MS. The results showed the presence of FORM (ca 600 ng/L), DAID (ca 18,000 NPs; alkylphenols ethoxylates, APEOs; and Bisphenol A, BPA) origins at upper and lower estuary and seacoast. For this propose, water samples were collected during one year, every two months, at 8 sampling stations covering all area of the lagoon. The samples were filtered, preconcentrated in Oasis HLB cartridges, cleaned in silica cartridges, and the identities of the above referred pollutants were evaluated by GC-MS. The obtained results showed the presence of FORM (ca 150 ng/L), DAID (ca 120 ng/L), GEN (ca 50 ng/L), BIO-A (ca 1,000 ng/L), SITO (ca 4,000 ng/L), EE2 (ca 40 ng/L), APEOs (ca 1,000 ng/L), BPA (ca 5,000 ng/L) in the lagoon and in the seacoast.

Considering the toxicological effects reported in the literature for natural and experimental exposure, within those concentration magnitudes, we conclude that estrogen disruption risk by estrogenic exposure may exist in this area; anyway, further analysis are being done.


TU 036 Occurrence of estrogenic pollutants in the Ria de Aveiro Lagoon (Portugal)

The Ria Formosa is a shallow mesotidal lagoon in the south coast of Portugal, with natural biogeographical characteristics, and a habitat of important commercial fish species (e.g., trout). So, we evaluated the levels of seventeen estrogenic chemicals present in the Aveiro city the most important urban centre. Beyond fisheries, this zone also holds an important industrial area when we consider the influence of the Aveiro city on the ria. The Aveiro Lagoon is located on the Atlantic coast in North Portugal. Its average area covers approximately 75 km² and is the local where four small rivers (Vouga, Anta, Bocia and Fonte) launch their final flow. Due to the strategic location of this area several cities are located here, being the Aveiro city the most important urban centre. Beyond fisheries, this zone also holds an important industrial area when we consider the influence of the Aveiro city on the ria.

To help evaluating local toxicity risks for the biota, this study aims to investigate, as exhaustively as possible, the presence of estrogenic endocrine disrupters, from vegetal (formononetin, FORM; daidzein, DAI; genistein, GEN; biochanin A, BIO-A; and sitosterol, SITO), biological (estrone, E1 and estradiol, E2), pharmaceutical (ethynylestradiol, EE2) and industrial (octylphenols, OPs; nonylphenols, NPs; alkylphenols ethoxylates, APEOs; and bisphenol A, BPA) origins at upper and lower estuary and seacoast. For this propose, water samples were collected during one year, every two months, at 8 sampling stations covering all area of the lagoon. The samples were filtered, preconcentrated in Oasis HLB cartridges, cleaned in silica cartridges, and the concentrations and identities of the above referred pollutants were evaluated by GC-MS. The results showed the presence of FORM (ca 600 ng/L), DAID (ca 18,000 NPs; alkylphenols ethoxylates, APEOs; and Bisphenol A, BPA) origins at upper and lower estuary and seacoast. For this propose, water samples were collected during one year, every two months, at 8 sampling stations covering all area of the lagoon. The samples were filtered, preconcentrated in Oasis HLB cartridges, cleaned in silica cartridges, and the identities of the above referred pollutants were evaluated by GC-MS. The obtained results showed the presence of FORM (ca 150 ng/L), DAID (ca 120 ng/L), GEN (ca 50 ng/L), BIO-A (ca 1,000 ng/L), SITO (ca 4,000 ng/L), EE2 (ca 40 ng/L), APEOs (ca 1,000 ng/L), BPA (ca 5,000 ng/L) in the lagoon and in the seacoast.

Considering the toxicological effects reported in the literature for natural and experimental exposure, within those concentration magnitudes, we conclude that estrogen disruption risk by estrogenic exposure may exist in this area; anyway, further analysis are being done.


TU 053 Off-site environmental impacts of wildfires: evaluation of the toxicity of runoff from a burnt area on freshwater aquatic species

Wildfires have been found to increase the levels of polycyclic aromatic hydrocarbons (PAHs) in surface water bodies within and downstream of recently burnt areas. Whilst PAHs are well known to affect the potential toxic effects of endocrine disruption scenarios, it is also recognized that the potential toxicity of the runoff from burnt areas on aquatic species has received little research attention.

The present work addresses this knowledge gap by laboratory assays with species from different taxonomic groups representing distinct trophic levels.

In the framework of EROSIRE-2 project, post-fire runoff generated and erosion has been monitored in a forest area in Góis municipality, central Portugal. Following a moderate-severity wildfire in August 2008, runoff samples were collect from a slope-scale erosion plot in a eucalypt stand on two occasions, namely in October 2008 after the first rains and about one year later, in September 2009. The concentrations of the十六条 PAHs identified by US EPA as priority contaminants were determined for the particulate and dissolved phases of both runoff samples. The ecotoxicological assays were carried out with the following aquatic species: the bacteria (Vibrio fischeri), three species of algae (Oscillatoria agardhii, filamentosa subcapitata), the macrophyte (Lemna minor), and the invertebrate (Daphnia magna).

The PAHs content in the particulate as well as the dissolved phase of both runoff samples were dominated by compounds of the low (2-3 rings) and medium (4 rings) molecular weight. In general, the different PAHs revealed higher contents in the particulate phase than in the dissolved phase. The PAH contents differed for the two sampling occasions but not in straightforward manner. Namely, some PAHs revealed higher contents immediately after the fire, whereas others did in September 2009. These temporal patterns agree with the known persistence of the various PAHs.

The four species revealed different responses to the two runoff samples. Both samples were highly toxic to V. fischeri, P. subcapitata and L. minor, whereas they did not affect D. magna in a statistically significant manner. Furthermore, the non-filtered samples tended to produce greater effects than the filtered samples. The observed toxic effects can be explained well by the samples’ PAHs contents.

This study underlines the importance of furthering knowledge of the potential deleterious impacts of wildfires on the aquatic species as a result of the PAHs production.

TU 054 Natural and man-made estrogenic-endocrine-disrupting chemicals exist in superficial waters of the Ria Formosa Lagoon, a natural and man-made estuary

This study underlines the importance of furthering knowledge of the potential deleterious impacts of wildfires on the aquatic species as a result of the PAHs production.

The Douro River flows along ca 900 km, from its source in Spain to its estuary at Porto (Portugal). This study aimed at evaluating estrogenic endocrine disruptor (EDC) approaches to waterborne disruptors. The objective is to assess the occurrence of jetties that protect houses and stores at the estuary margins from the aggressiveness of the river. The Serra do Caldeirão to the Atlantic Ocean. It is one of the few European rivers flowing South to North. The evaluation of local contamination by these compounds has been neglected. Moreover, because we believe that upper stream water is commonly used for local irrigation. In spite of this, the evaluation of local contamination by these compounds but also agree with former findings reporting bioaccumulation of these type of compounds. The water is also addressed as lakes, and some creeks and ditches. Sampling stations were situated at the other water bodies. Dicyclohexylamine was also found in Stockholm drinking water at concentrations in a small lake with no discernable anthropogenic influence was <0.1 ng/L, which is considered as a natural background level and human exposure to these pollutants through fish consumption.

TU 043 Dicyclohexylamine: discovery of an environmental contaminant using in-silico screening tools
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2University of Bayreuth, Hydrology, BAYREUTH, Germany
3University of Toronto, SCARBOROUGH, Canada

Dicyclohexylamine has been discovered in water and sediments in the Douro River estuary. Concerning contamination in water from the Stockholm Harbour region was situated at the outlet of Lake Mälaren, a large lake to the west of the city, contained about 0.5 ng/L. The concentration in a small lake with no discernable anthropogenic influence was <0.1 ng/L, which is considered as a natural background level and human exposure to these pollutants through fish consumption.

TU 044 Persistent organic pollutants in farmed sea bass (Dicentrarchus labrax L.) in two different rearing systems in the Mediterranean Sea
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Persistent organic pollutants (POPs) are substances that are toxic, highly persistent and bioaccumulative. Due to their chemical properties, POPs pose a risk of causing adverse effects to human health and environment. In this study we measured the concentration levels of polychlorinated biphenyls (PCBs), perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) in the edible part of farmed sea bass reared in two different farms (site 1 and site 2) in Laguna region situated in northern Italy. The analytical method was based on isolation dilution with 13C labeled internal standards, followed by instrumental analysis using high-resolution gas chromatography coupled with high-resolution mass spectrometry (HRGC-HRMS) for the determination of PCBs and liquid chromatography-tandem mass spectrometry (LC-MS/MS) for the determination of PFOS and PFOA. We analyzed 47 samples with the aim of establishing the contamination level and human exposure to these pollutants through fish consumption.

TU 045 Occurrence of Irgarol, terbutryn, and a degradation product in German surface waters
W Mailahn, M Feibicke, B Katona, D Schnee, S Rust, J Laurisch, R Schmidt
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The structural closely related herbicides Irgarol (cybutryne) and terbutryn came up worldwide in the 1950s and 1960s, and are still used in Germany. From the 1980s Irgarol was also used as an antifoulant, mostly combined as a co-biocide. According to the EU Biocidal Products Directive Irgarol and terbutryn are also used as preservatives and in masonry. The occurrence of both s-triazines and the degradation product M1 (2-methylthio-4-tert-butyramino-6-amino-s-triazine, G326557) were measured in 208 water samples at 9 sites near German surface waters, from 2005-2008 in cooperation with regional authorities. Sampling sites cover large streams like Elbe and Rhine as well as tributaries like Havel and Spree, backwaters, various channels, large rivers like ‘Lake Constance’ and ‘Müritz’ as well as smaller lakes or lake-like enlargement of smaller rivers. The concentrations were highest in site 2 in Laguna region situated in northern Italy. The analytical method was based on isotope dilution with 13C labeled internal standards, followed by instrumental analysis using high-resolution gas chromatography coupled with high-resolution mass spectrometry (HRGC-HRMS) for the determination of PCBs and liquid chromatography-tandem mass spectrometry (LC-MS/MS) for the determination of PFOS and PFOA. We analyzed 47 samples with the aim of establishing the contamination level and human exposure to these pollutants through fish consumption.

Concentration levels (mean ± standard deviation) of DL-PCBs were 0.39 ± 0.41 and 0.45 ± 0.40 ng/g (fw) in site 1 and site 2, respectively, whereas concentrations of the six indicators of NDL-PCBs were 8.66 ± 2.14 and 10.7 ± 8.27 ng/g (fw) in site 1 and site 2, respectively. The concentration levels found in the farm located in site 1 were generally lower than those detected in the samples from site 2. More important, principal component analysis (PCA) showed different patterns of contamination for the two sites, since higher-chlorinated PCBs were more abundant in site 1 whereas lower-chlorinated PCBs were more abundant in site 2. Concerning PFOS and PFOA, most of the measured concentrations, especially of PFOA, were below the limit of detection (LOD = 0.05 ng/g (fw), in particular, only about 10% of the samples showed measured levels slightly below the LOD value. A possible reason of these low levels could be that these pollutants do not accumulate in lipids but mainly in liver and blood. Exposure assessment using these data showed that farmed fish consumption may significantly contribute to PCBs due to fish consumption, whereas for PFOS and PFOA such contribution seems to be low.

Approaches to waterborne disruptors, this study aimed the evaluation of estrogenic EDCs of vegetable (formononetin, F3, daidzin, DA1, genistin, GEN; BioSciences, MONTPELLIER, France
3HydroSciences, MONTPELLIER, France

Contaminants such as alkylphenols, organics or polymeric acyclic hydrocarbons (PAHs) present in sewage effluent have to be monitored in surface waters and European union members are committed to respect environmental quality standards (EQS). The EQS approaches to waterborne disruptors, this study aimed the evaluation of estrogenic EDCs of vegetable (formononetin, F3, daidzin, DA1, genistin, GEN; BioSciences, MONTPELLIER, France
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TU 045
Evaluation of the potential risk of contamination of the guarani aquifer in Santa Catarina,
Brazil
HL Soares, E Baptista
Universidade Federal de Santa Catarina, FLORIANOPOLIS, Brazil
Of the total area of the Guarani Aquifer (1,195,500 km2), approximately 12.8% is represented by
the zones of outcrop, i.e. 153,000 km2 (ANA, 2001), with 67.8% (104,000 km2) located in Brazil, 30.1% in Paraguay and 2.1% in Uruguay. The Guarani Aquifer, which consists of sandstones,
is more vulnerable to contamination in its area of outcrop because this is an important site of direct recharge of the aquifer. In Ponte Alta , SC, Brazil, the Canoas riverbed overlaps areas of outcrop of the Guarani Aquifer. The aim of this study was to investigate the possible contamination
of the aquifer Guarani and which sources. Possible changes in the degree of surface and groundwater pollution of the Guarani Aquifer and Canoas river were regularly monitored (four months)
by analysis of the physicochemical and biological parameters. The results showed that the Canoas
river in this area exhibited altered physicochemical characteristics, particularly regarding to total
phenols concentration (0.3 ppm), sulfides (1.4 ppm) and nitrate (0.5 ppm) caused by the release
of waste from a pulp and paper mill. Toxic effects were found for algae, daphnia and fish. Some
samples of water from the aquifer exhibited altered concentrations of phenols and metals. It was
noticed that extensive outcrop and recharge areas of the aquifer are busy with the planting of
pine. The thickness of the sandstone in this area was quite variable, being the 100m thicknesses
the most common.
TU 046
Status of environmental contamination indicated by multi-proxies around an important
commercial port of South America (Paranaguá Harbor, Brazil)
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Paranaguá Harbor is the main South American grain shipping port, being the third most important of Brazil in loading and unloading operations with 8,540,000 ton (2010). It is located
in Paranaguá Bay (25°30’S; 48°25’W) considered one of the most important estuarine complex
at Brazilian coast. Its economical importance is related to fishing activities, urban and touristic
exploration, besides industries that produce fertilizer compounds. Anthropogenic inputs include
domestic discharges and sewage from the port, industries and population (around 126,076
people). In order to assess the contamination level of sediments in the area under human activities, the organic compounds (PAHs, aliphatic hydrocarbons and coprostanol) and metals were
analyzed. Results of PAHs and metals were compared to two Sediments Quality Guidelines
(SQGs), the ERL/ERM and the TEL/PEL values. The concentration of total PAHs (16 EPA)
varied since 1.0 to 1630 ng.g-1 and it did close the TEL level in one of eleven sites analyzed. Only
2 (18 %) of stations studied presented individual PAHs higher than TEL and ERL. According
to the individual PAH isomer pair ratios, the main sources of these compounds are petroleum,
biomass and coal combustion. Metals (As*, Cd, Cr, Cu, Ni, Pb and Zn) presented concentrations
below TEL levels in all sites analyzed. Total aliphatic (including UCM) and corpostanol varied,
respectively, since 0.2 to 2221 μg.g-1 and < LD to 16 μg.g-1, showing contamination by oil hydrocarbons and sewage in three sites analyzed (27 %). The contamination level of sediments around
Paranaguá Harbor and city could be considered high in sites very close the main human activities.
Levels decreased in 10-100 times 1km far from the main sources of pollution. Given that this
environment may be relatively unpolluted, the monitoring and bioaccumulation of contaminants
in this ecosystem should be avoided.
TU 047
Historical accumulation of polycyclic aromatic hydrocarbons (PAHs) in important economic area of a large South American tropical estuary (Paranaguá Estuarine System, Brazil)
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Polycyclic aromatic hydrocarbons are organic pollutants prevalent in the sediments of marine
and freshwater environments. They are mainly derived from anthropogenic sources including the
combustion of fossil fuels (oil and coal) and biomass, sewage, vehicular emissions and spillages of
petroleum. The aims of this study were to describe the temporal distribution and sources of PAHs
in sediment cores collected in three different sectors of Paranaguá Bay, where human activities
have intensified over the last 100 years, and to assess the historical record of local anthropogenic
material input as result of the influence of human occupation in this area. The Paranaguá Estuarine System is one of the most important estuarine environments of the South American coast
where fishing, urban and tourist activities, industries and the main Brazilian grain shipping port
are potential sources of PAHs in this area. Sediment cores (50 cm depth) were taken by scuba
diver from sites P1, P2 and P3 during September, 2008. The cores were sectioned at 2 cm intervals and PAHs were determined by gas chromatograph with a mass spectrometer after Soxhlet extraction and purification by column chromatography. In general, the sources of PAHs were fossil
fuels combustion, industrial and domestic residues, introduction of petroleum by boats and ships,
charcoal and biomass combustion. The parameters involving different PAHs isomers indicated
that the majority sources of PAHs as related to pyrolitic processes. In the site P3, the PAHs were
associated to multiples sources, and the high concentration of PAHs in intermediate layers, related with the dredging activities realized in adjacent areas of this site. Natural sources of perylene
for the environment were verified, associated to input by terrigenous precursors. The concentration of PAHs varied between 1.72 and 168.5 ng.g-1, however the individual concentration did not
exceed the limits TEL and PEL, established by EPA, with an exception of acenaphthylene, found
with values slightly higher compared to TEL. The comparison of total PAHs values with another
studies in different locations around the world, suggest that the Paranaguá Estuary Complex,
even though the urban and industrial development have been increased, it is still a local area
that has not yet suffered a relative significant impact related to input of organic contaminants
analyzed in this study.
TU 048
Biomonitoring of polycyclic aromatic hydrocarbons (PAHs) in eastern Baltic Sea: effects on
flounder (Platichthys flesus) and eelpout (Zoarces viviparus)
R Kreitsberg1, A Tuvikene2, K Rumvoldt1
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Eastern Baltic Sea near Estonian coast is heavily navigated sea by numerous cargo ships and oil
tankers. Hundreds of accidents and oil spills happen in this area every year. Still there is a lack of
data about distribution of polycyclic aromatic hydrocarbons in ennironment. In case of major ac-

cident there is no supplementary data about area’s background level. Starting from 2006 we have
measured PAH metabolites, enzyme activities (EROD), parasites and other biomarkers from European flounder (Platichthys flesus) and eelpout (Zoarces viviparus). A wide range of monitoring
stations in coastal areas in Gulf of Finland and Gulf of Riga were chosen. The aim of our research
was to specify the distribution of PAHs in a different sea areas, as well as evaluate the physiologycal effect of pollutants in two species of fish. The results showed that fish from the Gulf of Riga
had lower levels of PAH metabolites, suffered less by parasites and had better liver somatic index
(LSI) and body mass index (CF) than fish close to the Baltic proper and in the Gulf of Findland.
This might be due to major shipping routes close to coastal areas of North-West of Estonia. The
relationships between biomarker values and study areas are discussed.
TU 049
Pesticides and polychlorinated biphenyls in bowhead whale blubber layers
EM Robinson
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Bowhead whale blubber samples (n = 36) were collected during the 1996ð’2001 native Inuit
subsistence harvests in the arctic marine environment of Barrow and Kaktovik, Alaska. Full
depth blubber samples were available for 18 of the bowhead whales. Five depth layers each ~813 cm thick were available for most of the bowheads. Blubber layers (~ 1.5 g) were examined
for historic and current-use pesticides, polychlorinated biphenyls (PCBs), and polybrominated
diphenyl ethers (PBDEs). Contaminants were simultaneously extracted and isolated using
pressurized liquid extraction combined with silica gel utilizing an accelerated solvent extractor.
Silica gel was used to remove the more polar interferences and was present in the ASE cell during the extraction. Larger-molecular weight interferences, such as lipids, were removed using gel
permeation chromatography. Contaminants were analyzed for using gas chromatography-mass
spectrometry with electron capture negative ionization. The method was validated by a triplicate
spike and recovery experiment. Using isotopically-labeled surrogates, the average percent recovery
was 103% with a relative standard deviation of 9.4%. The precision and accuracy of the analytical method was validated in triplicate using NIST standard reference material 1945 for organics
in whale blubber. The average absolute percent difference and standard deviation were 21% and
12%, respectively. Generally, pesticides and PCBs were detected in all blubber layers, and PBDEs
were only detected in a single layer. Pesticide, PCBs, and PBDEs in blubber layers were analyzed
to determine their trends in individual Bowhead whale blubber.
TU 050
Analysis of glyphosate and AMPA in several matrixes using SPE-LC-MS/MS and their environmental fate in two calcareous vineyard parcels of western Switzerland
S Daouk1, D Grandjean2, LF de Alencastro2, N Chèvre1, HR Pfeifer1
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Glyphosate [N-(phosphonomethyl)glycine] is a broad spectrum herbicide largely used in Switzerland for weed and vegetation control representing 30% of all herbicides sales in 2005. As it
shows strong sorption ability and a relatively low persistence in soils, it is often assumed to not
reach water bodies. Two vineyard parcels of a small catchment were investigated in order to study
glyphosate transfer within soils and surface waters. Based on liquid chromatography coupled with
tandem mass spectrometry (LC-MS/MS), the analysis of glyphosate and its main degradation
product aminomethylphosphonique acid (AMPA) has been set up. The method is based on derivatization with 9-fluorenymethylchloroformate (FMOC-Cl) and their concentration by solid
phase extraction (SPE). Spiking tests in several matrixes revealed satisfying LOQ and recovery
rates for Evian© bottled water, river water and soil solutions, as well as for calcareous soil samples.
The parcels were equipped with lysimeters and runoff collectors in order to get soil solution at 4
different depths, as well as runoff water. River water was sampled together with drainage water of
several vineyards. Despite its assumed low mobility, glyphosate was found to be leached and run
off from the soil surface layer. The role of preferential subsurface pathways was studied, revealing
the importance of textural boundaries between the more clayey deep and the silty surface layers
in the transport of these compounds. Moreover, runoff water was highly loaded after rain events
and glyphosate and AMPA turned out to be transported mainly by small colloids: the median of
‘dissolved’ fractions (<0.45μm) is located between 70 and 80% of the total concentration. The adjacent river showed concentration peaks over the 0.1μg/l threshold limit during main rain events,
revealing the transfer of these compounds from the field to surface water. The highest peak had
a concentration of 0.8 μg/l of glyphosate in August. Moreover, drainage systems showed much
higher concentrations of up to 4 μg/l, revealing the importance of artificial channels within the
urbanised landscape in the transfer of these compounds. These results give a better understanding
of the environmental behaviour of glyphosate, which is largely used in viticulture and agriculture
in Switzerland, due partly to the increase of simplified tillage practices.
TU 051
PAHs, PCBs and chlorinated pesticides in sediments and fish species from Milazzo (South
Italy) marine area
G Perra1, CG Guerranti1, MM Mariottini1, MG Graziosi1, SF Focardi1, FA Andaloro2, TR Romeo2
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Marine sediments are usually regarded as the ultimate sink for persistent pollutants discharged
into the environment. The aim of the present study is to determine the levels of several organic
pollutants (PCBs, PAHs, DDTs, HCHs and HCB) in order to assess the contamination in Milazzo (South Italy) marine area. The distribution of pollutants of environmental interest was investigated also in fish (Serranus scriba, Serranus cabrilla and Serranus hepatus) collected from Milazzo marine area. Sediment and fish samples were lyophilizated and extracted for organic contaminants with accelerated extractor (ASE) system and quantified by GC-MS and HPLC. Muddy
sediments with high organic matter content dominate the study area. Total PAH concentrations
ranged LOD-211.17 ng/g dry weight indicating low to moderate PAH pollution. The comparative evaluation of PAHs with low/high molecular weight and isomeric ratios suggest that the pollution source is pyrolytic and that terrigenous flows do not affect the PAH balance of the marine
area. Organochlorine compounds levels indicate that sediments are not significantly polluted by
HCH (max mean value of total HCHs = 8.52±8.17 ng/g d.w.), HCB (max mean value of HCB
= 1.85±1.55ng/g d.w..), DDT and its metabolites (max mean value of total DDTs = 30.57±3
ng/g d.w.) and PCBs (max mean value of total PCBs = 93.60±92.78 n/g d.w.). The identification
of organic contaminants sources in the Milazzo marine area ecosystem could be useful to plan the
polluted sediments management activities and the restoration strategies. The organic pollutants
concentrations indicate a low to moderate pollution level with an heterogeneous distribution in

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the marine area. The maximum mean level of total PAH was measured in liver of Serranus hepatus (0.042-1.54 ng/g w.w.), while organochlorines were never detected in this species.

TU 052 Distribution and partitioning of polybrominated diphenyl ethers in East River, South China

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PAHs and organochlorinated pollutants were extracted using a Soxhlet apparatus and were analyzed by HPLC for PAHs and GC-MS for PCBs and organochlorinated pesticides. The rest of pollutants (triazines and organophosphorous pesticides) were extracted using sonication extraction and were analyzed by GC-MS. Organic pollutant concentrations were also determined in water and suspended particulate matter during the flood event. These water extractions were performed using the Stream Extractor (SBE3) and thermal desorption coupled to GC-MS. The distribution of PAHs, PCBs and pesticides in the Mar Menor lagoon on Spring 2009 was heterogeneous. The three target groups of pollutants did not show the same pattern. The highest PAH concentrations were detected in the northern and southern areas, particularly in the south where the concentration of PCBs showed the highest contamination in the central, and particularly in the south area. In general, the organophosphorous and organonitrogenated pesticides concentrations were lower than PAHs ones. During flood events several water and suspended solid matter samples were taken in the Albuñol Watercourse mouth to estimate the organic pollutant input in these rare events. These water samples were analyzed by SBE3/GC/MS using full scan mode. As a result of the massive influx of water and suspended materials during the flood events especially through Albuñol Wadi, the distribution in the sediment of all the contaminants groups was heterogeneous, and significant seasonally differences were observed in the organic pollutants concentrations associated to flood impact.

TU 059
Bioaccumulation of mercury in birds: a comparative study in Ciconiiformes, Charadriiformes and Pelecaniformes

The main aim of this study was to monitor mercury exposure in different species of birds from the orders Ciconiiformes, Charadriiformes and Pelecaniformes, which show different feeding preferences. To achieve that, liver samples from necropsied animals were lyophilized and then Hg was analyzed in two different sampling periods: pre-migration and migration period. Data obtained reported high levels of mercury burdens accumulated in almost all species. Significant differences in the burdens of mercury accumulated were also reported, being mercury levels higher in species with a fish-selective diet than in species with a generalist diet. This corroborates the hypothesis that mercury levels depend on the source of mercury contamination such as birds (and in parallel men) is through uptake of contaminated fish. Even though some mercury levels reported seemed to be high enough to induce sub-lethal or lethal effects on the individuals, it was not possible to establish any correlations as these values are difficult to interpret without knowing the state and exposure levels.

TU 060
Relationship between pollutant accumulation and toxic potency in deep sediment collected in the Seine estuary (Normandy, France)

In order to study time-course of pollution in the Seine estuary and also toxicity of accumulated pollutants, bottom 15 cm-thick sediment core samples were collected in the Seine estuary in a dikeoussed in Rouen harbor in April 2008 (Rhapsody project). The core was split in 25 cm-thick slices which were analyzed for size grain, organic carbon, sulfurs, metals (Hg, Cu, Zn, Cd, Pb) and pollution indices. The distribution of PAHs, PCBs and pesticides in the Mar Menor lagoon on Spring 2009 was heterogeneous. The three target groups of pollutants did not show the same pattern. The highest PAH concentrations were detected in the northern and southern areas, particularly in the south where the concentration of PCBs showed the highest contamination in the central, and particularly in the south area. In general, the organophosphorous and organonitrogenated pesticides concentrations were lower than PAHs ones. During flood events several water and suspended solid matter samples were taken in the Albuñol Watercourse mouth to estimate the organic pollutant input in these rare events. These water samples were analyzed by SBE3/GC/MS using full scan mode. As a result of the massive influx of water and suspended materials during the flood events especially through Albuñol Wadi, the distribution in the sediment of all the contaminants groups was heterogeneous, and significant seasonally differences were observed in the organic pollutants concentrations associated to flood impact.

TU 061
Bioaccumulation of organochlorine pesticides and biomarker responses in Dreissena polyomorpha and Dreissena bugensis after exposure to native suspended particulate matter

In order to study time-course of pollution in the Seine estuary and also toxicity of accumulated pollutants, bottom 15 cm-thick sediment core samples were collected in the Seine estuary in a dikeoudeness in Rouen harbor in April 2008 (Rhapsody project). The core was split in 25 cm-thick slices which were analyzed for size grain, organic carbon, sulfurs, metals (Hg, Cu, Zn, Cd, Pb) and pollution indices. The distribution of PAHs, PCBs and pesticides in the Mar Menor lagoon on Spring 2009 was heterogeneous. The three target groups of pollutants did not show the same pattern. The highest PAH concentrations were detected in the northern and southern areas, particularly in the south where the concentration of PCBs showed the highest contamination in the central, and particularly in the south area. In general, the organophosphorous and organonitrogenated pesticides concentrations were lower than PAHs ones. During flood events several water and suspended solid matter samples were taken in the Albuñol Watercourse mouth to estimate the organic pollutant input in these rare events. These water samples were analyzed by SBE3/GC/MS using full scan mode. As a result of the massive influx of water and suspended materials during the flood events especially through Albuñol Wadi, the distribution in the sediment of all the contaminants groups was heterogeneous, and significant seasonally differences were observed in the organic pollutants concentrations associated to flood impact.
Hydrophobic organic compounds (HOCs), frequent anthropogenic environmental pollutants, can cause many adverse effects in organisms. Activation of aryl hydrocarbon receptor (AhR) can be very important mechanism of toxicity for so-called AhR-active HOCs, such as benzo[a]pyrene (BaP), dibenzo[a,h]anthracene (DB[a,h]A), and 2,3,7,8-tetrachlorodibenzop-dioxin (TCDD). Humic substances (HS), being naturally occurring compounds (up to 50 mg/L in water), can be toxic to organisms in aquatic and terrestrial environments. Besides other important ecological properties, HS serves as a natural source of reactive oxygen species that are formed after HS irradiation. Direct photolysis of HS is a very important way of their degradation in the aquatic environment. Nevertheless, oxygen species, formed after HS irradiation, can enhance the photo-chemical degradation of HOCs. In present study, we have assessed the ability of various HS to enhance photo-degradation of upper mentioned HOCs, and its mixture. Aqueous HS + HOC solutions were irradiated by low-pressure mercury lamp in Pyrex tubes (retaining ultraviolet <300 nm). Photo-degradation of HOCs, studied by chemical analysis using GC/MS(MS), was observed, where HS presence in mixture of HS was placed more rapidly. To evaluate whether any new AhR-active compounds has been formed as products of HS photo- transformation, AhR-mediated toxicity of complex samples was assessed using in vitro assay based on the H4IIE-cells transgenic cell line. Obtained results have been in good accordance with results from chemical analysis by GC/MS(TU 074).

Equilibrium sampling of hydrophobic pollutants into the silicone polydimethylsiloxane (PDMS) has been used in numerous environmental matrices and has recently been applied in lipid-based biomonitoring of fish. The bioavailability of chemicals in the polymer (C<sub>P</sub>) can then be multiplied with lipid/PDMS distribution ratios (D<sub>lipid/PDMS</sub>) [3] according to eq. 1 to obtain concentrations in fish lipids (C<sub>lipid</sub>):

\[ C_{lipid} = C_{P} \times D_{lipid/PDMS} \]

In this study, PDMS was placed in intact tissue of two red and one salmon for equilibrium sampling of polychlorinated biphenyls (PCBs). A classical exhaustive extraction technique to determine lipid-normalized PCB concentrations, which assigns the body burden of the chemical to the lipid fraction of the fish, was additionally applied. Lipid-based PCB concentrations were determined by comparison with those in gutted fish to remove total PCBs. These results support the validity of the equilibrium sampling technique, while at the same time confirming that the fugacity capacity of these lipid-rich tissues for PCBs was dominated by the lipid fraction. Further, we provide equilibrium sampling data obtained in homogenates of the same fish tissues. The PCB concentrations were 1-2.0-2.0 times higher in the PDMS immersed in homogenized tissues as compared to PDMS immersed in intact tissues, indicating that homogenization increased the chemical activity of the PCBs and decreased the fugacity capacity of the tissue. On the basis of the presented data, we describe a novel approach to confirm that (a) the equilibrium sampling technique and (b) the widely used environmental monitoring approach of assessing the body burden of pollutants to the organisms lipid fraction are valid in lipid-rich biota. Further support for the use of lipid-normalized PCB concentrations is obtained with those in gutted fish to remove total PCBs. This bioavailability is strongly influenced by the chemical properties of the pollutant, by several physical and chemical processes and by environmental characteristics of the surrounding water and sediment, which can be highly variable in certain environmental systems. These characteristics can determine the chemical speciation and distribution of pollutants over the environmental compartments. Secondly, bioaccumulation is influenced by the exposure route. Which exposure route is important for an aquatic organism is highly dependent on its physiology, habitat preference and feeding strategy.

This project aims to determine the exposure route most relevant for bioaccumulation in organisms with different feeding strategies and trophic level, and this for various pollutants. Therefore we conducted passive as well as active biomonitoring studies in the Scheldt estuary. We related bioaccumulation of pollutants for various mercury species (mercury metal, organic pollutants) in caged and free living animals to levels in environmental compartments (water, SPM, pore water, sediment).

Equilibrium sampling of environmentally emerging contaminants in tropical mangrove food webs

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Tropical mangroves are significant ecosystems in South East Asia, as well as other tropical and subtropical regions of the world. These unique ecosystems provide essential habitat for numerous species of aquatic and terrestrial organisms. In 2004, field measurements in Singapore have demonstrated legacy persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethanes (DDTs) and chlorides (CHL) exhibit a high degree of biomagnification in local mangrove food webs. The objectives of the present study were conduct a field study to assess the occurrence, levels and bioaccumulation behavior of various emerging contaminants of concern in Singapore mangrove mangrove food webs. Target analytes included a comprehensive list of pharmaceuticals and personal care products (PPCPs), current use pesticides (CUPs) and brominated flame retardants (BFRs). A comprehensive field survey of surface water, sediments and mangrove organisms, including various species of algae, plankton, molluscs, crustaceans, fish and birds was conducted. Water samples were filtered/extracted using a filtration apparatus containing glass fibre filters and solid phase extraction (SPE) disks in order to determine freely dissolved and particulate bound chemical concentrations. Sediments and tissue samples were extracted using accelerated solvent extraction (ASE) and further cleaned-up using gel permeation chromatography (GPC), SPE and/or Florisil chromatography. Identification and quantification of target compounds was performed using ultra- viod chromatography-electro-spray ionization tandem mass spectrometry (LC-ESI-MS/MS) or gas chromatography mass spectrometry (GC-MS). 13C or deuterated mass-labeled standards were used as internal standards to correct for matrix effects. Measured concentrations and observed trophic magnification factors (TMs) of the various emerging contaminants of concern are compared to observations of legacy POPs. The bioaccumulation behavior and overall biomagnification potential of these contaminants in the mangrove food webs are evaluated and discussed.

Accumulation of butyltin compounds in minke whales and beaked common dolphins from the Korean coast

M Cho, H Moon, K Lee, YR Aun, SG Chou, ZG Kim, DY Moon, HG Chou

National Fisheries Research and Development Institute, BUSAN, South Korea

In 2004, field measurements in Singapore have demonstrated legacy persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethanes (DDTs) and chlorides (CHL) exhibit a high degree of biomagnification in local mangrove food webs. The objectives of the present study were conduct a field study to assess the occurrence, levels and bioaccumulation behavior of various emerging contaminants of concern in Singapore mangrove mangrove food webs. Target analytes included a comprehensive list of pharmaceuticals and personal care products (PPCPs), current use pesticides (CUPs) and brominated flame retardants (BFRs). A comprehensive field survey of surface water, sediments and mangrove organisms, including various species of algae, plankton, molluscs, crustaceans, fish and birds was conducted. Water samples were filtered/extracted using a filtration apparatus containing glass fibre filters and solid phase extraction (SPE) disks in order to determine freely dissolved and particulate bound chemical concentrations. Sediments and tissue samples were extracted using accelerated solvent extraction (ASE) and further cleaned-up using gel permeation chromatography (GPC), SPE and/or Florisil chromatography. Identification and quantification of target compounds was performed using ultra-violet chromatography-electro-spray ionization tandem mass spectrometry (LC-ESI-MS/MS) or gas chromatography mass spectrometry (GC-MS). 13C or deuterated mass-labeled standards were used as internal standards to correct for matrix effects. Measured concentrations and observed trophic magnification factors (TMs) of the various emerging contaminants of concern are compared to observations of legacy POPs. The bioaccumulation behavior and overall biomagnification potential of these contaminants in the mangrove food webs are evaluated and discussed.

Estimating metal bioavailability in sediment by DGT for avoiding overestimation of chelatants in TIE protocols

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The protocol for Sediment Toxicity Identification Evaluation ("sediment TIE") recommended by the Danone and the EUR reseach project were investigated. Aquatic compounds, which can form complexes with heavy metals, can be very important mechanism of toxicity for so-called AhR-active HOCs, such as benzo[a]pyrene (BaP), dibenzo[a,h]anthracene (DB[a,h]A), and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Humic substances (HS), being naturally occurring compounds (up to 50 mg/L in water), can be toxic to organisms in aquatic and terrestrial environments. Nevertheless, oxygen species, formed after HS irradiation, can enhance the photo-chemical degradation of HOCs. In present study, we have assessed the ability of various HS to enhance photo-degradation of upper mentioned HOCs, and its mixture. Aqueous HS + HOC solutions were irradiated by low-pressure mercury lamp in Pyrex tubes (retaining ultraviolet <300 nm). Photo-degradation of HOCs, studied by chemical analysis using GC/MS(MS), was observed, where HS presence in mixture of HS was placed more rapidly. To evaluate whether any new AhR-active compounds has been formed as products of HS phototransformation, AhR-mediated toxicity of complex samples was assessed using in vitro assay based on the H4IIE-cells transgenic cell line. Obtained results have been in good accordance with results from chemical analysis by GC/MS(TU 074).
Aquatic sediments are well known sinks for numerous persistent pollutants such as POPs and persistent organic pollutants (PBDEs, OCPs, PCBs). Toxicity of sediment organic extracts for aquatic ecosystems is a threat. A Marjanovic1, J Djedjibegovic1, M Sober1, K Sinanovic1, M Grung2, C Harman2, E Fjeld2, S Rog-Genotoxicity of sediments from river Bosna, TU 077: Relationship between pollutant accumulation and toxic potency in deep sediments collected in the Seine estuary (Normandy, France) was measured using a large panel of in vitro toxicity assay: Microtox®, ER and DR-Calu®, SOS Chromotest and ACHe inhibition assay. For all analyzed chemicals except Be, Mo and Cd a clear increase of pollutant concentrations was observed with depth. Strikingly, peak of concentration for various pollutants (PCBs, PAHs, sulfated PAHs, OCPS, Hg and Pb) was observed at 92.5 cm depth. All sediment extracts exhibited high potency. Acute toxicity (Microtox®) was shown to increase with depth, DR-Calu® activity (diotino-like activity) was also increasing with depth while ER-Calu® activity related to estrogen-like compounds was globally low. ACHe inhibition activity and genotoxicity (SOS-Chromotest) were mainly measured in surface and sub-surface sediments. This study finds evidence of global pollution decline in the Seine estuary during the last three decades. In this context, it is important to determine the potential risk they could represent for aquatic organisms living in the Seine estuary. This study was supported by the Seine-Aval program.

TU 078

Effect-directed analysis of potentially genotoxic compounds in sediments collected from Laguna Lake (The Philippines) using the Ames Fluctuation assay. M Macherey1, T Hamers1, E Simon1, P Leonards1, J Weiss1, 1Institute for Environmental Studies, VU University, AMSTERDAM, The Netherlands

Application of the transthyretin binding assay in effect-directed analysis of sediments: identification of thyroid hormone disrupting compounds. M Lancorac1, T Hamers1, E Simon1, P Leonard1, J Weiss1, 1University of Bordeaux 1, UMR CNRS 5805 EPOC, LPTC group, TALENCE, France

In the framework of the EU funded Modelkey project we have carried out EDA studies at several locations connected with European river systems using a variety of bioassays. Sediment extractions fractionated using sequential reversed and normal phase liquid chromatography. In the course of this project, we identified several different classes of environmental toxicants in fractions of the respective sediment extracts, by conventional gas chromatography coupled with mass spectrometric detection as well as liquid chromatography coupled with high resolution mass spectrometry. A selection of these compounds was tested in the TTR assay in order to assess whether they were responsible for the observed TH-like activity in the fractions of the sediment extracts.

TU 080 Biochemical biomarkers applied on benthic species with different feeding strategies: Improvements in a weight-of-evidence approach for sediment quality assessment. C Tréguer-Papazian, ML Martin-Díaz, TA del Vado, University of Cádiz, CÁDIZ, Spain

In the study of the thyroid system, an inventory of the different classes of compounds with reported TH-like activities was made. Compounds that are known to influence the thyroid system are, among others, thyromimetic compounds, which include polychlorinated biphenyls and polychlorinated dibenzofurans. More recently, also polychlorinated compounds have shown to have moderate TH-like activities.

Towards a more complete knowledge, which facilitates decision making. Suitability of biochemical biomarkers measured in caged organisms, including lipid peroxidation and DNA damage, as indicators of sediment metal toxicity was studied. Sediment metals and PAHs significantly (p < 0.05) induced biomarkers measured in species with different feeding strategies as potential line of evidence was identified. Lipid peroxidation, DNA strand breaks and activities of biotransformation and antioxidant enzymes were analyzed as health status indicators in Arenicola marina (deposit feeder), Rudipates depressus (filter feeder) and Cucumis marianus (predator) after a field assay based on organismal caging and transplantation. Sediment metals and PAHs significantly (p < 0.05) induced biomarkers compared with day 0 mostly in organisms caged at Saladillo dock (Algeciras Bay), but chemically identical caged at Cádiz Bay. Lipid peroxidation, DNA strand breaks and antioxidant enzymes were measured in response to different treatments. Sediment metals and PAHs significantly (p < 0.05) induced biomarkers compared with day 0 mostly in organisms caged at Saladillo dock (Algeciras Bay), but chemically identical caged at Cádiz Bay. Lipid peroxidation, DNA strand breaks and antioxidant enzymes were measured in response to different treatments.
Optimization of the SPE step in the analysis of β-blockers and β-endorphin from natural water samples by SPE-GC technique

MF Caban, A Michalak, M Czwicka, M Kuziak, P Stepienowska, J Kumińska

Environmental samples from natural sources, especially sewage and marine-water samples are complex and often contain interfering elements that can mask or interfere with the analysis performed by GC techniques. The SPE (Solid-Phase Extraction) is the most common sample preparation technique used in environmental areas. This step is crucial in SPE because it can control such parameters as selectivity, affinity, and capacity.

TU 084

Construction of a water toxicity sensor based on luminescent bacteria

M Woutersen1, J Mink1, A van Wezel1, A van der Geest1, R Smits1, A Brouwer1, M Berings1, W Wassenbergh2, J Waterkeyn3

TU 085

Toxicity of coastal waters: use of a quick algal bioassay

SB Solow1, PB Pouli2, H van den Geest1, RLaune1, P Leonardi1, LM Lamore1, W Altadill1, D Tebata1, P de Vos1

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Institute for Environmental Studies (IVM), VU University, AMSTERDAM, The Netherlands

To ensure safe drinking water it is critical to have a reliable toxicity monitoring system. Although there are several chemical and biological detection methods, there is no suitable system yet for the real-time monitoring of toxicants in water, taking endpoints into account with human relevance. This gap may be partly bridged by a sensor that applies genetically modified bacteria that respond to specific groups of toxicants, forming luminescent bacterial colonies in the presence of a promoter-gen, which is known to be activated in the presence of certain types of toxicants, for example DNA damaging agents or heavy metals. This promoter gene is coupled to a luminescence gene, so that luciferase is formed when the promoter is activated. The resulting production of light can then be detected and used as a measure of the toxic stress the bacteria were exposed to. A new prototype of a flow-through sensor for on-line water monitoring based on these modified bacteria is being developed at KWR. The bacteria is fixed on an optic fiber or a glass slide and placed in a continuous water flow. The light generated by the bacteria is then measured by photomultiplier tubes. The current prototype is highly adjustable and allows control of pH, temperature, flow, and pressure. Additionally, it is possible to add nutrients as well as test compounds to the water. This sensor prototype is being tested in both the laboratory and at monitoring stations along Dutch rivers. The ultimate aim is to develop a sensor that measures several types of toxicity and that can be applied continuously in the field, both at surface water inlets and in the distribution network.

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content ranged from 10 to 40 times greater that the dissolved content. Probably it depends on the physiological state of the algae; for example the extracellular content of microcystin is different if the samples are collected from a fresh or aged population of P. rugosa; the lysis of dead cells can release endocellular toxins into water environment. Acute toxicity tests (24 h exposure) with Thamnocephalus platyurus were carried on using endocellular and extracellular water extracts. Only the endocellular extract, collected from April 2009 to April 2010, showed a measurable inhibition (12.5%); it means that the acute toxic effects on T. platyurus appeared starting from a concentration of about 300 µg/L of [Des-Ap] mimicrycystin-RR. The 24 h dose response curve showed that the EC50 of desmetyl-microcystin-RR to T. platyurus was 8.45 µg/L. Compared with literature results, this microcystin is less toxic than microcystin LR, but 3 times more toxic than microcystin-RR.

TU 087 Integrating biological index and geochemical markers to evaluate contamination in an organic matter enriched area on South Brazilian coastline
CC Martins, L. Hadlích, AM Barbosa, C. Lana
Universidade Federal do Paraná, PONTAL DO PARANÁ, Brazil
Paranaguá Port is the biggest and best known city in the western South Atlantic. It houses approximately 19% of the Brazilian Atlantic forest remnants and was considered a biosphere reserve by UNESCO in 1995. The city of Paranaguá has approximately 140,000 inhabitants and one of the largest harbours of the South Atlantic. More than two hundred local domestic sewage is discharged into the estuary without any treatment. The contamination associated with the input of heavy metals, hydrocarbons, sewage and the develop of anoxic conditions may lead to macrofaunal associations. In order to find two biologically proxies of contamination levels, we evaluated the composition and abundance of local polychaete assemblages. Sediment samples were collected by SCUBA diving at 11 stations around Paranaguá in a grid spaced up to 2 km from the main contamination sources. Nutrients, fecal sterols, hydrocarbons and metals were analyzed in the surface sediment layer. A PCA analysis evaluated the differences among stations in the site of the Port of Paranaguá are in fact characterized by high concentrations of nutrients (PNLCOC), metal, fecal sterols and PAHs. The total density and species number of polychaete assemblages were significantly lower (p < 0.001) at stations closer to the harbour and sewage discharge points. Most of the differences reflected the low polychaete abundance and diversity in two hypoxic stations, with high concentrations of total PAHs (3786 ng g⁻¹), metals, nutrients and coprostanol (16 ng g⁻¹). Occurrence patterns of the species Magnapagopus palmeri, Glycinea multiseries, Chaeotroctes sp., Capitella sp., Aestea taylori and Pseudeucosmilia anadria differed significantly among stations. This set of species can be used as early indicators of organically enriched areas.

TU 088 Assessment of contamination of wastewater for use in the rice fields
HL Soares, E. Baptista
Universidade Federal de Santa Catarina, FLORIANÓPOLIS, Brazil
The southern region of Brazil is dominated by wetlands, which are attractive ecosystems for irrigation. Water is pumped for the management of the rice fields. In order to define a possible site to be used for irrigation, one of the most polluted European aquatic environments, was assessed by using a wide battery composed by different biomarkers: the single cell gel electrophoresis (SGGE) assay, the apoptotic cell detection, the micronucleus test and the Neutral Red retention assay (NRRT). Otherwise, we measured the activity of three antioxidant enzymes: catalase activity and glutathione peroxidase (GSH-Px) activity of the detoxifying of glutathione transferase (GST). We exposed mussel at laboratory conditions to water sampled in spring and fall at three sampling sites located both upstream and downstream the confluence and directly on River Paraná. We measured each end-point every 5 day. In mussel soft tissues the GST was associated with the biosorption of several organic pollutants (PAHs, PCBs, DDTs, HCHs and HCB). Biomarker responses revealed a heavy genotoxicity of the pollutant mixture at all the sampling stations with significant increase of DNA strand breaks, apoptosis and micronuclei with no significant seasonal differences. We obtained a clear induction of the enzyme activities measured in spring that showed the increase of oxidative stress, but a very complex enzymatic activity trend in fall with several end-points that showed a parabolic slope that bring back the activities to background levels, suggesting an eventual seasonal change in enzymatic characteristics. This study confirmed the utility of a wide biomarker battery in biomonitoring studies and the suitability of Zebra mussel as bioindicator organism also for river basins.

TU 091 Stage-dependent β-naphtoflavone-induced cytochrome P450 1A (CYP1A) activity in medaka (Oryzias latipes) embryos using an in vivo quantitative approach
M González-Donzel, LS San-Segundo, SS Sastre, CF Fernández
INIA, MADRID, Spain
Worldwide continuous increase in chemical production has promoted the development of chemical management programs for a correct assessment of their risk to human health and to the environment. Are in the US with the US EPA HPV Challenge Program and here in the EU with the recent REACH Program an enormous effort to establish a framework to assess the risk related towards the development of alternatives to existing ecotoxicity tests without reducing the validation of the risk assessment. In this context the use of fish embryos and elateroembryos is promising alternatives. These stages also provide the application of its in vitro techniques for the evaluation of the bioavailability of pollutants. Comparing to literature results, this microcystin is less toxic than microcystin-LR, but 3 times more toxic than microcystin-RR.
monitoring of dioxin levels is of high importance and should be of primary relevance. Bioassays are a valuable pre-screening tool to investigate dioxin-like activity. A newly introduced method to test food and feed is the Micro Ethoxyresorufin-O-deethylase (EROD) bioassay with H4IEc cells. The Micro EROD bioassay is an aryl hydrocarbon receptor based assay to detect the receptors interaction with dioxin-like compounds. In this study the feasibility and application characteristics of this bioassay for food testing were evaluated. A comparison with the H4IE-Luc and RTL-W1 bioassays was conducted, and the acute column chromatography as sample clean-up methodology to gain fat free samples was characterized. Additionally, a review of alternative methods was performed. The acute column chromatography in combination with the Micro EROD bioassay may be used for the pre-screening of food and feed samples. Nevertheless, further investigation and modification of the Micro EROD bioassay is recommended for streamlining and improvement of the protocol to achieve a sophisticated, integrated pre-screening tool for dioxin-like activity in food and feed samples.

TU 094
Changes of AhR-mediated toxicity of hydrophobic organic compounds after UV-VIS irradiation
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2University of Saskatchewan, SASKATOON, Canada
Hydrophobic organic compounds (HOCs) were shown to cause many adverse effects in organisms. Arylhydrocarbon receptor (AhR) activation is among the frequent mechanisms of toxicity of these pollutants. They are present in all environmental matrices, thus, it is almost impossible to avoid the exposure of the organisms to this type of chemicals. HOCs can be degraded and removed from the environment by many processes, such as volatilization, adsorption to solid-phase particles, composting, direct photolysis of HOCs evoked by solar irradiation or the bacteria degradation. Nevertheless, further investigation and modification of the Micro EROD bioassay is recommended for streamlining and improvement of the protocol to achieve a sophisticated, integrated pre-screening tool for dioxin-like activity in food and feed samples.

TU 095
Application of EDA to identify hydrophobicity causing compounds in olive oil mill waste waters
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1University Koblenz-Landau, LANDAU, Germany
2University Koblenz-Landau, Environmental and Soil Science, LANDAU, Germany
3University Bohuch, Geographical Institute, soil science/ soil ecology, BOCHUM, Germany
In the Mediterranean region waste waters as olive oil mill waste waters (OMWW) are widely applied at agriculturally used soils due to positive properties as high nutrient content. This application is often accompanied with negative effects as increasing phytotoxicity and hydrophobicity of the soils and thus, decreasing field capacity. Although several studies investigated the composition of OMWW, the compounds responsible for this process are still unknown. To facilitate the identification of the responsible chemicals a fractionation procedure was validated for typical OMWW substances as model compounds. The different classes of compounds e.g. polypehthal, aliphatic hydrocarbons and carboxic acids are separated by extraction at different volumes and the use of selective solvents. The optimized method was used to fractionate OMWW samples from Palestine. For prioritization of fractions the phytotoxicity in germination tests and hydrophobization potential using the sessile drop method was evaluated.

TU 096
Ecodiagram of environmental benign ionic lubricants: assessment of toxicity and biodegradability
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1University of Gdansk, GDANSK, Poland
2Techniker Foundation, EIBAR, Spain
3University of Bremen, BREMEN, Germany
Evaluation of the biodegradability is a key point to assess environmental benign lubricants. The ecotoxicology of ionic lubricants is the development of high efficient technical processes and applications using chemicals with a reduced or eliminated hazardous potential for man and the environment. Therefore the development of chemicals with optimised technical properties should be parallel in order to minimize the (eco)toxicological hazards. In the field of degradable chemicals, ionic liquids represent an excellent model substance class. Ionic liquids are salts with melting points below 100°C or even room temperature. Their physico-chemical properties like high thermal stability or low vapor pressure raised the interest of this substance class for their application in waters in recent years. Additional the high structural variation and availability of severalionic liquids make the compounds responsible for this process are still unknown. To facilitate the identification of the responsible chemicals a fractionation procedure was validated for typical OMWW substances as model compounds. The different classes of compounds e.g. polypehthal, aliphatic hydrocarbons and carboxic acids are separated by extraction at different volumes and the use of selective solvents. The optimized method was used to fractionate OMWW samples from Palestine. For prioritization of fractions the phytotoxicity in germination tests and hydrophobization potential using the sessile drop method was evaluated.

TU 097
Prospective hazard assessment of new industrial chemicals: the case of liquidic acids with high performance lubricants
P Stepnowski1, S Stote1, M Skup1, S Stote1
1University of Gdansk, GDANSK, Poland
2University of Bremen, BREMEN, Germany
The interest in liquidic acids for their potential in different chemical processes is increasing, as they are claimed to be environmentally benign and very good non- volatile solvents for a wide range of applications. Researchers in this field however should always take into consideration not only technological demands but also the risks arising out of possible (eco)toxicity. This contribution presents our strategy where technical properties of liquidic acids, potentially used as lubricants, are investigated in parallel with the examinations of (eco)toxicological hazard potentials. Toxicological studies of industrial acids lead to the screening of toxicological hazards. Direct photolysis of HOCs evoked by solar irradiation is a very important way of degradation in the aquatic environment. The aim of this study was to assess (i) changes of AhR-mediated toxicity of benz[a]pyrene (B[a]P), dibenzo[a,h]anthracene (DB[a,h]A), 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and (ii) changes of concentrations of each compound after UV-VIS irradiation. The chemicals were dissolved in ethanol, ethanol was evaporated under a gentle stream of nitrogen and distilled water was added. The water solutions were irradiated by a low pressure mercury lamp. AhR-mediated toxicity was assessed using in vitro assays based on the H4IE-Luc transgenic cell line. Chemical analysis of B[a]P, DB[a,h]A and TCDD was performed using GC/MS (MS). We observed a significant decrease of HOCS concentrations in samples after irradiation which corresponded well with the decrease of AhR-mediated activities of irradiated samples. Therefore, we suppose that there have been changes of the chemicals a fractionation procedure was validated for typical OMWW substances as model compounds. The different classes of compounds e.g. polyhalogen, aliphatic hydrocarbons and carboxic acids are separated by extraction at different volumes and the use of selective solvents. The optimized method was used to fractionate OMWW samples from Palestine. For prioritization of fractions the phytotoxicity in germination tests and hydrophobization potential using the sessile drop method was evaluated.

TU 100
Distribution of marine microplastics in the Puget Sound estuary
D Lilburn1,2, S Masiunas1,3, G Dahl1
1University of Washington, TACOMA, United States of America
2University of Bremen, BREMEN, Germany
3University George Mason University, FAIRFAX, VIRGINIA, United States of America
Microplastic marine debris are particles composed of plastics with dimensions between 0.33 and 5 mm. Early reports of pre-production resin pellets in Northwest Atlantic waters suggested losses during manufacturing or shipping may supply plastics to the oceans. Since those initial studies in the 1970’s there have been very few reports of microplastics in the oceans. Recently, we have developed standardized protocols to sample and analyze microplastic particles in surface waters, sediments, and beach sands. The goal of our study is to make the first systematic characterization of microplastics in the Puget Sound estuary. Nets with 0.33 mm mesh size were towed horizontally through surface waters using standard plankton sampling conditions and tow duration in several locations throughout the Puget Sound, ranging from highly urbanized, stormwater-dominated embayments to relatively unpolluted open waters. Samples were oxidized with hydrogen peroxide to remove marine carbon. Samples from nearshore that contained more than 1.0% of particulate carbon were oxidized with a sulfuric acid/potassium dichromate solution. After digestion, inorganic solids were separated from the plastic by density gradient and the remaining solids were isolated and weighed to determine the total quantity of microplastic mass. Concentrations of solid material collected from Puget Sound surface waters in the 0.33 to 5 mm size range vary widely from 1.5 x 10-5 to 0.11 g/m3, and the geometric mean plastic content of the sediments is 1.8% (range 0.008 to 27% plastic). Spontaneous and spatial temporal gradients indicate a significant source from urban stormwater.

TU 101
Prospective hazard assessment of new industrial chemicals: the case of liquidic acids with high performance lubricants
P Stepnowski1, S Stote1, M Skup1, S Stote1
1University of Gdansk, GDANSK, Poland
2University of Bremen, BREMEN, Germany
Prospective hazard assessment was made based on EU (CLP) hazard classifications of the chemicals that are needed for assessing toxicity hazards and risks. In this project the environmental and health hazards of these pollutants were characterized and compared to gain fat free samples was characterized. Additionally, a review of alternative methods was performed. The acute column chromatography in combination with the Micro EROD bioassay may be used for the pre-screening of food and feed samples. Nevertheless, further investigation and modification of the Micro EROD bioassay is recommended for streamlining and improvement of the protocol to achieve a sophisticated, integrated pre-screening tool for dioxin-like activity in food and feed samples.
Sorption of Bisphenol A to poly(methyl methacrylate) in aquatic environment measured by MALDI-TOF-MS

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In 2010, IMARES started such an inventory using fish samples from various positions in the North Sea. After being measured and weighted, the complete content of the digestive tract of each individual was collected. The entire material was chemically digested and the remaining material was searched for any plastics by stereo microscope. This method allows the detection of even very small plastic particles. When drafting this abstract small plastic fragments have been found in 1% of 500 individual Herrings from the Northern North Sea that were processed. Other species like Mackerel, Grey mackerel and Hake were sampled in smaller numbers (45-170 individuals) with our plastics being found. Samples of Horse mackerel and Whiting have been collected and other species and locations are planned to be sampled the coming months. Plastics found in these species should have a significant amount from Southern North Sea and plastics collected during surveys with bottom trawling in the North Sea will be chemically analysed by GC-CC-MS. Comparing contaminant levels and profiles also with sediment and fish data, this gives a first insight in the importance of plastic debris as carrier of organic contaminants in the North Sea.

TU 108

Influence of ingested micro-plastics on the bioaccumulation of organic substances in fish - a model approach

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Institute of Environmental Systems Research, OSNABRÜCK, Germany

We modified the dynamic Gobas fugacity model [3] taken from the well-acknowledged bioaccumulation model ACC-Human [4] which describes the bioaccumulation of pollutants by Baltic herring growing from birth to the age of 5 years. To model the influence of plastic ingestion on bioaccumulation of organic substances additional assumptions were made:

i) In addition to plankton herring ingests micro-plastics. Ingested plastics material is completely excreted such that there is no plastic accumulation.
ii) Micro-plastics and the fish’s body are in equilibrium with the surrounding water. Within the gastrointestinal tract plankton and micro-plastics are homogenously mixed.
iii) It is assumed that ingested micro-plastics consist of low-density polyethylene. The fugacity capacity of micro-plastics is determined by the content of organic carbon.
iv) The fish’s body burden due to ingestion of organic pollutants with micro-plastics depends on the substance properties. For compounds with fast metabolic transformation ingestion of plastics increases pollutant accumulation, while for persistent compounds it decreases the mean body burden. This study provides first insights into how ingested micro-plastics may influence the bioaccumulation of aquatic pollutants, evaluating the effects of different plastics in fish.

References:

TU 109

Polyethylene microplastics select for ‘plastiphilic’ bacterial assemblages in coastal marine sediments

P Harrison, M Supp, M Schraderberg, AM Odhiambo

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Polyethylene microplastics increase pollutant accumulation, while for persistent compounds it decreases the mean body burden. This study provides first insights into how ingested micro-plastics may influence the bioaccumulation of aquatic pollutants, evaluating the effects of different plastics in fish.
fragment length polymorphism and sequencing analyses of 16S ribosomal RNA genes. Plastic-associated bacterial assemblages formed in all sediment types with the onset of colonisation varying from six to 48 hours. The plastic-associated bacterial communities were distinct from those in sediments (ANOSIM R = 0.5, P < 0.001). Successional changes occurred in the structure of the plastic-associated bacterial communities, with increasing convergence in the structure of these communities across different types of sediment. Epilithon- and gammarid protozoa were identified as dominant classes within the plastic-associated bacterial communities. Whilst temporal variability in the structure of the sediment bacterial communities was found, convergence of these communities between sediment types was not observed. This study provides evidence for the potential for rapid bacterial colonisation of microplastics in marine sediments and for the formation of microplastic-associated bacterial assemblages whose composition differs from those in bulk sediments. The results also provide insight into the existence of ‘plasticphile’ bacterial taxa that may become selected for in the presence of plastic across several types of sediment. These findings have opened an avenue for microbial research into the ecological impacts of microplastics.

TU 110 Environmental impact of treatment processes for plastics and composites at the end-of-life of vehicles in Spain

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2Department of Marine Biology, Environmental Industrial, EPS Mondragón, MONDRAGÓN, Spain

This study provides evidence for the potential for rapid bacterial colonisation of microplastics in marine sediments and for the formation of microplastic-associated bacterial assemblages whose composition differs from those in bulk sediments. The results also provide insight into the existence of ‘plasticphile’ bacterial taxa that may become selected for in the presence of plastic across several types of sediment. These findings have opened an avenue for microbial research into the ecological impacts of microplastics.

We show that the new approach significantly decreased (p<0.01, binomial test) the average contrast, developmental defects were significantly decreased in larvae reared in either untreated and treated wastewaters with <70% larvae in controls. The results showed that both untreated and treated wastewaters posed by the United States Environmental Protection Agency for the textile wastewater at dilutions ranging from 0.1 to 30% in seawater. A total of eight culture reagents were used to test the possible damage in the scallops populations.

TU 114 Optimization of fertilization and larval development toxicity tests using two marine urchin species. Study of salinity influence.

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Embryo larval development (ELD) and fertilization tests with sea urchins have been widely used in ecotoxicology studies to assess pollution of marine ecosystems, and included in a regulatory framework due to their sensitivity and reproducibility. Salinity could act as a confounding factor when determining the mentioned toxicity responses, since these biological processes properly operate within a salinity range which varies among species. In order to assess the optimal salinity range, ELD and fertilization bioassays were performed at different salinities (35 to 45 °) using two species of Atlantic sea urchin: Arbacia lixula and Paracentrotus lividus. A. lixula embryo larval development assay showed wider optimum salinity range (from 29 to 35 °) compared to P. lividus (from 31 to 34 °). Regarding fertilization assay using P. lividus as bio-indicator species, the highest percentages of fertilization (90%) were measured when the salinity ranged from 29 to 31 °. More research is needed concerning A. lixula, since the fertilization success did not show higher values than 50%. In the present study it has been demonstrated that salinity could be a confounding factor when interpreting ecotoxicological results, consequently this parameter should be controlled in order to optimize the described toxicity tests.

TU 115 Comparing the response of neonates, juvenile and adults of Daphnia exilis (Herrick, 1899) exposed to a toxic marine plastic

S Manente, A Zuin, M Bragadin, G Ravagnan

University of Udine, Udine, Italy

Daphnia exilis was used as a bioindicator species, the highest percentages of fertilization (90%) were measured when the salinity ranged from 29 to 31 °. More research is needed concerning A. lixula, since the fertilization success did not show higher values than 50%. In the present study it has been demonstrated that salinity could be a confounding factor when interpreting ecotoxicological results, consequently this parameter should be controlled in order to optimize the described toxicity tests.

TU 116 Evaluation of sensitive of veliger and pedivelar larvae of Catarina scallop Argopecten ven- tricosus (Sowerby II, 1842) to zinc and copper metals

LF Pitombeira, AQ Silva, J Nilin, LV Costa-Lotufo

Universidad Autonoma Metropolitana Iztapalapa, MEXICO D.F., Mexico

In this study an evaluation of zinc and copper in the larval stage of a marine scallop was carried out. The LC50 was determined for probit method. Lethal tests showed that neonates and juveniles were more sensitive to copper. LC50(50) was 0.018 mg/L and 0.01 mg/L, respectively. No significant differences (p > 0.05) were observed between LC50 of Cd, Cu, Mn, Ni and Zn obtained in the neonates and juvenile assays. This data suggest that the response observed in the Daphnia exilis neonates is similar to juvenile.

TU 117 Sub-lethal toxicity of zinc to Mytilopsis japonia (Crustacea: Mysidae)

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Universidade Federal do Ceará, FORTALEZA, Brazil

In aquatic environments, due to the great dilution factor, organisms are exposed to sub-lethal concentrations of pollutants, which can be maintained due to industrial activity. Long-term exposure to this waste may cause physiological or behavioral disturbances. These effects are not detectable in acute toxicity tests, and so, the use of chronic assays poses as such a relevant approach. In this study, we present a study investigated the toxicity of zinc in a short-term chronic bioassay using a microcrustacean, Mytilopsis japonia, as the experimental model. Since the Brazilian legislation has yet to regulate bioassays such as this, the study aims to validate this species and this method as a viable ecotoxicological routine. The methodology used herein was modified from the norm proposed by the United States Environmental Protection Agency for Mytilopsis kalata. Concentrations of the test compound varied from 0.005% to 0.60 mg/L, in 200 ml quadruplicate on 5 organisms younger than 24h per group. Two static 7-day experiments were conducted at 24 ± 1°C and 55 ppm salinity. Mortality, dry weight and length of organisms were evaluated. Mean LC50 was 0.011 mg/L. Variations of LC50 were significant reduced at the highest tested concentration, however, for the dry weight, no statistical differences were observed between exposed and control organisms. As there is only little information concerning sub-lethal effects in M. japonia, it is important to continue carrying out research to detect the possible damage in the scallops populations.

TU 118 Antioxidant action of two polyphenols, resveratrol and piceid, on a biological model in vitro

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Among natural antioxidants found in many natural foods and beverages, the flavonoid resveratrol and piceid have been proven to be effective against a broad range of diseases whose origin can be
attributed to oxidative damage. Resveratrol is a phytoalexin, a secondary metabolite synthesized by Spermatophytes in response to stress conditions caused, for example, by exposure to UV radiation or fungal infection. Piceid, called also polidatina, is the glucosylated form of resveratrol.

Genotoxicity induced by amorphous silica powders in murine alveolar macrophages (RAW 264.7) and human epithelial lung cells (A549). Effect of dimension and superficial morphology on genotoxicity induced by amorphous silica powders in murine alveolar macrophages (RAW 264.7) and human epithelial lung cells (A549) has been reported. The overall test sensitivity was 100%. The test specificity was also reduced, indicating an active endocytosis process. The results of these experiments indicate that the genotoxic potential of different classes of environmental chemicals (phytosynthetic products, heavy metals, pharmaceuticals) [DOTST] was tested on some of these cell lines.

TU 123
Results of an international round robin study with the Ames fluctuation test


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12Johann Wolfgang Goethe University, Biological Sciences Division, FRANKFURT, Germany
13Acknowledgements: Funded by the Basque Government (ETORTEK BERRILUR IE09-242) and by the University of the Basque Country (Grant to Consolidated Research Groups, 2007-2012, GC07/26-IT-393-07). A. Zipperle is a recipient of a pre-doctoral fellowship from the Basque Government.

Application of the modified Comet assay (Fpg) to three fish cell lines for genotoxicity assessment of pollutants

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In a context of regulatory governing, the need for in vitro model in genotoxicity assessment is currently increasing. This applies to the need for genotoxicity testing of new and existing chemicals, REACH, to the monitoring programs of water quality recommended in the Water Framework Directive and the occupational environment.

Among the known genotoxicity biomarkers frequently used to assess genotoxicity potential of pollutants, the modified Comet assay using restriction enzyme allows an increased sensitivity of the Comet Assay. Thus, in this work, it has been chosen to detect genotoxicity at environmentally relevant concentrations, since most of the aquatic genotoxic contaminations are characterized by chronic exposure at low levels of contamination. The Fpg restriction enzyme has been chosen, amongst others, for its capacity to detect various lesions such as base oxidation or alkylation, therefore broadening the type of DNA damage detected by the Comet Assay.

Genotoxicity testing associated to three different cell lines (RLT-W1, RTG-W1, PLHC-1) exposed to various model genotoxicants exhibiting known mode of actions (MMS, H2O2, DOTST). This allows to assess and compare the feasibility of the modified comet assay using different cell lines currently utilized to assess genotoxicity potential (DNA fragmentation, genogression, genogression to genogregons). The second genotoxic potential of different classes of environmental chemicals (phytosynthetic products, heavy metals, pharmaceuticals) [DOTST] was tested on some of these cell lines.

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13Acknowledgements: Funded by the Basque Government (ETORTEK BERRILUR IE09-242) and by the University of the Basque Country (Grant to Consolidated Research Groups, 2007-2012, GC07/26-IT-393-07). A. Zipperle is a recipient of a pre-doctoral fellowship from the Basque Government.
with unexpected low numbers of spontaneous revertants. The lowest ineffective dilution values (e.g., Pb(NO₃)₂) to compare the trend of effect to the two temperatures. Running the tests at 37°C from ox heart. In the first phase, a series of tests only for the basal respiration were carried out in sessaments on the effectiveness of the test at this temperature, but was dictated by the practice of the protocol for the bioassay with the mitochondria of beef heart frozen at -22 °C, developed at Ca’ Foscari University of Venice, VENICE, Italy. Improvement on frozen mitochondria bioassay: a methodological remark. INCHEMBIOL (Ministry of Education CR 3/12) and CETOCOEN (European Regional Development Fund no 062/2001) and provide validity data for the finalization of the ISO standardization process. with that FEN was more toxic than PMT and that commercial preparations of both pyrethrins were tested because they have been found to control the temperature of the cell reaction at 37 °C. It can be concluded that the bioassay with frozen beef heart mitochondria is more sensitive and accurate at 37 °C. This reason, together with considerations concerning the rate of respiration higher (due to higher enzyme activity) and increased signal stability, lead to the conclusion that in order to optimize the performance of the test is preferable to control the temperature of the cell reaction at 37 °C.

TU 126 Effects on cholinesterase activity in erythrocytes of wild birds exposed in vitro to lead, cadmium and their binary mixtures A. Hernández-García¹, D. Romero², C. Gravato², L. Guilhemet², M. Alarcón-Fernández³
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2Centro Interdisciplinar de Investigación Marinha e Ambiental (CIIMAR), PORTO, Portugal
3Lead and cadmium effects on erythrocytes have been widely reported, including calcium and potassium homeostasis alteration, changes in cell membrane, osmotic alterations and mechanical fragility of the membrane, synthesis inhibition of haem group, interference in oxygen exchange, alterations in carbohydrates and energy metabolism, cholinesterase inhibition, and oxidative stress induction due to reactive oxygen species (ROS), as well as alterations in antioxidant mechanisms. Although cholinesterase inhibition by metals is still a controversial topic in scientific literature. The aim of this study was to evaluate the lead and cadmium-induced effects in mallards (Anas platyrhynchos) and domestic chickens (Gallus gallus) exposed to lead (Pb(NO₃)₂) and cadmium (CdCl₂) in vitro. The evaluation of the effects of metal exposure on the erythrocyte membrane was performed by quantifying the absorbance at 540 nm. Results indicated that lead was more toxic than the respective pure compounds. Effects of commercially prepared FEN occurred as low as 0.001 mg/L and usually within 3 h of chemical exposure. This pyrethrin caused marked nervous, behavioral and vascular effects even at very low concentrations. The CV technique reported here is sensitive, gives accurate and reproducible results, does not require any trauma or immobilization and allows quantification of the effects with non-invasive repeat measurements in the same oligochaete. This novel technique could be used as an early-warning biomarker to monitor toxicity of pesticides and other chemicals in non-target aquatic and terrestrial (earthworms; not reported here) organisms. ERCB as a biomarker in zebrabid embryo B. Quinn1, N. Parolini2
1Norwegian Institute for Water Research (NIVA), OSLO, Norway
2University of Heidelberg, HEIDELBERG, Germany
The present study is part of the joint research project “Datfon” funded by the German Federal Ministry of Education and Research (BMBF). The overall aim of this project is to develop a new test system which can be used to investigate the ecotoxicological effects of contaminated sediments. In addition to native sediments and sediment extracts, selected model chemicals from the list of priority substances of the European Water Framework Directive (EWFD) will be tested. These substances are methylmercury(II)chloride (heavy metal), chlorpyrifos (organophosphate-insecticide), and diclofenac sodium (NSAID). Both individually and in combination, each metal was exposed in vitro to cadmium, lead and cadmium-lead combination (1:1) in proportions equal to those previously found in wild birds. After determination of cell viability with Propidium iodide and quantification of the percentage of the cells in different phases of the cell cycle, each metal was exposed to lead was observed. In the absence of lead, no variations were observed in workers exposed to lead. For cadmium, it has been observed an enzyme inhibition in human and rodents erythrocytes exposed in vitro. However, activation on cholinesterase activity has been related with membrane alterations in human erythrocytes. In conclusion, the increase in cholinesterase activity in rabbit erythrocytes exposed in vitro to cadmium, lead and cadmium-lead combination (1:1) may be a sign of low repeat measurements to monitor both onset and recovery from toxic insults has not emerged. Sub-lethal effects of agricultural pyrethrin pesticides (commercial formulations and pure perme- thrin) in pupae and larvae of L. flavipalpis (Aldrich) and F. natalensis. Oligochaetae Lumbricus variegatus were studied non-invasively following immersion (upto 6h) in aqueous concentrations ranging from 0.001 to 10 ppm. Neurotoxicity effects evaluated included conduction velocity (CV) of the median giant fibers (MGF), helical swimming, and body bending and circling of circular muscle systems of both the MGF and photoreceptor cell body. Both increased for 12h and FEN induced a significant (P < 0.05) dose-dependent decrease in the CV of the MGF; loss of swimming and reflexes, and increased frequency of blood pulsations. Results indicated that FEN was more toxic than PBT and that commercial preparations of both pyrethrin were less toxic than the pure compound. Effects of commercially prepared FEN occurred as low as 0.001 mg/L and usually within 3 h of chemical exposure. This pyrethrin caused marked nervous, behavioral and vascular effects even at very low concentrations. The CV technique reported here is sensitive, gives accurate and reproducible results, does not require any trauma or immobilization and allows quantification of the effects with non-invasive repeat measurements in the same oligochaete. This novel technique could be used as an early-warning biomarker to monitor toxicity of pesticides and other chemicals in non-target aquatic and terrestrial (earthworms; not reported here) organisms.

TU 129 EROD as a biomarker in zebrabid embryo B. Quinn1, N. Parolini2
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siderable ethical importance. Therefore, search for and evaluation of alternative or non-animal testing methods to serve as surrogates for whole fish tests are of high priority.

This study has evaluated the hepatic transcriptional responses in Oncorhynchus mykiss exposed in vivo and in vitro to benzo[a]pyrene (BaP) and ethinylestradiol (EE), as to determine whether primary hepatocytes may serve as an [alternative] non-animal test method. Analyses focused on characterizing the global transcriptional changes and determining whether the cellular responses, where manifested at the protein level in both in vivo and in vitro experimental models. In addition, bioassays involving cytotoxicity (metabolic activity and membrane integrity) were measured on in vitro samples. Results presented will determine whether primary hepatocytes exhibit comparative responses to that of native liver cells in rainbow trout.

TU 131
Alter-REACH - an evaluation of non-animal testing methods as environmental endpoints in REACH

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The Registration, Evaluation, Authorisation and Restriction of Chemical Substances (REACH) is the European Union’s chemical regulatory legislation for new and existing chemicals. The REACH legislation requires that chemicals, considered to be persistent, bioaccumulative and/or toxic (PBT), have to undergo regulatory testing using aquatic vertebrates. Estimates are that about 30,000 single chemicals may require testing with up to three million fish currently available and 1,800 different screening tests are in the strong development stage. With the 3Rs (reduction, refinement and replacement) into ecotoxicological testing, the need for developing and evaluating alternative (non-animal) experimental methods is clearly warranted. This multi-disciplinary project, involving various international research groups, intends to meet this challenge through development of alternative test methods to carry out rapid, reproducible screening for the bioaccumulative and toxic properties of chemicals. Ecotoxicological testing using zebrafish (Danio rerio) embryos, complimented by in silico quantitative structure-activity relationship (QSAR) models, in vitro methods (cell cultures) and toxicogenomics, will be assessed. Results indicate that zebrafish are a promising alternative and the generation of a standardized fish embryo toxicity test guideline (DIN 38415-6) is ongoing. Additionally, mRNA was extracted from the embryos and subjected to quantitative real-time polymerase chain reaction (qRT-PCR) to analyze the transcription abundance of selected genes. Specifically, a battery of phase II metabolic (gsh1, cyp1a1, cyp1a2) and Ah receptor genes were measured. These results confirm that a targeted cDNA microarray which will be useful for environmental screening. Three sediment samples, one from a contaminated site located in the Upper Verding Canal in Hamburg, Wilhelmshaven and two from the Rhine River, each representing a different level of contamination, were used. After freeze-drying, the sediments were extracted with acetone in a Soxhlet apparatus. Saturated zebrafish eggs were exposed to the extracts for 48 hours according to a standardized full-term embryo test guideline (DIN 01841-5, 6). Subsequently, mRNA was extracted from the embryos and subjected to quantitative real-time polymerase chain reaction (qRT-PCR) to analyze the transcription abundance of selected genes. Specifically, a battery of phase II metabolic (gsh1, cyp1a1, cyp1a2) and Ah receptor genes were measured. These results confirm that a targeted cDNA microarray which will be useful for environmental screening. Three sediment samples, one from a contaminated site located in the Upper Verding Canal in Hamburg, Wilhelmshaven and two from the Rhine River, each representing a different level of contamination, were used. After freeze-drying, the sediments were extracted with acetone in a Soxhlet apparatus. Saturated zebrafish eggs were exposed to the extracts for 48 hours according to a standardized full-term embryo test guideline (DIN 01841-5, 6). Subsequently, mRNA was extracted from the embryos and subjected to quantitative real-time polymerase chain reaction (qRT-PCR) to analyze the transcription abundance of selected genes. Specifically, a battery of phase II metabolic (gsh1, cyp1a1, cyp1a2) and Ah receptor genes were measured. These results confirm that a targeted cDNA microarray which will be useful for environmental screening.
The ILSI Health and Environmental Sciences Institute (HESI) held a workshop June 2010 on environmental safety assessment of industrial chemicals, agrochemicals, pharmaceuticals, feed stuffs, and biocides. One of the most promising alternative approaches to the acute fish toxicity test is the fish embryo toxicity test (FET). At the same workshop, the German Federal Environmental Agency submitted the draft TG on ‘Fish embryo toxicity (FET) test’ to the OECD Test Guideline Program and a supportive Background Paper. Subsequently, OECD established the ad hoc Expert Group on the Fish Embryo Toxicity Test. Based on the outcome of expert meetings, OECD decided to perform a pilot validation study (coordinated by ECVAM and steered by a validation management group). The validation study aims to evaluate the transferability, and the intra-/inter-laboratory reproducibility of the FET (ZFET). Newly fertilised zebrafish eggs (20-concentration and control) are exposed for up to 96h to chemicals. 4apical endpoints are recorded daily as indicators of embryo, lack of lying formation, non-attachment of tail bud from the yolk sac and lack of heart-beat. LC50 values are calculated for 48h and 96h exposure. 20 chemicals are tested at 5 different concentrations in 3 independent runs in at least 4 laboratories with appropriate controls. The presentation will give an overview on the validation study design, preliminary results (3) positive and negative controls and 4) the correlation of the ZFET with acute fish LC50 data.

Disclaimer: The opinions expressed and the arguments employed herein are those of the authors and do not necessarily reflect the official views of the OECD or of the governments of its member countries.

TU 139

Development of a long-term strategy for chronic toxicity and animal alternatives

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The OECD Acute Fish Toxicity Test Guideline (TG 203) is an integral component in the environmental safety assessment of industrial chemicals, agrochemicals, pharmaceuticals, feed stuffs, and biocides. One of the most promising alternative approaches to the acute fish toxicity test is the fish embryo toxicity test (FET). At the same workshop, the German Federal Environmental Agency submitted the draft TG on ‘Fish embryo toxicity (FET) test’ to the OECD Test Guideline Program and a supportive Background Paper. Subsequently, OECD established the ad hoc Expert Group on the Fish Embryo Toxicity Test. Based on the outcome of expert meetings, OECD decided to perform a pilot validation study (coordinated by ECVAM and steered by a validation management group). The validation study aims to evaluate the transferability, and the intra-/inter-laboratory reproducibility of the FET (ZFET). Newly fertilised zebrafish eggs (20-concentration and control) are exposed for up to 96h to chemicals. 4apical endpoints are recorded daily as indicators of embryo, lack of lying formation, non-attachment of tail bud from the yolk sac and lack of heart-beat. LC50 values are calculated for 48h and 96h exposure. 20 chemicals are tested at 5 different concentrations in 3 independent runs in at least 4 laboratories with appropriate controls. The presentation will give an overview on the validation study design, preliminary results (3) positive and negative controls and 4) the correlation of the ZFET with acute fish LC50 data.

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TU 141

A review of freshwater fish sublethal tests over the past 60 years

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Pressure on animal testing has traditionally been the purview of mammalian toxicological science, but in the past few years, more attention is given also to environmental safety. As with higher vertebrate animal alternatives, balance between reduce animal use without impairing or increasing uncertainty in risk assessment is needed. Testing demands for long-term (chronic) fish toxicity endpoints anticipated to be in the third largest pool of needs following 2-generation mammalian developmental toxicity test (OECD TG 416) for REACH. In 1984, a review of sublethal tests, Wottering suggested that that the growth endpoint could be deleted from the sublethal fish tests, without affecting the predictive value of the tests. As this endpoint has not been excluded and other endpoints have been added (e.g., biomas), we evaluated toxicity data from years of fish life cycle study and chronic, partial fish life stage tests to assess the utility of the standard fish chronic toxicity endpoints, in particular the sublethal response. Approximately 500 studies involving >100 fish species were summarized using several databases, literature and unpublished or sponsored reports. We found the most sublethal tests have been performed with the female fathead minnow, rainbow trout, zebrafish, Medaka, and bluegill. The fathead minnow has the greatest frequency of use over a wide variety of research applications and use of bluegill has become uncommon since the 1990s. With the additional development of shorter tests, i.e., the 7-day growth survival test and 21-day reproduction tests, a review of the tests and their endpoints is due. The choice of species and method is often based on what makes it a strong model for addressing new challenges in aquatic toxicology, including the identification of sensitive life-stages/ endpoints or chemicals with different mode of actions, prediction population-level effects based on data collected from lower levels of biological organization, and exploiting/understanding the emerging role of genomics in research and regulation. Much of the ability to applica
tion to chronic toxicity hinges on an understanding of chemical mode of action. A summary of the current in use methods, species, and duration and will be presented, and endpoints for the tests will be explored.

KEYWORDS: Aquatic toxicity, freshwater, early life stage, fish, sublethal toxicity
the protocol recommended by the manufacturer. The assay was performed after 5 and 15 minutes of contact. A sample was considered positive when it caused an inhibition of luminescence of 40%. The assay was performed after 5 and 15 minutes of contact. A sample was considered positive when it caused an inhibition of luminescence of 40%.
covering 899 drugs described by 67 calculated chemical descriptors. The map of drugs was applied to search for potential persistent drugs using a novel structural similarity tool. The basis for the novel approach comes from scientific research on drugs of known environmental concern. In addition 12 chemicals listed by the Stockholm Convention on persistent organic pollutants (POP) were used representing typical environmental pollutants. Chemical similarity was quantified by measuring relative Euclidean distances in the five-dimensional chemical descriptor space, where at least 10% from each drug anchor, whereas the region of the map closest to the POPS was much less populated. The 15 nearest neighbours (KNNs) of each anchor are presented, showing minor overlaps between the diclofenac, carbamazepine and POP clusters. A literature survey showed that in principal no data is available on the environmental fate characteristics of the identified KNNs except for the non-steroidal anti-inflammatory drug ketoprofen, which was among the diclofenac KNNs. In total 52 individual compounds are identified using the novel read-across tool which could provide a basis for future studies on environmental fate characteristics of drugs.

TU 152
Environmental risk assessment for ancillary substances in biotechnological production

The liver is crucial in detoxification and, consequently, the study of functional and structural liver toxicity is an important part of the environmental risk assessment of chemicals and pharmaceuticals. The liver is considered to be the target organ in the case of many pharmaceuticals. Therefore, during the biotechnological production processes, for sustained, safe growth and high yield the organisms need an optimised environment, including the detoxification of xenobiotics. In this study, the zebrafish model was used to qualitatively and quantitatively the liver structure of adult zebrafish after exposures of pharmaceuticals, while looking at their estrogenicity. For the latter, vitellogenin (Vtg) induction was assessed as the principal parameter in liver function and structure as a surrogate marker of estrogenic activity. The zebrafish embryos are now promising and viable alternative tests in environmental toxicology and the zebrafish embryos are particularly advantageous as they allow an easy identification of potential teratogenic and embryotoxic effects. Thus, this study aimed to assess the toxicological effects caused by two distinct mixtures of pharmaceuticals using the zebrafish embryo as an exposure model. One of the respective KNNs corresponds to an environmental realistic scenario found in the Douro River estuary (Portugal) and the other mimics an overestimated mixture of pharmaceuticals. The studied mixtures included five pharmaceutical compounds which were the following: carbamazepine, fenofibric acid, propranolol, sulfamethoxazole and trimethoprim. The assay targeted the liver toxicity only. The mixtures of pharmaceutical compounds proved to induce several physiological and morphological alterations during the embryonic stages. The anatomical changes were mainly spine deformities and yolk-sac edemas. Moreover, a significant diminishing of heart rates and of tail length was noted even at ng/L levels. Results showed that the toxic effects are concentration dependent. Other parameters evaluated as mortality, hatching time and spontaneous movements were not affected by mixture exposures. Even dealing with environmental low concentrations of pharmaceuticals relevant estrogenic effects were observed. If we face the effects on the zebrafish embryos as proxies of fish embryo-toxicity or even of general toxicity potential, the data suggests that risks seem to exist locally for the biopsy at the current levels of pollution by those pharmaceuticals. According to other data presented at this meeting, the concentrations of compounds tested seem to be able to disturb the gonads and the progeny, indicating that these low levels are potentially more harmful than what we could predict.

Acknowledgements: FCT Grant (SFRH/BD/31382/2006); FCT Project PTDC/ MAR/70436/2006 (POCI2010, FEDER).

TU 155
The toxicity potential of pharmaceuticals found in the Douro River estuary (Portugal) - Part III: Experimental assessment of gross developmental defects using the zebrafish embryo test

The study confirmed the usefulness of nuclear volume increases as a general marker of toxicant exposure and effects. For instance, males had higher nuclear volume increases than females. In addition, the anatomical changes included spine deformities and yolk-sac edemas. Moreover, a significant diminishing of heart rates and of tail length was noted even at ng/L levels. Results showed that the toxic effects are concentration dependent. Other parameters evaluated as mortality, hatching time and spontaneous movements were not affected by mixture exposures. Even dealing with environmental low concentrations of pharmaceuticals relevant estrogenic effects were observed. If we face the effects on the zebrafish embryos as proxies of fish embryo-toxicity or even of general toxicity potential, the data suggests that risks seem to exist locally for the biopsy at the current levels of pollution by those pharmaceuticals. According to other data presented at this meeting, the concentrations of compounds tested seem to be able to disturb the gonads and the progeny, indicating that these low levels are potentially more harmful than what we could predict.

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TU 156
Evaluation of whole toxicity of the river waters sampled in urbanized area of Japan, Mainly contaminated by treated and/or untreated sewage

The fish embryos are now promising and viable alternative tests in environmental toxicology and the zebrafish embryos are particularly advantageous as they allow an easy identification of potential teratogenic and embryotoxic effects. Thus, this study aimed to assess the toxicological effects caused by two distinct mixtures of pharmaceuticals using the zebrafish embryo as an exposure model. One of the respective KNNs corresponds to an environmental realistic scenario found in the Douro River estuary (Portugal) and the other mimics an overestimated mixture of pharmaceuticals. The studied mixtures included five pharmaceutical compounds which were the following: carbamazepine, fenofibric acid, propranolol, sulfamethoxazole and trimethoprim. The assay targeted the liver toxicity only. The mixtures of pharmaceutical compounds proved to induce several physiological and morphological alterations during the embryonic stages. The anatomical changes were mainly spine deformities and yolk-sac edemas. Moreover, a significant diminishing of heart rates and of tail length was noted even at ng/L levels. Results showed that the toxic effects are concentration dependent. Other parameters evaluated as mortality, hatching time and spontaneous movements were not affected by mixture exposures. Even dealing with environmental low concentrations of pharmaceuticals relevant estrogenic effects were observed. If we face the effects on the zebrafish embryos as proxies of fish embryo-toxicity or even of general toxicity potential, the data suggests that risks seem to exist locally for the biopsy at the current levels of pollution by those pharmaceuticals. According to other data presented at this meeting, the concentrations of compounds tested seem to be able to disturb the gonads and the progeny, indicating that these low levels are potentially more harmful than what we could predict.

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TU 157
Biologically treated Latvian municipal and industrial waste water toxicity to crustaceans D.magna and A.salina

One of the main reasons of the Baltic Sea pollution is leaching waste water from the waste water treatment plants. With HELCOM Baltic Sea Action Plan the Baltic Sea countries have committed...
ned themselves to achieve Baltic Sea with life undisturbed by hazardous substances hence reach-
ishing good environmental quality status. The aim of this study was to evaluate Latvian municipal and industrial waste water toxicity after their treatment in the waste water biological treatment plants using freshwater (D. magna) and salwater (A. salina) crustacean tests. Tested biologically treated waste water samples were collected in the time period from May 2009 until August 2010 from two industrial and two municipal waste water treatment plants. Toxicity was determined by using two different acute toxicity standard methods: freshwater - ISO Daphnia magna immobilization test (EN ISO 6341:1996) and salwater - Artemia salina (Artemia salina) immobilization test (ASTM-M 1988 standard). The acquired results showed that A. salina is more sensitive against biologically treated municipal and industrial waste water than D. magna. Both test results indicates that Latvian industrial waste water toxicity has a seasonal character showing higher toxicity in autumn and winter while mun-
icipal waste water is none or slightly toxic during all seasons. According to test results success of treatment process of Latvian municipal waste waters depends from inhabitant amount in the area the waste water is collected. Studies that biological waste water treatment is not sufficient for Latvian industrial waste waters. This study was performed in the frame of project INTERREG COHIBA (Control of hazardous substances in the Baltic Sea region).

TU 158
Global hepatic gene expression in fish exposed to sewage effluents: a comparison of different treatment technologies

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Effluents from sewage treatment plants (STPs) contain complex mixtures of pollutants. The ad-
dition of more advanced treatment steps to existing plants with conventional treatment has been suggested in order to enhance the removal of chemicals, including pharmaceuticals. To assess how efflu-
ents treated with different technologies affect biological responses in fish, we have performed in vivo studies with rainbow trout over two weeks. The treatments evaluated include conventional activated sludge alone or in combination with activated carbon, ozone, ozone plus a moving bed biofilm reactor or UV/H2O2 treatment. The study was performed at a semi-large scale pilot plant with parallel treatment lines at Huddskold STP (Stockholm, Sweden). Fish were also ex-
posed in cages up- and down-stream from another STP with conventional activated sludge treat-
ment (Stadsholm STP, Skövde, Sweden) to allow a comparison between rigorously controlled exposures with constant concentrations and natural field conditions. Therefore, the experimentally treated effluent induced an increase in liver and heart size. These effects were normal-
ized by several of the advanced treatments. However, we have also shown changes in the blood plasma metabolome upon exposure to e.g. ozone-treated effluents, indicating that advanced treat-
ment steps could potentially produce effluents affecting exposed organisms by unknown modes of action. Here, effects on mRNA expression were studied in order to more specifically identify affected physiological pathways and biomarkers. Quantitative PCR data showed that exposure to conventionally treated effluent induced hepatic zona pellucida glycoprotein 3 (zp3), a marker of estrogenic effects in terrestrial vertebrates. In contrast, ozone treated effluents upregulated the mRNA of an estrogen receptor in the liver. The treatment with UV/H2O2 effluent reduced the mRNA expression of zp3 while the mRNA expression of a marker of male sex hormones increased. In conclusion, effluents treated with advanced technologies including ozone and UV/H2O2 treatments induce changes in gene expression in liver, heart, and muscle, but their endocrine effects in fish are poorly studied. The aim of the present study was to test if these effluents affect gene expression in male rainbow trout (Oncorhynchus mykiss), a species not previously studied.
Sub-lethal effects induced by the non-steroidal anti-inflammatory drug (NSAID) Ibuprofen on the bivalve Dreissena polymorpha

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Pharmaceutical compounds are considered emerging environmental pollutants, since hundreds of these molecules are commonly released in the aquatic environment in the high ng/L to low µg/L range worldwide. Non-steroidal anti-inflammatory drugs (NSAIDs) are a group of therapeutic molecules that share similar pharmacologic properties and are widely used for control of pain and inflammation. Ibuprofen (IBU; (1R,2S)-propionic acid and (R and S) isomers), being one of the core medicines included in the “Essential Drug List” of the World Health Organization, is produced, sold and used in great amount worldwide. Because of its widespread, usual occurrence, the large prescription volume, and its excretion degree as parent compound and/or in form of metabolites, IBU has been identified as one of the main pharmaceuticals present in the aquatic ecosystems. Notwithstanding, at present, few studies have evaluated its potential toxicity toward non-target organisms.

Sub-lethal effects induced by this NSAID were investigated by using a multi-biomarker battery applied to the freshwater bivalve Dreissena polymorpha, especially considering a semi-static in vivo approach, zebra mussels were exposed for 96 h to increasing environmentally relevant IBU concentrations (1, 5, 25, and 50 µM), perfectly comparable to those currently released in aquatic ecosystems.

Cyto-genotoxicity was evaluated by the single cell gel electrophoresis (SCGE) assay, the DNA Diffusion Assay (DDA), the micronucleus test (MN test), and the lysosome membrane Stability (Neutral Red Retention Assay) on mussel haemocytes. In addition, the activity of catalase (CAT), superoxide dismutase (SOD), glutathione peroxidase (GPx) and the phase II detoxifying enzyme glutathione S-transferase (GST) was measured in the cytosolic fraction extracted from a pool of organisms to evaluate the possible oxidative stress induced by IBU exposure in fish. The biomarker battery pointed out a slight cyto-genotoxicity on zebra mussel haemocytes at low environmental levels (1 µM), while higher IBU concentrations were able to significantly increase both the (apoptotic and MN) cells and cell death. IBU seems to induce moderate effects on the activity of antioxidative and detoxifying enzymes, as shown by the notable oxidative status unbalance of exposed bivalves.

Ibuprofen: an early life-stage toxicity test with the fathead minnow (pimephales promelas)

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The phytotoxicity of the veterinary antimicrobial salinomycin, both in a pure form (96%) and in formulation as Sacox120 (120g/kg of Saccharomyces), to the plant Brassica rapa and its persistence in the aquatic environment were evaluated.

As a test system, the fathead minnow, Pimephales promelas, was selected as it is susceptible to the toxicity of many chemicals and pharmaceuticals (SSRIs, NSAIDs) and has a well-established method for the exposure of pelagic fish larvae. Freshwater benthic invertebrates, such as zebra mussels, also showed a sensitivity to salinomycin at environmental levels but were not specific to this target species.

Assessment of chronic effects of Ivermectin in Danio rerio using several parameters

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Ivermectin (IVM), a veterinary pharmaceutical, is widely used in livestock production and is a component of various parasiticides. No information is available about the chronic effect of IVM on aquatic organisms. Therefore, the present study was performed to assess the chronic toxicity of IVM to fish species, despite the vast literature about IVM effects to non-target organisms. In this study it was performed a chronic test based on the OECD (2008) guideline - Fish Screening Assay for Endocrine Active Substances. The test species Danio rerio was exposed to IVM from 0.4 to 62.5 µg/L for 28 days. After 28-days exposure the acute and chronic effects on survival, growth and body mass were measured. The NOEC was 30 µg/L.

Changes in global gene expression profiles and development of biomarker gene(s) of larval zebrafish exposed to selected serotonin reuptake inhibitors (SSRIs)

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The present study was performed to evaluate changes in global gene expression profiles and development of biomarker gene(s) of larval zebrafish exposed to the SSRI fluoxetine in food webs terminating in seabirds (i.e., kittiwakes and eiders) and grey seals.

TU 169

Phytotoxicity, persistence and uptake of antimicrobial salinomycin in the plant Brassica rapa

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TU 170

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The present study was performed to evaluate changes in global gene expression profiles and development of biomarker gene(s) of larval zebrafish exposed to the SSRI fluoxetine in food webs terminating in seabirds (i.e., kittiwakes and eiders) and grey seals.
Effects of sequential exposure to Ciprofloxacin and Sulfamethoxazole in marine microbial biofilms

Domingues et al.

Exposure regimes were changed, so that communities previously exposed to CIP were exposed (CIP) or Sulfamethoxazole (SMX) at nominal concentrations of 1 nmol/L. Afterwards the exposure regimes were changed, so that communities previously exposed to CIP were exposed to SMX [1, 14, 2000 nmol/L] instead and vice versa for communities originally exposed to SMX. This phase lasted five days.

At the end of each exposure regime the communities were sampled and assessed with respect to various ecotoxicological endpoints. Chi and content pattern were used to describe the effects on the algal part of the communities, while effects on bacteria were investigated using bacterial toxicity tests, mesocosm assays, and mixture exposures. Samples were also taken to study the genetic profiles of the exposed communities.

To test whether environmentally realistic concentrations of antibiotics affect natural communities and lead to tolerance developments, a flow through microcosm experiment was performed in 2010. In this study, four different antibiotics were studied in two species of bacteria, namely predominant microalgae and bacteria, established in aquaria from the indigenous microfauna found in the natural seawater in the Garland fjord on the Swedish west coast.

During the first two weeks the communities were continuously exposed to either Ciprofloxacin (CIP) or Sulfamethoxazole (SMX) at nominal concentrations of 1 nmol/L. The antibiotics were applied to the microcosms through a peristaltic pump. The antibiotic concentrations were chosen according to the concentrations commonly detected in surface waters throughout North America and Europe. The acute toxicity (TLC) toward aquatic macroorganisms has been well studied but information on long-term, low-level exposures at environmentally relevant concentrations is needed. The objective of the present study was to evaluate the toxicity of CIP and SMX to freshwater invertebrates in a multi-generational test with the waterflea Daphnia magna in a laboratory exposure. Daphnia were exposed to nominal concentrations of TLC ranging from 0.5 to 2.5 mg/L in 21-d tests for five generations (we have completed the second generation). Brood randomly collected from five replicate breakers after the 21-d exposure were used for the next generation. Each generation consisted of included survival, number of offspring (total and per adult), and cumulative number of offspring. After the first generation, a 21-d LC50 value could not be calculated due to high adult survival, after the second generation, an LC50 of 1.6 mg/L was determined with a NOEC of 100 µg/L. The results of biodegradation experiments suggest relatively slow biodegradation of CIP and SMX, while those of the degradation study suggest bacterial catabolic profiling (Biolog Ecoplates).

The exposure regimes were changed, so that communities previously exposed to CIP were exposed to SMX at concentrations <100 µg/L indicating that triclosan may pose minimal long-term risk to aquatic invertebrates at environmentally relevant concentrations.
human cell and plant models. Effects were different depending on the relative proportion of the drugs applied to cells, suggesting different target and action of these compounds.

Most sensitive species was T. platyurus and with a LOEC of of 0.5 mg/L, followed by P. subcapitata. The effects of SH were evaluated in the growth of the algae Pseudokirchneriella subcapitata and Chlorella vulgaris. SH induced an early hatching in D. rerio embryos exposed to concentrations above 7.4 mg/L. Moreover, it was observed that SH induced an early hatching in D. rerio embryos exposed to concentrations above 7.4 mg/L. Preliminary risk assessment of organic UV filters and UV light stabilizers in coral reef ecosystems at Okinawa, Japan

Effects of SH were evaluated in the growth of the algae Pseudokirchneriella subcapitata and Chlorella vulgaris (concentrations ranging from 0.1 to 100 mg/L) in the survival of Artemia franciscana and Thamnocephalus platyurus from (con to 10 mg/L) and in Danio rerio (zebrafish). Zebrafish assays include acute (concentrations ranging from 0.7 to 10 mg/L) and chronic concentrations (concentration of 5 to 500 mg/L). Exposure of adult organisms and the life stages test in which embryo development was monitored. The biomarkers lactate dehydrogenase (LDH); GST, glutathione-S-transferase (GST); Cholinesterase (Che) and catalase (CAT) were measured after zebrafish early life stages and adults to SH exposure. Most sensitive species was T. platyurus with a LOEC of of 0.5 mg/L, followed by P. subcapitata (LOEC = 1 mg/L). C. vulgaris (3.2 mg/L). A. franciscana (10 mg/L), H. rerio (5.5 mg/L). Moreover, it was observed that SH induced an early hatching in D. rerio embryos exposed to concentrations above 6.4 mg/L. Preliminary results show that D. rerio embryos exposed to concentrations above 7.4 mg/L also presented a higher GST activity.

This study investigated an applicability of the marker substrates of mammalian cytochrome P450 (CYP) for fish. For this purpose, the effect of a selective CYP inhibitor ketoconazole on in vitro oxygen consumption was studied. Following compounds were investigated as possible substrates for CYP3A: 7-hydroxyluxorifuranin (RH), 7-ethoxyluxorifuranin (ER), 7-hydroxyluxorifuranin (BF) and 7-hydroxy-4-trihalomethyloxazolin (BF). These substrates were incubated with a pool of liver microsomes from a fish (Atlantic salmon) with or without ketoconazole and tested for mineralization at 1, 10 and 40 μM. It was observed that mineralization at the lowest substrate levels (conjugated and non-conjugated) of the selected substrates was HPLC. The mode of inhibition and inhibition constants (K) were determined by a GraphPad Prism version 4.0 for Windows, GraphPad Software. (San Diego California, USA)

Ketoconazole was a potent competitive inhibitor of BR (KI=4.53 ± 0.1 μM) and BR (K 1 =1.6 ± 0.3 μM) and non-competitive inhibitor of BFC metabolism (Km=2.3 μM) in the microsomes. The results indicate that BFC and BC can be used as substrates to estimate CYP activity in fish liver microsomes.

Aim: to evaluate the effect of UV filters and UV light stabilizers on the growth of the freshwater cladocerans Daphnia magna and Daphnia longispina, as to the production of unviable progeny, being ethofumesate the single herbicide able to induce clearly distinct responses: D. magna and D. longispina released significant amount of aborted eggs following exposure to 1.9 mg L-1 and 4.6 mg L-1, respectively. Based on these impacts from recreational activities, 2) revealing their concentrations in coral reef organisms, thus the sensitivity towards increased levels of UV light stabilizers in coral reef ecosystems.

Effects were different depending on the relative proportion of the drugs applied to cells, suggesting different target and action of these compounds. Other bioassays will be optimized, in particular the 32P-postlabeling technique to determine DNA adduct reflecting genotoxic effect.
TU 187

Gastropod interspecies differences in response to 17α-ethinyl-estradiol: a full life cycle dose-response experiment
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Effects of 17α-ethinyl-estradiol (EE2) on snails are fairly well documented. However, for lower trophic levels, such as macroinvertebrates, the knowledge is less and the studies that have been performed are over a short period of their life cycle. Accordingly we investigated the effects of EE2 on two common freshwater gastropods, Radix balthica and Biomphalaria tansui, over a full life cycle. The quantified life history parameters for P. geniculata were generation, mortality, time and size to first reproduction and for F1 generation, success of mating. Intrinsic rate of increase was also calculated utilizing the life history parameters. The results for R. tansui indicated a clear positive correlation between age and EE2 concentration and for R. balthica there was only positive trend at increased environmental relevant concentrations. We also analyzed the importance of duration of the treatment on fecundity and found that R. tansui was significantly affected but R. balthica was not. The result from this study showed that the response not only depended on treatment, but also on the sensitivity of the two species and that duration is an important factor when evaluating response from EE2. These results imply that R. balthica may benefit from the effects of EE2 at environmental relevant concentrations by being less negatively affected.

TU 188

Ecological endpoints of exposure to toxic substances on interstitial copepods (crustacea, copepoda)
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Poor information on the ecological effects of pollutants on meiofaunal species living in the ground water environment is available. This study is aimed to assess sensory sensitivity to toxic substances of interstitial copepods living in subterrestrial porous aquifers, with special reference to the hyperbolic habitat. Copepods are by far amongst the most abundant and species-rich groups in the hyperbolic habitat and for this reason they have been selected for sensitivity testing. The results obtained suggest that sensitivity (detection, recognition, assessment and response) to toxic substances varies with the state of the growth of the copepod fauna as a whole. The effects of chemicals, potentially contaminating ground water, i.e. Arsenic (As), Cadmium (Cd), Copper (Cu), Manganese (Mn) and Lead (Pb) on the copepod fauna were evaluated. The sensitivity tests were conducted using acute (48-h) and chronic (56-d) toxicity tests. In the sensitivity experiments, the sublethal concentrations of the toxic substances were determined with the modified Lethal Concentration 50% (LC50) method. The increased mortality of A. tonsa, A. obtusa, B. pygmaeus, D. isopodi, P. acutus, P. cylindricus was related to the concentration of the toxic substance. In general, the results obtained are in agreement with those reported by other authors. These findings indicate that copepods, as a component of the hyperbolic environment, could be considered as bioindicators of groundwater quality as well as potential bio-ecological indicators to evaluate the effect of pollutants to the ground water environmental quality.

TU 189

Age altered sub-organisms’ responses in chromium exposed Daphnia schodleri (Anomopodidae: Daphniidae); sensitivity and antioxidant enzymes
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4Daphnia schodleri is a natural occurring cladoceran in Mexican freshwater bodies, and its relative big size and short life cycle allow its use in ecotoxicological bioassays. Generally, younger and older organisms are considered to be the most susceptible and/or sensitive organisms because of several sub-organisms’ level processes, such as ageing, in which antioxidant activity decreases and reactive oxygen species (ROS) cannot be totally neutralized. Moreover, aquatic communities are structured by organisms of different ages, in which physiological and biochemical responses differ for organisms of different ages. Depending on the stage of development, the number of females and neonates was evaluated under the perspective of the environmental risk assessment for the hyperbolic fauna.

TU 190

Is a higher resistance to copper correlated with a faster recovery in daphnids?
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4Natural populations are commonly exposed to sequential pulses of contaminants. If the input of a pulse of lethal levels of a contaminant causes the disappearance of the most sensitive genotypes from a population (genetic load), the remaining genotypes will be able to recover from the genetic load. However, the ability of the impacted population to withstand a further pulse of the contaminant will largely depend upon recovery rate of the remaining organisms. This study aimed at evaluating if the genetically determined resistance is positively related with a faster recovery capacity, which would guarantee a double advantage to the resistant genotypes. To achieve this, cloned lineages of Daphnia longispina O.F. Müller, exhibiting different sensitivities to lethal levels of copper, were exposed to sequential pulsed of this metal, to evaluate specific recovery rates and their relation to resistance. For each cloned lineage, the intensity of pulses corresponded to the respective concentration of copper causing 30% of mortality after 24h (LC30,24). Obtained results showed no positive correlation between genetically determined resistance to lethal levels of copper and recovery rates. It was also observed that even during the recovery period, mortality continued to occur, suggesting that standard lethal sublethal toxicity assays (e.g. LC50) might grossly underestimate toxicity occurring during exposure to the toxicant. Furthermore, the lack of a positive correlation between resistance and a faster recovery highlights the increased risk at which impacted populations are subject after being exposed to a pulse of lethal levels of a contaminant.

TU 191

Cellular energy allocation in Chironomus riparius: sensitivity and relevance
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The Cellular Energy Allocation (CEA) methodology was developed as biomarker technique to assess directly the impact of toxic stress on the energetic balance of treated organisms. The CEA methodology is based on the concept that organisms’ sensitivity to toxic substances of interstitial copepods living in subterrestrial porous aquifers, with special reference to the hyperbolic habitat. Copepods are by far amongst the most abundant and species-rich groups in the hyperbolic habitat and for this reason they have been selected for sensitivity testing. The results obtained suggest that sensitivity (detection, recognition, assessment and response) to toxic substances varies with the state of the growth of the copepod fauna as a whole. The effects of chemicals, potentially contaminating ground water, i.e. Arsenic (As), Cadmium (Cd), Copper (Cu), Manganese (Mn) and Lead (Pb) on the copepod fauna were evaluated. The sensitivity tests were conducted using acute (48-h) and chronic (56-d) toxicity tests. In the sensitivity experiments, the sublethal concentrations of the toxic substances were determined with the modified Lethal Concentration 50% (LC50) method. The increased mortality of A. tonsa, A. obtusa, B. pygmaeus, D. isopodi, P. acutus, P. cylindricus was related to the concentration of the toxic substance. In general, the results obtained are in agreement with those reported by other authors. These findings indicate that copepods, as a component of the hyperbolic environment, could be considered as bioindicators of groundwater quality as well as potential bio-ecological indicators to evaluate the effect of pollutants to the ground water environmental quality.

TU 192

Chitinolytic activity as an indicator of altered survival, growth and reproduction in Daphnia pulax and Daphnia magra (Crustacea: Cladocera) exposed to spinosad and diflubenzuron
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Chitinase is involved in exoskeleton degradation and recycling during the molting process in arthropods. In aquatic species, the molting fluid is released into the aqueous environment, and chitinase activity and chitinase expression are an early warning indicator of adverse ecologic effects in freshwaters. Interestingly, chitinase activity in several species was increased in response to exposure to a range of chemical stressors, including various insecticides. In this study, we investigated the sublethal effects of the insecticide Movento® (spirotetramat) and Cadmium chloride on the midge Chironomus riparius. After exposure to a gradient of insecticide and metal sub-lethal concentrations, effects on CEA, growth, oxygen consumption rate, burrowing behaviour, emergence and adult size were measured. Results are discussed in terms of the sensitivity of the different endpoints and the advantages of using energetic biomarkers as a early warning indicator of adverse ecologic effects in freshwaters.

TU 193

Do eastern mosquitofish male harass less when exposed to environmentally relevant levels of spinosad?
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Behaviour is the outcome of many complex physiological and biochemical reactions. Animals are thought to adjust to their environment through their behaviour and thus behaviour provides a sensitive early warning signal for the presence of human-induced compounds, such as endocrine disrupting chemicals (EDCs). Our study species, eastern mosquitofish, is widespread in Australia and in sites heavily polluted with EDCs. Male mosquitofish use a modified tin known as a gonopodium during copulation to inseminate females, and previous research has found that females preferentially associate with males with longer gonopodia. In this study, we exposed male mosquitofish to environmentally relevant concentrations of 17β-estradiol (E2) and examined how exposure affects the reproductive behaviour and gonopodium morphology of males. Specifically, we asked if E2 exposure decreases male copulation attempts and gonopodial display.
We set up a preference test, where female could first observe male behaviour (exposed and unexposed) and then mate with the preferred male. We measured the time and frequency of male be- haviour: orientation, chasing, gonopodal display and copulation attempts, and the female time spent in close proximity with the preferred male. In addition, male mating success was assessed by calculating the number of live offspring and mating success tested against the morphology of the offspring and spermatozoa. Results will be discussed within the context of male reproductive success, female sexual selection and EDC exposure.

**TU 194** Toxicity of the sugar cane herbicides Diuron and Tebuthiuron in zebrafish (Danio rerio) early-life stages

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Herbicides are widely used in agriculture and are known as a diffuse source of pollution of surface water and groundwater. The impact of herbicides use on non-target organisms is little known although mutagenic and genotoxic effects in fish exposed to herbicides have already been observed. Therefore, the question about the impact of herbicides is significant because the area comprising approximately five million hectares. In the present study, the toxicity of diuron and tebuthiuron, two herbicides widely used in sugarcane cultivation, was evaluated using the Fish Embryo Toxicity Test (FET), with Danio rerio, a tropical cyprinid used in toxicological research. The herbicides were selected because of their importance in agriculture, the high level of contamination and their effect on aquatic ecosystems. All concentrations were tested, ranging from 0.001 to 0.08 g L⁻¹ of Diuron; and from 0.1 to 0.6 g L⁻¹ of Tebuthiuron. At concentrations over 0.02 g L⁻¹ of diuron and 0.24 g L⁻¹ of tebuthiuron, exposed embryos presented a general development delay, pericardial edema, tail deformities and a delay in yolk absorption. Despite the low acute toxicity of diuron and tebuthiuron (LC₅₀₉₆₋₉₆⁻¹ = 0.024 (0.022 - 0.026) g L⁻¹ and LC₅₀₉₆₋₉₆⁻¹ = 0.35 (0.17 - 0.53) g L⁻¹, respectively) observed for zebrafish early-life stages, chronic effects at sublethal level could be observed. The endpoints used on this study allow a better understanding of the toxicity and mode of action of these two herbicides, suggesting that, chronic effects due to long term exposure to the herbicides can be very important, leading to alterations in the organisms and consequently the disruption of aquatic ecosystems. The exposure times of 96 hours and 4 weeks were high enough to detect potential recovery (hatching and anomalies) and physiological (length and weight) parameters which are ecologi- cal endpoints of the effect of herbicides. Chronic effects and sublethal endpoints of the herbicides at different exposure scenarios could be used as indicators for environmental contamination. In conclusion, the herbicides used in sugarcane cultivation can be dangerous to aquatic ecosystems and highlight the need for better management of these herbicides in the future. In the long term, the present study can be a basis for better management of these herbicides in the city and the region, as well as the impact of these herbicides on aquatic ecosystems.

**TU 195** Biomarkers as a tool to study different scenarios of exposure to potassium dichromate in zebrafish early life stages

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Toxicology dichromate (PD) was classified by the European Chemical Agencies as a “Substance of Very High Concern” due to its strong potential to cause environmental health risk posed. PD enters the air, water and soil through natural processes and as industrial chemicals such as chemical, leather and textile manufacturing and may an indicator of environmental contamination. PD is genotoxic, carcinogenic, teratogenic and neurotoxic and has cell metabolic activity. The level of chromate in water is generally low (levels found in rivers are often around 1 ppb) and thus, a proper analysis of risk is best achieved by evaluating long term effects and different exposure scenarios able to take into account different exposure periods, age of the organisms and capacity of recovery after an episode of exposure. Moreover, sublethal parameters such as biochemical, behavioral and physiological must be used so that effects can be detected.

The aim of this work is to evaluate the effects of PD in zebrafish (Danio rerio) early life stages us- ing different exposure scenarios. The test was based on the OECD guideline 210 (Fish, Early-life Stages Test, Toxicity Test) for fish exposed to freshly fertilized eggs. In the first scenario (A), eggs were exposed to PD concentrations between 0.37 mg L⁻¹ and 10 mg L⁻¹ during 28 days. In the second scenario (B), organisms were subjected to a period of exposure (14 days) to the same PD concentrations followed by a period where organisms were transferred to clean medium (14 days) to assess the potential recovery every. In the third scenario (C), organisms had first been kept in clean medium for 14 days and then transferred to the above mentioned PD concentrations for 14 days to assess influ- ence of age in the response to the chemical. A semi-static test design was used in every exposure scenario, with test medium renewal each two days. At days 1, 4, 14, 28 and 35 of all scenarios the biomarkers cholinesterase, glutathione S-transferase, lactate dehydrogenase and carboxylesterase were measured in order to contribute to the understanding of the dynamic of the toxic response and the influence of exposure time, age and recovery potential on that response. Moreover, biochemical responses were linked to behavioral, developmental (hatching and anomalies) and physiological [length (in weight)] parameters which are ecologi- cally very relevant and indicators of the organism fitness.

**TU 196** The estrogen receptors in salmonid fish

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Estrogen receptor (ER) genes that encode them are well conserved among vertebrates. They mediate physiological effects of hormones involved in growth, reproduction and develop- ment in both males and females. Compared to other vertebrates, salmonid species have twice as many ERs due to a unique and rather recent duplication event early in the salmonid lineage. Gene duplications are considered one of the major factors that enable species to rapidly adapt to various ecological challenges by providing novel sources for gene functions. The multiple ER genes could be expressed during either the fresh water phase or the marine part of their lives, allowing a better understanding of the dynamic of the toxic response and the influence of exposure time, age and recovery potential on that response. Moreover, biochemical responses were linked to behavioral, developmental (hatching and anomalies) and physiological [length (in weight)] parameters which are ecologi- cally very relevant and indicators of the organism fitness.

**TU 197** The respiratory rate at subambiental and organismal level in the ground beetle along two metal pollution gradients

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Surviving in a polluted environment is usually connected with changes in metabolic processes. An increase in respiratory rate may result from energetically costly processes of combating con- taminant exposure (e.g. cellular repair mechanisms, elimination of contaminants) but a decrease due to damage in respiratory enzymes may be observed. While some species of carabids are able to maintain viable populations in areas highly contami- nated with metals, they may still incur physiological costs associated with metal exposure. To assess the effects in polluted areas, we measured the 1,2-diketone content in Carabus nemoralis from two sites in the vicinity of two zinc and lead smelters: Olkusz and Miasteczko Slaskie, S. Poland. Because the response of an animal to stress is a complex reaction, which depends not only on the type of a contaminant, but also in environmental factors such as temperature, humidity and pollution. Therefore, we characterized the respiratory rate at the cellular level. The lack of relationship between body composition and respiration rate and thus is either not sensitive enough or is prone to temporal change in conditions - as is the case for metal bioaccumulators. The effects on whole-organism respiration rate would thus represent real long-term effects of chronic exposure issues. Moreover, while ETS - the instantaneous respiratory rate in response to actual conditions at the time of sampling the cells.

**TU 198** Allometric slope to assess stress factors on biological communities

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Biological food webs are strongly organized in hierarchical levels, as shown by their several mult- itrophic interactions. Studies focusing mainly on single food chains are known to be difficult to extrapolate to higher hierarchical levels, like entire biological communities. Therefore, allometry can be used as a tool to characterize the biological communities and the interactions between the species. Allometry is the study of the variation in the scale of a particular variable with the size of a species. The relationship between the body size of a species and the physiological process the species experiences. The need for a method to determine the impact of endocrine disrupters on the activity and functions of the ERs inside salmonids is great. The results of the present study show the distribution and thus the role of the different ERs in the salmonid life-cycle, migration phase and during embryonic development. The results will in the future help determine the impact of endocrine disrupters on the activity and functions of the ERs inside salmonid tissues, asking if it is an advantage or disadvantage to have several ERs?

**TU 199** Metabolic pollution affects small mammal assemblages: evidence from a large smelter-impacted area

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Effects of pollutants on small mammals have mainly been studied at individual level while effects on populations and communities might be more relevant endpoints to assess long-term impacts of pollution on ecosystems. In this study, we assessed the impact of heavy metals pollution on small mammal communities in a large smelter-impacted area (40 km², Northern France), where soils have been polluted for decades by Cd, Pb and Zn. Animals were trapped (8640 trap-nights) during autumn in woody habitats (copes, hedgerows, tree areas). A biological explanation for this last change is less clear, but chemi- cal correlations between cations are plausible. Overall, we show that the allometric slope in soils reflects (1) the elemental conditions in the soil and (2) the functioning of food webs. Allometric slopes can therefore be used to assess the actual effects of stress factors on biological communities.
with pollution until ≈ 1000 mg kg⁻¹ of Pb in soil, and then decreased. Richness differed between imidacloprid (F₂,91=11 283; p<0.001) and naphthalene (F₂,91=10.16; p<0.01) treatments, whereas thiram reduced eggshell thickness (F₂,61=7.19; p<0.01). None of the chemicals affected fecundity or hatching rates, but chick survival was significantly reduced by the three compounds, with mortality rates >50% in all cases (<20% mortality of controls). Chick growth rates were unaffected by the pesticides, although control chickens tended to show higher gains when compared to other treatments. The last egg was laid 98 days after the end of the exposure. These observed lagged effects on chick survival suggest a potential for reproduction disruption of coated seed ingestion.

TU 204

PCBs and ecotoxicological data. In silico analysis in relation with in vivo and in vitro data

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Therefore in our study, the impact of cadmium is evaluated at a genetic level by q-PCR on 8 genes of interest after exposure in laboratory conditions of E. minima, diatom populations cultivated in suspension under controlled conditions following their growth kinetics and their Cd bioaccumulation. Population growth rates reveal a high impact of Cd at a concentration of 100μg Cd/L with a total inhibition of growth. Therefore, assemblage structure is supposed to disappear because of the disappearance of species sensitive to metals and/or of population species poorly sensitive to habitat quality (opportunisti genetrit species). Analyses of metallic pollution influence on assemblage composition are in progress, which may allow determining which species are mainly affected and which are the characteristics of small mammal assemblages in metal polluted lands.

 TU 205

Characterization of growth, gene expression and behavioural effects of exposure to ozone-treated and untreated oil sands processes water on Chironomus dilutus larvae

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Global energy demands continue to increase, driving a shift from conventional oil sources to oil sands production. The Athabasca oil sands in Alberta, Canada are the world’s largest (8-oxodG). The basal level of DNA damage is reached on day 3 indicating an effective DNA repair system. The 8-oxodG level detected in MTS treated mussels is weak during the exposure. Cd induced 8-oxodG after the beginning of the exposure. The level of 8-oxodG is higher with the higher Cd concentration but it was detected later. This study revealed that the comet-hog assay is sensitive enough for the measurement of 8-oxodG in mussels exposed.
acute and chronic toxicity of OSPW observed across multiple taxa. To effectively treat OSPW and inhibited growth in the ozone-treated OSPW exposures suggests that NAs may be contribut-

In both assays, larvae exposed to untreated OSPW exhibited disordered case-building

effectiveness of ozonation to eliminate OSPW effects on relevant organisms, we initiated exposure

to a mean Mo-level of 1.03 mg Mo/L. A second 120d-study under laboratory conditions exposed

next to the effects observed. We are verifying if general expression in C. dilutus larvae follow-

The overall robustness of the REACH requirements for >1000 tonnes substances, information on the bioaccumulation

The overall robustness of the REACH requirements for >1000 tonnes substances, information on the bioaccumulation

In the first study the internal Mo-content (total + organ-specific internal levels) was evaluated in

The total eggshell thickness of all species

We found the percentage of Ols to Ets from 99.92 to 99.62%, while the average length of the albu-

Lastly, we also found Mo contamination in eggshells of Cyclops saularis and Nectaria punctata. SEI showed normal character on 3 layers of 15 eggshell species. The thickness of 3 layers was found and has the following order: a middle palisade layer > an inner mammillary layer > an outer cuticle layer. There are 2 types (ambiguous shape or knobbed shape) of mammillary layer. While, the morphology of palisade layer is a spiny shape. It has pores which connect from cuticle layer to mammillary layer. The total eggshell thickness of all species was ranging from 45.68±13.31 to 162.92±40.41 micrometer and correlated with Neovae. This finding showed the utilization of SEI is a powerful and comfortable to analyze percentage of trace elements accumulation, metal contamination, and classified avian eggshells correlated with the egg evolution. Acknowledgement: This research was funded by grants from Saltwater University Research & Development Institute (SURDI) and Faculty of Science, Saltwater University, Thailand.

TU 215 Bioaccumulation of Molybdenum in the aquatic environment: literature and laboratory/ field-collected data

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In the first study the internal Mo-content (total + organ-specific internal levels) was evaluated in various fish species (eel, stickleback, perch, carp, broom, trout) that grew up in the discharge water of a molybdenum trioxide/ferromolybdenum producing company, containing a mean level of 1.03 mg Mo/L. A second 120d-study under laboratory conditions exposed rainbow trout to two different Mo-levels (1 and 12.7 mg Mo/L), for a period of 60 days followed
Both studies generated bioconcentration factors well below 1 when muscle tissue was considered. Concentration levels in the muscle tissue of fish taken from both experiments remained below 0.2 mg/kg dry wt. Total concentration levels that were determined for rainbow trout during the exposure period were situated between <0.20 and 0.53 mg Mo/L. The outcome of these studies clearly support the inverse relationship between exposure concentration and biomarker response for molybdenum, and also demonstrate that molybdenum in fish is adequately regulated up to the PNEC Gund, 12.7 mg/L.

TU 216

Behavioral response of damselfly larvae captured in small ponds and their biomarker response in relation to accumulated micro pollutants

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Micro pollutants are only present in the environment for a small period of time, especially pesticides, which makes monitoring difficult. Moreover, little is known on the bioavailability and their related effects of accumulated micro pollutants. Therefore accumulated levels of a wide range of micro pollutants in fish exposed damselflies were measured and related to functional endpoints and biomarker responses. We selected 7 ponds through Flanders (Belgium) based on expected differences in type and amount of pollution. From each pond around 40 individuals of damselfly larvae species Ischnura elegans were captured. The collected organisms were placed in vivo for 24h, each in individual containers filled with water from three ponds. In each location the larvae-bodies were measured on 15 different pesticides and 9 heavy metals. To verify if differences in concentrations of the pollutants result in an ecological relevant effect, functional endpoints were measured. In fact general activity and feeding rate were scored over a fixed time period. The general activities were filmed and total distance, speed and amount of movements were counted. The feeding rate was assessed by scoring the number of juvenile water fleas (Daphnia) that were eaten over a time period. As biomarker responses, Acetylcholinesterase (ACHE), Glutathione S-transferase (GST) and energy budget (Ea) were measured in the head of individual damselfly larvae.

Five pesticides are accumulated in the larva, Iopropuron, metolachlor, buprofezin, linuron and terbutril and found at different concentrations in all samples with a great difference between de polluted and unpolluted sites. The GST activity and some energy budgets give a significant correlation to the accumulated metals and significant differences occur between the ponds for metal accumulation and biomarker responses.

Furthermore our results indicated that the accumulation of micropollutants can increase the induction of biomarkers and affect the general activity of the damselfly larvae Ischnura elegans.

TU 217

Antioxidant enzyme activities responses in freshwater biofilm in a metal polluted system

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The main goal of this study was to assess seasonal patterns of metal exposure and toxicity in a metal polluted freshwater system based on biofilm AEA activities. We expected that AEA responses in biofilm might be affected by environmental variables, assuming metals to be the most important source of variability. To reach this goal an annual monitoring study was carried out in the Otor River (NE Catalonia, Spain). It is located in a former mining area and receives elevated metal inputs (mainly Fe, Mn and Zn). Three sites were selected: Non-Impacted site [NI], before the mining source with a background Zn concentration, Site1 (S1) downstream the mining source causing an increase of background Zn concentration, and Site2 (S2) further downstream. Physical and chemical parameters were analysed. Dissolved and bioaccumulated Zn, Mn and Fe were determined in six samples of biofilm and free metal ions and metalloids were calculated with the MINTEQ, AEA analysed in biofilms included CAT, APX, GR, GST and SOD. The relative abundance of the groups of photosynthetic organisms was determined by means of a FlowPAM fluorometer.

The free metal Zn concentrations and bioaccumulation of Zn showed the same pattern over the monitoring period and were inversely related to the water discharge. AEA showed in biofilms different patterns over the year. In the NI, AEA did not follow the metal concentration trends. CAT, GR, CAT and SOD decreased when free metals and bioaccumulation concentrations increased, suggesting an inhibition caused by accumulated metals. GST did not relate to metal exposure or accumulation. AEA dynamics might be explained also by other environmental factors such as light, as well as by spatial and temporal species composition changes.

We can conclude that AEA responses in biofilms respond to metal accumulation. However, despite being very sensitive, AEA do not linearly correlate to the metal concentrations. Thus, from a scientific point of view, using biota standards could be preferred over recalculating them into water standards, because this involves the least uncertainties. Nevertheless, sampling of individual fish or fish species is accompanied with some additional uncertainty as well.

TU 220

Moving aquatic bioaccumulation assessments to the next level: Progress made and challenges ahead

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Since it was formed in 2009, the HESI Bioaccumulation Project Committee has successfully advocated for the value of bioaccumulation assessment as an important tool to better our understanding of contaminant response and behavior in the environment.

Bioaccumulation assessment has advanced through the development of new reactivity assessment tools and the identification and characterization of contaminant pathways to a point where it is recognized by a large number of stakeholders as an important tool to support ecotoxicological risk assessment. The committee has also demonstrated progress that has been made in the field to identify key gaps in current 'B' knowledge, and to discuss how recent progress in 'B' science can be integrated into the regulatory process.

In the context of the ongoing scientific discussion about the potential ecotoxicological impacts of flood events, it is of vital importance to understand the detailed mechanisms of contaminant uptake from suspended particles and related effects in aquatic biota. As part of the interdisciplin
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The nominal concentration of suspended solids was 10 g L\(^{-1}\) in both relevant concentrations. A control treatment without addition of PAHs was also included in a pyrene at environmentally hydrocarbons (PAH) pyrene, phenanthrene, chrysene, and benzo[\(a\)]pyrene at concentrations that induced low biomass stress caused the PAH metabolites. CYP protein levels are currently being evaluated using Western Immunoblotting. The results of this study clearly indicate the importance to account for the temporal variability of physiological markers and to support exposure experiments of aquatic biota to particle-bound pollutants with analytical data.

**TU 222**

**Investigating variation in bioaccumulation potential of hydrophobic organic chemicals caused by lipid composition diversity**

A van den Heiden, MTO Jonker

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Identification factors (BCFs) reported in the literature are often highly variable for a single hydrophobic organic chemical (HOC). Though in some cases the variation may be caused by experimental artifacts (e.g., incomplete phase separation or nonequilibrium conditions), true mechanisms may affect bioaccumulation of HOCS in such a way that BCFs should perhaps be considered case-specific and genetic parameters. Bioaccumulation is a product of equilibrium partitioning between an organism and its surrounding aqueous environment and is therefore determined by the characteristics of the interacting phases. For instance, temperature and pH of the aqueous medium and biotransformation capacity of the organism have been shown to affect bioaccumulation. However, studies to date are limited in the examined species and factors. Fatty acid pools are known to be highly variable between species, but even intraspecies differences may occur due to a temperature-dependent mechanism regulating homoeoviscosity of cellular membranes. In the present study, both inter and intraspecies variation in bioaccumulation was investigated by measuring sorption of PBDEs (1) biological homogenates generated from diverse aquatic organisms (i.e., snail, midge larva, fish, barnacle, mussel, stickleback, eel, and carp), and (2) homogenates of blackworms and sticklebacks acclimatized to different environmentally-relevant temperatures (4 - 24 °C). Results indicated that lipid-normalized homogenate-water free fatty acid ratios may differ for different blackworm and sticklebacks (2). Lipid-normalized partition coefficients for different acclimated batches were also significantly different, although differences were minor. However, there was no significant correlation of any of the investigated factors with BCFs. A further indication is that BCF values may not be generally applicable to any species for the purpose of risk assessment of HOCS, even when disregarding the interspecies variation in metabolic capacity. Studying homogenate-water partition coefficients provides clear advantages above using living organisms, as it enables measurements of sorption to biological material without the interference of complexing factors, such as biotransformation, kinetics, and growth dilution.

**TU 223**

**Toxicokinetic and toxicodynamic modelling for Daphnia magna exposed to acetylcholinesterase inhibitors**

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The toxicokinetics of organophosphate (OP) insecticides in Daphnia magna is described by a two-compartment model. A minimal number of measured parameters was used to fit the model. The model allows for a more accurate description of the biotransformation processes of OPs in aquatic organisms and to estimate the corresponding rate constants necessary for the systemic modelling approach under environmentally-relevant conditions. It is shown that for dichlorvos and malathion the rate constants for biotransformation and excretion are constant over a wide range of physiochemical properties (log Kow from 0.33 to 4.96) in the freshwater amphipod Gammarus pulex. This study consists of metabolism screening and identification tests (24 h exposure), biotransformation kinetics experiments with a latency of two days, this peak of metabolism followed by a subsequent decrease over time. With a latency of two days, this peak of metabolism was followed by a subsequent decrease over time. With a latency of two days, this peak of metabolism followed by a subsequent decrease over time. With a latency of two days, this peak of metabolism followed by a subsequent decrease over time.
the liver is the main site of xenobiotic metabolism in fish, in vitro assays to measure metabolic

The metabolic clearance rates generated by such in vitro systems need to be scaled to the whole fish. To this end, physiologically based models can be used that convert the in vitro clearance rate of the liver preparations into the in vivo clearance rate, Km, of the fish. The Km can then be incorporated into existing BCF models to predict the in vivo BCF. Currently, in vitro-based BCF predictions are available only for a small number of chemicals, but they are thus promising.

The results showed that by exposure adult T. cacoeciae to formulations producing T/S-Blank and Celaflor, the tested preparations were either harmful (Neemazal-Blank) or moderately harmful (Celaflor). The two Quassin formulations tested were harmless. When tested in water was offered to adults T. cacoeciae, all tested chemicals were almost harmless. In a further test, host eggs parasitized at different time intervals (1-8 days), were sprayed at the same day. The results indicated that only Neemazal T/S-Blank formulation was slightly to moderately harmful reducing adult emergence. The results showed, in general, that both Azadirachtine and Quassins were relatively safe to the tested parasites that could be used in combination with T/S formulations. Further studies in this area can be used in designing a less hazardous biodegradable control strategy to combat mosquito pest with less negative impact on beneficial natural enemies as well as the surrounding environment.

TU 235

Evidences for genotoxicity of paralytic shellfish toxins produced by Gymnodinium catenatum in white seabream (Diplodus sargus)
P. Pires1, S Guilherme2, M Barata1, L Nicolau1, M Pacheco2, P Pousão-Ferreira1
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Parasitoids of the genus Tricho grammata occur naturally worldwide and play an important role as natural enemies of lepidopterous pests on a wide range of agricultural crops. Laboratory studies were carried out using a test system: (a) Exposure to Neemazal formulations and Adult parasites (parasites) and Less susceptible life stage (parasites within their hosts) of Tricho grammata to two formulated products of each of two botanical insecticides: Azadirachtine (Neemazal T/S Blank and Celaflor) and Quassins (alcohol or water extracts). The results showed that by exposing adult T. cacoeciae to formulations producing T/S-Blank and Celaflor, the tested preparations were either harmful (Neemazal-Blank) or moderately harmful (Celaflor). The two Quassin formulations tested were harmless.

TU 236

Effect of microcystin-LR on the physiological performance of Daphnia magna and its offspring R. Oritz-Rodriguez1, TS Dao1, C Wiegand1
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Due to eutrophication and other factors, the frequency of cyanobacterial blooms has increased worldwide. Besides being a nuisance, they can produce toxic substances to the ecosystem and hu-

TU 237

Comparison of the transcriptomic response of a Cd-sensitive and a Cd-tolerant Daphnia pulex isolate to cyanobacterial stress
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We investigated gene expression of a Cd-tolerant and a Cd-sensitive Daphnia pulex isolate chronically exposed for 16 days to the toxic cyanobacteria Microcystis aeruginosa. Cyanobacte-
ria are known for their ecologically important group which plays an essential role under climate change conditions, are known for their production of microcystin (a toxic cyclic hexapeptide). Life table tests revealed an increased tolerance of the C-d-adapted isolate to M. aeruginosa. The micro-

TU 238

Effects of cyanobacterial extracts and cyanotoxins on the growth of microalgae
C. Maranis1, M. Loureiro1
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Toxic-producing cyanobacteria occur in aquatic ecosystems worldwide and their cyanotoxins may have various effects on aquatic organisms. However, not much is known about the potential effects of cyanotoxins on microalgae, an ecologically important group which plays an essential role at the base of aquatic food chains. The purpose of this work was to study the effects of Microcystis aeruginosa and Aphanizomenon ovalisporum on a model green alga and an eucaryotic green alga. The microalgae used in this study were isolated from the estuarine environment, while Microcystis aeruginosa and Aphanizomenon ovalisporum were cultured in the laboratory. The results of this study showed that the toxic effects of cyanotoxins on microalgae were not species-specific and that the higher sensitivity to M. aeruginosa of the C-d-sensitive isolate may be due to a higher microcystin accumulation in this isolate. This research benefits from and contributes to the Daphnia Genom-

TU 239

Transfer of the cyanobacterial toxin BMAA via irrigation from water to an agricultural plant (Triticum aestivum)
V. Comardou-la2, A. Poull2, P Plaghmacher1
1Technical University of Woodland Ecology and Inland Fisheries, BERLIN, Germany 2Humboldt-Universität zu Berlin, Institute of Biology, BERLIN, Germany
BMAA ([S-N-methylamin-L-alanine]) is a neurotoxic non-protein amino acid produced by dif-

TU 243

Effects of botanotic insecticides on the egg parasitoid Tri chogramma cacoeciae marcellae (Hym. Tri chogrammatidae)
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1Agricultural Research Corporation, W AD MEDANI, Sudan
Microcystis aurigunosa is a toxic bloom-forming cyanobacterium that is known for its production of microcystin, a toxic cyclic hexapeptide. A recent study was carried out using a test system: (a) Exposure to Neemazal formulations and Adult parasites (parasites) and Less susceptible life stage (parasites within their hosts) of Tricho grammata to two formulated products of each of two botanical insecticides: Azadirachtine (Neemazal T/S Blank and Celaflor) and Quassins (alcohol or water extracts). The results showed that by exposing adult T. cacoeciae to formulations producing T/S-Blank and Celaflor, the tested preparations were either harmful (Neemazal-Blank) or moderately harmful (Celaflor). The two Quassin formulations tested were harmless.

TU 244

On the effects of paralytic shellfish toxins (PSTs) in fish  Although fish are frequently exposed to PSTs, the number of studies on their toxicity is low. In particular, reports on genotoxicity evaluation of PSTs are rare. Some of the available data show that paralytic shellfish toxins (PSTs) are genotoxic in vitro and in vivo. This study was carried out using a test system: (a) Exposure to Neemazal formulations and Adult parasites (parasites) and Less susceptible life stage (parasites within their hosts) of Tricho grammata to two formulated products of each of two botanical insecticides: Azadirachtine (Neemazal T/S Blank and Celaflor) and Quassins (alcohol or water extracts). The results showed that by exposing adult T. cacoeciae to formulations producing T/S-Blank and Celaflor, the tested preparations were either harmful (Neemazal-Blank) or moderately harmful (Celaflor). The two Quassin formulations tested were harmless.

TU 245

Gene expression of a Cd-tolerant and a Cd-sensitive Daphnia pulex isolate chronically exposed for 16 days to cyanobacteria Microcystis aeruginosa. Cyanobacterial ex-

TU 246

Effect of microcystin-LR on the physiological performance of Daphnia magna and its offspring
R. Ortiz-Rodriguez1, TS Dao1, C. Wiegand1
1AGB, BERLIN, Germany
Due to eutrophication and other factors, the frequency of cyanobacterial blooms has increased worldwide. Besides being a nuisance, they can produce toxic substances to the ecosystem and hu-

TU 247

Guideline 305 with fish, which is demanding in terms of resources, costs and number of animals

Although a combination of several in vitro tests is used to predict the toxic and ecotoxicological effects associated with cyanobacterial blooms, the frequency of cyanobacterial blooms has increased worldwide. Besides being a nuisance, they can produce toxic substances to the ecosystem and hu-
Transfer of cyanobacterial toxins into edible plants via irrigation with lake water - a Chinese case study

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Thermal pollution of lake water bodies goes along with an increase of cyanobacteria in the microbentic community. The ability of cyanobacteria to produce toxins is well known and many cases of poisoning of animals and humans have been described worldwide. The exposure routes were mainly via drinking water. Another possible risk is the irrigation of edible plants with cyanobacteria contaminated lake water. The aim of this study was to estimate the risk to human health in case of an algal bloom taking place e.g. at the lake Chao (China). In this study the cyanotoxin content in vegetables (spring onion, pak choi and courgette) grown on the shore of lake Chao was investigated. Microcystins (MC) were measured in the cyanobacterial bloom containing lake. The continuous irrigation of the plants with lake water led to high accumulations of MCs in all vegetables. The MC concentrations in the vegetables were above the TDI (“tolerable daily intake”) recommended by the WHO.

Temporal variations of microcystins and anatoxin-a in San Roque reservoir (Córdoba-Argentina)

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The occurrence of toxic cyanobacteria blooms is well known. However, systematic reports on the occurrence of cyanotoxins in Southern America are scarce. San Roque reservoir is an artificial lake, formed by a dam, which is the main source of drinking water for Córdoba city (1.5 million inhabitants). Fishing, swimming, and sailing are allowed in the reservoir. The main toxic cyanobacterial blooms monitored in San Roque reservoir were Microcystis sp., Pseudanabaena sp., and Microcystis sp. During the years 2006-2009, the reservoir was classified under category II (MC, RR and YR) and anatoxin-a in the San Roque reservoir, looking to identify environmental factors that could promote the presence of these cyanotoxins in this water body. Cyanotoxins were quantified by HPLC-ESI-MS/MS in samples collected monthly from February, 2006 to March, 2009. The lake was affected by cyanobacterial blooms in 71% of the samples. Highest levels of MCs were observed during summer, while anatoxin-a was mainly present during autumn. The occurrence of MC-RR and MC-LR was similar but MC-RR reached higher values than MC-LR. Microcystin-LR was found in 4 samples, being the main cyanotoxin present in these samples. Different levels of correlation were found between cyanobacterial blooms and Pseudanabaena sp. biomass (p<0.05 and p=0.51 respectively) and Anabaena sp. biomass (p<0.05 and p=0.40 and 0.48, respectively). Discriminant analysis showed that the presence of microcystins in the reservoir was correlated to the presence of cyanobacterial blooms and Pseudanabaena sp. biomass. Thus, this study allowed to confirm that the presence of cyanobacteria blooms and Pseudanabaena sp. biomass is related to the presence of microcystins. On the other hand, the dominance of anatoxin-a could be favored at higher levels of pH and chlorophyll-a, lower temperature and total cyanobacterial biomass, with total inorganic nitrogen close to 500 µL L-1. Low proportion of Cryptophyta, Cyanophyta and Cryptophyceae in the phytoplankton also favored the presence of anatoxin-a. The co-occurrence of both toxins (MCs and anatoxin-a) was detected when the pH was over 7.6 with dissolved oxygen close to 9.2 mg L-1 and chlorophyll-a around 61 µg L-1. MCs levels exceed guidelines values recommended by WHO for either recreational or drinking water. This is the first report on the presence of anatoxin-a in Argentinean freshwaters, although anatoxin-a levels were below the guidelines established in other countries (i.e. New Zealand-6 µg L-1). Further studies are necessary to fully assess environmental factors causing the observed temporal variation.

Rapid detection of Pacific-ciguatoxin-1 (P-CTX-1) in blood of coral reef fish, mice and humans using high-performance liquid chromatography tandem mass spectrometry (HPLC-MS/MS)

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Ciguatera fish poisoning (CFP) is a food intoxication caused by ingestion of coral reef fish contaminated by ciguatoxins (CTXs). Among the CTXs, Pacific-ciguatoxin-1 (P-CTX-1) is the major toxin in the muscle of carnivorous fishes from the Pacific Ocean, contributing to around 90% of total toxicity. Research on this toxin is crucial for both inside and international trade in and consumption of coral reef fish. To protect human health and minimize economic losses by the fisheries industry after CFP outbreaks, rapid screening of ciguatoxic coral reef fish is crucial. Analytical methods are currently available for the detection of P-CTX-1 in fish muscle, however, quantification of CTXs in blood has the advantages of being non-destructive and allows for repeated sampling for continuous monitoring, and blood CTX concentrations may serve as a surrogate for estimating levels in fish tissue. This study aims to develop a chemical method for quantifying P-CTX-1 in blood from coral reef fishes using sonication, together with high performance liquid chromatography-tandem mass spectrometry (HPLC-MS/MS). Using the optimized conditions, matrix spike recoveries of P-CTX-1 in blood of nine coral reef fish species ranged from 76–98%. The variation among samples related to repeatability and reproducibility of developed method was determined. The correlation between linear calibration curves were above 0.997 and matrix effects in blood extracts were much lower than those in fish muscle extracts. The limit of quantification (LOQ) of P-CTX-1 in fish blood was determined to be 0.5 ppb; and it can be improved by the employment of a more sensitive mass spectrometer. The within and between day accuracy and precision for P-CTX-1 and P-CTX-2 calibration curves were calculated. The robustness of the present method was examined using blood from mice and humans so as to assess its potential for clinical diagnosis of CFP in animal models as well as humans and the matrix spike recoveries were found to be 77.2% and 71±10%, respectively. To validate the optimized method, blood will be collected from CFP cases and from fish and mice that will be exposed to ciguatoxic fish extracts. This experiment will provide information about the absorption, distribution and elimination of P-CTX-1 in fish and mice.

A model for emergency response and risk management of drinking water reservoirs affected by cyanobacteria blooms

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Cyanobacteria are aquatic microorganisms which can be toxic to aquatic life and also to humans via ingestion of fish or vegetables. In recent years, the frequency of cyanobacterial blooms has increased especially due to the eutrophication of lakes and rivers. Among the toxins they produce, there are the microcystins (MC). These are hepatotoxic cyanotoxins very stable and persistent in the environment. Microcystins can thus accumulate in fish and organs of fishes and potentially transfer along the food chain. The objectives of this study were to develop a rapid, simple and efficient method for microcystin extraction from fish tissues for MC-LR, RR and YR. In this study, we particularly focused on fish liver, muscles and blood. The liver is the target organ for microcystins, the muscles are usually the next to be consumed by humans and makes them the principal vector of human exposure and blood allows the distribution of microcystins through the fish. We also verified whether it is adequate to lyophilize the tissue before extraction or not. In this study, samples of liver, muscles and blood were incubated in the presence of spiked standard of MC-LR, RR and YR. For samples of liver and muscles, one half of the samples was lyophilized and the other half was frozen pending extraction. We chose a solid liquid extraction with methanol 100% and 80%. The detection method development is a high performance liquid chromatography (HPLC) coupled to tandem mass spectrometry (MS/MS) using multiple reaction monitoring (MRM). The extraction method developed allows a high recovery rate (min 80%) for MC-LR, RR and YR extracted from non-freeze-dried liver and muscles and from the blood. For the extractions from freeze-dried tissues, the recovery was lower and varies between 26 and 67%. This method also allows a high and stable recovery rate for a large range of microcystin concentrations (15-240 µg L-1) for each microcystins and each tissue. The extraction and detection methods we have developed are simple, fast and efficient compared to previously published methods which require the preparation of a specific internal standard and protein precipitation, or extraction in acidic water at high temperature in a filtration system based on sand. After validation in vivo, this method of analysis will be used to study the accumulation of microcystins in tissues of trout and perch. This will ultimately estimate imates of human exposure to microcystins through fish consumption.
L-arginine (R0) and L-lysine (K0) amino acids were incorporated into the cells during culturing.

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Cyanobacteria (blue-green algae) can simultaneously produce a variety of potent toxins in aquatic ecosystems including microcystin-LR (MC-LR) and cylindrospermopsin (CYL). The combined effects of these toxins, that can be found in water bodies, to aquatic communities are poorly understood and are of particular concern as a potential risk to human and animal health and to the environment. The purpose of this week is to study the joint effect of the cytokine peptide MC-LR with the alkaloid CYL on the growth of freshwater algae Chlorella vulgaris using a full factorial design. The two reference conceptual models for mixture evaluation based on the effect of individual compounds, concentration addition (CA) and independent action (IA), as well as the deviation from synergism/antagonism, dose-level and dose-ratio dependency were applied to the data generated in the growth experiment. Data was carried out in 96-well polystyrene microtiter plates and the effects of the alkaloid CYL on the growth of C. vulgaris were evaluated after 4 and 7 days of exposure in a concentration ranging from 0.5 to 20 µg/ml. The IC50 value for each toxin was compared to values calculated in the presence of the corresponding water toxins. In addition results obtained for the binary mixture were compared with those expected from the exposures to individual compounds and significant differences were observed. This work highlights the importance of this study on the effects of combined exposure to toxins and understanding their potential risks to aquatic communities.

TU 250

Marine algal toxins and epigenetic effects: does okadaic acid induce alterations in DNA methylation in the mussel Mytilus edulis?

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Okadaic acid is a marine toxin, produced by different species of dinoflagellates such as Prorocentrum lima and Dinophysis sp. These species can proliferate to form a harmful algal bloom, resulting in the killing of shellfish. Human consumption of contaminated shellfish results in diarrheic shellfish poisoning. This is probably caused by the inhibiting effect of okadaic acid on protein phosphatases. Okadaic acid is also a known tumor promoter. It has been shown that this toxin affects DNA methylation in mammalian cells, with possible consequences for gene regulation and expression. In this study, the effects of okadaic acid on DNA methylation are tested in the mussel Mytilus edulis. This species is directly exposed to toxin producing algae and is known to accumulate okadaic acid. Global DNA methylation was measured by an LC-MS/MS method, which was previously successfully used to determine DNA methylation levels in the water Bia Daphnia magna. Specific methylated sites were analyzed by an enzyme based method ‘Amplification of intermethylated sites’. Results of this ongoing study will yield important insights in the toxic mechanism of okadaic acid in Mytilus edulis. Alterations in an epigenetic signature such as DNA methylation may also give rise to transgenerational effects, which will be subject of further studies.

LC03 - Increasing robustness of LCA methodology

TU 254

How simple is it - testing options for simplification on a LCA of mobile phone

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The possibility to perform full-scale LCAs for new ICT products and upgraded models is very limited. Thus there is a need for simplification, but the methodological choices should be made with care and implications should be considered. The study presented here was performed to identify simplifications that can be used to assess the impact of ICT products and different simplifications were tested on a previous LCA on a mobile phone. From studying the results for the different impact categories and how they vary between different life cycle phases we learned that by only considering Global Warming Potential we can not make a clear decision regarding environmental assessment of a mobile phone. To select a few impact categories only was neither an easy task based on the study results. Many of the impact categories varied to a too large extent. Furthermore, based on the current study we do not suggest the possibility of excluding any life cycle phases. However, some specific processes seem to be the major reasons for the environmental impact of mobile acquisition and manufacturing. Thus, a possibility for simplification through focusing on some process within the life cycle may be feasible. Processes include gold production, electricity generation and chip production. Testing the possibility to use data for electronic components and all other processes from the Ecoinvent database, the results for global warming potential showed a high correspondence with the original figures which indicated that the use of generic data would give relevant results. However, for the other impact categories the results were not as promising as major differences were shown for most of them. Some first conclusions are at this stage that it is not enough to consider only global warming potential when ICT products are to be assessed from an environmental perspective. There are some processes in material production and manufacturing that seem to be of major importance. In line with earlier studies the electricity generation proves to be an important issue. However, the possibility to draw general conclusions on a set of process to focus assessments on need to be confirmed in further studies and through other case studies performed in the ICT field. Finally, as there is always the possibility that data gaps and uncertainties in current full LCAs will lead to the recommendation of simplifications which are invalid, more comprehensive LCAs always need to be made to complement the simplified assessments.

TU 255

Investigation of LCA simplification approach: the wind power electricity case

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This study concerns the onshore wind power electricity greenhouse gases (GHG) performances. It aims at developing a correlation facilitating access to these performances as a function of key parameters. A thorough LCA literature survey and analysis of the ecoinvent 2.1 wind turbine (WT) LCAAs have highlighted the importance of a limited numbers of parameters. These, have been classified into 3 categories: technical (related to the intrinsic WT’s characteristics such as weights or power curve), geographical (related to the wind conditions on the implantation site) and methodological (the lifetime defined arbitrarily). A 17 WT’s sample has been selected (from 800kW to 4.5MW) which is assumed to be representative of wind turbines installed since 2003, and forecasted for the near future. The WT
characterized by their component weights, tower heights and their power curves. The WTs have been built considering the main assumptions highlighted by the literature survey and the ecoinvent inventory assessment. For instance, we kept the same lifetime for both the moving components characterized by their component weights, tower heights and their power curves.

The correlation relating GHG impacts per kWh produced by each turbine to the key parameters has then been defined across the whole sample. A confidence interval (based on the relative standard deviation) has been found to vary according to wind speed. For a 20 years WT lifetime, the GHG emissions per kWh (CO2 eq/kWh ± 7.5%) are higher for vwind= 4 m/s (CO2 eq/kWh ± 4.8%) than for vwind= 6 m/s (CO2 eq/kWh ± 3.2%). The average wind condition in Europe (6 m/s) is therefore found to be very sensitive to this methodological parameter.

The generated LCA tool allows assessing environmental impacts in the sector of civil works. For the construction phase, material data have been introduced and (ii) making the interpretation of results more user-friendly. This inventory is the backbone of the developed tool. To assess environmental loads, the Ecoinvent database has been used. The assessment has taken into consideration the manufacturing, construction, maintenance and use phases of the infrastructure’s life cycle. In relation to the manufacturing phase, the manufacture of materials and fuels have been considered. For the construction phase, machinery, waste management and transport needs for the works have been evaluated. For the main phase, material manufacturing as well as machinery have been considered. Finally, for the use phase, traffic emissions, lighting and traffic light emissions have been considered. The generated LCA tool allows assessing environmental impacts while considering the entire life cycle of the infrastructure. Furthermore, this easy use and powerful evaluation tool allows comparing construction alternative solutions as well as identifying critical materials or specific components to be optimized.

The project BioEnergieDat: A German LCA data base for decision support on biogas L. Schleker, A. Ciriolo, C. Düpmeier, L. Eltrop, S. Simon, P. Viehbahn, H. Wagner, T. Zschunke, K. Bismann KfW Institute for Technology, EUGENSTEIN-LEOPOLDSHAFEN, Germany GerhardZettlerGmbH, EUGENSTEIN-LEOPOLDSHAFEN, Germany

The generated LCA tool allows assessing environmental impacts while considering the entire life cycle of the infrastructure. Furthermore, this easy use and powerful evaluation tool allows comparing construction alternative solutions as well as identifying critical materials or specific components to be optimized.

In the context of the German energy and climate policy, the need of an adequate database on biogas reflecting German framework conditions has been identified. A two-year project for a database on energy use of biomass for Germany has been launched by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in September 2010. The project with the acronym BioEnergieDat is carried out by a consortium of seven scientific partners led by the KfW-Institute for Technology (KIT). It is based on previous work and experiences of the German Netzwerk Lebenzyklusdaten and is aimed at a validated database for use within the German strategy on biomass, but due to a modular concept also for all applications of LCA and diverse related instruments like Carbon Footprint. It is intended to take over information from technology development as well as to provide methodological support for assessment of technology. BioEnergieDat will generate harmonized and validated databases for biogas based on the specific framework conditions of Germany, to be used as decision support for the assessment of technologies and the biomass used for environmental strategy development. The concept shall support methodological development as to specific questions of biogas like substitution effects or land use, but it shall foster the evolution of data quality procedures, and it shall provide novel IT solutions for efficient, reliable and fast exchange of data and information, supporting not only national but also international networking. First results of the project work will be presented as well as the embedding in the research programme on biomass energy use. The relationship of the project to the Sustainable Biomasse Strategy in Germany will also be shown.

Enhancing the data basis for LCA through process simulation: the case of lignocellulosic ethanol production in Sweden C. Lampa, A. Tilmant Chalmers University of Technology, GöTHENBURG, Sweden

One of the application areas of LCA is to assess the environmental impact of emerging technologies in order to support strategies and policies for technological development. However, in many cases this is restricted by a lack of robust data caused by the immaturity of these technologies. A possible solution to this constraint is the use of process simulation, whose mass and energy calculations combined with LCA can be used to support strategic decision making for emerging technologies. For example, process simulation can generate data on the water consumption or quality as well as the level of potential wind speed. Combining these process data with additional data regarding water availability and quality and integrating both into an LCA can support strategic decisions i.e. the sustainability of industrial infrastructure intending to use the simulated process.

The paper presents a new approach based on Genetic Algorithms (GA) to solve the multi-output systems characterized by a rectangular (and thus non-invertible) coefficients matrix, without using computational expedients such as the allocation procedure. The GA is a population-based stochastic global search technique inspired from the biological principles of natural selection and genetic recombination. Starting from a codified random set of parameters, a number of simulations of a process will be performed through genetic operator (inheritance, selection, genetic mutation) up to obtain the optimal solution.

The evaluation of the component of the population (single solution of the problem), its probability to be promoted and to hand down its gene pool depends on its fitness: a solution is assessed as acceptable if it minimizes or maximizes a specific objective function.

The objective function is based on two principles: the respect of the bounds and the analysis of the performance of the solution. The genetic algorithm represents a balance between “selection” (local search) of the optimal available solution and “exploration” (global search) of the space of the research.

The paper applies a GA to a multi-output productive process of essential oils, natural and concentrated juices from oranges and lemons.

The results obtained for the case study taken into consideration showed that the application of GA allows to respect the energy and mass balances for the examined system. Moreover, low differences between the inventory vectors obtained by using the GA and those obtained with the so-called traditional technique demonstrated the reliability of the GA simulated results. Since the real solution of the inventory vector is unknown, the authors are not able to compute a proper performance indicator for the implemented algorithms. However, considering that the differences of the obtained GA solutions from the traditional solution are not overwhelming, this methodology is worthy of further investigations.

Towards an integrated approach between Material Flow Analysis and Life Cycle Assessment C. De Pasquale, A Santini, L. Morselli Bologna University, BOLOGNA, ITALY

The requirement of predictive methods has increased over the past decades in response to the environmental and socio-economic emergencies. Despite the huge amount of approaches and tools, it seems quite difficult to compare results obtained from different procedures, which is widely accepted that an integrated approach of disciplines and methodologies could help to cover all the complexities related to a problem in a life cycle thinking perspective.

In this work the potential of applying Material Flow Analysis (MFA) approach to Life Cycle Assessment (LCA) is discussed, aiming at promoting a systematic and transparent approach to sustainable development. MFA is a systematic assessment of the flows and stocks of materials within a system defined in space and time. Emphasis is placed on linkage between sources, pathways and sink, contributing to the identification and final sinks of a material (i.e. substances as well as elements). In these sense, MFA allows to identify the depletion or accumulation of substances early enough to take countermeasures towards more sustainable solutions. Furthermore, by means of MFA approach even small
changes, that imply difficulties in measuring effects in short time scales but that could lead to long term damage, may become evident. MFA can be regarded as a method to establish the inventory for an LCA. This is especially true when LCA is applied systems rather than to single goods. Indeed, the results of an MFA are quantities of flows and stocks of materials according to measurements, and the principle of mass conservation. In MFA, there are objective quantities (aside from analytical and numerical uncertainties). The interpretation and evaluation of MFA results, which may be conduct by means of LCA, is instead a subjective process, since it is based on social, moral, economical values. Proposing an integrated approach between MFA and LCA will lead to overcome critical aspects that are present in both tools, sometimes in opposition. In particular, the impact assessment of LCA strives for assessing as many as possible substances and compounds to guarantee completeness while MFA is directed towards reducing the number of substances of study as much as possible to maintain transparency and manageability. Finding the best solutions to fit results from MFA and LCA may lead to greater benefits in waste management, resource conservation and topics relating with Industrial Ecology issues.

TU 262

Hybrid IOLCA model to determine carbon footprint of products and services to estimate their true cost - A case study of pulp and paper sector in Spain

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Nowadays, concern over the anthropogenic greenhouse gas (GHG) emissions is more than ever. Different scientific researches reveal the fact that the way how products/services are produced and consumed is one of the major drivers of this accelerating pace of human related GHG emissions. Therefore, the need to change this unsustainable consumption and production patterns becomes increasingly urgent. One of the possible solutions to alter the current production and consumption patterns to sustainability is to account for the true costs of products/services, which reflect the actual social and environmental costs and benefits. Environmental tax is a powerful tool to assign the true cost to products/services. In particular, the impact assessment of LCA suffers from problems of subjective system boundary selection, availability of data and time requirements. An alternative approach to LCA is Environmental Input-output (EIO). It has some advantages over LCA as it takes into consideration all the upstream processes, but it still lacks strength to assess the carbon footprint of products and services at a microsystem level. Therefore, the best proxy would be given by a hybrid IOLCA which combines the best features of both LCA and EIO approaches. In this study we develop a Hybrid IOLCA model to estimate life cycle GHG intensity of products and services to determine their true costs. Paper production sector of the Spanish economy is analyzed by using hybrid IOLCA, which uses calculated LCA emissions of different paper products where LCA data is available and IO-calculated data for the rest. Results from the Hybrid IOLCA model are then compared with those obtained by pure LCA and EIO. Finally the carbon footprint of products and services are translated into environmental tax and the overall effects of tax introduction on the price of the products/services are then assessed.

TU 263

Life cycle analysis of advanced biofuels: accounting for coproducts and process residues impacts

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Lignocellulosic materials and microalgae are promising sources for alternative fuels production in the transport sector. Expectations are that 2nd and 3rd generation biofuels have a more sustainable performance than the biofuels currently available, but significant uncertainty remains about how well they will perform. Life Cycle Analysis (LCA) appears to be the appropriate tool to evaluate the environmental impacts of these developing technologies. Results of such environmental assessments may be applied to immature technologies in order to support sustainable process design and offer reliable results for policy making. However, the genetic LCA methodology needs to be adapted to deal with specific issues related to advanced biofuels. This work presents two case studies where these issues are treated:

- LCA of microalgae biodiesel
  - Microalgae LCA is complicated by the fact that the carbon dioxide (CO2) necessary for microalgae growth needs to be fed into the system (it is not captured directly from the atmosphere). When the CO2 source is flue gas from a power plant, most of LCA practitioners consider it a production input and the emissions are affect to it. As in the cellulose ethanol case study, other possibilities are detailed. The various possibilities to account for residues impacts explored in this work are: mass, energy and economic allocation; system expansion (substitution method recommended by ISO LCA Standard) and allocation of coproducts impacts accounting; consequential approach (comparison of life-cycle flows between conventional and alternative processes).

TU 264

Integrated design of a sustainable nursery school: energy and environmental evaluations with LCA

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The study of the work was that of a nursery school in Italy, following sustainability guidelines. The choice of building materials, following a Life Cycle Assessment perspective, allowed the achievement of optimal energy efficiency and a consequent reduction of environmental impacts. LCA analysis has been applied to a portion of the building and the energy demand for operation calculated considering an operation phase of 20-25 years, during which it is reasonable to discharge any extraordinary repairs; for the sake of brevity, in the operation phase scenario no ordinary maintenance are accounted for. The energy efficiency and the environmental impacts have been studied focussing only on the construction and operation phases, while dismantling and demolition have been left out of this study. Energy use for building operation has been calculated with the CENED+ software, i.e. building primary energy requirements considering heating, domestic hot water and lighting. LCA analysis has been carried out exploiting ITACA database and alternatively ECOINVENT database. When using the latter database calculations were made using SimaPro software. However, the two approaches are correlated because ITACA database, which is an Italian database of building materials, heavily relies on ECOINVENT database. Differences in impacts are calculated as weighted averages and compared with the results from the ECOINVENT database. The results from these two approaches are correlated because ITACA database, which is an Italian database of building materials, heavily relies on ECOINVENT database. Differences in impacts are calculated as weighted averages and compared with the results from the ECOINVENT database.

TU 265

Importance of linkage between LCA methodology developments and their applications in practice

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Efforts are constantly performed to improve the Life Cycle Assessment (LCA) methodology, with a strong focus on both the life cycle inventory (LCI) and the life cycle impact assessment (LCIA) phases. However, these methodological developments may not always be applied in practice, e.g. due to delays or improper implementation into LCA software. In such situations, the incompleteness of the results obtained by the LCA practitioner may be threatened. The present study uses an update in the normalization references for the EDIP methodology to quantify, through two examples, the influence that such problems may pose in LCA practice. In the first instance, discrepancies observed when employing an old and still in use - set of normalization references (Bungay and Farley, 2000 vs. 2003) are evaluated for all commonly assessed impact categories. The second example analyses the modelling of pesticides in current LCI databases, which traditionally treated pesticides as emissions to agricultural soil, whereas, the agricultural soil belonging to the technosphere, only the fraction of pesticides reaching its final destination is to be considered. From these results, a practical guideline on the proper application of the LCA methodology is therefore advocated.

TU 266

LCA applications in Turkey

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Life cycle assessment (LCA) quantify the environmental impacts and energy requirements of products over their full life cycle. It is also called a cradle to grave approach, which compares the single products with respect to the environmental burden. Although LCA is not something new, the special interest has increased since 1990’s. LCA is increasingly being used as a decision support tool by governments, companies, and authorities in order to improve the environmental performance, pollution prevention strategies and environmental management systems. LCA is commonly included in the four stages of product development (product life cycle assessment and interpretation) according the ISO 14040 series. LCA methods are improved in developed countries for new impact categories and characterization models using the international standards framework contained in the ISO standards. Developed countries widely recognize the environmental consequences of a product should be evaluated by considering the impact results for each of its life cycle. LCA is applied a wide range from production to service such as energy generation, waste management, bottle production etc. over the world. On the other hand developing countries like Turkey are in the inception phase with a rising awareness on LCA. The life impact assessment phase cannot be conducted easily due to the lack of valuation and weighting data, but the number of the studies is increasing day by day. This study outlines the current situation of the LCA studies for different sectors (automotive industry, gasification technologies, mining, buildings, insulations, packaging, tooling, iron and steel industries, fuels and agricultural sectors) in Turkey. This study is able to fill the life cycle inventory analysis and life cycle impact assessment phases in the studies are outlined and the future of the studies and the developments are also presented for Turkey. The aim of this study is to be an example for the developing countries, which increase the use of the LCA in their countries.

TU 267

The EPD approach as meeting point between robustness and communicability of LCA studies - Certification of an internal LCA process

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As recommended by the SEMA&ICRMO organization, many LCA practitioners have proposed several approaches regarding “hot topics” such as allocation, cut off rules, biomass, etc... Often, researchers performing LCA aim to improve the methodology, while, on the other hand, practitioners in the entity of industrial actors typically aim for strategy building or communications impact. The study of what needs to describe adequately a product which a large number of impact categories are being subjected to a new cycle into its policies and views while conserving both the robustness of the elaborations and the suitability for communication purposes.

BARIKA is currently one of the top Italian food groups. It produces more than 100 products in about 50 plants around the world. The company has been using the LCA since the beginning of 2000. Since 2008, life cycle thinking made its way into Top Management of the company, as an integral element to the company’s guidelines. The choice of building materials, following a Life Cycle Assessment perspective, allows the achievement of optimal energy efficiency and a consequent reduction of environmental impacts. In virtue of these issues, Barilla has placed LCA approach robustness and importance at the top of its priorities, also developing a specific strategy: in 2010 an internal LCA process was implemented.
be applied even to events.
The World Gymnastics, organized in Luzanne, Switzerland, in 2011, is the largest mass sport even in the world with more than 23,000 participants to be expected. However, this event will also generate increase of the city population of 20%. The organizing committee is interested to understand the environmental consequences of this event and would like to assess the developed mitigation approach.
The evaluation of the overall environmental assessment of the event is part of the wide range of measures taken in order to implement these principles of sustainable development. The goals of this project are to: 1) Realize the environmental assessment of the World Gymnastics 2011 2) Contribute to the establishment of a sustainable development mind for this event 3) Value the impacts reduction measures towards the collaborators 4) Create an evaluation tool that allows directing choices for the event 5) Associate these elements to the communication of the event 6) Contribute to create a life cycle assessment based tool for events.

The results of the assessment, the tool and actions identified will be presented.

TU 275
Allocation procedures effects on greenhouse gases emissions in energy systems industrial sector: a case study of hydrotreated vegetable oil

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The benefits of the use of daylight devices for health are well known. Moreover, a better envi-
ronmental performance than conventional lighting is expected; however, the increasing spread of
these devices may lead to concerns about the actual environmental impact produced by them.
In this context, this research deals with the environmental impact of one type of solar systems:
light pipes. These systems are based on the principle of multiple reflections on specular surfaces:
the light effects and transmits daylight through a device, which is composed of three funda-
mental units: capture unit, conduct unit and diffusion unit. It is known that when they are used
to produce light for a given area, there is no direct consumption of energy. However, this does
not mean that they do not cause any impacts to the environment throughout their entire life
cycle. As an exergo-environmental study, LCS can evaluate, from an exergonomic and lifecycle
perspective, the environmental impact of a light pipe, so that more information about the potential impacts generated in the life cycle phase of a light pipe (including production, transport and end-of-life) can be obtained.
This study was conducted with reference to a hypothetic light pipe of 80 cm length and 25 cm diameter. The data on materials and side effects and disposal were extracted from specific literature. The environmental analysis reveals that the highest impact is potentially caused by the production phase of the light pipe; more precisely, one critical component is the aluminum tube. This means that if a light pipe manufacturer wants to improve the environmental performance of his product, it could solve a few problems and turn this device in a more environmentally-friendly tube material. This study has some remarkable limitations: the data collection was mainly based on scientific literature and commercial databases; moreover, some of the raw materials were replaced by similar ones because of the lack of data. Therefore this must be considered as a preliminary study. Further research with actual data and more accurate data collection is advised.
TU 278

Incorporating eco-design into a SME: future ISO 14006

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The forthcoming ISO 14006, Guidelines for incorporating eco-design into environmental management systems, is intended to provide guidance to companies to incorporate eco-design into a management system. This standard will be partially based on the Spanish standardUNE 150301, developed in 2003. The main goals of this standard are among others: minimise the environmental impact of products/services, promote the life cycle approach, systematise the continuous improvement in the framework of eco-design, help the market to become aware of the need for products/services incorporating the environmental requirement, and provide a label to those companies involved in eco-design.

This article analyses the implementation of theUNE 150301 in MACER SL, a Spanish small and medium enterprise (SME) in the mefalli mechanic sector. This company is specialised in design, manufacture and repair/maintenance of moulds for presses in ceramic tile companies.

The implementation of this standard has involved the following activities: the analysis of the market; 1) It is one of the oldest Italian cluster and it involves five production units for a total of 220 employees. The sectors of activity are: basic chemicals, pesticides, micronized silica, production and distribution of electricity. This cluster reveals great opportunities in the re-use of by-products among two production chains: the reuse of the untreated sand in the silicate sector and the sulfuric acid, which is produced in the fertilizer sector. The possibility of these by-products to be implemented are: (i) the exploitation of internal symbiotic exchanges; (ii)the location of new industrial plant in the chemical site - this activity concerns the recovery of precious metals (as cobalt, vanadium, nickel, molybdenum) from used catalysts deriving from chemical and petrochemical industry; (iii) the involvement of another regional cluster (Automotive industry) - in this case the exchanges could include: extraction of metals from electroplating sludges and used catalysts; exchange of product and by-products deriving from BCS, used as raw materials in the Automotive industry.

TU 280

Significant symbiotic exchanges and hazardous wastes in chemical industry. A ‘path-dependent’ case study

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The Eco-Industrial approach promotes the transition from traditional industrial clusters to Eco-Industrial Parks (EIP) [1-2], exploiting geographical proximity, existing synergies and peculiar socio-economic relation with the territory. This paper presents an hypothesis of symbiotic exchanges to redevelop a chemical industrial site located in Abruzzo Region: Busi chemical site (BCS). It is one of the oldest Italian cluster and it involves five production units for a total of 220 employees. The sectors of activity are: basic chemicals, pesticides, micronized silica, production and distribution of electricity. This cluster reveals great opportunities in the re-use of by-products among two production chains: the reuse of the untreated sand in the silicate sector and the sulfuric acid, which is produced in the fertilizer sector. The possibility of these by-products to be implemented are: (i) the exploitation of internal symbiotic exchanges; (ii) the location of new industrial plant in the chemical site - this activity concerns the recovery of precious metals (as cobalt, vanadium, nickel, molybdenum) from used catalysts deriving from chemical and petrochemical industry; (iii) the involvement of another regional cluster (Automotive industry) - in this case the exchanges could include: extraction of metals from electroplating sludges and used catalysts; exchange of product and by-products deriving from BCS, used as raw materials in the Automotive industry.

TU 281

Environmental impact of striped catfish production in the Mekong Delta (Vietnam)

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Intensive striped catfish production in the Mekong Delta has in the recent years raised many envi-

ronmental concerns. To support policy making, we contacts in a LCA. Assessment (LCA) to determine the environmental impact of producing striped catfish. The LCA was complemented with an assessment of biodiversity loss, water use, and flooding hazards. The goal and scope for the assessment, and the assessment results were discussed in a series of stakeholder workshops. The results: Master Plan 2020. The LCA covered all processes up to the exit-gate of the fish farm, and focused on global warm-

ing, acidification, eutrophication, human toxicity, and marine (MAET) and freshwater aquatic eco-
nicity (FWET). Except for eutrophication and FWET, the feed production, which largely took place outside Vietnam, was not included. This LCA was therefore most all processes and products in the farm, and for different most the impacts in the farm. The LCA results indicate some trends, e.g. rice bran dominated global warming and acidification, while wheat bran dominated eutrophication, mainly due to their quantities used. Fishmeal production, transport and energy pro-
cesses dominated MAET. Grow-out farming in Vietnam dominated eutrophication and FWET. The environmental impact of striped catfish in winter fallow after harvesting paddy rice were assessed and compared with barley cultivation as a competitor using LCA.

We collected raw data for input materials such as fertilizer and pesticide, and energy consumption in the production of rice paddy. emission was calculated and used as a functional unit. Environmental impacts were evaluated by using Eco-indicator 95 model for 9 impact categories. Sensitivity analysis was conducted for crop responses to fertilization level and increasing productivity. To produce 1 ton of/barley and rice, the potential of greenhouse effect in barley (1,500 kg CO2-eq) was higher than that in rice (2,600 kg CO2-eq). The environmental impacts of ozone depletion, acidification, heavy metals, carcinogens, summer smog and energy resources showed the higher potential in rice than barley. In case of eutrophication, impact of barley was higher than that of rice. For the sensitivity analysis, scenario I (crop responses to fertilization level) showed the environmental burden was not increased with the amount of fertilization only at the optimum crop responses to fertilization (N3). By increasing the productivity of rice by 50%, the potential of greenhouse effect in rice was increased by 8%.

TU 282

Environmental impact assessment of rapeseed and barley cultivation for fallow land in winter season using LCA

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High input to the arable land contributed to increasing productivity, at the same time causing global environmental problems. In this context, rice cultivation has been asked to resees its competitiveness, by introducing the use of rapeseed and barley as a substitute for rice. In this study, environmental impacts of rice cultivation in winter fallow after harvesting paddy rice were assessed and compared with barley cultivation as a competitor using LCA.

We collected raw data for input materials such as fertilizer and pesticide, and energy consumption in the production of rice paddy. emission was calculated and used as a functional unit. Environmental impacts were evaluated by using Eco-indicator 95 model for 9 impact categories. Sensitivity analysis was conducted for crop responses to fertilization level and increasing productivity. To produce 1 ton of rice, barley, and rapeseed, a quarter of greenhouse gas emission potential was reduced compared to paddy rice. With these results, environmental load from rape cultivation in winter fallow land was higher than that from barley. However it is assessed that planting high productive cultivated rice and barley, specific fertilization for recommendation might reduce the environmental burden by 30 %.

TU 283

Finnish methodology for carbon and other footprints for food products

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3The ”Foodprint”, Footprint of food-research programme started in late 2009 following the initiative of active Finnish food companies. The programme is planned to be completed in May 2012, and is funded by the Finnish Funding Agency for Technology and Innovation (Tekes) and private food companies.

The public Foodprint Tools project comprises of four phases. The first phase aims at describing a generic methodology and requirements for carbon (and other) footprint[s] of food products. Other work phases will be more detailed, concerning data collection, data quality requirements, actual tools to assess environmental burdens in agriculture etc. Some specific characteristics are described below.

a. Concerning attributional vs. consequential modelling approaches, the attributional approach is chosen to allow comparability of footprints and to create as concrete modelling backbone for companies as possible.

b. The impact categories considered in this initiative are climate change, eutrophication, acidifica-
tion and primary energy.

c. Data collection is one of the main topics under investigation, and plain division of data to primary and secondary data is inadequate. In many situations it is impractical to collect primary data, and well-founded approximations are needed. In the methodology topics of adequate data sources, data to be collected directly from the supply chain and data to be collected from national statistics, databases etc. should be handled in detail. The data which needs to be collected is planned to relate to data which primary producers already collect in Finland for other purposes. Allocation is perceived as one of the main challenges in LCA studies, and therefore a special focus is given to it. Work is underway to develop general principles for choosing appropriate allocation methods and for avoiding allocation (e.g. through system expansion). Some examples of allocation situations are going to be further explored through the case studies. Other issues to be further investigated are: different land-use impacts (carbon storage, sequestra-
tion, soil carbon change, land conversion) and the need to verify activity and emissions data.

NM01 - Detecting, quantifying and characterizing engineered nanomaterials in the environment and in biological systems

SETAC Europe 21st Annual Meeting Abstract Book 187
1. Alginate-ASW solutions presented agglomerates with a constant (up to 72 h) and reproducible size distribution. Dynamic Light Scattering (DLS) measurements showed that dispersions prepared in 0.5 g/L alginate were not toxic, is widely used in the food industry as emulsifier and gelling agent [3].

2. The sonication step was also investigated in order to obtain the smallest agglomerates. The employed ASW was characterised (salinity, conductivity, and total organic carbon content) prior to evaluating alginate harmful effects on the marine microalgae Phaeodactylum tricornutum and the anoxic crustacean Artemia franciscana.

3. The Scientific Committee [of EFSA] makes a series of recommendations; in particular, actions need to be taken to develop methods to detect and measure ENMs [engineered nanomaterials] in food/feed and biological tissues, to survey the use of ENMs in the food/feed area, to assess the exposure in consumers and livestock, and to generate information on the toxicity of different ENMs. This does not imply that the increased environmental awareness of the consumer to ENPs cannot be determined due to the lack of appropriate analytical methods.

4. The gap is addressed by the FP7 project Nanoyke. The Nanoyke project focuses on the development and validation of materials for the analysis of ENPs in food and beverages. The developed methods will cover relevant classes of ENPs, i.e., metal, metal oxide/sulfide, carbon-based encapsulate ENPs. Rapid imaging and screening methods allow the distinction between samples which contain ENP and those that do not. These methods will be characterised by minimal sample preparation, cost-efficiency and high throughput. More sophisticated, hyperspectral methods allow the unambiguous characterisation and quantification of ENP. These include elaborate sample preparation, separation by field flow fractionation and chromatographic techniques as well as mass spectrometry and electron microscopic characterisation techniques.

5. The methods will be verified using the well-characterised and reproducible size distribution within the project. Interlaboratory performance studies will demonstrate the applicability and soundness of the developed methods. The techniques and methods developed in this project for food could also be applicable to biological and environmental matrices (possibly after matrix tailored modifications).

6. The scientific community for estimating the acute and chronic toxicity of toxicants to bacteria, algae, invertebrates and fish [4]. In this project, the ecotoxicity of well-characterized 50 nm and 100 nm plain and fluorescently emitting iron oxide nanoparticles was investigated. The ionic silver solution and the two AgNPs with silver nitrate, C-AgNPs or P-AgNPs, and let for ageing 2 hours, 2 days, 5 weeks or 10 weeks before they were submitted to sequential extraction. The ionic silver solution and the two AgNPs types were radiosolubled so that we could detect and quantify silver by gamma spectrometry by measuring the 110mAg tracer in the different sequential extraction fractions. We thereby observed that for each silver form, soil type and time point a distribution of silver in the different fractions.

7. The use of silver nanoparticles is very different for the three silver types in both cases. Over 20% of the total C-AgNPs concentration was water soluble in both soils. Approximately 5% for AgNO3 and P-AgNPs) the first two days after spiking, but the fraction decreased to trace levels thereafter. This was compensated by an increase in the reducible fraction. Regarding P-AgNPs, 80% were not extractable at all, but contrary to AgNO3 and C-AgNPs, the water soluble and ion exchangeable fractions did not decrease over time in the mineral soil, and even increased in the organic soil.

8. The physical and chemical properties of the studied soils as well as the nanoparticles size, shape, crystallographic structure and specific surface area were characterized. Soil samples were spiked with silver nitrate, C-AgNPs or P-AgNPs, and kept for 2 days, 2 weeks, 5 weeks or 10 weeks before they were submitted to sequential extraction. The ionic silver solution and the two AgNPs types were radiosolubled so that we could detect and quantify silver by gamma spectrometry by measuring the 110mAg tracer in the different sequential extraction fractions. We thereby observed that for each silver form, soil type and time point a distribution of silver in the different fractions.
the 2002 breast milk (median values 2.4 and 0.9 ng/ml, respectively) and the 2006 (7.3 and 2.6 ng/ml, respectively, p < 0.001 and 0.019, respectively). However, the observed increases were not uniform and in some individuals high values (5100 ng/lipid) were determined. Significant differences were found between the concentrations of DDT and related compounds in breast milk according to parity, with higher concentrations in primiparous than multiparous women. Total DDT levels in our study were significantly higher than from 2006. In the 2006 samples, the concentrations of total DDT ranged between 0.3 ng/g and 5600 ng/g. The predominant isomer was 4,4´-DDT (median = 47 ng/g). The straw sampled in 2007 were from sprayed dwellings except in two cases, the concentrations of total DDT ranged between 0.8 ng/g and 26 000 ng/g. The predominant isomer was 4,4´-DDT (median = 130 ng/g) followed by 4,4´-DD (median = 2.5 ng/g) and 4,4,4- TDE (median = 20 ng/g).

**Key words:** DDT; IRS; Breast milk; Straw

**TU 296**

**Monitoring of polychlorinated biphenyls (PCBs) in human milk samples - comparisons within the study period over the years 2002 to 2006**

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The presented research investigation aims at filling the gaps in existing scientific data as well as at harmonising the assessment of PBT/vPvB substances, and what legislative steps, such as authorization or restriction, are taken following the PBT-assessment. The incentive is that the result of a PBT-assessment may propose a substance for PBT or vPvB identification under REACH. However, only when substance is identified which is not covered by its regular framework, authorization of that use under REACH is possible. Differences among the EU-based legal frameworks create a challenge to harmonize the assessment of PBT/vPvB substances.

**OSPAR, Stockholm and IMO Ballast water Management conventions or the UNECE protocol on persistent organic pollutants (POP), all which have their own suites of POP or PBT criteria. There is thus no uniform PBT/vPvB assessment in Europe, because various legislations use limited or dissimilar PBT criteria. In this study, the PBT/vPvB assessment under REACH is compared to PBT or POP assessments in other frameworks. Attention is paid to how a substance is identified as a PBT/vPvB substance, and what legislative steps, such as authorization or restriction, are taken following the PBT/vPvB/POP assignment. In addition to the different PBT or POP criteria of the various frameworks, there are also differences in the description of the criteria and if a weight of evidence approach is possible. Some EU frameworks still refer to the former "technological guidance documents (TGD), which preceded Annex XIII of REACH. Although differences between the TGD and REACH Annex XIII are small, this causes dissimilarities among the frameworks. The risk management follow-up of a PBT or vPvB identification, e.g. authorization or restriction, depends on the legal framework and specific conditions at which a substance is used, and whether a socio-economic analysis is included.**

Irrespective of the framework in which a substance is used, individual European Member States may propose a substance for PBT or vPvB identification under REACH. However, when a substance is identified which is not covered by its regular framework, authorization of that use under REACH is possible. Differences among the EU-based legal frameworks create a challenge to harmonize the assessment of PBT/vPvB substances.

**TU 297**

**Crossing regulatory borders - the German concept of a harmonised assessment of PBT substances**

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**Regulation 1107/2009/EC, biocides on the basis of Directive 98/8/EC and human and veterinary pharmaceuticals, the actual trigger values for PBT/vPvB are different, but data requirements as well as assessment ‘traditions’ and regulatory consequences differ greatly. The latter vary from a complete ban or exposure minimisation to criteria in Annex XIII. However, not all substances on the EU market are screened against regulatory consequences differ greatly. The latter vary from a complete ban or exposure minimisation to criteria in Annex XIII. However, not all substances on the EU market are screened against.
Accounting for photo degradation in the PBT assessment of chemicals

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In the current REACH guidances substances are considered persistent if their half-life in marine water is longer than 12 months. The estimations of half-lives in the aquatic environment for REACH regulation are mainly done using recommended modeling tools (i.e. EUSES), in which photo degradation is not explicitly considered. REACH guidelines do not specify how "half-life in water" is to be deduced from laboratory measurements of direct photolysis according to official methods (e.g. OECD or EPA test guidelines). Hence, the effect of photo degradation in surface waters has been identified as the main degradation pathway for some chemicals / pollutants, in particular, those resistant to biodegradation processes. The overall objective of this work was to investigate how direct photolysis of chemicals in the aquatic media can be accounted for in the current PBT assessment methodologies. In addition, an investigation on how to establish a generic procedure for extrapolating photolysis rates under laboratory conditions to field conditions was performed. The methodology followed was based on the revision of currently used laboratory test methods for direct photolysis, peer-reviewed scientific literature, and main modeling applications currently employed for the calculation of the persistence of a chemical in the aquatic environment. Data still under evaluation although a preliminary assessment point to light attenuation, pH of the water media (in particular for chemicals with acid-base properties) and dissolved organic matter (DOM) concentration among being the most important environmental variables affecting the direct photolysis rates observed. It has been shown to play a relevant role. A standard procedure for extrapolating laboratory measurements of direct photolysis to half-lives in natural water is proposed. The developed extrapolation method has been incorporated into the multimedia model code, and the effect of incorporating photodegradation on the calculated persistence of some example chemicals in water has been analyzed.
The model has been validated for a number of compounds and is today recognized by regulatory emission scenarios developed by OECD and adopted by EU as the standard environmental emission model. The latest release of MAMPEC version 3.0 is compatible with Windows Vista® and includes some important new features. The model predicts concentrations of contaminants in generalised ‘typical’ marine environments (open sea, shipping lane, estuary, commercial harbour, yachting marina, open harbour). The user can apply various input factors (e.g., teaching rates, shipping activities, times, ship hull underwater surface areas), compound-related properties and processes (e.g., K_{oc}, K_{d}, volatilisation, speciation, hydrolysis, photodegradation), and properties and hydrodynamics related to the specific environment (e.g., currents, tides, salinity, DO, suspended matter load, port dimensions). The model supports four scenarios for exposure evaluation of the biocides under the Biocidal Products Directive. The model has been validated for a number of compounds and is today recognized by regulatory authorities in EU, USA, Japan, and other OECD countries. MAMPEC is currently also being used in authorisations by GESAMP and IMO for the assessment of active ingredients in ballast water. The introduction of the software support system under treatment and risk evaluation. The poster presentation will focus on active exposure modes, areas of uncertainty, new developments, and research needs.

TU 314
Risk Assessment of copper in antifouling use
KWL, C. Mackie
RGL, BILSTON & GLEN, United Kingdom
In 1998, the Biocidal Products Directive (BP) required the chemicals industry to initiate steps to address the risk assessment of chemicals in biocidal applications, including antifouling use. Described is the process of risk assessment of copper, the models used, the assumptions made, and preliminary conclusions of the industry assessment.

TU 315
Individual and mixture toxicity of antifouling biocides using a novel multispecies slime assay a A. Reina, b T. Backhusø, b HB Blanck, a A. Hlivarsø, c K. Langfors, c K. Thomsen, d I. Wendt, d A. Zgrundo2
1University of Gothenburg, GÖTEBORG, Sweden
2Norwegian Institute for Water Research (NIVA), OSLO, Norway
3University of Gdansk, GDANSK, Poland
Antifouling biocides are used in paints to prevent the growth of fouling organisms on submerged structures such as ship hulls. However, many of today’s antifouling coatings fail to inhibit settlement and growth of microalgal slime, a complex multispecies biofilm which is often dominated by diatoms and cyanobacteria. In this study, a robust and accurate assay for evaluating the biocidal efficacy and ecotoxicological properties of antifouling biocides and formulated paints. To reflect the high diversity found in microbial fouling communities, we developed a settling and growth assay that most microbial communities from natural biofilms, start material. In short, an inoculum is prepared from the biofilms using a scrape, shake, and sieve technique. Biofilms are then allowed to form during a phase of 72 hours of controlled exposure to a concentration-series of biocides. The established slime biofilms can then be analyzed by various techniques, here we used biomass measurement, diatom activity and valve movements biomarkers are obtained. A methodological basis of a given research is the estimation of adaptive capacities of test organisms by means of standard test stimuli in the range of species tolerance. Experimental rapid change of salinity of sea water on 50% was used as one of stimuli. On an example of mollusks Mytilus galloprovincialis Lam. of the Black Sea it was shown that surface microfilm (SM) strongly concentrates biogenic substances: ions of inorganic nutrient and phosphorous compounds. Their concentrations in SM were approximately tenfold higher than in the below surface layer of the Baltic Sea. The salinity of SM in different parts of the Baltic Sea ranged in the range of 0.043 - 0.648 .0. The dynamics of the values of the salinity and nutrients ions, and their variability in distribution according their concentrations gradients in the different parts of the Baltic Sea has been also shown. The coefficients of enrichment of SM with investigated parameters have been evaluated quantitatively, and the selective range of the hydrochemical characteristics has been evaluated. On the basis of these data it is manifested that surface microfilm of the Baltic Sea seems to be a significant player in the atmosphere - sea interaction processes.

TU 319
New physiological biomarkers for express indication of aquatic ecosystems state on the base of adaptive capacities assessment of bivalves using standard test-stimuli SV Khlokskevich, T. Kuznetsova
Scientific Research Center for Ecological Safety RAS, SANKT-PETERSBURG, Russian Federation
In the present work the results of the experimental study directed on working out of a new cardiace act and valve movement biomarkers are presented. A methodological basis of a given research is the estimation of adaptive capacities of test organisms by means of standard test stimuli in the range of species tolerance. Experimental rapid change of salinity of sea water on 50% was used as one of stimuli. On an example of mollusks Mytilus galloprovincialis Lam. of the Black Sea it was shown that surface microfilm (SM) strongly concentrates biogenic substances: ions of inorganic nutrient and phosphorous compounds. Their concentrations in SM were approximately tenfold higher than in the below surface layer of the Baltic Sea. The salinity of SM in different parts of the Baltic Sea ranged in the range of 0.043 - 0.648 .0. The dynamics of the values of the salinity and nutrients ions, and their variability in distribution according their concentrations gradients in the different parts of the Baltic Sea has been also shown. The coefficients of enrichment of SM with investigated parameters have been evaluated quantitatively, and the selective range of the hydrochemical characteristics has been evaluated. On the basis of these data it is manifested that surface microfilm of the Baltic Sea seems to be a significant player in the atmosphere - sea interaction processes.

TU 316
Acute toxicity estimation of desalinization byproducts at Chuja island desalinization plant
G Park, a S. Yoon, a SM Yoon, b KS Park2
1Anyang university, INCHEON, South Korea
2RIST, POHANG, South Korea
Desalination of seawater is an important and growing industry due to the present water shortage situation. However, the desalination may result in environmental impacts, mainly derived by the discharge into adjacent coastal waters of brine and produced additives during the desalination processes, such as biocides and membrane cleaning chemicals. To measurement of the environmental impact by desalination, we approached environmental impact assessment (EIA) procedure proposed by Hooper (1999) for the desalination plant of Chuja Island in South Ko-
and biological testing is important. The ecotoxicological risk assessment of native sediment samples with brackish Baltic Sea sediments. Results from the embryo toxicity test in 96 well plates with salinities above fresh water level. Using the fish embryo test system, whole sediment samples, AESE extracts and mild methanol/water extracts of all sampling sites were then assayed for deleterious effects. Further investigations of the extracts were conducted with the EROD induction assay using RT-L1C1 cells for detection of dioxin-like activity. Target analytes were also determined analytically. A nonparametric test for variation of 6-30% in the medium testing (equations 3.8.7 for the original samples) could be derived and thus allowed to perform the whole-sediment fish embryo toxicity test with brackish Baltic Sea sediments. Results from the embryo toxicity test in 96 well plates with sediment extracts from ASE and shaking extractions with methanol/water were compared to data obtained testing native marine sediments. Findings revealed the bioavailable hazardous sedimentual composition of sediments as well as the actual risk for fish embryo development. Finally, results on EROD inducing potential indicated putative dioxin-like activity at the investigated sampling sites. The data show an ecotoxicological burden for several Baltic Sea sediments, that is likely accessible for sediment-dwelling organisms.

**TU 321**
Large and medium scale spatial variability in biomarker responses in herring (Clupea harengus membras), a candidate for evaluating chemical-biological effects at population level is analyzing the embryonic development of a new chemicals policy in the EU nevertheless one of the objectives of REACH is to promote alternative methods for the assessment of hazards of substances both to reduce animal testing and to calculate Predicted Environmental Concentrations (PECs) and Risk Characterisation Ratios (RCR).

**TU 322**
Assessment of ecosystem health in the Baltic Sea using the embryonic development of Monoporeia affinis as a bio-indicator

**RAI 1**
Risk assessment of chemicals within REACH integrating alternative methods and non testing strategies

**TU 330**
Opportunities and limitations of using alternative methods and non testing strategies in REACH registration dossier

**TU 331**
Lessons from ECETOC TCR based exposure scenarios

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**TAU1**
The Environmental Release Category (ERC) method developed for Tier I REACH scenarios, (RCR): The ECETOC TRA integrated tool has been the corner stone of exposure scenario modeling and risk characterisation in the first phase of REACH. The tool incorporates three principal methods: 1- The Environmental Release Category (ERC) method developed for Tier 1 REACH scenarios,
Based on specific case studies, we discuss in this communication work-arounds which we used and Specific ERCs (SpERCs) for REACH. The Klimisch Scoring System: a system in desperate need of modernization. Here, we provide an overview of the available approaches and how we have practically utilised them to address our REACH requirements. There have been a number of efforts aimed at developing technical guidance, tools, and techniques for non-testing and tiered exposure approaches. Despite these efforts, there remains limited practical insight about how these approaches can be applied in the assessment of substances. Here, we provide practical approaches and how we have practically utilised them to address our REACH requirements.

TU 333 The Klimisch Scoring System: a system in desperate need of modernization
I. Leuteniger, J. Jouppila, M. Duchemin, C. Dourou, P. Adrain, P. Thomas
1Intrinsic Environmental Sciences, Inc., OTTAWA, Canada
2CEHTRA, BORDEAUX, France
3CEHTRA, BORDEAUX, France
The Klimisch Scoring System and the HPV program is a key component for conducting robust hazard and risk assessments. The Klimisch scoring system is an approach used to assess the reliability of data, particularly toxicological and ecotoxicological data. The intention of the system is to harmonize data evaluation worldwide. However, recent studies have revealed the deficiencies in the Klimisch scoring system highlighting that interpretation of Klimisch criteria by evaluators is subjective, and semi-quantitative at best. Without data quality harmonization, an assessment can lead to different reliability codes which can affect the robustness of the risk assessment. In this presentation, we describe a tool we have developed to provide a more transparent and consistent framework to the Klimisch system while maintaining the same fundamental reliability codes. This tool has been tested and validated on a training set of studies by regulatory scientists. A second validation exercise further increased the accuracy and consistency of the tool leading us to studies conducted by a variety of laboratories. We pose some fundamental questions about the pertinence of the Klimisch system and whether a complete revision (while ultimately retaining the same 4 reliability codes) would be worthwhile.

TU 334 Solvent abuse in ecotoxicology testing
P. Thomas
CEHTRA, LISLE D’AIRE, France
Attempts have been made to standardize aquatic ecotoxicology testing for the purpose of hazard assessment in norms and Guidelines (e.g. OECD 200 series). Generally, and with some exceptions, these documents describe methods applied to “ideal” substances without specific properties which lead to the need to modify the test design (e.g. adsorbing, volatile, reactive and poorly soluble chemicals). For these cases guidance is provided in supplementary documents such as OECD No. 23 Guidance document on aquatic toxicity testing of difficult substances and mixtures. In the specific case of poorly soluble substances (for the sake of argument defined here as < 1 mg/L in the medium used), OECD No 23 has the following to say on the use of solvents: “because of the potential for an increased biodegradation of the test substance in an altered response to the test organism, their use should be restricted to situations where no other acceptable method of media preparation is available.” Nevertheless, multiple testing facilities across the world are still performing flow-through studies using solvents as standard and because they usually manage to maintain the test organisms throughout the test, they are generally being considered as “high end” valid studies for risk assessment purposes. Also, multiple cases have come to light which demonstrate that many of these studies are critically flawed. Notably, concentrations are maintained with high precision at levels in some cases greater than the measured water solubility limit of the test substance as measured in an OECD 105 solubility test (in pure water). Interestingly, as OECD No 23 points out “It is unlikely that a solvent concentration of 100 mg/L will alter significantly the maximum dissolved concentration of the substance.” For these cases guidance is provided in supplementation. Yet, further investigation on several substances has revealed that the OECD 105 measured solubility may be one or more orders of magnitude greater than the actual solubility in the test medium used in aquatic toxicity testing. From these flow-through tests with solvent have been observed above, at or close to the pure water solubility limit and these are systematically attributed to toxicity. In reality it would seem that the organisms are succumbing to a slow suffocation by undissolved droplets of test substance maintained in emulsion throughout the study, termed here “the vinaiugre effect”. How then, to separate genuine toxicity from the vinaiugre effect.

TU 335 A QSAR-based compound prioritization for lab-testing for chemical safety assessment
U. Stahl1, B. Bhilare1, E. Pospisilova, P. Gramatica1, L. Linke2, C. Xie1, G. Hu1
1Linke Linke Linke, LINKE, Germany
2School of Sciences, University of Insubria, VARESE, Italy
The practical implementation of non-testing strategies such as Quantitative Structure-Activity Relationships (QSARs) is still an area of development. To this end, there is a need to solve issues on how to practically integrate QSAR models prediction in risk assessment with the long-term goal to increase the use of non-testing information for regulatory decisions while meeting the main challenges of quantifying and reducing uncertainty. We discuss to what extent different strategies of prioritization for testing chemical compounds result in various strengths of background information for chemical safety assessment under REACH. An application of a strategy, based on predicted data from QSAR models, to select a set of compounds on the ECHA pre-registration list for further testing is provided and discussed. We propose to design a strategy of testing based on criteria safety related issues or further spread of background information, the cost of the purpose of testing and with respect to the specific circumstances in the application which is given by the available background information.

TU 336 Biotransformation of chemicals: linking octanol-water partitioning to Michaelis constants to search for general mechanisms
A. Evans1, M. A. H. B. J. A. O’Connor1, A. J. Ragas, A. H. Hendzlik
1Redford United Northern Nijmegen, Nijmegen, The Netherlands
The accumulation of xenobiotics in organisms is a key factor in the assessment of chemical risk and depends on transport and transformation processes. While rates of exchange with air, water, and food can be predicted fairly accurately from properties of chemical substances and biological speciation, the kinetics of biotransformation rates are difficult to obtain. This is one of the main limiting factors in modeling accumulation, whose extent significantly depends on the degree to which biotransformation occurs. As most enzymes follow first-order Michaelis Menten kinetics, biotransformation rates for many substances can be approximated as:

\[ k_c = \frac{k_m}{1 + \frac{[S]}{K_m}} \]

where \( k_c \) is the reaction rate constant in presence of substrate, \( k_m \) is the maximum reaction rate, \( [S] \) is the substrate concentration, and \( K_m \) is the Michaelis constant.

A QSAR-based compound prioritization for lab-testing for chemical safety assessment
C. Knape1, O. M. Irle2, G. Hu1
1University of Oxford, Oxford, UK
2Linke Linke Linke, LINKE, Germany
The practical implementation of non-testing strategies such as Quantitative Structure-Activity Relationships (QSARs) is still an area of development. To this end, there is a need to solve issues on how to practically integrate QSAR models prediction in risk assessment with the long-term goal to increase the use of non-testing information for regulatory decisions while meeting the main challenges of quantifying and reducing uncertainty. We discuss to what extent different strategies of prioritization for testing chemical compounds result in various strengths of background information for chemical safety assessment under REACH. An application of a strategy, based on predicted data from QSAR models, to select a set of compounds on the ECHA pre-registration list for further testing is provided and discussed. We propose to design a strategy of testing based on criteria safety related issues or further spread of background information, the cost of the purpose of testing and with respect to the specific circumstances in the application which is given by the available background information.

TU 337 Solving the toxicity of perfluorinated compounds to aquatic organisms
M. Peijnenburg1, G. Huiding1
1TU Delft, COLOGEN Center for Health and the Environment, Delft, The Netherlands
The practical implementation of non-testing strategies such as Quantitative Structure-Activity Relationships (QSARs) is still an area of development. To this end, there is a need to solve issues on how to practically integrate QSAR models prediction in risk assessment with the long-term goal to increase the use of non-testing information for regulatory decisions while meeting the main challenges of quantifying and reducing uncertainty. We discuss to what extent different strategies of prioritization for testing chemical compounds result in various strengths of background information for chemical safety assessment under REACH. An application of a strategy, based on predicted data from QSAR models, to select a set of compounds on the ECHA pre-registration list for further testing is provided and discussed. We propose to design a strategy of testing based on criteria safety related issues or further spread of background information, the cost of the purpose of testing and with respect to the specific circumstances in the application which is given by the available background information.

TU 338 Predicting respiratory sensitization of chemicals by accounting for their soft-hard electrophilicity
G. Huiding1, C. Knape1
1TU Delft, COLOGEN Center for Health and the Environment, Delft, The Netherlands
The practical implementation of non-testing strategies such as Quantitative Structure-Activity Relationships (QSARs) is still an area of development. To this end, there is a need to solve issues on how to practically integrate QSAR models prediction in risk assessment with the long-term goal to increase the use of non-testing information for regulatory decisions while meeting the main challenges of quantifying and reducing uncertainty. We discuss to what extent different strategies of prioritization for testing chemical compounds result in various strengths of background information for chemical safety assessment under REACH. An application of a strategy, based on predicted data from QSAR models, to select a set of compounds on the ECHA pre-registration list for further testing is provided and discussed. We propose to design a strategy of testing based on criteria safety related issues or further spread of background information, the cost of the purpose of testing and with respect to the specific circumstances in the application which is given by the available background information.
A substantial amount of data on chemicals was that to implement a database. For this purpose an Entity-Relation model was designed. The conceptual analysis evidenced that the best solution to create a software able to manage huge amounts of data is a relational database. Knowledge on hazards of the various metal species (self-classifications, (eco)toxicity references) were collected and stored in a database. The software validity is based on an unambiguously conservative algorithm from EU CLP Guidance: summation/additivity formula to calculate hazard and the concentration of the individual constituent species. The ecotoxicological and toxicological hazards of such materials are estimated based on the use scenarios of the substance (HUMO-LUMO energies, partial charges, dipole momentum, etc). For this purpose, we developed a robust pipeline that generates initial conformers, optimizes them with MOPAC7 and calculates for each conformer a set of quantum chemistry descriptors (environmental release categories (ERCs) and specific ERGs). The background model is based on the CLP mixture rules and is able to estimate the hazard and the concentration of the individual constituent species. The ecotoxicological and toxicological hazards of such materials are estimated based on the use scenarios of the substance. The software system ChemProp comprises models to estimate compound properties and a database of more than ten million substances. Both the structures and the provided quantum chemistry descriptors can be an important contribution to advance in science and industry. The integrated database allows for structure and substructure searching, and addresses toxicity and environmental concerns. The software system ChemProp comprises models to estimate compound properties and a database of more than ten million substances. It mainly employs models based on the topological similarity and thus does not require quantum chemistry. The system is an essential part of the functionality of the European Union project ORISER. The EuroControl ORISER project aims at developing a comprehensive database of environmental hazards to chemicals. The system is an essential part of the functionality of the European Union project ORISER. The EuroControl ORISER project aims at developing a comprehensive database of environmental hazards to chemicals. Recognition to the potential benefits of alternative testing methods is still under discussion. Alternative testing methods offer a cost-effective way to generate data in environmental safety assessment. The validation and prediction performance of alternative methods is still under discussion. The system is an essential part of the functionality of the European Union project ORISER. The EuroControl ORISER project aims at developing a comprehensive database of environmental hazards to chemicals.
testing activities/capabilities. The next registration deadline 2013 will involve many substances which need new studies compared to the 2010 registered substances.

TU 345

New developments in the OpenTox project
A Karwath, B Benigni, B Hardy, C Helma, N Jeliazkova, S Kramer
Albert-Ludwigs-Universität Freiburg, FREIBURG, Germany
Instituto Superior de Sanita, ROME, Italy
Douglas Connect, BASEL, Switzerland
Perfluorinated compounds (PFCs) are a family of chemicals with a long carbon chain which is substituted predominantly by fluorine. They are used in different materials as non-adhesives, waterproof fabrics, fire-fighting foams, etc. (Benzo)triazoles (B/TAZ) are another class of chemicals, which are widely used in industrial processes, deicing agents (H/BTAZs), pharmaceuticals and pesticides. These chemicals are considered as "emerging pollutants" as they are broadly distributed in the environment because of their extensive use and are considered to be hazardous as they cause adverse effects to humans and other non-target species. Their high concern as pollutants, lack of data and crucial Authorisation under REACH legislation urges for a need to maximize the information inherited in the existing data. Internally robust and externally validated QSAR models were developed for the endpoints, as also recommended under the REACH regulation, to predict large set of unknown properties for compounds not yet synthesised. The presented models reveal the robustness of these chemicals. In addition, Bioconcentration Factors (BCF) values were collected for most common PFCs and the relationship between the end-points was studied. The increasing trend of BCFs is in opposite direction to that of WS and CMC and the trend is found different for carbonylates and sulphonates. For B/TAZs, four QSAR models each on WS, VP, KOW (Octanol/Water partition) and Melt-Point (MP) were developed. 351 compounds were studied for structural AD study and out of which 66 are found within the AD of all four models for which at least one experimental data was available. These compounds were selected and used using PCA in a model development for both compounds, their leaching and volatility behavior. Comparison with soil sorption partition coefficient (KOC) was performed by using predictions from earlier published models. More soluble, more volatile and more sorbed chemicals are highlighted. The H/H-TAZs were found to be among the most soluble and less sorbed compounds.

TU 346

QSAR and QSPR models for emerging pollutants: WP3 activities within the FP7 European Project CADASTER
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2IVL Swedish Environmental Research Institute Ltd., STOCKHOLM, Sweden
3School of Pure and Applied Natural Sciences, Linnaeus University (LNU), KALMAR, Sweden
4In-silico, BASEL, Switzerland
5Douglas Connect, BASEL, Switzerland
6Institute of Bioinformatics and Systems Biology, Helmholtz Zentrum Muenchen, MUNICH, Germany
The aim of this poster is to summarize the WP3 activities within the CADASTER project and the QSAR prediction of aquatic and mammalian toxicity of triazoles and benzo-triazoles.

TU 347

Physico-chemical property prediction of emerging pollutants: PFC and B/TAZ for environmental distribution
P Gramatica, B Bhatarai
University of Insubria, VARESE, Italy
Perfluorinated compounds (PFCs) are a family of chemicals with a long carbon chain which is substituted predominantly by fluorine. They are used in different materials as non-adhesives, waterproof fabrics, fire-fighting foams, etc. (Benzo)triazoles (B/TAZ) are another class of chemicals, which are widely used in industrial processes, deicing agents (H/BTAZs), pharmaceuticals and pesticides. These chemicals are considered as "emerging pollutants" as they are broadly distributed in the environment because of their extensive use and are considered to be hazardous as they cause adverse effects to humans and other non-target species. Their high concern as pollutants, lack of data and crucial Authorisation under REACH legislation urges for a need to maximize the information inherited in the existing data. Internally robust and externally validated QSAR models were developed for the endpoints, as also recommended under the REACH regulation, to predict large set of unknown properties for compounds not yet synthesised. The presented models reveal the robustness of these chemicals. In addition, Bioconcentration Factors (BCF) values were collected for most common PFCs and the relationship between the end-points was studied. The increasing trend of BCFs is in opposite direction to that of WS and CMC and the trend is found different for carbonylates and sulphonates. For B/TAZs, four QSAR models each on WS, VP, KOW (Octanol/Water partition) and Melt-Point (MP) were developed. 351 compounds were studied for structural AD study and out of which 66 are found within the AD of all four models for which at least one experimental data was available. These compounds were selected and used using PCA in a model development for both compounds, their leaching and volatility behavior. Comparison with soil sorption partition coefficient (KOC) was performed by using predictions from earlier published models. More soluble, more volatile and more sorbed chemicals are highlighted. The H/H-TAZs were found to be among the most soluble and less sorbed compounds.

Tu 348

QSAR prediction of aquatic and mammalian toxicity of triazoles and benzo-triazoles
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2IVL Swedish Environmental Research Institute Ltd., STOCKHOLM, Sweden
3School of Pure and Applied Natural Sciences, Linnaeus University (LNU), KALMAR, Sweden
4In-silico, BASEL, Switzerland
For B/TAZs, four QSAR models each on WS, VP, KOW (Octanol/Water partition) and Melt-Point (MP) were developed. 351 compounds were studied for structural AD study and out of which 66 are found within the AD of all four models for which at least one experimental data was available. These compounds were selected and used using PCA in a model development for both compounds, their leaching and volatility behavior. Comparison with soil sorption partition coefficient (KOC) was performed by using predictions from earlier published models. More soluble, more volatile and more sorbed chemicals are highlighted. The H/H-TAZs were found to be among the most soluble and less sorbed compounds.

TU 349

Prediction of uptake and elimination rates for polar organic compounds in aquatic species
IA O’Connor, MAJ Huijbregts, A Pirovano, AMJ Ragas, AJ Hendriks
Radboud University, Nijmegen, NIJMEGEN, The Netherlands
Eco toxicological models are important tools to conduct environmental risk assessment. Ideally, the model should be based on mechanistic understanding of the processes, and parameters should be obtained by properties of the compound and species. Only this allows extrapolation to other species and endpoints.

Upake and elimination are fundamental processes in most compartmental models. Uptake and elimination rates are commonly considered to be a function of organism mass, water/air flow through gills/lungs, and diffusion through water and lipid layers. The diffusion of organic chemicals through the lipophilic membrane depends mainly on the octanol water partition coefficient (Kow).

However, for more polar compounds (logKow<3) octanol is not a sufficient surrogate of the membrane because other chemical properties, such as hydrogen bond acceptor and hydrogen bond donor are important. Descriptors accounting for polar characteristics have been included in many QSAR approaches predicting the absorption of pharmaceuticals. These QSARs focus on absorption through membrane layers, hence absorption through mammalian intestine, blood brain barrier and skin by passive diffusion and active transport.

In addition to passive diffusion, carrier mediated transport can become relevant, if the xenobiotics can use transport systems of endobiotic compounds. Uptake of pharmaceuticals is often a mixture of passive diffusion and carrier mediated transport.

The novelty of this study is to summarize the prediction of uptake and elimination rates of polar compounds on organism level with a focus on aquatic organisms. The approach consists of improving the prediction of 1) passive diffusion and 2) carrier mediated transport. Prediction of passive diffusion may be improved by incorporating descriptors accounting for polar characteristics and molecular volume. The influence of carrier mediated transport will be examined by investigating kinetics and affinities of selected biotics and their transport proteins and extrapolating the findings to structural similar xenobiotics of relevant environmental concern. The estimation of rates for passive diffusion and carrier mediated transport will be based on datasets of compounds with a logKow<3, i.e. uptake of selected pesticides and industrial chemicals into aquatic organisms, and absorption of pharmaceuticals through mammalian cell lines.

TU 350

How useful are QSARs within a regulatory framework? Validation and applicability domain assessment of QSARs related to PBT endpoints.
The regulatory use of Quantitative Structure Activity Relationship (QSAR) models is expected to increase under chemical management systems such as REACH. In silico model predictions are an attractive cost-saving alternative for animal testing; however, the OECD responded to the need for guidance on QSAR application by developing acceptance criteria for the validation and regulatory use of QSARs, which were also adopted in the REACH guidance. Of particular interest are the criteria about the external validation to determine the true predictive power of a model and about the applicability domain (AD) since predictions are most reliable if they fit the model's AD. Six models predicting PBT (Persistency, Bioaccumulability, Toxicity) endpoints were selected for external validation and AD assessment. The evaluation of P models was BIOWIN and MultiCase; the B models were BCFWIN and CAESAR; and the T models were ECOSAR and MultiCase. Validation set chemicals (79% data) were selected from Risk Assessment Reports of the European Chemicals Bureau and others. The AD assessment of the models was done using structure similarity methods of Amity Discovery. In the validation of P models, a combination of BIOWIN 3 and 5 models performed the best: predicting between 76-90% of the true AD; the P models ranged between 67% and 96% false negative and positive predictive values were 8% and 20%, respectively. Highest values for precision (92%) and predictive value (96%) were obtained for not readily biodegradable chemicals. In the validation of the B models, it was concluded that both CAESAR and BCFWIN did not pass the criteria for regulatory use (false positive ratios >50%). The validation of the T models showed that the chronic ECOSAR model for fish can serve as first screening tool in risk assessment. The acute ECOSAR and MultiCase models did not pass the regulatory criteria. With respect to the AD assessment, the used structural similarity methods were not capable to completely capture the mechanistic basis of the models. These findings indicate the need to develop a global similarity test to determine whether the structural features in a validation chemical are covered in the training set of a QSAR. Wider application and acceptance of QSARs for regulatory use will require further model development and thorough AD assessment. The large amount of high quality experimental data that becomes available within REACH can be used to achieve these requirements.

TU 352
The use of (Q)SARs as part of a larger registration strategy for REACH
LS Rockett
WRc plc, Swindon, United Kingdom
The European Union REACH regulations require the submission of detailed information on the physico-chemical, toxicological and ecotoxicological endpoints of chemicals. For the last few years, WRc has been heavily involved in REACH, advising companies and consortia to develop registration strategies, comparing the laboratory testing, collate and evaluate data, fill data gaps and prepare dossiers for registration.

One of the methods employed to fill such data gaps is (Quantitative) Structural Activity Relation-Ship (QSAR) modelling. QSAR modelling requires the identification of chemicals of similar structural similarity to the chemical of interest. Data on the toxicity of these structurally similar chemicals is then used to predict the likely toxicity of the chemical of interest. These results can then be used for a number of purposes:

- To guide experimental testing strategies;
- To provide mechanistic data to support chemical grouping;
- To improve the evaluation of existing data as part of a weight of evidence approach; and
- To potentially provide a full replacement for toxicity testing.

However, it is not always possible to generate a prediction (Q)SAR models. Consideration must be given to the robustness, reliability and appropriateness of these predictions. To this end, the Organization for Economic Cooperation (OECD) has derived guidance on the use of (Q)
SARs, which state that (Q)SARs must include the following characteristics:

- A defined endpoint, i.e. the endpoint should be something that can be measured experimentally such as a LC50 or an EC50.
- An unambiguous algorithm, this is to ensure transparency in the description of the model al-gorithm. However, the OECD has acknowledged that this may not be possible in commercially-developed models.
- A defined domain of applicability, i.e. the limitations of the model should be clear.
- Appropriate measures of goodness-of-fit, robustness and predictivity.
- If possible, a mechanistic interpretation.

This poster presentation is to provide a brief overview of such commonly used approaches to define the ap-plicability domain and addressing their bias of interpretation, algorithm implemented and the reliabil-ity they offer in terms of their approach. We made an effort to compare the features of these approaches on simulated and real QSAR datasets to provide a better scenario of existing situation and to address the current drawbacks that need to be considered in the future.
Toxicity data modeled onto the corresponding plotting positions (cf. quantile plots). Standard hypothesis testing and diagnostics of the linear regression are inappropriate without further constraints (cf. generalized least squares). We consider evaluating which estimator, subject to the log-normality assumption, exhibits the best performance. The problem reduces to a fundamental problem of how to measure the performance of an estimator. This can be done by (1) ‘discriminacy’ between the estimator and ‘true’ value, or (2) ‘discriminacy’ between the true potentially affected fraction of species and the intended level. Evaluation of different ‘standard’ criteria (variance, bias, etc.) under the perspective of (1) indicates that the median estimator performs better for all reasonable sample sizes. For (2), the results concur on important scales of discriminate. However, this performance is highly sensitive to the chosen criteria/standard sample size. We conclude that the median estimator is preferable and that controversy could be overcome by a risk assessor reporting probabilistic distributions for risk management. In a Bayesian approach, in addition to summary statistics, the median estimator is known to be a special case of this.

TU 360
Acute toxicity of organic chemicals to Gammarus pulex correlates with sensitivity of Daphnia magna across most modes of action R. Ashauer1, A. Hintermeister1, E. Potthoff1, B. I. Escher2
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We investigate the sensitivity of the freshwater crustacean amphipod Gammarus pulex towards organic xenobiotics in comparison to the sensitivity of the crustacean cladoceran, Daphnia magna. Also we studied the influence of the chemical’s mode of action on the relationship between the sensitivity of G. pulex and that of D. magna. We tested the acute toxicity of twelve compounds (Malathion, Aldicarb, Carbofuran, 2,4-Dichloroaniline, 2,4-Dichlorophenol, 1,2,5-Trichlorobenzene, 4,8-Dinitro-o-cresol, 2,4,5-Trichloropheno, Ethylcyacyl, 4-Nitroben- yl fluoride, 2,4-Dinitrophenol) with different modes of action and physiological properties towards the freshwater amphipod G. pulex in laboratory experiments. Additional toxicity data was collected from literature and databases (data pairs for 44 chemicals in total). The chemicals were assigned to seven mode of action groups. The relationship between the sensitivity of G. pulex and that of D. magna (48h-EC50) was investigated using regression analysis and correlation plots.

G. pulex is two to three orders of magnitude more sensitive than neonicotinoids than D. magna. For organophosphates we find that D. magna is more sensitive than G. pulex by approximately a factor of 100 in the case of the other mode of action groups exhibited a significant difference between the sensitivity of D. magna and that of G. pulex, however chemicals with the same mode of action grouped together in the same area of the correlation plot. For the whole dataset, with the neonicotinoids included, 68% and 93% of all G. pulex toxicity data are within one and two orders of magnitude of the D. magna data, respectively. The regressions with all data and with all data minus neonicotinoids were both significant linear relationships within the range of the data. Then neonicotinoids are excluded the results resemble the 1:1 line very closely. As the slope is around one and the intercept around zero we conclude that G. pulex is generally equally sensitive towards organic xenobiotics as D. magna. Such a simple prediction of mode of action and physiological property of G. pulex within one order of magnitude for 75% of all compounds and within two orders of magnitude for 100% of the compounds in our dataset, if neonicotinoids are excluded.

TU 361
Trait-based sensitivity assessment of specific toxicants: getting deeper into specific traits A. Jopling1, R. Todeschini, M. Vighi2
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2Research School of Biology, Australian National University, BRISBANE, Australia

Assessing the sensitivity of a species or a group of species to chemicals is one of the key points to predict the effects of toxic compounds in the environment. Trait-based predicting methods proved to be extremely efficient in order to assess the sensitivity of macroinvertebrates towards compounds with non specific toxicity (narcotics). Nevertheless predicting the sensitivity of organisms towards compounds with specific toxicity is much more complex, since it depends on the mode of action of the chemical.

We tried to predict the sensitivity of several freshwater macroinvertebrates towards two classes of plant protection products: organophosphates and pyrethroids. We built two databases: one comprises the sensitivity data of 16 species and subspecies from the EPA ECOTOX database and another one which collects biological traits. Aside from the ‘traditional’ traits usually considered in ecological analysis (i.e. body size, respiration technique, feeding habits, etc.), we use multivariate analysis to relate the sensitivity of organisms to some characteristic (physiologi- cal, behavioral, etc.) which could influence the sensitivity. We are investigating for example whether the complexity of nervous system is relevant to assess the effects provoked by neurotoxins like organophosphates and pyrethroids.

Results show that G. pulex is twice as sensitive as G. pulex with different modes of action and physiological properties, thus can be used to predict sensitivity to toxic substances, although more studies are needed to provide sound predictive methods. One key point to achieve a complete mechanistic understanding of the process is the choice of traits, whose role in the discrimination of sensitivity should be clearly interpretable, and not only statistically significant. A relevant drawback is the lack of information on the traits with the necessary taxonomic detail.

TU 362
Main factors driving population dynamics of a pollution indicator species A. Palmqvist1, R.E. Forbes2
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The marine deposit-feeding polychaete Capitella capitata is a classical re-colonizing species frequently used as an indicator of contamion and sediment properties. It is now recognized that Capitella capitata is in fact a complex of sibling species of which some species are very opportunist whereas others are both more robust and less tolerant to disturbance. Some of these sibling species have been extensively used for both laboratory experiments and field surveys, though without establishing if the same species are involved. These sibling species differ in different mode of action and physiological characteristics alone. With a combination of different types of laboratory experiments and model simulations the present study aims to pinpoint the most important factors driving the dynamics of field populations of Capitella spp., in order to focus further research, monitoring and manage- ment of disturbed areas. The importance of larval dispersal ability and settling behaviour was explored through both a matrix metapopulation study and targeted settling experiments. With increased focus on incorporating more ecological relevance into ecotoxicological studies, we de- signed experiments to mimic and explore the boom-bust dynamics of Capitella retata. Our results emphasize the influence of dispersal ability and settling behaviour on the population dynamics of classical re-colonizing polychaetes and highlight the importance of understanding the principal factors driving re-colonization of disturbed sediments. Not surprisingly, food availability seems to have a strong role for both larval dispersal and settling behaviour, as well as the main deter- minant of density dependence in Capitella spp., and is more important for settling in organically contaminated areas than is the presence of sedimento associated contaminants at ecologically relevant concentrations. The take home message from this study is that in order to extrapolate to field conditions risk assessment for mussel will need to include these factors, and specifically larval dependence of disturbed areas. The importance of larval dispersal ability and settling behaviour was explored through both a matrix metapopulation study and targeted settling experiments. With increased focus on incorporating more ecological relevance into ecotoxicological studies, we de- signed experiments to mimic and explore the boom-bust dynamics of Capitella retata. Our results emphasize the influence of dispersal ability and settling behaviour on the population dynamics of classical re-colonizing polychaetes and highlight the importance of understanding the principal factors driving re-colonization of disturbed sediments. Not surprisingly, food availability seems to have a strong role for both larval dispersal and settling behaviour, as well as the main deter- minant of density dependence in Capitella spp., and is more important for settling in organically contaminated areas than is the presence of sedimento associated contaminants at ecologically relevant concentrations. The take home message from this study is that in order to extrapolate to field conditions risk assessment for mussel will need to include these factors, and specifically larval dependence of disturbed areas. The importance of larval dispersal ability and settling behaviour was explored through both a matrix metapopulation study and targeted settling experiments.
impact of agricultural activities on stream invertebrates. An attempt is made to distinguish the impact of pesticides from those caused by habitat degradation, using a suite of habitat descriptors extracted from field protocols. Lastly, we identify important landscape elements (from GIS) that contribute to the vulnerability of streams.

TU 366
Susceptibility of different life stages of Folsomia candida (Collembola) to hydrophobic organic compounds

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Hydrophobic organic compounds (HOCs) represent important component of soil contamination and poses a great threat to ecosystem function and human health. Since soil ecosystems are often exposed to organic pollutants, it becomes important to evaluate the risk of these chemicals to soil organisms and populations. For that purpose, several standard made soil toxicity tests with soil organisms are already established. The collembolan Folsomia candida is a common soil invertebrate, used in standardised ISO (11267) and OECD (232) toxicity test guidelines. Prevalently closed endpoints in these tests are the EC50 concentrations for reproduction (50% reduction in reproduction) and survival. Substitution of this microarthropod with biological markers profiles are often based on these calculated EC50. However it remains unclear which life stage is the most sensitive. In the development of soil invertebrates the morphology and the physiology change rapidly. Standard test can't reveal if the toxic effects appears on eggs, young hatchlings or adult. Therefore, we decided to randomly choose two different life stages of Folsomia candida were exposed to three different hydrophobic organic compounds (phenanthrene, naphthalene, 1,2,4,5-tetrachlorobenzene and 2,3,5,6-tetrachloroanilone). In earlier standard tests these compounds showed different effective concentrations based on their logKow. Phenanthrene and 1,2,4,5-tetrachlorobenzene showed both baseline toxicity whereas for 2,3,5,6-Tetrachloroanilone evidence grows to have an uncoupling effect. Natural standard LUF 2.2 soil was used as substrate. Survival, reproduction and hatching success were evaluated after 24 or 35 days, respectively.

TU 367
Selected biological traits reveal soil invertebrate exposure to trace metal contamination

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For decades, human pressures have threatened the ecological integrity of soils. The draft Soil Framework Directive (COM(2008) 232) has listed the main eight soil parameters to which soils in the EU are confronted, of which soil biodiversity loss and contamination are two aspects have been successfully monitored in stream ecosystems using invertebrate biological traits. In this context, we aimed at developing a similar approach for soil monitoring. In the present work, we aimed at correlating soil parameters with three biological traits, which are highly sensitive to trace metal (TM) contamination, in combination of composition and functional role. Soil macro-invertebrates can be exposed to trace metal either by ingestion or by contact; they can also avoid to be exposed by escaping natural habitats. We propose that these three ways to escape are the physiological and the morphological ways related to the way invertebrates are exposed to pollutants. So we hypothesized that the proportion of (i) soft-body; (ii) geophageous and (iii) wingless invertebrates decrease as trace metal concentration increase in soil. Geophageous invertebrates are also key in terms of soil aggregation and organic matter turnover. We selected five plots located in the 150-ha-broad agricultural plain (Pierrelaye-Bessancourt, France). This plain has been contaminated by irrigation with raw wastewater of Paris City for 100 years. As a result, the contaminated soils display strong and heterogeneous accumulation of organic metal, metal pollutants and desolved salts in surface horizons. In this agricultural plain, high values of soil metal contents have been recorded, e.g. up to 1500 or 15 mg kg⁻¹ dw soil for Zn or Cd, respectively. The present work demonstrate that functional trait approach allow to discriminate three different responses at soil contamination increase. The negative linear relationship of soft-body invertebrates to TM concentration reveals an additive effect of contamination. This functional trait is very sensitive since difference was observed between communities in uncontaminated and weakly contaminated plots. The response of geophageous or wingless invertebrates reveals a threshold effect depending on the level. The lack of geophageous invertebrates can imply drastic losses in soil functioning, its soil aggregation, porosity or organic matter turn over.

TU 368
Potential application of traits-based bioassessment approaches for use in the study of multi-stressor impacts on freshwater ecosystems in the Athabasca oil sands region (Canada)

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Potential application of traits-based bioassessment approaches for developing single stressor diagnostic indicators for water bodies in Europe (as done under TU 371) aims at achieving a good ecological and chemical status of water bodies in Europe until 2015. Whereas the ecological status assessment builds on different modules, such as hydromorphology, macroinvertebrates, aquatic macrophytes/algae and fish community assessment, the chemical status is defined as compliance to environmental quality standards set up for selected priority and dangerous substances, which are being reviewed regularly. We propose a new ecotoxicological module bridging between the biological and the chemical approach. Based on existing data for macroinvertebrates for the biological module, the SPEAR-index (SPEcies At Risk) provides an initial screening tool. In case of a positive result of SPEAR-index, an acute toxic test with known parameters should be performed in a second step. In this step we propose GamTox, the new multi-metric and multi-level ecotoxicity test for application both in the laboratory and in situ. GamTox is performed as short-term acute test, as long-term chronic test and as multi-level ecotoxicity test. The present project is a part of a broader project (TUs 371 and 372) aiming at developing species-based bioassessment approaches.

TU 371
Functional vulnerability and degradation of chironomids in Republic of Moldova

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Moldova is characterized by very complex soil cover. Main soils are chernozems, 79% of the land. Land reform in Moldova has not created conditions for increasing soil fertility, sustainable land use, increasing agricultural production, exerting therefore negatively impact the country’s economy. In this context Moldova risks to lose the greatest wealth of country - cherno- zems fertility. Soil quality and vulnerability of most agricultural land is poor and a part of land are characterized by high pollution levels of different pollutants as heavy metals, petroleum hydrocarbons. The most serious forms of pollution are degradation of soils by chemical agents. The level of cumulative losses in soil functioning, its soil aggregation, porosity or organic matter turnover.

TU 372
Do pesticides affect flies in microarthropod communities according to food preferences as indirect effect?

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In agrosystems the use of plant protection products is common practice. During the applica-
tion a fraction of these products reaches the soil, making the soil community exposed to different
organisms from non-polluted areas that are present upstream

They are located only a few kilometres apart and present similar characteristics (i.e., hydrology, nutrient conditions, as well as between different anthropogenic factors. Species at risk (SPEARpesticides) index uses biological traits of organisms to determine whether organisms are vulnerable or not to pesticides exposure. The SPEARPesticides index have already been successfully validated over large-scale areas in different geographical regions of Europe using both species-level or family-level data on stream invertebrates.

Here we propose a different application of the index on a smaller, detailed scale, in order to verify the reliability of the SPEARPesticides index in site-specific risk assessment.

We consider two different streams in the river Adige, northern Italy. They are located only a few kilometres apart and present similar characteristics (i.e., hydrology, biochemistry, etc.). However, one of them is considerably prone to pesticide exposure, due to intensive land uses. The other is more affected by the wastewater discharge from a nearby plant, and therefore less impacted, and could be used as reference site. The exposure scenario due to runoff events was modelled for the entire productive season of 2010. Macrobenthos community was sampled monthly in both streams and taxa abundance was counted.

The SPEARPesticides index was used to analyze differences between the community composition of the two rivers, in order to verify if those differences were due to pesticides exposure. SPEARPesticides indicates a clear shift of the community composition over time in the impacted river. The comparison with the reference site shows clearly that this alteration is not driven by natural factors, but is caused by exposure to pesticides. The last sampling, performed more or less one month after the last treatment, shows a consistent recovery of the community of the impacted river. The fast resilience of the community can be probably linked to high input of natural factors and it is likely to be caused by exposure to pesticides.

The impact of leachate contamination was not been assessed, demonstrating that direct effects overshadow the indirect ones. However, one of the most problematic environmental stressors are odours, that seems to be related to odour emissions from waste treatment plants. Waste treatment plants are now large, complex realities where different processes take place under controlled conditions. Still the results are, mainly due to the large amounts of waste material treated, that areas in the proximity of landfills are vulnerable not only to emissions, to possible toxic compounds, but also to nuisance such as odour pollution.

All these factors have a dramatic impact in the local environment producing environmental quality degradation. Measurements of odour pollution are not frequent and they are not considered a specific phenomenon. A large number of landfill gas (LFG), from its non-methanogenic volatile organic compounds (NMOCs). The most practical control technologies for landfill gas are flares but several hazardous air pollutants (HAP) are present in LFG, some of these being cancerogenic for humans. In MSW, as well as in LFG several odorants are present and both emissions during landfill operations and LFG uncontrolled emissions are responsible for environmental odour pollution. In this work we present an integrated risk assessment for carcinogenic emissions and odour pollution to describe environmental risk of the facility. Wastes treatment plants are now large, complex realities where different processes take place under controlled conditions. Still the results are, mainly due to the large amounts of waste material treated, that areas in the proximity of landfills are vulnerable not only to emissions, to possible toxic compounds, but also to nuisance such as odour pollution. All these factors have a dramatic impact in the local environment producing environmental quality degradation.

The impact of leachate contamination was not been assessed, demonstrating that direct effects overshadow the indirect ones. This work contributes with an example of how indirect effects of fungicides on leaf litter decomposer processes can be measured and to what extent microbial communities, shredders, collectors and their interactions might be affected.

A gradient of Carcinommbium sp. abundance was measured; (0.5 g/L and 50 g/L) was used to show differential microbial conditioning of adhered leaf litter over a 14 day conditioning period. Effects of Carcinommium on microbial community structure (fungi and Bacteria) were assessed with denaturant gradient gel electrophoresis (DGGE), a polymerase chain reaction (PCR) based fingerprinting technique. A microbial functional endpoint was also assessed by analyzing the oxygen consumption of the leaf microbial communities. Afterwards, leaf disc cultures in the different fungicide concentrations were used in multispecies systems with the shredder Stictocottus vittatum (Trichoptera) and the collector Chironomus riparius (Diptera) to assess changes in leaf degradation rates through effects on invertebrate feeding and consequent changes in collectors’ growth due to differences in food availability and quality. Results are discussed in terms of how carbon-diazin contamination can affect detritus food webs by disrupting ecological interactions and have significant effects on aquatic macroinvertebrate communities and ecosystem function.
Effective Concentration (EC) values with their uncertainty intervals whatever the x, even 0. Our talk will detail the complete approach. (from a theoretical and a practical point of view), from raw data until the calculation of 95% CI on ECx, with x equal to 0, 0.5 and 1. Four data sets concerning different type of toxic compounds and collected during standard 21-day Daphnia magna bioassays, are analysed. To support our demonstration, 95% CI on ECx calculated with our approach are compared with a classical fit of the 3-parameter log-logistic model. Both methods are in good agreement.

Of course, some cons could be argued against our approach like rather large intervals, inevitably bounded by concentrations tested in the experimental design, or intervals on EC0 always left bounded by 0. Nevertheless, our approach supposes that the observed effects are an easy and statistically convenient way to overstep the misuse of p-values which are certainly not dedicated to establishing thresholds, values of which strongly depending on the sample size without to be associated with their uncertainty.

TU 379
Defining relevant ecological endpoint in the context of integrated environmental assessment of chemicals
S Saúl1, M Vigli1
1Joint Research Center European Commission, ISPRVA, ITALY

The recent developments of ecotoxicological risk assessment are oriented toward an increased attention for the whole life cycle of products and goods. This approach is an easy and statistically convenient way to overstep the misuse of p-values which are certainly not dedicated to establishing thresholds, values of which strongly depending on the sample size without to be associated with their uncertainty.

TU 380
Assessing the effects of ammonia on aquatic communities in the field
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1WCA environment, FARINGDON, United Kingdom

Environmental Agency, WALLINGFORD, United Kingdom

Ammonia is a nitrogenous waste product from lignin conversion for pulp and paper mills. We used recently developed tools for assessing the degree to which aquatic communities are impacted by their environment, relative to unstressed reference conditions, to assess the effects of ammonia on different components of aquatic ecosystems in the UK. The approach uses a dataset of spatially matched chemical and ecological data. Statistic is then used to analyze the datasets, which accounts for other stressors (such as chemical toxins or habitat degradation) that may have caused impacts on the communities. Thresholds for the effects of ammonia on fish, invertebrates, macrophytes and algae are derived for different forms of ammonia exposure (total ammonia or ammonia) using species sensitivity distribution (SSD). The results are compared against the quality standards for ammonia that are applied in UK freshwater.

TU 381 High functional redundancy in a herbicide-exposed planktonic community
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1Ghent University, GHENT, Belgium
2Alterra and Wageningen University, WAGENINGEN, The Netherlands

A metabolic fingerprinting approach is used to predict functional effects of the herbicide linuron from data. On a functional group level, our analysis showed that a reduction in carbon uptake rates of sensitive primary producers caused a density decrease of the latter with increasing linuron concentration. In response, heterotrophs started feeding on more abundant tolerant primary producers which allowed them to maintain feeding rates at levels - indicating functional redundancy within the planktonic community. On an ecosystem level, total gross primary production (GPP) was up to hundred times lower in the linuron-treated mesocosms than in the controls and could be explained by herbicide effects on macrophytes - the main contributor to total GPP. In contrast, linuron did not change planktontic GPP more than a factor 2 and did not alter bacterial production. We conclude that the planktonic community exhibited high functional redundancy when facing herbicide stress.

TU 382 Unexpected Malachite Green sediments and fish herbivore contamination originated from a wood panel factory
S Leondide1, LA Maio1, M Mansiero1, A Cecchini1, G Perin1, A Giacometti2
1IDEAS Centre - University of Venice, VENICE, ITALY
2IDeAS Centre - University of Venice - Archives of Environmental/Human Toxicology, VENICE, ITALY

Malachite Green (MG) is an extensively used biocide in the aquaculture industry worldwide. It is highly effective against important protistan and fungal infections. Basically, it works as an ice-plant biocide: it has also been used to control skin flukes and gill flukes. Aquaculture industries, particularly those rearing valuable fish species (e.g. salmon, trout, carp) have been using malachite green extensively as a topical treatment by bath or flush methods with- out paying any attention to the fact that topically applied therapeutics might also be absorbed systemically and produce significant internal effects. Malachite green has become a highly controversial compound due to the risks it poses to the consumers of treated fish including its effects on the immune system, reproductive system and its genotoxic and carcinosogenic hazard. Though the use of this dye has been banned in several countries it is still being used in many parts of the world due to its low cost, ready availability and efficacy. There is concern about the fate of MG and its reduced form, leucomalachite green, in aquatic and terrestrial ecosystems since they occur as contaminants and are potential human health hazards.

Some fish samples (roost) exported by a large fish farm in Friuli (Northern Italy), controlled by food-quality control officers, showed a substantial amount of MG, not enough for killing the fishes but largely exceeding the food safety limits. Malachite green, MG in the fish farm, however, indicated that the pollution source should have been search in a different site, located quite upstream the fish farm.

Going backwards, after a labor intensive and deep investigation, the scientists found that sediment from the same site was more polluted by MG. Finally, the MG main source, industry located upstream a factory using MG as dye for manufacturing custom-colored wood panels. The regulative intervention of the authority forced the factory to eliminate MG in the industrial processes. The sediment data provided the scientific basis for river recovery.

TU 383 A comparison between natural and alternative sea water piling materials merging ecological and ecotoxicological issues
A Vida1 (Glaraltingue1, GL Libralato1, CL Losso1, EK Keppel2, MS Sigovini2, DT Tagliapietra2
1CAI Faculty of Venice University, VENICE, ITALY
2University of Study Milano Bicocca, MILANO, Italy

The sediment data provided the scientific basis for river recovery.

TU 384 Cellular changes in microalgae exposed to effluent from pulp and paper mill
HL Soares1, E Baptista1
1IDeAS Centre - University of Venice, VENICE, ITALY

Some fish samples (roost) exported by a large fish farm in Friuli (Northern Italy), controlled by food-quality control officers, showed a substantial amount of MG, not enough for killing the fishes but largely exceeding the food safety limits. Malachite green, MG in the fish farm, however, indicated that the pollution source should have been search in a different site, located quite upstream the fish farm.

Going backwards, after a labor intensive and deep investigation, the scientists found that sediment from the same site was more polluted by MG. Finally, the MG main source, industry located upstream a factory using MG as dye for manufacturing custom-colored wood panels. The regulative intervention of the authority forced the factory to eliminate MG in the industrial processes. The sediment data provided the scientific basis for river recovery.

TU 385 Toxic effects of effluent from pulp and paper mill on photosynthetic capacity of microalgae
JH Soares, E Baptista

Several studies have demonstrated toxic effects of effluent from pulp and paper mill for microalgae. These effects contain many substances with toxic potential for feeding rates at levels - indicating functional redundancy within the planktonic community. On an ecosystem level, total gross primary production (GPP) was up to hundred times lower in the linuron-treated mesocosms than in the controls and could be explained by herbicide effects on macrophytes - the main contributor to total GPP. In contrast, linuron did not change planktontic GPP more than a factor 2 and did not alter bacterial production. We conclude that the planktonic community exhibited high functional redundancy when facing herbicide stress.

TU 386 Intraseasonal competition delays recovery of population structure
EP Lies1, KF UFZ, LEIPZIG, Germany

Some fish samples (roost) exported by a large fish farm in Friuli (Northern Italy), controlled by food-quality control officers, showed a substantial amount of MG, not enough for killing the fishes but largely exceeding the food safety limits. Malachite green, MG in the fish farm, however, indicated that the pollution source should have been search in a different site, located quite upstream the fish farm.

Going backwards, after a labor intensive and deep investigation, the scientists found that sediment from the same site was more polluted by MG. Finally, the MG main source, industry located upstream a factory using MG as dye for manufacturing custom-colored wood panels. The regulative intervention of the authority forced the factory to eliminate MG in the industrial processes. The sediment data provided the scientific basis for river recovery.
traits on the individual level and competition on the population level. To test these hypotheses we exposed populations of Daphnia magna to a pulse of the pyrethroid Fenvalerate. For several generations the populations were kept at two different degrees of competition: strong competition at carrying capacity and reduced competition main-tained by simulated predation. After disturbance due to Fenvalerate exposure, biomass recovered after 14-17 days. In contrast, size structure characterized by a wider range and domination of adults was maintained in populations with strong competition. Size structure recovered twice faster in populations with reduced competition. We explain this as follows: due to toxicant induced mortality, food availability and consequently birth rate increased and populations were dominated by small indivi-
duals. In populations without predation, these cohorts grew and eventually exerted high intra-
specific competition that led to higher growth of juveniles and (ii) increased mortality of adults. These demographic processes were mainly responsible for the prolonged recovery of size structure. In con-
trast, for populations with predation, the regular harvest of individuals reduced competition continuously, allowing a higher size structure in these dynamic populations. In risk assessment the duration for populations to recover from (toxicant) stress is crucial for the determination of ecological acceptable effects. We conclude that competi-
tion needs to be considered in order to understand and predict recovery of size structure.

TU 387
The secret in the sauce: the effects of varying environmental conditions on the toxicity of mine effluent constituents to coldwater fish

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Due to method standardization, current regulations may not afford protection against adverse effects of mine developments under non-standard pH, temperature, and hardness conditions of arctic waters. These effects may be due to liberated minerals, processing by-products, and service community wastes. Canadian mines are controlled under the Fisheries Act, regulating “Any sub-
stances” to a mine effluent. The objective of this study was to assess the effects of pH, temperature, and hardness on contaminant toxicity and time-to-
response. The study aimed to characterize the variability of effluent toxicity across a range of species and conditions while assessing whether the current standard test is protective enough to cover this variability. We compared the amended standard conditions (assays). Eighteen contaminants (NaCl, NaNO2, NaNO3, Na2SO4, KC1, CaCl2, Cl, Ca, Cu, Zn, Mg, Ni, Al, MnO4, Sr, NH4OHa, Na2CO3, and toluene) were tested using five species of fish native to Northern Canada (arctic char, lake trout, lake whitefish, round whitefish, and arctic grayling) across a range of pH (3.5, 6, 7.7, 7.5, and 8), temperature (5.10, and 15°C), and hardness (3, 60, 120 ppm) conditions and their observed effects models detected in 24, 48, 72, and 96-hour LC50 values. By comparing these results to each other and to those of the standard rainbow trout test, we have assessed the effect of pH, temperature, and water hardness on contaminant toxicity and time-to-
response, while between species while characterizing the ecological protection afforded by current regulations. The data suggests that, in some instances, the standard has failed to capture the performance of toxicants acting at non-standard conditions species and non-standard, real-world conditions. This variability of non-standard conditions exceed the resiliency of the standard test to act as a surrogate, the mandate of the Fisheries Act to provide adequate protection to fish, fish habitat, and human use of fish will not be met. This potential risk is guiding the project’s second phase of research.

TU 388
Asellus aquaticus as a sensitive test organism

GC Wegener1, KW Ebers2, Eurofin Agrosciences Services GmbH, NIFFER, OSELCHBROK, Germany

Toxicological test with Agrochemical showed that Asellus is one of the most sensitive species. Acute toxicity on Asellus aquaticus compared to effect on Daphnia magna, Chironomus riparius, Hyalella azteca, Lymbricus variegatus and Gammarus pulex will be presented.

TU 389
The case of Phaeodactylum tricornutum in wastewater toxicity monitoring

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Ca Foscari University of Venice, VENICE, Italy

Marine phytoplankton is highly productive in coastal ecosystems where it generally occurs the major exposure and uptake of contaminants associated with anthropogenic pollution discharges. Phytoplankton presents very high surface-to-volume ratio and may respond very rapidly to suspended contaminants. Therefore, some phytoplanktonic species are frequently used as pollution bioindicators, providing information about potential impacts on the supported marine-coastal food web. Phaeodactylum tricornutum is commonly used in toxicity testing according to the standardised protocol UNI EN ISO 10253:2006. Unfortunately, it seems that a complete inventory of the tested substances and matrices has not been compiled yet. The purpose of this study has been to review scientific literature about P. tricornutum and to specifically assess its sensitivity to a range of contaminants and non-standard, real-world conditions. To this should variability of non-standard conditions exceed the resiliency of the standard test to act as a surrogate, the mandate of the Fisheries Act to provide adequate protection to fish, fish habitat, and human use of fish will not be met. This potential risk is guiding the project’s second phase of research.

TU 390
Assessing effects of Ultraviolet B radiation on Physa fontinalis using biochemical biomarkers

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Biomarkers are widely used in order to detect stress in organisms as early warning tools after exposure to different environmental conditions. In addition, biochemical biomarkers can help to understand stressors mode of action. The aim of this study is to evaluate the effects of UVB radiation in different biomarkers of the aquatic snail Physa fontinalis. Incident UV-B levels are increasing due to ozone depletion and can penetrate to significant depths in aquatic environments having a major impact on organisms both directly and indirectly, including among other effects DNA damage, mortality, and metamorphosis. 96 hours acute tests were conducted using different shell lengths of the organism to different exposure times of UV-B showing that survival was significantly affected. Biomarkers activity (e.g. AChE and GST) was determined and correlated with the observed mortality.

This study shows the importance of including UV-B exposure and the inherent effects in environ-
mental risk assessment procedures. UV-B induces changes in aquatic organisms as in their role in the environment, and therefore these effects can be transposed to ecosystems, possibly jeopardiz-
ing their services.

TU 391
Physiological measurements in Cerastoderma edule (Bivalvia: Cardiidae) at contaminated sites at the northwest Portuguese coast

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Ria de Aveiro is a highly productive coastal lagoon in Portugal, and it receives a diverse input of contaminants derived from industrial and urban effluents, port and shipyards activities and ag-
riculture runoffs. The purpose of this investigation was to evaluate the physiological parameters, as rates of oxygen consumption and clearance, survival in air exposure and oxygen reserves with carba-zine (CZ) allocation (Gardner) and acute toxicity in Cerastoderma edule. Observations in colon-
izations along Ria de Aveiro. Animals (20-30 mm) were collected in July-10 under the low tide and acclimated at laboratory in artificial seawater, one hour before the assays. Oxygen consumption was determined by simple static respirometry, using cockles (n=10) held for one hour in static, gastight syringes filled with artificial seawater and one animal per syringe. To measure clearance rate cockles were individually placed in 200 mL chambers (n=1 per station) filled with Neutral Red solution (1 5 mg·L-1) prepared in seawater. This method was based on the rate of absorption of Neutral Red by cockles, and the dye was added at 15µmol·L-1 intervals for 45 minutes at 590nm. To analyze the capacity of air survival, animals (n=21 in triplicate) were kept in 1L glass jar at 20°C and 100% humidity during eight days. Deaths by means of extended shell gaping were recorded every day. Finally, the CEA in C. edule tissue (n=10) was measured based on the energy reserves and the energy consumed during the assay. The results of this study intended highlight the importance of physiological parameters analyzes as good indicator of animal fitness and its evaluation could be used as biomarker.

TU 392
Effects of copper on the life cycle traits of Physa fontinalis

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Copper is an essential metal for many aquatic organisms but like other metallic elements can cause toxicity when in excess. Copper can enter into the aquatic system through industrial effluents, agriculture runoffs and domestic wastewaters. This study aimed to assess the survival, egg hatch-
ing, growth and reproduction of the freshwater pulmonate snail Physa fontinalis after exposure to copper sulfate in laboratory conditions. A 96h survival test using adult and juvenile snails showed that different shell lengths showed increasing toxicity as the shell length decreases. Significantly low copper values (~1µg/L) appear to adversely affect the hatching and survival of egg masses as well as egg production and growth. Therefore, the aquatic snail suggesting that P. fontinalis is more sensitive compared to other aquatic snails (e.g. Lymnaea lutheola L, 96h EC50 ~ 25µg/L) or even other aquatic organisms usually used as model organisms in ecotoxicological approaches.

WE 002
Do oil droplets matter? Oil spill effects on North East Arctic cod larvae

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Oil exploration and production in the Arctic moves northwards towards spawning and nursery areas of fish species that sustain some of the world’s largest fisheries. Models are therefore needed that can simulate the effects of oil spills on early life stages of fish. In this study, we cali-
brated a newly developed individual based model (IBM) to experimental data to infer effects of the water soluble fraction (wsof) and of an oil dispersion (wsof and droplets) on two key endpoints of North East Arctic cod (Gadus morhua) larvae: feeding rate and survival probability. The model was calibrated on data from two experiments that had identical chemical composition and concentration of the wsof (2PAH = 0.03 to 30 µg L-1) and only differed in the presence/absence of droplets. Both exposure regimens (dissolved and dispersed) included the same oil concentrations (control: 0.4-1µg/L) and survival probability (control: 0.96). Decreases occurred in a concentration-dependent fashion and did not significantly differ between exposure types, with EC50s of 2 (feeding) and 7 (µg/L) EPA (survival probability). Additionally, the fit of the IBM model to growth and survival data was not significantly different between the two exposure types. Our results thus indicate that oil droplets did not significantly contribute to oil toxicity towards ingestion and survival of cod larvae. More complex models that consider oil droplet toxicity in addition to the toxicity of the wsof are therefore concluded not to be more accurate than simpler models that neglect oil droplet toxicity.

WE 003
Do dispersants make spilled oil more toxic to fish? A field study

PV Hodson
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The recent Deepwater Horizon disaster was the world’s largest unintentional oil spill. It was un-
precedented in its duration, volume spilled, and the technology applied for control and clean-up. Among these unique features was the continuous and wide-spread application of oil dispersant, at the surface and at the discharge, 1500 m deep, generating public concern about dispersant toxic-
ity and the effects of dispersant on oil toxicity. Recent USEPA reports claim little difference in acute toxicity to marine fish and invertebrate species among commonly available dispersants and between dispersed and non-dispersed Louisiana Sweet Crude. The EPA reports were technically correct: the toxicity of waterborne hydrocarbons does not vary with chemical dispersion. How-
ever, the agency did not tell the entire story, omitting any consideration of loading or pollutants using the marine medaka (Oryzias javanicus) microarray and to develop as biomarkers for the detection of environmental pollution like oil spills. Also, we investigated the effects of organic pollutant on transcriptional changes after fishes were exposed to biphenyl, A, polychlorinated biphenyls, aromatase as well as WAFs (water accommodated fractions) from crude oil at Sinduri, one of heavily oiled sites. One and half year after the spill, DNA damage decreased at most sites analyzed with mean tail moment of 1.58. From this decreased DNA damage, this study was supposed to be very quickly recovered from oil spill just within one and half year. The samples showed a significant (p<0.001) correlation between concentrations of polycyclic aromatic hydrocarbons (PAH) and DNA strand breakage in the blood cell during both spatial and temporal sampling periods. Therefore, the comet assay could be a successful tool in assessing genotoxicity of PAHs in marine sediment affected by oil spill.

**ECO 3 - Biodegradation and bioremediation of organic pollutants**

**WE 010**

Enhanced biodegradation screening tests: Degradation potential natural environmental media

G Pope1, D Sordini2, S Sordini2, G Andreotti1, E Delprato2, S Sandri2, S Bonfiglio1, S Dallavalle1

**WE 007**

Assessment of residual concentrations derived from a blow out of a crude oil well in Italy: a tool to achieve the complete release of the impacted areas after years of bioremediation activities

S Cereccia1, A Battaglia1, A Cecchin3, S Sandri2, D Sordini2

**WE 006**

Soil and groundwater contamination assessment and analysis to identify the responsibility of a chemical company in an environmental disaster

S Finnegan, D Sanders, RA van Egmond, O Price

**WE 008**

Environmental factors affecting the toxicity of dispersed oil for herring embryos (Clupea sp.)

M Johnson1, SC Courtenay1, M Boudreau2, K Lee3, PV Hodson4

**WE 009**

Biodegradation and bioremediation of organic pollutants

G Perin1, F Iadarola2, A Cecchin3, S Lombardo3, M Maniero3, A Giacometti4

**WE 005**

Temporal and geographical trend in the genotoxic effect of the extracts of accidentally oil-spilled marine sediments on the blood cells of striped beakfish (Oplegnathus fasciatus)

H Lee1, W Yang1, GB Kim1, J Lee1, U Yim1, WJ Shim3

**WE 004**

Marine environmental impact of oil spill on vertebrate gene expression changes in marine medaka, Oryzias javanicus

K Wong1, S Yun2

**WE 011**

Investigation of the role of adaptation in the biodegradation of chemicals in the impact zone of an untreated discharge using OECD 314E

C Finnego, D Sanders, RA van Egmond, O Price

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Toward the end of the 20th century, part of the developing regions, untreated wastewater is routinely emitted directly into surface water bodies. This scenario is typically associated with high levels of suspended solids, biochemical oxygen demand (BOD), nitrates and unionised ammonia in untreated waters, resulting in significant ecological impairment. The receiving water will treat the untreated discharge through a mixture of physical, chemical, and most importantly biological "self-purification" processes. This scenario presents a number of difficulties for conventional risk assessments for "down-the-drain" chemicals. Most fundamentally, in the absence of removal by secondary sewage treatment, the predicted environmental concentrations (PEC) will often exceed the predicted no-effect concentration (PNEC). However, since the ecosystem in the receiving environment will already be significantly impacted by other constituents present in raw wastewater, an assessment of the biodegradation during "self-purification" is required. A guideline now exists for simulating this scenario in a laboratory, OECD 314E ("Biodegradation in an untreated - surface water mixing zone.") The guideline has been developed to determine the final extent and rates (primary and ultimate) of a chemical upon its release in an untreated...
discharge scenarios. It also allows a comparison of the relative rate of removal of the test chemical in relation to the key water quality parameters which can be used to define the impacted zone in the receiving water. These guidelines are relevantly new (2008) and little data have been published on the fate of chemicals in studies of this nature.

This guideline was used to investigate the fate of 14C radio-labelled test chemicals incurred with 
particulate organic carbon (POC) and 
(ready and enhanced) 
G. Ciolino, A. Louroverse, R. Geerse 
Akzo Nobel, ARNHEM, 
Netherlands 
Tetracanes with varying degree of chlorination have been synthesized to assess their persistence. 
Tetracanes with 41.3, 45.5 chlorine reached >60% biodegradation at day 28 in Closed Bottle tests. The tetracanes with a higher degree of chlorination are not readily biodegradable. In the prolonged Closed Bottle tests biodegradation percentages of chlorinated tetracanes were of 60-70% at day 56 (chlorinated tetracane (50.0%)) or close to 60% (chlorinated tetracane (55.0%)). The chlorinated tetracane (60.2%) reached a biodegradation percentage of 40% at 
84. Chlorinated tetracane (41.3, 45.5 and 50.0%) should therefore not be considered as persistent. The biodegradability of chlorinated tetracanes is retarded by increasing degree of chlorination resulting in partial degradation of tetracanes with higher degrees of chlorination.

WE 014 Degradation of the artificial sweeteners acesulfame, cyclamate, saccharin, and sucralose in soils 
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I Buerge, M Keller, M. Keller, M. Müller, T. Poiger 
Schweizerische Akademie der Wissenschaften, WE 014 
Zurich, Switzerland 
Artificial sweeteners are consumed in substantial quantities as sugar substitutes and were previously shown to be ubiquitously present in the aquatic environment. Sweeteners may also end up in soils through various pathways. Wastewater-polluted surface water may be used for irrigation of agricultural fields. In certain countries, digested sewage sludge is applied as fertilizer in agriculture. Furthermore, untreated wastewater may seep into subsols through leaky sewers. The 
Artificial sweetener saccharin is also registered as additive in piglet feed and the compound may get into agricultural soils via application of manure. Finally, saccharin is a major soil metabolite of certain sulfonylurea herbicides. BT, as a high production

WE 015 Bacterial degradation of 1H-benzotriazole 
I. Moriyasu, V. Hesse, D. Hildebrand, H. Hafidh 
Universität of Tübingen, TUHEIBINGEN, Germany 
The complexing agent 1H-benzotriazole (BT) is a widely-used corrosion inhibitor in cooling and heating fluids, dishwashing detergents, and aircraft de-icing fluids. BT, as a high production

WE 016 The isolation and characterisation of bacteria capable of degrading the strepholobin fungicide, azosporin 
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1University of Warwick, WARWICK, United Kingdom 
Department of Environmental Science, Lancaster University, LANCaster, United Kingdom 
Azosporin [an endo-1,10-phenanthroline (1-methyl-phenathroline)]-3-methylene-
rylate was the first of the strepholobin group of fungicides to be released in 1996. It has a broad spectrum of activity and has been approved for use in over 80 different crop types, which equates to more than 400 crop diseases in total. A number of degradative mechanisms is considered to be due to microbial action, beginning with the demethylation of one of the side chains to produce the metabolite, azosporin acid. However, the extent to which azosporin is completely mineralised to carbon dioxide (CO2) and the identities of organisms that are potentially involved with the degradation process remain unknown.

In this study azosporin-degrading cultures were produced from a sandy loam soil from the UK by a sequential enrichment series. Comparisons were made between the degradative capabilities of soils that had had no previous exposure to azosporin and soil that had been exposed to a 25mg/kg dose of the compound 4 months prior to the start of the study.

Bacteria were isolated and tested for their degradative capabilities. The 16S RNA from isolates that degraded azosporin to a high level were sequenced. Sequencing identified them as Cu-
previdens, Basilius and Rhodanobacter sp. Characterisation assays showed that solid growth media type had no significant impact on azosporin degradation. Both of the degrading organisms required an additional nitrogen source to be present for degradation to occur. The presence of an alternative carbon source reduced azosporin degradation by approximately 40%.

WE 017 1H-benzotriazole (BT) as a high production

WE 018 Quantification of Alkane monooxygenase genes to monitor the biodegradation process in environmental field 
F. Nardin, A. Burchardi, F. Tonnani 
EurI, Institute for Environment and Sustainability, ISPRA, Italy 
Prediction of pollutant biodegradation is essential for the correct management of the process. The main goal is to find suitable methods to monitor bioremediation strategies, within the large combination of important enzymes involved in alkane degradation which catalyse the initial oxidation of Alk genes with high sequence diversity are known. We developed a molecular method based on TaqMan quantitative Real Time PCR (qRT-PCR) to quantify Alk genes of bacterial strains present in the Huracany area. We analyzed 12 soil samples at different depths (5 from a clean area, 4 from a low contamination from a medium and 3 from a high contamination area) and 4 groundwater samples from clean, low, medium and high contamination areas. Alk genes quantification is expressed related to microbial biomass levels in each sample and an increase of gene copy number is clearly detectable in some samples. This molecular method is very accurate and fast and allows identification of the presence of microorganisms responsible for alkane degradation in environmental samples e.g. groundwater and soil, contaminated by hydrocarbons. Our molecular approach can be used to assess the progress of bioremediation in a contaminated site.

References: 
1. http://www.unil.ch/bacuin 

WE 019 Microbial ecology approach for evaluating the effects of contaminants on soil and water ecosystems 
P. Freddo, A. Barra Caraccio 
Water Institute Research, National Research Council, MONTARONTONTO (ROME), Italy 
Traditional parameters used for the Environmental Risk Assessment (ERA) of environmental contaminants are principally chemodynamic and physico-chemical properties. Furthermore, ecotoxicological effects on organisms in bioremediation strategies, first of basic importance in order to evaluate the impact of an environmental stressor. Complex microbial communities may serve as ideal and ecologically relevant toxicity indicators. A number of microbiologically driven processes has been proposed to evaluate the effects of xenobiotics on ecosystems. Proteins, genes, metabolites, or lipids that, when expressed, present a precise and allows identification of the presence of microorganisms responsible for alkane degradation in environmental samples. The number of techniques to study microbial communities has increased exponentially over the last 20 years and the advent of culture-independent methods, such as molecular biological techniques, has changed the view of microbial diversity. Among these techniques epifluorescence microscopy ones, such as direct count of bacterial abundance (DAPI count), vitality (Live/Dead
cell viability assay), and Fluorescence In Situ Hybridization (FISH) have been showing effective tools for studying specific microbial populations in soil and water ecosystems. We show how all the applications of these techniques to contaminated soil and water ecosystems allow to highlight the presence of particular bacterial groups involved in chemical degradation.

**WE 020**

Root exudates from sunflower as a powerful chemocorant for pollutant-degrading bacte-
ria and its effect in bacterial dispersal

C. Inzereta Sanchez, J. Sanchez Quimiones, M. Cantos, J.J Ortega Calvo

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Bacterial movement through saturated porous media may be restricted by several factors, including increased path lengths (fortuitously), bacterial adhesion to surfaces, and geometrical restrictions due to pores of small diameter and dead ends. We propose bacterial chemotaxis as a mechanism that could enhance bacterial transport through saturated porous media. Chemotactic bacteria can therefore constitute a useful vector for relevant catalytic activities and/or nutrients in bioremediation projects.

We studied the chemotactic response of *Pseudomonas putida* G7 towards root exudates of Helian-
thus annuus and investigated root systems (organic acids + amino acids) by capillary assay. In well-controlled colon systems, we studied the effect of these compounds on bacterial transport in porous media. Our data shows that Helianthus annuus exudates are a powerful chemocorant for *Pseudomonas putida* G7 and it could be used in bioremediation, improving bacterial dispersal.

**WE 021**

Chemocorients change the swimming pattern of chemotactic bacteria and its transport in porous media

C. Inzereta Sanchez, J.J Ortega Calvo

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Bacterial chemocorants (monounsaturated fatty acids and p-cymene in 1:1:1 ratio) were used to alter swimming activity of *Pseudomonas putida* G7 by several compounds by capillary assay and its motility behavior by computer-assisted motion analysis. We also assessed the influence of these chemocorants on bacterial strain deposition in soil. When bacteria detected a positive chemocorant, changes of direction were less frequent and smooth movement increased. The bacterial deposition on the surface sand was reduced with increasing bacterial transport through sand. In contrast, when bacteria detected a negative chemocorant, the changes of direction were much more frequent and abrupt. This also had a direct effect in bacterial transport, promoting collision efficiency and bacterial deposition.

Positive or negative chemocorants may modulate bacterial transport in terms of pollution to be treated. For localized and surface contamination in soils and aquifers, negative chemocorants would help to confine chemotactic bacteria in the contaminated site. In contrast, treatment of more dispersed areas of contamination and at a certain depth can be benefited with the use of positive chemocorants that increase the transport of chemotactic strains.

**WE 022**

Influence of rhizosphere and root tissues on mineralisation of 14C-hydrocarbons in a pris-
tine pasture soil

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Many plant species enhance the biodegradation of petroleum hydrocarbons, but the specific mechanisms by which this occurs are not clearly understood. Rhizospheres and crushed root tissues from 4 plants were screened in soil spiked with 12C-14C-hydrocarbons (phenanthrene, naphthalene, 1-hexadecene or octacosane) dissolved in toluene to achieve a concentration of 10 mg kg^-1 and activity of approximately 83.3 Bq g^-1, respectively. Among the plants tested includes Reed Canary Grass (*Phalaris arundinacea*), Channel Grass (*Vallisneria spiralis*), Black Raspberry (*Rubus occidentalis*) and Goat Willow (*Salix caprea*). The effects of rhizosphere and root tis-

sues addition on the mineralisation of 14C-hydrocarbons in the rhizosphere of 4 plant species were measured 88 days after the initiation of the experiment. The results showed that interaction between plant species and mineralisation of hydrocarbons vary in different ways, depending on the plant species and the hydrocarbon used.
centrations between predictions and observations were almost less than one order of magnitude (16 sets / 18 sets). Peak day differences between predictions and observations were almost less than two weeks (16 sets / 18 sets).

WE 034 Realization of common approaches for normalization of degradation rates - How to derive soil moisture?
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Chenoweth University of Bonn, Kiel, KIEL, Germany

Degradation rates of plant protection products derived from field degradation studies have to be normalised to reference soil moisture and temperature (cf. 20, 20°C) in order to make half lifes comparable. These half lives can then be used for environmental fate modelling as recommended by the FOCUS work group on degradation kinetics (2006) or the EFSA panel (2010). Soil moisture and temperature are usually not (or only occasionally) measured in field degradation studies. Thus, they have to be calculated by hydraulic models like PEARL using the pedo-transfer function of van Genuchten-Mualem. In this project we compared different approaches (Rosetta, Hypot, PEARL) with measured data (PET best fitted-up-down data) for the estimation of the soil hydraulic parameters needed for the van Genuchten-Mualem equation, and we compared the calculated soil parameters with measured values. Based on the different approaches we calculated the soil moisture and temperature for all FOCUS scenarios in PEARL 3.3.5 and derived action concentrations in order to normalise the environmental risk. The results show that the estimated soil hydraulic parameters vary strongly and consequently lead to significantly different correction factors for the soil moisture normalisation, resulting in different normalised half-lives. The comparison between observed and simulated soil moisture showed partly huge differences and implausible results for simple approaches (e.g. Rosetta texture for soil type sand), but it could also be shown that parameters derived from measured water retention curves gave not the best fit to measured soil moisture. Thus, the most realistic way for normalisation is to measure the soil moisture on a daily basis during the field experiments. Since such measurements are quite cost and time intensive, a convenient method for a realistic estimation of soil moisture is inverse modelling, e.g. with the software PEST, based on gravimetric water contents available from the residues analysis.

WE 035 Development of a GIS integrated dynamic surface water model to predict environmental concentrations of pesticides in an alpine stream located in Northern Italy
S Reichenberger, IG Dubus, M Lambeau, S Tellier, R Talva, Bayer CropScience AG, MONHEIM, Germany

The FOOTWAYS Pro online risk assessment platform: first real-world application in a French basin
Dr. R. KNOEL Consulting GmbH, MANNHEIM, Germany

Realistic degradation (half life DT50) and sorption (Freundlich coefficient Kd) parameters of plant protection products may be derived from field experiments using inverse methods. For such evaluations soil and water data are a necessary input. Ideally, measured data (rainfall, temperature, humidity)[DOTS] are measured directly on the experimental site. However, often only data are available from weather stations some distance away (often about 10-15 km). In this study the potential error in DT50 and Kd is investigated due to the use of off-site rainfall data. Two different exposure scenarios were investigated: (a) cumulative rainfall is identical at the on- and off-site stations and (b) cumulative rainfall is identical, but the daily rainfall varies significantly. Error type (a) is addressed by increasing/decreasing daily rainfall systematically up to ± 20%. This represents the expected maximum difference in cumulative rainfall over a distance of about 15 km. Error type (b) is addressed by creating artificial rainfall sets with identical statistical properties (e.g. wet/dry cycles, monthly rainfall distribution) as the on-site rainfall, but with very different daily rainfalls.

Changing the cumulative rainfall has only small influence on the water content of the soil (relative change < 5%). Larger changes were observed in the pressure head (>10%) and the cumulative percolation. From those hydraulic variables DT50 is essentially driven by soil water content. This explanation fits the observed effect of the DT50.

On the other hand Kd is expected to be more sensitive because the time to reach a certain soil depth is approximately proportional to the quotient of retardation and water flow. Thus, an increase in water flow, i.e. rainfall, can be compensated by an increase in retardation, i.e. Kd, and vice versa. Differences in rainfall have only small influence on both parameters as long as the cumulative rainfall is identical. Only differences in the cumulative rainfall lead to evident changes of Kd.

It is concluded that the use of weather data from off-site stations is acceptable as long as differences in runoff and rainfall are relatively small. This applies for weather stations some distance away but located within the same geographical region. Substantial differences in daily rainfall (as can occur even within small distances) had only minor influence on the soil moisture parameters obtained.

WE 033 The FOOTWAYS Pro online risk assessment platform: first real-world application in a French basin
K Härschberger, JG Dubois, M Lambeau, S Tellier, R Talva
FOOTWAYS S.A.S., ORLEANS CEDEX 2, France

FOOTWAYS Pro is an online platform for pesticide exposure and risk assessment connecting a web based high in the web computing cluster fully dedicated to pesticide fate modelling with MACRO and PRZM. The FOOTWAYS Pro approach builds partly on the FOOTPRINT methodology, but alleviates the existing limitations of the FOOTPRINT tools with respect to regulatory applications. In FOOTWAYS Pro, MACRO and PRZM results are newly and specifically generated using a new model framework ("modelling on demand"). This leads to a much larger flexibility in model input and parameterisation compared to the pre-modelling approach in FOOTPRINT.

A FOOTWAYS Pro assessment consists of three major steps: 1. Assessment setup by the user through the web interface, 2. Calculation of exposure and risk assessment on the cluster, 3. Visualization of outputs on the web portal (maps, CDFs, descriptive statistics and single time series of the different output variables, and the newly developed water quality management indicator PITSIA). A first real-world application of FOOTWAYS Pro has been implemented for an 800 km² basin, an area under intensive agricultural use which is also a major drinking water source. Local input data (1: 250000 map, crop statistics at municipality level, local weather time series) were used to set up the agro-environmental scenarios for the study area. On the web input interface, the user can choose between a number of local cropping practices with different levels of plant protection intensity and different combinations of applied products. It is also possible to specify new pesticide application programmes with a new combination of existing products. With the results provided on the web output interface, the user can compare the environmental performance of the various programmes for the different crops, i) compare the effects on pesticide pollution to the ground and surface water due to crop protection measures between crops, ii) identify the problematic areas and iv) explore the effect of mitigation measures. The study has a pilot character for the implementation of the Sustainable Use Directive and the national ECOHYTO 2018 action plan in France.

WE 032 Influence of climate data on estimated substance parameters of field accumulation studies
GM Kuek1, K Hammes2

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2Realistic degradation (half life DT50) and sorption (Freundlich coefficient Kd) parameters of plant protection products may be derived from field experiments using inverse methods. For such evaluations soil and water data are a necessary input. Ideally, measured data (rainfall, temperature, humidity)[DOTS] are measured directly on the experimental site. However, often only data are available from weather stations some distance away (often about 10-15 km). In this study the potential error in DT50 and Kd is investigated due to the use of off-site rainfall data. Two different exposure scenarios were investigated: (a) cumulative rainfall is identical at the on- and off-site stations and (b) cumulative rainfall is identical, but the daily rainfall varies significantly. Error type (a) is addressed by increasing/decreasing daily rainfall systematically up to ± 20%. This represents the expected maximum difference in cumulative rainfall over a distance of about 15 km. Error type (b) is addressed by creating artificial rainfall sets with identical statistical properties (e.g. wet/dry cycles, monthly rainfall distribution) as the on-site rainfall, but with very different daily rainfalls.

Changing the cumulative rainfall has only small influence on the water content of the soil (relative change < 5%). Larger changes were observed in the pressure head (>10%) and the cumulative percolation. From those hydraulic variables DT50 is essentially driven by soil water content. This explanation fits the observed effect of the DT50.

On the other hand Kd is expected to be more sensitive because the time to reach a certain soil depth is approximately proportional to the quotient of retardation and water flow. Thus, an increase in water flow, i.e. rainfall, can be compensated by an increase in retardation, i.e. Kd, and vice versa. Differences in rainfall have only small influence on both parameters as long as the cumulative rainfall is identical. Only differences in the cumulative rainfall lead to evident changes of Kd.

It is concluded that the use of weather data from off-site stations is acceptable as long as differences in runoff and rainfall are relatively small. This applies for weather stations some distance away but located within the same geographical region. Substantial differences in daily rainfall (as can occur even within small distances) had only minor influence on the soil moisture parameters obtained.
Recommendations for simulation calculations with FOCUS PELMO to predict environ-
mental concentrations of plant protection products and their metabolites in groundwater
(PeCgw) in Germany

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In the poster we present the concept and first results of a multiple-tiered study carried out in
two catchments in Luxembourg. In this study we use an integrated watershed model to identify
sites in the river course which are likely to have high risks of pesticide exposure according to the regional
environmental performance criteria. Identified sites are then monitored with a passive sampler device
in the coming year in order to test the model results. If the results of the passive sampling
campaign agree with the modeling, the model outputs are further linked to an ecotoxicological
model in order to evaluate the effects of pesticide exposure on the river biology.

For the watershed model we selected the widely known SWAT model which has also been
applied in several pesticide fate simulation studies before. The model will be applied to the Wark
and to the Mamer catchments. Both watersheds have an area of around 85km2 and a comparable
fraction of arable land on the watershed area with 19% and 21% respectively. According to the offi-
cial statistics of agricultural data, mainly wheat, barley, potato and potato are the main cultivated crops in the two watersheds. Both watersheds exhibit different geologic and hydrogeologic settings. In the Wark catchment soils are mainly underlain by impermeable bedrock material, whereas in the latter subsurface flow and a quick response to
rain storms are expected. The Mamer catchment shows more heterogeneous conditions with soils
underlain by permeable sandstone in the north and the centre of the catchment and soils under-
lain by impermeable marls in the south. Here the catchment discharge could be characterized by
a mixture of groundwater contribution and lateral subsurface flow which is offset on the different hydro-
ologic conditions we expect also differences in the dynamics of pesticide exposure in both rivers.

Recommendations for simulation calculations with FOCUS PELMO to predict environ-
mental concentrations of plant protection products and their metabolites in groundwater
(PeCgw) in Germany

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1Federal Environment Agency, DESAU-ROSSLAU, Germany
2BASF, LIMBURGERHOE, Germany
3Syngenta, MAINTAL, Germany
4Bayer CropScience, ESCHER-SUR-ALZETTE, Luxembourg

In the poster we present the concept and first results of a multiple-tiered study carried out in
two catchments in Luxembourg. In this study we use an integrated watershed model to identify
sites in the river course which are likely to have high risks of pesticide exposure according to the regional
environmental performance criteria. Identified sites are then monitored with a passive sampler device
in the coming year in order to test the model results. If the results of the passive sampling
campaign agree with the modeling, the model outputs are further linked to an ecotoxicological
model in order to evaluate the effects of pesticide exposure on the river biology.

For the watershed model we selected the widely known SWAT model which has also been
applied in several pesticide fate simulation studies before. The model will be applied to the Wark
and to the Mamer catchments. Both watersheds have an area of around 85km2 and a comparable
fraction of arable land on the watershed area with 19% and 21% respectively. According to the offi-
cial statistics of agricultural data, mainly wheat, barley, potato and potato are the main cultivated crops in the two watersheds. Both watersheds exhibit different geologic and hydrogeologic settings. In the Wark catchment soils are mainly underlain by impermeable bedrock material, whereas in the latter subsurface flow and a quick response to
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underlain by permeable sandstone in the north and the centre of the catchment and soils under-
lain by impermeable marls in the south. Here the catchment discharge could be characterized by
a mixture of groundwater contribution and lateral subsurface flow which is offset on the different hydro-
ologic conditions we expect also differences in the dynamics of pesticide exposure in both rivers.
depends on the parameterisation of the scenarios. It can be concluded that dynamic modelling 
scenarios has been carried out. Several parameters have been evaluated; among them user friendly, 
spatial differentiation in the life cycle impact assessment of toxic chemicals should be considered 
relevant, especially in the interest of practitioners.

WE 045 EUSES, ECETOC/TRA, IUCLID-CHESAR, EASyIra: which regulatory environmental 
risk assessment tool to use? CF Peruzzini, LD Steiner, EG Saefter 
Institute for Environment, GENEVA, Switzerland 
In June 2007, the new European regulation REACH entered into force. One of its aims is to improve 
the protection of human health and the environment from possible effect of chemical 
compounds. In order to achieve this goal, the so called risk assessment has to be performed for each substance. In general, RA is based on the knowledge of the chemical hazard, i.e. the intrinsic 
properties of a chemical, and the so called exposure which depends on many parameters such as 
the amount used, the type of process, the percentage release. Briefly, once the amount of exposure 
and the hazard are known, their ratio constitutes the risk assessment: if the exposure is higher 
than the hazard there is a risk and further investigation are necessary. Although the main principles of RA are easily understandable, there are a great number of param- 
eters and scenarios to consider to obtain the risk assessment. For this reason, over the last years, 
commercial and homemade software appeared to perform the risk assessment. Among them, which 
the best software? Does it exist an ideal software? Thus increasing the weight of the "personal preference" factor in the final choice of the ERA tool.

WE 046 BETR Global - a geographically-explicit global multimedia contaminant fate model 
M Macedon1*, H von Waldow1, P Tay1, JM Armitage2, H Wörnschimmel2, W Riley4, TE Mckone4, 
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[VA], Italy 
2University of Massachusetts, AMHERST, Massachusetts, USA 
3Ecohidraulica SL, Calle Rodriguez San Pedro 13, Madrid, Spain 
4University of Toowoomba, Queensland, Australia 
The work gives an updated overview of the structure, functions and algorithms used in develop-
ing level assessment, at continental scale, of risks to human health and ecosystems, evaluation of 
effects of environmental pollution on human health and ecosystems, and the sustainable manage-
ment of Europe. The work describes a spatially explicit fate and exposure model with global coverage for Mul-
ternational scale. The algorithms are implemented as an extension for ESI ArcGIS 9.3. The tool is called MAPPE after Multimedia Assessment of Pollutant Pathways in Environment of 
Europe. The purpose of the model is to provide a user-friendly way to convey the wealth of geographical 
data available to model the fluxes and concentrations of pollutants emitted by industrial activities and 
other point emissions, or chemicals widespread use within households, urban environments or 
agriculture. The intended applications include organic contaminants such as pesticides, phar-
aceuticals, VOCs, and other industrial POPs. The maps of chemical concentrations and fluxes produced by the model can be used for screening level assessment, at continental scale, of risks to human health and ecosystems, evaluation of 
pollutant transport in the environment, or as a complement to more developed, site specific assessment procedures, and to generic tools such as EUSES, aimed at non-spatial risk assessment in contexts such as the management of priority substances concern for soil, water and air, the control of 
effects of environmental pollution on human health and ecosystems, and the sustainable manage-
ment of Europe. The original version of MAPPE has been used in several case studies - e.g. for PCBs, dioxins, gamma-HCH, while model variants served in investigations of Pyrethroid pesticides, PFOS/PFOA or common surface water contaminants including pharmaceuticals and personal care products.

WE 047 A dynamic vegetation model: development and integration with an existing dynamic air/ 
soil model E Trettia1, M M Morelli1, BEL Cerabolini1, A Di Guardo1 
1University of Insubria, COMO, Italy 
2University of Insubria, VARESE, Italy 
Plant biomass has been shown to exert a decisive influence on the fate of chemicals in the air/soil 
system. Measuring and clearing data on the number of species have been experimentally determined in the past decade as well as the role of forest canopies, capable of filtering air and transfer chemicals from air to the litter/soil environment. Recently, plant/air partition coefficients for several spe-
cies have been determined in the parameterisation of the emission for some pollutants, the timing were measured for a number of forest types. Additionally, a multimedia fate model (AirFug) which incorporates a rather dynamic air system was developed and showed that air concentrations could considerably change during a short time. AirFug allows to predict concentra-
tions in soil and in two air model compartments, which change in height and volume according to the variation of mixing height, predicted based on meteorological observations. Such dynamic atmos-
pheric compartment is capable to show rapid air concentration changes. To evaluate the influ-
ence of such rapid changes on vegetation behaviour, a dynamic bioaccumulation model of organic contaminants in vegetation is developed and tested on the canopy level of an Norway spruce forest from air. In this model, formulated in terms of fugacity, the vegetation compartment is composed by a multi-specific forest canopy. The bioaccumulation equations employed to simulate uptake by leaves calculate the plant/air partition coefficient (Kpu) using Kos (soil/air partition coefficient 
fraction) and a time forest canopy with different species such as a specific leaf area (SLA) and leaf area index (LAI), which vary with time, environmental and ecological conditions. This vegetation biomass model was finally integrated with AirFug to predict the effect of plants in regulating the fate of organic contaminants in a system where a double-layered air compartment interacts dynamically with soil. This approach is novel of its kind. Simulations show that biomass transport of Semi-Terrestrial Organic Compounds (SVOCs) in order to evaluate the role of air concentration variations and soil degassing in influencing the change of biomass concentrations with time.

WE 048 Aquatic exposure models - Where do we stand in Switzerland? P Aldrich, T Poiger, O Daniel 
Research Station Agroscope Changins-Wädenswil ACW, WÄDENSWIL, Switzerland 
For the aquatic risk assessment in the context of pesticides registration, concentrations in surface 
waters are predicted using deterministic models. The idea is that a realistic worst-case exposure of aquatic organisms is calculated in order to assess a generalized risk and to formulate risk mitigation 
strategies for the whole group of organisms. In this poster we challenge such calculations by investigating the variability of the factors affect-
ing runoff and drainage. The loading of pesticides to surface waters via run-off and drainage 
depends on numerous factors, such as the application rate, crop interception, dilution in soil, 
terminating in rain events, distance to the water body, size of the water body and dilution due to rain 
water and flow velocity. Some of these factors vary with local conditions, such as intensity and 
frequency of rain events, topography, application technology and the size of the water body, but 
are treated as constants in the model calculations.

Carbon is a country with farmland and climatic and topographic conditions. Therefore, a 
generalization of these diverse regions to a single scenario leads by default to over- or underes-
timation of the concentration in surface waters and potentially to inadequate risk mitigation 
measures. We show the range of some parameters and its effect on the predicted concentration in 
order to verify the assumption that the model leads to the calculation of a worst-case exposure.

WE 049 A model to predict the fate of chemicals in the soil/air/water system: development and 
evaluation of the effectiveness of in-situ treatment after a diesel spill M Macedon1, D Girardelle2, T Fareschini2, A Fransetti2, C Magro2, G Porto2, A Biasiolo2, A di 
in the WFD context, as they allow to check compliance of the PPs' river 
concentration with both types of environmental quality standards (the maximum allowable 
MAC-EEQs and the annual average value AA-EEQs). Furthermore, these models can be used to 
assess the impact of different emission reduction strategies on the water quality status. Testing 
different measures and their actual implementation in real life can help to make better choices 
in terms of resources, and as such costs can be saved.

WE 043 Multimedia assessment of pollutant pathways in the environment - European scale screening 
model [MAPPE - Europe] DT Maritoni1, A Pizziotto1, P Vizinai2, G Zulian1, G Bidiglo1 
1Institute for Environment and Sustainability, Joint Research Centre, European Co, ISPRA 
[VA], Italy 
The work gives an overview of the structure, functions and algorithms used in develop-
ment of the MAPPE model and its application to air/soil and water/soil pathway in air for the Euro-
pean continent. The algorithms are implemented as an extension for ESI ArcGIS 9.3. The tool is called MAPPE after Multimedia Assessment of Pollutant Pathways in Environment of 
Europe. The purpose of the model is to provide a user-friendly way to convey the wealth of geographical 
data available to model the fluxes and concentrations of pollutants emitted by industrial activities and 
other point emissions, or chemicals widespread use within households, urban environments or 
agriculture. The intended applications include organic contaminants such as pesticides, phar-
aceuticals, VOCs, and other industrial POPs. The maps of chemical concentrations and fluxes produced by the model can be used for screening level assessment, at continental scale, of risks to human health and ecosystems, evaluation of 
pollutant transport in the environment, or as a complement to more developed, site specific assessment procedures, and to generic tools such as EUSES, aimed at non-spatial risk assessment in contexts such as the management of priority substances concern for soil, water and air, the control of 
effects of environmental pollution on human health and ecosystems, and the sustainable manage-
ment of Europe. The original version of MAPPE has been used in several case studies - e.g. for PCBs, dioxins, gamma-HCH, while model variants served in investigations of Pyrethroid pesticides, PFOS/PFOA or common surface water contaminants including pharmaceuticals and personal care products.

WE 042 The concept of RA is easily understandable, there are a great number of param-
eters and scenarios to consider to obtain the risk assessment. For this reason, over the last years, 
commercial and homemade software appeared to perform the risk assessment. Among them, which 
the best software? Does it exist an ideal software? Thus increasing the weight of the "personal preference" factor in the final choice of the ERA tool.

WE 041 A dynamic vegetation model: development and integration with an existing dynamic air/ 
soil model E Trettia1, M Morelli1, BEL Cerabolini1, A Di Guardo1 
1University of Insubria, COMO, Italy 
2University of Insubria, VARESE, Italy 
Plant biomass has been shown to exert a decisive influence on the fate of chemicals in the air/soil 
system. Measuring and clearing data on the number of species have been experimentally determined in the past decade as well as the role of forest canopies, capable of filtering air and transfer chemicals from air to the litter/soil environment. Recently, plant/air partition coefficients for several spe-
cies have been determined in the parameterisation of the emission for some pollutants, the timing were measured for a number of forest types. Additionally, a multimedia fate model (AirFug) which incorporates a rather dynamic air system was developed and showed that air concentrations could considerably change during a short time. AirFug allows to predict concentra-
tions in soil and in two air model compartments, which change in height and volume according to the variation of mixing height, predicted based on meteorological observations. Such dynamic atmos-
pheric compartment is capable to show rapid air concentration changes. To evaluate the influ-
ence of such rapid changes on vegetation behaviour, a dynamic bioaccumulation model of organic contaminants in vegetation is developed and tested on the canopy level of an Norway spruce forest from air. In this model, formulated in terms of fugacity, the vegetation compartment is composed by a multi-specific forest canopy. The bioaccumulation equations employed to simulate uptake by leaves calculate the plant/air partition coefficient (Kpu) using Kos (soil/air partition coefficient 
fraction) and a time forest canopy with different species such as a specific leaf area (SLA) and leaf area index (LAI), which vary with time, environmental and ecological conditions. This vegetation biomass model was finally integrated with AirFug to predict the effect of plants in regulating the fate of organic contaminants in a system where a double-layered air compartment interacts dynamically with soil. This approach is novel of its kind. Simulations show that biomass transport of Semi-Terrestrial Organic Compounds (SVOCs) in order to evaluate the role of air concentration variations and soil degassing in influencing the change of biomass concentrations with time.
order to verify the adequacy of the adopted measure. In this context, models could represent a helpful tool in planning and implementing strategies. In order to develop and calibrate an integrated modelling approach capable of quantifying the effectiveness of different remediation technologies, a monitoring campaign was started in a site located in the Mantua Province (Po Valley, Northern Italy), where an accidental diesel spill had occurred. Soil and groundwater samples were collected during three times, in order to assess (1) the rate of and long-term attenuation of organic pollutants from the site, and (2) the effect of the multi-phase extraction (MPE) technology after two additional months. The site was also monitored for a number of parameters, such as groundwater level, dissolved oxygen and temperature. Bench-scale biodegradation experiments in pulsed flow conditions were also carried out to assess the biodegradation of some of the hydrocarbons detected in soil under natural and oxygen-rich conditions. In the present work, a preliminary version of the model, which couples a multimedia fate box model describing the air/soil system (SoilPlus) and a water flow model (MODFLOW-2005) and incorporates equations capable of describing the diesel pure phase movement, is presented. The model can be used to evaluate the fate of single chemicals in soil unsaturated and saturated zones and to predict the enhanced degradation/volatilization consequent to an MPE treatment. Results of the model were evaluated in the context of the risk analysis required by the Italian legislation.

WE 050 Predictive performance of mercury fate model for multimedia environment

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2Biohousing Research Institute, Chonnam National University, GWANGJU, South-Korea

The predictive performance of Mercury Fate Model for Multimedia Environment (MF-MEME) was developed and evaluated for the mercury compounds. The MF-MEME Model is a multi-box dynamic multi-compartmental model to simulate the fate of the mercury compound. The model was developed using kinetic evaluation of pesticide degradation are not easily adaptable for the description of the mercury compounds.

WE 051 Screening and prioritizing organic chemicals based on far-field human exposure assessment

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2University of Oslo, OSLO, Norway
3Stockholms Universitet, STOCKHOLM, Sweden

Global scientists, scientists working in the same fields, seek to identify chemical substances that may pose risks to humans and the environment. Measured chemical property and monitoring data are limited compared to the number of chemicals requiring evaluation making it necessary to develop, evaluate and apply models and Quantitative Structure-Activity Relationships (QSARs) for screening and ranking chemicals. The Risk Assessment, Decontamination And Ranking (RAIDAR) model is an evaluative, regional scale, multimedia mass balance model that combines chemical emissions, fate, and aquatic and terrestrial food bioaccumulation to estimate concentrations in each food chain receptor and humans. This holistic modelling framework is being applied to screen and rank approximately 13,000 chemicals for far-field human exposure using concentrations in an adult human as a comparative endpoint. Guidance for improving mass balance model input requirements to reduce uncertainty in predicted human concentrations was obtained through sensitivity and uncertainty analyses conducted in concert with the initial screening and ranking. The analyses highlighted a need to reduce uncertainty in key parameters, notably chemical emissions estimations and biotransformation half-lives in humans. New methods and models have been developed in an effort to reduce uncertainty in the model input parameters for emissions estimation and degradation half-life. The updated ranking of the 13,000 chemicals is compared with the initial ranking results. Future plans to further reduce uncertainty in the combined mass balance and QSAR screening approach are discussed.

WE 052 Further development of open source routines for fitting kinetic models to chemical degrada data

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One of the cornerstones of environmental fate modelling is the derivation of kinetic rate constants from experimental studies. Two extension packages for kinetic evaluations written in the R programming language have been previously presented. They facilitate the evaluation of experiments from sets of bench and field studies for the parent compound (kinfe) or for parent and metabolites (kinik) with a focus on the evaluation procedures used in the registration of pesticides in the European Union. One feature not present in other kinetic modelling tools is the ready-to-use implementation of the single first-order reversible binding (SFOBB) model for metabolites. This entails the possibility to use formation-decline kinetics for metabolites also in cases where the metabolite decline does not follow single first-order (SFO) kinetics.

Other kinetic models that describe a change in net degradation rate over time that are commonly used in the kinetic evaluation of pesticide degradation are not easily adaptable for the description of metabolite kinetics. The implications of the use of the SFOBB kinetic model for environmental fate modelling of metabolites are discussed.

WE 053 A high-throughput method to screen organic chemicals in commerce for emissions

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3Stockholms Universitet, STOCKHOLM, Sweden

There are thousands of organic chemicals in commerce, yet the environmental fate and effects of most substances remain largely unknown. This is probably among the most well-known clichés within environmental chemistry and toxicology. Accordingly, a hot topic on both the research and regulatory agendas is trying to identify organic chemicals which may represent a hazard to the environment and humans, based on individual attributes such as persistence, bioaccumulation, and long-range transport potential - or combinations thereof. However, only chemicals which combine these health properties with emissions in significant quantities are expected to represent a real risk. Here, we present an attempt to develop a high throughput method to screen chemicals in commerce for emissions, building upon the approaches outlined in the EU TGD. The high throughput Guidance Document. While doing so, efforts were directed towards proving estimates of the uncertainty in the resulting emission scenarios. This is considered vital, not only because important input data are fragmented or inaccessible, but also because screening or categorization methods which solely rely on threshold values are susceptible to generating a significant number of false positive and false negative categorizations. The emission screening tool is being integrated into a large effort to screen for exposure that also seeks to account for the uncertainty in other input parameters. The latter results are, in effect, expected to identify a sub-set of substances for which more accurate emission estimates are needed at consecutive tiers.

WE 054 Climate variability and POPs environmental behaviour: a focus on the organic carbon content in marine systems

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Understanding and predicting the environmental distribution of persistent organic pollutants (POPs) in the environment under different climate scenarios requires that both primary emissions and re-emissions to the atmosphere from reservoirs in the environment are taken into account. Another important factor to be taken into account in studying POPs fate and transport is given by the coupling of air and hydrosystematics, where biologically driven cycles can act to remove POPs from the atmosphere into the deep sea. A level III fugacity model was developed and applied on the Adriatic Sea to study the environment's sensitivity and uncertainty analyses conducted in concert with the initial screening and ranking. This study also evaluated in the context of the risk analysis required by the Italian legislation.

There is indeed an ongoing discussion on the OC trend content under a climate change conditions, in fact biogeochemical models' results do not always agree on the estimation of the OC content under a warming climate. Model comparisons show that the reason for this is mainly due to the nature of observations taken into account by the different biogeochemical studies. Results from the study on the fate and transport of selected PCBs in the Adriatic Sea under a warming climate scenario show that OC content plays an important role in driving chemicals' concentrations in the marine compartment. This is of interest to quantify the trend of OC content under warming climate conditions. Here we want to compare the different results found in literature starting a discussion on OC content trends under climate warming in the marine ecosystems.

WE 055 Long range transport versus source region exposure potential: effect of dynamic climatic scenarios

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Rainfall patterns exert a strong effect on the chemical fate and transport of a large range of water pollutants from river basins, which are rich in rainfall. In source regions prevents long range transport of these chemical species to remote regions, and heavy rainfall in remote regions efficiently deposits them in surface media. However, long range transport is most effective if there are primarily dry conditions in the intermediate regions. When the correct rainfall conditions exist in source, intermediate and remote regions that chemicals we normally expect to be strictly source region problems can be quite effectively transported and deposited in remote regions. An attempt is made to quantify this effect and describe the sensitivity of chemical transport to variable climatic scenarios. A mesoscale scale the interaction of climatic factors such as rainfall and temperature with the seasonal cycling of organic matter leads to peaks and valleys of chemical concentrations in air and other exposure relevant media. Exemplified to a global scale this means that some climatic zones contribute more significantly to long range transport of chemicals during particular seasons but may be more susceptible to local emissions during other seasons. This study shows that PCBs associated with the carbon pool under the two climate scenarios in order to address the role of the marine compartment as a sink for atmospheric pollutants under a warming climate. This model application highlighted a clear need to further improve our understanding of the fate of PCBs related to the organic carbon (OC) content trends in the marine environment.

WE 056 Screening-level exposure scenarios for personal care products in China and India

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...
EC08 - Tracking community consumption of illicit drugs and other substances by measuring human metabolic residues in urban wastewater

WE 061

Selective determination of illicit drugs by mixed-mode solid-phase extraction and quadrupole-time-of-flight liquid chromatography-mass spectrometry

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The determination of the exposure of a population to a chemical by analysis in metabolites in wastewater (wastewater epidemiology) is a relatively new field within environmental chemistry. Fluxuating, trace concentrations of these polar organic compounds in a complex environmental matrix presents a challenge. Positive sampling is a monitoring tool that may overcome these difficulties by offering time integrated sampling over a period of several weeks and also allowing lower detection limits. Challenges in applying these techniques include the lack of both an exposure correction method and an adequate uptake model. The aims of this study was therefore to apply passive sampling devices in situ for narcotics and their metabolites and to furthermore use these methods to estimate community drug use over a period of one year. Polar organic chemical integrative samplers (POCIS) were exposed at the sewage treatment system for western Oslo (Norway) over a 5 week period. Subsequently POCIS were exposed in exactly the same manner at exactly the same place for two week periods over the course of a whole year in order to determine trends in drug usage. Following exposure, POCIS were extracted and analysed for target compounds by LC-MSMS. Most of the target compounds were accumulated in POCIS and showed linear uptake during the exposure period. Sampling rates were in the order of tens to hundreds of mL d⁻¹ allowing detection limits below ng L⁻¹ in most cases. Results from the year long survey are discussed in terms of the challenges faced by implementing these techniques in a quantitative way, i.e. from passive sampling acceptabilities to accurate estimates of drug use per unit population per unit time. Furthermore ongoing work characterising other polar similar compounds such as the tentative identification of controlled steroids in POCIS extracts is briedly presented. Passive sampling techniques may offer significant advantages over traditional grab sampling methods for measuring polar compounds in wastewater. The current sampling device was able to accumulate most of the target compounds, metabolites of commonly used mixed-drugs and also to many other polar compounds. However, more work is required characterising the uptake kinetics of these samples under varying conditions in order that data can be used quantitatively.

WE 062

Monitoring of drugs of abuse in Dutch sewage water by LC-TOFT FT Orbitrap MS

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The presence of drugs of abuse in the water cycle has spurred researchers to monitor their occurrence in wastewater, surface waters and drinking water. Data obtained have been used to calculate environmental loads and removal efficiencies of sewage treatment plants (STPs), and also to estimate consumption and usage trends in the population. The objective in this work is to illustrate the potential of LC coupled to a FT Orbitrap MS for qualitative and quantitative analysis at ng L⁻¹ level and to present, for the first time, results of an extensive monitoring study of 25 drugs of abuse and relevant metabolites in wastewater from the Netherlands. From five different STPs of the Netherlands, 24-h composite samples were collected from 32 influents and 32 effluents, and sampled for substances in a high level SFE using Oasis HLB cartridges. The chromatographic separation was achieved within 30 min. Full-scan accurate mass spectra, from 100 to 600 Da, were obtained in positive-ion mode (ESI) at a resolution of 30 000 FWHM. Along the complete chromatographic run, the mass spectrometer operated in a data-dependent-acquisition (DDA) mode, in which both MS and MSe spectra were acquired. In this way, highly confident information for identification, quantification and confirmation could be obtained in a single analysis.

Influent wastewater samples were analysed with target substances concentrations higher than 300ng/L for cocaine, benzoylecgonine, codeine, oxazepam and THC-COOH. Relatively high concentrations of amphetamine (~500 ng/L) and ketamin (~20 ng/L) were found in influents from a STP located in the south of the Netherlands. In general, concentrations of drugs of abuse in effluents were lower than those of the preceding benzodiazepines and benzodiprenes, and MDMA. By performing additional PCA the analytical results could be evaluated semi quantitatively and allowed to have a better insight on drugs and abuse wastewater treatment efficiency in the Netherlands.

WE 063

Monitoring and uncertainty assessment of cocaine and benzoylecgonine wastewater loads in Switzerland

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To check the effectiveness of campaigns preventing drug abuse or indicating local effects of efforts to control drug taking, it is important to identify drug consumption and usage trends in the population and temporal resolution. The analysis of drugs in sewage has the potential to provide this information. Here, we present two analytical procedures to determine cocaine (COC) and its main metabolite benzoylecgonine (BE) in sewage treatment plant (STP) influent and effluent water.

COC and BE were monitored on solid phase extraction followed by gas chromatography-mass spectrometry (GC-MS), the MS uses direct injection high performance liquid chromatography-tandem mass spectrometry (HPLC-MS/MS). In addition, we provide novel experimental data from several Swiss STPs and suggest a simulation-based method to assess the total uncertainty of the monitored sewage drug loads from flow measurements, sampling, and analytics. The GC-MS method was then applied to collect a 14-days profile of COC and BE in the STP wastewater (WW) of Berne. In addition, weekend and Wednesday samples were analyzed from the STPs of Zurich, Basel, Geneva, and Lucerne. With 1521 ng/L, the highest COC concentration was found in Geneva WW. With 2900 ng/L, the maximum BE concentration was measured in Zurich WW, collected after a mass rave event. For Berne, the estimated mean daily consumed amount was 107 ± 21 g of pure COC, corresponding to 321 g of street-grade COC. We were able to show that for WW loads of COC and BE in catchments with more than 100'000 inhabitants, the analytical uncertainty is the dominating influencing factor. The random errors from sampling are expected to be in the same range as that of flow measurements.

WE 064

Potential of LC-QTOF MS for investigation of drugs of abuse in the aquatic environment

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In our work, liquid chromatography was coupled to a quadrupole to time-of-flight mass spectrometers (QTOF MS) has been used for the investigation of emerging contaminants (e.g. drugs of abuse (DOA)) in the aquatic environment. QTOF MS offers interesting features in this field: full-spectrum acquisition with satisfactory sensitivity, accurate mass measurements of the analyte molecule and its main fragments, the absence of library drawbacks of L-CMS/MS is the occurrence of matrix effects during determination. Along, at least a second confirmation transition is necessary in order to properly identify a positive on a QQQ system, which can also be problematic in complex samples, e.g. for amphetamines due to their low m/z. Thus, the main objective of this study was to develop a two step confirmation process, in order to determine the occurrence of 24 drugs of abuse and metabolites in wastewater. This was achieved by the use of a mixed-mode SPE where sample preparation of the raw wastewater influents and effluents was performed. Neutrals and strong acids were eluted first with methanol and the basic analytes were eluted subsequently with basic methanol. This protocol resulted in less matrix effects (15% to 40% mean signal suppression) as compared to others employed in the literature (ca. 50% to ca. 60% mean signal suppression).

Additionally, the use of a mixed-mode SPE with high throughput capabilities (200 samples per day) including a second column and an MS drift tube was evaluated, in order to improve the selectivity of LC-QMS/MS determination. Due to its high resolution and mass accuracy, only a single MS/MS transition is required, but even the second one could be recorded with a higher mass accuracy than a QQQ. Moreover, the modern Agilent system tested provided an excellent linearity (R²>0.99) in the 1-1000 ng/mL range and LODs in the 0.2-4.3 ng/mL range. Overall, the method provided recoveries in the 80-120% range for most analytes and LOQs, after SPE, between 1 and 20 ng/L. A further advantage of the QTOF system is the fact that it acquires simultaneously full scan MS and targeted MS/MS data. Thus, a database of accurate masses of more than 90 illicit drugs and metabolites was created and samples could be screened for the presence of new drugs reaching the black market.
WE 063
The stability of illicit drugs and metabolites in the aquatic environment - implications for sewage epidemiology

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The stability of nine illicit drugs and metabolites (cocaïne (COC), benzoylecgonine (BE), ephedrine (E), amphetamine (AMP), methylamphetamine (MDMA), methamphetamine (METH), methadone (MDT), 2-ethylidene-1,5-dimethyl-3,3-dipropylpyrroli- dione (EDDP), and 6-acetamido-6-methylmorphine (S6AMM)) in surface water and wastewater was evaluated in 36-hour experiments at representative pH-values and temperatures. Blank surface and wastewater was spiked with relevant concentrations of each compound, based on published concentrations in surface and wastewater. At fixed time intervals (e.g., each hour), 100 mL aliquots were collected, internal standards were added for quantification, and the aliquots were stored at -20°C in the dark until analysis. Analysis was done with a validated method based on solid-phase extraction and liquid chromatography tandem mass spectrometry (LC-MS/MS) method. All collected aliquots were analyzed in duplicate the day after the collection. The stability for each compound at each time was calculated as a percentage of the initial concentration present in the water. Generally, BE, AMP, MDMA, MDT and EDDP showed a high stability while for COC, E, AMP and 6-MAM significant degradation was observed. As could be expected, a faster degradation was observed at higher temperatures of the water. Differences between surface and wastewater were observed; a higher degree of degradation in wastewater was observed possibly due to the higher content of microorganisms. A thorough evaluation of the stability of illicit drugs and metabolites in the aquatic environment is of great importance in sewage epidemiology. If degradation during the transport from the place of excretion to the wastewater treatment plant occurs, measured concentrations in wastewater should be corrected for this. Ignoring stability issues in wastewater can lead to serious underestimations in sewage epidemiology.

WE 066
Estimation of the collective consumption of illicit and licit drugs in the city of Zagreb using sewage epidemiology approach

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The work presented in this paper reports on a sewage epidemiology approach for the estimation of the collective consumption of illicit and licit drugs in the city of Zagreb. The study was performed in 2009 at the central wastewater treatment plant of the city of Zagreb. Selected licit and illicit drugs were monitored in wastewater samples in the city of Zagreb over a period of eight months. The analytical procedures used for the determination of selected drug target residues (DTRs) included solid phase extraction and subsequent analysis by liquid chromatography tandem mass spectrometry (LC-MS/MS). The collective consumption of a number of selected drugs, including 5 illicit drugs (cannabis, heroin, cocaine, amphetamine, methadone) and several licit drugs belonging to therapeutic opiate and antimicrobials was estimated for the city of Zagreb, based on the representative mass loads of the corresponding DTRs, and the average excretion rates, reported in the literature. The average daily mass loads of studied DTRs varied in the range 1.6 - 122.6 g/day. The observed mass loads were relatively uniform during the investigated period for most of the studied drugs. However, stimulating illicit drugs, including cocaine and amphetamine-type drugs, exhibited a clear weekday-dependent pattern, characteristic of the daily drug consumption during working week. This indicates the importance of the definition of licit and illicit drugs determined in this study was compared with the available official figures and observed agreements and disagreements were discussed.

WE 069
Biodegradability and toxicity of halogen free flame retardants

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The DP inventory from 2006 to 2010 were estimated to be 0.33 kg for Jiaozhou Bay, 0.49 kg for Sishili Bay and 0.38 kg/kg dw for Taoszi Bay, respectively. In these samples we also quantified PBDEs and other more hydrophobic BFRs. Reported levels of ETBPI, TBBPA AE, and TBBPA DBPE are thus compared with the regularly monitored BFRs including.

WE 070
Identification of the flame retardants Ethylene bis(tetrabromom phosphalimide), TBPPA diallyl ether and TBPPA bis(2,3-dipropylpropyl ether) in environmental samples using LC-APPI tandem-MS/MS

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An analytical method using liquid chromatography atmospheric pressure photoionisation tandem mass spectrometry (LC-APPI tandem-MS/MS) was developed for the analysis of the current use brominated flame retardants (BFRs) Ethylene bis(tetrabromom phosphalimide) (ETBPI), Tetrabromobisphenol A diallyl ether (TBPPA AE) and Tetrabromobisphenol A bis(2,3-dibromodipropyl ether) (TBPPA DBPE). The developed method was applied on diverse environmental samples obtained from three regions in Norway, including waste water, seawage sludge, sewage water, and sediment. ETBPI was detected in sewage water taken close to a metal recycling facility; TBPPA AE was detected both in sewage water and sediment, and TBPPA DBPE in waste water and sewage water. The identities of the BFRs were verified by accurate mass measurements using LC-APPI tandem-MS/MS with high resolution mass spectrometry. The analytes were found in few samples in ng/L levels. To our best knowledge this is the first detection of ETBPI and TBPPA AE in environmental samples. The analyzed samples were taken during a survey of new BFRs in the Norwegian environment and in these samples we also quantified PBDEs and other more hydrophobic BFRs. Reported levels of ETBPI, TBBPA AE, and TBBPA DBPE are thus compared with the regularly monitored BFRs including.

EP01 - Alternative flame retardants: Environmental exposure, fate and trends

WE 068
Biodegradability and toxicity of halogen free flame retardants

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Dechlorane Plus (DP), which was first synthesized in 1970s, has widely been used as a substitute for Dechlorane and brominated flame retardants. Both syn- and iso-omers have widely been detected in air, water, sediment, soils and human serum, but little information is available for their environmental fate. The aim of this study was to study the environmental fate and persistence of alternative flame retardants, especially DP, in marine environments. To study the mechanisms and processes of DP bioaccumulation and toxicity, the DP inventories from 2006 to 2010 were estimated to be 0.33 kg in Jiaozhou Bay, 0.49 kg in Sishili Bay and 0.38 kg in Taoszi Bay, respectively. The concentration level was comparable with that of rural river sediments from China (~160 mg/kg dw) and of sediments from Lake Winnipeg. The concentration level is dramatically lower in marine sediments than for example, Hu¨an canal, China, (1800 to 8000 mg/kg dw) and Lake Ontario, Canada (2.23 to 586 mg/kg dw).

The term is defined as the syn-isomer (iso- + anti-isomer) to identify possible sources of DP in the environment. The bioaccumulation of DP from the Bohai Sea.

The sedimentation rates were 0.074 cm/a in Jiaozhou Bay and 1.24 cm/a in Sishili and Taosi Bay. The DP inventories from 2006 to 2010 were estimated to be 0.33 mg/kg f in Jiaozhou Bay, 0.049 mg/kg for Sishili Bay and 0.037 mg/kg for Taosi Bay, respectively.

WE 073
Seasonal trends in concentrations of organophosphorus flame retardants in coastal surface waters

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3Dalarna University, UMEå, Sweden

In the late 1970s organophosphorus flame retardants (OPFR) were detected in the environment for the first time. Due to the fact that OPFR are used as substitutes for the prohibited polybrominated diphenyl ethers (PBDE) an increase in the OPFR production is expected. Various alkyl- and aryl ester groups were found halogenated, to lead to a large variation in the physico-chemical properties - ranging from very polar and volatile (e.g. trimethyl phosphate) to non-polar and non-volatile (e.g. tri(ethyl) phosphate). Therefore they can be transported in different environmental media and have been detected in various environmental compartments. Especially the halogenated OPFR are supposed to be highly persistent in the environment. Several OPFR are known to be toxic (e.g. carcinogenicity) and additionally the lipophilic OPFR
have the potential to bioaccumulate. This study focused on the seasonality of OPFR concentrations in the estuary of the River Elbe and the German Bight (North Sea).

Surface water samples were taken during four cruises of RV Ludwig Prandtl in the estuary of the Elbe in March, May, August and October 2010 and three cruises of RV Heincke in the North Sea in July 2010 and August 2010. The samples were extracted using solid phase extraction (SPE, SiliaSPE, 100 mg, 3 ml, 3A). The eluates were evaporated to dryness under nitrogen and quantified by gas chromatography-mass spectrometry (GC-MS) using a 1900 Series GC-MS (Thermo Scientific, USA). A 1-μl aliquot of each extract was injected in a splitless mode using a non-polar capillary column (J&W, HP-5 30 m×0.25 mm×0.25 μm) and the eluate was detected using a mass selective detector. The identification of the OPFRs was achieved by comparing the retention times and tandem mass spectra with those obtained from authentic standards.

In conclusion, this study shows a seasonal variation of OPFR in riverine and marine surface water. In summer, non-halogenated OPFRs are affected by biodegradation leading to decreasing concentrations while halogenated OPFRs are more stable.

WE 074 Occurrence of chlorinated organophosphate flame retardants in soil

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Restrictions on the use of some polybrominated diphenyl ethers (PBDEs) have resulted in an increased consumption of chlorinated organophosphate esters (OPEs) as alternate flame retardants. This resulted in a ubiquitous detection of chlorinated OPEs in the environment but, surprisingly, we have so far not found any information on their occurrence in soil. In this study, the spatial distribution of tri(2-chloroethyl) (TCEP) and tris(2-chloroisopropyl) phosphate (TCPD) in soil samples was investigated. Soil samples were collected between April and November 2010 from four different locations in Germany: (i) Frankfurt, city centre (ii) Osnabrück, city centre (iii) Osnabrück, 6 km distant from the city centre, and (iv) 3 km distant from the village Jengum. The selected sampling locations were each surrounded by different building and traffic densities which decreased from sampling location (i) to sampling location (ii), (iii) and (iv).

Samples were freeze dried and sieved (2 mm), equilibrated for 24 h, and extracted for 12 h using 150 ml of toluene in a Twissmann apparatus. Extracts were evaporated to dryness, resolved again in a mixture of 1 ml methanol and 15 ml of tap water, ultrasonicated for 60 min and filtered. 7 ml aliquots were spiked with TriDPh and analyzed by solid phase microextraction (SPME) and gas chromatography-mass spectrometry (GC-MS). A one ANOVA (p > 0.05) was performed to analyze the influence of the sampling location on the concentrations of TCEP and TCPD in soil.

Mean concentrations of nBFRs varied between 1.75 and 13.5 μg/g for TCPD between 1.23 and 8.33 ng/g for TCEP. Mean TCEP concentrations decreased from sampling location (i) to (iii) and (iv) whereas mean TCPD concentrations (n=3) decreased from sampling location (i) to (ii), (iii) and (iv). Results of ANOVA demonstrated a significant influence of the sampling location on the concentrations of TCPD (F2.6=127.6) and TCEP (F2.6=102.4). Our results demonstrated that atmospheric deposition leads to a contamination of soil with chlorinated OPEs with a significant influence of building and/or traffic density. However, these are the first data on OPEs in soil and more data are needed to clarify the atmospheric deposition processes. The results indicate that atmospheric deposition must be considered in existing risk assessments for TCEP and TCPD.

WE 075 Study of novel brominated flame retardants (nBFRs) in biota and sediment samples from the UK

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Brominated flame retardants (BFRs) have been widely used to avoid or control fires. The most used BFRs have been the polybrominated diphenyl ethers (PBDEs) and biphenyls (PBBs), tetrabromobisphenol-A (TBBPA-A) and hexabromocyclododecane (HBCD). In recent years, many new BFRs have been the polybrominated diphenyl ethers (PBDEs) and biphenyls (PBBs), tetrabromobisphenol-A (TBBPA-A) and hexabromocyclododecane (HBCD). In recent years, many additional depletion probably due to enzymatic reactions might occur. Concluded from the ratio of halogenated to non-halogenated OPFR halogenated OPFR seem to be more stable to this depletion. In the German Bight the sum concentration of OPFR is higher in spring than in summer (100-300 ng/g in March and 20-60 ng/g in July), but the number of individual OPFR compounds is lower. In the non tided influenced part of the Elbe the sum concentration of OPFR ranged from 200 (May) to 700 ng/g (August).

In this study, conch the spatial distribution of tri(2-chloroethyl) (TCEP) and tris(2-chloroisopropyl) phosphate (TCPD) in soil samples was investigated. Soil samples were collected between April and November 2010 from four different locations in Germany: (i) Frankfurt, city centre (ii) Osnabrück, city centre (iii) Osnabrück, 6 km distant from the city centre, and (iv) 3 km distant from the village Jengum. The selected sampling locations were each surrounded by different building and traffic densities which decreased from sampling location (i) to sampling location (ii), (iii) and (iv).

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from integrated fish farms in China and gene cassette array dfrA17-aadA5 was first detected in integrated fish farms in China. Results of this study indicated that fish farms may be a reservoir of highly diverse and abundant ARGs and gene cassettes. Integrons may play a key role in multiple antibiotic resistances with the antibiotic selective pressures, posing potential health risks to the general public and aquaculture. Keywords: fish farm, antibiotic resistance, resistance genes, integrons, gene cassettes.

WE 085
Pollution Induced Community Tolerance (PICT) as a tool for environmental risk assessment of antibiotics
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Pollution Induction, Susceptibility Tolerance (PICT) is a concept where toxicant-induced succession in a microbial community is quantified by an increase in tolerance of the total community to the compound in question. This increase is thought to reflect three possible effects: (i) the disappearance of sensitive species through direct intoxication and the proliferation of more tolerant species; (ii) changes in the expression of genes that encode resistance; (iii) changes such as acquiring mobile genetic material encoding more resistance. Traditionally, PICT has been used to study microbial communities based on physiological profiling or growth parameters and is often presented as dose-response curves. However, the causative effects explaining the PICT results are not understood. In this presentation, we evaluate PICT as a tool for assessing the risk of introducing antibiotics into the soil environment using the synthetic antibiotic sulfadiazine as a model compound. The potential hazard of exposure of SDZ on a scale was calculated using experimental and predicted properties of mobility, volatilization, persistence, bioconcentration and solubility of the compound. Finally, a preliminarily ecotoxicological and human risk assessment was conducted using both traditional methods and the PICT assays.

WE 086
Antibiotic resistance profiles of bacterial strains isolated from a treatment plant receiving wastewater from the manufacture of pharmaceuticals
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2University of Gothenburg, GOTEBOGR, Sweden
The selection pressure created by wastewater containing antibiotic production residues may cause the potential to select for resistance factors that can be transferred between bacteria, contributing to the establishment of multidrug-resistant variants. In the present study we have investigated the antibiotic sensitivity pattern of bacterial strains isolated from a treatment plant that receives waste-water from 90 different Indian bulk drug producers. In the treated effluent from this plant, we have previously reported very high levels of antibiotics, predominantly fluoroquinolones, at concentrations up to 1,000,000 times greater than those normally observed in treated sewage effluents. The taxonomic identities of all isolates were determined by 16S rDNA gene sequencing, followed by screening their sensitivity to 37 antibiotics, belonging to 11 different classes. All isolates were resistant to, at least, 4 antibiotics, thus conforming a 100% multi-drug resistant population, and the majority were resistant to more than 20 antibiotics. Our study suggests that the wastewater-treatment plant studied is potentially selecting for an enrichment site for multidrug-resistant bacteria, which could pose a major public health issue in the future.

WE 087
Influence of sulfadiazine on the dynamic of bacterial resistance genes in manure and amended soil
A Focks1, H Heuer1, M Lamloß1, K Smallia, M Matthies2, M Spitteler3
1Institute of Environmental Systems Research, OSNABRUECK, Germany
2Federal Research Centre for Cultivated plants (JKU), BRAUNSFELD, Germany
3Institute of Environmental Research, DORTMUND, Germany
In the last years, the relation between the use of antibiotics in animal production and the environmental occurrence of antibiotic resistance genes (ARG) has received growing interest. The implication of the transfer of resistance genes from animal manure to the environment is currently the subject of intense research. ARGs are present at many levels in antibiotics, predominantly fluoroquinolones, at concentrations up to 1,000,000 times greater than those normally observed in treated sewage effluents. The taxonomic identities of all isolates were determined by 16S rDNA gene sequencing, followed by screening their sensitivity to 37 antibiotics, belonging to 11 different classes. All isolates were resistant to, at least, 4 antibiotics, thus conforming a 100% multi-drug resistant population, and the majority were resistant to more than 20 antibiotics. Our study suggests that the wastewater-treatment plant studied is potentially selecting for an enrichment site for multidrug-resistant bacteria, which could pose a major public health issue in the future.

EP02 - Antimicrobial resistance in the environment
WE 084
Occurrence of antibiotic resistance and characterization of resistant genes and integrons in gram-negative bacilli (GNB) isolated from integrated fish farms in Zhongshan, southern China
J Cristale, R Chaler1, F Ventura, L Socorro
1IDAEA - CSIC, BARCELONA, Spain
2Argies de Barcelona, BARCELONA, Spain
A multiresidue method based in gas chromatography coupled to quadrupole mass spectrometry was developed to determine organophosphorus flame retardants (TCP, TCEP, TCPP, TDP, PBDEs, BDEs 28, 47, 99, 100, 153, 154, 183 and 209) non-PBDE flame retardants (PFBD, DPTE, HBB, HCBDCO, EHTPB, BTBP, BEHBP, DBDE), bromophenols, bromotoluenes, bromoanilines and bromoanisoles. Its performances, identification, EL and electron capture negative ionization, ECNI) and two acquisition modes (selected ion monitoring, SIM, and multiple reaction monitoring, MRM) were compared as regards to identification, sensitivity and quantification capabilities. Highest sensitivity, at expenses of identification, was achieved in SIM mode. Different content of PBDEs were found in the samples ranging from 4.8 μg g-1 to 23.98 μg g-1. UAE showed equivalent results to Soxhlet with the benefit of being an easy, quick, and easy technique. Thereafter, we evaluated the presence and detectability of flame retardants in water within a waterwork facility. TCEP, TCPP, TDCPP and TPhP were detected in influent waters, and TCEP and TCPP were not degraded throughout the different treatment stages and were identified in finished water.

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EP03 - Emerging per- and polyfluorinated compounds: Source identification, environmental fate, and remediation strategies

Perfluorinated compounds (PFCs) are ubiquitous contaminants in humans and animals worldwide [1]. Furthermore, concern has increased about the toxicity of these compounds. In addition, different studies have shown that PFCs affect the lipid metabolism, disturbs the immune system, can cause liver cancer and can be a cause of human infertility [2]. Therefore, monitoring human exposure to PFCs is necessary.

In the present work a high-throughput method for measuring trace levels of 21 PFCs in human hair have been developed. The method consists of an ultrasonic extraction with acetone, followed by an on-line clean-up step utilizing the Turbomatrix TurboFlow (ADEMARX) technology coupled to ultra-performance liquid chromatography and tandem mass spectrometry (UPLC-MS/MS). The method is sensitive, with LOD between 0.025 and 1 ng/g of hair, involves minimal sample preparation, and it is suitable for large epidemiologic studies to assess human exposure to PFCs. This approach involves the on-line extraction of C12-C18 PFCs. The injection volume was 50 – 160 µl.

The on-line extraction from hair is a promising approach for the promotion of the presence of the PFCs. Here, we examined the relationship between antibiotic resistance and certain geochemic conditions in Scottish soils, and we found that antibiotic-resistant bacteria are abundant directly correlated with Cu, Zn and clay levels. The study suggests that geochemical conditions can impact the potential for resistance among soil micro-organisms. The extensive survey of soils done here, over wide range of geologic conditions, will help inform risk assessors understand background environmental conditions, which is essential to help drive policy and decision-making to protect agricultural and human health.

EP09 - Survival and leaching of Tetracycline resistant bacteria and fecal indicators from manure in field scale experiments

In the field experiment pig manure was injected into agricultural soil. The distribution and survival of natural occurring indicator bacteria around a manure slurry slit in the soil was followed. Distinct period of 12 months, section of soils with different distance to the manure string were assayed to obtain information on survival and spread of bacteria, face indicators (Escherichia coli), and Tetracycline resistant bacteria. The die-off of the different groups was quantified showing an extended survival close to the manure string. The study suggests that geochemical conditions can impact the potential for resistance among soil micro-organisms.

EP09 - Analysis of 18 perfluorinated compounds in blood by on-line turbo flow-LC-MS/MS

Analysis of 18 perfluorinated compounds in blood by on-line turbo flow-LC-MS/MS was conducted as a large multidisciplinary project. Pig manure with a natural content of Tetracycline resistant bacteria and fecal indicator organisms was followed in soil columns and a field scale experiment. The first manure application was injected into agricultural soil. The distribution and survival of natural occurring indicator bacteria around a manure slurry slit in the soil was followed. Distinct period of 12 months, section of soils with different distance to the manure string were assayed to obtain information on survival and spread of bacteria, face indicators (Escherichia coli), and Tetracycline resistant bacteria. The die-off of the different groups was quantified showing an extended survival close to the manure string. The study suggests that geochemical conditions can impact the potential for resistance among soil micro-organisms.

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Analysis of 18 perfluorinated compounds in blood by on-line turbo flow-LC-MS/MS was conducted as a large multidisciplinary project. Pig manure with a natural content of Tetracycline resistant bacteria and fecal indicator organisms was followed in soil columns and a field scale experiment. The first manure application was injected into agricultural soil. The distribution and survival of natural occurring indicator bacteria around a manure slurry slit in the soil was followed. Distinct period of 12 months, section of soils with different distance to the manure string were assayed to obtain information on survival and spread of bacteria, face indicators (Escherichia coli), and Tetracycline resistant bacteria. The die-off of the different groups was quantified showing an extended survival close to the manure string. The study suggests that geochemical conditions can impact the potential for resistance among soil micro-organisms.
Their specific properties, especially high chemical and thermal stability and low surface free energy, make these chemicals unique for their ability to repel both water and oil, and useful in several applications, such as surface treatments for coatings, clothes, carpets, packaging products, cookware, and food contact papers. As a result of their widespread use, they are globally distributed and detected in environmental and biological samples. Moreover, they are extremely persistent, bioaccumulative and of toxicological concern because they have been shown to be carcinogenic in experimental animals.

In this study we present a new and fast analytical method to quantify these compounds in the edible part of fish samples. The method, based on isotope dilution with 13C labeled internal standards, uses a simple extraction by sonication, followed by a direct determination using liquid chromatography - tandem mass spectrometry and avoids a solid phase extraction step (SPE), resulting in a lower sample consumption by extraction solvents and in a shortening of the analysis time. The linearity of the instrumental response wasgood, since the average regression coefficients of the calibration curves were always close to 1. The repeatability, expressed as average coefficient of variation, was 14% and 20% (inter-day) and 8% and 19% (intra-day) for PFOS and PFOA, respectively. The method was applied to samples of homogenized fillets of wild fish from Mediterranean Sea. Most of the samples showed low or contamination below limit of detection values (LOD = 0.01 ng/g). PFOA was the same for the fillets. The highest concentrations of PFOS (5.96 ng/g fw) and PFOA (1.89 ng/g fw) were found in an anchovy (Engraulis Encracinus) and in a norway lobster (Nephrops Norvegicus), respectively. The developed and validated method can be used as a tool to monitor and to assess human exposure to perfluorinated compounds through sea food consumption, which seems to be one of the main routes of exposure to these pollutants for human population.

WE 097

Different quantification methods to calculate PFC concentrations in biota samples
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In this study we investigated the applicability of different quantification methods to calculate the concentrations of twelve perfluorinated compounds (PFCs) in biota samples. Four perfluorinated sulfonates (PF Sa) and two perfluorinated carboxylates (PF Car) were analyzed at the inlet and at the outlet of the WWTP. The perfluoroalkyl sulfonates (PF Sa) were determined by liquid chromatography and mass spectrometry (LC-MS). The calibrations were performed in the range of concentrations between 0.1 and 10 mg/L. The calibrations in solvent and in matrix were performed for PF Sa in the matrix of seawater and for PF Car in the matrix of fish tissue. The recoveries of the quality control samples were between 70% and 110%. The concentrations of PF Sa and PF Car were calculated according to the corresponding calibration curves. The results showed that the developed laboratory method is suitable for the determination of PF Sa and PF Car in seawater and fish tissue.

WE 098

Occurrence of perfluorinated surfactants in the Korean water system and human exposure
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In this study, we investigate the occurrence of perfluorinated surfactants (PFSs) in the Korean water system and human exposure. Surfactants are molecules that can lower the surface tension between two different phases, and they are widely used in various industries, such as in the production of cosmetics, pharmaceuticals, and textiles. PFSs are known to be hazardous to human health due to their persistent nature and their ability to bioaccumulate in the human body. In this study, we collected water samples from various sources, such as rivers, lakes, and seawater, and analyzed the occurrence of PFSs in these samples. The results showed that PFSs were detected in all the samples, with the highest concentrations found in seawater samples. The concentrations of PFSs were compared with the guideline values established by the Korean government and other international organizations. The results showed that the concentrations of PFSs were below the guideline values in most cases, indicating that the occurrence of PFSs in the Korean water system is not a significant health concern. However, further studies are needed to better understand the potential health effects of PFSs on human populations.

WE 099

Distribution and sources of polyfluoroalkyl substances (PFASs) in the river Po (north of Italy)
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To investigate the distribution and sources of polyfluoroalkyl substances (PFASs) in the river Po, we collected water samples at different sites along the river, from the mouth to the source. The samples were analyzed using high-performance liquid chromatography-mass spectrometry (HPLC-MS) to quantify the concentrations of PFASs. The results showed that PFASs were detected in all the samples, with the highest concentrations found in the upstream areas of the river. The concentrations of PFASs were compared with the guideline values established by the European Union and other international organizations. The results showed that the concentrations of PFASs were below the guideline values in most cases, indicating that the occurrence of PFASs in the river Po is not a significant health concern. However, further studies are needed to better understand the potential health effects of PFASs on human populations.

WE 100

Perfluorinated compounds: from urban wastewater to the river
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Our everyday life is a source of environmental pollution through domestic wastewater. The wastewater treatment plants (WWTPs) have been conceived to biologically eliminate pollutants, such as organic matter or nitrogen. However, the used treatments are not effective for the elimination of many compounds that have been increasingly appearing in our everyday use for several decades. Pharmaceuticals, biocides present in body care products or non-adhesive surface of frying pans. This study aims at assessing the concentration of two perfluorinated compounds (PFCs), perfluorooctanoic acid (PFOA) and perfluorodecanoic acid (PFDA) of the wastewater in an urban area. We have followed the wastewater issued from a residential area on the one hand and from a mixed area (administrations, hospital, houses, etc.) on the other hand, both at the inlet of the WWTP (300 000 eq.fw), which collects the wastewater from different municipalities, and at the WWTP’s outlet. The samples’ aqueous phase was extracted by solid phase extraction (SPE) and the extract was analyzed by UPLC/MS/MS. The PFCs concentrations measured in the residential and mixed area were similar: PFOA was around 6-8 ng/L and PFDA around 4-8 ng/L. The concentrations obtained in tap water (an inlet of the WWTP) were identical: 10-15 ng/L for PFOA and 25-27 ng/L for PFDA. This showed that the biological treatment did not eliminate these compounds. The daily mass flow of PFCs to the river was of around 600 mg/d of PFOA and 1600 mg/d of PFDA.

WE 101

Contribution of wastewaters to PFCs contamination in ambient river waters of South Korea
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In this study, we investigated the contribution of wastewaters to PFCs contamination in ambient river waters of South Korea. Wastewaters from various sources, such as industrial, municipal, and hospital facilities, were collected and analyzed for PFC concentrations. The results showed that the concentrations of PFCs in the wastewaters were significantly higher than in the ambient river waters. The contribution of wastewaters to PFCs contamination in ambient river waters was estimated to be around 25-30% of the total concentration in the river. The contribution of wastewaters to PFCs contamination in ambient river waters was found to be higher in the downstream areas of the river than in the upstream areas. The results of this study showed that the contribution of wastewaters to PFCs contamination in ambient river waters is not negligible and should be considered in environmental risk assessments.

WE 102

Ombrotrophic peatbogs as natural archives to investigate the historical deposition of polyfluoroorganic compounds (PFOSs)
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Ombrotrophic peatbogs are wetland ecosystems that develop in the absence of surface water inflow. They are formed by plants that extract water from the atmosphere and are characterized by a high water table and a low oxygen content. In this study, we investigated the historical deposition of polyfluoroorganic compounds (PFOSs) in ombrotrophic peatbogs in the German part of the Bavarian Forest and the Czech part of the Bohemian Forest. We collected peat samples from five ombrotrophic peatbogs and analyzed them for PFOS concentrations using liquid chromatography-mass spectrometry (LC-MS). The results showed that PFOS concentrations in the peat samples were below the detection limit in all cases. This suggests that there has been no significant deposition of PFOSs in these ombrotrophic peatbogs over the last few decades. The results of this study showed that ombrotrophic peatbogs are not suitable natural archives for the investigation of historical deposition of PFOSs.
results will be compared to previous findings of PFCs in a shallow firn core from Mount Ortler, Switzerland.

A shallow ice core was drilled at Colle Gnifetti (4452 m above sea level, Italy, Swiss) and was dated using the delta-18O method. The overall, the ice core is dated from 1996 to 2008. The core contains a series of layers, which are components to the PFC analysis. The segment was extracted using solid phase extraction and were separated and detected by HPLC-ESI-MS/MS. The target analytes included 17 PFCs (perfluorinated carbonyls (PFCs) and perfluorinated sulfonamides (PFSAs)).

We will present the results of PFC contamination from Colle Gnifetti. Concentrations, vertical deposition and distribution rates of PFCs were determined in the different ice core layers. The results will be compared to previous findings of PFCs in a shallow firn core from Mount Ortler.

We 104

Mass balance analysis of fluorinated compounds in wet precipitation

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12004 to 2009 were only demonstrated for PFBA (0.3 - 1.7 ng L-1), PFNA (0.2 - 1.9 ng L-1) and PFOA (0.1 - 0.9 mg L-1). Increasing concentrations from 2004 to 2009 were only demonstrated for PFBA (1.3 to 1.4 ng L-1).

Anomalous PAH profiles from low PAH containing sites

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Although PAHs are ubiquitous throughout the environment, there are sites that are low in PAH contaminant concentrations. We report some PAH profiles associated with low PAH containing sites.

Impact of water management practices on PFOS levels in drinking water

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Several drinking water systems in the northern part of Massachusetts had elevated PFOS levels. We evaluated the impact of water management practices on PFOS levels in drinking water.
tions of the PFAS uptake with the water uptake were examined. The contribution presents the results of the greenhouse experiments.

WE 110
Uptake and depuration of PFOS in liver and muscle tissue of bluegill sunfish under environmental conditions

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Uptake and depuration of PFOS in liver and muscle tissue of bluegill sunfish under environmental conditions were examined. The exposure conditions were chosen in order to represent real-world exposure. The results showed that PFOS is readily taken up by bluegill sunfish from contaminated water and that the depuration process is slow, with a half-life of more than 100 days in both liver and muscle tissue. These findings highlight the importance of PFOS pollution in aquatic ecosystems and emphasize the need for further research to understand the long-term impacts of PFOS on fish health and ecosystems.

WE 111
Perfluorooctanoic acid toxicity in zebrafish (Danio rerio)

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Perfluorooctanoic acid (PFOA) is a common surfactant with wide use, and has been detected as a contaminant in soil, air, water and biota. Previous studies have shown that PFOA has detrimental effects on different life stages of zebrafish (Danio rerio). We studied the effects of PFOA on zebrafish at different life stages of zebrafish through three tests that were based on OECD guidelines. The key finding from our study is that PFOA has significant effects on the early life stages of zebrafish, with potential impacts on the survival and development of larvae. This indicates that PFOA may pose a risk to the survival and biodiversity of aquatic ecosystems, highlighting the need for further research to understand the long-term impacts of PFOA on aquatic organisms.

WE 112
Macro algae, Ecklonia cava - Ecotoxicogenomic approach for environmental stress responses

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Macroalgae, such as Ecklonia cava, are important components of the marine ecosystem and play a vital role in the provision of goods and services, including the production of food and biofuels. They are also important in the cycling of nutrients and the regulation of the carbon cycle. In this study, we used Ecklonia cava as a model organism to investigate the effects of environmental stress on gene expression at the ecotoxicogenomic level and to prove that gene expressions represent the individual organism’s health as well as its environmental status. The study used a combination of molecular techniques, including transcriptomics and proteomics, to identify changes in gene expression and protein abundance in response to different environmental stressors, such as stress due to the presence of pollutants. The results showed that stressors can affect gene expression in different ways, with some genes being upregulated and others downregulated. This information can be used to develop new biomarkers and to monitor the health of marine ecosystems in real-time.

WE 113
Enchytraeus albidus is an important and typical inhabitant of a wide variety of soil types and full-fils vital functions such as improvement of the soil pore structure and indirectly the degradation of organic matter. Traditionally, in soil Environmental Risk Assessment (ERA), several biologi- cal tests are commonly performed with E. albidus (ISO No 16387, 2005, OECD 202, 2004), providing information about effects on survival and reproduction. Such traditional test methods are important to predict realistic threshold values for policy makers and to screen the overall toxicity of polluted soils. Nevertheless, such bioassays are time-consuming and consider limited effects. Therefore, an ecotoxicogenomic approach was chosen in this study to be implemented at lower levels to better understand the underlying response mechanisms but so far, very little is known about the effects induced by different toxicants on these organisms at the molecular level. Recently, substantial efforts have been made to further develop and enrich the existing microar- ray technology, and in our recent study, E. albidus was exposed during 4 days and 8 days to concentrations of zinc and cadmium known to cause 50 and 90% effects on their reproduction. The main goal of this study was to elucidate the early molecular responses and the toxic mechanisms of these metals in E. albidus with the use of transcriptomic analysis. The gene expression analysis was performed through hybridization of fluorescently labelled probes from the exposed and control organisms on the newly developed Custom Gene Expression Microarrays (GEOID & GREEKX) (15 k spots model. Agilent Technologies). Results show differentially expressed genes involved in functions like transcription and translation, immune and stress response, protein folding, energy metabolism, cell structure, and cell division. The expression profiles of organisms reacting to particle bound pollution. The benthic habitat constitutes an integral and dynamic part of aquatic ecosystems, whose processes are important for the whole water body. Sediments can act as both, potential sinks but under other conditions as potential sources for mobile bioaccumulative substances. Particulate and dissolved contaminants are problematic due to their particular persistence and liability to bio-accumulation. Taking this into account several methods for sediment contact tests with various species were developed in the recent years. Sediment contact assays have the advantage to cover various routes of exposure (e.g. direct particle contact as well as exposure via the sediment pore water). In the present study sediment contact tests with rice (Oryza sativa) were performed with Ni-spiked artificial sediments. Oryza sativa can be grown under extreme conditions and has - as a prerequisite for a comprehensive exposure analysis - a sequenced genome. The sensitive end point of exposure to Ni was the root length; in addition to growth inhibition a different morphology of the root was observable. Roots of exposed plants were less branched and thicker compared to the unexposed control. In order to establish an endpoint with ecotoxicological relevance that is based on gene expression it is crucial to correlate expres- sion data with an adverse phenotype and the inhibition of root development. We used rice- sprouted seeds of Oryza sativa were exposed to different Ni-doses, i.e. EC10 at 200 mg/kg and EC50 at 600 mg/kg, with a subsequent analysis of the genome wide expression profile by DNA- microarray. The objective of the study is to determine if it is possible to discriminate between exposed / non-exposed samples but as well between affected (exposed at EC50) and unaffected (control and exposure at EC25) samples based on the gene expression data. If such a differentiation is possible, robust molecular markers should be identified the expression levels of which can be used as indicators for exposure and/or adverse effect. The successful correlation of molecular markers and adverse phenotypes in studies like the one presented here, is an essential prerequisite for the use of techniques like expression profiling in the field of regulation in the future.
compare the toxicity of six pesticides and identify biomarkers of toxicity

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However, there is no knowledge of any work reporting changes on mussels, M. galloprovincialis to nonsteroidal anti-inflammatory drugs at environmentally realistic concentrations. We used bone and cartilage abnormalities found in higher vertebrates. In order to better understand the development of DTC induced craniofacial abnormalities, together, we provide evidence for a novel teratogenic endpoint and a molecular basis for a better understanding of DTC induced teratogenesis in vertebrates.

A proteomic study in zebra mussels (D. polymorpha) exposed to benzo[a]pyrene: role played by gender and exposure concentrations

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WE 122

WE 120

Transcriptomic approach to assess the effects of two Active Pharmaceutical Ingredients

Short-term bioassays using non-animal eukaryotic models are required for the preliminary screening of the toxicity of chemicals and to early-war potential toxic effects of chemicals in whole environmental samples. The yeast Saccharomyces cerevisiae is a useful experimental model of the eukaryotic cell, it is distributed, easily cultivated, and has a vast amount of genomic knowledge and resources available. This work aims to identify molecular biomarkers in the yeast model to be used in monitoring and diagnosing the effects of xenobiotics, and to help uncover mechanistic aspects of the yeast responses to pesticide-stress. Affymetrix GeneChip Yeast Gene

WE 125

Ecotoxicoproteomics tests on Daphnia pulex : preliminary steps

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Drugs administered in humans are eliminated through the excreta in either intact or metabolized form leading pharmaceuticals and their derivatives to reach sewage treatment plants. Several drugs are able to induce genetic and cell cycle changes and the current burgeoning of new therapeutic agents with original mechanisms of action call for a comprehensive assessment of their potential effects on the aquatic fauna and flora. It is therefore crucial to find out robust biomarkers to identify the effects of these compounds. We assume that proteomics approach will allow us to identify at the protein level such biomarkers, which then may be used to assess the risk of drugs and their metabolites for aquatic life.

Ecotoxicoproteomics is a field of science that seeks to understand changes at the protein level, in organisms exposed to stress (e.g. such as pollutants or drugs). Nowadays, toxicoproteomics can be used in environmental toxicology to find early ecotoxicological markers at the protein level; this field is called ecotoxicoproteomics. In this study, proteomics analyses were performed on the zebra mussel, Dreissena polymorpha, as a model species for ecotoxicology (i.e. for the identification of possible endpoints). The use of 2D gel electrophoresis is used to resolve proteins as a proof of concept in the development of this new tool.

The main aim of this study was to assess the gene expression profiles using a 1.7 K cDNA microarray (Mytarray V1.1) in the digestive gland of mussels exposed to environmental realistic concentrations of benzo[a]pyrene and diclofenac (250 µg/L) during short-term exposure.

The current study tested the expression of immune- and stress- response genes after exposure to PCBs. The Flounder Platichthys flesus lives in estuarine environments along the European East Atlantic coasts. Estuarine environments are strongly subjected to anthropogenic stress factors such as hypoxia linked to eutrophication, chemical pollution especially in industrial area, or thermal stress in the context of global warming. Therefore, it is at understanding the expression of the immune system in flounder to adapt to different stress factors and multi-stress conditions, and to determine whether a local adaptation to a specific stress could modify the ability of the individuals to cope with other stress. Flounders were exposed to different contaminants, such as the southern limit of this species (the Monigo - Portugal), the oyster farm, chemically polluted (the - France), or displaying hypoxia events (the Vilaine - France) or considered as a control area (the Canche -France). Some farm flounders were also raised in the laboratory under contaminated conditions (PAs and PAHs). Flounders were raised at a concentration of 1010 times the concentration found in the Seine. They were then subjected to a second stress (thermal or hypoxic) to study the way they cope with the multiple stress; thus, a proteomic approach by 2-dimensional electrophoresis has been performed on these animals. This allowed us to identify differentially expressed proteins by MALDI-TOF/TOF mass spectrometry. The objective of this study was to explore the molecular responses of a marine fish to single versus multiple stress, looking for specific versus convergent pathways.

Increased expression of immune- and stress- response genes in the Sydney rock oyster, Saccostrea glomerata

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The multiple stress; thus, a proteomic approach by 2-dimensional electrophoresis has been performed on the zebra mussel, Dreissena polymorpha, after exposure to benzo[a]pyrene (a known teratogen). The aim of this study was to assess the expression of immune- and stress- response genes in the Sydney rock oyster, Saccostrea glomerata. We have tested two temporal periods: 10 and 20 days. The Flounder Platichthys flesus lives in estuarine environments along the European East Atlantic coasts. Estuarine environments are strongly subjected to anthropogenic stress factors such as hypoxia linked to eutrophication, chemical pollution especially in industrial area, or thermal stress in the context of global warming. Therefore, it is at understanding the expression of the immune system in flounder to adapt to different stress factors and multi-stress conditions, and to determine whether a local adaptation to a specific stress could modify the ability of the individuals to cope with other stress. Flounders were exposed to different contaminants, such as the southern limit of this species (the Monigo – Portugal), the oyster farm, chemically polluted (the - France), or displaying hypoxia events (the Vilaine – France) or considered as a control area (the Canche –France). Some farm flounders were also raised in the laboratory under contaminated conditions (PAs and PAHs). Flounders were raised at a concentration of 1010 times the concentration found in the Seine. They were then subjected to a second stress (thermal or hypoxic) to study the way they cope with the multiple stress; thus, a proteomic approach by 2-dimensional electrophoresis has been performed on these animals. This allowed us to identify differentially expressed proteins by MALDI-TOF/TOF mass spectrometry. The objective of this study was to explore the molecular responses of a marine fish to single versus multiple stress, looking for specific versus convergent pathways.

The effects of heavy metal contamination in Sydney Rock oysters (Saccostrea glomerata) gene expression patterns were affected by 2-dimensional electrophoresis techniques. The current study tested the expression of immune- and stress- response genes after exposure to heavy metal contamination in Sydney Rock oysters (Saccostrea glomerata). Target genes (HSP70, HSP90, Metallothionein, Superoxide dismutase, Defensin and Ferritin) were selected from...
previous studies that investigated the effects of contaminants on immune- and stress- responses in marine mussels. Quantitative (real time) PCR analyses of gene expression showed that labora-
tory exposures to different metals (cadmium, copper, lead and zinc) 100ug/3 elicited different 
gene expression profiles. The expression of defence, an antimicrobial peptide, was up-regulated 
in response to lead exposure, but down-regulated in the presence of zinc. The bacteriocidal, 
metazoan defence promoting protein, ficolin (a lectin involved in phagocytosis), was down-
regulated in response to lead. Conversely, superoxide dismutase (an antioxidant enzyme 
involved in phagocytosis) was down-regulated by exposure to all four metals. These results suggest 
that metal exposure may have complex, differential effects on the immune- 
and stress- responses of species and can potentially provide a mechanism for identifying the 
specific stressors responsible for changes in gene expression. The present study aimed to 
continue using oysters transplanted to a polluted estuarine environment so that their exposure profiles can be analysed in the same way.

WE 126
Molecular Biomarkers of exposure in marine diatom Thalassiosira pseudonana upon exposure 
to polyacrylic aromatic hydrocarbons (PAHs): from in vitro to field studies
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Marine diatoms have a key role in the global carbon fixation and therefore in the ecosystem 
functioning. These microalgae are ubiquitous and exist in all marine habitats. They are responsible for about 40% of the total carbon fixation in oceans [1]. We used Thalassiosira 
pseudonana as a model organism to assess the effects of exposure to environmental pollutants at the gene expression level. Diatoms were exposed to polyacrylic aromatic hydrocarbons mixture (PAHs) at a high concentration and a shorter period in a temperature controlled 
nean Sea (Genoa, Italy), due to intense industrial and harbor activities. The gene expression data for exposure to the sediment-derived PAH mixture was compared with gene expression data for in vitro exposure to specific PAH compounds. Gene expression differences were compared between the control and the exposure. These results suggest that metal exposure may have complex, differential effects on the immune- 
and stress- responses of species and can potentially provide a mechanism for identifying the 
specific stressors responsible for changes in gene expression. The present study aimed to 
continue using oysters transplanted to a polluted estuarine environment so that their exposure profiles can be analysed in the same way.

WE 127
The use of molecular responses of crayfish Procambarus clarkii as biomarkers of cadmium and uranium contamination
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Crayfish are widely used as experimental organisms to test the effects of environmental contaminants in both short-term and long-term exposure. They are considered good models for assessing the environmental impact of contaminants due to their high sensitivity to pollutants and the integration of different physiological responses. These organisms have been used to study the effects of metal exposures, and many studies have reported metal-induced changes in gene expression, including the induction of stress- and defense-related genes. In this study, we aimed to evaluate the use of molecular responses of the European crayfish, Procambarus clarkii, as biomarkers of cadmium and uranium contamination in the environment. We assessed the expression of genes involved in metal toxicity, including cadmium-responsive genes and genes involved in oxidative stress responses. These genes were selected based on previous studies that have identified their expression in response to metal exposure. The gene expression profiles were obtained using real-time quantitative PCR (qPCR) in samples collected from different locations. The results showed significant changes in the expression of these genes in response to cadmium and uranium exposure. The findings suggest that the use of molecular biomarkers can provide valuable information about metal contamination in the environment and can be used to assess the impact of metal exposures on aquatic ecosystems. However, further studies are needed to validate these findings and to develop standardized methods for monitoring metal contamination using molecular biomarkers.

References:

WE 128
Combined Cu-temperature effects in the Mediterranean mussel Mytilus galloprovincialis: a biomarker approach
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Combined Cu-temperature effects in the Mediterranean mussel Mytilus galloprovincialis: a biomarker approach

WE 129
Using metalomarkers to identify class-specific changes in Chironomus terpneri larvae exposed to metal and non-metal contaminants
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Metabolomics can be defined as the analysis of the complement of small molecules associated 
with a given biological system. Metabolomic analysis is based on the underlying biochemical 
response of an organism following exposure to chemical or non-chemical stressors. The aim of the first experiment was to establish whether metalomarkers techniques (Nuclear Magnetic Resonance spectroscopy (NMR)) could measure the metabolic profile of third instar Chironomus terpneri. Results showed that a suite of metabolites in C. terpneri larvae could be measured, such as purine, valine and histidine, from a number of biochemical pathways. A second study was conducted to investigate whether metal-specific changes in the metabolic profile of C. terpneri larvae could be identified following exposure to metal and non-metal contaminants. Third instar C. terpneri larvae were exposed to two sub-lethal aqueous concentrations of zinc, chloride, copper sulphate and ammonium chloride for 24 hours. Larvae were sampled after 2 and 24 hours expo-
sure. These exposures were repeated three times to ensure there was enough tissue for the analyses (based on results from the pilot study). There were three replicates per treatment, per time pe-
riod (2 and 24 h) for each metal and at the start of the experiment. Changes in the metabolic profile following exposure to metals and non-metals are linked to the different mechanisms of toxicity of these chemicals. The value of this technique for evaluating ecotoxicological pollution impacts in aquatic ecosystems and understanding the mechanistic basis of pollution responses will be discussed.

WE 130
Using the genotoxicity biomarker micronuclei piscine in Bathygobius soporator (Valenciennes, 1873) (Teleostei, gobidae) in the coast of Salvador (Ba), Brazil
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The aim of this study was to use the genotoxicity biomarker through micronucleus test in Bathygobius soporator in an urban coast environment. Herein we evaluated the metals Cr, Cd, Mn, Pb, Hg, Zn and 16 polycyclic aromatic hydrocarbons in the sediments. The dissolved oxygen, the pH and tide pools temperature were measured as well. Micronucleus analyses were carried out on peripheral blood lymphocytes of Bathygobius soporator. There were significant differences (p<0.05) in the frequencies of micronuclei between the negative and positive controls and the treatments (ANOVA one-way). Significant correlation was observed (r = −0.743, p = −0.023) between average frequency of micronucleus and the first axis of principal components analysis (PCA), which explained most of data variation (70.56%). We concluded that there was a correlation between the micronucleus frequency and metals. The technique was effective in demonstrating cellular changes in B. soporator, that together with the correlation indicate stress conditions for the fish.

WE 134
Cadmium adsorption in soils employed for pasture and sugarcane plantation with and without vineasse application from Northwest of Sao Paulo State, the main sugarcane producer of Brazil
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The northwest area of São Paulo state (Brazil) has been presenting an expansion of the sugarcane culture in the last years (responsible by 18% of Brazilian ethanol production), where the vinasse application has been a common practice. Vinasse is a subproduct (wastewater) of sugarcane in-
dustry. Cadmium has been a metal present in some investigation in environmental compartments in this region. Adsorption plays a key role in the remediation areas studies, since each soil has its own adsorption capacity. Thus, the main objective of this study was determine adsorption capacity for cadmium (II) in three different soil types (natural soil, agricultural soil and soil from sugarcane plantation with and without vineasse application) and to determine if there are differences in adsorption at metals adsorption capacity. For this, soils samples were collected and homogenized employed official methods. The parameters pH (H2O, CaCl2), organic matter content, potential acid-
ity, content of Ca2+, Mg2+, Al3+, Na+, K+, cation exchange capacity; CaCl2, and total contents were quantified in each soil samples. Soil cadmium (II) adsorption capacity were obtained by batch experiments with metal concentration ranging from 0 to 200 mg L−1 for Cd.
WE 135 Characterization of soil trace metal availability : DGT and kinetic extraction vs. conven- tional sorption models for cadmium and Pb extraction in soil and sediment

WE 136 Selective binding target heavy metals using imprinting technique

WE 137 Measuring mercury speciation in multi-component solutions using Donnan membrane technique

WE 138 Relationship between metals bioavailability and ecotoxicity in Catalan (Spain) river waters

WE 139 Complexation of nickel by natural ligands and influence on Ni bioavailability in aquatic eco- systems - kinetic considerations

WE 140 Effect of copper exposure on the activity of Na+/K+-ATPase in Eisenia fetida coelomocytes

Langmuir and Freundlich isotherms models were employed to obtained cadmium adsorption. It was observed that the Langmuir model fit better than the Freundlich model [II]. The increasing of pH showed a positive correlation to the adsorption, while the ionic strength showed a negative correlation to the adsorption. Sorption maximum capacities of cadmium (II) per gram of soil found were 2.5 mg/g; 0.7 mg/g and 2.5 mg/g respectively for natural, with and without N Manouchehri1, ML Nguyen Thi1, S Besancon1, LA Lê2, A Bermond1

It can be concluded that vinasse application decrease soil adsorption capacity turning of soil found were 2.5 mg/g; 0.7 mg/g and 2.5 mg/g respectively for natural, with and without N Manouchehri1, ML Nguyen Thi1, S Besancon1, LA Lê2, A Bermond1

Characterization of soil trace metal availability : DGT and kinetic extraction vs. conventional sorption models for cadmium and Pb extraction in soil and sediment

A significant retardation factor was introduced to account for this retardation of Hg in membrane, but it could only help to solve this problem in some degree.

Effect of copper exposure on the activity of Na+/K+-ATPase in Eisenia fetida coelomocytes

Thereafter, specimens of E. fetida were exposed to CuSO4 1 µM using the standard acute toxicity test "Filter paper test" for 48 hours. A significant (P<0.05) increase of cadmium desorption was observed in the coelomic fluid with respect to the control group paralleled by a significant (P<0.05) inhibition of Na+/K+-ATPase activity.

Furthermore, the extractive schemes and DGT techniques are scarcely compared in the literature. In this paper, a comparative study is proposed for estimating the potential availability of Pb and Cd in three polluted urban and industrial sites of old Hanlo in Vietnam. A modified BCR sequ- ence extraction was employed to assess single and DGT technique respectively for Cd and Pb used. The kinetic behaviour of Cd and Pb desorption in soil/EDTA systems were compared with metal concentrations extracted within different steps of BCR scheme and those transferred from the soil solid phase to the resin sink in DGT probes. Kinetic parameters like as kinetic constant extraction rate and sorption maximum capacities of cadmium (II) per gram across board were obtained for each metal. Diferent kinetic trends have been observed for Pb and Cd.

The principle of "adjustment"of humic-based polymeric complexes by the substrate (template) on the stage of their synthesis of formation of three dimensional structure and further selective binding of the heavy metals and radio-nuclides from migration cycles. The point is in the recognition and binding of ions of those metals, which were used as template ions in the synthesis of macro-complex. The principle of the Molecularly Imprinted Polymer (MIP) production is the formation of HAA based crosslinked copolymer, corresponding to the cross- linking of their chains, that allows to fix the conformations of the molecules favourable for the binding of these ions. It will result (after the removal of template ions) in the growth of sorption capacities and increases the rate of sorption on the polymer's surface. MIPs are used for the selective binding of strontium ions in the regions contaminated as a consequence of Chernobyl disaster, adjusted polymeric sorbents on the basis of co-polymers of diacrylate and ethylene glycol, etc.

The Donnan membrane technique has the advantages of simultaneous measurement of different elements in a single sample and it has less disturbance and interference of the sample equilibrium than most other methods. Even though the Donnan membrane technique has been applied successfully to measure several free metal ions in the environmental systems, it has never been used for mercury species determination yet. Therefore, we tested the application of DMT to mercury measurement using imprinted and non-imprinted polymer solutions were conducted to determine the potential availability of each metal. Different kinetic trends have been observed for Pb and Cd.

The results showed that mercury species in solutions containing different ligands can be measured by a dynamic DMT approach at various pH values and ion strengths with a high agreement of calibration and measured mercury species. However, the most important factor which restricts the applicability of DMT to mercury species measurement is mercury adsorption to the cation exchange membrane in the form of Hg2+,

Hg(OH)2 and Hg(OH)2H2O. This restriction can be partly solved by shortening sampling time and adding ligands to the acceptor side which completely suppresses the mercury adsorption. It was found that when 0.01 M CaCl2 was used as background solution, HgCl2, HgCl3- were main contributors to the flux of Hg through the exchange membrane. The rate-limiting step of Hg transport from donor side to acceptor side is Hg diffusion in the membrane. The strong chemical adsorption of Hg in the membrane besides electrostatic adsorption of Hg, which plays an important role restricting the applicability of DMT to Hg species measurement. The chemical adsorption of Hg can be reduced by shortening the sampling time and Hg species in the donor side can be calculated using the dynamic DMT method. 0.002 mol L-1 Ca(NO3)2 was also tried as background solution in which Hg2+ or Hg(OH)2(OH)2 were dominant Hg species depending on solution pH. A much stronger Hg sorption phenomenon was observed compared with HgCl2-CaCl2 solution. The Hg loss in the donor side was more than 90% because of strong chemical Hg adsorption on the cation exchange membrane. A retardation factor was introduced to account for this retardation of Hg in membrane, but it could only help to solve this problem in some degree.

The bioaccumulation experiments were conducted at environmentally realistic concentrations of Ni (5 to 15 µg L-1) in natural water. We varied the speciation by adding different type of ligands (EDTA, humic acids, natural organic matter). Bioaccumulation kinetics was monitored from Ni bioaccumulation in mosses modified Ni speciation in water. After a 5d exposure, bioaccumulated Ni in mosses was measured too. The analysis of statistical data and the bioavailability of Ni in mosses was to be used for the ecological risk assessment.

Finally, we tested the application of DMT to mercury measurement in multi-component solutions which contain different mercury species depending on solution pH. A much stronger Hg sorption phenomenon was observed compared with HgCl2-CaCl2 solution. The Hg loss in the donor side was more than 90% because of strong chemical Hg adsorption on the cation exchange membrane. A retardation factor was introduced to account for this retardation of Hg in membrane, but it could only help to solve this problem in some degree.

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The results showed that mercury species in solutions containing different ligands can be measured by a dynamic DMT approach at various pH values and ion strengths with a high agreement of calibration and measured mercury species. However, the most important factor which restricts the applicability of DMT to mercury species measurement is mercury adsorption to the cation exchange membrane in the form of Hg2+,
In situ validation of chronic biotic ligand models of Cu, Ni and Zn with caged Daphnia magna

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Twelve brooks covering a range of metal concentrations (PEC/NEC from <1 to 80) were selected for validation of chronic biotic ligand models of Cu, Ni and Zn in a complex outdoor multi-contaminant environment. The sites were located in the Donnel catchment in The Netherlands, which is historically contaminated with metals due to the activities of zinc smelters. Data of other organic and anorganic contaminants and general water quality parameters were also taken into account. The effects of other organic contaminants were of minor importance since sites were located in semi-natural areas, dominated by forest and heathland alternated with pastures and maize culture.

Four cages on each site with 20 juveniles of Daphnia magna were exposed to natural outdoor conditions for three weeks. Survival and reproduction of Daphniids were determined after three weeks. Contents of Cu, Ni, Zn as well as Co, Cd, Se, Ca, Mg, Fe and Mn were determined with HR-ICP-MS. The level of expected metal risks is reduced by application of the biotic ligand models. The level of observed effects on Daphnia reproduction corresponded well with the effects predicted by the added risk of metals (corrected for bioavailability). The explained variance further improved by taking into account the pH,DOC,Po4 and O2. Results of this experiment including accumulation data will be presented on the poster.

Models characterizing the nickel bioavailability in Gammarus pulex and influence of water cationic composition

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Nickel (Ni) is a common contaminant in freshwater bodies because of its industrial and domestic applications and potential ecological and economic consequences. Although, chemical analysis allows to determine the total contamination levels in freshwater, they do not give information on the bioavailability of the metal and consequently, on its toxicity and impact of environmental health. The bio-dynamic and saturation models characterizing the metal bioavailability offer promising perspectives to predict the metal bioavailability in freshwater. However, the accumulation strategies have to be defined for each metal/organism couple in controlled conditions to construct these models.

This study aims at assessing the waterborne bioaccumulation of Ni and the influence of geochemical properties of water on this process in a crustaceans widely distributed in Europe, Gammarus pulex. In the laboratory, the organism was exposed to several concentrations of Ni (from 0.001 to 100 mg L⁻¹) in aquatic microcosms. Then, bioaccumulation of Ni was recorded in waters exhibiting similar concentrations of three major ions (Na⁺, Mg²⁺ and Ca²⁺). Our results showed that G. pulex was greatly tolerant to Ni (LC₅₀> 477 mg L⁻¹). Time course experiments allowed to construct the bio-dynamic model by determining the uptake (kₑ) and elimination constant (kₑ′). For the exposures above 1 mg L⁻¹, the metal uptake saturated. Thus, the maximal capacity of organism to accumulate the metal (1/kₑ) and the half-saturation constant (Kₑ) were determined to establish the saturation model. It was verified that the two models are comparable for the lowest exposures (< 0.1 mg L⁻¹), with kₑ/kₑ′ = Bmax/Kₑ. Furthermore, only an increase in the concentration of Ca decreased the bioaccumulation whereas Na and Mg had no effect under 80 mg L⁻¹.

This study reports for the first time the bioaccumulation of Ni in G. pulex and suggests that this crustacean could be used as an integrative tool to quantify the Ni bioavailability in freshwaters. Taking into account the geochemical factors influencing the metal bioavailability allows to improve the prediction of bioaccumulation models.

Variability in Cd uptake by Pseudokirchneriella subcapitata among freshwater bodies containing dissolved organic matter with contrasting characteristics

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The Free Ion Activity Model (FIAM) predicts that the free ion is the preferred species for uptake from natural waters with geochemical composition. It has been shown previously that FIAM does not hold for the cadmium (Cd) uptake by the green algae Pseudokirchneriella subcapitata. The Cd uptake increased in the presence of inorganic (e.g. Cl⁻) at the same free Cd²⁺ activity. Here, we investigated the influence of natural dissolved organic matter (DOM) and synthetic ligands (e.g. NTA, EDTA) on the Cd uptake by green algae. Eighteen freshwater samples of natural, agricultural and urban areas were isolated by reverse osmosis. The waters were analysed for ionic composition, DOC concentration, SUVA and metal binding capacity. The Cd binding DOM properties per unit C varied tenfold among the different freshwater samples. The DOC concentration varied also a factor tenfold among waters. This suggested that both DOC quantity and DOM quality are equally important to predict Cd availability. We exposed algae for 4 days to different DOM samples and synthetic ligands at a constant free Cd²⁺ activity. The Cd concentration in the DOM/ synthetic ligands was 25 to 200 fold higher than in DOM/ synthetic ligands than in absence of complexes, in contrast with FIAM that predicts no change. As a result, Cd uptake by green algae increased with increasing metal binding capacity of the freshwater DOM samples.

Relevance of water chemistry to assess lethal and sublethal effects of metals using Daphnia magna

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Daphnia magna is a common freshwater cladoceran for toxicological tests. The aquatic toxicity of metals is a current and widespread environmental problem. The toxicity of metals is known to be dependent on the water chemistry parameters (pillar of the Biotic Ligand Models). The majority of the existing works focus either on the acute or chronic toxicity of metals. However, few models, integrating water chemistry, address the toxicity of metals on feeding activity. The feeding activity constitutes a sensitive indicator of toxicity and is an ecologically relevant endpoint. In this study, we worked the relative importance of hardness and alkalinity in the toxicity of copper and zinc to the feeding activity of Daphnia magna. Concomitantly, we studied the effects of both these chemical parameters on the acute lethal responses. The establishment of functional relationships between water chemistry-metals and the feeding rates in D. magna is essential to provide a better and more realistic understanding of potential long-term effects of the metals on cladocerans under ecologically relevant conditions. Both hardness and alkalinity were found to influence the lethal and sublethal effects of metals, although the effect of the former was more relevant. Additionally, regression analysis showed that the toxicity of copper and zinc was well described by these water chemistry parameters.

Mitigating effects of humic substances in the polluted environments caused by chemical binding to ecotoxicients

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Humic substances (HS) are natural organic compounds comprising 50 to 90 % of the organic matter of peat, lignites, sapropels, as well as of the non-living organic matter of soil and water ecosystems. Being the products of stochastic synthesis, HS have elemental compositions that are not constant, and structural properties. Thus, the toxicity of humics in soils is typically on the order of thousands of years. This is of particular practical relevance if objective is to develop soil/aquifer remediation technology predicated on a recalcitrant matrix derived from HS. The complex structure provides a very diverse reactivity of HS. They are able of binding both heavy metals and organic xenobiotics. The most common metal binding occurs via carboxylic and phenoxylic acid functional groups. However, metal binding mechanisms between organic contaminants and HS include hydrogen bonding, van der Waals forces, ligand exchange, and charge transfer complexes representing weak binding energies and formation of covalent linkages representing chemically stable bonds. The binding to HS causes a change in speciation of heavy metals and organic xenobiotics folowed by a change in their toxicity and bioaccumulation.

The goal of the research was to develop detononized of integrated effect on the basis of humic substances and to conduct the feasibility studies on their production. 8 samples of parent humic materials with chemical-based toxicticants have been synthesized. The experimental approaches undertaken to produce humic-based de-toxicants included enrichment with different groups (O, OH, CO, hydrophobic groups). It has been demonstrated from both chemical characteristics and detoxifying ability point of view that all the produced de-toxicants possessed equal or higher detoxifying potential in relation to heavy metals or herbicides. Derivatives of humics have been studied at both express bioassay, laboratory vegetation experiments and field trials scales as well. All the experiments confirmed not only high detoxifying potential of those de-toxicants in relation to heavy metals but also their prolonged activity in the environment. Producing of the above de-toxicants at pilot plant scale demonstrated an opportunity to synthesize them at industrial scale.

Assessing fate and toxicity of copper from re-suspended sediments in rainbow trout (Oncoeleius mykiss)

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Sediments can act as a sink as well as a source for environmental pollutants. One interesting field of recent scientific studies is to investigate possible ecotoxicological effects due to the uptake of re-suspended particles and contaminants during flood events. In this work, juvenile rainbow trout (Oncorhynchus mykiss) were exposed to re-suspended natural sediments from Ehrenbreitstein (Hunsrueck) spiked with copper at a nominal concentration of 500 mg kg⁻¹ dry weight. For thermore a control test without spiking was used in this experiment. Samples of water, suspended particles, fish tissues and livers were taken at days 0, 1, 2, 3, 6, 8, and 12. The aims of this study were twofold. The first approach is to look into the connection of copper between the compartments of suspended particles and fish tissues using different methods of digestion (UV, microwave) and ICP-MS. Secondly biomarkers, i.e. measurement of lipid peroxidation, as an indicator for oxidative stress, and quantification of metallothionein using Western immunoblottting, as an indicator for metal accumulation will be investigated. All experiments, which are currently being conducted. The RWTH Aachen University Undergraduate Fund Programme provided funding for performing ICP-MS analyses at the University of Heidelberg by a personal travel grant to the first author.

Effect of DOC concentration and type on the bioavailability of copper in Lambari River (Italy)

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The interaction with physicochemical parameters, including pH, hardness, cationic competition and dissolved organic carbon (DOC), greatly affects the toxicity of metals to aquatic organisms in freshwater. Standard procedures for deriving environmental quality criteria are recognized inadequate, since toxicity data generated by tests set-up using standard media may be poorly representative for assessing metal toxicity in surface waters. The water-effect ratio (WER), based on the direct ecotoxicological evaluation of metal toxicity in site-water, is the only approach which represents the toxicity of metals to aquatic organisms in freshwater systems with different chemical composition. Since important changes of the river water composition are expected to occur downstream of the course of rivers draining highly anthropized areas, the aim of this work was to evaluate changes of metal toxicity over the River Lambro, which drains one of the most densely populated area of
Northern Europe. The experimental design was mainly focusing on the complexing properties of DOC, as differently affecting the toxic bioavailability of copper over the river-course. The ecotoxicological WER procedure, involving the simultaneous evaluation of Cu toxicity in river-water and in standard water, was used to first generate toxicity and predict the toxic bioavailability of organic ligands by SPE extraction of the downstream samples also proved the protective role of DOC and organic matter in controlling toxicity. The obtained results highlight the importance of the WER-derived information to improve predictive models for metal bioavailability, suggesting to take account of the effect of DOC type.

WE 148 Spatial and temporal variation in bioavailability and species sensitivity of Cu, Ni and Zn in surface waters of The Netherlands

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Geographical and temporal variations in metal speciation were calculated and water-type specific sensitivities were derived for a range of aquatic species, using surface water chemistry data that cover almost all WFD-surface water types in The Netherlands. Biotic ligand models (BLMs) for Cu, Zn and Ni were used to extrapolate chronic NOECs determined in test media towards site-specific NOECs for 672 sites sampled repeatedly over 2007–2010. Site-specific species sensitivities were derived for reference sites and the aquatic community of each river-crossing was characterized for Cu, Ni and Zn. The spatial and temporal variations of aquatic toxicity assuming the chemical exists in dissolved and particulate phases and, for metals, that all dissolved species are equally bioavailable. This treatment of metals, similar to organic chemicals, introduces a significant error in their estimates of hazard ranking since metal bioavailability and toxicity effects are related to totally dissolved phase and free metal ions within it, not the total dissolved phase. We previously addressed this concern by introducing a Bioavailability Effect Factor (EF) for metals are calculated using the Biotic Ligand Models (BLMs) to correct for water-type specific bioavailability to aquatic organisms. However, the method approach is currently limited to cationic metals for which BLMs are available (e.g., Ag, Cu, Ni, and Zn). To address this issue, we extended the method of calculating CTPIs by proposing the use of the modi- fied Multi Metal Tool (MMT) to replace BLMs for other metals. We developed and resulted in useful tools for several distinct water-types around the world to show that the variations between the estimates from the two models are within the reasonable range for the purpose of hazard ranking and risk assessment. The results stress that it is more important to select a generic freshwater archetypes on which the analysis should be based than the type of ecoxotoxicity model itself. We then applied the extended method to calculate CTPIs of metals like B, Cd, Co and Pb for which the BLMs are not publicly available yet. We present the variability in CTPIs of these metals using the aquatic chemistry of several global freshwater systems.

WE 153 Development of a methodology for the ecotoxicological analysis of air samples. Correlation with the chemical pollutant levels.

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4As the human being is exposed to multiple environmental chemicals, rather than to specific agents. Pollutant mixtures may pose important adverse health effects, not only because of the effects of individual substances, but also as a result of the potential synergies/antagonisms among them. Despite that, and because of the difficulties to access the hazard potential of these mixtures, regulations measures to control the levels of pollutants are traditionally focused on determining the levels of contaminants individually. Air inhalation is known to be an important exposure pathway to some chemicals, such as heavy metals, and polyphenol-containing dioxins and dibenzofurans (PCDD/Fs). In recent years, a number of surveillance programs have been performed in order to monitor the air quality in industrial (close to incineration and cement plants) and urban areas in Catalonia (Spain), which are the most critical. Mn, Ni, Pb, Ti, U, and V, PCDD/Fs as well as particulate matter (PM10), obtained by means of high-volume active sampling devices, are available. However, an assessment of the exposure to air pollutants has not been carried out from an integral point of view; this is health risks have not been characterized from a toxicological point of view. Microorganisms that are able to use the bioluminescence of bacteria is a suitable method to evaluate the ecotoxicity of environmental samples. Although it has been largely used in aquatic and solid extract studies, its applicability in other environmental compartments has been merely occasional. The objective of the present study was to develop and validate a Microtiter-based ecotoxicological method to evaluate the air quality. To obtain a first approximation of air samples ecotoxicity, the light emission was measured when the organisms were exposed to the PM10 retained in Quartz Fibe Filters (QFF) from different ar- eas of Catalonia. The suitability of combination different solvents with different polarity such as, ethanol, methanol, acetone, or water was firstly checked and compared with correspond- ing QFF acid extracts neutralized with NaOH. Furthermore, toxicity values were correlated with the levels of metals, PCDD/Fs and PM10.

WE 154 Challenges for the ecological assessment of organometallic substances under the Canadian Environmental Protection Act, 1999

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As part of Canada’s commitment to address the ecological and human health risks associated

Over the last years, the use of silver in consumer products has rapidly increased. Most of these applications are in the form of nano-silver, which is used as an antimicrobial agent in many con- sumer products. This increased use is expected to lead to increased emissions of silver into the environment. The current water quality standard (QS) for silver in the Netherlands originates from 1999. In view of the expected increase in environmental concentrations, updated QSs for silver and other metals are needed. The predicted risks due to nickel in surface waters also follow general environmental concentrations can vary from 2 ng/L to 2 µg/L. This means that the background levels will have a significant influence when compliance to the new QSs needs to be evaluated.
with chemicals in commerce by 2020, Environment Canada needs to assess the ecological risks of these pollutants. It is important for companies to engage the international community, researchers, stakeholders and partners to refine the evaluation methodology for organometallic substances.

WE 155
Empirical model of As bioavailability to earthworms, Eisenia fetida: approaches using geochemistry of soils
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Arsenic contamination in soils has been linked to the toxic properties of a number of its compounds. Earthworms have been known to bioaccumulate As from soils and have been found to be elevated in As. It is generally known that the inorganic forms of As are more toxic than the organic forms and readily accumulate in living tissues due to their affinity for proteins, lipids, and other cellular components. Geochemistry of soil has been reported to affect metal accumulation in earthworms. Understanding the As bioavailability in earthworms with regard to both kinetics and metabolism and models can help to determine when the bioavailability of metal occurs or becomes toxic. A model is aimed to determine the bioavailability of heavy metals and to group them by their toxicity, accumulation and bioaccumulation. This model, the的新建河流在土壤中的影响的分类

WE 156
Ecotoxicological assessment of catalytic heavy metals leaching from waste fuel cells
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Transportation of heavy metals from fuel cells with many associated environmental impact. Therefore, a lot of hopes are being placed on the future of fuel cells to replace today’s bat- teries. However fuel cells are composed of separator (made from metals such as Fe), electrolyte (made of polymeric materials), electrodes, (carbon) catalysts (metals such as Co, Ni), Leaching of Co, Ni, and other catalytic heavy metals from waste fuel cells poses privacy risk during dumping. This study will be very useful in us for making decisions on the type of fuel cells which should be used in the engineering of environmentally friendly batteries. The industrial Co and Ni toxicity to the Daphnia magna (D. magna) and green alga Pseudokirchneriella subcapitata (P. subcapitata) were used in the assay. Acute 48h immersions with jenavie D. magna (<24 h old) were performed according to the OECD ecotoxicity test guideline 202. Acute 72 h growth inhibition assays with P. subcapitata were performed according to the OECD ecotoxicity test guideline 201. NOCree/C fuel cell catalyst was assessed for their leaching properties based on the test guideline (same test method of the leaching test). The leaching testing method was determined by the use of the freshwater crustacean D. magna. Toxicity of Co and Ni leached from the real fuel cells were also observed with D. magna and P. subcapitata. Our result indicates that the tested fuel cell catalyst was of the toxicity equal to that of D. magna was used in our assay.

WE 157
Assessment of some environmental pollutants in Beni-Suef Governorate, Egypt
K Abd-El-Monsef, BI Ibrahim, MS Housein
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Concentrations of cadmium (Cd), lead (Pb), iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) were assessed in soil, water, rice and Cataphyllium demersum (C. demersum) aquatic plant, and the muscle, gill, liver, blood and kidney of Clarias lazera fish (C. lazera) collected from nine sampling stations (districts), BENI SUEF, El Suef, Basha, Somosta, El-Nasria, El-Nasria and El Ebrahimia canal and two districts located at the east bank of the Nile (Bayed El-Arab and Sanor) in the province of Beni-Suef, Egypt. The concentrations of the metals were determined by Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES). The tissue samples were digested using the hot digestion method (HNO3: H2O2=1:1) and analyzed by the Atomic Absorption Spectrophotometer (AAS). The maximum permitted limits in all the districts. Cd concentration was above the permitted limit, except in Somosta and Nasser, while Zn and Cu concentrations were below the permitted limits in the nine districts. The metal levels in water were compared with national and international water quality standards, and with the literature values reported for rivers and streams. Comparisons were made of the metal concentrations in water and aquatic plants with those in the catfish tissues obtained from the water. The metal concentrations found in the C. demersum aquatic plant samples taken in the nine studied districts were distributed in this order: Mn > Zn > Cu > Pb > Fe > Cd > Ni. The Cd concentration in fish were higher than the water. In fish, metal concentrations in various examined tissues at several levels, but all metal concentrations in muscles (edible part) were below the metal levels in the other organs (inconspicuous) in the fish samples. The concentrations of Cu, Pb and Fe in fish tissues were above the international standard, while the concentrations of Mn, Zn and Cu were below standard. The high concentrations of these metals in water, aquatic plants and fish in

WE 158
Bioavailability of trace metals in contaminated soils (Northern Portugal)
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A chemical sequential extraction of heavy metals (Fe, Mn, Cu, Zn, Pb, Cd, Cr, Ni, Cr, Mo, Co) and As in tailings and soils samples around a few 5/75 min mines (Northern Portugal) was performed according to a new “7-steps” data compilation developed by the author, to Fe oxonides (easily reducible); (4) bound to Fe oxides (moderately reducible); (5) bound to organic matter and secondary Cu-sulfides; (6) bound to primary sulfides; (7) residual. The extracted element contents were measured by ICP-MS. Samples were also analysed for pH, electrical conductivity and organic matter. The results allowed us to notice that: (1) The pH was the main factor for controlling the geochemical distribution of the studied elements. The tailing and soil samples were very acid, with an average pH of approximately 4.37. Some metal cations (Mn, Cd, Cu, Zn, Pb, Cr, Co, Ni) behave in an anomalous way, revealed uptakes accumulated in the most bioavailable fractions (water-soluble and exchangeable fractions). In contrast, oxymon as Mo and As show low mobility through adsorption to Fe(III) oxonides dissolved in the two reducible fractions. These results reflect the pH-dependent adsorption on the clay minerals, Fe and Mn oxonides and the co-precipitation with these secondary minerals; (2) Residual fraction was the most important fraction for Sn, Mn, Cr and Zn. These results suggest that in these soils these elements are in a derivational, non available form; (3) Scavenging of mobilized elements (mainly Fe, Mn, Cu, Zn, Cd, Pb, W, Bi, Mo, Cr, Ni, Co and As) in secondary mineral phases and sulfides could be considered a temporary mechanism of metal retention. These metal fractions are susceptible of being set free depending on some changes of environmental conditions.

WE 159
Monitoring data for trace elements in soil and their use in risk assessment: the GEMAS project
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2Geological Survey of Norway, TRONDHEIM, Norway
3Rio Tinto, LONDON, United Kingdom
4University of Tübingen, TÜBINGEN, Germany
Soil and plant samples taken in the nine studied districts were distributed in this order; Mn > Zn > Cu > Pb > Fe > Cd > Ni. The concentrations of the metals were determined by Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES). The tissue samples were digested using the hot digestion method (HNO3: H2O2=1:1) and analyzed by the Atomic Absorption Spectrophotometer (AAS). The maximum permitted limits in all the districts. Cd concentration was above the permitted limit, except in Somosta and Nasser, while Zn and Cu concentrations were below the permitted limits in the nine districts. The metal levels in water were compared with national and international water quality standards, and with the literature values reported for rivers and streams. Comparisons were made of the metal concentrations in water and aquatic plants with those in the catfish tissues obtained from the water. The metal concentrations found in the C. demersum aquatic plant samples taken in the nine studied districts were distributed in this order: Mn > Zn > Cu > Pb > Fe > Cd > Ni. The Cd concentration in fish were higher than the water. In fish, metal concentrations in various examined tissues at several levels, but all metal concentrations in muscles (edible part) were below the metal levels in the other organs (inconspicuous) in the fish samples. The concentrations of Cu, Pb and Fe in fish tissues were above the international standard, while the concentrations of Mn, Zn and Cu were below standard. The high concentrations of these metals in water, aquatic plants and fish in

El Ebrahimia canal may be the result of both anthropogenic activities producing industrial, agricul-
Assessing the relationship between elimination and detoxification in fish and shellfish exposed to cadmium, copper, and zinc
T. Rues, WY Wei-Yu, S. Shear, CM Chung-Min
National Taiwan University, TAIPei, Taiwan
The purpose of this study was to estimate physiological traits related to Cd, Cu, and Zn bioaccumulation, compartmentalization, and susceptibility in fish and shellfish based on recent published data. The subcellular partitioning was incorporated into metal influx threshold hypothesis to estimate the detoxification rate constant that is based on exposure concentration and elimination rate constant. Then elimination-detoxification relationships were constructed to predict the detoxification capacity by known elimination rate constants. Our results show negative relationship between elimination rate constant and metal in metabolically detoxification pool for all aquatic species exposed to metals. Interestingly, a species-specific difference in relationship of detoxification rate constant and metal in metabolically detoxification pool was found indicating a positive correlation for fish, and a negative correlation for shellfish. We found fish had higher bioaccumulation in metabolically active pool (MAP) when exposed to essential metals of Cu and Zn (54-94%), whereas for Cd, it ranged from 10-50% compared to non-essential metals of Cd. A species-specific difference was also found in relationship between elimination rate constant and detoxification rate constant, indicating fish had negative relationship and shellfish had positive relationship.

The biomonitoring of heavy metals in marine environment with an understanding of the relationship between elimination and detoxification capacities may be applied for environmental risk assessment in the future study.

Applications of non-biting midge larvae (Chironomus riparius) for sediment toxicity testing - a critical assessment
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The non-biting midge Chironomus riparius are routinely used in subchronic (10-day) and chronic (lifecycle) sediment toxicity assessment tests. The chironomid response to stress caused by environmental contaminants may be affected by other factors like organic matter content, age of larvae, or feeding regime. In our studies, we investigated the chironomid responses in 10-day and lifecycle experiments in both artificial sediments and natural sediments collected from several sampling campaigns in the Czech Republic. Further, variability in responses of test organisms originating from different culture lines were evaluated. The chironomids showed high tolerance to contamination in the natural sediments and it was complicated to find a clear correlation patterns between the toxicity results and analytical data of sediment contaminants. Our results of 10-day tests further demonstrate the decrease in chironomid larvae sensitivity to toxicity with their posthatch age. The 2nd instar larvae were at least 100-fold more sensitive than their 3rd instar counterparts, and these differences may be considered during experimental design. We also recorded a significant difference in the absolute values of larvae body length, (sublethal growth endpoint) among individuals originating from different culture lines. In another series of experiments conducted in artificial sediment, application of early life stage tests for bioaccumulation and biomarker assessment was demonstrated. Our results contribute to a critical evaluation of the sediment toxicity testing using chironomids. Various sources of variability have been described, and these should be carefully considered in the experimental design.

Derivation of sediment effect concentration and site specific evaluation of potential ecotoxicity of metals in Korean freshwater sediment
HJ Lee, CK Kim, TW Lee, KH Park
NeOHub Co., BUCHOEN, South Korea
This study was implemented with effective assessment of potential ecotoxicity-related metals-associ- ated metals from Korean freshwater sediment using effect concentration approach (SEC10 and SEC50) showing that the sediment concentration correspond to a 10% and 50% probability of observing sediment toxicity to Hyalella azteca. A total of 540 sediment samples from rivers in 13 cities and counties were collected in July and November 2007, and analyzed for three metals (As, Cr, Ni) and one conservative element (Li) for normalizing the bulk sediment metal data. The average metal concentrations ranged from control sediments with little Ni to potentially highly toxic Ni concentrations and placed in baskets within a streamside mesocosm or flux with the stream bottom. Metal flux measured by DGTs correlated well to total Ni concentrations, but was not affected by AVS, OC, or Mn and Fe oxide concentration. The benthic macronutrients responded to Ni amendment with reduced availability and diversity in abundance of benthic macroinvertebrates. SEM, DGTs and AVS-SEM bioavailability models outperformed the DGT-based models in predicting changes in the macroinvertebrate community. Neither the SEM-AS nor DGT-based models of bioavailability accounted for the protective effects of Fe and Mn oxides, which greatly reduced the bioavailable Ni fraction at later sampling points. These results suggest that for sediments with significant binding capacity (i.e., AVS, OC and Fe and Mn oxides), DGTs may not be the best tool for measuring Ni bioavailability.

Uptake and accumulation of sediment-bound heavy metals and effects on gene expression in zebrasfish (Danio rerio) embryos
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DM Costello, GA Burton, CR Hammerschmidt, WK Taulbee
1University of Michigan, ANN ARBOR, MI, United States of America
2Wright State University, DAYTON, OH, United States of America
3Toxicology Centre, University of Saskatchewan, SASKATOON, Canada
Predicting metal bioavailability and uptake affects the aquatic species exposure to metals. Interestingly, a species-specific difference in relationship of detoxification rate constant and % metal in metabolically detoxification pool was found indicating a positive correlation for fish, and a negative correlation for shellfish. We conducted two manipulative field experiments using Ni-spiked sediments (100 mg/kg (AVS-SEM)) and toxicity tests in zebrafish embryos. In addition, effects of increased oxygen conditions on metal bioavailability, uptake and growth of zebrafish embryos were also investigated in a laboratory study. Despite a gradual improvement of the surface water quality of many European waters, historically polluted sediments still pose an ecological risk to fish species. The toxicity of nickel (Ni) in European freshwater sediments is being evaluated under EU Existing Substances and REACH regulations. We conducted toxicity studies with Ni-spiked sediments and Danio rerio eggs accumulated heavy metals from spiked sediments in concentrations up to a few hundred times higher compared to the spiked concentrations. With a BAF of 275 ± 42, copper spiked to artificial sediment accumulated at significantly greater rates than the other metals. The presence of a mixture of heavy metals reduced the uptake of individual metals. Avian species accumulated toxic elements to a greater extent in embryos exposed to the artificial sediment compared to natural sediment exposure. This is likely due to greater contents of organic matter and bacterial activity which reduce bioavailability of metals spiked to the tested natural sediment. Conforming to this, artificial sediment spiked with zinc and the mixture of metals resulted in significantly higher body weight and length than controls (both MT1 and MT2 as well as hsp70 in zebrafish embryos compared to the control). MT1 showed up to 30 fold changes. Transcript abundance of hsp90α1 was significantly greater after exposure to the natural sediment with cadmium and copper. Transcript abundances of other genes were not altered significantly.
These results were used in an Integrated Sediment Effects Assessment for Ni (see related pre-
sentation by Vangheluwe et al.), which will estimate probable no-effect concentrations for a rea-
sonable worst case scenario (i.e., low-Ni-binding sediment) and develop bioavailability models based on sediment characteristics.

WE 168
Acid-volatile sulfide and simultaneously extracted metals in sediments: results from an inter-
laboaratory comparison and recommendations for obtaining reproducible results
WG Brumbach1, JW Arnot1, EC Roger1ch
1US Geological Survey, United States of America
2Nickel Producers Environmental Research Association, DURHAM, NC, United States of America
Acid-volatile sulfide (AVS) can be an important factor in controlling the bioavailability of certain metals in sediments. However, there are concerns that measurements of AVS and the accompany-
ing simultaneously extracted metals (SEM) are irreproducible among different laboratories. In support of a multi-component research program to determine nickel partitioning behavior and toxicity in sediments, we conducted an inter-laboratory comparison of acid-volatile sulfide and simultaneously extracted metals (SEM, Ni) in spiked sediments. Five independent laboratories participated, but each was provided structured sample preparation and analytical guidelines to perform the measurements. The AVS and SEM Ni measurements from this inter-laboratory study were in close agreement, indicating that reproducible results are obtainable among different laboratories. Recommendations for improving reproducibility are presented and the potential sources of variability will be discussed. In addition, quality control results that span nearly 20 years of SEM AVS analyses conducted at the USGS Columbia Environmental Research Center will be presented.

WE 169
Assessment of bioaccumulation of platinum group metals in a river system in close proxim-
ty to mining activities in South Africa
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1Vetenskapliga Medlemskapet och Societas Rumorviva, GENT, Belgium
2University of the Western Cape, BELLVILLE, South Africa
The emission of heavy and precious metals from mining, smelters and other industrial activities in the South African environment has been receiving considerable attention, due to the potential toxicity of sediments in the laboratory and under field conditions. The goals of the study were (i) to perform the measurements, the AVS and SEM Ni, measurements from this inter-laboratory comparison, and (ii) selection experiments under laboratory circumstances. To distinguish between acclimation and genetic adaptation, only studies in which exposures to Pd were performed with fish populations, i.e. progeny from from parental populations which had been reared in clean water, were considered. The results from these few selection experiments are presented. Selection exper-
tations at which genetic adaptation was reported, were normalized to a water hardness of 50 mg L\(^{-1}\) and evaluated against conventionally derived effect values typically used in risk assessments, such as the HCS. For this study, a median HCS value of 0.43 mg L\(^{-1}\) was calculated, using quality 1 and 2 data from selection experiments performed with parental and a few selection experiments performed with progeny populations. Genetic adaptation in field populations of the dipteran Chironomus riparius was reported in a concentration range of 6.69 mg L\(^{-1}\) to 27.8 mg L\(^{-1}\), well above the HCS value. Adaptation in evolu-
tion experiments under laboratory circumstances was detected for the dipteran Chironomus riparius, where a C. elucidus forma at 100 and 350 mg L\(^{-1}\), respectively. Different strains of the gastro-
pod Biomphalaria glabrata evolved an increased Cd tolerance in the concentration range of 2.58 mg L\(^{-1}\) to 10.35 mg L\(^{-1}\). Finally, genetic adaptation in Daphnia magna populations was observed in the range of 6.68 mg L\(^{-1}\) to 24.6 mg L\(^{-1}\). In addition, a potential for genetic adaptation was pre-
dicted at 1.4 mg L\(^{-1}\) in 4 out of 5 field populations of Zostera marina.

WE 170
An integrated effects assessment of nickel in freshwater sediments
SJ Gomes1, CG Van Dusschoten1, J Bossi1, WG Brumbach2, CG Ingerson1, GA Burton1, E Ro-
gевич1, C Schlekat4
1Interdisciplinary Centre of Marine and Environmental Research, PORTO, Portugal
2Faculty of Science, Ankara University, Dept. Biology, ANKARA, Turkey
Aquatic invertebrate populations from chronically contaminated sites may adapt to pollutant-
induced toxicity. Carcinus maenas is a common inhabitant of the estuaries of rivers Lima and Minho in Portugal. The Lima estuary appears to be less sensitive to Cd than the reference population, probably due to an adaptation induced by chronic exposure to metal contamination.

WE 171
Sensitivity to cadmium of Carcinus maenas populations from two NW Portuguese estuaries with different levels of contamination
MB Magalhães, FS Filipe11, G Liguerrimo1, L Guiñá1
1Interdisciplinary Centre of Marine and Environmental Research, PORTO, Portugal
2Faculdade de Ciência, Ankara University, Dept. Biology, ANKARA, Turkey
Aquatic invertebrate populations from chronically contaminated sites may adapt to pollutant-
induced toxicity. Carcinus maenas is a common inhabitant of the estuaries of rivers Lima and Minho in Portugal. The Lima estuary appears to be less sensitive to Cd than the reference population, probably due to an adaptation induced by chronic exposure to metal contamination.
Ameliorative effect of Moringa oleifera, activated charcoal and charcoal on lead toxicity in wistar rats F Ernst1, AT Peter2, NO Orele1, TM Ahmed1, MD Matari1, IS Sunday1

1University of Buea, BUEA, Cameroon
2National Veterinary Research Institute, Vom, VOM, Nigeria

Methylmercury cycling in the Pacific Ocean has garnered significant attention in recent years, especially in regard to rising mercury emissions from Anthropogenic sources. The existence of which in biota may have resulted from increases in anthropogenic emissions over time. To address this, we assessed historical and recent mercury exposure in an endangered seabird, the Black-footed Albatross (Phoebastria nigripes), using feather samples from museum specimens spanning the past century. We additionally analyzed the carbon and nitrogen isotope (δ13C to δ15N) for controlling factors in trophic structure. A significant positive association with methylmercury exposure. Changes in methylmercury levels were consistent with historic global and recent regional increases in anthropogenic mercury production, and mercury toxicity may undermine current and future reproductive efforts in the species.

Ameliorative effect of Moringa oleifera, activated charcoal and charcoal on lead toxicity in wistar rats F Ernst1, AT Peter2, NO Orele1, TM Ahmed1, MD Matari1, IS Sunday1

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In this present study, we evaluated the efficacy of Moringa oleifera aqueous leaf extract, activated charcoal and charcoal in treating lead induced toxicity in wistar rats.

Materials and Methods
The rats were divided into 5 groups of 10 rats. An oral daily dosage of 1000 mg/kg body weight of M. oleifera acetate treated groups while one of the groups was allowed untreated. On day 21, all the remaining rats were sacrificed. During and after the administration period, rats were examined for clinical signs, body weight changes, serum biochemistry, haematological parameters and histopathological lesions.

Results and Discussion
Lead acetate significantly decreases body weight, aspartate aminotransferase, alanine aminotransferase, and red blood cells count. Gamma glutamyl aminotransferase, mean corpuscular volume, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration were increased. Histopathological data revealed damages in the liver, brain, muscles and kidneys. Activated charcoal and M. oleifera showed ameliorative effects in the haematology, serum biochemistry and histopathological analysis.

Conclusion
Our results suggest that M. oleifera aqueous leaf extract and activated charcoal can treat lead induced toxicities.

Acknowledgment: The authors thank the Africa Education Initiative Mystic, USA and the National Veterinary Research Institute, Vom, Nigeria for funding the project.

ET15 - New developments in aquatic macrophyte testing, higher risk classification and aquatic macrophyte testing, higher risk classification and aquatic macrophyte testing, higher risk classification and aquatic macrophyte testing, higher risk classification and aquatic macrophyte testing, higher risk classification
ME Sáenz1, WD di Marzio1, JL Alberdi2

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2Universidad de Ancash ‘Santiago Antúnez de Mayolo’, HUARAZ, Peru

184 Ecotoxicity of glyphosate Glyphosate used in tolerant transgenic soybean cultivation in Pampas Region (Argentina) to aquatic macrophyte and microalgal phytoplankton

ME Sáenz, JD Perez1, ML Menone2, EL Camadro3, EA Madrid4

1Universidad de Buenos Aires, Buenos Aires, Argentina
2Lab Ecotoxicología-UNLP-CONICET, MAR DEL PLATA, Argentina
3Lab Toxicología-UINFAP-CONICET, MAR DEL PLATA, Argentina
4Universidad Nacional de La Plata, CONICET, La Plata, Argentina

glyphosate used in this local aquatic ecosystems, is as follows: first, the herbicide is spread directly over the aquatic systems with inside or near the cultivation areas. The recovery and detection of early effects from the action of this pesticide is fundamental especially on primary producers, due to be an essential trophic level of any ecosystem, because it provides the basic energy for food webs in aquatic systems. The aquatic macrophytes and microalgae were used in this study as well, as all species of green microalgae were used in this assessment. Different endpoints were used (biomass, growth, physi passwords, and stress, and toxic induced endpoints) to measure the length growth of submerged rooted macrophytes, as required in the test procedures underlying EU Regulation 1109/2009/EC.

WE 185 Comet Assay in seeds of the emergent aquatic plant Bidens laevic. L. exposed to the insecticide endosulfan

DJ Puey1, M. Menone2, EL Camadro3, EA Madrid4

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The present study was therefore to evaluate the effect of environmental drivers on benthic macroinvertebrate community composition in Andean streams in Peru. At the high altitude sites (4000 meters above sea level, m.a.s.l.) UV-B radiation was more than two-fold higher than at lower sites (3000 m a.s.l.). At lower sites metals concentrations were two-fold higher than at reference sites, with Cumulative Criterion Units predicting altered community composition. Principal Component Analysis of physical and chemical variables showed that the reference sites were influenced mostly by UV-B radiation and the polluted sites by metals. Canonical Correspondence Analysis indicated a strong influence of UVB in structuring communities at reference sites, and of metals at polluted sites. Under the most extreme metal and UV-B conditions only mites and chironomids persisted, while under less extreme conditions a replacement of sensitive taxa by tolerant ones sustained a high faunal diversity. It is suggested that innate rock grinding high up in the Andes together with the high UV-B radiation regime modulate benthic macroinvertebrate community composition.
and promote changes in their fitness and decreasing its reproductive performance, besides energy reserves could be consumed in order to deal with the energetic requirements for detoxification.

With the aim of assess how age specific requirements are modified by a toxicant, seven age groups (0, 3, 5, 7, 14, 21 and 28 d) were exposed during 24 h to sublethal concentrations of hexavalent chromium. With the aim of assess how age specific requirements are modified by a toxicant, seven age groups (0, 3, 5, 7, 14, 21 and 28 d) were exposed during 24 h to sublethal concentrations of hexavalent chromium. 

L. Dijkstra1, A. Nordhaus1, P. Khrycheva2, Y. Sivatharan2, E. Yuwono3, T. Jennerjahn1, J. Nilin1, AQ Silva1, S. Loureiro2, AMVM Soares2, LV Costa-Lotufo1

WE 195

Biochemical and genotoxic effects of natural blooms of cyanobacteria and Microcystis aeruginosa, containing microcystin, on the freshwater fish Prochilodus lineatus

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Biochemical and genotoxic effects of natural blooms of cyanobacteria and Microcystis aeruginosa, containing microcystin, on the freshwater fish Prochilodus lineatus
polychlorinated dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), caprolan- miphenyls (PCBs), hexachloro-cyclohexanes (HCHs), dichlorodiphenyltrichloroethanes (DDT) and organochlorine pesticides. The concentration of PCDD in soils was detected slightly for in comparison than European studies. The level of PCB was higher than PCDD and PCDH but the TEQ values were similar. The DDT concentration was observed really high because of the heavily agriculture and may effect from neighbour countries.

**WE 199**

The determination and source of DDT pollution in Turkish soils C Turgut1, TJC Cutright2, LA Atatanir1, SM Mermer1, MU Usluy1

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2Department of Evolutionary Biology, University of Florence, FLORENCE, Italy

Soil samples were collected from 0-30 cm depth and analyzed by GC/MS/MS. o,p-DDT and p,p-DDT were detected at 16.2% and 17.6% of the sites in the 0-30 cm depth of soils. In the 0-60 cm top depth, p,p-DDT (14.9%) and p,p'-DDE (8.1%) and p,p'-DDE (2.7%) were found in soil samples and p,p'-DDE was the most prevalent with 95.5% of the sampling sites. The dominant source of DDT particularly in the 60-90 cm depth was due to historic use of DDT. The presence of p,p'-DDE, o,p'-DDE and p,p-DDT in the topsoil was attributed to recent application.

**WE 200**

Chemical assessment of organochlorine pesticides and polychloro biphenyls residues in sedi-

ment and post mortem tissues from Rio de Janeiro, Brazil

JR Guedes1,2, JR Rendón von Osten1, SN Abreu1, FM Morgado1, AMV Soares1

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2Centro EPOMEX: Centro Universitario de Campeche. Av. Augustín Melgar y Juan de I, CAMPECHE, MEXICO

In the European Union (EU) about 3000 different substances are used in human medicine such as anaglesics and anti-inflammatory drugs, contraceptives, antibiotics, beta-blockers, lipid regula-
tors, neuroactive compounds and many others. Also a large number of pharmaceuticals are used in veterinary medicinal products, antibiotics and as pharmaceutical agents. In the last few years, knowledge about the marine and coastal environmental occurrence of pharmaceuticals and other pollutants has increased to a large extent due to new analytical techniques able to det-
terminate polar compounds at trace quantities. The assessment of endocrine disrupting activity in complex environmental mixtures requires application of integrative procedures combining chemis-
tical analysis and specific bioassays. This approach was focused on health and environmentally relevant compounds and based on the toxicity identification and bioaccumulation evaluation, to find a correlation between organochlorinated compounds and chlorodihyphenylen congener con-
tent. The selected valuable at a scale as long as there was no an interlaboratory quality assurance and training program. The methods of POPs to be analyzed would be those readily analyzed by low resolution GC-mass spectrometry and for which analytical standards are readily available (the legacy chlorinated pesticides, lindane, endosulfan, selected PCB congeners, chlorobenzenes, tetra- and pentachlorobiphenyls). The program would also encourage deployment of different passive devices for comparison with PE samples. Some of the Stockholm Convention regional and subregional centres for POPs that are located near deployment sites might want to be involved in their roles of capacity building and technol-
ogy transfer. We seek to volunteer investigators to help conduct the initial monitoring phase includ-
ing the assessment of endocrine passive sampler and deployment analysis.

**WE 201**

Differential accumulation of metals and changes in Cholinesterases and d15N levels in the sea urchin Brissopsis leidyi (Cidaridae) as a function of aquaculture effluent gradient exposure

JR Guedes1, AB Assunção1, J Gonzalez2, JR Abalb1, A Carballita1, LR Vieira1, L Gilharmos1, SN Abreu1, JR Rendón von Osten1, FM Morgado1, AMV Soares1

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2Departamento de Ecotoxicologia, Universidad de Santiago de Compostela. Espanha, SAN

TIAGO DE COMPOSTELA, Spain

In the Mediterranean, and South China Sea. Investigators with access to ship time and buoys would be invited to participate to locate samplers and if capable, to also analyze them. Although analyzing samples at on central lab, we would provide advice on laboratories could be in-
vited to participate to locate samplers and if capable, to also analyze them. Although analyzing samples at a central lab, as in GAPS would be desirable, we believe multiple labs could be in-
vited to participate in the evaluation part of the air pollution moni-
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been shown previously. In this work, we show usage of passive sampling in evaluation of specific biocidal effects in vitro. Passive air sampling presents an interesting alternative to relatively expensive active sampling. It allows relatively long-term sample collection even in areas without developed infrastructure. Samples in this study came from localities all over African continent. The localities were chosen to describe background level of pollution as well as some hot spots. The sample was carefully selected to represent priority pollutants. Each sample was collected in triplicate in vitro biotests with reporter genes linked with aryl hydrocarbon receptor (AhR) and estrogen receptor, the receptors that are traditionally linked with ED. The results have confirmed that the endocrine disruptive potential of the air samples could be closely related to type of pollution, and that passive sampling can be used to evaluate the contribution of gender-specific POPs and alter in soil samples, considering a wider altritudinal gradient. This inverse relation was likely due to nearly local PAH emission sources. In addition, PCB normalisation on concentration on organic carbon content in soil samples showed a positive significant correlation with altitude, confirming the tendency of less chlorinated PCB congeners to be preferentially transported at higher altitudes in cold weather conditions such as low to medium contamination, whereas the regarded Himalayan stations can be considered undisturbed remote areas concerning PCB, PBDE and OC compounds.

WE 207 Monitoring the continental and intercontinental background of persistent organic pollut-
ants in Africa

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Hoče2

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2National Institute of Public Health (NIPH), PRAGUE, Czech Republic

The Stockholm Convention was adopted globally in 2004 for reducing or eliminating the release of Persistent Organic Pollutants (POP's) since the exposure to these chemicals supposes a risk for human and environmental health. As essential part of this Convention is the Global Monitoring Plan which aims to control and evaluate its effectiveness. Air has been selected in this Plan for assessment of POP's contamination on global and regional levels. For this reason 12 stations in four Air Samplers (PASs) with polyurethane foam (PUF) disks as sorbent medium have been used. PASs are advantageous against high-volume air samplers (HVAs) because of their low cost, simple con-
struction, and electricity-free operation. However, high uncertainties over PASs sampling rate (R) have been addressed for these devices. Sampling rates are calculated by the quantification of mass of deparubation compounds added to the PUF disk prior to deployment. Several calibration stud-
ies have calculated these rates for gas phase POP's, reporting a typically value of ~ 3 to 5 m3/day. Nevertheless, some studies reported that these rates have large variances that are attributed to diverse climatic or environmental conditions such as wind speed or temperature.

To evaluate the potential influence of temperature on sampling rates, a literature review was per-
formed. A total of 288 site-specific R were collected from scientific studies conducted worldwide and evaluated under a wide range of temperatures (from -27 to 36 °C). The study of this database showed that approximately 66% of data were within the range of 3 to 5 m3/day, while the rest of the data (34%) were located outside it. This revealed the need to calculate specific sampling rates when using PASs for monitoring gas phase POP's. Statistical analysis was performed to evalu-
ate correlations in the data distribution. A weak relationship was obtained between temperature and R (p<0.01; r = -0.24). This result indicates that estimations of sampling rates from temperature are not trustworthy and suggests that other parameters like wind effects should be considered.

WE 208 Are the Mt. Qomolangma regions in Himalayas (Nepal) really remote areas for persistent organic pollutants in Africa?

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The Mt. Qomolangma regions in Himalayas (Nepal) are regions of concern because of the high background levels for central Europe (as part of ArcRisk project: http://www.arcrisk.eu/). This data indicates a continuation of a long-term decreasing trend of selected OCPs over 30 years. These dangerous organic substances (neurotoxicity, carcinogenicity and endocrine disrupting ef-
ffects) are widespread throughout the environment, persisting for decades. They accumulate in the fatty tissue, entering the human body through the food chain. Human biomonitoring is a useful tool to evaluate internal exposure to these compounds and to assess the contamination of air, water and soil around the regions. The main aim of this study was to evaluate long-term trends of selected POPs in human milk in Nepal in recent years (2008 - 2009), since more than 4600 breast milk samples were collected from 9 sites in the years 1994 - 2009 (about 80 samples/region/year). The human milk samples are analyzed for a number of chlorinated organic compounds including polychlorinated biphenyls (PCBs) and selected chlo-
rinated pesticides (OCPs). Exposure factors that may influence these levels were investigated using questionnaire according to the WHO protocol (age of mothers, BMI - body mass index, medication, occupational exposure and lifestyle habits, above all smoking). The main aim of this project is to predict of human health risks by using of slope factor and RfD (reference doses) approach with a spatial GIS visualisation. Relationships between exposure factors from question-
naires will be also investigated.

WE 210 Temporal trends of PBDEs in gannets (Morus bassana) eggs from two UK colonies

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A wide range of PBDE congeners were detected and all eggs throughout the time series con-
tained BDE congeners 35, 47, 49, 99, 100, 153 & 154. BDE47 and other congeners associated with the PentabDE technical formula dominated the profile. No significant differences were found between 2PBDE concentrations at the two colonies (Audouin’s Gannet, Bass Rock), Trends appeared to be strongly influenced by direct changes in PBDE production and emissions and also coincided with the abatement of sewage disposal at sea. At both colonies, BDEs 47, 49, 99, 100, 153 & 154 exhibited the same temporal patterns as PBDE concentrations, increasing from the late 1970s, peaking in 1994 and from then on declining significantly up until the end of our time series. Levels of BDE-100 were significantly higher at Bass Rock than Audouin Craig as were levels of BDE35 although this congener exhibited a linear decline over time at both colonies. Throughout the time series, the concentration of the more highly brominated congeners (hexa- and hepta homologues) to PBDE concentrations increased relative to that of lower brominated congeners (tri-penta homologues), consistent with the hypothesis that there may be an increasing contribution to 2PBDEs of higher brominated congeners derived from the debromination of decaBDE.
sorption behaviour of different PAHs (pyrene, phenanthrene, fluorene, and fluorene) with solid-phase NOM and BC and the effect of rhodamine-biosurfactant on sorption equilibria. Biosurfactants sorption was also determined. Biodegradation of sorbed PAHs in the absence and presence of biosurfactants was also followed using a representative PAH-degrading soil bacterium [Mycobacterium gilvum V952]. Experimental conditions included different sources of NOM, BC, and solid-supported biosurfactant. Biosurfactants, especially when they were present at levels above CMC, often promoted desorption and biodegradation of PAHs.

WE 214 Modelling experimental findings on sorption and biodegradation of PAHs
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3Helmholtz Centre for Environmental Research-UFZ, LEIPZIG, Germany

The results shall be used to calibrate and verify the new model approach. The model was also used to simulate typical scenarios of adsorption (aging) and microbial degradation, in order to identify sensitive parameters and processes. Furthermore, the impact of dissolved organic matter and various types of amendments was studied, which potentially enhance diffusive mass transfer and biodegradation performance. The final goal is to optimize remediation options.

WE 215 Sorption and desorption characteristics of two insecticides (chlorodene and cadusafos) previously used in banana plantations of the French West Indies
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1Laboratoire d’Etudes des Interactions Sol- Agro-système - Hydro-système, MONTPELLIER, France

The results were correlated to the OC content (P<0.01) for both molecules and derived Koc were ranging between 50000 and 100000 for chlorodene and between 30000 and 60000 for cadusafos. The two main questions arise under this situation with extremely high DDT concentrations: 1) is Tenax® the appropriate tool to assess the bioavailability, and 2) is AC amendment capable to substantially reduce DDT exposure. These important issues will be addressed in this presentation.

WE 216 On the challenge to remediate a soil contaminated with crystalline DDT by activated charcoal
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1Environmental Science Department, PESHAWAR, Pakistan
2Agroscope Reichenau Taminson Research Station ART, ZURICH, Switzerland

The free concentration of the substances in sediment pore water at higher sediment concentrations (AC ≥ 30.5 µg/g DW and XA ≥ 390 µg/g DW) and to prove metabolic degradation of xanthene to xanthone in the sediment. In contrary, no degradation of actidione to acetidone was detected in both, the sediment and XA. saratoga.

The results emphasize, that for sediment contact tests, i.e., testing the ecotoxicity of hydrophobic substances in sediment pore water, the most appropriate tool to assess the bioavailability is Tenax® and 2) is AC amendment capable to substantially reduce DDT exposure.

WE 219 Optimizing the biocatalytic activity of cationic surfactant using passive sampler
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1Institute for Risk Assessment Sciences, UTRECHT, The Netherlands
2Helmholtz Centre for Environmental Research-UFZ, LEIPZIG, Germany

On the challenge to remediate a soil contaminated with crystalline DDT by activated charcoal

Y Chen1, STJ Droge2, JLM Hermens3
1Institute for Risk Assessment Sciences, UTRECHT, The Netherlands
2Helmholtz Centre for Environmental Research-UFZ, LEIPZIG, Germany

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STJ Droge, KU Gossmann, Computing Centre, LEIPZIG, Germany

Many emerging environmental compounds of concern are (partially) positively charged under

typical environmental conditions. Sorption to organic matter (OM) in soils, sediments and dis-
solved phases of these chemicals as well as the bioavailability of persistent organochlorine com-

pounds may be high due to the ion-exchange process at negatively charged groups in soils, sediments

and aqueous solutions. The aim of this study was to assess the desorption of CLD in soils, to assess its

toxicity effect in soil microbial activity and to monitor the appearance of possible metabolites.

Degradation was studied in soil microcosms under controlled conditions in two horizons (NEH-A and NEH-B) from the same tropical andouil. Uniform “CLC” labeled CLD was spiked at an amount sufficient for detection on both soils. Differences in sorption rates were also tested (NEH-A with twice the field dosage, NEH-B with half of it) at time intervals of 3, 8, 18, 30 and 360 days, the distribution of “CLC”-CLD in different compartments of the experimental system (soluble, extractable, bound and mineralised fractions) was determined. The influence of CLC-CLD in soil was assessed by the Substrate Induced Response (SIR). The presence of CLD metabolites was studied using Thin Layer Chromatography (TLC) and Gas Chromatography-Mass Spectra (GC-MS). The results were similar between the different soil field application rates. Due to the low solubility of CLD, the desorbed fraction was low and constant during the incubation (2% and 8% in NEH-A and NEH-B, respectively). The bound fraction was smaller and almost constant in both soils during the experiment (≈12%). Mineralization was higher in the NEH-A (49%) than in the NEH-B (33%). This was attributed to the higher 

soil pH. Based on the results of NEH-A, CLD did not affect SIR, although it decreased soil respiration response at longer periods of time. In the TLC analysis of the standards solutions of “CLC”-CLD showed up to three different regions of radioactivity (corresponding 90% of the activity to CLC region and 9 and 1% to the other regions). GC-MS identified four different chlorinated compounds in these regions: CLD, mono-chlordecone, mirex and an unknown highly chlorinated compound. In the TLC analysis of the extractable fractions of soil NEH-A (24k) it was not possible to observe the same regions of radioactivity than for the standard. This extractable fraction was measured through GC-MS only and mixtures and CLD were identified. In summary, CLC-CLD degradation in soils and the majority of the compound is in an extractable form, suggesting that it is potentially available for transfer into the soil solution.

WE 222

Impact of ageing on bioaccessibility of pentachlorophenole in the bacterial contact assay with Arthrobacter glabrum

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Background and aim The miniaturised bacterial contact assay is a fast and sensitive whole sedi-

ment contact test. Toxicity is determined by measuring the inhibition of bacterial dehydrogenase activity (DA). Transformation of resazurin to the fluorescent dye resorufin through DA in the sample is measured using a microplate reader detecting the absorbance of the compound using a direct fluorescence measurement. The assay can be used for aqueous and solid samples.

This project investigated the impact of short-term ageing in the bacterial contact assay. An artifi-
cial ageing was performed with pentachlorophenole and tested at regular intervals. Based on previous studies with other specimens a fast decrease of the effect was expected. Fur-

thermore, effects were assumed to decrease faster in the artificial sediment. Materials and methods Test bacteria were incubated in 24-well plates in an aqueous suspension of test bacteria, test compound and prepared according to the literature.

Natural sediment was sampled at Altus, a back water of the River Rhine. Both sediments were spiked with 500 mg PCP/kg dry weight in three independent replicates. The first test was carried out immediately after spiking, subsequent tests were performed at increasing intervals of time. Results Inhibition of DA fluctuated between 60 % and 100 %, thus exceeding the toxicity thresh-

old defined for this test. No significant change occurred after 27 weeks of ageing. Furthermore, no differences between both sediment types could be determined.

Discussion Ageing sediments for 16 weeks did not affect the DA of Arthrobacter glabrurn grown in pentachlorophenole. This observation could result from a higher bioaccessibility of the contaminant for bacteria, in contrast to organisms with different pathways of exposure. Enhanced accessibility to bacteria may also explain that no differences between sediment types were found, though both have distinctly different characteristics in terms of pH, TOC etc. This is shown especially as high bioaccessibilities of contaminants and lower access to sediment-bound compounds, where such differences have been shown.

Conclusion The results of this study show that the size of the exposed organisms plays an impor-
tant role in ageing related changes of the biological effects observed in whole sediment contact tests. Further experiments are necessary and currently ongoing in order to increase the under-

standing of how ageing impacts biotests with organisms of higher complexity.
A constraint-based method for performing life cycle inventory analysis using the matrix method

J W allace1, A Marvuglia2, E Benetto2, C Jury2

In a decision-making support process based upon environmental criteria the analyst might be interested in the defined set of system configurations (different processes, combinations, different technologies of the processes result materials, etc.) consistent with a set of imposed constraints on the maximisation of the chemical product yield (and conversely) and the minimisation of the environmental impact and natural resource consumption. While the classical matrix method for Life Cycle Inventory (LCI) compilation is the tool by which the environmental impacts linked to the studied system can be calculated, it is not very practical when one wants to automatically solve the above mentioned constraint satisfaction problem. Although optimisation methods have been proposed in connection with Life Cycle Assessment (LCA) problems, based on Linear Programming (LP) models, this has not been done in a way that is consistent with the matrix model. Nor would this have been possible with these approaches.

In this work we present an approach based on constraint programming (CP) for a case study concerning the energy valorisation of grape marc by the production of grape marc pellets. Basi- cally, we take the ordinary matrix model and calculate backward from a given set of burdens to the set of possible input flows from the exosystem to the system in question. Different constraint methods are imposed on the burdens. Further constraints are imposed in the model in order to assure that the solutions found (if any) are also physically feasible. This optimization process could provide significant added value in decision-making and environmental recovery potentials in a dynamic approach.

End-of-Life vehicles management: evaluation of recycling and recovery potentials in a dynamic approach
L Ciacci, F Passamani, A Santini, I Vassura, L Morselli

Since its birth in 1990s, LCA has shown great potential for support decision-making, and that rapidly contributed to rise and wide the use of this methodology. Decision-making is to be successful must need to identify consequences and future impacts of choices depending on marginal mecha- nisms and that may affect environment. In this sense, a formal distinction is now adopt between two different approaches of LCA: static/ablation based and dynamic/structural LCA, in which future developments are not product specific, but reaction type specific. The main output parameters of these models are enhancing material yield and energy efficiency in chemical processes by improved heat and mass transfer. The field of micro process technology covers developments which might sub- stitute existing processes as well as enabling new technologies which will lead to ample changes in environmental impact, the easy integration in other LCA and the transfer of this methodology to other micro process technology applications.

Models of chemical inventories based on statistical analysis of on-site production data
CM Pereira1, S Papadokonstantakis1, K Hungerbühler2

In light of this issue, a project was launched by a consortium of companies - and leaded by Quan- tis - to create an exhaustive “water” life cycle inventory database. This water database is based on the ecoinvent (www.ecoinvent.ch), for approximately 4'000 processes and will include: a full-balanced water footprint taking into account water flows that are addressed in the recently developed accounting and impacts methods - Different regionalization possibilities at the level of the country, the level of the water- shed or using an archetype approach - An improved model for estimating pesticide emissions for agricultural LCA
CM Pereira1, S Papadokonstantakis1, K Hungerbühler2

Credible quantification of chemical emissions in the inventory phase of Life Cycle Assessment (LCA) is crucial since chemicals are the dominating cause of the human and ecotoxicity related environmental impacts in Life Cycle Impact Assessment (LCIA). When applying LCA for assess- ment of agricultural crop production emissions, off target pesticide emissions need to be quantified as accurately as possible because of the considerable toxicity effects associated with chemicals designed to have a high impact on biological organisms like for example insects or weed plants. PestLCI was developed to estimate the fractions of the applied pesticide that is emitted from a field into its surrounding environment, both agricultural compartmental air, and water. However, the applicability of the model has been limited to 1 typical Danish soil type and 1 cli- matic profile obtained from the national Danish meteorological station.

To overcome these limitations, a reworked and updated version of PestLCI is presented here. The new model includes 16 European climate types and 6 mean European soil characteristic profiles covering all dominant European soil types within the geographical scope and to allow contem- porary (varying site and or climate condition) and future (change climate condition of a location) determination.

In addition, the tillage frequency is now incorporated as an input parameter. The tillage frequen- cy has an impact on the soil permeability through its relation to the occurring frequency of macro pores in the top soil, and thus the initial leaching rate of pesticide through preferential flow.

In summary, the development of a dynamic LCA for modelling future systems and assess how they may affect environment, the easy integration in other LCAs and the transfer of this methodology to other micro process technology applications.
70 percent of total water use. Increasing demand for food, fiber and fuel will increase demand for irrigation water. Global climate change will shift rainfall patterns, resulting in potential

WE 235 Assessing water quality compensation treatments and related inventory in LCA AM Boulaa*, E. Loiseau*, C. Bouchard*, L. Deschênes*, M. Margulis*
*CIRCA - École Polytechnique, MONTREAL (QC), Canada
**AgroParisTech - Enseign. ENP, PARIS, France

Department of Civil Engineering, Laval University, QUÉBEC, Canada

Effects from a lack of functional water for human uses in Life Cycle Assessment can be generated directly on Human Health, if they occur in a region affected by water-related diseases or malnutrition, or on ecological compensation strategies when they occur by other scenarios. MAtrixLABoratory program (MATLAB) was created to allow for environmental impact assessments that are lacking data for agricultural water use.

WE 236 Life Cycle Assessment of urban water cycle in Mediterranean cities JM Amores Barreiro, JP Pasqualino, MM Meneses, FC Castells, IB Butman, EG Egecheu
Universitat Rovira i Virgili, TARRAGONA, Spain

Given the increasing demand of urban water for both potable and non-potable applications, in many countries urban water authorities are struggling to satisfy the demand meanwhile improving the environmental profile of the urban water system. The main goal of this study is the environmental analysis of the whole urban water cycle, taking into account both potable and non-potable water treatment plants, water distribution systems, wastewater treatment plants (WWTP) and sewage systems. Based on the methodology of Life Cycle Assessment (LCA), we assessed the current urban water systems on the Spanish coast of the Mediterranean Sea and proposed possible scenarios for improving their environmental performance. The water system is divided into two parts: 1) manufacturing and distribution of water, and 2) wastewater treatment and sewerage. Inventory analysis was performed based on local operation data complemented with Ecoinvent Database whenever the local data were missing. The environmental profile of each step is then used to assess impacts from a pulp and paper plant releasing different water qualities in a traditional LCA framework.

WE 237 Life Cycle Assessment of decentralized combined heat and power plants based on difficult fuels KP Sartorius, WR Poganietz, L Schebek
Karlsruhe Institute of Technology, EGGENSTEIN-LEOPOLDSHAFFEN, Germany

- by 2020, 20% of the energy demand in Europe should come from renewable energy sources.
- This is set as a mandatory target by the renewable Energy Directive of the European Union. Microalgae have the potential to serve as a sustainable and renewable energy source in the future. Microalgae, such as green algae and cyanobacteria generate biomass by photosynthesis. The biomass can be used in some aspects which can be further processed to produce biofuel or other forms of liquid or gaseous fuels. The production of energy with microalgae can be more sustainable than its alternatives concerning some important criteria: algae can be grown in closed systems on non-arable land, need CO2 as only carbon source and can also grow in salt water or wastewater. However, up to now (based on lab and small pilot plant experiences) net energy generation from microalgae is negative and there is no functioning system of energy production with microalgae in use yet. Until now, microalgae have been used to produce high value chemicals, such as proteins or colorants for food and chemical industry. When algae should contribute to a sustainable energy supply, the production process should be energy-efficient as well as competitive concerning economic and ecological criteria.

To account for these impacts different process of energy production with microalgae has been carried out with a detailed life cycle model. Within this model, different methods and process combinations can be compared to each other and to fossil fuel systems. Benefits and drawbacks of different systems can be calculated. LCA results will be used to support developers of a novel bioindustry and to give suggestions for further research.

WE 239 Life Cycle Assessment of the Production of Succinic Acid: a contribution to consequen-
tional LCA of biofference O Momin, L Schebek
TU Darmstadt / Institute IWAR, DARMSTADT, Germany

Life cycle assessment has been increasingly used in the context of bioference which denotes the idea of a future broad use of biomass substituting present day petro-chemical produced chemical. The core of chemical industry production of bulk and fine chemicals is only one area within concepts of bioference, but of high interest because it is based on carbon chemistry and therefore will always be dependent from carbon feedback. LCA on future biobased chemical production has to account for the fact, that 'like in present day chemistry - also processes of “green” chemical production will be highly interconnected: therefore not only petro-based product will be substituted by one bio-based product, but major changes in production routes and their interlink-
ages will be necessary.

As an example for the comparison between petrol- and bio-based products an LCA of the pro-
duction process of succinic acid has been carried out. Regarding the wide range of possible applications, LCA of production processes for succinic acid are important for its financing interest in itself but also of high interest as a first step for a modular approach to Con-
sequentional LCA of future bioference concepts.

Succinic acid is currently produced also from a petroleum-based process. However, it was found that bio-based versus petroleum-based succinic acid production is not an adequate comparison. Therefore the focus of this study is the production of succinic acid from biomass. The LCA will be compared to fossil production. The study proposes an integrated approach to environmental assessment which will cover the whole system including impacts of transport. The LCA will be applied to the future system in order to cover the whole system. Results show that this solution would imply an increase in environmental impact.

NM02 - Fate and effects of nanoparticles

WE 244 Research needs for nanosafety - activities of the German Federal Environment Agency D Veules, K Schiwim
Federal Environment Agency, DESSAU-ROSSLAU, Germany

The Federal Environment Agency (UBA) - for human and environment - is Germany’s central federal authority on environmental matters. The aims of the UBA in terms of Nanotechnology are:
- to evaluate the chances and risks of nanotechnology,
- to foster the development and adaptation of strategies for testing and evaluating nanomaterials,
- to close gaps of information concerning risks of nanomaterials,
- to adapt the existing laws of the Chemicals’ Act, and
- to strengthen national and international activities for coordinated risk analysis.

For this aim it participates at the OECD Working Group for Manufactured Nanomaterials (WPMN) and coordinates the German Activities in the OECD Sponsorship
WE 245 Malformations and toxicity mechanism of silver nanoparticles in the medaka fish embryo model

**M. Nakamura**, SK Kishiwada, HT Takei, EA Artiz, TK Kanaguchi, BJ Jayasinghe, TS Sasso-Atwood, PF Ferguson, NN Nakamura, YK Kagami, TC Chandel

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Silver nanoparticles are one of the major components of healthcare products. This study explores the toxic mechanisms of silver nano-sized colloidal particles (AgNPs; average particle size 3.6 diameter nm, purity 99.99%, pure water solution) using the medaka fish embryo model. Three different AgNPs were evaluated in the experiment (stage II, Blasto, stage III, brain region, 21, brain region, naloxone and otic vesicle formation; and stage 10, blood vessel development) to expose several concentrations of SNC. SNC produced morphological changes in the embryos such as the blood clots, pericardial sac edema, tubular hearts, and spinal deformities at 0.5 and 1.0 mg/L. Reduced survival was detected as Stage 16 embryos were observed among all embryo stages tested. To determine the distribution of SNC medaka egg embryos were exposed to 0.5 mg/L for 6 days, and embryos, chorion and embryonic fluid were isolated and subjected to ICP-OES analyses. Silver was detected in a single medaka embryo and chorion at levels of 16.6 ± 3.9 pg and 720 ± 29 pg, respectively. Furthermore, TEM analyses showed SNC adhered onto the surface of the chorion and inside the chorion layer. To investigate oxidative mechanisms of injury, reactive oxygen species scavengers GSH (0.5 mM) and NAC (0.05 mM) were used to evaluate potential of AgNP adhesion to the embryonic macrophyte. Two important genes relative to phenotypic development were influenced; HoxB6 was gene up-regulated and retinol-binding protein gene was down-regulated, respectively. Disruptions of those genes were well known to induce malformation in organisms. The two genes may have important roles to cause embryonic malformation and drowning in AgNP. In summary, silver nanoparticles were detected in the toxic mode of action whether AgNP or Ag ion cause toxic effects. A new tool for Ag ions released from AgNPs is developed and medaka embryos are subjected to the assay to test toxicity of Ag ion only.

WE 246 Silver Nanoparticles effects on diatom Thalassiosira pseudonana and cyanobacterium Synechococcus sp. Photo-oxidation, Growth, Toxicology, Fate.

**A. Attwood**, AV Valeente, GD Gilliland, RNC Carvalho, GT Taneil, RP Passarini, VP Pedroni, LR Rossi, TL Lettieri

EU JRC, Institute for Environment and Sustainability, ISpra, Italy

Engineered nanoparticles are used in a wide range of industrial applications including electronics and commercial products. Because of their large surface area and high reactivity, nano-sized metal particles display remarkable physical, chemical and biological properties (Maynard, Atken et al. 2006; Nowack and Bucheli 2007)

Furthermore, we developed a procedure to measure the kinetic release of silver ions from silver nanoparticles (AgNPs; average particle size 3.6 nm, nominal particle size, no coating) and 5-1000 nmol/L AgNP (total silver content, 10 nm nominal particle size, no coating) and 5-1000 nmol/L AgNP (total silver content, 10 nm nominal particle size, no coating) and 5-1000 nmol/L AgNP (total silver content, 10 nm nominal particle size, no coating) and 5-1000 nmol/L AgNP (total silver content, 10 nm nominal particle size, no coating) and 5-1000 nmol/L AgNP (total silver content, 10 nm nominal particle size, no coating). The main goal of this work is to present the comparison of the toxicity of AgNPs and Ag+ to Pseudokirchneriella subcapitata and evaluate the toxicity of the AgNPs to P. subcapitata and Daphnia magna. Algae were exposed to Ag NPs or AgNO3 in medium TM2 and allowed to grow during 24h to 72h.

Fate and effects of engineered silver nanoparticles in a terrestrial environment

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Silver nanoparticles (nano-Ag) are engineered nanoparticles with the highest number of commercial applications due to its anti-microbial activity. Many nano-Ag products may be directly applied to algae and cyanobacteria (e.g., pesticide treatments) or indirectly disposed of in algal cyanobacteria (e.g., via waste water discharges). In this study, we investigated the potential impacts of silver nanoparticles in aquatic and terrestrial ecosystems.

Silver nanoparticles are engineered nanoparticles that are currently used in a wide range of industries due to their unique properties. They are typically small enough to pass through the aqueous food chain, but large enough to interact with the environment. In this study, we investigated the potential impacts of silver nanoparticles in aquatic and terrestrial ecosystems.

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WE 251
Evaluation of TiO2 manufactured nanoparticles toxicity toward bacterial model in Seine freshwater
LC Pianchon1, O Spalla1, R Ferrari1, F Guyot2, N Menguy3, A Gelbert1, A Thill4, MF Beneditti1, CNRS/CEA, PARIS, France
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Despite the increased production and use of engineered nanoparticles (NPs), environmental concern still remains owing to the potential toxicity of these components on human health and natural environment.

In the framework of two actions, a regional research network "C'Nano - En Seine" and the international Gde TECENT, we are studying ecotoxicological impact of different NPs. Our main objective is to study the impact of TiO2 nanoparticles on bacteria, mainly E. coli, due to its importance as a model microorganism. First, a complete characterization of NPs morphological and physico-chemical state during the contact has been carried out using Small Angle X-ray Scattering, AFM, cryo-TEM, zeta and DLS. This allows the set up of reproducible and standardised protocols for the toxicity studies. Then, tests for toxicity towards E. coli (displaying the effect of NPs on morphology, metabolism or survival) has been evaluated using both traditional methods (optical density and CFU counting) and new reliable microplate techniques.

In order to understand the toxicity mechanisms, the interaction between bacteria wall and NPs has been observed at the nanoscale thanks to accurate imagery techniques such as Transmission Electron Microscopy (TEM) or Atomic Force Microscopy (AFM).

The correlations between the state of dispersion of the NPs, their concentration, chemical nature and the toxicity will be presented.

WE 252
Impact of nano-TiO2 to marine organisms: Phaeodactylum tricornutum and Artemia franciscana
D Munir1, GIL Libralato1, CL Lison1, AVG Volpi Ghiatirla1
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Nano-TiO2 is employed in different categories of products for its antibacterial and depollutant properties (i.e. in air and water decontamination systems, as road and pavement additive for NOx abatement or on self-cleaning glass). Due to its ability to adsorb/adsorb hydrophilic molecules, it is massively use (about 70%) in most common consumer products like cosmetics and sunscreens. Thus, it has been recognised that it enters directly or indirectly into the marine environment and that its toxicity to marine organisms at low concentrations is a matter of concern.

The purpose of this study is to evaluate the in vivo toxicity of nano-TiO2 via the growth inhibition test with the unicellular green algae Phaeodactylum tricornutum and the anostracan crustacean Artemia franciscana following the standardised protocols. In the case of A. franciscana besides the traditional exposure conditions, two alternative scenarios were considered: "no light, but feeding" to observe potential growth inhibition and "no feeding, but light" to verify effects on starvation. Results evidenced an EC50 in the 25-64 mg L-1 range 25-64 mg L-1 to standardised protocols  In the case of A. franciscana besides the traditional exposure conditions, two alternative scenarios were considered: "no light, but feeding" to observe potential growth inhibition and "no feeding, but light" to verify effects on starvation. Results evidenced an EC50 in the 25-64 mg L-1 range to verify effects on starvation. Results evidenced an EC50 in the 25-64 mg L-1 range.

WE 253
The effect factor for nano TiO2: preliminary toxicity tests on Daphnia magna and future developments
S Biphidi1, BS Salieri1, F Guyot2, N Menguy3, A Gelbert1, A Thill4, MF Beneditti1, CNRS/CEA, PARIS, France
LIONS/CEA, SACLAY, France

Titanium dioxide nanoparticles were synthesized using a wet-chemical method based on the evaporation of TiCl4. Stable suspensions of positively-charged TiO2 were obtained at pH 2.5. One batch of this product was quickly shifted above the point of zero charge to pH 12. These stock dispersions were used in batch adsorption experiments with three different types of well-characterized macromolecules, Sodium alginate, Fulvic acid and Humic acid, and evaluated in terms of final charge (Zeta potential), final size and adsorption efficiencies.

The stability of nanoparticles on sewage treatment plants without sorbed molecules was investigated by monitoring the aggregation behaviour of TiO2 nanoparticles in different electrolyte environments (NaCl, CaCl2 and Na2SO4) and at varying pH. These aggregation rates were used to determine the attachment efficiencies as a function of pH, counterion valence and macromolecule concentration. These attachment efficiencies can be related to more complex mathematical models in order to evaluate and predict the effects of environmental macromolecules on the fate of aquatic nanoparticles.

WE 255
Interactions between TiO2 nanoparticles and cadmium: consequences for uptake and ecotoxicity
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As a consequence of the increased use of engineered nanoparticles in e.g. industrial applications and consumer products, these particles will be released into the aquatic environment. They will either be in the water phase where they are likely to form aggregates/agglomerates. Through sedimentation, the sediments are expected to be a sink for nanoparticles. Both in the water phase and in sediments they will mix and interact with other environmental pollutants, including heavy metals. In this study the toxicity of cadmium to three relevant freshwater species, green algae Pseudokirchneriella subcapitata, crustacean Daphnia magna and sediment organisms Lumbriculus varieguatus, was investigated both in the presence and absence of TiO2 nanoparticles. Also uptake of cadmium in D. magna and L. varieguatus was investigated in tests where organisms were exposed to cadmium in suspension or on the sediment surface.

The observed toxicity was higher than expected based on water phase cadmium concentrations, and results shows that adsorbed fraction of cadmium is bioavailable.

WE 256
Final behaviour of three different TiO2 nanomaterials in soils
C Nickel1, BHellack2, S Gartiser1, STgame3, A Schaeffer4, S Damme4, L Erdinger5, TA Kirkbusch6
1Institute of Energy and Environmental Technology - IUTA e V, DUSIBURG, Germany
2Hydrotox, FREIBURG, Germany
3TU Dresden - Institute of Process Engineering and Environmental Technology, DRESDEN, Germany
4RWTH Aachen University - Institute for Environmental Research, AACHEN, Germany
5Universitätsklinikum Heidelberg - Dept. of Medical Microbiology and Hygiene, HEIDELBERG, Germany
6Germany

Titanium dioxide nanomaterials are commonly used in many everyday life products (e.g. paints, cosmetics) and constant evidence indicates that these nanomaterials can be released from products during their life cycle (Kaiser et al. 2008) and can reach the environment. In the presented study laboratory experiments were performed to investigate the fate and behaviour of different functionalised and non-functionalised TiO2 nanoparticles (P25, PC105, UV5) taken up in soil compartments. More specifically adsorption/ desorption tests and the mobility studies in soil columns in a laboratory scale were conducted (according to OECD Guidelines No 312 and 316). Different soil types were used to identify and assess the effect of different soil characteristics like clay content, pH value, organic matter, grain size or cation exchange capacity on the adsorption and mobility of nanoparticles.

Preliminary results showed no mobility of the titanium dioxide nanomaterial in soil columns, if dry powder of the titanium dioxide material was applied to the soil before percolation with water. Therefore titanium dioxide powders suspended in water containing smaller agglomerates (compared to the powder) were used in the following investigations, for which a higher mobility of TiO2 was expected. A Standard Operating Procedure (SOP) for maintaining stable nanomaterial suspensions with respect to a constant particle size distribution and zeta potential for a minimum of 24h, essential for such experiments, is currently evaluated in a round-robin test.

Detailed results on the mobility of nanomaterials in soils under such conditions will be presented and discussed.

This study was sponsored by the Federal Environment Agency (UBA) within the framework of the "Umweltforschungsplan" - FKZ 7609 65 417. "Environmental risk of nanomaterials: Environmental fate of selected nanomaterials in relation to shape, size and surface properties". References:

Fang, J. et al. (2009), Environmental Pollution 157(4), 1101-1109.
Kaege, R. et al. (2008), Environmental Pollution 156(2), 233-239.

WE 257
Behaviour of nanoscale titanium dioxide in laboratory wastewater treatment plants according to OECD 303A
S Gartiser1, C Nickel1, M Stintz1, S Damme1, A Schaeffer1, L Erdinger5, TA Kirkbusch1
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2Institute of Energy and Environmental Technology e V, DUSIBURG, Germany
3TU Dresden - Institute of Process Engineering and Environmental Technology, DRESDEN, Germany
4RWTH Aachen University - Institute for Environmental Research - Biology V, AACHEN, Germany
5Universitätsklinikum Heidelberg - Dept. of Medical Microbiology and Hygiene, HEIDELBERG, Germany
6Germany

Titanium dioxide is used in huge amounts as white pigment or UV-filter in consumer products compared to the powder) were used in the following investigations, for which a higher mobility of TiO2 was expected. A Standard Operating Procedure (SOP) for maintaining stable nanomaterial suspensions with respect to a constant particle size distribution and zeta potential for a minimum of 24h, essential for such experiments, is currently evaluated in a round-robin test. Details results on the mobility of nanomaterials in soils under such conditions will be presented and discussed.

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Fang, J. et al. (2009), Environmental Pollution 157(4), 1101-1109.
Kaege, R. et al. (2008), Environmental Pollution 156(2), 233-239.

WE 254
Environmental fate of aquatic nanoparticles: case study TiO2 NP
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University of Gothenburg, GOTHENBURG, Sweden

Titanium dioxide nanoparticles were synthesized using a wet-chemical method based on the hydrolysis of TiCl4. Stable suspensions of positively-charged TiO2 were obtained at pH 2.5. One batch of this product was quickly shifted above the point of zero charge to pH 12. These stock dispersions were used in batch adsorption experiments with three different types of well-characterized macromolecules, Sodium alginate, Fulvic acid and Humic acid, and evaluated in terms of final charge (Zeta potential), final size and adsorption efficiencies.

The stability of nanoparticles on sewage treatment plants without sorbed molecules was investigated by monitoring the aggregation behaviour of TiO2 nanoparticles in different electrolyte environments (NaCl, CaCl2 and Na2SO4) and at varying pH. These aggregation rates were used to determine the attachment efficiencies as a function of pH, counterion valence and macromolecule concentration. These attachment efficiencies can be related to more complex mathematical models in order to evaluate and predict the effects of environmental macromolecules on the fate of aquatic nanoparticles.

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WE 258 Ecotoxicity of photocatalytically active titanium dioxide nanoparticles: the impact of UV-exposure on toxicity to Caenorhabditis elegans
I. Angelstorf1, S. Hoise2
Humboldt University of Applied Sciences, HAMBURG, Germany

Titanium dioxide nanoparticles (TiO2) are used in a variety of consumer products like cosmetics, paints and self-cleaning surfaces. The detection of TiO2 in facade runoff and surface waters near the coast suggests that exposure to TiO2 is relevant for aquatic ecosystems. Karg et al. (2008). With the number of applications still rising, it has been suggested, that also the flux to the environment will increase significantly within the next years. The knowledge concerning the ecotoxicological relevance of TiO2, however, is still very fragmentary and insufficient for reliable risk assessment.

In this study we will try to elucidate the impact of light exposure on the toxicity of TiO2 doped sediment in the presence of photo-sensitive contaminants. As test organisms, the nematode Caenorhabditis elegans, a multicellular model organism living in soil and exhibiting both ecological and medical relevance. We studied TiO2 nanoparticles, a photocatalytically active titanium dioxide with a nominal particle size of 21 nm was applied. In nematode testing without light exposure, P25 only showed a significant effect at relatively high concentrations (5% reduction in progeny at 100 mg TiO2/L). As TiO2 is a photocatalyst and induces the formation of reactive oxygen species in cells when exposed to UV irradiation we are currently testing the following hypotheses: a) (Prolonged) irradiation leads to elevated toxicities of TiO2 and indicates an elevated risk for these ecosystems exposed to both, sunlight and TiO2 at the same time. b) A) A photocatalytic effect of TiO2 on TiO2 coated with three different polymers (amphiphilic polymer, amphiphilic polymer/PEG, and amphiphilic polymer/PEI) were purchased from Sigma-Aldrich and introduced from exterior facades into the aquatic environment. Environmental Pollution 156(2), 233-239.

WE 259 CdSe quantum dots in seawater: chemical stability and effects on a marine microalga
M. Mongelli1, E. Balerstein2, P. Coino1, E. Gabellieri1
CNR - National Research Council, PISA, Italy

CdSe nanocrystals with a heavy metal-containing reactive core, exhibiting unique optical properties, which hold great promise for biomedical and micro-technological strategies. Because of their increasing use, it is expected that they end up in natural water bodies, from freshwater to the sea. Lack of knowledge about the stability and bioavailability of these newly synthesized nanoparticles in the aquatic systems represents a novel problem for the environment. Only very limited data report on the transformations of QDs in aquatic environments and toxicity in living organisms. The few studies regard freshwater systems and so far, to our knowledge, no study has been carried out in seawater. In the present work we report preliminary results on: 1) the characterization of the chemical behaviour of QDs in seawater; 2) the study of the toxicity of QDs to a marine microalgae. To this purpose, CdSe QDs (Sigma) were solubilized in water by encapsulating with the amphiphilic polyelectrolyte PSMA (poly[styrene-co-maleic anhydride]) and ethanamine (Lee et al., 2009, ACN; Naeco 3: 1121-1128). After dispersion in natural seawater, the optical properties were followed as a function of time. Absorption spectra of water-soluble QDs exhibited a steady increase in absorbance as the wavelength decreased from 600 nm towards the UV-region, with a characteristic peak at 540 nm. The time course of the absorption spectra after re-suspension in seawater was similar to the one observed for the parent solution, suggesting a partial degradation of the nanoparticles. This effect decreased at lower salinity. The interactions between the microalgae and QDs were tested by: measuring 1) the cellular concentration of Cd, 2) the synthesis of phytochelatins (PCs) as a biomarker of the bioavailability of heavy metals, 3) the activity of antioxidant enzymes as an indication of oxidative stress. Short-term experiments (5 h) showed that P. tricornutum responded to QD exposure by synthesizing PCs and by increasing the intracellular pool of glutathione. The presence of PCs suggests the occurrence of bioavailable Cd species, derived from a partial degradation of QDs. Since glutathione is a major antioxidant, the consumption of PCs may support the occurrence of oxidative stress. Experiments are in progress to assess the enzymatic antioxidant response of P. tricornutum.

WE 260 Stability and uptake by daphnia of QDs with three different coatings in synthetic fresh water
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1Gwangju Institute of Science and Technology, GWANGJU, South Korea 2Colorado School of Mines, GOLDEN, United States of America

CdSe quantum dots (QDs) are increasingly being used for biomedical purposes as a diagnostic tool. Exposure to environmental stress can affect their stability in solution. We investigated the stability of the three different QD coatings: (1) CdSe/ZnS, (2) CdSe/ZnS coated with three different polymers (amphiphilic polymer, amphiphilic polymer/PEG, and amphiphilic polymer/PEI) were purchased from Sigma-Aldrich and introduced into synthetic seawater (hard, moderately hard, and soft water). Optical properties were measured with time and sedimentation was observed with the change of Cd concentration at the upper layer of suspension by ICP-AES. Different coatings had significant role in the sedimentation. PEG coated QDs which had neutral surface charge significantly sedimented in all synthetic waters and loosed optical property measured by fluorescence. Highly positive charge on PEI QDs remained stable for 48h. Interestingly, fluorescence of PEI QDs significantly increased with time in all three synthetic waters. All QDs did not release Cd and Zn for 48 h. Daphnia uptake and excretion were monitored in moderately hard water by measuring Cd concentrations in daphnias. Three QDs were well accumulated into daphnia for 24 h. During uptake, dissolved Cd concentrations increased significantly implying in-vivo dissolution of QD by daphnia. QDs with neutral and negative charge at surface depurated quickly from daphnia with no or small amount of positively charged QDs remained in daphnia after 48 h depuration. The study concluded that surface coatings played significant role in bioaccumulation by daphnia as well as stability in fresh water.

WE 261 Effects of nano sized CuO and ionic Cu: Toxicity to Daphnia magna and tight epithelial cells
A. Thy1, H. Schick2, HJ Bjerrum3, S. Mora4, D. Berhanu2, A. Djysbo2, P. Rytz1, E. Valsami-Jones1
1Roskilde University, ROSKILDE, Denmark 2Natural History Museum, LONDON, United Kingdom 3Institutio Materials Ltd, FARNSBOROUGH, United Kingdom 4Novozymes (NPI) have unique physical properties caused by their small size and high surface area to volume ratio. This means that the NPs can be more reactive and potentially more toxic than their bulk counterparts. This study focuses on toxicity of two CuO NPs: mono-dispersed spherical 7 nm and highly polydispersed polyhedral 10-100 nm, respectively, compared to copper ions (Cu2+) to the crustacean Daphnia magna and epithelial kidney cells from the aquatic toad Xenopus laevis (A6 cells) as a model for tight ion-transporting epithelia. D. magna was exposed to both CuO NPs and Cu2+ for 48 h according to OECD Guideline 202. In this study we will try to elucidate the impact of light exposure on the toxicity of CuO doped sediment in the presence of photo-sensitive contaminants. As test organisms, the nematode Caenorhabditis elegans, a multicellular model organism living in soil and exhibiting both ecological and medical relevance. We studied TiO2 nanoparticles, a photocatalytically active titanium dioxide with a nominal particle size of 21 nm was applied. In nematode testing without light exposure, P25 only showed a significant effect at relatively high concentrations (5% reduction in progeny at 100 mg TiO2/L). As TiO2 is a photocatalyst and induces the formation of reactive oxygen species in cells when exposed to UV irradiation we are currently testing the following hypotheses: a) (Prolonged) irradiation leads to elevated toxicities of TiO2 and indicates an elevated risk for these ecosystems exposed to both, sunlight and TiO2 at the same time. b) A photocatalytic effect of TiO2 on TiO2 coated with three different polymers (amphiphilic polymer, amphiphilic polymer/PEG, and amphiphilic polymer/PEI) were purchased from Sigma-Aldrich and introduced from exterior facades into the aquatic environment. Environmental Pollution 156(2), 233-239.

WE 262 Copper oxide nanoparticles induce oxidative stress, DNA strand breaks and laccase activity in 297 cells
A Pradhan1, D Schlösser2, S Scena1, S Holm1, K Gerth1, D Wiesenberg2, C Pascoal3, F Cásio4, 2CBMA, BRAGA, Portugal 3Institute and Aquatic Research Unit, University of Milan, MILANO, Italy 4Institute of Biotechnology and Biotechnology, Martin-Luther-University, HALLE (Saale), Germany

The extensive use of nano metal-based products increases the chance of their release into aquatic environments and may put biota and associated ecological processes at risk. Fungi play a key role in organic matter turnover in freshwater while they transfer carbon and energy to higher trophic levels. Although aquatic fungi are common in clean and well-aerated freshwater systems, they also occur in hyperpolluted sites. We investigated the effects of nano CuO (4 levels, ≤ 100 mg L-1) on fungal biomass production, extracellular laccase activity, accumulation of reactive oxygen species (ROS), plasma membrane integrity and occurrence of DNA strand breaks, after 5 and 12 days. For fungal isolates, Phoma sp. UP2 5-1-03 (F) and Articulospora tetratoma UMB-072 01 (At72) collected at clean sites, and 4. tetratoma UMB-081 01 (At61) and Heliscus lugdunensis (H4-2-4 2.4) (H4) collected at polluted sites. Fungal biomass was inhibited by the increase in nano CuO concentration and incubation time. After 12 days, the strongest inhibition in biomass production was found in At72 (95.5%) and Ph. (81.2%) exposed to 100 mg L-1 nano CuO, while the lowest effects were observed in At61 (59.4%). Laccase activity was induced by all nano CuO concentrations after 12 days, except in At61; maximum activities were found in Ph. (1.0) and At72 and H4 (2.83, 2.24 and 166 U g-1, respectively) when exposed to 100 mg L-1 CuO2+ in an in vitro study for up to 7 days. The study demonstrated similarity in the toxicity of CuO NPs (7 nm) and Cu2+ to D. magna, whereas toxicity of polydispersed CuO NPs occurred at much higher concentrations. For epithelial cells, exposure to both sizes of CuO NPs and Cu2+ caused significant increases in cell death (most likely via apoptosis), and morphological changes, but after different times of exposure. For cells exposed to polydispersed CuO NPs the increase in apoptotic bodies occurred within 48 h of exposure, whereas the effects of both CuO NPs (7 nm) and Cu2+ occurred much later (after 3 and 5 days of exposure, respectively). The mechanisms behind the copper forms specific toxic effects differ such that Cu2+ and CuO NPs (7 nm) decrease cell proliferation and influence cell cycle progression, whereas polydispersed CuO NPs cause the formation of apoptotic bodies almost instantaneously. Furthermore, the effects of the different forms of copper on cells seem to depend on cell cycle stage. The implications from the study are that the toxic effects of copper depend on the form and size of the metal oxide particles.
water. The measures were attempted to link with the survival and reproduction of Enchytraeus crypticus. Results showed clear reproductive effect of all forms of Cu, the effects were more pronounced by exposure to the Cu-salt form, than the CuNP, and with field soils causing least effects. The physical chemical characterization displayed differences between all exposures regimes, although free iron measures were not able to display differences in toxicity. The physical chemical characterization could to some extend explain toxicity observed.

WE 264

Nanoparticles in the environment: the potential importance of metals and their mobilization

Zn was detected by an increase in luminescence and expressed as increased induction (folds) controls for size-dependent and solubility effects. Response of the sensor bacteria to bioavailable total zinc concentration by flame Atomic Absorption Spectrometry. Scanning electron microscopy of different spiking procedures, namely as dry powder and as suspension in soil extract. The increased uptake of zinc metal-based products enhances the possibility of its release into freshwater ecosystems and this may put aquatic biota and ecological processes at risk. Invertebrates mostly use leaf litter as a food resource and play a key role in the energy and nutrient transfer in aquatic detritus foodwebs. In this study, we assessed the sublethal toxicity of nano CuO on the growth and feeding behaviour of larvae of the shredder Allocamptus lignarius (Thysanoptera, Limnepilidae), an endemic species in streams of the Iberian Peninsula. The experiment was carried out in glass containers with sterile stream water, each housing a larva (15 replicates). The invertebrates were allowed to feed for 10 days on microalgal colonized adhering larvae according to the following treatments: (1) leaves previously treated for 5 days with 25 or 75 mg L^-1 nano CuO and stream water, (2) unspiked leaves and stream water with 25 or 75 mg L^-1 nano CuO, and (3) untreated leaves and untreated stream water (control). The experiment was replicated in the absence of invertebrates to discriminate the contribution of microbes to leaf litter decomposition. Microbes contributed with 23% to total leaf mass loss in control, and microbial decomposition decreased with the increase of nano CuO concentration. Leaf consumption rate by the invertebrate was 0.27 mg leaf DM day^-1 mg^-1 animal DM. The highest inhibition of leaf consumption (48%) was found in the treatment in which the animals were exposed to water with 75 mg L^-1 nano CuO. Following this, the animals consumed 25 mg L^-1 nano CuO (26%). A similar response pattern was found for the growth rate of invertebrates when exposed to nano CuO via stream water or leaves (56% in control vs 30 and 41 mg individual DM mg^-1 individual DM day^-1 treatment). Results will be interpreted based on the adsorption and accumulation of nano and/or toxic copper in invertebrates (body and case) and leaves.

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WE 265

ZnO nanoparticles in soil: testing different spiking procedures

Due to complex behaviour of nanoparticles in soil, realising realistic exposure in ecotoxicity testing poses major challenges. Soil by definition is heterogeneous, which requires consistent introduction of any test compound and oftentimes sub-samples are analysed to ensure a homogeneous distribution and availability. In general, metal nanoparticles are soluble in water, making it a difficult task to obtain homogeneity of nanoparticle distribution in spiked soil. Depending on their physical and chemical properties as well as soil properties, nanoparticles tend to form aggregates and are likely to settle within a relatively short time. The present study investigates the spiking of natural soil with two sizes of zinc oxide particles (30 and 200 nm) using two different spiking procedures, namely as dry powder and as suspension in soil extract. Five samples per treatment were randomly taken from the batches of spiked soil and analysed for total zinc concentration by flame Atomic Absorption Spectrometry. Scanning electron microscopy of zinc oxide nanoparticles (SEM) was applied in an attempt to visualize zinc oxide nanoparticles in our test soil. SEM did not allow to see whether particles were present as such or as aggregates or agglomerates. Both spiking procedures showed a good recovery (> 85%) of the metal zinc and based on total zinc concentration no difference was found between the two spiking methods. SEM procedures resulted in a fairly homogeneous distribution of the zinc oxide nanoparticles in soil, as evidenced by the low variation between replicate samples (< 10% in most cases). We conclude that spiking with dry powder or suspension does not influence zinc distribution in the soil.

WE 266

Evaluation of the bioavailability of nanosized and bulk ZnO in soils and solutions using two recombinant sensor bacteria

M.J. van Gestel, T. Koster, J. van der Heijden, Vrij University, Amsterdam, the Netherlands

The environmental hazard of metal-containing nanoparticles (NPs) in soils depends to a large extent on their bioavailability. The approach used in this study enables the determination of bioavailable fractions of metal-containing NPs in soils. In general, reductive conditions in water, making it a difficult task to obtain homogeneity of nanoparticle distribution in spiked soil. Depending on their physical and chemical properties as well as soil properties, nanoparticles tend to form aggregates and are likely to settle within a relatively short time. The present study investigates the spiking of natural soil with two sizes of zinc oxide particles (30 and 200 nm) using two different spiking procedures, namely as dry powder and as suspension in soil extract. Five samples per treatment were randomly taken from the batches of spiked soil and analysed for total zinc concentration by flame Atomic Absorption Spectrometry. Scanning electron microscopy of zinc oxide nanoparticles (SEM) was applied in an attempt to visualize zinc oxide nanoparticles in our test soil. SEM did not allow to see whether particles were present as such or as aggregates or agglomerates. Both spiking procedures showed a good recovery (> 85%) of the metal zinc and based on total zinc concentration no difference was found between the two spiking methods. SEM procedures resulted in a fairly homogeneous distribution of the zinc oxide nanoparticles in soil, as evidenced by the low variation between replicate samples (< 10% in most cases). We conclude that spiking with dry powder or suspension does not influence zinc distribution in the soil.

WE 267

Comparing ecotoxicity of nano and bulk forms of CoO

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The development and use of engineered nanomaterials (NMs) is increasing at an ever accelerating rate even if little is known about their likely impacts, fate, behaviour and effects in the environment. Moreover, concerns are being expressed whether NMs would not pose a serious environmental threat. Ecotoxicological data concerning nanomaterials are also generally lacking even if the investigation of the environmental effects of NMs is of utmost importance, especially in the aquatic environment since it will ultimately involve the release of NMs into the food chain and industrial sources and has been targeted for some nano-scale environmental remediation techniques.

This study investigated the biological response of P. subcapitata exposed to single-walled carbon nanotubes. The effects of SWNTs and surfactants and concentrations on P. subcapitata were determined. Changes in algal biomass and cell morphology associated with SWNTs were monitored and the mechanisms of the different biological responses investigated through a combination of biochemical and spectroscopic methods. Results show either growth inhibition or stimulation depending on the type of surfactant used, and the speciation of SWNTs into metallic versus semi-conducting fractions. Trends of glutathione concentrations determined in culture media and the presence of high levels iron-based impurities in SWNTs used suggested the presence of reactive oxygen species and the resulting induced
Bioaccumulation in fish - revision of the OECD-testguideline
CAR Rauert1, EAJ Bleeker2, DAS Merckel3, TP Traas2

Bioaccumulation is a key element within the environmental hazard and risk assessment of substances. The OECD test guideline 305 addressing determination of bioconcentration is currently under revision within the OECD-test guideline programme. The test measures a chemical's bioconcentration factor (BCF; the ratio of the concentration in the fish to the dissolved concentration in the water) in fish, by exposing fish to the chemical dissolved in the water. This particular method is used in regulations for industrial chemicals, plant protection products, hydrocarbons and pharmaceuticals, for risk assessment, Classification and Labelling and in PBT assessment.

The guideline will be expanded with a new possible method, exposing test animals to water spiked with the test substance, which results in a bioaccumulation factor (the ratio of the substance in the animal's body to concentration in its food) rather than a BCF. Validation testing needs to be conducted to demonstrate reproducibility of results and provide information on inter-laboratory variation for this new method.

A number of laboratories have volunteered to conduct studies for this validation exercise, using rainbow trout and carp. Five test substances will be tested in each study, with the substances being concurrently “spiked” to fish food on which the test fish are fed daily during a set exposure period. This exposure period is followed by a depuration phase, in which the fish are fed a clean diet for a set period. Chemical analysis of fish tissue during the depuration phase, coupled with test set temperature concentrations in the food and feeding rate, and known fish weights, and fish food lipid contents allows the calculation, for each test substance, of:
- a depuration rate constant
- the assimilation efficiency
- the growth rate constant
- the biomagnification factor
- it is also possible to produce a kinetic BCF (range) from the data, if an uptake rate constant can be estimated.

The paper describes the envisaged changes and first ring-test results will be presented.

Saving test animals, time, and costs in fish bioconcentration tests
M Schleichlach, M Adolfsen-Erici, G Akerman

The OECD 305 protocol for determining the bioconcentration factor (BCF) in fish is long, costly, and test animal intensive. Commonly an uptake phase of 28 days is followed by a depuration phase of 56 days, and a minimum of 40 fish are required. In an effort to reduce the costs and test animal requirements, a revised protocol was tested. The key elements of the revised protocol included:
- Shortened uptake and elimination phases (4/10 days)
- Reduced number of fish (8)
- Simultaneous study of several chemicals
- Use of internal benchmarks to increase accuracy and precision

The revised protocol and the OECD 305 protocol were run for 10 chemicals using rainbow trout. Good agreement was found between the BCFs measured with the two methods. This supports the feasibility of reducing the cost and animal requirements of fish bioconcentration experiments. The revised protocol should be particularly useful in assessing whether chemicals above or below regulatory thresholds, as the internal benchmarking facilitates the determination of relative bioaccumulation behaviour.

A partition based dosing method for fish bioconcentration experiments
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Creating and maintaining a constant freely dissolved concentration of test chemicals in water is a requirement for laboratory bioconcentration experiments. This can be difficult, particularly for poorly soluble chemicals. Generator columns have been used, but they are limited to dosing at the aqueous solubility limit. We developed a new partition based dosing method using a silicone membrane module consisting of 15 000 silicone microtubes through which water is pumped. The chemical was loaded with the chemical by pumping a methanol solution stepwise down a microtube and stepwise displacing the methanol with water. Water was then pumped through the tubes into an aquarium. The system was tested using a mixture of 10 organic chemicals with log KOW ranging from 3.95 to 6.60. The concentrations in the aquarium water were measured using both solid phase extraction and passive sampling. The concentrations of most chemicals were maintained within 10% over a 4 week period. A decline in concentration of some of the low KOW chemicals was observed. The concentrations in the water could be easily controlled by regulating the water flow through the passive dosing module. The reproducibility of the water concentrations obtained using different passive dosing modules was also investigated.

Comparison of in-tissue passive sampling and whole fish extraction to measure elimination kinetics of organic chemicals
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Fish bioconcentration and bioaccumulation tests such as OECD 305 measure the change in chemical concentration in the fish over time, i.e. during chemical uptake and depuration experiments. This requires that fish be sacrificed at a number of time points during the experiments, and it is clear that the bioaccumulation factor is not being measured concurrently rather using a collection of data points, each from a different fish. In an effort to reduce the animal requirements for these tests and to enable the study of bioaccumulation kinetics in individual organisms, a passive sampling method was developed that could be employed in vivo in fish. This passive sampler consisted of an acupuncture needle with a sleeve of silicon tubing. Rainbow trout were simultaneously exposed to 10 organic chemicals for 25 days and then allowed to depurate for 56 days. The depuration kinetics were studied using both the novel in-tissue passive sampler and i) by the traditional sacrifice/extraction/analysis of whole fish. There was good qualitative agreement between the kinetics measured with the two methods. However, the variances were considerably higher using the passive sampler, and some chemicals could not be quantified. The results suggest that in-tissue passive sampling method has the potential to be useful in laboratory bioconcentration experiments, lowering costs for sample preparation and helping to reduce the number of test animals required. However, it also has several disadvantages in this context including the need to use large fish to allow deployment of the samplers and the need to expose the fish to high chemical concentrations due to the higher LOQ of the passive sampling method compared to whole fish extraction.

Comparison of liquid-liquid-extraction (LLE) and solid-phase microextraction (SPME) to determine aqueous anaerobic concentrations in fish bioconcentration studies according to OECD TG 305
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Perfluorinated organic compounds (PFC) are a large group of chemicals which have been used in a variety of applications. Perfluorooctane sulfonate (PFOS) and its derivatives have been measured in the environment and in biota. Aqueous concentrations often significantly reduced due to sorption to OM - already beneath the permitted concentration of 2 μg/L. However, the determination of aqueous concentrations is possible, as is the determination of sorption. Extraction of aqueous concentrations is described in the literature. SPME measurements should not replace LLE measurements. However, it also has several disadvantages in this context including the need to use large fish to allow deployment of the samplers and the need to expose the fish to high chemical concentrations due to the higher LOQ of the passive sampling method compared to whole fish extraction.

Procedures to keep the results of BCF studies comparable, however, SPME can give important information on the ratio between bound and freely dissolved compounds and help to estimate suitable TOC for highly lipophilic substances prior to a BCF study.

Can high concentrations of perflurorinated organic compounds in fish be explained by dietary accumulation?
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Perflurorinated organic compounds (PFC) are a large group of chemicals which have been since the 1950s because of their unique properties such as chemical inertness, resistance to heat and their ability to repel water and oil. We are only now beginning to realize that these
WE 280
Exploring a new in vivo screening technique for assessing the bioconcentration potential of pharmaceuticals in fish
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Understanding whether an active pharmaceutical ingredient is likely to be taken up from the aquatic environment and bioaccumulate has triggered the need to conduct bioconcentration studies in fish. Such studies are typically considered appropriate for pharmaceuticals having a bioconcentration factor (BCF) of >3 and >4 respectively. While the standard OECD guideline 305 includes an exposure (uptake) phase followed by a post-exposure (deposition) phase typically equal to 6 days, the duration of the uptake phase. Based on the screening potential outlined in the guideline, >100 fish per study may be required to determine a kinetic BCF value. Based on the resources required to conduct the full bioconcentration study and the potential for metabolic biotransformation, alternative techniques such as current BCF screening tests as a first tier have been explored and employed for the last several years. A new approach was used to explore the feasibility of developing a new screening tool to assess the bioconcentration potential in fish. Results of this research will be presented.

WE 281
Extrapolation of BCF from the in vitro rainbow trout (Oncorhynchus mykiss) liver S9 metabolic assay results
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2Life Technologies, AUSTIN, TX, United States of America
3ILSI Health and Environmental Sciences Institute, WASHINGTON, DC, United States of America

The bioaccumulation potential of a substance gives an indication that higher concentrations of a fish are not available. This may lead to a bias due to unbalanced weighing of available data. It also considered in a weight of evidence approach. Among these, the molecular size and molecular weight (MW) can indicate a low bioaccumulation potential. Several descriptors can reflect molecular size but at present, the most reliable is the “average maximum diameter” (Dmax aver) developed. As OASIS is a very expensive program, our aim was to examine and tested different modeling softwares giving descriptors related to molecular dimensions.

WE 282
Simple and efficient method to assess the bioaccumulation potential of ionogenic chemicals in fish
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Using molecular dimensions to evaluate bioaccumulation potential
NC Petry, C Dayton, P Adrian
CHETRA, SAINT-EULALIE, France

The REACH Regulation, which entered into force in late 2007, requires the industry to conduct assessment studies on the potential occupational exposure to a chemical. Many of these studies, however, have focused on the potential respiratory exposure to the chemical. The study of the potential systemic exposure is usually neglected.

WE 283
Using molecular dimensions to evaluate bioaccumulation potential
NC Petry, C Dayton, P Adrian
CHETRA, SAINT-EULALIE, France

The REACH Regulation, which entered into force in late 2007, requires the industry to conduct assessment studies on the potential occupational exposure to a chemical. Many of these studies, however, have focused on the potential respiratory exposure to the chemical. The study of the potential systemic exposure is usually neglected.

WE 284
The CEFIC ECO16 project: critical body residue validation for aquatic organisms exposed to toxicants causing toxicokinetic interactions
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4The Procter & Gamble Company, CINCINNATI, OH, United States of America
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6Life Technologies, AUSTIN, TX, United States of America
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8University of North Texas, DENTON, TX, United States of America
9University of California, BERKELEY, CA, United States of America

Understanding whether an active pharmaceutical ingredient is likely to be taken up from the aquatic environment and bioaccumulate has triggered the need to conduct bioconcentration studies in fish. Such studies are typically considered appropriate for pharmaceuticals having a logD value >3 and >4 respectively. As OASIS is a very expensive program, our aim was to examine and tested different modeling softwares giving descriptors related to molecular dimensions.

WE 285
PBT assessment and trophic dilution - Regulatory consequences
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Simulated trophic magnification factors: sensitivity analysis and comparison to human exposure modelling
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2Stockholm University, STOCKHOLM, Sweden
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Environmental contaminants may have serious environmental and health effects. PFCs have been detected in aquatic and terrestrial organisms with the highest concentrations found in top predators. High concentrations of PFC (i.e., PFOS and PFOA) were found in fish collected from different German rivers, although the analytical results were variable between species and the different tissues analysed (www.hru.bayern.de). Apart from a few studies on bioaccumulation in fish, a sophisticated examination of the food chain is missing. Martin et al. (Environ. Toxicol. Chem., 22, 189-195, 2003) investigated the dietary accumulation of PFC in juvenile rainbow trout but dietary exposure did not result in biomagnification. The authors emphasized that extrapolation of the estimated bioaccumulation factors to larger fish should not be performed because the half-lives of hydrophobic compounds, can be higher in large or mature fish than in smaller animals of the same species. The aim of this study was to compare the dietary accumulation potential of different perfluoroalkylates (PFOS, PFHxS, PFBS) and perfluorocarboxylates (PFOA, PFNA) in small and large rainbow trout. A dietary accumulation study was carried out on juvenile rainbow trout (2g) according to the draft document of the revised OECD TG 305. Biomagnification factors (BMF) were calculated for each of the five PFCs tested. In a further experiment large rainbow trout (40g) were fed for four weeks an experimental diet spiked with the same compounds followed by a depuration period lasting four weeks. The trajectories of the different chemicals were analysed. Knowledge of these processes was compared with the results obtained for juvenile animals. The results of both studies are summarized and discussed with regard to the accumulation of PFC in the aquatic food web and the potential impact on human health.

WE 286
Simulated trophic magnification factors: sensitivity analysis and comparison to human exposure modelling
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In this study two ecosystem level bioaccumulation screening metrics are simulated and compared.
Trophic magnification factor (TMF) is a metric applied to chemical measurements collected from a range of biota in a localized food web, and is interpreted as an approximation of the average biomagnification factor (BMF) for the chemicals in the analyzed food web. Many confounding factors such as species-specific metabolic elimination and food web structure mean that the TMF of a chemical measured in one food web cannot be used to assess the bioaccumulation of the chemical in another food web. Another metric for evaluating bioaccumulation potential is the human emission ratio (HER) which relates the amount of chemical in the physical environment directly to the human end-point. HER is also strongly dependent on the structure of the food web and other factors. A linked chemical fate and bioaccumulation model (CoZMoMAN) is applied to a set of hypothetical chemicals using lipid normalized concentrations measured in organisms of a food web and their relative trophic position. This lipophilic normalized TMF calculation is analogous to calculating the change in chemical fugacities in organisms of a food web with respect to their relative trophic position. Fugacity based fate and food web bioaccumulation model calculations also used a set of hypothetical chemicals using lipid normalized concentrations measured in other food webs and the human end-point. HER is also strongly dependent on the structure of the food web and other factors.

The hormone 17 α - methyltestosterone (MT) is used in fish farms through animal feed to enhance growth and improve disease resistance. In fish farms, MT is expected to bioaccumulate in biota including fish, mussels and other aquatic organisms. The presence of MT in biota reflects exposure to the hormone from farm practices and bioaccumulation through the food web. Exposure to MT can cause genotoxic and reproductive effects in fish. In a recent study, Brown mussels (P. perna) were transplanted at five South African harbours for 10 weeks to assess organic bioaccumulation. Genotoxicity assessment of dissolved hydrocarbons conducted in Table Bay Harbour was in the 1980s. As a consequence there is increased awareness to conduct more current organic pollutant assessments. Brown mussels (P. perna) and artificial devices, semi-permeable membrane devices (SPMDs) were transplanted at five South African harbours for 10 weeks to assess organic bioaccumulation. The model was used to show how disequilibrium conditions in the physical environment (air, water, soil and sediment) influence steady state TMFs. These results highlight the need to clearly define the TMF with respect to the analyzed components of the food web and the need to consider holistic methods that reflect environmental fate and food web bioaccumulation for screening chemicals and for chemical exposure assessment.

RA06 - Monitoring and risk-assessment of organic compounds in developing countries

WE 290 Monitoring of organic pollutants in the South African marine environment - which are better turbines or artificial devices? K Wiperstein1, N Digger1, J Richardson1, SS Wu1

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The developed global community is increasingly aware of man’s activities on environmental sustainability, and the development towards the minimal and ecological character of pollution due to the increased discharges of effluents containing pollutants such as organic contaminants. A distinct lack of historical and current data on the status of organic pollutant contaminants within the South African marine environment has been acknowledged. The last published assessment of dissolved hydrocarbons conducted in Table Bay Harbour was in the 1980s. As a consequence there is increased awareness to conduct more current organic pollutant assessments. Brown mussels (P. perna) and artificial devices, semi-permeable membrane devices (SPMDs) were transplanted at five South African harbours for 10 weeks to assess organic bioaccumulation. The model was used to show how disequilibrium conditions in the physical environment (air, water, soil and sediment) influence steady state TMFs. These results highlight the need to clearly define the TMF with respect to the analyzed components of the food web and the need to consider holistic methods that reflect environmental fate and food web bioaccumulation for screening chemicals and for chemical exposure assessment.

WE 291 Evaluation of the genotoxicity of 17α-methyltestosterone on Orychochromis niloticus widely used in pisciculture to induce monosex males GK Wende1, LM Vilela1, MF Ferreira1, HL Loudovani1, CK Grisolia2, GR Wendt1, LM Vilela1, MF Ferreira1, HL Loudovani1, CK Grisolia2

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The hormone 17 α - methyltestosterone (MT) is used in fish farms through animal feed to induce monosex males. In Brazil, this substance is still used without registration. The purpose of this study is to investigate the genotoxic effects of this hormone on Orychochromis niloticus. Tilapia is grown in fish farms due to its strong commercial interest. Evaluation of the genotoxicity was carried out through micronucleus test (MN), comet assay (CA) and nuclear abnormalities (NAS) in individuals with reproductive and non reproductive maturity. Fish were purchased from the Federal District Government fish farms. The animals were exposed to the substance diluted in the water for 96 hours to 10 hours at concentrations varying from 100 to 1 mg/L, not exceeding 0.94% of ethyl alcohol in the solution. Then, reproducitively mature individuals, measuring 09-12 cm, were kept for 28 days in fish tanks in our laboratory and fed the same diet used to produce monosex males. Finally, O. niloticus were collected at the end of 28 days of food administration containing 0.10 mg/L of 17α - methyltestosterone, as determined by GC-ECD and GC-MS, was genotoxic after exposure to 96 hours when compared with the negative control and control with alcohol. After 28-day of exposure to MT in the diet, no genotoxicity was observed. Results from in situ exposure study showed an increased level of MN. According to the literature, 17 α - methyltestosterone is depigmented in the liver of animals, so it can be suggested that the route of exposure can influences on the genotoxicity of the MT. Regarding the results obtained from the in situ study, we can observed that in the early development stages MT present genotoxic risks. Key words: genotoxicity, methyltestosterone, Orychochromis niloticus Support: Brazilian Research Council (CNPq) and University of Brasilia.
were familiar to the volunteers and would be trusted as impartial. Blood was collected before spraying, 4–5 days and 4 months post-spraying. The samples were processed in a local laboratory and prepared for assessing Italy. These results showed that the highest frequency of BNMN was in Boyaca where no aerial erosion spraying of glyphosate was carried out and Valle del Cauca where glyphosate was used for maturation of sugar cane. There was no significant association between self-reported direct contact with eradication sprays and frequency of BNMN. Overall, these results suggest that genotoxic damage associated with glyphosate spraying, as evidenced by the MN test, is small and transient. These data were used in a risk assessment which concluded that risks to sensitive wildlife and human health from the use of glyphosate in the control of coca are negligible.

WE 295
Fuzzy approach for risk assessment of brominated flame retardants in aquatic ecosystems of Latin America
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Brominated Flame retardants (BFR) are pollutants that represent a threat to human health and the environment due to their widespread use, their persistence to biological degradation, and their ability to bioaccumulate and biomagnify in food chains, especially in the aquatic one. For the last ten years contamination levels for this type of compounds have been reported for European, North American and Asian human tissue, sediments and biota samples [1,3]. However, monitoring efforts on the assessment of BFR contamination levels in Latin America are scarce.

Contamination levels, bioaccumulation and biomagnification in the aquatic trophic chain of two groups of BFR compounds (polychlorinated diphenylethers (PCDEs) and hexabromocyclododecanes (HBCD)) were evaluated in American ecosystems, one from Chile (San Vicente bay and Lenga estuary) and another one from Colombia (delta-estuary of the Magdalena river) under the framework of an international research project titled BROMACUA. Within this framework, a methodology based on fuzzy logic has been developed to evaluate the risk of contamination in aquatic organisms by using experimentally determined levels and contamination data from the literature. Fuzzy logic is characterized to be conceptually easy to understand and is based on natural language. It has been used successfully to model non-linear functions, to establish inference systems on top of the experience of experts and to deal with imprecise data. Fuzzy approaches can be very useful in the environmental field due to the uncertainty associated to this type of data.

A description of the fuzzy model proposed is given in this work, including a summary of the main outcomes of a questionnaire (replied by 38 international experts) that has been created to obtain information on different topics relevant for the model development. Results associated to the behavior and the sensitivity of the proposed model are also presented.

References

WE 296
Good quality of groundwater sources as the challenge for science and sustainability
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Groundwater sources are strategic resource for every country and population. Its availability and security is strongly connected with human health, protection of environment and economy status. Good quality of groundwater sources, providing safe drinking water for population, became the priority, and, at the same time, a big challenge for science and sustainability, and healthy, clean environment. Groundwater is the largest reservoir of fresh water to the world. About 80% of the freshwater consumption uses groundwater as primary source of water. It is traditional water supply resource in Serbia, as well. It is exclusive source of water supply of central and northern Serbia - region of Vojvodina, with only exception in city of Belgrade, where part of the water supply originates from Sara river. More than half of the abstracted water is groundwater from alluvial aquifers, and therefore more than 90 % originates from infiltrated water from rivers. These aquifers belong to the so called rapidly rechargable aquifers since they depend on hydrologic regime of water. In some groundwater sources, during previous research, emerging substance of concern (ECS) have been identified as carbofosinazine and carbamazepine. Ten years after the intervention in Serbia and the destruction of city of Novi Sad's oil refinery, bridges and water supply, providing safe drinking water and protecting the environment is still a major challenge. The potassium comes from the fertilisers profusely used by CTE farmers. Education of the farmers on appropriate hygiene measures and measures to prevent contamination is essential.

WE 297
Uncertainty assessment by a Monte Carlo simulation for methylmercury from hair of Colombian population
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2University of Buea Cameroon, BUEA, Cameroon
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The aim of this report is model the exposure and risk assessment to methyl mercury associated with fish consumption from fishermen Colombian population. Type and amount of fish consumed by the individuals as well as the concentration of fish were estimated for Colombian population was 0.68 mg/day-Kg bw and mean values of methyl mercury in blood and hair were 42.5 μg/L and 10.5 μg/g, respectively. This report intended to related methylmercury concentrations of hair from a cross-sectional study on Colombian population that currently consumes fish. Type and amount of fish consumed by the individuals as well as the concentration of fish were estimated for Colombian population.

WE 298
Uptake of pesticides in potatoes grown in Colombia: monitoring, modelling, and human health risk assessment
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3University of Zurich, ZURICH, Switzerland
4University Boyaca, TUNJA, Colombia
5University of Graz, GRAZ, Austria
A dynamic model for uptake of pesticides in potatoes is presented and evaluated with measure- ments performed within a field trial in the region of Boyaca, Colombia. The model takes into account the time between pesticide applications and harvest, the time between harvest and con- sumption, the amount of spray deposition on soil surface, mobility and degradation of pesticide in soil, diffusive uptake and persistence due to crop growth and metabolism in plant material, and loss during food processing. Pesticide concentrations were measured periodically in soil and potato samples from the beginning of tuber formation until harvest. The model was able to predict the magnitude and temporal profile of the experimentally derived pesticide concentrations well, with all measure- ments falling within the 90% confidence interval. The fraction of chlorpyrifos applied on the field during plant cultivation that eventually is ingested by the consumer is on average 10^-10^-, depending on the time between pesticide application and the processing step considered.

WE 299
Assessment of the effects of Anopheles breeding environment’ chemistry on the development of malaria vectors larvae in Mount Cameroon Region: an ecobiologically relevant control solution
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3Institute for Agricultural Research and Development, BUEA, Cameroon
Mount Cameroon region is a malaria endemic area with high transmission level, particularly among women and young children in Cameroon Tea Estate (CTE) settlements. Understanding Anopheles ecology is therefore crucial to achieve effective control of malaria.

A study was therefore designed and carried out in 6 CTE settlements to assess the influence of physicochemical water quality and environmental characteristics of Anopheles breeding sites on Anopheles distribution and densities. Breeding sites were surveyed and larvae collected and identified morphologically to species. 25 water samples from representative breeding sites were analyzed. The influence of physicochemical, environmental, and lake basin factors (vegetation, turbidity, exposure to sunlight, and distance to the nearest inhabited house - DNII) and physicochemical (temperature, pH, calcium, potassium, sodium, chloride, carbonate, bicarbonate, ammonium, nitrate, phosphate, magnesium, sulphate ions, and conductivity) parameters on larval densities and the vector was assessed.

2996 Anopheles larvae were collected from the various breeding sites. The morphological identifi- cation yielded 8 species: An. gambiae, An. marshalli, An. funestus, An. moucheti, An. perginti, An. harscoviczii, An. coluzzii, and DNII, type of breeding sites and physicochemical parameters falling within the 90% confidence interval. The presence of Anopheles larvae in breeding sites. An. gambiae showed a clear preference for temporary breeding sites close to inhabited houses (DNII > 20m) with high larval densities.

The potassium comes from the fertilisers profusely used by CTE farmers. Education of the farmers on appropriate hygiene measures and measures to prevent contamination is essential. In CTE planta- tions, are essential to suppress the increasing vector densities and malaria transmission intensity in the area.

RA10 - Risk assessment of chemical mixtures: how can we crack the nut?

WE 302
Statistical approaches for distinguishing individual chemical toxicity thresholds in poten- tially complex mixtures
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It is not known how closely the protection afforded by an Environmental Quality Standard (EQS) corresponds to the depiction of the Good Ecological Status (GEO) of the Water Framework Directive (WFD) i.e. are the requirements for ‘Good’ status between chemistry and biology con- sistent? This could have important implications for deriving EQS and it is important to under- stand how EQS compare to field data. An analysis of ‘matched’ biological quality element and chemical monitoring data from England and Wales was undertaken. It is important to consider that ecological communities are subject to numerous stressors (both physical and chemical), in-
cloning exposure to mixtures of both anthropogenic and naturally occurring chemicals. Quantile regression (QR) was used to investigate the relationship between chemical concentration and biological quality and to distinguish between the impact of a single chemical and the effects of complex mixtures. QR can be used to identify a concentration of a stressor which is likely to result in a limitation of ecological quality, and is particularly useful in cases where it is not possible to exclude all of the potentially confounding factors (e.g., co-exposure to other chemical stressors in a mixture). Forty determinands (including metals, pesticides and sanitary determinands) were included in the analysis. “Thresholds” of chemical exposure consistent with definitions of “high”, “good” and “moderate” ecological quality under the WFD could be derived for some, but not all, chemicals. The schematic risk model dataset size for inclusion of censored chemical exposure data (i.e. below LOD). An analysis of co-variance was also undertaken. These thresholds are useful for calibrating the relative stringency of EQS compared with ecological protection goals. In most cases, existing EQS appear to offer adequate protection for ecological communities.

WE 303

Evaluation of tank mixing in British agricultural environment: industrial implications
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Tank mixtures of pesticides have the potential to introduce different levels of toxic impact to the environment than is accounted for by single product risk assessment and authorisation. We have conducted a review of the potentially confounding factors (e.g., co-exposure to other chemical stressors in a mixture). Determinands (including metals, pesticides and sanitary determinands) were included in the analysis of the “thresholds” of chemical exposure consistent with definitions of “high”, “good” and “moderate” ecological quality under the WFD could be derived for some, but not all, chemicals. The schematic risk model dataset size for inclusion of censored chemical exposure data (i.e. below LOD). An analysis of co-variance was also undertaken. These thresholds are useful for calibrating the relative stringency of EQS compared with ecological protection goals. In most cases, existing EQS appear to offer adequate protection for ecological communities.

WE 304

The fish embryo toxicity (FET) test as a screening method to support a component-based risk assessment of biocidal products
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ECT Environment Federal Agency (UBA), DESAU, Germany

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The fish embryo toxicity (FET) test as a screening method to check for concentration-additive behaviour of biocides. Five commercial wood protection products, the three biocidal active substances contained in these products as well as six different generic binary mixtures of these active substances were investigated in fish embryo toxicity tests. Median lethal concentrations (LC50) were determined for each concentration-response curve and corrected for measured concentrations of the substances were compared to the toxicity predicted by the concept of concentration addition. Less than 2 fold deviation between measured and predicted toxicity was observed for all binary mixtures of the active substances and for three of the five biocidal products. This demonstrates that the toxicity of two products by the mixture toxicity prediction could be explained by the influence of certain formulation additives. Overall, the FET was found to be a suitable tool for verifying whether the toxicity of formulated biocidal products can be reliably predicted by the concept of concentration addition. Although it was difficult to demonstrate interaction effects such as synergy, the possibility of synergy should not be discounted. Rather it should be carefully evaluated on the basis of existing knowledge of synergy between pesticide active ingredients. A simple, reasonable conservative rule of thumb for synergy that could be used as an initial ranking tool for potentially risky mixtures for further refined investigation would be to assume that all tank mixes are 2.5 times more toxic than the concentration addition of their component pesticides.

WE 305

Should the receiving environment be considered a mixture in chemical risk assessment? If so, how?
D Neumann, D Taylor, M Crean
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There are three different types of mixtures that could be of concern in terms of impacts on humans and the environment: products consisting of multiple components, wastes and effluents which are present in the environment itself which will contain a vast number of substances of anthropogenic and natural origin at very low concentration. Establishing the effects of the first two mixture types is straightforward since the mixture itself is both bound and physically available. As such the developing techniques for mixtures assessments are not yet well developed. However in the case of the receiving environment, the problem is not how to measure the toxic effects of the mixture but how to identify which components, out of all of those available, should be included in the mixture to evaluate. This poster presentation will outline this critical issue in more detail, review the current methods that might be used and suggest further avenues for research.

WE 306

Risk assessment of mixture of herbicides: the case study of lake Geneva
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University of Lausanne, LAUSANNE, Switzerland

In surface waters, aquatic organisms are not only exposed to single substances but typically to mixtures. Therefore joint action of toxicants should be taken into account in ecological risk assessment. In the last years, new approaches have been proposed to reach this goal until now. In ecotoxicology, mixtures effects prediction is largely influenced by toxicological theory. In concrete terms, two concepts/models are particularly used and play a pivotal role: concentration addition (or dose addition) and response addition. Synergistic and antagonistic effects are generally neglected because of their complexity to predict. To assess the ecological risk of substances, these two models could be combined with either the Assessment-Factor method or the species sensitivity distribution (SSD) curves. Nevertheless these approaches aren’t common applied for two major reasons: the gap of data (ecotoxicological data, information on mechanism of action, etc.), and the lack of predictions validation. In this study, we propose to assess the risk of mixture of similar and dissimilarly acting pesticides. This approach combines the use of SSD curves and joint action models and is illustrated based on long-term monitoring data of lake Geneva, Switzerland. The assessment protocol combining the two approaches will also be presented and discussed. The results show a decrease of toxicity of herbicide mixtures since 2004 and lead to the question whether this improve-ment is observable in term of algal communities response. However, due to the low toxicity and its correlation with phosphorous change in the lake, the main nutrient driving, it is difficult to link the observed alteration to a specific mechanism change. Also the development of a methodology for classifi-cation in functional groups may provide a better answer along this environmental gradient.

WE 307

Effects of s-triazines and metalchlo-dioxid on chlorpyrifos toxicity in Zebrafish (Danio rerio) early-life stages
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Previous work showed the existence of ecotoxicity of water samples from the Alqueva reservoir (south of Portugal) due to the presence of significant concentrations of herbicides (e.g., atrazine, simazine, terbutylazine and metolachlor) and the insecticide chlorpyrifos. Here we examine the effects of these pesticides singly and as binary mixtures on Zebrafish (Danio rerio) early-life stages through a Fish Embryo Toxicity (FET) Test, in the lab. Our results indicate patterns where deviations from the conceptual models CA (concentration addition) and IA (independent action) like synergism, antagonism, and dose ratio level dependencies were observed. As examples, there was an increase in the toxicity of chlorpyrifos on the triazines-treated embryos, possibly due to the biotransformation of chlorpyrifos into more toxic o-analog metabolites. This study represents an important step to understand the interactions among various pesticides detected in the Alqueva’s reservoir.

WE 308

Learning lessons from exposure assessment of complex metal mixtures
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1ARCHE, GENT, Belgium
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REACH requires registration in 2010 of all substances that are produced above 1000 tonnes/year. As such, a chemical inventory of our current (CSA) needs to be developed. Complex mixtures such as intermediates from metal production processes, ores and concentrates, slags and alloys contain different metals in several species or mineral forms. The uptake of these species by living organisms is related to the solubility and bio-availability of the metal bearing species (de- tensity) and through transformation reactions in the receiving environment. The human health risk management approach of risk assessment for chemical safety assessment (CSA) needs to be developed. Complex mixtures were derived from monitoring data of the detected and compared with the toxicity predicted by the concept of concentration addition. Less than 2 fold deviation between measured and predicted toxicity was observed for all binary mixtures of the active substances and for three of the five biocidal products. This demonstrates that the toxicity of two products by the mixture toxicity prediction could be explained by the influence of certain formulation additives. Overall, the FET was found to be a suitable tool for verifying whether the toxicity of formulated biocidal products can be reliably predicted by the concept of concentration addition. Although it was difficult to demonstrate interaction effects such as synergy, the possibility of synergy should not be discounted. Rather it should be carefully evaluated on the basis of existing knowledge of synergy between pesticide active ingredients. A simple, reasonable conservative rule of thumb for synergy that could be used as an initial ranking tool for potentially risky mixtures for further refined investigation would be to assume that all tank mixes are 2.5 times more toxic than the concentration addition of their component pesticides.

WE 309

Environmental risk assessment of complex metal mixtures of some PPCPs in Kuwait WWTPs (Parabens/estrogens)
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Parabens are a group of alkyl esters of p-hydroxybenzoic acid. Parabens (or their salts) are widely used as preservatives and bactericides in cosmetics, toiletries, and pharmaceuticals (deodorants, bath gels, shampoo, cream etc.). Various in vitro assays shown paraben can bind to the estrogen receptor (Durbar et al. 2002). From the environmental point of view, information concerning parabens is limited. However in the case of the receiving environment, the problem is not how to measure the toxic effects of the mixture but how to identify which components, out of all of those available, should be included in the mixture to evaluate. This poster presentation will outline this critical issue in more detail, review the current methods that might be used and suggest further avenues for research.

WE 310

Direct Toxicity Assessment of mixtures in effluents: current UK experiences
C Simpson, DH Leverett

Direct Toxicity Assessment of mixtures in effluents: current UK experiences
C Simpson, DH Leverett

SETAC Europe 21st Annual Meeting Abstract Book
WE 314  Mixture toxicity in practice: what are the needs?

K Jantti, C Kendel, L Acker, L J Werner

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Scaht, Centre Swif for Applied Human Toxicology, Basel, Switzerland

WE 315  Environmental and health impact of unknown / unregulated chemical mixtures - case study of the State of Punjab, India

V Saini

Samridhan Foundation, Faridabad, Haryana, India

Samridhan Foundation shares its experience in the mind set of the regulators, both at the Centre and State level. The problems of keeping a check on the complex chemical mixtures finding its way into agriculture and its impact on human health. The various laws available and enforced still have a long way to go in controlling and finding its way into the environment, primarily as a result of unorganized industrialization. A typical problem in Punjab, the broad basket state and pioneer of the famous Green Revolution of INDIA.

SO7P - Special Poster Session: 30 years of Environmental Systems Research - A tribute to Michael Matthies

In the last 30 years, considerable progress was achieved in the field of environmental research by means of systems analysis and application of mathematical simulation models with active and envisioning contributions from Michael Matthies. Some landmarks of his scientific career are highlighted in this poster session.

Predicting the fate of the numerous environmental contaminants is a major challenge in chemical risk assessment and management. The development of multimedia fate and transport models was motivated by the objective to simulate the environmental fate of organic chemicals more realistically, to predict modelling of partitioning into and transport between different environmental compartments beyond simple equilibrium approaches allow considering the effects of the emission compartment, kinetics of inter-media transfer and loss processes. To reduce the effort in the determination of substance specific input parameters, quantitative structure-activity relationships (QSARs) were developed. These methods predict substance properties by correlating them with chemical structure.

Introduction of specific mixtures such as overall persistence (Pov) and characteristic travel distance (CTD) within the model ELPOS constitutes a well acknowledged contribution in the field of assessment of chemicals with respect to their persistence and long-range transport potential (LRTP). Bioaccumulation potential as of specific interest for PBT assessment was recently integrated into ELPOS by combining a food chain model with the fate model. In this way, multimedia models have become a powerful tool for the assessment of organic chemicals according to prevailing legislations like the Stockholm Convention and the European chemical legislation REACH.

Michael Matthies was among the first researchers to investigate the uptake of organic pollutants into plants and subsequent accumulation therein. With a simple one compartment model, he was able to predict internal concentrations of plants based on a few physico-chemical parameters. Ad- vanced model approaches split up the plant into separate compartments such as root, stem, leaves or fruits and consider temporal variability. These models proved to be useful tools e.g. to predict concentrations of chemicals in plants in the scope of risk assessment procedures.

Basic research elucidating the possible need to refine environmental risk assessment for veterinary antibiotics took advantage of model-based analysis and integration of experimental results. Simulation models for the fate of the sulfonamide sulfadiazine in soil were coupled via cellular uptake with the effect on the cellular level and furthermore used to predict effects concerning soil nitrification and the selection of antibiotic resistance genes.
Early Environmental Information Systems basically followed database driven approaches and provided access to homogenous datasets. A major focus was on chemical data needed for environmental exposure assessment and hazard management. Later on, Matthias and colleagues used information systems to structure the growing amount of heterogeneous environmental data for use in appropriate simulation models. With the development of Geographic Information Systems (GIS), consideration of the spatial dimension of environmental problems became possible.

Environmental exposure assessment of aquatic micropollutants needs to consider spatial and temporal variability of concentrations in river basins. The software tool GREAT-ER (Geo-referenced Regional Exposure Assessment Tool for European Rivers) has been developed to simulate surface water concentrations as an effect of overlying multipoint and diffuse sources into receiving waters under the aegis of Michael Matthies. The model considers emissions from local sources and calculates concentrations in whole river basins on a high spatial resolution (>2000 m) taking into account removal and transport processes. It has been successfully applied to simulate surface water concentrations of typical household chemicals, pharmaceuticals and metals in various catchments. Temporal variability can be included within a Monte-Carlo type probabilistic simulation routine. By coupling with a GIS, resulting concentration patterns can be visualized in form of digital colour-coded maps or concentration profiles of selected rivers. This enables investigation of spatial concentration variability and analysis of exceedence of environmental quality standards. The model can be embedded in integrated river basin management systems which constitute a useful tool in water quality management of aquatic micro pollutants. It was already successfully linked to an environmental information system and coupled with analysis tools to build up a Decision Support System (DSS) for integrated management tasks in the Elbe catchment.

WE 320
From integrated modelling to decision support
J. Reckkamp
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WE 321
unPOPal: defining long-range transport and persistence of POPs
A. River
Biotechnology Center, TU Dresden, Dresden, Germany

WE 322
Modelling and data analysis of chemicals
A. Breugemann
Leibniz Institute for Food Composition and Toxicology, Berlin, Germany

WE 323
A GIS integrated dynamic model to predict runoff water pesticide concentrations in agricultural basins
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2National Research Council (CNR), Legnano, Italy
3University of Padova, LEGNARO, Italy

WE 324
Veterinary medicines in soils: Basic research for risk analysis
A. Fecks
Institute of Environmental Systems Research, Osnabrueck, Germany

WE 325
Surface water exposure to chemicals - Recent developments of the GREAT-ER model tool
K. Klotz
University Osnabrueck, Osnabrueck, Germany

WE 326
Characteristic Travel Distance (CTD): The use of multimedia models to track the geographic range of pollutants
T. Fiedler
University of California, Berkeley, CA, United States of America

WE 327
Intercomparison of multimedia environmental fate models and the OECD Screening Tool for Overall Persistence and Long-Range Transport Potential
M. Scheltens
Swiss Federal Institute of Technology, Zürich, Switzerland

WE 328
Simultaneous simulations of uptake into plants and leaching to groundwater
S. Voight
Technical University of Denmark, KGS, Lyngby, Denmark

WE 329
Definition, calculation and measurement of POVP and LRTP
M. von der Meer
National Institute for public health and the environment (RIVM), Bilthoven, Netherlands

WE 330
Poster for Special Session Michael Matthies
V. Vivier
Heinrich-Heine University, Düsseldorf, Germany

WE 331
Evaluation of chemicals for PBT or POP properties using multimedia fate modeling
C. Ehling1, C. Zarfl1
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SS06P - SETAC/ISES poster session - Integrating the sciences & development of methods, approaches & tools to meet emerging exp. needs in chem. reg.

WT 338
Black Carbon Measurements is Effective in Detecting the Benefits of Traffic Restriction Policy on Outdoor Air Quality - the Field Study of Ecopass Area in Milan, Italy
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2National Cancer Institute, MILANO, Italy
3Cornell University, ITHACA NY, United States of America
4University of Southern California, LOS ANGELES, United States of America
5Aerosol d.o.o., Ljubljana, Slovenia

OBJECTIVE: To verify if the Black Carbon (BC) measurements could detect and demonstrate more suitably than PM differences in local urban air quality among three traffic scheme zones: unrestricted traffic, Ecopass zone with traffic restrictions, and pedestrian zone in the Milan city center.

METHOD: Instruments: measurements of BC with Aethalometer AE51 by Mage Scientific, USA and PM10, PM2.5, PM1, with a mass precalibrated Aerocet 531 by Metone Instruments Inc, USA.

Procedure: concurrent measurements in three fixed stations within the three different zones repeated in three different days and from 8.00 am till 7.00 pm and with different weather conditions.

RESULTS: campaign day 1: 1.6 (2.9); 3.1 (1.7); 1.6 (0.9) Campaign day 2: 5.2 (2.8); 2.0 (1.4); 0.3 (0.4) Campaign day 3: 3.3 (1.9); 2.6 (1.8); 1.5 (0.5) mean BC (SD) levels μg/m3 for un-restricted, ecopass and pedestrian zones respectively. The differences in mean BC levels in the same day in the different traffic scheme locations were highly significant for each comparison (p < 0.0001).

Mean PM10, PM2.5, PM1 concentrations did not show significant differences among the different traffic zones on the different campaign days. BC/PM10 ratios decreased significantly from the unrestricted zone to the pedestrian zone: on average, the BC content in PM10 decreased by about 52% and 65% in the Ecopass and the pedestrian zone respectively, as compared to the no-restriction zone.

CONCLUSION: Different city areas with different traffic intensity and quality showed different black carbon levels. Traffic reduction within the Ecopass zone results in a significant reduction in black carbon concentrations compared to the no-restriction zone, while the pedestrian zone rated even better. These data suggest that black carbon is a highly relevant metric of traffic pollution and should be taken into consideration in demonstrating the effectiveness of air quality mitigation measures.

WT 339
Influence of Outdoor Smoking on Urban Pollution. PM and Black Carbon (BC) Concentration Measurement over a Typical Summer Weekend in the Pedestrian Breza Historical District of Milan, Italy
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2National Cancer Institute, MILANO, Italy
3Cornell University, ITHACA NY, United States of America
4University of Southern California, LOS ANGELES, United States of America
5Aerosol d.o.o., Ljubljana, Slovenia

INTRODUCTION: Historical Milan city center is characterized by “street canyons”, some pedestrian islands and some open car traffic. On the pedestrian areas many people are smoking worsening the outdoor air quality.

SCOPE: To compare PM10, PM2.5 and PM1 concentrations in pedestrian Via Brera with parallel high trafficked Via Pontaccio, on summer weekends.

METHODS: Two analysers (Aerocet 531, MetOne) were used to record PM10, PM2.5 and PM1 and BC with two micro Aethalometers AE51 (Mage). They were placed concurrently from Friday until Monday on the balcony at one floor flat, one in Via Brera, the other in Via Pontaccio.

Outdoor nicotine vapour phase was sampled using passive samplers at the same position and time of the other instruments and analysed using gas chromatography. Cigarette consumption and traffic density were estimated.

RESULTS: In the rush hours >458 smokers/h in Brera and 922 cars and motorbikes/h in Pontaccio. Mean (SD) of data recorded are reported in Table 1. BC in Via Brera reached but not over come Pontaccio concentrations during crowded hours, but all PM increased more in Brera than in Pontaccio by a increase factor of 2.38, 2.30 and 2.08 in Brera and 1.19, 1.21 and 1.22 only in Pontaccio for PM10, PM2.5 and PM1 respectively. Nicotine was below detection limit on Pontaccio (>0.02 μg/m3) and 0.26 μg/m3 confirming presence of ETS.

CONCLUSIONS: Outdoor ETS increase PM concentrations during the crowded hours in the pedestrian street more than in the trafficked nearby street. BC also showed an increase in the pedestrian street during the rush hours, but the difference was not as much relevant.

WT 340
Measurements of Particulate Matter (PM) pollution in the Subway System of the City of Milan, Italy
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2National Cancer Institute, MILANO, Italy
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5Aerosol d.o.o., Ljubljana, Slovenia

Background. Restrictions to vehicular traffic in cities are increasingly implemented in order to reduce pollutant emission with an increase in the utilization of the subways systems in the metropolis cities. A strict monitoring of the index of air quality (IAQQ) in the underground transportation system should be therefore carried out.

SCOPE: To assess the concentration of particulate matter (PM) in the subway system of Line 1 and 3 of the Milan subway.

METHODS: Analyzer: portable laser mass analyzer model Aerocet 531, MetOne, USA precalibrated to record PM10, PM2.5 and PM1. Procedure: complete journeys on the three subway lines measuring the stations outdoor, the platforms and the carriages concentrations.

RESULTS: Mean (SD) outdoor: PM10 14.6 (13.3); PM2.5 29.5 (24.3); PM1 9.5 (7.2) μg/m3; Mean (SD) platforms: PM10 19.7 (9.5); PM2.5 62.4 (29.5); PM1 14.8 (6.4). Mean(SD) carriages:
PM concentrations on the platforms resulted 1.2, 2.1 and 2.9 times greater than the outdoor for the PM10, PM2.5 and PM1, respectively and in the carriages and 1.3, 3.4 and 5.1.

CONCLUSIONS. PM levels were much higher in the whole underground system as compared to outdoor pollution. In the whole network PM concentrations always exceeded EU outdoor limits by 250 μg/m³ and the suggested 25 μg/m³ for the PM2.5. Extremely high concentrations (over 250 μg/m³) were found inside subway carriages. Such an exposure is considered hazardous for sensitive groups of people (respiratory and cardiovascular patients, children, pregnant women).

We suggest that the air quality should be constantly be controlled with fixed monitoring sites at platforms and with portable analyzers in the carriages, as in other subways in the world. Improvement in filtration efficiency on the carriages and installation on all platforms of screen doors should reduce exposure to adverse air pollution levels of passengers and commuters.

WT 341

Impact of no-traffic Sundays on atmospheric pollution in the City of Milan, January 2011: black carbon concentration measurement as a reliable traffic pollution metric

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On February 11, 2011: black carbon concentration measurement as a reliable traffic pollution metric

The PM concentrations on the platforms resulted 1.2, 2.1 and 2.9 times greater than the outdoor for the PM10, PM2.5 and PM1, respectively and in the carriages and 1.3, 3.4 and 5.1.

CONCLUSIONS. PM levels were much higher in the whole underground system as compared to outdoor pollution. In the whole network PM concentrations always exceeded EU outdoor limits by 250 μg/m³ and the suggested 25 μg/m³ for the PM2.5. Extremely high concentrations (over 250 μg/m³) were found inside subway carriages. Such an exposure is considered hazardous for sensitive groups of people (respiratory and cardiovascular patients, children, pregnant women).

We suggest that the air quality should be constantly be controlled with fixed monitoring sites at platforms and with portable analyzers in the carriages, as in other subways in the world. Improvement in filtration efficiency on the carriages and installation on all platforms of screen doors should reduce exposure to adverse air pollution levels of passengers and commuters.

WT 342

Seasonal source apportionment of volatile organic compounds in Windsor, Ontario (Canada)

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Air quality in Windsor, Ontario Canada is heavily impacted by the automotive industry within the city, the industrial sources in Ohio and Michigan (US), and the large volume of cars and trucks crossing the border on Huron Church road leading to the Ambassador Bridge. Both emissions and ambient concentrations are expected to change with season. A source apportionment study was conducted using the Chemical Mass Balance (CMB) model. Once every 6-day, 6 Liter Summa canisters were used to collect 24-h air samples at Windsor West station operated by Environment Canada. There were 25 samples in 2005 during winter (Jan-March) and fall (Oct-Dec). The samples were analyzed by GC/MS in the Thorpe laboratory. Source profiles were selected based on a previous study in Windsor. The CMB results showed large inter-season and intra-season variability. Vehicle emissions (Diesel Exhaust, Gasoline Exhaust, Liquid Gasoline, Gasoline Vapors) were the most consistently greatest sources, 54% in winter and 46% in summer. Contribution from Industrial Refinery was higher in winter (21%) than in fall (18%). Significant contributions from Commercial Natural Gas (17%) and Liquefied Petroleum (7%) were observed in both seasons. The contributions from Biogenic and Coating sources were small and varied little between the two seasons.

WT 343

Simulation and instrumental data conjugation for ambient air monitoring

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The proposed method includes the conjugation of simulated air pollutant dispersion (in Russia, atmospheric diffusion model based on the comprehensive solution of atmospheric chopped layer thermo-hydrodynamics equations and turbulent diffusion equations is used) and data obtained by measurements.

Air quality measurements are known to be characterized by high accuracy but low spatial reliability and vice versa. In this case, with portable analyzers provides a reliable spatial exposure assessment but it is not sufficiently accurate. The conjugation of spatial distribution characteristics obtained by measurements and simulation data allows us to reduce uncertainties in both methods.

The technique includes the conjugation of field data interpreted to the system of points within the studied area using spatial interpolation, and spatial data obtained by measurements. It also calculates compliance coefficients in the points of measurements (fixed monitoring stations) and then approximates the coefficients over the studied area.

The method was applied in the city of Perm with the total area of 799.62 km2 and the population estimated at 1.25 million. Altogether 2,512 thousand tons of more than 340 pollutants are annually emitted into the atmosphere. Pollutant distribution simulation and the conjugation of the simulation data and instrumental data from seven monitoring stations were carried out for 7.5 thousand points within residential districts. The verification of the obtained data by check measurements showed an improvement of simulation and instrumental data convergence up to 95-97% compared to the previously recorded convergence of 85%. We also determined zones with high air pollution levels which could not be identified using linear interpolation of instrumental data and/or were not estimated as polluted zones by the analysis of pollutant distribution simulation.

The method can be used for sanitation and epidemiology studies, investigations, expert examinations and assessments.

WT 344

Application of Adsorption Sampling and Thermal Desorption with GC Analysis for the Measurement of Low-Molecular Weight Polyyclic Aromatic Hydrocarbons in Ambient Air

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Polyyclic aromatic hydrocarbons (PAHs) have been of particular concern since they are present both in the vapor and particle phases in ambient air. Historically, polyurethane foam (PUF) or XAD-2 has been widely used for the extraction of low molecular weight polyaromatic hydrocarbons such asbreakthrough of samples and inevitable pressure drop during sampling. Furthermore, collected samples may be significantly lost during solvent extraction and concentration procedures. In this study, a simple method was applied to determine gas phase PAH, and the performance of the new method was evaluated with conventional method. The method was based on adsorption sampling and thermal desorption with GC/MS analysis, which is generally applied to VOC measurement. Target compounds included two rings PAH such as naphthalene, acenaphthylene, and acenaphthene. As a reference method for comparison purposes, adsorption sampling using XAD-2 and thermal desorption with GC-MS analysis was adopted. The performance of the adsorption sampling and thermal desorption with GC analysis for the measurement of low-molecular weight PAHs in ambient air were evaluated to be satisfactory because repeatabilities of standard sample and target sample are all within 20%. Also, lower detection limits value was estimated to be less than 0.1 ppb. The results from comparison studies between two methods for real air samples revealed the correlation coefficients were more than 0.8, and the difference between two groups of data from the different methods appeared to be all statistically not significant. Although the adsorption sampling and thermal desorption with GC analysis is easier to conduct and more accurate than adsorption sampling using XAD-2 and thermal desorption with GC-MS analysis, the method is more simple, rapid, and reliable for lower-molecular weight PAHs. In addition, the method can be used for the simultaneous measurement of toxic VOCs, including benzene, toluene, xylenes, and naphthalene.

WT 345

Exposure and toxicity assessment for size-related airborne particulate matter from nearby traffic in Seoul

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Automobiles are considered as the primary source of air pollution and many studies are being conducted especially on the risk of particulate matter (PM). In this study we determined the concentration of PM, and estimated the contribution of PM on health risk.

METHODS: Analyzers: A precalibrated analysers (Aerocet 531, MetOne) was used to record the BC content in PM, and a micro Aethalometer AE51 (Magee) for BC. PM and BC concentrations were measured at fixed monitoring site at the same hours at the curbside of a high-traffic street of Milan city center and from Friday 4th until Sunday 6th February, 2011. During the Sunday, BC concentration measured the concentration before and after the cessation of the traffic restrictions. Traffic density was also measured.

RESULTS. On Friday, Saturday and Sunday PM mean (SD) concentrations were 89.8 (10.6), 78.3 (15.9) and 120.6 (42.2) μg/m³, respectively; while BC concentrations were 9.5 (3.0), 11.4 (3.7) and 11.5 (3.8) μg/m³, respectively. Intra-season BC concentration in PM was 6.6 percent respectively. Traffic density was 1,600/2,000 and 350/400 vehicles/h on no-restriction and restriction time, respectively. The BC in PM percent increased from 6.6 to 12.4 one hour after the cessation of traffic restrictions on Sunday. Mean (SD) BC was 8.1 (1.8) and 17.6 (3.9) μg/m³ in the last hour of restriction and in the first hour after resumption of full traffic, respectively (p < 0.0001).

CONCLUSION. Despite the considerable increase in PM, on Sunday as compared with Saturday, BC concentrations were lower in both absolute values and in percent in indicating a reduction in BC content.

CONCLUSIONS. No-traffic Sundays seem to bring immediate benefits in air quality regardless of the benefits disappear after less than one hour after normal traffic resumption.

WT 346

Research and Analysis on the Current Situation of the Noise Pollution in Xi’an City’s Atmospheric Environmental Basins

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Objective: To find out the noise pollution situation in the acoustic environmental domains in Xi’an city. Method: Measure the noise level in Xi’an city’s domains day and night during a year and a day, and report the monitor result in the seasonal average and year average, calculate the sound level. Result: The monitor result of the noise pollution in Xi’an city’s five kinds of acoustic environmental domains is listed as follows: Special residential area’s daytime noise all the year is within the national standard, but night noise is all beyond it; Residential area only has one kind of noise level within the national limit, which is the daytime in the second season; The mixed area’s daytime noise is without the limit in the second season; The industrial area’s daytime noise is all within the limit, but the night is beyond the limit. The area of the main transportation routes has qualified daytime noise for all season, yet the night noise is beyond the limit. Conclusion: The situation of noise exceeding the national limit exists in all domains in the city, and the night noise situation is more serious. Besides, the noise levels in the night time of the third season in the industrial area and the daytime of the second season in the mixed area have an obvious increase compared with the other seasons, which might affect the Xi’an city residents’ normal quality of life, and should be controlled.

WT 347

Transfer of chlorinated volatile organic compounds from soil and groundwater into indoor air buildings

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Soil-gas migration into buildings, i.e. indoor air, is often the main exposure pathway to humans at sites contaminated with Volatile Organic Compounds (VOCs). Two approaches are commonly used for quantification of indoor concentrations: indoor gas measurement or transfer modeling from the soil.

Model development is relatively well advanced [1-3] but measurements for model calibration and ‘validation’ hardly exist in the literature. Furthermore, predictions of indoor gas concentrations...
from different models may vary by several orders of magnitude, depending on the application \[4\] . We also compare the within county AERMOD iFs with a county-level box model, based on breathing rate, population, mixing height, wind speed and county area. The box model iFs track the lower range of the within-county AERMOD iFs. Exceptions are counties with smaller land area and high population density. We are expanding our approach to characterize the within-county and extra-county iFs for every county in the continental US. Additionally, we are introducing persistent (e.g. reaction and degradation) of each on-road MV-emitted HAP to the box-model derived iFs. Results can be easily incorporated in health impact assessments of on-road MVs at various spatial scales, such as county, regional, and national scales.

WT 349

A population-based modeling framework to assess health impacts from indoor pollutants emitted from gas cooking burners

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Natural gas cooking burners - including cooktop, oven and broiler burners - emit substantial quantities of air pollutants, such as CO, NOx, and HCHO, that can affect residential indoor air quality. Due to the large related health impacts from gas cooking burners we use a physics-based, data-driven simulation model to build virtual cohorts of homes that are representative of residences in the state of California. Time dependent indoor exposure to these compounds is then calculated based on modeled peak and time-averaged concentrations in residences and for individual occupants. For validation, modeled values have been compared with measured values carried out at real workplaces in the fields of antifouling treatment and stored-product protection. The exposure concentrations of the active substances used were determined by time-resolved and particle size-segregated personal sampling and subsequent chemical analysis. In addition, the modelling results of SprayExpo have been compared with similar modelling using ConExpo and BC-Spray. SprayExpo was found to be an appropriate model for assessing exposures during indoor spraying processes and especially suited for large room volumes. The sensitivity analysis confirmed the assumptions that besides the substance release rate, the droplet spectrum of the spraying device is the process parameter which decisively influences the exposure.

 Validation of SprayExpo is of relevance for acceptance of this tool to assess the exposure to hazardous substances in indoor air. For regulatory purposes such as the Biocidal Products Directive 98/8/EC, it is improved valuable tool to estimate inhalation exposure to non-volatile active substances during spray applications.

WT 351

A mechanistically-based model for estimating exposure to volatile insecticides from a solid resin matrix ('pest strip')

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This poster describes a mathematical model that can accurately predict the release of chemicals contained in such resin formulations. The model incorporates the diffusion-based slow release mechanism, with parameters estimated using experimental chamber data, and it is independently validated using experimental data from one of the most common applications of chemical-laden resins, i.e., dichlorvos (DDVP) contained in commercially available "Pest Strips". This poster also outlines an exposure assessment that combines reliable monitoring data for long-term ambient dichlorvos concentrations in relevant indoor situations with exposure modeling to assess the actual situation with the use of such pesticidal strips. The exposure assessment demonstrates the accuracy of the model predictions compared to the existing monitoring data.

WT 352

Perfluorinated Compounds in Human Blood, Freshwater Fish and Seafood from China:

Regional and Global Implications for Human Exposure

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Despite the growing public interest in perfluorinated compounds (PFCs), very few studies have reported the sources and pathways of human exposure to these compounds. In this study, concentrations of PFCs were measured in human blood (n=93) and freshwater fish and seafood (n=73) samples collected from China to determine residue levels, dietary intakes, regional differences in exposure, and ingestion of PFCs from a primary food source for the Chinese population. The highest mean perfluorooctane sulfonate (PFOS) concentration in human blood was 12.5 ng/ml (from Tianjin), and 25.4 ng/ml (or 0.92 ng/kg bw/d) after excluding an outlier value in freshwater fish and seafood. An extremely high concentration of PFOS was found in a crucian carp collected from Wuhan at 1610 ng/g wet wt. The daily intake of PFOS, perfluorooctanoic acid (PFOA), and perfluoroundecanoic acid (PFUnDA) via fish and seafood consumption (EDIFishSeafood) ranged from 0.10 to 2.51, 0.13 to 0.38, and 0.16 to 0.32 kg/kg bw/d, respectively, for different age groups (i.e., toddlers, adolescents and children, and adults) from selected regions in China (i.e., Tianjin, Nanchang, Wuhan, Shenyang). The daily dietary PFOS intake values increased (p > 0.05) with age. Comparison of EDIFishSeafood values with the modeled total dietary intake (TDF) of PFCs by adults from Tianjin, Nanchang, Wuhan and Shenyang, showed that contributions of fish and seafood to TDF of PFCs varied depending on the location, and seafood accounted for 6%, 25%, 80%, and 85% of PFOA intake in Nanchang, Shenyang, Wuhan and Tianjin, respectively, suggesting regional difference in human exposure to PFOS. Based on the export of fish and fishery products from China in 2009, the outflow of PFOS was estimated to range from 0.22 (perfluorooctane sulfonate, PFOS) to 5.42 (perfluoroundecanoic acid, PFUnDA) kg per year for all global regions considered.

WT 354

Human biomonitoring to assess exposure of Norwegian infants to perfluorinated compounds

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3Perfluorokyl alcohol (PFA) compounds (PFCs) comprise a large group of man-made fluorinated organic compounds used in numerous consumer products and industrial applications. Several PFCs have been shown to be persistent and bioaccumulative and have been found widespread in the environment and in humans. Animal studies have demonstrated hepatotoxicity, developmental toxicity, immunotoxicity as well as hormonal effects. In order to explore pre- and postnatal exposure to PFCs, we have initiated several studies. Up to 7 PFCs were detected in the 123 paired samples of maternal and umbilical cord blood plasma. The maternal and fetal liver samples were significantly correlated for perfluorohexanesulfonic acid (PFHxS), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluorooctanoic acid (PFOA), perfluoro-
breast milk samples monthly from about two weeks after birth and up to 12 months. Using linear mixed effect models, the data revealed no correlation between body mass index and concentrations of PBDEs with computer use hours and chemical substances or industrial chemicals, HBCDs with recommended dose and 5.158 and 4.716 days at the double dose, respectively. The estimated APU's are derived using data from the Interpolated Census of Agriculture (2006) and pesticide applications (NOCS - 2006) is combined with regional (ecodistrict) estimates of annual pesticide use (APU). The APU (tonnes) were derived for 2,4-D (mean 111; range 0-61) and Chlorothalonil (mean 100; range 0-54). At the moment, we had no information on the concentrations of U in foodstuffs. The main purposes of this study were to: determine the number of agricultural workers exposed to pesticides and estimate the number of agricultural workers at risk of exposure to IARC "possibly" carcinogenic pesticides is necessary to understand the impact of these pesticides. This study investigated three brominated flame retardants compromising 23 tri- to deca- BDEs, PBDEs, TRPBPA, alpha-, beta- and gamma: HBCDs in 38 pair blood serum samples of mother and neonates pair samples from Korea population. Also, the effect of environmental factors or impact to health status like thyroid function on internal accumulation of BFRs with 76 blood serum samples was analyzed statistically. Total PBDE concentration in blood serum was ranged from 1.559 to 50.85 ng/g lipid (mean: 17.72 ng/g-lipid) in normal group neonates and from 8.282 to 252.9 ng/g-lipid (mean: 46.29 ng/g-lipid) in normal group neonates. In case of patient group, E3-7 BDEs concentration was detected from 3.092 to 1563 ng/g-lipid (mean: 77.65 ng/g-lipid) in normal group neonates. In case of patient group, TRPBPA concentration was detected from <LOQ to 14.15 ng/g-lipid (mean: 3.164 ng/g-lipid) for mothers and from <LOQ to 69.96 ng/g-lipid (mean: 7.884 ng/g-lipid) for neonates. Total PBDEs were less than 20% among 3 PBFRs in four groups of this study but relatively highly observed in normal mothers as 31%. TRPBPA was analyzed for 76 blood samples and ranged from below LOQ to 73.96 ng/g-lipid (mean: 18.93 ng/g-lipid) in normal mothers below LOQ to 457.4 ng/g-lipid (mean: 77.65 ng/g-lipid) in normal group neonates. In case of patient group, TRPBPA concentration was detected from <LOQ to 48.25 ng/g-lipid (mean: 8.888 ng/g-lipid) for mothers and from <LOQ to 73.16 ng/g-lipid (mean: 83.42 ng/g-lipid) for neonates. Among various environmental factors- BDEs, TRPBPA, alpha-, beta- and gamma: HBCDs and PBDEs in blood serum of mothers through the dietary reconstruction process, it is consistent with biomonitoring data and requires modeling tools and other key data such as environmental and biomarker measurements, activity pattern, and chemical toxicokinetics. To aid in identifying critical research components and parameters to improve biomarker-based exposure assessments for non-persistent chemicals, we have designed an exposure reconstruction framework. Using the framework, we identified the major data gaps and modeling inputs that were likely needed to improve exposure estimates for the pyrethroid insecticides. The Pilot Study to Estimate Human Exposures to Pyrethroids Using An Exposure Reconstruction Approach was designed to collect and analyze data on variability of pyrethroids and their metabolites in environmental media, cumulative oral intake estimates of pyrethroids/ metabolites, temporal variability of urinary pyrethroid metabolites, and total food, pesticide-use, and activity pattern data. Adults collect their own environmental (food, water, dust, and surface Este dietary intake to Uranium in Catalonia, Spain was estimated for the population of Catalonia, Spain. Fish and seafood, vegetables, fruits, and rice, were randomly acquired in five ecodistricts of the zone of the Catalan company, March and June. U levels were determined in 100 range 0-1029). Using GIS, ecosurveys were mapped by exposure group to visually identify high risk regions for agricultural workers. Conclusions Information on the number of agricultural workers at risk of exposure to IARC "possibly" carcinogenic pesticides is necessary to understand the impact of these pesticides. This study was carried out to estimate the dietary intakes of pesticide residues of commonly used insecticides, bifenthrin and indoxacarb in leaf mustard. The pesticides were sprayed onto the leaf mustard at recommended and double doses at the 14 days before the harvest and then sampling was carried out at 1, 2, 3, 4, 5, 6, 7, 9, 10 and 14 days after spraying under greenhouse conditions. The amounts of pesticides residues in the crop were analyzed with GC-ECD. Limits of detection(LODs) of both bifenthrin and indoxacarb were 0.0088 ng g⁻¹. Mean of the recoveries were from 110.1 to 112.9% in case of bifenthrin and from 102.8 to 110.8% in case of indoxacarb, respectively. Biological half lives of bifenthrin and indoxacarb were 6.390 and 6.211 days at the respectively. The estimated daily intakes (EDIs) of the pesticides in the crop harvested at 14 days after spraying were less than 0.05% of their acceptable daily intakes (ADI), representing that risk of the pesticides were generally low.
probabilistic modelling to create a software tool that can determine the exposure in consumers to chemicals in food. Sources of exposure that are considered include (but are not limited to) pesticides, Food Contact Materials (FCMs), additives, flavourings, contaminants, and food ingredients. In order to accurately determine exposure to a food chemical for a population, an extensive dietary food consumption surveys needs to be conducted with the appropriate chemical concentrations for the food items. This concentration data may be uncertain, have low variability, be the output of a model, or be at a greatly aggregated level. In order to adequately determine the risk to consumers, thousands of simulations are required. These simulations can then be collated to determine sustainable subpopulations by determining e.g. the health burdens, the health benefits and the exposure to such chemicals in the environment. This requires the use of CFD techniques which can be taken in FACET (Flavourings, Additives and Food Contact Materials Exposure Task, a four year EU FP7 project).

WT 362 Evaluating different approaches to uncertainty in fugacity-based multimedia modeling: Probabilistic and non-probabilistic method

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Multimedia environmental fate models are used for evaluating the fate and distributions of organic chemicals in the environment. Uncertainty is associated with the input parameters used in these models and will thus influence the assessment of exposure and risk. Monte Carlo simulations using assumed parametric distributions have been applied previously, but suffer from the problem of capturing true knowledge uncertainty, for example regarding the choice of distribution or uncertainty in its parameters. Uncertainty can also be described by fuzzy numbers or in combination with distributions as probability boxes. Here we report preliminary results from applying these three different approaches (fuzzy arithmetic, probability bounds analysis and parametric distribution) to characterize uncertainty in a fugacity-based equilibrium criterion level-1 mass balance model in an evaluative environment. The uncertainty analysis was performed for three input parameters: the Henry’s law constant, the organic-carbon water partition coefficient, and bioconcentration factors for fish were collected from literature. Both the measurement uncertainty and the availability of the Henry’s law constant, the organic-carbon water partition coefficient, and bioconcentration factors for fish were collected from literature. Both the measurement uncertainty and the availability of data were substantially different between investigated properties and test compounds, direct uncertainty and variability in the parameter values was therefore applied to all input parameters. As a distribution for uncertainty the normal distribution was chosen for the Henry’s law constant, the organic-carbon water partition coefficient, and bioconcentration factors for fish were collected from literature. This distribution gives faster calculation times. Further, a description of uncertainty assuming log-normal distribution was used. The results demonstrate a considerable uncertainty in the calculation results that can be explained by variability in the input parameters and the method used to apply uncertainty. In order to adequately communicate the uncertainty of multimedia fate models, a guide for the applicability of simplified analytical models for near and far field exposure assessments is proposed. A typical indoor office environment has been chosen for the case study and comparing the analytical multi-zone models with the CFD approach.

WT 365 Evaluation of intake fraction for near and far field exposure using Computational Fluid Dynamics models

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Intake exposure can be represented through Intake Fraction (IF) which is defined as the mass of pollutant ingested by an individual over a given time per total mass of pollution emitted in the environment in which the individual resides. This term has been proposed by a number of researchers as a robust tool in order to establish the link between emission sources and health effects without applying full chain modeling including mechanistic models. However, the estimation based on the Intake Fraction may contain significant errors, especially when based on the assumption of homogeneous concentration in indoor environments. This is mostly the case in environments where multiple sources are strongly localized and thus indoor concentrations may vary significantly even within a small distance from the source. Various analytical models have been developed in order to assess the near and far field exposure for indoor environments, where multiple sources are considered. Among the disadvantages of such an approach is that the division of the environment into various zones has to take place before the analysis, thus influencing the final assessment. In the present work the use of CFD techniques is proposed in order to evaluate more accurately the near and far field exposure and thus create a more detailed map of the indoor pollutants concentration close to the occupant. The comparison of the CFD model with the available analytical multi-zone models can help to create a guide for the applicability of simplified analytical models for near and far field exposure assessments. A typical indoor office environment has been chosen for performing the case study and comparing the analytical multi-zone models with the CFD approach.

WT 366 Refined REACH consumer exposure assessment for adhesives

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REACH, the EU chemical legislation, implements the principle ‘no safe use - no market’. This implies that the safe use of dangerous chemicals can be demonstrated and requires that exposure assessments be performed. For adhesives and sealants intended for consumer use the exposure resulting from the domestic use of such products has to be assessed. Chapter R15 of the REACH guidance on Data requirements and Chemical Safety Assessment outlines the basis for tier-1 exposure assessment. Chapter R15 requires the manufacturers of adhesives and sealants concluded that the tier-1 exposure assessment methodology results in significant overprediction of consumer exposure. Consequently, to refine exposure assessments, FEICA developed its knowledge base on the consumer use of adhesives and sealants into a dedicated exposure assessment tool: REACT - REACH Exposure Assessment for Consumers Tool. The tool is based on empirical data from the manufacturers of adhesives and sealants in consumer use. It is structurally similar to the consumer ETCETOCA TRA tool and based on simple, transparent algorithms. The tool has been widely used in the 2010 registrations for raw materials of FEICA member companies.

WT 367 Connectivity: causal web for exposure and risk assessment of combined exposure to chemicals

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This article presents an exposure and risk assessment approach to mechanistically-based exposure and risk assessment of environmental chemical mixtures comprising the following steps: a) Characterization of exposure factors quantifying the parameters that affect human exposure to environmental chemicals, such as personal habits, environmental and workplace settings, and consumer choice. These exposure factors can be used to derive aggregate and cumulative exposure models, leading in probabilistic exposure assessments. b) Current toxicological state of the art combines estimations of biologically effective dose with each individual event to determine dose-effect models, which can be used in combination with the probabilistic exposure estimates to derive biomarkers of exposure and/or effect. Combined use of epidemiological, clinical and genetic data analysis may shed light on the effect of risk modifying factors such as lifestyle choices or DNA polymorphisms. Observation of real clinical data and/or its biomonitoring, if coupled with the exposure/effect biomarker discovery systems, can produce biomarkers of individual susceptibility and thus allow estimations of individual response to toxic insults. Toxicogenomics (transcriptomics, proteomics, metabolomics) is key to this kind of analytical and data interpretation process. c) The integrated analysis of all the relevant exposure data (including results on biomarkers of exposure, effects and individual susceptibility) results in the integrated assessment of risk factors. Use of information on risk factors with molecular dosimetry data (i.e. estimation of the actual internal and biologically effective dose of xenobiotic substance found in the target organ and, indeed, producing the effect) enables exposure and internal dosimetry assessment of exposure profiles into population risk metrics having taken into account inter-individual variability of response and exposure uncertainty.

WT 368 Tiered aggregate exposure assessment methodology and toolbox: the TAGS approach

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The objective of the TAGS project is the development of a tiered approach to aggregate exposure assessment and the compilation of a computational platform, able to perform quantitative aggregate exposure assessments for environmental and consumer products following a full chain approach including emission assessment and environmental fate modeling. The use of biomarkers to verify model predictions, to reconstruct population exposure and allocate to apportion exposure sources (reverse modeling) constitutes a part of the tiered approach and the accompanying guidance. The tiered approach guides the user through the preparation of the exposure assessment. It offers the possibility to perform of crucial quantitative information to evaluate the need for an aggregate assessment and will allow delineation of the assessment to its relevant aspects. Clear criteria for the advancement from Tier 0 (qualitative assessment) to Tier 2 (fully quantitative assessment, coupling probabilistic and deterministic information) have been defined for use in the frame of EU chemical and consumer product safety legislation. The methodology for quantitative aggregate exposure assessment has been implemented into a proof-of-concept computational platform, the core of which is a synthetic dynamic modeling environment able to track and describe in mathematical terms all the steps of the full chain approach, implementing both mechanistic (e.g. dispersion models, Physiology Based Toxicokinetic Models) and probabilistic methodologies (Markov Chain Monte Carlo or maximum likelihood
estimates) are based on outcome optimization and the current status of knowledge and data availabil-
ity. The tool provides not only “forward”mode of analysis, but also analyzes in a more interactive way the procedure from the source to the target tissue in a way that all intermediate stages can be estimated when needed, with a well-defined level of uncertainty.

WT 369
The GeoFRAME: IT reflections of the Global Risk Assessment Dialogue
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Since 2008 the European Commission through DG SANCO supports the Global Risk Assess-
ment Dialogue, a Forum on ten exposure factors to harmonising risk assessment of chemical substances among the OECD member countries.

One of the main issues dealt with in the Forum is Exposure assessment. Key issues of Exposure Assessment identified include reviewing and comparing existing approaches world-
wide, in particular the sharing of exposure assessment methodologies and exposure training. Model credibility and uncertainty, systemic exposure scenarios develop-
ment (via the establishment of collaborative case studies) and applicability of models in various tiers of assessment are specific issues to focus on.

The new GeoFRAME platform for global exposure assessment supported by the Joint Research Centre (JRC) of the European Commission and designed to host exposure assessment models for inter-comparison and harmonisation purposes that includes also scenario and new model building capabilities. It allows exposure assessors to apply different, new or existing, low or high tier assessment ap-
proaches, under the same model and data management system and compare input assumptions and output results. As such, it provides the technology to tangibly address the key issues identi-

WT 370
Potential Screening Approaches for Identifying Indicator Compounds at Land affected by Contamination in the UK
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The assessment of land affected by contamination in the UK follows a risk-based framework, rely-
ing on the early identification of source-pathway-receptor (SPR) linkages, which could present unacceptable risk. Two main and complementary search interfaces are made available: either by guided search using a database of exposure factors or by free text search. ExpoFacts is accessible through the website http://expofacts.jrc.euro-
pe.eu and does not require any registration.

ExpoFacts Sourcebook, financed by CEFIC, was developed by THL and JRC, with a steering group composed of key EU academic and regulatory experts as well as opinion formers and sup-
porting peer review process. The database was placed on the JRC web server on 15th January 2007.

The ExpoFacts follow up project started in 2009 and aims to collect, maintain, and provide the new datasets and recommended the dissemination of its use as well as opinion formers and sup-
porting peer review process. The database was placed on the JRC server on 15th January 2007.
The ExpoFacts follow up project, the expert group of the ExpoFacts follow up project (including BfR, THL, LoA, LIGA, ANSV, WSL and VA in addition to HETUS and RefXP ambassadors and ExmoRef4) evaluated new datasets and recommended the dissemination of its use as well as opinion formers and supporting peer review process. The database was placed on the JRC server on 15th January 2007.

Recently PAHs in the environment have become serious concerns worldwide since the exposure to high concentrations has been linked to carcinogenic risk. The International Agency for Research on Cancer (IARC) has classified some PAHs as probably or probably likely to be carcinogenic to humans.

Presently in India, light duty diesel cars are selling in large numbers due to the fuel economy. Tumor incidence is on the rise, with multiple risk factors that involve interplay between genetic and environmental components. In India, the annual estimate of cancer cases being 1.3898 million (3).

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Under REACH, the safety of chemicals needs to be demonstrated by industry by means of specific ERCs (SPERCs) defined and used by industry is optional. SPERCs contain release factors that are related to the chemical properties, the key uses as well as the regulatory action that should be envisaged.

Based on two existing OECD ESDs, the potential of ESDs to transform ERCs into SPERCs was investigated. The feasibility of this approach as well as the observed shortcomings in the information requirements will be presented in this poster.

A decision tree for Exposure Based Warning of toxicological studies under REACH

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The EU 6th Framework Project OSIRIS (Optimized Strategies for Risk Assessment of Industrial chemicals through integration of non-test and test information) aims to improve integrated testing strategies for REACH and the use of non-testing information for regulatory decision making, and thus to minimize animal testing. A decision tree on the possibilities of Exposure Based Warning (EBW) for human health endpoints has been developed and will be presented in this poster. The regulatory requirements of REACH determine the legal possibilities for waiving toxicological studies. WAiving is legally possible for repeated dose, reproductive toxicity and carcinogenicity studies, but it has to be adequately justified. In general this requires sound argumentation that exposure levels are already so low that more knowledge on the hazards will not further reduce risk. Therefore the decision tree focusses on parameters of substance, product, process, conditions and risk management measures that will ensure these very low exposure levels. The following factors are taken into account:
- Substance concentration in products
- Encapsulation
- High integrity closed systems
- Personal Protective Equipment
- Process and product characteristics
- Absorption, distribution, metabolism and excretion
- Frequency and duration of exposure

For some of the factors, e.g. frequency of exposure and process characteristics an expert elicitation process delivered input to specify criteria or examples. Further options is to compare quantified exposure estimates to so-called “Thresholds of Toxicological Concern” (TTC), which are general thresholds for groups of substances below which the chance of any of these substances exerting an effect is very low. Proposals for TTCs for inhalation exposure and for dermal exposure have been made within OSIRIS. The final decision tree is included in the OSIRIS Integrated Testing Strategy tool at http://osiris.simple.com.

The protection of groundwater and drinking water within the REACH system

M. Neumann, A. Klein

Canada’s Chemical Management Plan Past, Present and Future - Human Health and Ecological Exposure Assessment under Canada’s Chemical Management Plan

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Assessing risk as part of Canada’s global commitment to address legacy chemicals by 2020 is implemented through the Chemical Management Plan. In 2006, Canada categorized approximately 23,000 existing substances into 5 categories based on their potential to cause human and ecological harm. Consequently we also discuss here the key physico-chemical properties, the key uses as well as the regulatory action that should be envisaged.

Past, Present and Future - Human Health and Ecological Exposure Assessment under Canada’s Chemical Management Plan

Metabolic study of rat exposed to pentabromodiphenyl ether

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Polybrominated diphenyl ethers (PBDEs) are a group of brominated flame retardants, which have been manufactured in large quantities and widely used in a variety of consumer goods. They are currently seen as environmental pollutants and have been detected in a wide range of environmental samples and humans.

Although tetra- to hexa-brominated congeners tend to dominate the patterns observed in wild-life, the penta-BDE product, which contains mainly tetra- and pentabrominated congeners, is a major contributor of the contamination in indoor environments. Consequently, we focus on the toxicity of PBDEs in animal models. In this work, we investigate the metabolic changes in rat force-fed with pentabromodiphenyl ether (PBDE) by NMR-based metabolomics. 1H-NMR spectra obtained from rat urine and
liver tissue samples.

In order to examine the bioavailability and bioaccumulation of PBDEs at low exposure levels, we have performed a mass balance study in rats fed a low dose of a penta-BDE for 5 days. Suitable extraction and analytical methods were developed to achieve the chromatographic separation of pentabromodiphenyl ether metabolites formed in vivo and to study their structure. The identification of the metabolites was supported by full scan electron ionization mass spectra and MS/MS spectra of LC-orbitrap mass spectrometer. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119.

This study provided the valuable information of metabolic difference between treatment and control group by using multivariate analysis and could be applied for understanding the toxicity with BDE119.

Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. 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Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarkers were candidate from NMR analysis of urine metabolites isolated from rat dosed with BDE119. Six biomarker...
Within the framework of ecosystem services, both marketed and non-marketed utilities of the natural climate may result in new interactions and new directions of ecosystem change due to differing climate impacts on the carbon system, thus inducing large uncertainties in the projected changes. In general, only very few truly multi-factorial ecophysiological experiments at the field scale exist. Research conducted on the physiological and biotic responses of ecosystems to climate variability during the dry season, after a prescribed fire, and during the dry season in comparison to climate control, in the same burned area in the wet season, only showed that the combined effects of UV radiation and triclosan on organisms remain poorly understood, and such experiments cannot be considered a test of the hypothesis 'Natural environment' (2008). Functional Ecology (22) 185-195.

**TH 010**

Climate change damage functions in LCA - (2) data availability and selection of indicators

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This work aims at studying the combined toxicity of UV radiation and triclosan, a biocide commonly used in personal care, acrylic, plastic, and textile products. Zebrasfish (Danio rerio) embryos were exposed to UV-B and triclosan individually and as a mixture, and the combined toxicity was evaluated. The results showed that the combined effects of UV radiation and triclosan were synergistic, leading to a significant increase in the proportion of mortality and developmental anomalies in zebrafish embryos. In conclusion, exposure to UV-B radiation and triclosan may pose a significant risk to aquatic ecosystems, and further research is needed to understand the mechanisms underlying these effects and develop strategies to mitigate them.

**TH 011**

Water temperature, ultraviolet radiation transparency, and motorized watercraft activity interact to control invasive warm-water fish in a Montane Lake

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Montane lakes have been shown to be good sentinels of and are sensitive to the impacts of climate change. In addition, because they are typically oligotrophic and located in aesthetically desirable surroundings, montane lakes are under increasing pressures due to human activity. The purpose of this study was to determine how multiple stressors affect both non-native and native fish species in Lake Tahoe, a montane lake located at an elevation of 1,900 m in the Sierra Nevada range of western United States. Lake Tahoe is a large, ultra-oligotrophic lake that has a history of impacts due to recreational activity and introduced species, including recent introductions of warmwater fish, such as bluegill sunfish. Warm-water fish must spawn in shallow littoral waters because of adult requirements for warmer spawning temperatures. In transparent lakes this potentially exposed native fish to the detrimental effects of climate change, habitat alteration, nutrient inputs, and recreational activity.

**TH 012**

Combined effects of UV radiation and triclosan in zebrasfish early life stages

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Combined effects of UV radiation and triclosan in zebrafish early life stages was followed. Embryos were exposed to nominal concentrations of 0.1, 0.3, 0.5 and 0.7 mg/l of triclosan, plus a control, under 5 different UV intensities for 8 hours. After this period, embryos were exposed to visible light until the end of the test (96h). Embryos/larvae were daily inspected for mortality, developmental anomalies and development delay. A general Morphology Score (GMS) (based on tail detachment, somite formation, pigmentation, eye development, heartbeat, movement, blood circulation, pectoral fin, mouth and hatching) was developed and compared to the OECD guideline on Fish Embryo Toxicity Test. The results showed that UV-B radiation and triclosan may pose a significant risk to aquatic ecosystems, and further research is needed to understand the mechanisms underlying these effects and develop strategies to mitigate them.

**TH 013**

Ultraviolet radiation increases sensitivity to pesticides - Synergistic effects on population growth rate of Daphnia magna at low concentrations

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The combined effects of UV-B radiation and pesticides on aquatic ecosystems within these wetland and aquatic habitats. These processes highlight the need for improved consideration of UV and other environmental stressors in ecological risk assessment of contaminants. However, the combined effects of UV and pesticides on ecosystems are poorly understood, and such studies are needed to understand the mechanisms underlying these effects and develop strategies to mitigate them. The results showed that UV-B radiation and three selected pesticides at environmentally realistic sublethal doses/concentrations had additive or synergistic effects on the survival, reproduction, and population growth rate of the standard test species Daphnia magna. We observed synergistic effects of UV-B and pesticides. The population growth rate for fenoxycarb and pirimicarb, but a less-than-additive effect for tebuconazole. The results indicated that a combined toxic effect of pesticides on aquatic ecosystems within these wetland and aquatic habitats. These processes highlight the need for improved consideration of UV and other environmental stressors in ecological risk assessment of contaminants.
Effects of parasitism and pesticide exposure on life-history and biochemical traits in two Daphnia magna clones

In nature multiple chemical stressors occur and interact, however, also other environmental stressors (biotic as well as abiotic) can have an influence on the environmental effects of a pollutant. In this study, the influence of the gram-positive bacterial parasite Pasteuria ramosa on the toxicity of the insecticide carbaryl to the waterflea Daphnia magna was evaluated. D. magna way full factorial design two different D. magna clones were exposed to carbaryl, the parasite and the combination of both. Several key life-history (growth, survival, reproduction, filtration- and castration rate) and biochemical traits (energy stores, electron transport system, acetylcholinesterase- and phenoloxidase activity) were measured. The two selected D. magna clones differed in the prevalence (clone P) or absence (clone A) of a previously detected synergistic effect of the combination of both stressors on the castration rate. The invertebrate carbaryl had a direct effect on reproduction in both clones. No effect on any of the other measured traits was found for clone A. In contrast, a significant effect of filtration rate, growth and survival were observed for clone P. Exposure to P. ramosa initiated a shift in energy reserves in both clones: protein reserves decreased while lipid- and carbohydrate reserves increased, suggesting a switch from lipid- and carbohydrate metabolism to protein metabolism. Although the previously detected synergistic effect on the castration rate was not confirmed, the above results clearly demonstrate clonal sensitivity differences towards carbaryl toxicity and endow knowledge on the biochemical mode of action of the parasite P. ramosa.

The use of biomarkers to assess effects of binary combinations of chemical and natural stressors to Daphnia magna

In aquatic ecosystems several stressors may act together and affect the life traits of organisms. Pesticide runoffs are usually associated with high inputs of organic matter and depletion of oxygen in the aquatic system of concern to use biomarkers (e.g. Chlorella vulgaris) to assess the single and combined effects of imidacloprid and thiacloprid and imidacloprid and low food levels to the life traits of Daphnia magna. Biomarkers were measured after a 96h exposure period showing that stress impaired the activity of several biomarkers used (e.g. related with energy and reproduction system). However, it was not possible, the two conceptual models, Independent action and Concentration Addition, usually used for assessing response patterns in binary combinations of chemical and natural stressors, were used to fit our data. Our results showed that biomarkers can be used as useful tools to understand the physiological processes that undergo detoxification processes or to understand stressors mode of action.

Multiple stressor effects of predation and chemical pollution in green algae

In the last decades, the use of veterinary pharmaceuticals has been increasingly frequent in aquaculture systems raising concern on their possible adverse effects on non target species. Florfenicol is an antibiotic widely used in animal production, including in aquaculture, which has been detected in freshwater ecosystems. To investigate the toxicity of chemicals for environmental risk assessment, standard toxicity tests were established which are conducted with single species under controlled and reproducible exposure conditions. In nature, however, species do not live isolated or under constant conditions, but due to changing environmental factors they are permanently challenged with abiotic and biotic stressors such as extreme temperature, nutrient limitation or predation stress. Still, little is known about the effect of the combined stress condition caused by changing environmental factors and chemical pollutants, and how the tolerance to such multiple stressors correlates with the tolerance to the individual stressors. In order to investigate the effect of predation stress on the toxicity of key chemicals in algae, we tested the sensitivity of eight different species of algae to the antibiotic florfenicol (Flor). In order to test the stressor antagonistic, the two conceptual models, Independent action and Concentration Addition, usually used for assessing response patterns in binary combinations of chemical and natural stressors, were used to fit our data. Our results showed that biomarkers can be used as useful tools to understand the physiological processes that undergo detoxification processes or to understand stressors mode of action.

Effects of temperature variation on the acute toxicity of florfenicol to Daphnia magna and Chlorella vulgaris

The results of these combined exposure conditions will be presented and interpreted in order to determine the role of individual stress factor on the susceptibility of the selected strains to the combined stressors.

Effects of temperature variation on the acute toxicity of florfenicol to Daphnia magna and Chlorella vulgaris

The insecticide carbaryl had a direct effect on reproduction in both clones. No effect on any of the other measured traits was found for clone A. In contrast, a significant effect of filtration rate, growth and survival were observed for clone P. Exposure to P. ramosa initiated a shift in energy reserves in both clones: protein reserves decreased while lipid- and carbohydrate reserves increased, suggesting a switch from lipid- and carbohydrate metabolism to protein metabolism. Although the previously detected synergistic effect on the castration rate was not confirmed, the above results clearly demonstrate clonal sensitivity differences towards carbaryl toxicity and endow knowledge on the biochemical mode of action of the parasite P. ramosa.

Genetic adaptation potential of Chironomus populations to temperature stress

The evolutionary potential of natural populations to environmental stress, is virtually unknown for most species. Under rapid anthropogenic modifications, such as water pollution and Global Climate Change the potential of populations to adapt to environmental changes is of increasing importance. Although the freshwater model organism Chironomus teri-
biont interaction and anti-oxidative stress defenses). The results are discussed in relation to field data on the invasive behaviour of the species and health status.

This study was done in the scope of the project NISTRAKS (PTDC/AAAC-AMB/121212/2008) funded by the Portuguese Foundation for the Science and the Technology (FCT) and COMPETE funds.

**TH 022**
Forecasting the effects of global change on bioaccumulation patterns in Great Lakes species

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Climate change will have substantial impacts on biodiversity, particularly for aquatic species. Warming temperatures and changing weather patterns will also remodelize and modify chemical partitioning. Holding millions of cubic yards of sediments contaminated with persistent legacy chemicals such as polychlorinated biphenyls (PCBs) and dioxins, the Laurentian Great Lakes are a laboratory for observing interactions between biological and chemical responses to climate change. They provide a wide range of habitat to a variety of species, from littoral forage fish to deepsea predators. In this paper, we couple biogeochemical and bioaccumulation models to investigate the biological and chemical effects of climate change in the Great Lakes. We consider three species: round goby, a warmwater invasive forage fish; mottled sculpin, a coolwater native forage fish; and lake trout, a coldwater native predator. Using our coupled models, we calculate the accumulation of persistent chemicals (PCBs, dioxins) under future climate scenarios for Lake Erie and Lake Superior. Predator prey (lake trout round goby) interactions and food availability (high low) are incorporated into our simulations. For coolwater cold water species (round goby) low waters temperature limit growth. For warmwater species (round goby) cold temperatures limit growth. The impact of climate warming on growth depends on the winter lows as well as the summer highs of the scenario, in combination with the species critical upper and lower thermal limits. We find conditions for high growth and consumption rates generally lead to increased burdens. However this can be attenuated by predator prey dynamics, that can increase the differences in the temperature preferences of predator and prey can lead to mismatches in relative growth and uptake rates. As predator prey dynamics are expected to undergo substantial shifts with changing climate, these relative thermal sensitivities will be key in determining the implications of climate change for bioaccumulation, particularly in top predator species.

**TH 023**
The impact of climate change related events on water quality

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Climate change may not only affect river water discharge and water quantity, but also in terms of water quality. During flooding periods, for instance, higher water discharges may cause a dilution of normal pollution levels while increased transport of suspended particulate matter (SPM) may strongly reduce the bioavailability of contaminants. On the other hand, higher discharge levels may cause erosion of polluted sediments and as a result, polluted flood plains and inundated urban areas. To study the impact of climate change on the quality of urban and coastal waters, a battery of in vitro bioassays was applied to determine the toxicity of model hydraulic fractions and river discharge related samples. In the frame of the CIPAM project, SPM samples were collected in rivers from Norway, Sweden, Denmark, Germany, and The Netherlands during periods of dryness, flooding and extreme run-off. In addition, passive sampling was performed using silicone rubber sheets during 4 to 6 weeks periods with different river discharges. Extracts from SPM and passive samples were tested for respiratory toxicity, dissolved oxygen consumption (autotrophic/an autotrophic and heterotrophic activity, and for mutagenicity. At the time of submission of this abstract, sample collection has been completed and toxicity profiling is being subsequently executed. Results will be presented in the context of the sampling events. The work described is performed within the context of the DiPV (Diffuse Pollution) project, which is funded by the Interreg IVB North Sea Region Programme.

**TH 024**
Impact of climate change on the drinking water resource - focus on emerging substances on the Vilaine’s basin

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The Vilaine’s basin is located in Brittany, the first agricultural and food industry region of France. This watershed covers two thirds of the region (10,500 km²). Its main river named the Vilaine is about 220 km long and crosses Rennes, which is the main city in this area (approximately 210,000 inhabitants). All these activities (urban, industrial and agricultural ones) could have an impact on the water quality of this river and its tributaries. Heavy rains could otherwise play a role. This region is often subject to significant rainfall events, it raised approximately 170 days and 730 millimeters in 2009 in Rennes. The DWTP located in Ferel (close to the mouth of the Vilaine) is the biggest facility in Brittany and it is operated by Saur company. So this study aims at following the evolution of the water quality under different rainfall conditions from the source of the Vilaine to the entrance of the DWTP. According to the resource characteristics this study could help optimize the different treatment steps on the DWTP.

Thirty one strategic sampling points have been identified with a preliminary study of land use. As a result, the Global Sampling Plan describes, three successive campaigns on the Vilaine and its tributaries are planned during dry periods. Another one, related to the impact of climate change on water quality, is planned after a rainfall event (preceded by a long dry period).

After analyzing the physicochemical characteristics of these samples, pesticides and human and veterinary pharmaceuticals will be looked for by developing adapted and robust analytical methods.

Results consist on the description of amounts of all these emerging substances along the Vilaine’s basin. Furthermore the main objectives are the comparison of data under dry weather and rainfall events with the objective to determine possible consequences on the drinking water resource quality. Finally the better understanding of the river basin quality could assist the water treatment company in managing their plants in response to a sudden climate change, particularly by modulating the quantity of consumables to implement.

**TH 025**
Predicting the effect of climate change on agricultural insecticide exposure and risk for freshwater communities

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Climate change exerts direct effects on ecosystems but has additional indirect effects due to changes in agricultural practice. These include the increased use of pesticides, changes in the areas that are cultivated, and changes in the crops cultivated. It is well known that pesticides, and in particular insecticides, affect aquatic ecosystems adversely. To implement effective mitigation measures it is necessary to identify those areas that are affected currently and those that will be affected in the future. As a consequence, we predicted potential exposure to insecticide (runoff potential, RP) under current conditions (1990) and under a model scenario of future climate and land use (2090) using a spatially explicit model on a continental scale, with a focus on Europe. Space-time substitution was used to predict future levels of insecticide application, intensity of agricultural land use, and cultivated crops. To assess the indirect effects of climate change, evaluation of the risk of insecticide exposure was based on a trait-based, climate-intensive indicator system (SPEAR - SPEAr ExT). To this end, RP and landscape characteristics that are relevant for the vulnerability of affected ecosystems were combined to predict the ecological risk (ER) for freshwater communities. We predicted a strong increase in the application of, and aquatic exposure to, insecticides under the future scenario, especially in Central and Northern Europe. We will result in a separation of risk by stream-regions, the thermally stratified sites adjacent to arable land that do not meet the requirements for good ecological status as defined by the EU Water Framework Directive will increase from (33% to 39% for the EU-25 countries), in particular in the Scandinavian and Baltic countries (from 6% to 19%). In the most affected regions adaptation mitigation strategies including vegetation buffer strips and recolonization zones along streams should be fostered.

**TH 026**
May results of aquatic microcosm and mesocosm experiments with pesticides be extrapolated to changes in climate zones in Europe?

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Higher tier studies to assess the environmental risks of pesticides have been performed mainly in Atlantic Central and Northern Europe and North America and results of such studies have been extrapolated to other regions such as South Europe. Since climate (e.g., sun hours, rainfall, temperature), agroecosystems (e.g., crop rotation, field size), and edge-of-field surface waters (e.g., hydrology, ecology) in those regions are quite different, it may be expected that exposure profiles and effects of pesticides in surface waters are also different. To account for the lack of studies in the Southern zone, a research project was initiated that started with the set up of an outdoor microcosm facility in Lisbon (Portugal). One of the aims of this facility is to study the possibilities and limitations in the spatial extrapolation of regulatory acceptable concentrations (RACs) derived from outdoor micro- mesocosm experiments between European climate zones. As a preliminary evaluation, differences in 1) ecological of edge of field surface waters, 2) exposure conditions to pesticides, 3) direct and indirect effects, and 4) recovery potential in pesticide stressed (semi-) field freshwater ecosystems under South zone compared to Central zone conditions that a MA Dauin may be anticipated, will be discussed.

**TH 027**
Ecological assessment of situation in Shirvan region of Azerbaijan

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The total area of flat and mountain part of Shirvan makes 748 thousand in hectares. Anthropogenic factors influence on changes of biogeochemistry are drainage and flooding of territories, agricultural and land development, pollution by chemical actions, increase of soils fertility, cutting down of woods and bushes, building of roads and industrial targets. The region climate is non-uniform climate: climate is damp in high-mountainous and middle-mountainous parts, in foothillihilly - drought, warm, in low-flat - dry and warm. The mountain zone of area is rich by mineral waters of medical and resort value. So, the rich springs basially by sulphur and hydrocarbonates are used as a source of medical and potable water. The mountain part is located at height of 700-3000 m over level of s.l. Soil resources of region differ by variety. Deterioration of physical and chemical properties of soils is observed, has accumulated water and wind erosion. It inseparably linked with a soil erosion, salification, chemical pollution, and as a whole soil deterioration. Development of degradation processes the soils depends on an overexploitation, unstable agriculture and irrigation, destruction of woods, biodiversity pauperization. These processes are caused by factors of political, economic character, absent of this knowledge, internal and border regions conflicts and natural factors. The basic industries of region are food processing industry, processing local agricultural production (wine-making, fruit growing) and light industry (sewing, carpet weaving). Besides, wood-working enterprises functions in Ismayilli district, stone open-cast mines, brick-works, the enterprises for agricultural machinery repair in Shamakhi and Gabustan districts. Insufficiency of Shirvan ecosystems negatively affects on it biogeochemistry and there is actual a working out of measures on its preservation. Constant monitoring of a soil and vegetative cover gives the chance monitoring of ecological condition of region. The full and all-round information is necessary for decision-making on protection of Shirvan environment.
and dioxin-like polychlorinated biphenyls, DL-PCBs) are considered potent toxicants capable of producing a wide spectrum of adverse health effects in biota and humans. There are still some areas in Europe for which none or little information is available on atmospheric ambient levels, occurrence and degradation of these contaminants. Such is the case with Southern-Western Europe for example. Moreover, the scarcity of consistent experimental data sets on atmospheric concentrations for DL-PCBs and DL-PCBs on a problem of the population of most countries. The objective of this study was to insti-tute POPs atmospheric measurements (weekly resolution) in order to assess air concentrations, seasonal variations and atmospheric deposition of PCDD/Fs and DL-PCBs in a sub-alpine loca-tion where little information is available on POPs ambient levels. To achieve this goal, a monitor-ing campaign was set up at the Joint Research Center (Ispra, Italy). A 1 year data set (2005-2006) on PCDD/Fs and DL-PCBs air concentrations (gas and particulate phases) is presented and discussed.

Top-core concentration levels were higher than those in deep-core, and they were higher than those observed in other European high mountain regions. The PAH profiles were uniform throughout and comparable to those observed in aerosol and snow, indicating that atmospheric deposition pathway to the lakes. Good agreement between estimated atmospheric deposition and sedimentation fluxes was observed. However, in several lakes in the remote mountain range higher soil concentrations than those observed in the remote mountain range. Higher sedimentation fluxes may also reflect contributions from potential emission source areas west of the mountain range.

References
Assessing legacy and current-use pesticide levels in air from an agricultural region of Valle del Cauca, Colombia

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The purpose of the study was to assess the concentration of pesticides in the air of an agricultural region in Colombia. The study was conducted in the city of Palmira, Valle del Cauca Region - Colombia. The results showed that the concentration of pesticides in the air was relatively high, with the highest concentration being for Endosulfan and its metabolites. The study also found that the concentration of pesticides in the air was higher during the rainy season than during the dry season. The study also found that the concentration of pesticides in the air was higher in the urban areas than in the rural areas. The study also found that the concentration of pesticides in the air was higher in the industrial areas than in the agricultural areas.

TH 043

Sources of and temporal trends in occurrence of Legacy Pesticides in atmosphere of eastern United States

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Legacy Pesticides, mostly Organochlorines, are pesticides whose use in most countries has been banned or severely restricted. To elucidate the atmospheric sources and temporal trends in concentrations of these chemicals, legacy pesticides were collected from 11 sites in the eastern United States from August 2010 to December 2010 in areas of the agricultural center (CORPOICA), in the city of Palmira, Valle del Cauca Region - Colombia. The purpose of the study was to assess the concentration of pesticides in the air of an agricultural region in Colombia. The study was conducted in the city of Palmira, Valle del Cauca Region - Colombia. The results showed that the concentration of pesticides in the air was relatively high, with the highest concentration being for Endosulfan and its metabolites. The study also found that the concentration of pesticides in the air was higher during the rainy season than during the dry season. The study also found that the concentration of pesticides in the air was higher in the urban areas than in the rural areas. The study also found that the concentration of pesticides in the air was higher in the industrial areas than in the agricultural areas.

TH 044

Pollution of atmospheric precipitation and predict of their acidification at agricultural area

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This study carried out to establish reentry interval after applying granular pesticide formulation on soil in greenhouse.

TH 045

Seasonal trends of airborne VOCs and microbiological pollution in the vicinity of mechanical plant. Humans, DNAs and fungi at 25ºC and A. fumigatus at 37ºC. The concentrations of both groups of agents, VOCs and fungi, were significantly higher in the winter period than in the summer period. The highest concentration of VOCs was for diene (60-84 µg/m³), g-HCH (37-83 µg/m³), and 4, 4'-DDE (16-80 µg/m³). The highest concentration of fungi was for Aspergillus fumigatus at 37ºC (186 4 µg/m³ within 13 hours and were ranged 17.8-186.4 µg/m³ during 46 hours after applying granular formulation at dose rate 150 g/a.i./245 m²). The cadusafos concentration in air at next 30 to 40 years due to acid precipitation chemical compositions is necessary. In this connection monitoring of atmospheric precipitation chemical compositions is necessary. Such 12 years monitoring (1994-2005) was carried out in agricultural area of Crimea (Ukraine).

TH 046

Nitakita botanical gardens, SIMFEROPOL, Ukraine

1Department of Plant Biology, University of Georgia, Athens, GA, USA

2Center of soil fertility protecting, SIMFEROPOL, Ukraine

The pollution of an atmosphere by sulfur and nitrogen oxides can cause acid deposits, which can damage vegetation and affect the health of humans. To study the pollution of atmospheric precipitation and predict of their acidification at agricultural area, the author of this study conducted a research from 1994 to 2005 in agricultural area of Crimea (Ukraine). The pollution of atmospheric precipitation and predict of their acidification at agricultural area was determined using the method of atmospheric precipitation chemical compositions. The results of this study showed that the concentration of atmospheric precipitation chemical compositions was relatively high, with the highest concentration being for nitrogen oxides and sulfur oxides. The study also found that the concentration of atmospheric precipitation chemical compositions was higher during the rainy season than during the dry season. The study also found that the concentration of atmospheric precipitation chemical compositions was higher in the winter period than in the summer period. The study also found that the concentration of atmospheric precipitation chemical compositions was higher in the industrial areas than in the agricultural areas.

TH 047

VOC emissions in offset printing plants

D. Adamovic, J. Kurski, M. Drago, S. Adamovic, M. Dlouhova, M. Vojinov Miroslav

Faculty of Technical Sciences, NOVI SAD, Serbia

The results of the study showed that the concentration of VOC emissions in offset printing plants was relatively high, with the highest concentration being for acetone and isopropyl alcohol. The study also found that the concentration of VOC emissions in offset printing plants was higher during the rainy season than during the dry season. The study also found that the concentration of VOC emissions in offset printing plants was higher in the urban areas than in the rural areas. The study also found that the concentration of VOC emissions in offset printing plants was higher in the industrial areas than in the agricultural areas.

TH 048

Study of the reentry interval and worker exposure after applying granular pesticide formulation on soil in greenhouse

EBI Park, SKA Son, HSM Jeon, HJM Hong

National Academy of Agricultural Sciences, Rural Development Administration, SUWONGYEONGGL, South Korea

This study carried out to establish reentry interval after applying granular pesticide formulation on soil in greenhouse for preventing farmer's pesticide intoxication. The recovery of pesticide, cadusafos, ethoprophos and probenazole on absorbent in air were ranged 80.9-121.1% in charcoal and 90.6-99.0% in XAD-4, respectively. Emission rate of pesticide from top soil added water in lysimeter was higher than that of pesticides from top soil added water at dose rate 150 g/a.i./245 m² after applying a mixture of granular formulation and soil. The cadusafos concentration in air at next 30 to 40 years due to acid precipitation chemical compositions is necessary. In this connection monitoring of atmospheric precipitation chemical compositions is necessary. Such 12 years monitoring (1994-2005) was carried out in agricultural area of Crimea (Ukraine).

TH 049

Nikitta botanical gardens, SIMFEROPOL, Ukraine

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TH 050

VOC emissions in offset printing plants

D. Adamovic, J. Kurski, M. Drago, S. Adamovic, M. Dlouhova, M. Vojinov Miroslav

Faculty of Technical Sciences, NOVI SAD, Serbia

The results of the study showed that the concentration of VOC emissions in offset printing plants was relatively high, with the highest concentration being for acetone and isopropyl alcohol. The study also found that the concentration of VOC emissions in offset printing plants was higher during the rainy season than during the dry season. The study also found that the concentration of VOC emissions in offset printing plants was higher in the urban areas than in the rural areas. The study also found that the concentration of VOC emissions in offset printing plants was higher in the industrial areas than in the agricultural areas.
TH 051

Ozone and volatile organic compounds as prominent pollutants of printing indoor

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In the present work we investigated the concentration levels of ozone and total volatile organic compounds (TVOCs) measured during working time in a screen printing facility of Novi Sad. Our objective is to report a detailed analysis of TVOCs and ozone data exceeding the thresholds established by the air quality guidelines in order to investigate the workers exposure level of TVOCs and ozone to identify correlation between ozone and TVOCs in a printing environment.

The air sampling was conducted in press department, including two different types of screen printing machines: semi-automatic and automatic. Air samples were collected and analyzed in six occasions, once per 2 hour, during the working time of 8 hour by volumometer. Aerosol Series 200, Aerosol Ltd. and mobile gas chromatograph Voyager, Photovac, Inc. Results were obtained promptly, registering current situation and status of the working environment, which enables swift and adequate reaction in case of accidents and abnormal activities. The ozone concentration was caused by surface catalytic hydrolysis on the reactive aerosols, while the TVOCs concentration was caused by semi-automatic and 0.69 to 0.81 ppm for automatic screen printing machine. The TVOC concentrations were from 27.31 to 36.74 ppm for semi-automatic and 8.05 to 12.17 ppm for automatic screen printing machine.

The experimental data showed that ambient ozone concentration slowly increases with increasing of TVOCs concentration and illumination intensity during screen printing process. The ozone concentration levels were above the permissible exposure limit (PEL) for 8 hour TWA (time-weighted average) recommended by the OSHA (Occupational Safety and Health Administration), while the TVOCs concentration was below the PEL prescribed by the OSHA. In the Republic of Serbia, the Regulation of permitted concentration levels of TVOCs and ozone until now has not adopted.

Keywords: Ozone, total volatile organic compounds (TVOCs), exposure, printing, Acknowledgement: This work was supported by the Ministry of Science and Technological Development of the Republic of Serbia, within the Project No. 340/1.

TH 052

Contribution of surface/air exchange to deposition potential for cyclic methylsiloxanes: a modelling assessment

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Partition of airborne contaminants to surface media such as soil, plant and aquatic suspended particulates have been identified as significant contributors to deposition potential for known persistent organic pollutants (POPs) such as PCBs and pesticides. In this study, the effects of partitioning of airborne cyclic volatile methylsiloxanes (cVMS) to soil, plant biomass and suspended particulate matter (SPM) on the deposition potential of cVMS were estimated by equilibrium modeling. For each process, partitioning equilibrium between surface medium and air was assumed and the partitioning coefficients were estimated based on available data and approaches. This study has found that soil surface media, air partition coefficients 1 to 6 orders of magnitude lower than those of the most volatile POP reference materials such as hexachlorobenzene (HCB) and PCB 28. This is especially true for octamethylcyclotetrasiloxane (D4) and decamethylcyclopentasiloxane (D5). Consequently, gas absorption via soil, air, sediment or air suspended particulate matter is the process that contributes minimally to the deposition potential of cVMS.

Key words: Cyclic volatile methylsiloxanes (cVMS), equilibrium partitioning, soil, plant, aquatic suspended particulate matter (SPM), deposition potential.

TH 053

Sorption behaviors of octamethylcyclotetrasiloxane (D4) and decamethylcyclopentasiloxane (D5) on various atmospheric aerosols

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The study investigated sorption and desorption behavior of octamethylcyclotetrasiloxane (D4) and decamethylcyclopentasiloxane (D5) with nine major atmospheric aerosols including both primary and secondary aerosols. Sorption and desorption took place via an initial rapid and a rather slow processes. The initial rapid processes were favored especially at low concentrations. Both distribution coefficients and irreversible sorption fraction for D4 and D5 on the aerosols were determined based on isotherms of sorption and desorption. Distribution coefficients of D4 and D5 varied in a range of 8.32(GREEX10 14) to 4.17(GREEX10 14) nm 2 m 3 and 1.47(GREEX10 14) to 0.71(GREEX10 14) nm 2 m 3 respectively depending on aerosol types. Due to unique interactions between D4 and D5 and each type of the aerosols tested, Kaulasite and sulfate aerosols showed high irreversible sorption for D4 and D5 whereas carbon black and sea salt aerosols reversibly interacted with the adsorbate. It was discovered that the irreversible sorption fraction for D4 and D5 is not included in the desorption. After the ring of the cyclic siloxanes was opened in the first step, consecutive surface reactions took place resulting in further cleavage of siloxane bonds. The degree of partitioning and transformation vary so widely that it is impossible to deal with the mixture of atmospheric aerosols as a single entity. Thus, atmospheric aerosols can play two or more roles on volatile siloxanes: to remove airborne VMS by sorption and to transform sorbed molecules to less volatile compounds such as silanols.

TH 054

Filteration performance characteristics of depth filter media using KCJ particles

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Chungang University, DAEJEON, South Korea
Initial filtration performance of the filter media is usually evaluated by measuring two of the most significant parameters: the initial pressure drop and fractional collection efficiency. In the literature [1,2,3] these parameters are described as indicators whether the filter media is suitable for their intended application. Initial pressure drop is tested and usually regarded as the pressure difference (DP) measured up- and downstream of the filter media specimen. Since the initial condition tests are conducted in a very short testing time, the loading of the filter media and thus its effect on pressure loss is usually negligible. For the purpose of filter media particle collection efficiency, test particles injected in the upstream of the test filter media can be of poly- or monodisperse nature.

The test with monodisperse particle has been conducted and results are reported. In our previous work [4], in case of polydisperse test particles it is possible to evaluate the most penetrating particle size (PPS) by comparing the measured and some slight effect on the pressure difference between the two runs. The two media tested during this study have shown different results, having the media TMF1 which exhibits a more or less constant particle collection efficiency for the whole particle range while TMF2 media exhibits an increasing efficiency with the increase of particle size.

For both test are required to be evaluated of the filter media during the test with submicron particles and the effect of particle loading.

TH 055

A novel process to remove SO2 in internal circulating fluidized bed reactor

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Currently, reducing SO2 emission from power plants is a main issue for the environmental protection. Accordingly, fine powder based semi-dry FGD was proposed for higher SO2 removal efficiency which was accomplished by interacting flue gas and powder sorbent to be adhered on to the surface of particle. The aim of the present research is to study a semi-dry FGD in fluidized bed reactor to be appropriate for the cleaning process; taking into account the efficiency of water injection flow rate, Ca/S and NaHCO3/SO2 molar ratio, superficial gas velocity and specific weight of water on SO2 removal efficiency.

Study of SO2 removal was carried out using fine powder of Ca(OH)2/NaHCO3 as sorbents to achieve high desulfurization (>98%) with continuously fed water. The effect of operating variables such as water injection flow rate, Ca/S and NaHCO3/SO2 molar ratio, superficial gas velocity, and specific water weight on SO2 removal was investigated.

The target efficiency (>98%) was achieved by specific water of 0.035 liter water/Nm3 gas operating condition at Ca/S molar ratio of 1.3 and gas flow rate of 20 Nm3/min. It was observed that the required specific water volume increases with the increase in superficial gas velocity or decrease in Ca/S molar ratio. SO2 removal efficiency of about 50–60% was achieved using NaHCO3 as sorbent in dry FGD test and SO2 removal efficiency used with Ca(OH)2 was higher it used with NaHCO3 in semi-dry flue gas desulfurization.

TH 056

FT-IR as promising method for rapid determination of adulteration of gasoline with kerosene

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Nakuru University College, NAROK, Kenya
ABSTRACT
Adulteration of automotive gasoline is widespread throughout the world and Kenya is not left out. Adulteration takes toll both in terms of the air quality and loss in tax revenue. Increase in the consumption of fuels and fuel intermediates is often cited as a cause for adulteration. Adulterated fuels deprive the consumers of assured quality fuels and lead to increased tail pipe emissions. In this study a method, using FTIR, has been developed to provide an alternative rapid analysis of adulteration of gasoline with kerosene using a peak at 1380 cm-1. This method has been found to be more reliable in terms of amount of gasoline used (2%) and the time for a single scan which is less than 1 min.

Key words: (1) Adulteration (2) Gasoline (3) FTIR (4) Kerosene

EH01 - Ecosystem services in natural, agricultural and urban areas

TH 064

A novel approach to assess exposure for pollinators

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One of the main drawbacks in ecotoxicological risk assessment for terrestrial ecosystems is the lack of suitable methods for assessing exposure to plant protection products (PPPs) for epigeous community (birds, insects). This has particular relevance in risk assessment for organisms with comparable size, such as bees and other pollinators. The current methods are mostly based on comparing the concentration of chemicals in leaves or flowers to the exposure of pollinators. This approach is unsuitable, as bees and other pollinators feed on different flower species, and are able to access different flower species. In this study, we propose a new method for assessing exposure of pollinators to a chemical that is different from the current methods, and based on the historical records of pollinators in the area. The method is based on the following steps: (1) Collection of historical records of pollinators in the area; (2) Selection of a chemical that is commonly used in the area; (3) Determination of the concentration of the chemical in the flowers; (4) Calculation of the exposure of pollinators based on the concentration of the chemical in the flowers and the historical records of pollinators in the area. The method is applied to the chemical glyphosate, which is commonly used in the area, and the pollinators are bees. The results show that the exposure of pollinators to glyphosate is lower than the exposure of other chemicals, such as pesticides. This method is a promising approach for assessing the risk of exposure of pollinators to chemicals in terrestrial ecosystems.

Key words: (1) Pollinators (2) Exposure (3) Ecotoxicological risk assessment

TH 065

Relevance of an Integrated Pest Management approach towards understanding the possible causes in decline of honeybee population in the State of Punjab, India

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India has been popularizing the concept of Integrated Pest Management through out the country since early 1980's, having a whole division dedicated to it under the Directorate of Plant pro-
tection, Quarantine and Storage. The Ministry of Agriculture, Government of India has been encouraging the promotion of bio-pesticides and bio-fertilizers in this regard. However, the ignorance of the farmer in understanding the hazard linked implications of the indiscriminate use of pesticides they practice, are not only resulting in having its impact on the environment and human health, but also are having an impact on the honey bee population existing naturally or commercially bred species. The current practice of application of pesticides and plant growth regulator’s, have given rise to the reduction of the honey bee populations and other beneficial insects of pollination importance. We tend to highlight our field experience and survey information collected in assessing the causes of decline in insect pollinators in Indian Agriculture, in the State of Punjab.

TH 066
Honeybee brood development: automated evaluation with the help of image analysis

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Commercial bee breeding programs use full documentation of these studies with possibility of control and revision at the individual comb level (Yttrid, Quarantine and Storage The Ministry of Agriculture, Government of India has been working on). The digital evaluation significantly accelerates the assessment of honeybee brood studies and allows full documentation of these studies with possibility of control and revision at the individual comb level.

TH 067
The value of using ecological models in the ecosystem service approach within ERA

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3Roskilde University, ROSKILDE, Denmark

These deficits can be resolved by purpose-built computerised image analysis tools. Ongoing development is aimed to implement pattern recognition of the combs’ content, allowing the completely automated assessment of entire bee broods studies in a batch mode and also enabling an evaluation of image morphometric on a real time basis, shared among many users. The value of using ecological models in the ecosystem service approach within ERA can be proven to be useful on many levels. Recently, they started gaining popularity in chemical, mainly pesticide, ecological risk assessment (ERA). Their first and foremost advantage is gaining deeper understanding of ecosystem processes, structures and functions, which can be described by the use of ecological models. First to identify the exact driver, or a service providing a part of it, makes cost-benefit analyses much more feasible. This makes ecological-economical models very useful in quantifying and negotiating trade-offs between services. These bioassays will follow the standard test guidelines (ISO, OECD) and will be evaluated.

TH 069
Decision analysis for a sustainable environment, economy & society

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Environmental decisions are often made without consideration of the roles that ecosystem services play. Most decision-makers do not currently have access to useful or usable methods and approaches when they are presented with choices that will have significant ecosystem impacts. The goal of the Ecosystem Services Research Program (ESRP) Decision Support Framework (DSF) Team is to help provide that access by identifying and developing effective and user-friendly decision methods and approaches that empower decision-makers to explicitly and routinely incorporate ecosystem services into their decision-making. To this end the ESRP DSF team is developing an open-source, web-based decision analysis framework called DASEES: Decision Analysis for a Sustainable Environment, Economy and Society. DASEES integrates guidance and decision support tools to implement a four-step iterative Bayesian decision process:

1. Understand Context
2. Define Objectives
3. Develop Options
4. Evaluate Options
5. Take Action

DASEES will be developed with stakeholder and decision-maker input, through case studies, to ensure the guidance, tools, and templates meet user needs and facilitate the incorporation of ecosystem services in the decision-making process.

TH 071
Ecosystem service models for balancing nature protection and wind energy development

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Ecosystem service models for balancing nature protection and wind energy development have been the focus of energy policy development in many countries worldwide, particularly among European Union Member States who have agreed to obtain national targets in support of multiple Directives. However, renewable energy development is often associated with fundamental conflicts between policies that mandate environmental protection and policies that mandate energy independence and sustainability. In October 2010, the European Union released guidance on wind energy development that is specifically designed to balance nature conservation with renewable energy development and siting policies. The resulting guidance proposes a development framework to guide assessment of potential impacts and resulting measures to mitigation stressors while balancing the need to provide the necessary energy development and financing community with predictable processes and mechanisms to implement wind generation projects. Successful implementation of such an approach will ultimately involve identification of the suite of stressors that may be associated with wind energy development, properly describing their relationship to ecosystem or nature protection status, and appropriately quantify mitigation to compensate for potential environmental impacts. Examples from related technical fields and regulatory frameworks in the U.S. and other countries such as Natural Resource Damage Assessment, Ecological Risk Assessment, and Environmental Impact Assessment provide ideal opportunities to describe the stressors associated with wind energy development, capture their relationship to ecosystem services, and appropriately quantify mitigation to compensate for potential environmental impacts. This presentation will draw upon approaches currently used in the U.S. to quantify stressor impacts and develop mitigation measures to protect biodiversity such as federally threatened or endangered species and their habitats. The model will demonstrate the utility and usefulness of an ecosystem service approach for evaluating wind energy development projects that balances the need to protect nature with the need for sustainable energy sources consistent with current environmental directives in the European Union and comparable regulatory requirements in the U.S. and other countries.

TH 072
Quantifying ecosystem service considerations during restoration of contaminated lands and waters

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Implications of the European Commission's September 2010 decision on measuring 'Good Environmental Status' in marine waters

(Wilming, N; Seaton, F; Buzzetto, M; Gaedke, F; Columbus, F)

ENVIRON, EMERYVILLE, United States of America
ENVIRON UK, BATH, United Kingdom
ENVIRON Italy, MILAN, Italy

While a significant part of regulatory decision making has focused on the protection of human health, regulatory agencies and international non-governmental organizations have re-emphasized the mandatory role of the environment by encouraging long-term sustainable practices and an increased focus on the ecological benefits of environmental policies and actions. This renewed effort reflects recognition by business, government, and other institutions of the need for more rigorous and comprehensive accounting of the ecosystem impacts of their activities. As such, business and government are starting to formulate strategies to account for these changes, and how the values of different types of services are ascertained and evaluated has become of paramount importance.

Several models and methods for quantifying ecosystem services and evaluating tradeoffs between different policy or management alternatives have emerged that enable decision makers to assess the implications of decision alternatives on preservation, enhancement, or reduction of different types of services. These tools make clear the ways in which regulatory policy and management choices affect the type, quality, and magnitude of services we receive from ecosystems - such as air, water, productive foods, soil, timber, and other resources and processes that sustain human and biota alike. These examples of tools, applications, include a framework for screening and cataloguing ecosystem attributes and the application of tools such as Habitat Equivalency Analysis (HEA) and Net Environmental Benefits Analysis (NEBA) to quantify and aggregate ecological, economic, and social benefits and costs associated with management alternatives and ecosystem attributes. A weighting scheme for compiling net changes in habitat value and ecosystem services, and approaches to monetize the relative changes in habitat value and ecosystem services between restoration alternatives will be demonstrated.

It is evident from the environmental directives in Europe and environmental policy changes occurring in the U.S. and elsewhere that business and government can both benefit - financially, as well as in terms of stewardship and reputation - by incorporating ecosystem service considerations into the management strategies guiding their environmental obligations.

TH 075

The 'Green Liver System' - using single basic ecosystem function of aquatic macrophytes for sustainable water purification

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The aquatic ecosystem must face a large input of xenobiotics, which are affecting organisms, ecosystems, populations, aquatic bodies with nearly no life concerning fish, plants etc. inside. But a few hundred kilometers after the city of Sao Paulo the river looks nice and clean with fish and plants in a nearly perfect ecosystem.

In the last years we developed the "Green Liver System" which is based on several basic ecosystem function using aquatic macrophytes. One of these basic functions is the ability of aquatic plants to take up and biotransform xenobiotics as well as natural toxins. Comparing the metabolic possibilities of plants with human liver, a lot of similar pathways could be detected.}

TH 050

Perfluorooctanoic acid induces peroxisome proliferation-associated effects in the liver of Japanese medaka

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Widespread contamination of perfluorooctanoic acid (PFOA) in the marine environment draws great concern over its ecotoxicological impact on marine mammals and wildlife. In the present study, the male Japanese medaka (Oryzias latipes) was adapted to the seawater to mimic the environmental exposure conditions in the marine environment and was then exposed to the nominal concentrations of 10, 50, 100 mg L-1 PFOA for 7 d. There was no impact on survival, relative liver and gonad size, and condition factor (measure of growth) at any concentration tested. Peroxialdehyde (AcO) accumulation and CAT activity were significantly increased at marginal significance. The enhancement of CAT activity was paralleled by the significant upregulation of PPAR-S expression at the same dose. PFOA induced a significant inhibition of catalase (CAT) activity at high doses with no changes in the superoxide dismutase (SOD) activity. In the liver of Japanese medaka, peroxisome proliferative (PPG) activities in the liver were demonstrated. These results strongly suggest that PFOA may induce peroxisomal fatty acid oxidation and impose the oxidative stress through the alteration of cellular oxidative homeostasis in the liver. PFOA increased the mRNA levels of proinflammatory cytokines such as IL-6, TNF-α and IL1-β, suggesting that it may be involved in inflammation and tissue injury. This study may contribute to understanding the mechanisms of PFOA-induced hepatic toxicity in Japanese medaka and assessing the potential risk of PFOA in marine fish and wildlife. In addition, the present results obtained at the high concentrations may provide important biological endpoints relevant to situations such as environmental spills.
Effects of solution chemistry on the interaction between triclosan and humic acid

Bioactivity of synergized neem (Azadirachta indica, A.Juss) and potentiated insecticides for the control of Culex quinquefasciatus Mosquito larvae

Interactive toxicity of alum and polydADMAC to Newzealand rabbits

Response of Newzealand rabbits to drinking water treatment with alum and polydADMAC in terms of change in electrolytes

Evaluation of the toxicity of glyphosate and its different formulations using the cell line human HepG2

Dissolution study of silver nanoparticles in toxicity media

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Evaluation of the toxicity of glyphosate and its different formulations using the cell line human HepG2

Dissolution study of silver nanoparticles in toxicity media
TH 088
Development of genitalia in the ivory shell (Babylonia japonica): observation of the specimens from wild populations and laboratory-reared juveniles
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We examined development of genitalia in the ivory shell (Babylonia japonica) with a histological method, using both wild populations and laboratory-reared juveniles for 0.1-0.6 year of age, in the chain of studies on analysis of induction mechanism of imposex caused by organoarsenic compounds, such as tributyltin (TBT) and triphenyltin (TPhT) from antifouling paints, in gastropods. Parent Ivory shells were collected in Milbo Bay, Tottori, Japan by commercial mussel collectors. Molluscs with empty shell valves and with flow-through systems, using natural seawater collected at Seto Inland Sea and deep sea water collected at approximately 400 m in depth of Suruga Bay, Japan, respectively. Concentrations of TBT and TPhT in both seawater were below the detection limit by gas chromatography with mass spectrometry (GC/MS). Egg capsules spawned by parent shells were rinsed by distilled water and then moved to other tanks/aquaria with flow-through systems. It took approximately 3 weeks until larvae hatched out. Veliger larvae were settled down at bottom of the tanks/aquaria within several more days. Settled juveniles were fed Antarctic krill (Euphausia superba) every day. Shell forges were conducted at the third, fifth, and seventh year of age, 1.2, 1.4, and 1.6 year of age respectively, in order to observe the growth of shell size and muscle tissue. Tissue samples were fixed in 4% formaldehyde, dehydrated, embedded using a resin medium, and observed with a light microscope. Cross sections of the shell were observed in those younger than 2 years old. Immatured oviduct was observed in 1-year-old juveniles. In 2-year-old shells from wild populations and laboratory-reared juveniles, the immuno-staining technique may represent a relatively straightforward way of determining MT concentrations in aquatic invertebrates exposed to metals.

TH 089
Interactions between endogenous and exogenous antioxidants against Pb-induced oxidative stress in wild unagulates from a Pb polluted mining area
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Heavy metals mining and smelting commonly contaminates air, water and soil and this contamination is then transferred to biota through food chains. It has been widely suggested that certain physiologic disorders and diseases attributed to the exposure of lead (Pb) are related to the generation of oxidative stress. To protect from oxidative damage, organism rely on a complex antioxidant system comprised of endogenous produced phytochemicals such as glutathione (GSH), superoxide dismutase (SOD) and glutathione peroxidase (GPX); and dietary antioxidants such as vitamins A and E. The aim of this work was to study the interactions between both kinds of antioxidants against Pb-induced oxidative stress on kidney tissues from wild unagulates from a Pb-polluted mining area. The animals were captured using a method combining netting and trap, and from 1.5 to 2.7 years old. The kidney tissues were homogenized, and the oxidative stress and antioxidant status were determined with the method as described above. The results showed more altered biomarker responses. Integrated biomarkers studies were able to successfully demonstrate biological effects from toxicants in the system and allowed better understanding on organisms responses to a combination of stressors other than just measuring mortality. The use of active biomonitoring as a reliable means of assessing environmental health is further established.

TH 090
Assessment of DNA adducts in Dreissena polymorpha exposed to benzo[a]pyrene
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This physiological system is particularly sensitive to chemical contamination. Immune biomarker measurements can be used in laboratory experiments to assess the impacts of xenobiotics on communities and functional responses at the population and ecosystem levels. Measurements can also be applied under field conditions to characterize the health of wild fish. In environmental immunotoxicology, analysis of immune parameters in native fish populations may be particularly difficult as immune cellular or biochemical responses have to be studied in fresh tissues with living cells. The aim of the present study was to determine in laboratory, required conditions to analyze cellular immune responses from kidney tissue samples in European bullhead (Cottus gobio) and to evaluate the immune-related biomarkers using flow cytometry methodology in the European bullhead, Cottus sp., a current freshwater fish. In this context, spleens of bullhead were interesting due to sampling facilities and to their immune function. After spleen tissue disruption, leukocytes of each spleen were centrifuged and re-suspended in PBS (pH 7.2) and the flow of DNA adducts in the non-biting midge Calómaelus americanus from wild populations and laboratory-reared juveniles
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TH 091
Integrated biomarkers responses in fish from active biomonitoring and whole effluent toxicity assessment of a mining polluted fresh water system
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An integrated assessment of fish health was conducted on two fish species in the Blesbokspruit wetland subjected to water pollution primarily with mining effluent. This is a hydrological impor- tant water body situated on the Grootfontein dam, in the southern part of South Africa and its ecological integrity is being continuously threatened by large volumes of effluent discharge. Previous studies were only conducted on metal accumulation. Active biomonitoring (ABM) was conducted by deploying laboratory reared Tilapia, Oresochromis mossambicus (n=20) in cages at five sites during the high flow period of 2008-2009. Whole effluent samples were collected at 4-weekly intervals. Water samples were preserved on endogenous antioxidants, therefore suggesting that dietary antioxidants are especially important for wildlife to fight against Pb-induced oxidative stress. Bone Pb in bear was essential to evaluate early childhood exposure to Pb. Pb, therefore controlling and mining area, thereby ratifying that long-term effects exposure on the antioxidant system are present in this species. We suggest that the management of these game species should consider a supplementary feeding with foods enriched with vitamins A and E when animals are suspected to be exposed to Pb pollution.

TH 092
Ex vivo evolution of kidney leukocytes immune parameters in European bullhead (Cottus gobio)
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TH 093
Genotoxicity analysis is widely used in biomonitoring programs for the evaluation of biological effects of pollutants on marine organisms whereas similar investigations are not currently envisaged for freshwater animals. In the present study, the relevance of DNA adducts as biomarker of genotoxicity related to PAHs contamination of urban water has been investigated using the freshwater mussels Dreissena polymorpha. This zebra mussel is a very suitable sentinel species for pollution monitoring in view of its abundance and its capacity of accumulation of metals and organic micro-pollutants. Mussels were collected in a reference site and then exposed in the laboratory to various concentrations of benzo[a]pyrene ranging from 1 µg/L to 100 µg/L for 4 days. Afterwards, mussels were kept in running water for 28 days of recovery period and DNA adducts levels were subsequently measured on two different organs, the digestive gland and the gills, using the 32P P-post-labelelling technique. Benzo[a]pyrene nominal concentrations and bioaccumulation in mussel tissues were measured by GC-MS (Gas chromatography-Mass spectrometry). Results show that DNA adducts formation following benzo[a]pyrene exposure and their relationship with nominal concentration and mussel benzo[a]pyrene accumulation, ii) the tissue differences in DNA adducts formation and iii) the persistence of DNA adducts. Ultimately, data converge towards the fact that DNA adducts represent a very promising biomarker for water quality monitoring.
Adverse effect level concentrations were included in TRV development. Tissue-based TRVs were developed using a weight-of-evidence approach similar to the procedure described in the U.S. Environmental Protection Agency’s Guidance for Developing Ecological Soil Screening Levels.

TH 097 Effects of polycyclic aromatic hydrocarbons (PAHs) by lipid oxidation in avian embryos

The input of PAHs into the atmospheric, aquatic and terrestrial system has been accelerating since the beginning of early industrialization. PAHs are well known to be potentially carcinogenic to humans and ecotoxicological effects of PAHs have been shown in a diverse suite of studies, including microorganisms, reptiles, birds, and mammals. Relatively few studies address questions concerning the health impact of PAHs in avian species, but some laboratory studies show that PAHs are highly embryotoxic to birds when injected into eggs. We have designed a method to investigate the effects of PAHs on the β-oxidation of fatty acids in hepatic embryonic tissue from chicken (Gallus domesticus). Using a combination of previous results and new data, we demonstrated an increase in β-oxidation of fatty acids in chicken embryonic liver tissue after in ovo exposure to some PAHs. The focus for this study is exposure to 16 PAHs injected on day 4 into the air cell. This is then followed by in vitro incubation of the embryonic liver on day 10 with a fermented meat mixture (palestinian fish and chicken) and a non-oxidative cleavage of carbon before entering the tricarboxylic pathway and cycles of β-oxidation. As a result of this lipid-oxidation titrated water is produced. The radioactive water (SH2O) is collected and measured. Using our assay the effects of PAH on the enzyme function regulating the hepatic fatty acid metabolism can be studied in vitro. This approach could be a very useful trying to find out possible mechanisms behind avian toxicity including disturbance of fatty acid oxidation and lipid homeostasis. Other compounds than PAHs will be tested. To the best of our knowledge, this is the first time such study has been performed. 

TH 098 In vitro effects of pesticides and metals on biomarkers in Cerastoderma edule (Bivalve: Cardiidae)

PRAGUE, CZECH REPUBLIC

Several studies have shown that metals and pesticides in water can affect the activity of enzymatic biomarkers in bivalves. However there is little information on the mechanisms and pathways involved in the toxicity of these contaminants that can often affect non-target species. In this perspective the objective of this study was to evaluate the activity of glutathione-S-transferases (GST), catalase (Cat) and cholinesterase (Che) of Cerastoderma edule tissues exposed to in vitro mercury, cadmium, dimethoate and carbofuran. Cockles (20-30 mm) were collected in July 2010 from a site commonly used as reference in toxicity studies at Ria of Aveiro, Portugal (Barra). Digestive gland extracts, used for GST Cat, and catalase analyzes, and adductor muscles extracts, used for ChE analyzes, were obtained from three animals from each sample. Enzyme activities were measured using the colorimetric method. Aliquots of each sample (50, 25, 12.5 and 6.25 mM) during 30 minutes at 25°C. This study will help to understand the range of the in vitro effects of metals and pesticides on the biomarkers before the whole metabolic process by organisms.
reaches of watersheds. In eastern North America, the development of once forested land causes habitat loss and interferes with natural processes and cycles especially in aquatic systems. During storm and rainfall events metals, poly cyclic aromatic hydrocarbons (PAHs), and other contaminants are washed into lakes, rivers, and streams instead of being absorbed into the ground. These chemicals are being found in drinking water which is often prepared from surface water. Aquatic ecosystems in these watersheds (lakes, rivers, and streams) are affected by these chemicals. Apart from these, due to the pollution of biosphere with radioactive substances, heavy metals, organic pollutants initiates alteration of gene expression, cell death. That alteration becomes the reason of the birth of new phenomena and signs, non-typical for individual organism.

The frequency of spontaneous mutations is sufficiently low and makes up 10^{-7} - 10^{-8} range. The rate of transpositions of MGE may increase in few orders under unsuitable conditions such as radiation, heat shock, chemical mutagens. In its turn, this process in turn may lead to increasing adaptive signs. In other cases the selection on dicreasing adaptive characteristics have lead to changing sites of MGE. The selection on increasing adaptive level have lead to special adaptive signs are observed. In other cases the selection on decreasing adaptive characteristics have lead to changing sites of MGE. The selection on increasing adaptive level have lead to special indications to the previous sites in the previous expressions. Such behaviour of MGE provides genotypic adaptability to harmful factors.

TH 101
Influence of radiation on prolificity and viability of stable strains Drosophila melanogaster

TH 102
Heterological effects of 1% Alum to Newzealand rabbits

TH 103
Copper exposure increases histamine levels in marbled crayfish (Procambarus clarkii)

TH 104
Synergistic androgenic effects of an engine oil caused by the joint action of at least three chemically different compounds

TH 107
Testing the effects of environmental levels of xenobiotics as found in the Douro River estuary (Portugal) on the maturation kinetics of fish gonads - A stereological study using the zebrasfish

TH 108
Enzyme-induced exposure of brown trout hepatocytes in primary culture can induce the emergence of smaller peroxisomes, mimicking new estrogenic effects uncovered in vivo

TH 109
Stereological and genetic effects of an engine oil caused by the joint action of at least three chemically different compounds

E07? - Endocrine disrupting chemicals in the environment
Our results demonstrate that different EDCs can directly interfere with lipid metabolism in the test organisms. On the other hand, the flame retardant TBBPA (tetrabromo bisphenol A) did not affect the lipid accumulation, as evaluated by Oil-Red-O staining and determination of triglycerides and cholesterol content. Moreover, no significant down-regulation of the examined hormone-related genes was observed in testis in male fish exposed to BDE-209 at concentrations of 0.1, 1, 10, and 100 μg/L for 21 days. The results showed that the LC₅₀ value of 2-chloro-4-phenylphenol on fish in 96 h was 1.29 mg/L. An histopathological observation showed that mass cell apoptosis were observed in liver of the fish. Moreover, to determine the endocrine disruption effects of 2-chloro-4-phenylphenol, adult fish was exposed to concentrations of 0.1, 1, 10, and 100 μg/L for 21 days. The results showed that mortality was down-regulated, in testis of male fish were degenerated at 10 μg/L treatment, and inhibition of spermatogenesis were observed in testis in male fish. In addition, the thyroid hormone receptor α (TRα), androgen receptor (AR) mRNA levels in the liver of male and female fish were significantly down-regulated. These results indicate that exposure to 2-chloro-4-phenylphenol had anti-testosterone activity in male, antiestrogenic activity in female, and negative effect on thyroid system in male and female. Therefore, 2-chloro-4-phenylphenol could be a potential endocrine disruptor.
ture on MCF-7 cells. This in vitro model is an estrogen receptor (ER) positive cell line derived from a human breast adenocarcinoma. To determine the relative proliferative potency of organic extract from the waters, the E-SCREEN test was applied. This bioassay compares the cell yield between cultures of cells treated with estradiol, as positive controls, and cultures treated with different concentrations of extractions suspected of being estrogenic.

Our results showed low contamination of water and sediment by the monitored contaminants. Results from chemical analyses will also be presented applying the guidelines for human and ecological risk assessment in order to evaluate the adverse effects on human health and ecosystem induced by the levels of EDCs in the water.

**TH 117**

Evaluating and identifying estrogenic activity of the Yeast Estrogen Screen and the HPLC DAD of some Tunisian WWTPs

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HPLC DAD of some Tunisian WWTPs

The presence of estrone was also identified in the water from Mincio river. Our results showed low contamination of water and sediment by the monitored contaminants. In order to assess the estrogenic activity, a recombinant yeast-based assay has been used. Two sampling campaigns have been carried out in 2004 and 2010 to measure the estradiol equivalent concentrations of fourteen different stations in Tunisia. Dose-response relationships for selected substances and their relative estrogenic potencies expressed as estradiol equivalent factors (EEFs) were determined. EEFs together with previously obtained concentration data based on liquid chromatography tandem mass spectrometry measurements (HPLC-DAD) were used to calculate the total estrogenic activity. Solid-phase extraction was performed on approximately 11 water samples. From the final extract volume, aliquots were used for the measurement of estrogenic activity and estrogen one for chemical analysis, which was performed by liquid chromatography coupled to high performance liquid chromatography HPLC-DAD. From these results one can identify suspended materials with high estrogenic responses. Based on the activity of 17β-Estradiol in the YES assay we estimated the estrogenic response. The response in the YES was expressed as measured estradiol equivalents (EEQs). Samples from Wastewater Treatment plants located near an industrial or tourist area showed high estrogenic activities. Data obtained display high liquid chromatography estrogenic responses to the presence of various estrogenic compounds (17β-estradiol, ethinylestradiol, estrone and estriol). The main contributors to the overall estrogenic activity were synthetic and natural hormones. Finally, the results obtained by biological and chemical analysis were compared.

**TH 118**

Tournament of bioassays: Comparing different in vitro systems for detecting endocrine activity in environmental samples

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The hypothesis postulates that certain substances act like natural hormones, causing adverse effects by interfering with the endocrine systems of wildlife and humans. To identify the process is risk characterization, integrating all credible scientific information on hazard, dose-response, exposure and uncertainty to reach a scientifically defensible risk definition. To integrate available data into risk characterization, “weight of evidence” (WOE) approaches are often used to examine and prioritize results. Hazard identification and risk characterization for endocrine active chemicals has been presented in various documents, including reports from ECETOC and the US EPA two-tiered Endocrine Disruptor Screen.

In the US program, chemicals selected for screening are subjected to a battery of 11 assays to determine their potential to interact with the estrogen system through androgen, estrogen, or thyroid pathways. Data integration is necessary, beginning with screening assays that identify potential interactions with the estrogen system, to testing for adverse effects in long-term reproductive and developmental toxicity assays, to mode of action analysis and risk characterization. We have formulated a framework for conducting this process to meet the scientific objectives. For evaluating results of screening studies, null hypotheses are constructed for each of the three targeted hormonal modalities to test the premise that the chemical does not interact as an agonist or antagonist in estrogen, androgen, or thyroid pathways or with the aromatase or steroidalogenic enzymes systems. Following each hypothesis testing, we present relevant recommendations for reliability and validity. Reliability is assessed according to the degree to which three fundamental tenets are met, including that measurements are authentic and verifiable within an appropriate small level of error, that relevant test endpoints are complete, and that results are meaningful and lead to consistent conclusions.

**TH 120**

Endocrine disrupting potential of six major organophosphate flame retardants in H295R cells

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In the present study, the yeast estrogen screen (YES) has been used to assess the estrogenic activity of wastewater and wastewater treatment plant (WWTP) effluents of sewage treatment plants. The application of bioassays for environmental monitoring of wildlife populations has surpassed that of PBDEs in Europe. OP flame retardants are the third important group of flame retardants next to aluminabrominated flame retardants and brominated flame retardants. Compared with brominated flame retardants, OP flame retardants have received little attention with regards to potential health effects. Because of the high risk of exposure to brominated flame retardants, the OP flame retardant has surpassed that of PBDEs in Europe. OP flame retardants have been detected in the house dust, surface water, fresh water biota, human urine and milk, at the levels similar to or greater than those of PBDEs.

In order to assess the estrogenic activity, a recombinant yeast-based assay has been used. Two compounds were measured in the samples, including estradiol and estrone. In the YES was expressed as measured estradiol equivalents (EEQs). Samples from Wastewater Treatment plants located near an industrial or tourist area showed high estrogenic activities. Data obtained display high liquid chromatography estrogenic responses to the presence of various estrogenic compounds (17β-estradiol, ethinylestradiol, estrone and estriol). The main contributors to the overall estrogenic activity were synthetic and natural hormones. Finally, the results obtained by biological and chemical analysis were compared.

**TH 121**

Assessment of in situ estrogenic effects in the Black chinned Tilapia (Sarotherodon melanopterus) on two European fisheries

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The aim of this study was to develop an enzyme linked immunosorbent assay (ELISA) to quantify vitellogenin in the Black chinned Tilapia (Sarotherodon melanopterus). Vitellogenin (Vtg) was first purified from plasma samples of estradiol-induced fish using a two-step chromatographic method. The Vtg was characterized with an estimated molecular weight of 45 kDa. The antibody against vitellogenin was used in both in rabbits and ELISA. The specificity of the antibodies to recognized T-vtg was verified by Western blotting and indirect ELISA experiments on blood samples. By using these antibodies and purified T-vtg, a competitive ELISA was set-up and validated. This assay appears sensitive, with a detection limit of 0.011 mg/L of TCDPP, 0.01 mg/L of TCPP and 0.1 mg/L of TCP, respectively. The t-cyanuric acid and t-triazine showed higher AUC than those of PBDEs.

**TH 122**

Effects of EDCs in a wild gudgeon population (Gobio gobio L.) in Luxembourg

L H'Hoste1, DA Doblet1, GAC Gutleb1, PO Pallaič1, PJM Porcher2, SW Sanchez3, HH Hoffmann1, CHM Cauchie1, PJ Duyven1

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3Centre de Recherche Public - Gabriel Lippmann, BELVAUX, Luxembourg

For many decades human activities have dispersed toxic chemical substances in the environment. Over the last years many chemicals have been identified as endocrine disrupting chemicals which can have serious consequences for wildlife populations. Endocrine disrupting potential of six major organophosphate flame retardants in H295R cells

In this study, we investigated the endocrine disrupting potential of six organophosphate flame retardants (OPFRs) in H295R cells. The OPFRs were selected due to their common use in consumer products and their suspected estrogenic activity. The primary endpoints of this study were induction of vitellogenin (Vtg) and alteration of the cell cycle. Vtg is an estrogen-responsive gene that is expressed in liver cells and hepatocytes. A significant increase in Vtg was observed for all OPFRs tested, with the highest activity observed for TCP. Additionally, the cell cycle was affected by all OPFRs, with the highest activity observed for TCPP. The results of this study indicate that OPFRs have the potential to disrupt the endocrine system, which could have serious consequences for wildlife populations.
response mechanisms to pollution in fish may be achieved and help improving the ecological status of river ecosystems.

**TH 124**

Assessing the endocrine disrupting potential of Bacillus thuringiensis israelensis based on response mechanisms to pollution in fish may be achieved and help improving the ecological status of river ecosystems.

**TH 125**

Endocrine disruption effects of 3,3′:4,4′-dichlorodiphenyltrichloroethylene (PCB-77) on juvenile zebrafish

**TH 126**

Concentrations and space-temporal trends of polybrominated diphenyl ethers (PBDEs) in Eurasian eagle owl (Bubo bubo) unhatched eggs from Southeastern Spain

**TH 129**

U-shaped responses of fish zona pellucida protein and vitellogenin gene expression after octylphenol waterborne exposure

**TH 130**

Endocrine disruptor in humans: a longitudinal study of exposure and effects

**TF 127**

Where to cut-off? - Endocrine hazard profiles of EBI fungicides.

**TF 128**

In vitro screening of estrogens in waters pointed out another possible source of EDCs pollution than waste water treatment plants

**TF 129**

U-shaped responses of fish zona pellucida protein and vitellogenin gene expression after octylphenol waterborne exposure

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**TF 131**

Where to cut-off? - Endocrine hazard profiles of EBI fungicides.

**TF 132**

In vitro screening of estrogens in waters pointed out another possible source of EDCs pollution than waste water treatment plants
cizer, BPA is suspected to have estrogenic properties and endocrine-modulating ability. Due to the ubiquity of this compound, human exposure to BPA is virtually universal. Associations have been reported between urinary BPA concentrations, heart disease and diabetes in adults. Given this evidence, further human studies on the effects of low chronic exposure are needed. We performed the first longitudinal study on the daily exposures to BPA in a population representative sample of European adults. Measures of daily intake rely on two different time points (the baseline of the study and nine years after). Epidemiological analyses were performed to investigate BPA endocrine disrupting activity (circulating hormone and metabolite concentrations). A Genome Wide Analysis study was carried out and targeted replications were performed to validate the results. Study design: Analysis were performed on the baseline stage of the IntCHIANT1 follow-up study, an Italian population based cohort. Participants were 1453 adults aged more than 20. BPA excretion rates were measured by liquid chromatography mass spectrometry (LC-MS).

Results: Demographic differences in UER BPA and daily intake estimation will be present. Possible mechanism of actions of BPA resulting from the GWA study will be shown.

TH 131

Estrogenic active substances in bottled mineral water? P. König1, D. Tropiano1, B. Brischle2
1Institute for Environmental Research (Biology 5), RWTH Aachen University, Aachen, Germany
2Forschungszentrum Jülich GmbH, Jülich, Germany

Due to the increasing use of several diverse chemicals by modern society and the large-scale production of phthalate esters it is the only proposed endocrine disrupting activity of the wide variety of substances present in our living space is affected by numerous known and unknown chemicals of anthropogenic origin. A large range of these chemicals have shown to act as endocrine disrupting compounds. The present study was conducted to further investigate the state of contamination level of sediment samples from Laguna Lake. It is the second largest freshwater lake in Southeast Asia and the largest lake in the Philippines, it is also part of the Living Lakes Network. In this study the LYESS-Yeast estrogenic screen assay assisted by enzymatic digestion with Lytechis was performed to screen for estrogenic active fractions in sediment samples from Laguna Lake. Based on preliminary results, the present study analyzed sediment samples of two different sites and results were compared.

TH 132

Assessing estrogenic activities of sediment samples from Laguna Lake, Philippines and fractions obtained by Effect directed analysis in the LYESS-Assay C. Schönfeld1, T. Schulle1, W. Bruck1, G. Streck1, T. Floche2, A. Vallare3, H. Hölle1
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Due to the increasing use of several diverse chemicals by modern society and the large-scale production of phthalate esters it is the only proposed endocrine disrupting activity of the wide variety of substances present in our living space is affected by numerous known and unknown chemicals of anthropogenic origin. A large range of these chemicals have shown to act as endocrine disrupting compounds. The present study was conducted to further investigate the state of contamination level of sediment samples from Laguna Lake. It is the second largest freshwater lake in Southeast Asia and the largest lake in the Philippines, it is also part of the Living Lakes Network. In this study the LYESS-Yeast estrogenic screen assay assisted by enzymatic digestion with Lytechis was performed to screen for estrogenic active fractions in sediment samples from Laguna Lake. Based on preliminary results, the present study analyzed sediment samples of two different sites and results were compared.

TH 133

Chemical and endocrine disruptors - a joint strategy for different chemical regulations F. Streck1, J. Bachmann1, T. Friese2, A. Kolher1, G. Maack3
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While being identified as of special concern in the environment since decades, in the regulatory context endocrine disrupting substances are treated differently to substances acting via other toxic modes of actions until recently. Now, taking into account the current revisions of the Pesticides and Biocides directives, endocrine disruptors are at least explicitly mentioned in all substance regulations (REACH, Pesticides and Biocides directives, Pharmaceuticals). However, the way how substances with endocrine disrupting properties are identified, the outcome of the identification and the regulatory consequences differ between the individual regulations. While disturbance of the endocrine system is a toxic mode of action among others, it may result in adverse effects in the environment difficult to predict with our current set of laboratory tests. Although for some of the test systems and test strategies are available, similar approaches for other organism groups like invertebrates are still missing. A common understanding on how to identify substances of special concern due to their endocrine disrupting properties for the environment among different regulations was developed by the German Federal Environment Agency (UBA). UBA proposes to differentiate between these three groups a) substances for which endocrine disrupting properties are the basis of the pesticide or pharmaceutical mechanism of action in target organisms b) substances where endocrine disrupting properties are decisive for the overall side effects on non target organisms and c) substances where endocrine mechanisms of action are identified but are not relevant for the overall risk assessment. UBA proposes to focus special regulations on the second group. Some general thought on how to identify these types of substances e.g. for the identification as a substance of very high concern under REACH or as a “cut-off- candidate” for pesticides will be presented.

TH 134

A transcriptomic approach for the fish embryo test with zebrafish and mediafit to endocrine disruption V. Schiller1, R. Krichhuber1, X. Zhang1, M. Hecker2, A. Wichmann1, M. Fenske3
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The endocrine system is susceptible to disruption by various chemicals occurring in the environment. The current testing approach in regulatory toxicology for endocrine disrupting chemicals (EDCs) relies on long-term reproductive, animal intensive studies. These labour intensive tests entail high costs and are ethically disputable. The need for alternative test strategies for EDCs is urgent, and zebrafish and mediafit embryos have good potential as alternative test approaches for EDCs. Relevant endocrine pathways are already developed in the embryos, and endocrine related genes have been shown to respond similarly than in reproducing fish. Both species have therefore particular advantages. The aim of this study is to develop qPCR arrays for EDC-specific suites of genes using zebrafish for screening applications, whereas the longer endogenesity of mediafit may alleviate the prediction of chronic effects. To compare mediafit and zebrafish, we used embryos of both species to study adverse effects of endocrine active compounds like genistein, linoleum and methylparaben. 4th zebrafish were analyzed by microarrays and 7-day old mediafit by qPCR, to gain insights into the specific transcriptional modes of action. Sets of responsive genes specific to each chemical were found of which several indicate effects on endocrine pathways. In both species, genistein and linoleum enhanced mainly the expression of estrogenic genes, whereas methylparaben enhanced mainly the expression of estrogenic genes; linuron on the other hand, repressed androgen dependent enzyme genes. Simultaneously, we found a considerable intersection of steroidogenic genes regulated by all tested substances. Some of these genes show good promise for ED marker gene candidates and are now being validated for a potential screening application.

TH 135

Validation and interpretation of the amphibian mammophorism assay J. Burke1, G. Last2, P. Bowen2, G. Pap3
1Consortium Laboratories, Harrogate, United Kingdom
2Consortium Laboratories, Harrogate, United Kingdom
3Consortium Laboratories, Harrogate, United Kingdom

The fish short-term reproduction assay was conducted with fathead minnows using a chemical known to induce endocrine disrupting effects. A control and three test groups were prepared including four replicate tanks containing two males and two females. The test was designed to determine changes in spawning morphology, gonadal size and architecture and specific biochemical endpoints that reflect disturbances in the hypothalamic-pituitary-gonadal (HPG) axis, including oestrogen agonists/antagonists and vitellogenin induction in males. Collectively, the endpoints observed were intended to allow the test to be used with chemical mixtures. Overall the sediment samples did not reveal a high estrogenic impact as it can be observed in some European sites.

TH 136

The short term fish reproduction assay G. Last1, P. Bowen2, G. Pap3
1Consortium Laboratories, Harrogate, United Kingdom
2Consortium Laboratories, Harrogate, United Kingdom
3Consortium Laboratories, Harrogate, United Kingdom

The fish short-term reproduction assay was conducted with fathead minnows using a chemical known to induce endocrine disrupting effects. A control and three test groups were prepared including four replicate tanks containing two males and two females. The test was designed to determine changes in spawning morphology, gonadal size and architecture and specific biochemical endpoints that reflect disturbances in the hypothalamic-pituitary-gonadal (HPG) axis, including oestrogen agonists/antagonists and vitellogenin induction in males. Collectively, the endpoints observed were intended to allow the test to be used with chemical mixtures. Overall the sediment samples did not reveal a high estrogenic impact as it can be observed in some European sites.

TH 137

Contraceptive choices and the resultant estrogenic load on the environment U Khan, N Nicell
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As a decade of evidence suggests that the estrogenic content of wastewaters being released to the environment feminizes fish and that such feminizing effects could potentially comprise the reproductive capacity of the effective fish, Environmentally relevant estrogens can be broadly categorized in two classes; namely, those that are endogenously produced and those that are environmentally consumed. Of the two, the excretion and therefore the subsequent environmental presence of endogenous estrogens can be considered to be insignificant since they are a specific characteristic of our biology. When considering exogenously consumed estrogens used for human contraception, the most important by far in terms of amounts consumed and environmental relevance is the female birth control pill, containing the synthetic estrogen ethynylestradiol as its active ingredient. The pill was first approved 50-years ago as a form of contraception and is
currently used by approximately 11 million women in the USA for this purpose. Since the use of ethynylestradiol, and hence the estrogenic content released as a consequence, is a contraceptive choice made by members of society, a logical question arises: When evaluated from an environmental perspective, should the use of ethynylestradiol be mitigated or even eliminated? And if so, do greener alternatives exist to this contraceptive? How does one go about making such an evaluation? Further, the merits of either society's choice or society's failure to mitigate the environmental impact should be analyzed in a broader context. Are contraceptive choices that are greener also clinically and personally preferred? Would such a switch to more greener contraceptive choices also be financially feasible? This study will present a first attempt at answering these questions.

TH 138
Morphological changes in Girardia tigrina induced by atrazine
AR Ribeiro, GA Umbuzeiro
State University of Campinas - Faculty of Technology, LIMEIRA - SÃO PAULO, Brazil
Atrazine is applied to control weeds in different plantations and is among the most used herbicides in the world. This herbicide is also an endocrine disruptor and has been found in several water sources worldwide. Several studies of atrazine's effects on animal reproduction have been conducted in the laboratory. In the present study, 6-day-old G. tigrina were exposed to 50 ml of each test solutions in healthy 50% of atrazine were used. Atrazine p.a. was tested from 10 to the maximum water solubility (33 mg/L). The commercial product was tested from 10 to 100 mg/L (doses expressed in atrazine) 50% of atrazine were used. Atrazine p.a. was tested from 10 to the maximum water solubility (33 mg/L). The commercial product was tested from 10 to 100 mg/L (doses expressed in atrazine).
Acute toxicity tests were performed with young specimens using two vessels per dose. Seven healthy G. tigrina with maximum age 10 days were exposed to 50 ml of each test solutions in 100-ml vessels. Morphological alterations and mortality were observed under a stereomicroscope with maximum age 10 days. Both atrazine p.a. and the commercial product containing 50% of atrazine were used. Atrazine p.a. was tested from 10 to the maximum water solubility (33 mg/L). The commercial product was tested from 10 to 100 mg/L (doses expressed in atrazine).
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TH 139
Assessing potential risks to benthic organisms exposed to bisphenol A
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Bisphenol A (CAS RN 80-05-7) may enter the environment via permitted effluent discharges. In surface water, Bisphenol A will rapidly biodegrade and some will become entrained in suspended particles and deposit onto sediment. Currently, the assessment of potential risks to benthic sediments containing measurable concentrations of bisphenol A is based on aquatic toxicity chronic values and equilibrium partitioning to provide estimates of sediment toxicity. A recently completed risk assessment for bisphenol A in the European Union used this approach to assess risks to aquatic organisms. This approach supports the hazard assessment of bisphenol A in sediment, chronic toxicity tests have been performed using three sediment dwelling species representing different feeding and living conditions: an endobenthic freshwater annelid (the oligochaete, Lumbricillus variegatus), an epibenthic insect (the midge Chironomus riparius), and an eurytopic crustacean (the amphipod Leptocheirus plumulosus) expected to the NOEC reported for the three species ranged from 2.2 to 54 mg/kg-dw. Predicted no effect concentrations (PNEC) were calculated using current European Chemicals Agency guidance by dividing the lowest chronic NOEC for sediment organisms of 22 mg/L by an assessment factor of 10 for laboratory conditions and 50 for marine sediments. The freshwater and marine PNEC are 2.2 mg/kg-dw and 0.44 mg/kg-dw, respectively. PNEC were then compared to freshwater and marine sediment surface concentration data from monitoring programs reported from Europe and the USA. Risk characterization ratios were calculated using median and upper 95th percentile concentrations of bisphenol A in European and North American sediments. The risk characterization results will be used to update and refine sediment risk assessments in these regions.

ET11 - Mechanistic modelling for risk assessment: sub lethal responses and population level effects
TH 147
Bayesian calibration and evaluation of agent-based models: a case study of a skylark population model
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Dynamic energy budget theory (DEB theory) is a quantitative explanation for the time patterns of life history traits such as growth and reproduction. DEB theory has been widely used in the field of ecotoxicology. The process-based approach using DEB analysis of toxicity experiments differs from standard ecotoxicological analysis (LC50, ECx, etc.) in that it links the effect to internal concentration of the chemical and takes into account the biological characteristic of the test individual used. This is of great advantage in a population context because it allows one to extrapolate the effect of the chemical to among different size classes and to differing environmental conditions and exposure scenarios. So far, however, DEB theory has only occasionally been used in the population context. We therefore implement an individual-based population model (IBM) that is based on DEB theory. Our program is designed as a tool for risk assessment over a range of species and substances. It allows a relatively simple extrapolation from the individual effects determined from the analysis of standard OECD tests to population level. As an example, we present our initial results using this approach with Daphnia magna. We discuss the potential of DEB theory and our implementation of this theory in an IBM to serve as a standard tool for ecological risk assessment of chemicals.

TH 148
Dynamic energy budget theory meets individual-based modelling: a generic and accessible implementation for population risk assessment
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2Department of Theoretical Biology, Vrije Universiteit, AMSTERDAM, The Netherlands
Bayesian calibration and evaluation of agent-based models: a case study of a skylark population model
TH 149
Effects of uranium in Daphnia magna exposed over three successive generations: extrapolation of DEB toxin analyses to the population level
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The ecological risk assessment was developed for parathion-coproparaoxon. Parathion toxicity of waterborne uranium was recently investigated in the microcrustacean Daphnia magna, exposed over three successive generations. Toxic effects on daphnid life history and physiology, increasing over generations, were demonstrated at the individual level under controlled laboratory conditions. Nevertheless, the toxic effect at high uranium concentrations in terms of demographic toxicity, is now recognized as more relevant in a broader ecological context than toxicity at the individual level.
Effects of uranium on the copepods are considered to cause dysfunctions of the heart and circulatory system, effects such as heart rate and heart beat changes, etc. Uranium effects at the individual to organism level are expected to be predictive and not only descriptive. Uranium toxicity at the individual level was previously described with a DEBton modelling approach based on the dynamic energy budget (DEB) theory, which describes how organisms acquire energy from food and allocate it towards survival, growth, maturity and reproduction. Here, we extrapolated effects from the individual to the population level through multigenerational Leslie matrix models. DEBton models were fitted for each diet and divided into parameters and process-based parameters. Coefficient estimation was performed using潮流 hyperbolic model, which was used to model the biological response of organisms to different concentrations and food quality. Coefficient estimation was performed using a Least-Squares regression analysis. Each DEBton model was validated against laboratory data. Additionally, a Bayesian calibration of the DEBton model was performed using the program WinBUGS. Finally, the DEBton model was extrapolated to the ecological system level by means of multigenerational Leslie matrix models. The specific objectives of this study are to extrapolate the DEBton model to the ecological system level, to analyse the risk assessment at the population level and to predict the population dynamics over the three generations as a function of the uranium exposure concentration. The population extinction probability is suggested as a mathematically convenient and ecologically relevant toxicological outcome for risk assessment.
The importance of maternal environment in determining offspring size in *Daphnia magna* - an experimental approach for model parameterization

**NT Hamels, DM Jevtic, R Laskowski**

Institute of Environmental Science, Jagiellonian University, KRAKOW, Poland

A Life Table Response Experiment (LTRE) lasting 42 days was performed to investigate toxic effects of cadmium (Cd) and imidacloprid on reproduction and survivorship of aphids (*Aphytis melinus* Harris). Daily life table data obtained from the experiment described by Laskowski (2008) were used to construct and develop an age-classified matrix model to estimate population growth rate ($\Delta$) at each treatment level. Decomposition analysis was performed to examine the relative contributions of each life-history trait on $\Delta$, that is the difference between the control and a treatment

Results of the decomposition analysis indicate that the contribution of differences in survival to $\Delta$ was most important at the 1st and 2nd weeks, while the contribution of differences in fertility to $\Delta$ was the greatest at the 3rd and 4th weeks. The two toxicants exhibited different actions through their different concentrations -- Cd mostly by impairing fertility while of that of three weeks and survivorship from 2nd to 3rd week. On the other hand, imidacloprid affected mostly the survivorship at the 1st and 2nd weeks of the age.

This LTRE analysis clearly indicates the shortcomings of traditional ecological toxicology, which usually concentrate on the traits that are most sensitive to toxic effects. As shown in this study, the population-level interpretation of individual-level effects requires information on both the effects of a toxicant on vital rates and the demographic sensitivity of life stages. LTREs with decomposition analysis, as shown in this study, can be used as an important analytical tool to fill this gap by combining effects of toxicants with demographic sensitivity of the organism.

**TH 155**

Correlated random walk as mode of short distance dispersal for *Asellus aquaticus* - an experimental approach for model parameterization

**J Augustyn1, NP Dziepons2, JM Barczo2, PJ van den Brink3**

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3Current position for risk assessment of ecotoxicological effects (ERA) of pesticides mainly focuses on individual-level laboratory toxicity tests whereas envisaged protection goals mainly aim at popula- tions of non-target species. Within the context of pesticide ERA, ecological models are rarely recommended in official documents but are sometimes applied by researchers to estimate risks to populations. Concerning the role of and how much) as well as interactions with other agricultural practices (e.g. ploughing, tillage, dispersal, etc) and behaviour (e.g. foraging and territoriality) of the wood mouse; whilst the experimental model also tested the effects of the pesticide application patterns (i.e. where, when and how much) as well as interactions with other agricultural practices (e.g. ploughing, tillage and harvesting).

**TH 157**

Modelling toxic effects on *Chaoborus* populations under field conditions - an individual-based simulation study

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For the application of mechanistic population models in ecological risk assessment, a sufficiently high ecological complexity and an accurate description and prediction of the effects is recom- mended. This study presents a modelling approach for the extrapolation of toxic effects from individuals in the laboratory to populations in the field. As a model organism for emerging insects, we used the multivoltine aquatic phantom midge *Chaoborus variabilis*, which is an ideal species used for ecotoxicological experiments. For demographic and size of Chaoborus magna populations

**TH 158**

Evaluating the risk of dispersed pesticides in agricultural areas

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3Bayer CropScience AG, MONHEIM AM RHEIN, Germany

In the Federal Republic of Germany, thousands to millions of tonnes of pesticides are applied on agricultural land in much of Europe. It is commonly used as a focal species in higher tier risk assessment of pesticides. The aim of the project is to construct an ecological model in support of population level risk assessment of pesticides for the wood mouse. An individual-based model (IBM) is being developed to simulate and predict the population dynamics so as to assess the risk of pesticides with different pesticidal effects, e.g. acute effect on survival, sub-lethal effects on reproduction and somatic growth. Here both a control model and an experimental model are presented, the former showing the population dynamics without pesticide application and the latter showing some preliminary results from a spatio-temporal perspective of weeds as a focal species in higher tier risk assessment of pesticides. The poster will show results of simulated control populations, acute effects and recovery time. The importance of maternal environment in determining offspring size in *Daphnia magna* population models

**TH 154**

Decomposition analysis of LTREs may help to design short-term ecotoxicological tests: population modelling approach

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Institute of Environmental Science, Jagiellonian University, KRAKOW, Poland

A Life Table Response Experiment (LTRE) lasting 42 days was performed to investigate toxic effects of cadmium (Cd) and imidacloprid on reproduction and survivorship of aphids (*Aphytis melinus* Harris). Daily life table data obtained from the experiment described by Laskowski (2008) were used to construct and develop an age-classified matrix model to estimate population growth rate ($\Delta$) at each treatment level. Decomposition analysis was performed to examine the relative contributions of each life-history trait on $\Delta$, that is the difference between the control and a treatment.

Results of the decomposition analysis indicate that the contribution of differences in survival to $\Delta$ was most important at the 1st and 2nd weeks, while the contribution of differences in fertility to $\Delta$ was the greatest at the 3rd and 4th weeks. The two toxicants exhibited different actions through their different concentrations -- Cd mostly by impaireing fertility while of that of three weeks and survivorship from 2nd to 3rd week. On the other hand, imidacloprid affected mostly the survivorship at the 1st and 2nd weeks of the age.

This LTRE analysis clearly indicates the shortcomings of traditional ecological toxicology, which usually concentrate on the traits that are most sensitive to toxic effects. As shown in this study, the population-level interpretation of individual-level effects requires information on both the effects of a toxicant on vital rates and the demographic sensitivity of life stages. LTREs with decomposition analysis, as shown in this study, can be used as an important analytical tool to fill this gap by combining effects of toxicants with demographic sensitivity of the organism.

**TH 153**

Correlated random walk as mode of short distance dispersal for *Asellus aquaticus* - an experimental approach for model parameterization

**J Augustyn1, NP Dziepons2, JM Barczo2, PJ van den Brink3**

1Wageningen University, WAGENINGEN, The Netherlands
2Alterra, Wageningen University, WAGENINGEN, The Netherlands
3Current position for risk assessment of ecotoxicological effects (ERA) of pesticides mainly focuses on individual-level laboratory toxicity tests whereas envisaged protection goals mainly aim at popula- tions of non-target species. Within the context of pesticide ERA, ecological models are rarely recommended in official documents but are sometimes applied by researchers to estimate risks to populations. Concerning the role of pesticides with different potential toxic effects, e.g. acute effect on survival, sub-lethal effects on reproduction and survivorship of aphids (*Aphytis melinus* Harris). Daily life table data obtained from the experiment described by Laskowski (2008) were used to construct and develop an age-classified matrix model to estimate population growth rate ($\Delta$) at each treatment level. Decomposition analysis was performed to examine the relative contributions of each life-history trait on $\Delta$, that is the difference between the control and a treatment.

Results of the decomposition analysis indicate that the contribution of differences in survival to $\Delta$ was most important at the 1st and 2nd weeks, while the contribution of differences in fertility to $\Delta$ was the greatest at the 3rd and 4th weeks. The two toxicants exhibited different actions through their different concentrations -- Cd mostly by impaireing fertility while of that of three weeks and survivorship from 2nd to 3rd week. On the other hand, imidacloprid affected mostly the survivorship at the 1st and 2nd weeks of the age.

This LTRE analysis clearly indicates the shortcomings of traditional ecological toxicology, which usually concentrate on the traits that are most sensitive to toxic effects. As shown in this study, the population-level interpretation of individual-level effects requires information on both the effects of a toxicant on vital rates and the demographic sensitivity of life stages. LTREs with decomposition analysis, as shown in this study, can be used as an important analytical tool to fill this gap by combining effects of toxicants with demographic sensitivity of the organism.
TH 158
A case study of aquatic population modelling for pesticide regulatory risk assessment using the MASTEP model: chlorpyrifos
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1Makushkin Agan, THATCHAM, United Kingdom 2Dow AgroSciences, ABINGDON, United Kingdom 3Cheminnova, HARROGATE, United Kingdom 4Altair Solutions, WAGENINGEN, The Netherlands 5Rijkshoeizoolgie, Wageningen UR, Wageningen, The Netherlands
Chlorpyrifos is an organophosphate insecticide which is highly toxic to aquatic invertebrates and has a Regulatory Acceptable Concentration (RAC) of 0.1 g/L. Based on EU review of a number of outdoor mesocosm studies in north and south Europe, Application rates of chlorpyrifos of up to 16 g a.i./ha in spray applications and 2400 g/a in streams are registered. The combination of the low RAC coupled to a high exposure potential from spray drift onto edge of field water bodies makes the aquatic risk assessment challenging. However, the mesocosm studies on which the RAC is based are short-term static systems, whereas recovery may be possible in moving water, larger spatial units, or longer timescales; and the exposure calculations are simplistic. It is not possible to test all possible environmental and processes in reality. However, modelling offers the opportunity to theoretically test options. When based on realistic parameters, the model offers some degree of realism in its predictions. The individual-based population model MASTEP (Modelling Aquatic Species for Toxicity Effects and Predictions) has been used to evaluate the recovery potential of four aquatic invertebrates known to be sensitive to chlorpyrifos, with differing life histories, using real toxicity data, in various water bodies, with input from various crops, and with various risk mitigation measures. Model runs deliberately included scenarios that caused different proportion of adults, to indicate its sensitivity. Then various mitigation measures were tried to determine their influence on recovery. The methods and results to date will be presented and discussed. Toxicokinetic/toxicodynamic considerations are also planned. This study of chlorpyrifos is used to explore whether population modelling can provide valuable information to risk assessors and, in particular, to risk managers to support decisions on realistic risk mitigation possibilities.

TH 159
Spatially-explicit risk-assessment: what is the appropriate spatial scale for observing recovery
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When applying spatially-explicit individual-based population models for pesticide risk assessment in a realistic situation as defined in FOCUS scenarios, several spatial scales become relevant: the typical scale of the species set by its movement attributes, of the exposure pattern and of the structure of the habitat. In order to get a realistic risk assessment and to choose the most appropriate spatial scale of observation, we have to estimate time to recovery for the total population in the system or just for the population living in the (most) exposed part? How far should the total system extend, and which part of it we may consider as the ‘landscape context’? The total system may be composed of several parts. We investigate these questions using simple individual-based models (MASTEP) for four aquatic species with different life-history and mobility, roughly representing Asellus, Gammarus, Chironomus and a musselspecies. We assume a constant environmental (no seasonality driven by, e.g., temperature), linear aquatic habitat (ditch) and all spatial units equally sensitive to a hypothetical pesticide defined by a single dose-effect relationship for acute mortality. The landscape context is set by the length of the ditch: 200 to 1000m. A fixed part (100m) is directly exposed (spray-drift); the remaining part has exposure exponentially declining with distance. Only peak-values of exposure are considered. We calculate recovery times for the 100m part as well as for the whole system population and compare these to the ones expected for a well-mixed population recovering in absence of density-dependent limitation. Expected recovery time is determined by population growth rates, which we obtain by solving a discrete version of the Euler-Lotka equation.
Simulated total population recovery times that are longer than expected, indicate that the total system cannot be treated as well-mixed: the species operates at a smaller spatial scale and heterogeneity in exposure at this smaller scale does matter. Simulated recovery times at the 100m scale that are shorter than expected, indicate that the 100m part is too small to be considered in isolation: the species operates at a larger spatial scale and exposure outside the 100m zone has an impact on recovery in the 100m zone. Comparing outcome for different total system size we are able to identify for each species the most appropriate spatial scale for recovery.

TH 160
Development of ecological risk assessment methods for space- and time-varying herbicide exposure
TH Havashi, Y Izumiz, N Tatara, N Suzuki
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Ecological risk assessment methods to analyze risk from herbicides under space- and time-varying exposure were developed. First, we analyzed spatial variations of risk from herbicides by creating ecological risk maps in Japan. The hazard ratio of maximum environmental concentration pre-
population model of this species applicable in the risk assessment of chemicals. The study is a part of the EU Project CREAM (Mechanistic Effect Models for Ecological Risk Assessment of Chemicals).

TH 164 Screening for realistic worst-case species of freshwater fish for pesticide risk assessment in edge-of-field water bodies in the EU

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Fish are considered under all EU directives and regulations that are related to the environmental risk of chemicals. The assessment of potential effects of chemicals on fish is usually based on ecotoxicological tests on the level of the organism (e.g. effects on growth, survival, reproduction). However, because the environmental protection goals are, in most cases, related to the sustainability of populations, there are two types of extrapolation which might improve risk assessment for the fish: (i) sub-lethal effects on individuals to the population level, and (ii) ecological relevant species. There are several ecological models developed for fish available in the open literature. However, so far, none is used within the regulatory framework for plant protection products to refine the standard risk assessment for fish. Therefore, we intend to develop a population model of this species applicable in the risk assessment of chemicals.

TH 165 Modelling fish as indicator species for potential endocrine-disrupting effects

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Fish are considered under all EU directives and regulations that are related to the environmental risk of chemicals. The assessment of potential effects of chemicals on fish is usually based on ecotoxicological tests on the level of the organism (e.g. effects on growth, survival, reproduction). However, so far, none is used within the regulatory framework for plant protection products to refine the standard risk assessment for fish. Therefore, we intend to develop a population model of this species applicable in the risk assessment of chemicals.

In this poster we present the screening approach and the resulting list of the worst-case species.

TH 166 Use of the Comprehensive Aquatic Systems Model for Atrazine (CASMATZ) to estimate potential changes in primary producer community structure based on intensive stream monitoring chemographs

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The Comprehensive Aquatic Systems Model (CASM) was parameterized to use atrazine laboratory toxicity studies and the resulting modelled changes in producer populations. This generic stream version of CASM was implemented in the TIMES platform (http://oasis-lmc.org) and could be used for predictive ecological risk assessment of atrazine.

TH 167 Estimating costs of chemical impacts on populations: a case study on peregrine falcon exposed to PBDEs

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1North-west Germany where resistance to bromadiolone and difenacoum in Norway rats (Rattus norvegicus) is considered under all EU directives and regulations that are related to the environmental risk of chemicals. The assessment of potential effects of chemicals on fish is usually based on ecotoxicological tests on the level of the organism (e.g. effects on growth, survival, reproduction). However, because the environmental protection goals are, in most cases, related to the sustainability of populations, there are two types of extrapolation which might improve risk assessment for the fish: (i) sub-lethal effects on individuals to the population level, and (ii) ecological relevant species. There are several ecological models developed for fish available in the open literature. However, so far, none is used within the regulatory framework for plant protection products to refine the standard risk assessment for fish. Therefore, we intend to develop a population model of this species applicable in the risk assessment of chemicals.

In our presentation we will outline our modelling approach, present the main results of our case study, and discuss benefits and limitations.

TH 168 Analysing in vitro-in vivo genotoxicitygap: mechanistic models for in vivo liver genotoxicity and in vivo MNT

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6University of Augsburg, Institute for Environmental Research-RWTH Aachen University, AACHEN, Germany

Atrazine was the most frequent chemical detected in pesticide residues in water samples. Atrazine and its metabolites are found in many aquatic environments with high levels reported in soil and water of agricultural areas. The Comprehensive Aquatic Systems Model (CASM) was parameterized to use atrazine laboratory toxicity studies and the resulting modelled changes in producer populations are implemented in the TIMES platform (http://oasis-lmc.org) and could be used for predictive ecological risk assessment of atrazine.

To estimate ecological costs caused by chemical pollution, the following steps are involved: 1) quantifying changes in ecosystem attributes resulting from a chemical impact, and 2) translating these changes into monetary terms. To quantify the trade-offs between these benefits and risks, monetary evaluation methodologies can be used. In the following presentation, we will outline our modelling approach, present the main results of our case study, and discuss benefits and limitations.

TH 169 Determination of concentration of SSRIs in sewage sludge

HM02 - Impact and remediation of wastewater

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Pharmaceuticals are emergent contaminants in the aquatic environment, wastewater treatment plants and municipal sewage treatment systems (STPs). Selective serotonin reuptake inhibitors (SSRIs) are one of the most frequently detected pharmaceuticals in sludge. The presence of SSRIs in sewage sludge is not avoided. Liquid phase microextraction (LPME) is an alternative technique for the separation of analytes present in wastewater. How- ever, so far, none is used within the regulatory framework for plant protection products to refine the standard risk assessment for fish. Therefore, we intend to develop a population model of this species applicable in the risk assessment of chemicals.

H2O2 has been obtained in water samples. SSRIs may be involved in the formation of complex bigger molecules in sludge. The investigation of the metabolism is different, since it is “organized”towards detoxification. The investigation of the metabolism of SSRIs in sewage sludge could be used to predict the toxicity of SSRIs in sewage sludge. The latter is assumed to be the primary difference between in vitro and in vivo effects whereas the reactivity factor acts in same way in in vitro and in vivo interactions. In differences with the in vitro generated metabolites, which are freely able to interact with macromolecules, the metabolites in in vivo detoxification pathways are “trapped”being engaged in enzyme complexation (channeling effects) and subsequently unable to interact with DNA and proteins. A classification scheme interrelating the different levels of genotoxic effects has been created on the basis of a large amount of quality assured documented data. A classification scheme interrelating the different levels of genotoxicity and in vitro MNT which are the other aims in this work. These mechanistic models are of practical importance given that genotoxicity test batteries commonly comprise two in vitro (AMES, CA, MLA, SCE) and one in vivo tests (UDS, Comet, MNT). The two in vivo models are in vitro test batteries comprising a test battery of the most prescribed drugs due to their selectivity. SSRIs include citalopram, paroxetine, sertraline and fluoxetine which is metabolized to norfluoxetine. How- ever, so far, none is used within the regulatory framework for plant protection products to refine the standard risk assessment for fish. Therefore, we intend to develop a population model of this species applicable in the risk assessment of chemicals.

In this poster we present the screening approach and the resulting list of the worst-case species.

The most common technique applied to the extraction of organic contaminants from sewage sludge is the so-called liquid extraction which may be combined with solid phase extraction (SPE). However, this technique needs a considerable manipulation and the co-extraction of some interfering compounds is not avoided. Liquid phase microextraction (LPME) is an alternative technique for the selective extraction, clean-up and enrichment of organic pollutants. The most important advantages are: 1) PMLP minimizes the formation of interferences, 2) significant increase in enrichment capability, 3) easy and clean-up and selectivity, short time of analysis and low cost. Three phase hollow fiber liquid phase microextraction (HF-LPME) has been applied for the determination of concentration of SSRIs in sewage sludge. Enrichment factors between 250 and 900 have been obtained in water samples. Slurry samples spiked with different concentrations of sludge were analyzed and an increase of enrichment factor was observed. By relating this increase of the concentration in acceptor phase to the spike levels, initial concentrations of SSRIs in sludge can
be calculated. Concentrations found in sludge samples from Killby WWTP (Lund, Sweden) were 530 ng/g for citalopram, 37 ng/g for paroxetine, 210 ng/g for fluoxetine, 472 ng/g for norfluoxetine and 251 ng/g for sertraline.

**TH 173**

Analysis of perfluorinated compounds in sludge by pressurized solvent extraction followed by liquid chromatography-mass spectrometry

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Perfluorinated compounds (PFCs) are widely used in everyday life and one of the main recipients of these compounds were waste water treatment plants (WWTPs). Due to the structure and physicochemical properties of PFCs, these compounds could be redistributed from influent water to sludge or other WWTP treatments. The present work was focused to develop a useful extraction procedure for 18 PFCs from sludge samples based on pressurized solvant extraction (PSE) followed by anionic solid phase extraction (SPE) clean-up, analytes separation by liquid chromatography and analysis in an hybrid quadrupole-linear ion trap mass spectrometer (LC-MS/MS) working in a triple quadrupole mode.

During optimization process of PSE extraction, 3 different solvents mixtures including water-methanol (90:10), water-methanol (50:50) and methanol (100 %) were tested. In parallel, 3 different temperatures were studied (70, 100 and 150°C). The final method was established at 97°C, 13 mL min−1 for the flow rate of the elution solvent as well as solvent extracted a blank sewage sludge fortified at different concentration levels. The method limits of detection were ranging from 15 to 79 ng/Kg, with exception of perfluorobutanoic acid (PFBA), perfluorooctanoic acid (PFOA) and perfluorobutane sulfonic acid (PFBS) which were higher (831µg/Kg, 161µg/Kg and 219µg/Kg, respectively). The limits of quantification were from 50 to 264 ng/Kg for most PFCs. These values were comparable to the decision limit (CCa) and the detection capability (CCb), which were 17-114 ng/g and 18-137 ng/g, respectively. The percentage of recovery for different fortification levels was around 79-111% in the most cases, the reproducibility of the method was in the range 4% (perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA)) to 25% (RSPO).

In order to evaluate the applicability of the method, 5 sludge samples from WWTP were analyzed and results were compared with other authors. The PFCs present in all samples. However, the concentrations for most of them were below the limits of quantification. The compound present at highest concentrations was PFOS, which was in concentrations from 53.0 to 121.7µg/Kg. The other PFCs were at concentrations between 0.3 and 30.3µg/Kg.

**TH 174**

Solid phase extraction combined with large volume injection-gas chromatography-mass spectrometry for the determination of a wide variety of priority and emerging pollutants in wastewater samples

O. Zulugó1, A. Iparri2, E. Bukuzrugan3, O. Ros4, A. Valldos4, P. Navarro4, M. Olives4, L. Fernández5, A. Usobiaga6

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3In the complex process of harmonizing laws, directives and actions within the European Union countries, the European Water Framework Directive (WFD, 2000/60) is probably the most important law implemented in Spain for many years in the last Basin Country case by case on optimization of derivatization step in these analyses. Several derivatization agents (e.g. N-methyl-N-trifluorooacetamide (MSTFA), N-trimethylsilyltrimide (TMSI), the mixture of N.O.B.i(s)trimethylsilyl trifluoroacetic acid with trimethylchlorosilane (BSTFA+ TMCS)) were used to prepare the appropriate derivatives. Parameters such as the volume of derivatization reagent, time of the reaction, temperature of the reaction were tested. Additionally, different GC conditions were applied in term to obtain the highest chromatographic resolution and the lowest limits of detection. The results of this investigation will be shown and discussed.

Acknowledgements: Financial support was provided by the Polish Ministry of Research and Higher Education under grant N N204 262037 (2009-2012)

**TH 176**

Matrix effect during the determination of endocrine disruptor compounds in wastewater samples during membrane assisted solid extraction

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4EDCs, as defined as "environmental substances that alter function(s) of the endocrine system and consequently cause adverse effects in an intact organism, or its progeny, or (singly or in combination) to populations"[1], can have synthetic and biological origin and include hormones, insecticides, phystoestrogens or industrial chemicals. Such EDCs are often detected in water waste treatment plants (WWTPs) effluents and their receiving environments since not all micropollutants are completely removed in such plants [2,3]. In fact, effluents from several WWTPs have been reported to be estrogenic to fish [4]. The determination of EDCs such as alkylphenols (APs), hormones and sterols requires of a pre- concentration step in order to avoid to use analytical processes at low levels. Different methods have been developed for the use of sample preparation techniques that minimise solute consumption have been proposed as alternatives to classical techniques. Membrane-assisted solid extraction (MASE) guarantees low solvent consumption since the acceptor phase is protected by a non-porous membranes. MASE techniques are studied during MASE development and matrix effect should always be included when complex samples such as the effluents and effluents of wastewater treatment plants are studied. In the present work matrix effect during the determination of a variety of EDCs in wastewater was studied both during the extraction and the detection step. For the detection, liquid chromatography-mass spectrometry (LC-MS/MS) and large volume injection-gas chromatography-mass spectrometry were considered.

Acknowledgements

1This work was financially supported by the Spanish Ministry of Science and Innovation through the CTQ2008-02775/BQU project and the University of the Basque Country through the PhD 12009/03 project. A. Iparriague is grateful to the Basque Government for her pre-doctoral fellowship. P. Navarro is grateful to the Basque Government for her post-doctoral fellowship.

References


**TH 177**

The fate of pharmaceuticals during biological nutrient removal sewage treatment

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Biodegradation of pharmaceuticals by active heterotrophic biomass in activated sludge and its link to sludge age

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Microbial biomass is a key factor for the biological elimination of pol pharmaceutical active compounds (PAcCs) during activated sludge treatment. It is usually addressed by lumped param-
ets such as volatile or total suspended solids (Xss) that do not consider differences in microbial activity or consortia. This can lead to biased estimations in fate prediction or in the determination of biodegradation rates. In this context, only little attention has been paid to identify responsible PAhC-degrading microorganisms as well as to the question of weather they can be actually characterized (cost-effectively) as a sum parameter or estimated from other parameters such as the sum of biodegradation batch experiments and respiration tests. The latter allowed for the simultaneous estimation of the active heterotrophic biomass Xbh.

Investigating this, the presented study focused on the active heterotrophic biomass Xbh that governs COD removal suggesting a potential determining factor for biological PAhC removal as well. Activated sludges from two wastewater treatment plants that clearly differed in size, operation, SRT and active biomass were investigated. The biodegradation rates of the five polar PAhCs caffeine, paracetamol, sulfamethoxazole, diclofenac and carbamazepine were determined using a combination of biodegradation batch experiments and respiration tests. The latter allowed for the simultaneous estimation of the active heterotrophic biomass Xbh.

Biodegradation rates such as volatile or total suspended solids (Xss) that do not consider differences in microbial factors influencing PPCPs removal, such as the sum parameter or estimated from other parameters such as the sum of biodegradation batch experiments and respiration tests. The latter allowed for the simultaneous estimation of the active heterotrophic biomass Xbh. Fractions of Xbh / Xss varied significantly between the sludges showing that Xss contains little information if any concerning heterotrophic activity. Notedly higher removal rates of the selected compounds were observed in sludge with low SRT and a high Xbh fraction. The variability of biodegradation rates could be largely explained by using the Xbh in pseudo first-order reactions. It suggests that Xbh greatly governs the removal of the selected pharmaceutica.

This work analyzes the behavior, mass balance and efficiency of removal of 12 metals (Al, Ni, Cd, Zn, Hg, Fe, Cu, Mn, Sn, As and Pb) in three wastewater treatment plants in Bilbao (Bosque Countryside), Spain. The analysis of the sludge was performed according to the Spanish regulation RD 1310/1990 and is one of the main causes of pollution in water and soil [1]. This has been a growing concern over the effects of heavy metals due to their biomagnification [2] and, in this way, metal production has decreased due to legislation, as in the case of Hg.

The behavior of heavy metals in wastewater treatment plants has been extensively studied in recent years [3]. The removal of these metals in the water line of the plants generates accumulation in sewage sludge. The destination of sewage sludge is one of the problems of the wastewater treatment plants as they have high concentrations of metals. The agricultural use of the sludge according to the Spanish regulation RD 1310/1990 is one of the main causes of pollution in water and soil. [1] has been a growing concern over the effects of heavy metals due to their biomagnification [2] and, in this way, metal production has decreased due to legislation, as in the case of Hg.

The analysis of the obtained results concluded that the behavior of these three plants is quite similar in spite of their different characteristics. The removal of efficiency for the majorly of the metals is around 85%, except for Cd, Mn and Hg. The analysis of the sludge concluded that they are useful for agricultural use according to RD 1310/1990.

Reference:

TH 179
Heavy metals mass balance and efficiency of removal in three wastewater treatment plants
A Usobiaga, M Pazos, JA Carrero, N Goienaga, S Fernandez, G Arana, LA Fernandez, O Zuza

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Reference:

TH 180
Degradation of PPCPs in activated sludge: comparison between degradation kinetics obtained from sludges of different WWTPs under normalized conditions
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Concentration profiles and environmental load of emerging pollutants from Swedish sewage treatment plants
M Ulofsson, P Haglund

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In the society today, an ever-increasing number of chemicals are used. Some of these chemicals are eventually released into the waste streams handled by municipal sewage treatment plants (STPs). The purpose of this study was to perform an extensive screening of persistent organic pollutants (POPs), pharmaceuticals and personal care products (PPCPs) and other organic contaminants (including many emerging pollutants) both in effluent water and sludge from Swedish STPs. The STPs use conventional methods for treatment of the waste water, including mechanical, chemical and biological processes. Solids that are removed from the water is then anaerobically digested or aerobically stabilized and dewatered. The sampling campaign occurred in September and October 2010 when the weather conditions were approximately average of the time of year (average temperature: 9.4 ± 2°C). Composite (n = 7) effluent samples were flow proportionally sampled in dark 2.5 L bottles (totally 17.5 L) and stored in a dark cold store prior to chemical analysis. Sludge samples (1000 g wet weight) were collected as grab samples in dark bottles and stored in a freezer at -18°C until chemical analysis.

In order to be able to estimate the environmental load, mass flows of the pollutants at each STP were calculated from their measured concentrations and estimates of water and solid mass flows at the time of sampling. The environmental load of the pollutants, as well as concentration profiles, did not differ very much between the STPs. The distribution between the water and sludge fraction was estimated from their measured concentrations and estimates of water and solid mass flows at the time of sampling. The environmental load of the pollutants, as well as concentration profiles, did not differ very much between the STPs. The distribution between the water and sludge fraction was estimated from their measured concentrations and estimates of water and solid mass flows at the time of sampling.

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The level of pollution in Patraikos Gulf, Greece, was evaluated at two time intervals, in 1992 and eighteen years later, in 2010. Metals and Polycyclic Aromatic Compounds (PAHs) were determined in sediments, marine organisms and seawater. Sediment Quality Guidelines (SQGs) were applied to assess the contamination status. The main difference between the two time periods is that in 1990s no wastewater treatment plants existed to treat the municipal waste or domestic sewage of the city. Determined levels of metals in sediments, marine organisms and seawater showed that the pollution level was variable. The level of pollution in Patraikos Gulf, Greece, was evaluated at two time intervals, in 1992 and in 2010. The results of the analysis showed that the pollution level was variable between the two time periods, with the highest levels occurring in 1992.

The construction and operation of wastewater treatment plants, in compliance with the European legislation and with the national legislation of the member states, shall contribute to the protection of the aquatic environment and shall not pose a risk to the health of humans and animals. The European Union has set up a legislative framework to protect the aquatic environment and to ensure the safe disposal of waste products.

First evidences of polycyclic synthetic musk compounds in surface water systems in Italy: galaxolide, tonalide and celestolide concentrations in the Molgora river (Lombardia Region, Italy)

S Villa, AL Assi, BP Bonfanti, FA Finizio

University Milano Bicocca, MILANO, Italy

Polycyclic synthetic musk (PCMs) compounds, are used as fragrances in a wide array of personal care products. In view of their yearly global use, such substances are classified as High Volume Product Chemicals in Europe. For instance in 2000, at EU level, it has been estimated a global usage of 1427 and 343 tons of galaxolide and tonalide respectively. The removal of PCMs during municipal sewage treatment processes has been estimated at approximately 40-60%. In view of the extremely low removal efficiency and the toxicity of PCMs, their occurrence in surface waters has been documented.

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Towards understanding of ionic liquid (IL) fate in the degradation processes: investigations under grant N N523 423737 and DS/8270-4-0093-10

The degradation of ionic liquid on the electrodes with different electrocatalytic properties

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The degradation of ionic liquid on the electrodes with different electrocatalytic properties
mercury lamp (250 W), away 20 cm from the wastewater surface (effective volume of 100 mL), magnetically stirred at 450 rpm. The biological reactor almost removed all COD of the effluent (85–90%), although color was not removed. When photocatalysis was used as a pre-treatment with 60 minutes of irradiation, there was a color removal of 60% and the ecotoxicity to lettuce seeds did not change, with the variables optimized pH 5.7, 25°C, and 0.42 g L⁻¹ TiO₂. However, color removal was observed with an irradiation time of 5 hours and 30 minutes. The photocatalytic oxidation coupled with heterogeneous catalysts followed a first order model, with a R² = 0.992 and a k of (2.60 ± 0.24) × 10⁻² u⁻¹.min⁻¹. Photocatalysis is a good choice for removing the color of this effluent.

**TH 197**

Degradation of selected sulfonamides in the wastewater using heterogeneous Fenton system E Eljarrat1, D Barceló1

Sulfonamides are synthetic antibiotics frequently used in veterinary medicine. After use they are being excreted in large portion directly to the sewage both as the native form as well as biotransformation products. Traditional sewage treatment systems are incompatible to eliminate many of these chemicals, which environmental concentrations are noticeable and moreover most of them are quite resistant to physical and biological degradation. Therefore, the elimination process of these chemicals from wastewater is a very important step preventing their emission into the environment. Advanced oxidation processes (AOPs) present high effective alternative to traditional treatment processes while degrading toxic and biorefractory organic pollutants such as sulfonamides. These methods are based on the reaction of highly reactive agents such as hydroxyl radicals (•OH), which are very aggressive and not selective oxidants able to mineralize some type of organic compounds to CO₂ and H₂O. Among the various types of AOPs, Fenton process presents cheap and quite useful option, where radicals are produced by catalytic decomposition of hydrogen peroxide in reaction with ferrous ion. The main drawback of this system is sludge formation. This problem can be solved by using heterogeneous catalyst.

Due to the environmental accumulation of polybrominated diphenyl ethers (PBDEs), the search for strategies for their elimination is of great interest. In the present work, Trametes versicolor, a white-rot fungus capable of degrading a wide spectrum of toxic contaminants, was tested for PBDE removal. Characterization of sludge from the El Prat de Llobregat WWTP (Barcelona, Spain) was done and used to assess the degradation of several PBDE congeners, although deca-BDE-209 was the most abundant. In vitro experiments with T. versicolor in liquid medium revealed elimination from 50% to 75% for deca-BDE-209. Similar experiments demonstrated removal of 85% and 67% (minimum degradation of 38% and 28%) for the penta-BDE and octa-BDE commercial mixtures. The fungus was then applied to sterile sludge obtained from two stages of the WWTP: influents (53%, while a solid-phase treatment of the dry sludge produced a remarkable degradation of 86% in the deca-BDE-209. The results suggest the potential of T. versicolor as a bioremediation agent for PBDEs removal.

**TH 199**

Uranium accumulation in aquatic plants: possibilities for phytofiltration PIC Farrer1, JMS Pratases2, MNV Prasad3

1University of Trás-os-Montes e Alto Douro, VILA REAL, Portugal
2University of Coimbra, COIMBRA, Portugal
3University of Trás-os-Montes e Alto Douro, VILA REAL, Portugal

The work presented here is a part of the ongoing study on the uranium geochemical province of Central Portugal in which, the use of aquatic plants as indicators of uranium contamination is being explored using aquatic plants. The research has been funded by the European Commission. Several aquatic plants were used as indicator species in the monitoring methods. Many of the places were left in different stages of degradation. The samples were collected in running and in standing waters (lentic and lotic) in the places were it was possible to observe the presence of the T. urea and C. stagnalis vegetable species were taken. The plants collected represented the free-floating and the rooted emergent plants. In the ponds, only free-floating plants were found growing. The methodology adopted for the determination of the U content in the water and plants was fluorimetry.

Even though we have observed very low concentrations of U in the fresh waters of the studied sites we found a set of vegetable species with the ability to accumulate U in concentrations which are orders of magnitude higher than the surrounding environment. We have observed that Aipni nodiformis, Callitriche stagnalis, Lemma minor and Fontinalis antipyretica accumulated significant amounts of uranium. These species can be exploited either for phyto-sorption purposes or for in situ measuring methods. The plants show great potential for phyto-remediation because they are endemic and easy to grow in their native conditions. A. nodiformis and C. stagnalis have high bioprocessivity and yield good biomass.

**TH 200**

The evaluation of the genotoxicity of textile effluents from the Region of Fez-Boumalne (Morocco) by the use of Saccharomyces cerevisiae mutation assay and plant micronucleus assay S Fassasste1, H Talososte1, M Merlouzste1, L Calvaturoste1, C Geteste1, L Giorgioste1

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2Laboratory of Biotechnology, Faculty of Sciences Dhar El Mahraz, ATLAS-FEZ, Morocco

In order to investigate the genotoxicity effects of crude effluents from textile industries of Fez- Boumalne, Morocco, mutagenicity and phytoxicity tests were carried out using analytical methods, environmental assessments, and fish experiments. The results showed that all effluents tested were genotoxic to the yeast strains and caused an increase in the frequency of micronuclei, indicating potential genotoxic effects on aquatic organisms. The results also showed that the effluents were toxic to the freshwater plants, with a significant increase in the frequency of micronuclei. The data suggest that the effluents from Fez-Boumalne textile industries may pose a risk to the aquatic environment and human health.

**TH 201**

Toxicity of biologically treated municipal and industrial effluents M Babole, M Pfeiffer, J Punita, S Purvina, J Baldo, R Poisika, S Strake

Laurian Institute of Aquatic Ecology, RIGA, Latvia

The environmental situation in the Baltic Sea has drastically changed over recent decades. Sea pollution has been relieved to a large extent because of strict environmental regulations and the introduction of wastewater treatment plants. However, the situation is far from being good. Many coastal areas still suffer from pollution caused by various sources, including urban and industrial activities.

In this study, the toxicity of biologically treated wastewater from various sources was investigated. The effluents were tested for their toxicity to Daphnia magna and plants using various methods, including the acute toxicity test, the subchronic test, and the sublethal effects test.

The results showed that the biologically treated wastewater had a lower toxicity compared to the untreated wastewater. The toxicity tests revealed that the biologically treated wastewater was less toxic than the untreated wastewater. The results also indicated that the biologically treated wastewater was more acceptable for reuse in aquatic environments. The study highlights the importance of biologically treating wastewater before its discharge into the environment.

**TH 202**

Emerging pollutants in WWTPs effluents: ecotoxicological tests to assess the effects on specific organisms, representative of the aquatic environment G Carbonell, MM Bahin, MM Fábos, J Martini, L San-Segundo, M Torrijo, MP García-Hort iàs, JM Novas, ML Fernandez, A Valdiviia, M Fernandez

INIA, MADRID, Spain

The study evaluated the effects of emerging pollutants in wastewater treatment plants on aquatic organisms. The results showed that the biologically treated wastewater had a lower toxicity compared to the untreated wastewater. The toxicity tests revealed that the biologically treated wastewater was less toxic than the untreated wastewater. The results also indicated that the biologically treated wastewater was more acceptable for reuse in aquatic environments. The study highlights the importance of biologically treating wastewater before its discharge into the environment.
program of perishable wastewater discharge. There is no toxicity limitation in this regulations. In conclusion, the results confirmed that toxicity testing should be applied to effluent standard regulation. The results also clearly showed that D. magna assay was an excellent method for evaluation of aquatic toxicity of mixed domestic-industrial wastewater treatment plant effluents.

TH 204 Identification of potential toxicity caused by O3 and ClO2 treatment of pharmaceuticals in wastewater

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Luand University, LUAND, Sweden

Chemical oxidation treatment is an effective innovative technology in wastewater treatment plants for removal of micro-pollutants in the effluent. In particular, ozonation (O3) and chlorine dioxide (ClO2) treatments are commonly used to degrade organic pollutants. By oxidation, the micro-pollutants are generally transformed to compounds that are easier to degrade biologically. There is, however, a risk that the transformation products will have structures similar to the parent compound and still be biologically active. As shown, for example, that transformation products generated from Carbamazepine by chemical oxidation were more harmful to aquatic organisms compared to the parent compound. The aim of our study is to evaluate the potential risk of oxidation treatment, using OzO3 and ClO2, due to formation of toxic transformation products. In conclusion, the results confirmed that toxicity testing should be applied to effluent standard regulation.

TH 208 C. elegans as an indicator of environmental and human health risk due to fine dust from wood firing

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Along with the growing importance of wood as a renewable low-cost fuel for residential heating, a risk for human and environmental health is emerging due to high particle emission from wood combustion. This project aimed to adjust biological test systems for a practicable risk assessment of the particles by c. elegans. Test systems were used to evaluate the effect mechanism of various particles. As relevant properties of the particles we anticipate size, shape and chemical adsorbs. At first trials are conducted in suspension with characterised model particles and a sample of fine dust from wood briquette firing. The ecotoxicological effects caused by the two oxidation treatments were evaluated for milli-Q water spiked with an AP1-mixture (containing 114 Pharmaceuticals), wastewater (WW) and WW spiked with the AP1 mixture. Tests were conducted to evaluate the toxicity of the AP1-mixture itself and the spiked waters had an API concentration corresponding to the EC50/LC50 values obtained from these tests. The three test systems were subjected to different doses of the oxidants and used to evaluate acute toxicity for the cladoceran Daphnia magna (48h, OECD 2012) and the alga Pseudokircheniella subcapitata (72h, OECD 2011). The survival end-points were determined together with biomarkers to describe the oxidative stress in the test systems and species. All tests were complemented with chemical analysis to confirm to what degree the pharmaceuticals have been mineralized and degraded by oxidation. Early results with APIs in milli-Q water treated with CIO2 indicate an increased mortality rate of daphnia embryos in low concentrations of test oxidants while the growth rate of P. subcapitata was unaffected by the oxidation treatment.

NM02 - Fate and effects of nanoparticles

TH 209 Photo-induced toxicity of aged C60 in a marine invertebrate model

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Along with the growing importance of wood as a renewable low-cost fuel for residential heating, a risk for human and environmental health is emerging due to high particle emission from wood combustion. This project aimed to adjust biological test systems for a practicable risk assessment of the particles by c. elegans. Test systems were used to evaluate the effect mechanism of various particles. As relevant properties of the particles we anticipate size, shape and chemical adsorbs. At first trials are conducted in suspension with characterised model particles and a sample of fine dust from wood briquette firing. The ecotoxicological effects caused by the two oxidation treatments were evaluated for milli-Q water spiked with an AP1-mixture (containing 114 Pharmaceuticals), wastewater (WW) and WW spiked with the AP1 mixture. Tests were conducted to evaluate the toxicity of the AP1-mixture itself and the spiked waters had an API concentration corresponding to the EC50/LC50 values obtained from these tests. The three test systems were subjected to different doses of the oxidants and used to evaluate acute toxicity for the cladoceran Daphnia magna (48h, OECD 2012) and the alga Pseudokircheniella subcapitata (72h, OECD 2011). The survival end-points were determined together with biomarkers to describe the oxidative stress in the test systems and species. All tests were complemented with chemical analysis to confirm to what degree the pharmaceuticals have been mineralized and degraded by oxidation. Early results with APIs in milli-Q water treated with CIO2 indicate an increased mortality rate of daphnia embryos in low concentrations of test oxidants while the growth rate of P. subcapitata was unaffected by the oxidation treatment.

TH 210 Degradability of aged aquatic suspensions of C60 nanoparticles

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While studies of the potential human and environmental effects of C60 and its derivatives are emerging in the scientific literature, the environmental fate of C60 is still largely unknown. In this study, aged aqueous suspensions of C60 (ac60) were investigated in the respirometric OECD test for ready biodegradability. Two suspensions of ac60 were prepared by stirring and aged under indirect exposure to sunlight for 36 months, which resulted in relatively stable suspensions with a dark-brown colour. The suspended ac60 could not be extracted into toluene and indicating that the particles were no longer present as undissolved ac60 but had undergone a transformation. TEM images and particle tracking analysis showed that the suspensions consisted of particle aggregates with a size of 156 nm (SD=54nm) and 139 nm (SD=49), respectively, but also contained smaller aggregates. Samples of the ac60 suspensions (approx. 20 mg/L) were inoculated with activated sludge (30 mg TS/L) and incubated in a mineral medium under aerobic conditions for 28 days. After 28 days, ac60 was still present in the suspensions equivalent to inhibition of the biomass, since addition of 5 mg/L sodium acetate was completely mineralized within a few days. Even with this additional carbon source no mineralization of ac60 was observed after an additional 20 days. Based on these results, aged ac60 can be classified as not ready biodegradable according to the OECD test procedure.

TH 211 Fullerenes exposure to earthworms: from individual to population effects

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Division Toxicology, Wageningen University, Wageningen, The Netherlands

At present environmental risks of nanoparticles are still mostly unknown. Knowledge is lacking about possible effects on soil organisms and soil ecosystems. However, this knowledge is of critical importance because soil ecosystems may be exposed to nanoparticles and residence times of nanoparticles in soil may be long. We therefore conducted a study in which effects of nanoparticles on soil organisms were assessed. In this study, Lumbricus rubellus earthworms were exposed to fullerenes nanoparticles (nominal concentrations 0, 15, 54 and 154 mg/kg soil), which were added to the soil. The particles were characterised by size, surface charge and used to evaluate the effect of the oxidants and used to evaluate acute toxicity for the cladoceran Daphnia magna (48h, OECD 2012) and the alga Pseudokircheniella subcapitata (72h, OECD 2011). Survival of beeches logs and were evaluated in the assays. They caused cytotoxicity and genotoxicity in the bacterial contact and the Umu test respectively compared to blank filters.

TH 212 Fullerenes exposure to earthworms: from individual to population effects

MJC van der Ploeg1, NV van der Brink1, JM Baveco1, A van der Hout1, B Bakker2, IMCM Rietjens3
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TH 213 Influence of the surfactant properties on the coagulation kinetics of functionalized engineered nanomaterials in water system

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As derivatives of engineered nanoparticles (ENPs), functionalized ENPs (FENPs) are widely used in biomedical, catalysis, and electronics fields. This proliferation induces a risk concerning the potential of FENPs into the environment. Due to the low availability of reliable data on the toxicity of ENPs but much less attention has been given to exposure assessment especially of FENPs in the environment. The objective of this study is to assess the fate of FENPs in aquatic environment. Functionalized gold nanoparticles (FNGPs) are employed as a proxy for FENPs. With this in mind, the effects of FNGPs on the aquatic organisms were assessed. The Costa Rican population demonstrated reduced population growth rate with increasing C60 concentrations and a shift in structure of filtered C60 exposed populations, with this population moving towards a larger proportion of juveniles. This study suggests that FNGPs are biodegradable and relatively low in environmental toxicity.

FENPs in the environment are prone to be adsorbed on particles, which are exposed to several biotic and abiotic processes. Additionally, factors such as size and concentration of the FENPs and the type of filtration system used are critical for evaluating the effects of FENPs on aquatic populations. Furthermore, it was demonstrated that juveniles were more sensitive to C60 exposure than adults.

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ence by the particle size. Nevertheless, the FGNPs show fast aggregation only at pH below the pI of their surface functional acid group. Finally, addition of NOM decreased the coagulation rate of CFT 50 and CFT 100, but had surprisingly no effect on C1130 even at a NOM concentration of 100 mg/L. This might be attributed to the different bonding mechanisms between the core of the FGNPs and the different surfactants. Those results indicate that the physico-chemical properties of the surfactants have a significant influence on the coagulation behaviour than the composition and size of the particles or some of the currently considered environmental parameters.

TH 214 Sedimentation and dissolution of nanomaterials in natural waters

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The behavior and fate of nanoparticles needs to be understood as part of their risk assessment. Sedimentation and dissolution are thought to be the main removal processes that are specific for nanomaterials and are generally dependent on the size, shape, silica content and composition of fullerene nanoparticles. These particles were suspended at three concentrations, 0.5, 2.5 and 10 mg/L in 6 different natural water types. Water types and properties ranged from freshwater to seawater, from <0.1 to 25 mg/C/L natural organic matter and from pH 4 to 8. Sedimentation was measured by quantifying the concentration of nanoparticles during a 15 day settling period by ICP-MS (metals) and UV (fullerenes). Additionally, the particle size distribution and zeta potential were measured at different time points. In the same aquatic matrices after a 15 day equilibration period, they were measured by centrifugation on 3 KDa filter. Those results indicate that the physico-chemical properties of the surfactants capped with polyvinylpyrrolidone were extremely stable even in sea water. In comparison, the other three nanoparticles showed increased aggregation and sedimentation with increasing ionic strength. The relevance of these findings for developing and validating aquatic fate models for nanomaterials is discussed.

TH 215 Ecotoxicological characterization of carbon nanotubes according to standardized procedures for the ecotoxicological characterization of chemicals in the aquatic environment

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The behavior and fate of nanoparticles needs to be understood as part of their risk assessment. Sedimentation and dissolution are thought to be the main removal processes that are specific for nanomaterials and are generally dependent on the size, shape, silica content and composition of fullerene nanoparticles. Those results indicate that the physico-chemical properties of the surfactants have a significant influence on the coagulation behaviour than the composition and size of the particles or some of the currently considered environmental parameters.

TH 216 Amphorominal nanosilica induce ROS generation and DNA damage in keratinocytes

T Yamashita1, K Yamashita2, Y Yoshikawa1, Y Yoshida1, K Higashisaka2, K Nagano4, Y Abe4, H Kamada1, T Yoshida2, N Ichihito3, T Yosida2, T Yotsumi1, 1Graduate School of Pharmaceutical Sciences, Osaka University, OSAKA, Japan; 2ARKEMA, LACQ, France; 3CIRIMAT, TOULOUSE, France; 4National Institute for Public Health and the Environment (RIVM), BILTHOVEN, The Netherlands

In the regulatory scheme of ecotoxicological studies carried out to evaluate the ecotoxicity of a substance (EAEAP) (1), a novel approach taken by existing regulations is based on combined and standardized biosassays and procedures (OECD guidelines). In this context, the potential impact of industrial raw MWNM was thus investigated using organisms belonging to different trophic levels (decomposers (bacteria), primary producers (photosynthetic green algae, Porphyridium subspicatun), primary consumers (invertebrates Daphnia magna and Cranog cranog) and secondary consumers (fish and amphibians, Xenopus laevis and Danio rerio), using classical ecotoxicological standardized procedures used to evaluate chemicals in the aquatic media. The results indicated growth inhibition in amphibian exposed to 50 mg/L MWNM. No toxicity in fish and daphnia up to 100 mg/L was observed. Toxicity was observed in the marine shrimp according the protocol of the “sea test” (but in the presence of an organic carrier). A notable effect has also been demonstrated at high concentrations with the growth inhibition test in algae (EC50 = 120 mg/L; NOEC = 10 mg/L).

TH 217 Ambient nano-sized particles induce ROS generation and DNA damage in keratinocytes

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TH 218 Evaluation of biological response against various types of carbon nanotubes

T Yamashita1, Y Yoshikawa1, Y Yoshida1, K Higashisaka2, K Nagano4, Y Abe4, H Kamada1, T Yoshida2, N Ichihito3, T Yosida2, T Yotsumi1, 1Graduate School of Pharmaceutical Sciences, Osaka University, Osaka, Saitama, Japan; 2ARKEMA, LACQ, France; 3CIRIMAT, TOULOUSE, France; 4National Institute for Public Health and the Environment (RIVM), BILTHOVEN, The Netherlands

Nanomaterials acquire regulatory functions depending on their size. Recently, Nanomaterials are applied to various fields as innovative materials. Particularly, carbon nanotubes (CNTs) begin to use in car parts and TV display, therefore, CNTs are close for our life. On the other hand, CNTs has flammable shape like asbestos which induce mesothelioma. Because of this, it is thought that CNTs may have some problems. However, the knowledge about safety of CNTs is still not enough. We evaluated the biological response, such as cytotoxicity, DNA damage and inflammat...
Nanoparticles (NP) are particles of matter between 1-100 nanometers (nm). They exhibit different physical properties and thus have applications in various industries, such as cosmetics, electronics, and medicine. The biological effects of nanoparticles (NPs) on living organisms are of great concern due to their potential to induce oxidative stress and DNA damage. Moreover, differences in particle size, aggregation, and surface properties can influence their biological effects.

TH 220

**Biological effects of exposure to engineered nanoparticles in Saccharomyces cerevisiae**


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1University of Pisa, PISA, Italy

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5Physics Institute, MINSK, Republic of Belarus

The aim of the study was to investigate the cytotoxic effects of nanoparticles (NPs) on the yeast Saccharomyces cerevisiae. The effects of exposure to TiO2-NP, ZnO, CuO-NP, Ag, and Co3O4-NP were assessed. The results showed that TiO2-NP, ZnO, and CuO-NP induced DNA fragmentation, while Ag and Co3O4-NP did not. The TEM images confirmed the presence of nanoparticles in the cells, indicating that the nanoparticles had been successfully internalized.

TH 221

**Cell-nanoparticle interactions and cytotoxic effects in human lung cells depend on particle properties and aggregation state**


University of Aveiro, Aveiro, Portugal

The study aimed to investigate the cytotoxic effects of nanoparticles on human lung cells and to determine how these effects depend on the properties of the nanoparticles, such as size, shape, and surface charge.

TH 222

**Assessing the risks for aquatic organisms posed by waterborne copper and silver nanoparticles**

E. Riechel, A. AMVM Soares, S. P. Loureiro

University of Aveiro, Aveiro, Portugal

The study aimed to assess the risks posed by copper and silver nanoparticles to aquatic organisms, focusing on their potential to disrupt the immune system and cause genotoxic effects. The study used zebrafish (Danio rerio) as a model organism.

TH 223

**Comparative toxicity of silver nitrate and silver nanoparticles to representative species of an aquatic trophic chain**

E. Riechel, A. AMVM Soares, S. P. Loureiro

University of Aveiro, Aveiro, Portugal

The study aimed to compare the toxicity of silver nitrate and silver nanoparticles to different species of aquatic organisms, focusing on their potential to disrupt the immune system and cause genotoxic effects. The study used zebrafish (Danio rerio), daphnia, and a newt as model organisms.

TH 224

**Nanomaterials: Risk assessment and risk management of nanomaterials**

N. Hasel, C. Wehbel

National Taiwan University, TAIPEI, Taiwan

The study aimed to assess the risks posed by nanomaterials to human health and the environment, focusing on their potential to disrupt the immune system and cause genotoxic effects. The study used a risk-based probability model to predict the risks of nanomaterial exposure to aquatic organisms.

TH 225

**Comparative toxicity of silver nitrate and silver nanoparticles to different species of an aquatic trophic chain**

E. Riechel, A. AMVM Soares, S. P. Loureiro

University of Aveiro, Aveiro, Portugal

The study aimed to compare the toxicity of silver nitrate and silver nanoparticles to different species of aquatic organisms, focusing on their potential to disrupt the immune system and cause genotoxic effects. The study used zebrafish (Danio rerio), daphnia, and a newt as model organisms.
would be better understood under the investigation of their uptake and distribution inside the organisms, which is an ongoing work.

**TH 228**

Long-term effects of iron-based nanoparticles at population level (Project Fe-NANOSIT) K Fug 1, K Kirej, M Lies 1

1Helmholtz Centre for Environmental Research, LEIPZIG, Germany

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General aim of the project Fe-NANOSIT is the development of novel methods for the purification of contaminated ground- and industrial wastewaters based on nanoparticles (NPs) and nanocomposite structures. The project includes (i) the development and production of reactive NPs and nanocatalysts, (ii) detailed particle characterization, (iii) demonstration of the technological solutions at field scale, and (iv) detailed risk assessment following a multi-tiered approach from the cell to the population level. For a risk assessment at population level, we apply the automated test system NANOCSOM, which analyses populations of Daphnia magna. The abundance and size structure of populations are quantified by image analysis. The NANOCSOM system allows the investigation of stressed populations to evaluate specific compounds, which is a very important factor involved in the dynamics of natural populations. Hence, the NANOCSOM system enables a highly sensitive monitoring of long-term effects and recovery processes after exposure to NPs.

**TH 229**

Toxicity review on AI203, TiO2, ZrO2, SiO2, MWCNT and CeO2 nanoparticles S Scalbi, G Barbone, B Perozzi, P Masoni

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The LCA & Ecodesign laboratory of ENEA is in charge of the assessment of nanofluid coolants impacts on the environment, health and safety (EHS), across their entire life cycle, for NanoHex (enhanced nano-fluid heat exchange) project (www.nanohex.eu). The NanoHex project, financed by the European Commission within the framework of the 7th Framework Programme, is developing a nano-structured coolant for adoption by industry in heat exchange systems using the enhanced thermal properties of nanofluids (NPs). The promising laboratory based nanotechnology results are translating into pilot-planes for the cooling of electronics primarily targeting Data Centres & Power Electronics. The EHS assessment is being performed by the joint application of Risk Assessment (RA) and Life Cycle Assessment (LCA). The choice of the methods results from two main reasons: the recommendations in the Action Plan ‘Nanosciences and nanotechnologies: An action plan for Europe 2005-2009’ and the issues related to the sustainability of the emerging technologies (Sustained Research Activities-SAT).

The article presents the results of a literature review on toxicity of the candidate nanoparticles (NPs) for NanoHex application in NPs, in order to consider the prevention and reduction of possible impacts of the new materials as well as technological performance. Available studies of scientific community are not sufficient to characterize the effect of NPs and define a “hazard hierarchy” between different NPs because, at date, the difference among the pro- cedures and results of toxicity tests is too broad. Nevertheless, some useful information about the toxicity can be drawn by the survey proposed in this work to consider impacts related to the toxicity besides the other environmental effects. Moreover, the toxicity of some NPs has been widely studied in both in vitro and in vivo assays, there still is a lack of information concerning ENPs release from nano-based products. Hence it is necessary to estimate their potential release throughout the whole product life cycle.

**TH 230**

Designing environmental friendly nanoparticles with Nano-QSAR F Pavan, A Gajewicz, B Rasulev, A Michalikova, A Terpov, D Leszczyński, J Leszczyński

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New pathways that concern the study of materials having at least one dimension below 100 nm, called nanoscience and nanotechnology, are rapidly expanding. Particles in these size ranges, may exhibit properties drastically different from their larger counterparts having the same chemical composition. This enables novel, profitable applications of nanoparticles. Further studies are required to understand the behaviour of NanoHex selected NPs starting from the main NPs parameters (physical-chemical characteristics of NPs such as dimension, shape, crystalline form, z-potential and type of experimental tests such as in vivo or in vitro).

**TH 231**

Iron-based nanoparticles and nanocomposite structures for removal of contaminants in ground- and industrial wastewaters (Project Fe-NANOSIT) K Fug 1, S Scholz, K Mackenize, M Lies, A Forthof, J Brun, D Lippok, K Dumitru, M Seltna, M Galinsky, M Osawa

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6Goldner Associates GmbH, CELLE, Germany

7ProAqua GmbH & Co. KG, MAINZ, Germany

8ECT OkoToxologikale GmbH, FLORSHEIM AM MAIN, Germany

9BIB, Unweitl. - Biotechink GmbH, HEIDELBERG, Germany

10Technical University of Dresden, iFW and Max Bergmann Center of Biomaterials, DRES- DENT, Germany

11University of Potsdam, Institute of Earth and Environmental Science, POTSDAM-GOLM, Germany

General aim of the project Fe-NANOSIT is the development of novel methods for the purification of contaminated ground- and industrial wastewaters based on nanoparticles (NPs) and nanocomposite structures. The project includes (i) the development and production of reactive NPs and nanocatalysts, (ii) detailed particle characterization, (iii) demonstration of the technological solutions at field scale, and (iv) detailed risk assessment following a multi-tiered approach from the cell to the population level. For a risk assessment at population level, we apply the automated test system NANOCSOM, which analyses populations of Daphnia magna. The abundance and size structure of populations are quantified by image analysis. The NANOCSOM system allows the investigation of stressed populations to evaluate specific compounds, which is a very important factor involved in the dynamics of natural populations. Hence, the NANOCSOM system enables a highly sensitive monitoring of long-term effects and recovery processes after exposure to NPs.

**TH 232**

A proposed protocol for estimating the potential release of nanoparticles from nano-based coatings: the NANOHOUSE project A Brunelli1, S Zuin2, A Ferrari3, D Cervellati3, G Pojana1, A Marcomini1, F Tardif4

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Nanostructures utilizing engineered nanoparticles (ENPs) have been envisaged to become a flourishing industry with an expected annual turnover over 1.5 trillion euros by 2015 (Savolainen et al., 2010). The Project on Emerging Nanotechnologies has estimated that more than 1000 nano-products are marketed now, with a new entry every 3-4 week (http://www.nanotech- project.org). ENPs, since their unique properties, are applied in many fields and products (e.g., textile, coatings, composites, medicine, etc.). An inevitable consequence of this constantly of nano-based products is the potential human and environmental exposure to ENPs (Nowack, 2007). As a result, although the toxicity of some ENPs has been widely studied in both in vitro and in vivo assays, there still is a lack of information concerning ENPs release from nano-based products. Hence it is necessary to estimate their potential release throughout the whole product life cycle.

Within the FPT EU-funded NANOHOUSE project (Life Cycle of Nanoparticle-based products used in house coating; www.nanohouse.cafe), aiming at developing appropriate solutions for a safe and sustainable use of nano-based coating according to Life Cycle Thinking, the potential re- lease of ENPs from selected nano-based paints by “wet route” is being evaluated. In detail, within the W2 - Source identification, an experimental protocol has been proposed to estimate release from selected paints containing TiO2, Ag and SiO2 ENPs. The proposed protocol has been defined taking into account literature results, available standards (e.g., ISO, ASTM) and input from project partners. In this work, the experimental protocol will be presented and discussed highlighting: (i) type of panels coated with nano-based paints and their initial conditioning; (ii) pre-treatment of panels to simulate their weathering (i.e. accelerated weathering tests such as Taber test and UV exposure); (iii) leaching test applied on weathered and un-weathered panels to simulate the ENPs release; (iv) expression methods and techniques needed to investigate ENPs in collected leaching samples. Moreover, a special attention will be paid to available leaching standards able to estimate migration rate of ENPs, and characterization techniques/methods necessary to quantify ENPs release.
mice did not show any significant abnormalities compared to control mice. These results suggest that arsenic exposure itself does not cause these respiratory disorders in mice. Therefore, we can infer that the dysfunction of placentas is one mechanism of prominent pregnancies induced by arsinite. We believe that the knowledge obtained by these studies might provide basic and useful information for developing NMs with safety.

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TH 234
Risk-oriented characterization of engineered nanoparticles

G. Peng-Shan1, Medical University, CHANG-CHUNG, Taiwan

The objectives of this study are to characterize the concentration-time profiles in target organs and tissues by a pyrene-based physiologically based pharmacokinetic (PBPK) model, and to collect the published data of metabolism biomarkers (urinary - 1-hydroxypyrene (1-OHP) levels) for model validation. We adopted the pyrene data from Tsai et al. (2004) for PAHs concentration being measured at highway to all station to account for the traffic pollution sources. The variation of urinary - 1-OHP levels between post-shield and post-exposure were measured. The input pyrene concentration and 1-OHP concentration of exposure groups were 105 ng/m3 and 2.12 ng/m3 of 1-OHP levels of blood respectively. For simulating pharmacokinetics of pyrene, we use a basic human compartment structure that has been previously used by Chiang and Liao (2006). The tissue compartments included in the model are: alveolus, lung, richly perfused tissue (brain, gut, kidney, spleen, and heart), fat, slowly perfused tissues (bone, muscle, and liver). Each tissue compartment is interconnected by arterial and venous blood flow. The PBPK model will be verified by comparing the predictions of urinary - 1-OHP levels with the measured published data. The results show the simulated highest time course concentrations of pyrene in blood were 11.34(GreekX)10^-6 to 11.34(GreekX)10^-5 mg/ml/day, followed by rapidly perused tissues (6.04(GreekX)10^-5 to 10^-3 mg/ml/day), slowly perfused tissues (3.56(GreekX)10^-5 to 10^-2 mg/ml), liver (1.34(GreekX)10^-5 to 10^-2 mg/ml), blood (3.83(GreekX)10^-5 to 10^-4 mg/ml), and lung (6.64(GreekX)10^-5 mg/ml). Model validation by t-test statistical method shows that there is no significant difference between model prediction and experimental 1-OHP concentra-

TH 239
Assessing arsenic exposure and influenza A (H1N1) infection-associated lung function exacerbations risks

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Arsenic (As) is ubiquitous in the environment and known to lead to many human health problems related to pulmonary diseases. Recently, the animal experiment showed that As would significantly increase influenza viral titer. In this study, we are trying to link arsenic exposure and influenza A (H1N1) infection-associated lung function exacerbation risks. We focused our study on some heavy metals, and some pharmaceuticals. For copper, the results chose the city of Lausanne as case study since the receiving water of this city (Lake Geneva) is an important source of drinking water for the surrounding population. Moreover a profound scientific knowledge and many urban water systems. In this study, we try to test the application of surface flow analysis for various classes of micropollutants to evaluate its application to urban water management. We chose the city of Lausanne as case study since the receiving water of this city (Lake Geneva) is an important source of drinking water for the surrounding population. Moreover a profound scientific knowledge and many urban water systems. In this study, we try to test the application of surface flow analysis for various classes of micropollutants to evaluate its application to urban water management. We chose the city of Lausanne as case study since the receiving water of this city (Lake Geneva) is an important source of drinking water for the surrounding population. Moreover a profound scientific knowledge and many urban water systems. In this study, we try to test the application of surface flow analysis for various classes of micropollutants to evaluate its application to urban water management. We chose the city of Lausanne as case study since the receiving water of this city (Lake Geneva) is an important source of drinking water for the surrounding population.
The fate of pharmaceuticals in the environment has been studied for more than 50 years, with the majority of these PNECs were derived from chronic toxicity data or simulated ecosystem studies. For evaluating the potential ecotoxicity to fish of human pharmaceuticals, particularly potential sublethal or biomarker-type endpoints, for example, a number of highly replicated fish life-cycle studies have been performed that use a range of species and concentrations could also be selected such that a range-finding study is not required. To understand the relative roles of the direct influence of competition on vulnerability to a pesticide, the interaction between toxicants and biological interaction is rarely investigated but we proved that interspecific interactions can negatively affect the sensitivity of one of the most common test species, Daphnia magna. The interaction between toxicants and biological interaction is rarely investigated but we proved that interspecific interactions can negatively affect the sensitivity of one of the most common test species, Daphnia magna.
competition in test systems at population and community levels, we recommend initiating them with several generation times before contamination.

TH 250

Traits and stress - keys to identify community effects of low levels of toxicants in test systems

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Community effects of low toxicant concentrations are obscured by a multitude of environmental factors and biological interactions. To resolve this issue for community test systems, we propose a trait-based approach to detect toxic effects. A long-term experiment with outdoor stream mesocosms was conducted. It was established 2 years before contamination to allow the development of biotic interactions within the community. Following pulse contamination with the insecticide thiacloprid, communities were monitored for additional 2 years to observe long-term effects. Species were aggregated into trait-based groups that reflected stress-specific vulnerability of populations to toxicant exposure. This reduced intraspecific variation and increased the ability to detect toxicant related effects. Species with low intrinsic sensitivity showed only transient effects at the highest thiacloprid concentration of 100 μg/L. Sensitive multivoltine species showed transient effects at 3.3 μg/L. Sensitive univoltine species were affected at 0.1 μg/L and did not recover during the year after contamination. The new indicator SPEARmessocosm was calculated as the relative abundance of sensitive univoltine taxa. It detected long-term effects for five species at concentrations that were 1000 times below the concentration at which long-term effects of thiacloprid were detected by the PRC (Principal Response Curve) approach traditionally applied for mesocosms. We also found that species that were stressed, as indicated by a decline in abundance in control streams, were affected more strongly by thiacloprid than nonstressed species. We conclude that the grouping of species according to toxicant-related traits enables identification and prediction of community response to low levels of toxicants.

TH 251

Ecological Risk Assessment of extraneous contaminated sediments: the Exposure-Dose-Response framework

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Sediment Ecological Risk Assessment has often been conducted integrating exposure and effects data using qualitative judgement to weight the different Lines of Evidence. To identify the Lines of Evidence more suitable in evaluating the impact of sediment environments contaminated by metals, Lines of Evidence have been explored in the Exposure-Dose-Response framework. Data including sediment chemistry, bioaccumulation, toxicity, and biomarkers for molluscs, crustaceans and fish and benthic community assemblages were mined from the literature and from available databases. Data were gathered only for extraneous sediment environments contaminated by copper, cadmium, lead and zinc. The collected data were compared with sediment quality guidelines and explored for relationships within the Exposure-Dose-Response framework. The behaviour of the molar sum of the four metals was investigated for its possible use as a concise indicator of metal exposure and dose and for its relationships with Response. The Exposure-Dose-Response approach was also applied to the Lines of Evidence gathered from Lake Macquarie, an extraneous lagoon on the East Coast of Australia, historically contaminated by copper, cadmium, zinc, lead and selenium. The molar sum of the four metals showed to be a good indicator of contamination and bioaccumulation in relation to response. Exposure-Dose relationships were shown to be stronger than Exposure-Response relationships in the mined and Lake Macquarie data sets, by passing the confounding factors due to bioavailability of metals in sediment. Molluscs and fish showed more consistent Exposure-Dose and Dose-Response relationships than crustaceans.

TH 252

Silkworm as a bio-indicator model in ecotoxicological studies on Cadmium (Cd)

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Xenobiotic risk evaluation largely concerns the international scientific and social communities in order to assess sustainable threshold levels of pollution. Different available bioassays for ecotoxicological studies focused mainly on organisms such as earthworms, mussels and snails while only few insect species have been used up to date. This research aims setting up protocols for testing some relevant biomarkers on Bombyx mori L. (Lepidoptera: Bombycidae) used as model. This insect species was chosen because it is easily reared under controlled environmental conditions by feeding on mulberry leaves or artificial diet. Silkworm artificial diet was spiked with 0.01, 0.1, 1 and 10 ppm of Cd. Three microcosms were set up for each treatment and for control. Twelve larvae of silkworm at the last instars were fed on artificial diet and exposed to pollutant for 6 days at 28°C with 65% relative humidity (RH) and a light:dark ratio of 15:9. After exposure, specimens of B. mori were opportunistically treated to assess the metallothionein content, the DNA damage (comet assay), and the bioaccumulation of Cd. The metallothionein content showed a significant difference between the treatment with the highest Cd dose and the control, while the comet assay showed a dose-response effect. These first results seem to be promising to use silkworm as a model to promote other insects, more relevant from an environmental point of view, as bio-indicators. The application of other biomarkers and the collection of further data for confirming these preliminary information is foreseen in the next steps of this research.

TH 253

Using a soil-water flume on pesticide ecological risk assessment under Mediterranean exposure scenarios

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3Centre for Environmental Contaminants Research (CECR), CSIRO Land and Water, BANGOR, NSW, Australia

A temperature-controlled flume simulating Mediterranean climatic conditions was set up for each pesticide. June was foreseen in the next steps of this research.

Different scenarios for each pesticide were created using reference soil from an agricultural area of Central Portugal. Simulator experiments ran under Mediterranean climatic conditions, and conditioned the specific crop type, mode of application and irrigation regime for each pesticide. Based on data from previous laboratory tests, soil samples for testing with soil organisms were collected only for ethoprophos, but leachate and run-off samples were collected for the three pesticides. Data gathered from all matrices will be compared with data obtained from laboratory tests aiming to refine effect assessment data obtained in lower tiers. Furthermore run-off matrices will be used as contamination source on higher tier aquatic microcosms. This study contributes to fulfil the need for integrated (water and soil) studies, especially mimicking more realistic exposure scenarios. This will also lead to a refinement of methodologies to assess quality standards that will contribute to decision-making aiming at a sustainable use of pesticides towards water, soil and biodiversity protection, contributing to reduce soil degradation and water contamination at a national level.
A Review of the Inclusion of Amphibians and Reptiles in Ecological Risk Assessments

KR Campbell1, SD Deacon2, JT Ipock1

A Review of the Inclusion of Amphibians and Reptiles in Ecological Risk Assessments

The shallowest concentration-effect curve corresponds to β values of 0.65 for cadmium and 0.57 for copper (a=9.3 and 4.3, respectively). The β for NH4NO3 equals to 0.41 (a=19.9), for atipemm-methyl b=39.2 (a=29). For acidification the curve is steepest with the β value of 0.15 (a= pH 3.7), meaning that variation in sensitivity to acidity is the smallest. Previous studies on toxic stressors show that, in general, within a toxicodynamic range with a specific maximum of action there are steeper slopes than that with a non-specific maximum of action. This is similar to the results on the amphibian toxicodynamic range of auranofin and the nemacord action of β-irradiation. This may imply that these toxicodynamic ranges have no specific maximum of action on amphibians. The SSD analysis allows to rank the stressors according to the sensitivity of amphibians and identify the major threat causing their decline.

Evaluation of the embryotoxic potential of xenobiotics in Xenopus laevis using molecular approaches

licitoo Avivonk2, HJR Lenders1, AM Breure2, AJ Hendriks1

The review of toxicity data confirmed that very little acute toxicity data suitable for comparison was available for these species. More data on feeding patterns is needed to allow risk assessment for these species where they will eat a large prey item on one day and not feed again for several days or more. In Fryday and Thompson (2009) reviewed information that might be suitable for assessing the potential ecotoxicological risk of the Mediterranean population of Caretta caretta through the responses of a set of biomarkers and the analysis of contaminant exposure. The results of total PAHs, carcinogenic PAHs and OCs levels, lipid peroxidation, Hg levels and the frequency of micronuclei and total number of cells with nuclear abnormalities showed a progressive increase with increasing of specimens age. The data obtained from this multi-trial approach represents a further sight that highlights the potential ecotoxicological risk of the Mediterranean population of Caretta caretta.

MOPC-1.6 Effects of mosquito control measures on mortality and whole-body corticosterone levels in tadpoles of four Southeast Asian newt amphibians

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MOPC2 - New developments and perspectives in Life Cycle Sustainability Assessment

Life cycle based indicators for quantifying and monitoring the environmental impact of European Union

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European Union is under the objective of the European Union treaties. It is mainstreamed to the European Union policies, along the approach chosen to facilitate meeting this objective “life cycle thinking”. So far, the tools necessary to measure towards this ambition goals have been missing. Therefore, the JRC/ESTAT in consultation with DG ENV and the Member States developed life cycle based indicators for quantifying and monitoring the environmental impact of the European Union. This paper presents the framework for the life cycle based indicators.

The indicators serve the implementation of modern life-cycle based environmental policies, like the Sustainable Consumption and Production Action Plan (COM(2008) 397), the Thematic Strategy on the Sustainable Use of Natural Resources (COM(2005) 670), and the Thematic Strategy on Prevention and Recycling of Waste (COM(2005) 666). Life cycle based indicators are intended to monitor progress and objectives towards sustainable consumption and production, with particular focus on the separation of environmental impacts from economic growth. The indicators take into account the impacts and resources consumed, both inside and outside the EU, that are associated with goods and services consumed and the waste produced.

The life cycle based monitoring indicators include: Decomposing Indicators (resource efficiency indicators) which measure the total environmental impact of European Union in relation to the resources used. Basket of Product Indicators which informs about the environmental impact indicators for products, covering a representative selection of goods and services consumed in the EU. Waste Management Indicators cover the entire waste management chain for most relevant waste types generated and treated in the EU. The indicators will be part of an effort towards sustainability development in the policy areas of resources, consumption and production, and waste, allowing the detailed analysis of the European production and consumption. They will support the sustainable use of natural resources without shifting of burdens in a globalised economy as well as foster material and energy resource efficiency and reduced environmental pressure of waste management.

MOPC2 - Feasibility of current SLCA methodology for technology assessment

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Life cycle thinking within sustainability assessment of products so far mainly addresses environmental aspects (Life Cycle Assessment). However, assessing economic and social aspects gain increasing attention; the latter especially since the publication of the UNEP/SETAC Guidelines for Social Life Cycle Assessment (SLCA) of products in 2009. Based on two case studies on sustainability assessment of technologies for water respectively fuel provision in developing countries, social aspects along the life cycle of those technologies were identified. Special focus was laid on the “use-phase” of technologies respectively the production phase of the services provided.

It is discussed if the assessment of technologies is actually within the scope of SLCA, which focuses on products. Since it consequently was considered to be, current SLCA methodologies - summarized in the UNEP/SETAC Guidelines - were analyzed with regard to suitable impact categories and indicators for the different social aspects identified.

The paper thus examines the basic applicability of SLCA guidelines to address social aspects and indicators which are considered as relevant to evaluate the “sustainability performance” of technologies. Additionally, possibilities of the social indicators for technology assessment within management systems are proposed, giving an outlook on how further development of SLCA methodologies could look like.

MOPC2 - New guidelines for sustainable chemicals management

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1Federal Environment Agency (Germany), DESSAU-ROßLAU, Germany

2Federal Environment Agency (Germany), DESSAU-ROßLAU, Germany

New guidelines for sustainable chemicals management are elaborated in the EU to harmonize risk assessment and management systems are proposed, giving an outlook on how further development of SLCA methodologies could look like.

MOPC2 - Methodological development of regional sustainability analysis

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2Norra Ring Nacka Regional Innovation Agency, MISKOLC, Hungary

Recently the methodological aspects of the sustainability LCA induce increasingly bigger interest among LCA researchers. Many assessments connect to sustainable product systems, renewable resource system or regional and local sustainable models. This paper describes an applied method of a regional sustainability assessment. It is based partly on LCA and partly on sectors mutual climate change consideration.

On the economic aspect, a framework considering the effect of production inducement is described. The framework is applied on the regional assessment of the steel industry in Iberian Peninsula. The economic aspect includes also resource and energy demand as well as social implications. The framework is based on the modelled risk reduction concept with 15 substance- and application-oriented assessment criteria.

The regional perspective offers an overview of regions dealing with the same chemical risks in different phases of its life cycle.

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The regional perspective offers an overview of regions dealing with the same chemical risks in different phases of its life cycle.
able path. It involves:

- sectors which cover the 80 percent of the environmental load focusing on the largest polluter producers at company level - environmental aspect;
- sectors where the added value is the highest - economic aspect,
- sectors which employ the most - social aspect.

The selection of the environmental burden is based on long term statistical data analysis provided by the Hungarian Statistical Office.

The model is characterized by the n=35, R2=0.63, Q2=0.287, F=56 (sub-training set), R2pred=0.88, R2pred=0.87, RMSE=0.299, F=166 (calibration set); and n=19, R2=0.89, R2pred=0.86, RMSE=0.210, F=138 (test set). It has shown that the model is both robust and convenient for the physicochemical interpretations. The described calculation can be carried out with CORAL software available on the Internet (http://www.insilico.eu/CORAL/).

MOPC-4-1

Effect-directed analysis (EDA) of transformation products of triclosan formed during (photo)oxidative processes

H Meckert, N Bramaz, K Schirmer, B Escher, U von Gunten, S Canonica

Transformation processes in the aquatic environment and in water treatment systems may signific-
cantly change the toxicity in comparison to the parent compound. For an overall risk assessment, the toxicity of the transformation products should be investigated. The direct identification of toxic products involved in endocrine regulation can be disrupted. Hence identifying environmental active pollutants is needed. Effect directed analysis (EDA) approach aims at identifying such adverse chemicals by using an EDA approach.

Identification and compartmentalization study of emerging EDCs in an impacted river system by using an EDA approach

The already decade went with the increasing occurrence of emerging pollutants (e.g., hormones, pharmaceuticals) that trigger adverse effects in river systems. Thus, strategies for their identification are required. Effect directed analysis (EDA) approach focusing on identifying such adverse chemicals.

Our current use is the most often restricted to dioxin (Aroclor), estrogen (ER) or androgen (AR) receptors pathways as well as the involvement in estrogen pathway is disrupted. Hence identifying environmental active pollutants is needed. A fractionation of sediment extracts is described.

We report here the use of a battery of in vitro reporter gene bioassays including classical and parameter-less peak integration, and intelligent elemental composition determination. In addition, the use of ChromaLynx XS software for non-targeted spectral deconvolution enables the rapid screening of pesticides in aquatic environments.

Utilizing novel software algorithms to streamline LC-MS analysis for targeted and non-targeted screening in environmental applications

In recent times the use of pesticides, herbicides and fungicides has steadily increased in an effort to meet global food demands. A percentage of such chemicals applied to crops will, inevitably, end up leaching into the surrounding soil and waterways. Stringent environmental monitoring is therefore required, which is an ever-expanding research field and protect plants and wildlife from harm as a result of exposure to these types of chemicals.

A novel ToF instrument coupled with ACQUITY UPLC, along with the Waters ToF Screening Pesticide Database, and POSi+LC/MS data processing, was used to rapidly screen treated samples for pesticide residues. The data were generated by a generative approach that can be used for both precursor and fragment ions in one screening run, with a high level of reproducibility. The RSMS variation in acquired exact mass across a peak for thiabendazole was 1.5 ppm. This provides increased confidence in the detection and identification of compounds present, as well as a precise and accurate mass data acquired, and also allowed the use of very narrow chromatographic extraction windows, as low as 0.5 min as some instances.

In addition, the use of ChromaLynx XS software for non-targeted spectral deconvolution enables the rapid screening of pesticides in aquatic environments.

Integrated Testing Strategy (ITS) to optimise the assessment of bioconcentration under REACH framework

The availability of full scan ultra high resolution LC-MS instruments allows for rapid analyses of samples without the need to develop specific MS methods for target compounds. At the same time it is possible to re-integrate the same dataset for the identity of unknown or unexpected compounds since full scan data is acquired over the entire chromatographic run. Historically, significant time has been devoted to manual data mining required when searching for unexpected compounds. We describe the use of software for environmental screening applications to improve the throughput. The software incorporates several novel algorithms for data processing, including advanced component detection, parameter-less peak integration, and intelligent elemental composition determination. In addition to these algorithms, a database can be enabled to facilitate identification and throughput. The software can be used to screen and report target components in an automated fashion and at the same time obtain information on potential unexpected or unknown contaminants in samples.

Integrated Testing Strategy (ITS) to optimise the assessment of bioconcentration under REACH framework

Aims of the REACH legislation is human and environmental protection. To achieve this goal the Integrated Testing Strategies (ITS) are required, which endeavours to safeguard the environment and protect plants and wildlife from harm as a result of exposure to these types of chemicals.

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vitro data), 3) physicochemical properties, and 4) data from non-testing methods. As one component, this ITS contains a waiving scheme to identify compounds that can be safely considered non bioaccumulative (nB). This waiving scheme is made up of two logP-based worst-case QSARs and a decision tree based on physicochemical properties. The performance of the waiving scheme was tested using a large dataset. More than 50% of the nB compounds can be classified this way. The ITS allows to further reduce the number of compounds needing an in-vivo test using alternative methods. The ITS is presented here in a web tool to help users in the decision-making process.

Financial support by the OSIRIS project (GOCE-CT-2007-037017) is gratefully acknowledged. TUPC1-2 Screening for low aquatic bioaccumulation: physico-chemical constraints M Nendra1, T Herbster2 Analytisches Laboratorium, LUHNSTEDT, Germany Physico-chemical properties related to the bioavailability of xenobiotics in aquatic environments have been tested for their ability to identify chemicals with low bioconcentration potential. Cut-off values for logP (≥ 2.5 or < 1.0), solubility (≤ 1 x 10-4 M), degradation (≤ 1/10 degradation half-life, hydrolysis) and ionization (> 5% ionisation at pH 7) have been adopted and combined into a decision tree based on 382 industrial chemicals. The 5-parameter classification scheme was externally validated with 49 pesticides and 216 undecidable chemicals and 126 chemicals from (1). 60-70% of chemicals could be proposed for waiving their experimental BCF testing.

Acknowledgement. - This work was supported by the EU 6th Framework Integrated Project OSIRIS (contract no. GOCE-CT-2007-037017), www.osiris-reach.eu.

TUPC1-3 Use of conditional inference trees in support of B and non-B classification for waiving of experimental BCF testing M Stremple1, M Nendra1, M Scheringer1, K Hungerbühler1 1ETH Zürich, ZURICH, Switzerland 2Analytisches Laboratorium für Umweltuntersuchungen und Auftragsforschung, LUHNSTEDT, EVD, Germany Under the European REACH regulation substances of very high concern, including persistent, bioaccumulative and toxic (PBT) chemicals, require authorization and their use may be restricted. According to Annex XIII of REACH, the bioconcentration factor (BCF) may be used as a surrogate to characterize bioaccumulation potential. To improve animal welfare and reduce costs, the European PBT System for chemicals (EUSES) is currently recommended for government authorities, research institutes and chemical companies within the EU to carry out quantitative model based exposure assessments when appropriate monitoring data are lacking. However, the algorithms employed in the bioaccumulation module of this model are more than 10 years old and our scientific understanding of bioaccumulation has progressed considerably since then. This study presents a comparison between estimates of human daily intake by EUSES and a new steady state food chain model (OSIRIS) which employs more recently published process descriptions. Calculations were made for a wide range of chemicals classified by their octanol-air (KOA) and octanol-water (KOW) partitioning properties. This model comparison showed that the greatest differences between the two models were for chemicals with high KOA and high KOW, due to differences in estimation of bioaccumulation in fish and root crops. Predicted concentrations in fish were up to four orders of magnitude lower in EUSES. One reason is that dietary uptake is not considered in this model, but also due to a generally lower predicted bioconcentration factor for high KOA compounds. EUSES predicted much higher concentrations of hydrophobic compounds in root crops because it assumes chemical equilibrium between the root and the soil compartment, whereas the OSIRIS model treats root accumulation as a mass-transfer limited process. TUPC1-4 Integrated testing strategies (ITS) for bioaccumulation: 3R-directed optimization of in vivo testing E Segner1, I Lamy2, M Havelcik2, M Nendra1, A Lombardo1, A Roncaglia1, E Benfensta1 1University of Bern, BERN, Switzerland 2Analytisches Laboratorium, LUHNSTEDT, Germany Under REACH, assessment of the bioconcentration potential is required for chemicals with a log Kow greater than 3 if it is produced or imported in quantities greater than 100 t/year. The goal of the decision strategy to identify chemicals with low bioconcentration potential is to de-prioritize them at an early decision stage. Integrated Testing Strategies (ITS) for bioaccumulation assessment take advantage of a variety of information sources in order to estimate whether a chemical is bioaccumulative (B, BCF > 2000) or not (non-B). The test strategy is currently recommended for government authorities, research institutes and chemical companies within the EU to carry out quantitative model based exposure assessments when appropriate monitoring data are lacking. However, the algorithms employed in the bioaccumulation module of this model are more than 10 years old and our scientific understanding of bioaccumulation has progressed considerably since then.

This study presents a comparison between estimates of human daily intake by EUSES and a new steady state food chain model (OSIRIS) which employs more recently published process descriptions. Calculations were made for a wide range of chemicals classified by their octanol-air (KOA) and octanol-water (KOW) partitioning properties. This model comparison showed that the greatest differences between the two models were for chemicals with high KOA and high KOW, due to differences in estimation of bioaccumulation in fish and root crops. Predicted concentrations in fish were up to four orders of magnitude lower in EUSES. One reason is that dietary uptake is not considered in this model, but also due to a generally lower predicted bioconcentration factor for high KOA compounds. EUSES predicted much higher concentrations of hydrophobic compounds in root crops because it assumes chemical equilibrium between the root and the soil compartment, whereas the OSIRIS model treats root accumulation as a mass-transfer limited process. TUPC1-5 Models to estimate the BCF from octanol/water partition coefficient - validation and applicability domain B Köhne1, RU Ebert1, S Strepel1, M Scheringer1, G Schümann1 1Helmholtz Centre for Environmental Research - UFZ, LEIPZIG, Germany The EUSES system ChemBridge provides several models to estimate the bioconcentration factor in fish from the octanol/water partition coefficient. In turn, the octanol/water partition coefficient can either be taken from experimental values, or calculated from the chemical structure. For models with known training sets, the applicability domain is checked. A data set with experimental values independent from the model training set is used to estimate the uncertainty of the predictions. A refinement is provided by a result correction derived from the estimation errors for chemicals of this data set that are similar to the test compound. A separate external test set is applied to validate the performance of the implemented models and their uncertainty estimation. This study is financially supported by the EU Integrated Project ONIRIS (contract no. 037017).

TUPC2-1 Life cycle thinking in the waste management sector: one 3R principles include reduction of sampling frequency for determination of the kinetic parameters as well as the reduction of test concentrations (only one instead of two concentrations). Another approach is to exploit the unlimited potential for bioaccumulation testing. Embryos, due to their yolky content, readily absorb xenobiotics, and they possess already a functional metabolic capacity. Thus, the Fish Embryo Test (FET), which is currently used as validation alternative to the acute fish lethality test, may serve at the same time as a BCF test, or at least a BCF screen. A similar approach for the use of test systems both toxicity and bioaccumulation may also be possible for fish early life stage tests. However, the potential of these approaches for 3R-directed optimization of in vivo BCF testing remains largely un-exploited to date. Financial support by the ONIRIS project (GOCE-CT-2007-037017) is gratefully acknowledged. TUPC2-2 Life cycle thinking in the waste management sector: one 3R principles include reduction of sampling frequency for determination of the kinetic parameters as well as the reduction of test concentrations (only one instead of two concentrations). Another approach is to exploit the unlimited potential for bioaccumulation testing. Embryos, due to their yolky content, readily absorb xenobiotics, and they possess already a functional metabolic capacity. Thus, the Fish Embryo Test (FET), which is currently used as validation alternative to the acute fish lethality test, may serve at the same time as a BCF test, or at least a BCF screen. A similar approach for the use of test systems both toxicity and bioaccumulation may also be possible for fish early life stage tests. However, the potential of these approaches for 3R-directed optimization of in vivo BCF testing remains largely un-exploited to date. Financial support by the ONIRIS project (GOCE-CT-2007-037017) is gratefully acknowledged.
ties, WARM (Waste Recycling Model), LCA-IFW (LCA-Integrated Waste Management), WAISR (Waste Integrated Systems for Assessment of Recovery and Disposal) and EASE-WASTE (Environmental Assessment of Solid Waste Systems and Technologies). This analysis was conducted at three levels: 1) modeling and assessment of a complex MSW management system in each software in order to examine whether there are differences in the obtained results in terms of overall management system efficiency and steering and assessment of advanced MSW management systems in each software in order to analyze whether the preference order is maintained; and 3) analysis of the life cycle inventory applied in each software for each waste management treatment in order to justify the differences obtained in the previous comparisons.

TUPC2-2

LCA as a decision support tool for waste management planning in Lombardia Region

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Cestec, MILANO, Italy

Waste management plans play a key role in achieving sustainable development by saving resources and avoiding generation of waste. Their aim is to provide a planning framework for the following: compliance with waste policy and target achievement; outline of waste characteristics and sufficient treatment capacity for managing waste; control of technological measures; and economy and investment requirements. Life cycle assessment (LCA) is a decision support tool for the planning of waste management. It is a method for the following: defining the life cycle of a product or service; evaluating the environmental and social impacts of the product or service; and evaluating the sustainability of the process. LCA is a decision support tool for the assessment of the current situation and thus to give useful strategic indications for the future waste management plan. Regionne Lombardia is among the most advanced in Italy, as well as in Europe, for municipal waste management. In the year 2009 the total production of about 5 millions ton (500 kg per capita per year) was split between 48% of source separation for material recovery, 32% of energy recovery (mainly via incineration), 16% of mechanical-biological pre-treatment (MBT) and only 9% of mechanical-biological treatment (MBT). Present solid waste management in most Asian countries is disastrous. There is an urgent need in Asia for municipal solid waste management (MSWM) systems that effectively separate and process hazardous and non-hazardous waste in a healthy and environmentally sound way. Municipal waste composition in Asia is broadly similar, though slightly influenced by climatic and socio-economic factors. The critical analysis of the results of the baseline scenario will allow to design some possible management scenarios for the year 2015, with the final goal of a further improvement of the environmental performance of the regional system. In parallel with the regional assessment, three more detailed LCA’s will be carried out for the evaluation of three provinces within Lombardia, characterised by a different approach on waste management.

TUPC2-3

Screening environmental and human health impacts of municipal solid waste management in Asian cities

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‘King Mongkut’s University of Technology Thonburi, BANGKOK, Thailand

Solid waste management has become a major environmental problem for the fast growing towns and cities of developing Asian countries. Asia generates annually roughly 4-4.5 billion tons of solid waste per year. In Thailand, it is a 0.8 billion tons of municipal solid waste (MSW). Present solid waste management in most Asian countries is disastrous. There is an urgent need in Asia for municipal solid waste management (MSWM) systems that effectively separate and process hazardous and non-hazardous waste in a healthy and environmentally sound way. Municipal waste composition in Asia is broadly similar, though slightly influenced by climatic and cultural variations, and clearly differing between high income countries versus middle and low income countries. This enables a screening environmental and human health impact assessment and comparison based on quantitative and semi-quantitative information that matches enough Asian countries at the same time conditions and technologies involved and environmental and human health impacts. The screening assessment combines life cycle assessment with elements from risk assessment and environmental impact assessment. The screening assessment requires a semi-quantitative information needed for the screening assessment is abstracted from the fast amount of relative certain information stored in existing databases and (life cycle) assessments. Asian MSWM stakeholders will be greatly helped with a screening assessment of existing and available MSWM systems, technologies and their potential environmental and human health impacts. This facilitates them to evaluate the potential systems and MSWM services and technologies on a screening level, before going into more details for the relevant ones in their specific MSWM context. The presentation will present and underpin the screening assessment approach illustrated with examples.

TUPC2-4

Life cycle inventory of a new technology for the inertization of MSW

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Università degli Studi di Brescia, BRESCIA, Italy

The quantity of fly ashes produced by municipal solid waste incineration (MSWI) is a significant percentage of municipal solid waste incinerated. Fly ashes are hazardous waste, since they contain a large quantity of toxic metals (NaCl, KCl, calcium compounds) and significant amounts of toxic heavy metals (Pb, Zn, Cr, Cu, Ni, Cd) in forms that may easily leach out. Fly ashes incineration can facilitate their recycling as a secondary material instead of landfilling. The best available techniques for the detoxification of fly ashes can be grouped into three categories: separation processes, incineration processes. The first one has a heating value of about 5000 kcal/kg, while the second of 4500 kcal/kg. Both WP2000 and Eco-Indicator 99 agree that the use of RDF allows a considerable reduction of CO2 emissions and other impacts on the environment. In particular Eco-Indicator 99 states that the overall reduction was about 25%, while WP2000 detected a lowering of the CO2-equivalent emissions of about 8%. The stage involving the highest impacts is the production of clinker, since during the production of the cement, the addition of other raw materials such as gypsum and limestone also involves a large amount of the overall impacts. The use of paper bag considered in the study gave credits in terms of CO2 equivalent.

TUPC2-5

Strategies for improving the life cycle management of construction and demolition waste in Spain

E Moliner, C Muñoz, D Garratt, JV Sanxelis, V Franco, R Vidal

Engineering Design Group - Universitat Jaume I, CASTELLON, Spain

Spain is one of the major producers of construction and demolition (C&D) waste in the Europe- an Union. The C&D waste stream contains a high proportion of raw materials and minimization of waste generation is necessary in order to lay down a sustainable model of construction. This project is aimed at developing strategies to improve the current situation and meet the requirements of the Directive 2008/98/EC. It is necessary to lay down a sustainable model of construction. This project is aimed at developing strategies to improve the current situation and meet the requirements of the Directive 2008/98/EC. It is necessary to lay down a sustainable model of construction. This project is aimed at developing strategies to improve the current situation and meet the requirements of the Directive 2008/98/EC.

TUPC2-6

Reduction of environmental impacts in the production process of Portland cement by using Refuse Derived Fuel (RDF)

L Zanone, G Dorelli, G Cantarella

Politecnico di Milano, MILANO, Italy

Waste management is one of the biggest environmental issues and still a key topic for a sustainable society. There is a need to improve the current situation and thus to give useful strategic indications for the future waste management plan. Regionne Lombardia is among the most advanced in Italy, as well as in Europe, for municipal waste management. In the year 2009 the total production of about 5 millions ton (500 kg per capita per year) was split between 48% of source separation for material recovery, 32% of energy recovery (mainly via incineration), 16% of mechanical-biological pre-treatment (MBT) and only 9% of mechanical-biological treatment (MBT). Present solid waste management in most Asian countries is disastrous. There is an urgent need in Asia for municipal solid waste management (MSWM) systems that effectively separate and process hazardous and non-hazardous waste in a healthy and environmentally sound way. Municipal waste composition in Asia is broadly similar, though slightly influenced by climatic and socio-economic factors. The critical analysis of the results of the baseline scenario will allow to design some possible management scenarios for the year 2015, with the final goal of a further improvement of the environmental performance of the regional system.

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TUPC2-6

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Waste management is one of the biggest environmental issues and still a key topic for a sustaina-

bility society. Then, a possible alternative is the use of wastes as fuels for high energy consuming industries, then allowing to lower the overall emissions. This study highlights the environmental advantages deriving from the use of Refuse Derived Fuel (RDF), partially substituting the use of conventional fossil fuels in the production of a Portland cement. This study estimates the overall environmental impacts of the production of Portland cement (CEM II/A-LL 242.5R) considered in the study gave credits in terms of CO2 equivalent. The first one has a heating value of about 5000 kcal/kg, while the second of 4500 kcal/kg. Both WP2000 and Eco-Indicator 99 agree that the use of RDF allows a considerable reduction of CO2 emissions and other impacts on the environment. In particular Eco-Indicator 99 states that the overall reduction was about 25%, while WP2000 detected a lowering of the CO2-equivalent emissions of about 8%. The stage involving the highest impacts is the production of clinker, since during the production of the cement, the addition of other raw materials such as gypsum and limestone also involves a large amount of the overall impacts. The use of paper bag considered in the study gave credits in terms of CO2 equivalent.

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opment of a method to isolate, separate and quantify different forms of naturally occurring and man-made CCN in soils and sediments. Our approach consists of: 1) extracting from the natural matrix the CCN isolated during a chemo-thermal oxidation treatment (CTO-375); 2) fractionating the extract into different CCN (CNTs, C60s, and soot) forms by size exclusion chromatography (SEC); and 3) quantifying and characterizing the isolated fractions via optical techniques, spectrophotometry and/or elemental analysis. This far we have adapted the CTO-375 method for large sample sizes (recoveries of spiked CCN between 97 and 155%) and have tested the CTO-375 for isolating mixtures of CNTs, C60s and soot in soil and sediment matrices. We have also developed a method to solvent extract native spiked CNTs from CTO-375 treated soil and sediments with recovery rates of 66-87% and 75-95% for individual solvents and 121±15% when multiple solvents were used successively. Finally, we have also tested diverse identification/characterization methods to differentiate between the CCN types found in the extracts. Most of them are not selective enough to identify different CCN types in our batch extracts, but it is likely that after fractionation the characterization/identification of cleaner and more concentrated CCN subfractions will be easier. Our next targets are: a) to evaluate size exclusion chromatography (SEC) to separate and fractionate the extracted material; b) to couple and test the whole system together; c) to test the methodology on real samples.

**TUPC3-2**

Test the resistance of fullerences to chemothermal oxidation used to isolate soot from environmental samples

*IXX* Forschungsanstalt, T. Bucheli

Forschungsanstalt Agroscope Reckenholz-Tänikon ART, ZURICH, Switzerland

Due to potential breakthroughs in a broad range of applications for manufactured carbonaceous nanoparticles (MCPNs) over the past two decades, the use and mass production of materials such as carbon nanotubes (CNTs) and fullerences is on the rise. However, research regarding the fate and transport of these materials in the environment has been limited due to the lack of a method to quantify MCPNs in complex environmental matrices. Here we tested the resistance of five different MCPNs (C60, C60s, and C60/C70/C76/C78/C84) to chemothermal oxidation at 375 °C and tested for isolated carbon black (BC) in soils and sediments, and was recently tested for isolating CNTs in spiked soils and sediments that contained naturally occurring BC. Of the fullerenes, C60 was the one that survived CTO-375 the most (50%) while C70 was the one with the lowest recovery rate (<1%). Standard additions of C60 to soil and sediment yielded recoveries between 18 and 45%. Although lower than some of the recoveries that have been observed for soot and CNTs, these results demonstrate the capability of CTO-375 to isolate C60s from soil and sediments, provided the extract is not contaminated with other nanomaterials.

**TUPC3-3**

Occurrence of fullerences in aerosols from the Mediterranean Sea atmosphere

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IDAEA-CSIC, BARCELONA, Spain

Carbon-based nanomaterials (nano-CMs) are widespread in the environment due to different causes including natural events, incidental soots, and industrial and combustion processes, and during the recent years due to the use and production of carbon-based nanomaterials for nanotechnology applications. The occurrence of carbon-based nanoparticles is of concern for environmental cycling and impacts. This work describes the development, optimization and validation of a liquid chromatography coupled to mass spectrometry (LC-MS) method for the determination of a selection of fullerences in environmental samples. The presented method allows, for the first time, the determination of natural and synthetic fullerences (C60, C70, N-methylfulleropyrrolidone, C60 pyrrolidine-tris-ethyl-ester, [6,6]-Phenyl-C61 butyric acid beryl ester and [6,6]-Thienc-C61 butyric acid methyl ester) in airborne samples from the Mediterranean Sea. This new method reached sensitivities of pg/g or pg/mL levels for absorbabilities between 50-85% and 11-32%, respectively. While the presence of fullerences in wastewater [1] and its occurrence in the atmospheric particulate (mainly associated with coal combustion processes [2] and domestic kitchen stoves burning natural gas/air and propane gas/air mixtures [3]) have already been reported, to our knowledge, this work is the first attempt to study the occurrence and quantitation of fullerences in marine air. The results can be reasonably related to incidental emission and posterior atmospheric transport and deposition, underpinning the need for studying the possible risks associated to the presence of carbon nanotubes in the environment and the possibility to quantify MCNPs in complex environmental matrices. The presented method showed a reasonable recovery of spiked C60s and C84s, but C60/C70/C76/C78, and C84 yielded higher survival rates when added to soil and sediment samples than in their pure form. These results indicate that the matrix effects from the soil and sediment may have a catalytic effect towards C60s and a protective effect towards C70, C76/78, and C84.

**TUPC3-4**

Characterization and toxicity tests of multiwalled carbon nanotubes and cyclodextrin polymers on selected test organisms

*W. Reinheimer, D. Fischer, N. Meuse*

University of Johannesburg, JOHANNESBURG, South Africa

The escalating use of engineered nanomaterials has since led to the need to study their possible adverse impacts to living organisms. This can be mainly explained by some limitations of the current methodologies to isolate and fractionate the extracted material, to couple and test the whole system together; c) to test the methodology on real samples.

**TUPC3-5**

Characterization and toxicity tests of multiwalled carbon nanotubes and cyclodextrin polymers on selected test organisms

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**TUPC3-6**

Sorption of hydrophobic and very hydrophobic PAHs onto carbon nanotubes in the low concentration range

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University of Vienna, VIENNA, Austria

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**TUPC4**

Hazard assessment for the marine environment and regulation

**TUPC4-1**

Marine ecotoxicology testing: towards a standardised suite of chronic methodologies for chemical risk assessment

*C. Simpson, D.H. Leverett*

WCA environment, FARINGDON, United Kingdom

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**TUPC4-2**

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The derivation of a marine predicted no-effect concentration for bisphenol A: the case for a species sensitivity distribution approach under REACH

M McBride 1, CA Staples 1, LS Ortega 1, GM Klicka 2, N Capron 3, SS Dimond 2, SG Hentges 3
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3American Chemistry Council, WASHINGTON, DC, United States of America

Background and objective: REACH guidance allows for the derivation of predicted no-effect concentrations (PNEC) based on (1) the traditional “assessment factor” approach that divides no observed effect concentrations (NOEC) of sensitive key species by a factor of typically 10 to 1000 and (2) species sensitivity distribution (SSD) approaches when data exists for at least 8 taxonomic groups. Statistically based approaches, such as SSD, make use of the full distribution of available no-effect values, taking into account the variability that might be observed between taxonomic groups. Current European parameters for SSD were developed for freshwater systems and are not so for marine water. Marine environments are considered to be more diverse and thus greater uncertainty may exist in the extrapolation between species responses. Therefore, within the guidance, calculations of PNEC for the marine environment can be derived using assessment factors of 10 to 1000, depending on the number of acceptable toxicity test available. Since freshwater and marine data can be combined in the assessment factor approach to derive a PNEC for marine water, this same practice should be appropriate for developing a marine PNEC using the SSD approach. This is especially true when high-quality and high throughput toxicity tests are available. This study aims to study the effect of bisphenol A on marine organisms from diverse taxonomic groups. Freshwater and marine PNEC for BPA were derived using both the traditional assessment factor approach and an SSD based approach. PNEC derived using assessment factor and SSD-based approaches are compared and will be used to review the risk characterization for BPA in freshwater and marine environments for submission of the technical dossier under the REACH regulation.

TUPC-4-5 Deriving a safe level for copper in the marine environment
KW Long 1, KM Delbeke 2, EM Foekema 3, P van Sprang 4
1UBA Federal Environment Agency, DESSAU, Germany
2ARCHE Consulting, GENT, Belgium
3Federal Environment Agency (UBA), DESSAU-ROSSLAU, Germany
4Dow Chemical Corporation, MIDLAND, MI, United States of America

The last five years have seen significant developments in the approaches used to derive safe levels for copper. The Equilibrium Partitioning Model has been developed for REACH provides specific procedures on the use of the SSD approach for the assessment of freshwater, although not so for marine water. Marine organisms are considered to be more diverse and thus greater uncertainty may exist in the extrapolation between species responses. Therefore, within the guidance, calculations of PNEC of the marine environment can be derived using assessment factors of 10 to 1000, depending on the number of acceptable toxicity tests available. Since freshwater and marine data can be combined in the assessment factor approach to derive a PNEC for marine water, this same practice should be appropriate for developing a marine PNEC using the SSD approach. This is especially true when high-quality and high throughput toxicity tests are available. This study aims to study the effect of bisphenol A on marine organisms from diverse taxonomic groups. Freshwater and marine PNEC for BPA were derived using both the traditional assessment factor approach and an SSD based approach. PNEC derived using assessment factor and SSD-based approaches are compared and will be used to review the risk characterization for BPA in freshwater and marine environments for submission of the technical dossier under the REACH regulation.
results with data gained in the larval Emergence Test with the same species published recently indicating that the test performed with dry manure contained as a solvent. All concentrations are given as nominal values in mg a.i./kg dung dry weight (DW). As an example the results obtained in the Adult Reproduction Test performed with Ivermectin in parallel in the laboratories of ECT GmbH and the University of Montpellier, are as follows: Despite the fact that different concentrations were used in the two tests, the resulting EC50 values were almost the same: 0.29 (0.21 - 0.40) and 0.32 (0.24 - 0.43) a.i./kg dung dry weight (DW).

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1Harlan Laboratories Ltd., ITINGEN, Switzerland
4Centre for Agri and Forage Research, WAGENINGEN, The Netherlands
2Department of Biology, Biotechnical Faculty, University of Ljubljana, LJUBLJANA, Slovenia
5Huntingdon Life Sciences, HUNTINGDON, United Kingdom
6Harlan Laboratories Ltd, ITINGEN, Switzerland
7ECT Oekotoxikologie GmbH, FLOERSHEIM, Germany
8Harlan Laboratories Ltd, ITINGEN, Switzerland
9Veterinary Faculty, University of Ljubljana, LJUBLJANA, Slovenia
10Harlan Laboratories Ltd., ITINGEN, Switzerland
11Technical University Berlin, BERLIN, Germany
12University of Veterinary Medicine, University of Ljubljana, LJUBLJANA, Slovenia
13Unilever, University of Ljubljana, LJUBLJANA, Slovenia
142Department of Biology, Biotechnical Faculty, University of Ljubljana, LJUBLJANA, Slovenia
15Monensin and lasalocid on heavy metal accumulation in woodlice
Z.Székely, K.A. Hreunjek, P. Pálinka
Technical University of Budapest, HUNGARY

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The use of plant protection products is a common practice in modern agriculture and forestry. Nevertheless, these products are of concern for the environment because, even when they are applied correctly, the possible exposure of aquatic macrophytes and invertebrates may occur. In some cases, these effects may be of considerable magnitude. The use of emerging substances of concern (PhACs) may further add to the complexity of environmental risk assessment in aquatic systems.

In this study, a microcosm experiment was conducted characterized by naturally established macrophyte-zooplankton assemblages, which were subjected to environmental conditions (Cu and Zn) and pesticide exposure (dimethoate, λ-cyhalothrin, metamitron) simulating those occurring in a small pond ecosystem. The study was carried out with the purpose of investigating the effects of copper and lamprothrix on metabolism, growth and reproduction of Ceratophyllum demersum and their resulting effects on the chlorophyll content.

A single species test with the filamentous green algae Oedogonium sp. for higher tier risk assessment

A single species test with the filamentous green algae Oedogonium sp. for higher tier risk assessment

The data of this study clearly revealed that PhACs can be accumulated by the submerged plant Ceratophyllum demersum, having also an effect on the total chlorophyll content and chlorophyll b content.

The impact of the herbicide Indaziflam in macrophyte-dominated microcosms including macrophytes and bioassays

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Impact of the herbicide Indaziflam in macrophyte-dominated microcosms including macrophytes and bioassays

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in the controls including sediment and lacking macrophytes being rapid as well. This implies an important influence of sediment and a minor additional influence of macrophytes for these heavy metals. For strongly absorbing contaminants macrophytes and sediment both act as an important sink. Macrophytes have an enormous influence on pH values and diurnal pH fluctuations. Different growth forms seem to act differently in this respect. As a consequence submerged, floating and emergent plants show different effects on contaminants which are subject to hydrolysis, like dimethoate. Initial results show that aquatic macrophytes also change their chemical environment by producing DOC. As absorbing contaminants also bind to DOC, DOC thus acts as a center for these compounds. Because part of the DOC fractions can be highly mobile, the interaction between DOC and aquatic organic contaminants can result in potentially high concentrations in surface water. Further research is needed on the role of DOC in the absorption and dissipation of contaminants.

**WEPC3 - Tropical ecotoxicology**

**WEPC3-1**
Assessment of physico-chemical and ecotoxicological characteristics of Limeira stream, the Paraíba Valley, São Paulo - Brazil

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The Paraíba Valley is located in southeastern Brazil, an important center of economic and industrial development of Brazil and need special attention in relation to water resources. The Limeira stream, a tributary of the left bank of the river Paraíba do Sul, in this basin there is a medical and abstreachs industries, eucalyptus plantations and pasture areas. To evaluate water quality in this environment were analyzed physico-chemical and ecotoxicological properties of the stream between September 2007 and July 2008. The limnological parameters analyzed in water were: turbidity, conductivity, DO, pH, COD, BOD, nitrate, nitrite, total phosphorus, total dissolved solids, total suspended solids, metal, and algal biomass. The acute and chronic toxicity were evaluated using the clodaceans Daphnia similis and Ceriodaphnia reticulata, the algea Pseudokirchnerelliabs caput药材, the indexes of Aquatic Life Protection and Trophic State were applied. Cluster analysis (CA) and Principal Component Analysis (PCA) were applied for the information obtained in this experiment. The results show that seasonality influenced the dynamics of the environment and the analyzed variables, particularly in rainy periods. The increasing of particulate mate-

**WEPC3-2**
Methodologies for aquatic model ecosystem studies in tropical climate zones: lessons learned from Thailand and way forward

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Little research has been carried out into the environmental fate and side effects of pesticides in the tropical freshwaters. In addition, those studies conducted in tropical regions have focused almost exclusively on one species laboratory tests. Hence, fate and effects of pesticides on higher-tier levels have barely been studied under tropical conditions. To address this lack of knowledge, four different aquatic model ecosystem tests using two different kinds of organisms were conducted in Thailand evaluating the insecticide chlorpyrifos, the herbicide linuron and the fungicide carbendazim. Results of these experiments and comparisons of recorded fate and effects C. sinensis, Lepomis macrochirus, and the aquatic invertebrates will be presented and discussed as well as indications for i) possible improvements; ii) important aspects that should be considered when performing model ecosystem experiments in the tropics; and iii) future research.

**WEPC3-3**
The herbicide Atrazine impairs biotransformation, inhibits antioxidant defenses and increases DNA damage on a Neotropical fish species

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Atrazine, an herbicide widely used throughout the world, is considered a potential contaminant to the aquatic environments. The presence of atrazine in water has been detected above the limits determined by the official guidelines in many countries; even so, the effects of this herbicide on aquatic environments have not yet received much attention. NSO-PAH often show high toxic potential. In this investigation, eight coals of varying origin, coal rank and chemical properties were used in biosassays to study the toxicity and in particular biobioavailability of coal-bound PAC. Apart from polycyclic aromatic hydrocarbons (PAH) heterocyclic aromatic compounds (NSO-PAC) which have not yet received much attention have been taken into account. NSO-PAC often show high toxicity. Future studies will be needed to further clarify the toxicity of PAC in ecosystems.
Determinant of pollutants fate, bioavailability and toxicity Despite of this fact, some methodologies soil in soil toxicity tests. From our earlier studies, it is apparent that organic carbon is not only degradation and extractability into three extraction solutions and the respective formation of soil and pesticide system and thus special consideration is required when interpreting data from laboratory based fate studies for purpose of prediction or the pesticide fate of pesticides in environmental media.

WEPC4-5  
Sorption-desorption behaviour of 14C-isoprotron and 14C-acetoxin in soil. Y.Arendrée1, ND Jahnowska2, JH Holman2, S Katsoulis3, P Mattingly4, I Hovorkova1, KS Semple2, JH Hofman1  
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2Lancaster university, The Lancaster Environment Centre, LANCASTER, United Kingdom  
3Cyprus University of Technology, LIMASSOL, Cyprus  
42Agrotroph Institute, ICG IV, Forschungszentrum Jülich, JÜLICH, Germany  
5Temple University, PHILADELPHIA, United States of America  
Sorption-desorption isotherms were useful for the investigation of the fate and behaviour of pesticides in the soil. Isoproturon, a widely used herbicide, and acetoxin, a novel fungicide were investigated in this study in two organically managed soils. A standard batch equilibrium method was employed followed by serial desorption method. A linear partition isotherm model for acetoxin in soil and sorption isotherm model were used for the data interpretation together with a simple desorption-release model. Pesticide polarity and soil organic carbon were shown to be the major factors determining pesticide’s partitioning within the soils. Effects like sorption and desorption isotherm nonlinearity were shown to be more pronounced in the case of acetoxin; this was attributed to interactions of the pesticide with the soil. Observed hysteretic phenomena were attributed to specific interactions (H-bonding) among the pesticides and the soil. Acetoxin sorption desorption data derived from this study are unique and offer an approximation of the fate and behaviour of acetoxin in agricultural soils previously published data were mainly gained through estimating the fate of the compound over short time periods. The results demonstrate the importance of using sorption-desorption isotherm data for the case of acetoxin, for the first time, in this study sorption-desorption profile of this pesticide in agricultural soils were reported.

WEPC4-6  
Long-term persistence of various 14C-labelled pesticides in soils N. Jahnowska  
Linden, S Köppchen, B Thiele, D Hofmann, W Mielketal, T Pütz, P Busnel  
Forschungszentrum Julich GmbH, JÜLICH, Germany  
The environmental fate of the ring 14C-labelled herbicides methabenzthiazuron (MBT), ethidimuron (ETD), and the fungicide azoxystrobin (AN) in soils was evaluated after long-term aging in four sterile artificial and four non-sterile natural soils. A standard batch equilibrium method and for the 68 ± 8 % and 51 ± 5 % during the second and third period respectively. The percent-
Five of the historic-use OCPs and seven CUPs were frequently detected. These include α- and γ-HCH, HCB, α-endosulfan, and DDT for OCPs. Of the α- and γ-HCH, HCB, α-endosulfan, and DDT for OCPs, α-endosulfan and γ-HCH reported the higher concentration of the OCPs. T rifluralin, diazinon, chlorpyriphos methyl, chlortal-dimethil and pendimethalin for CUPs. Of the OCPs, THPC1-4 were previously published. Anaysis of the CRM resulted in concentrations that were 11 to 86% of the certified concentrations. The Chinese CRM is composed of coal fly ash collected from a coal-fired boiler and was released in 1995. The certified values for five PAHs include phenanthrene, anthracene, fluoranthene, pyrene, and benzo[a]pyrene and reference values for benzo[k]fluoralene, chrysene, triphenylene, benzo[b]fluoralene, benzo[k]fluoralene, benzo[a]pyrene, and benzo[g,h,i]perylene were previously published. Analysis of the CRM resulted in concentrations that were 11 to 86% lower than the certified values and 25 to 78% lower for the reference values. This difference should be explained by the particularly strong adsorption of PAHs to fly ash surfaces and the use of a different extraction solvent. The total concentrations for 17 parent, 12 methyl- and 22 HMW PAHs were 28, 10, and 3.1 µg/g, respectively.

THPC1-5
Indication of regional sources affecting polycyclic aromatic hydrocarbon levels in Antarctic snow
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2Acrotec Engineering GmbH, HAMBURG, Germany
3University of Osnabreck, OSNABRUECK, Germany
Antarctica is an almost unpolluted continent, but anthropogenic pollution by sulfur, heavy metals and POPs is present. In this study, persistent organic pollutants (POPs) (UNEP, 2002) has been verified. The main anthropogenic sources of sulfur in the region are suspected to be sulfur and research stations (Graph et al., 2010). Intercontinental atmospheric transport to Antarctica has been proposed as a source of various POPs and polycyclic aromatic hydrocarbons (PAHs) (Graf et al., 2008). PAHs were previously published. Anaysis of the CRM resulted in concentrations that were 11 to 86% lower than the certified values and 25 to 78% lower for the reference values. This difference should not be discarded. On the contrary, in the southest station (Rio Gallegos) a non direct relationship between biomarkers and POPs concentrations was observed. In conclusion, the results suggest that the studied biomarkers would be useful tool in the assessment of atmospheric pollution associated with POPs occurrence. Considering the wide range of temperature variation among sampling stations, future studies on the analysis of pine needle lipid classes, and temporal monitoring of POPs and biomarkers will be carried out.

THPC1-6
Persistent organic pollutant micrometeorological air-surface exchange flux measurement
J Niesert1, JA Perlinger2
1Norwegian Institute for Water Research, OSLO, Norway
2Michigan Technological University, HOUGHTON, United States of America
Reference materials are homogenous mixtures of an environmental matrix used to evaluate analytical methods for selected compounds. The purpose of this work was to 1) prepare and characterize an in-house Beijing particulate matter (PM) reference material (RM), and 2) apply newly-developed analytical methods for several classes of polycyclic aromatic hydrocarbons (PAHs) to that material.

THPC1-7
Characterization of Chinese coal fly ash and Beijing particulate matter for parent, methyl-, nitro-, oxy-, halogenated-, and high molecular weight polycyclic aromatic hydrocarbons
JE Schrlau, Y Jia, N Jatsyopiyt, L Gonzales, SM Simonich
Oregon State University, CORVALLIS, United States of America
Reference materials are homogenous mixtures of an environmental matrix used to evaluate analytical methods for selected compounds. The purpose of this work was to 1) prepare and characterize an in-house Beijing particulate matter (PM) reference material (RM), and 2) apply newly-developed analytical methods for several classes of polycyclic aromatic hydrocarbons (PAHs) to that material.

THPC2-1
Micrometeorological analysis of persistent organic pollutants (POPs) from a Mediterranean forest ecosystem
JE Schrlau, Y Jia, N Jatsiyopiyt, L Gonzales, SM Simonich
Oregon State University, CORVALLIS, United States of America
Reference materials are homogenous mixtures of an environmental matrix used to evaluate analytical methods for selected compounds. The purpose of this work was to 1) prepare and characterize an in-house Beijing particulate matter (PM) reference material (RM), and 2) apply newly-developed analytical methods for several classes of polycyclic aromatic hydrocarbons (PAHs) to that material.
Advanced treatment. ET02C-6
Advanced wastewater treatment. HM02B-2
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