

# EuNetAir Newsletter

COST Action TD1105 Iss. 2/June 2013

## Editorial

Dear Reader,

this is the second issue of the Newsletter of COST Action TD1105 EuNetAir. The Newsletter is a tool to inform about news in the field of New Sensing Technologies for Air-Pollution Control and Environmental Sustainability and to disseminate briefly latest results, especially with respect to commercialization.

The focus in this issue is on field monitoring of the Air Quality. In several brief news from Working Groups and Special Interest Groups remarkable results are reported.

Furthermore, scientists report on achievements and experiences obtained from so-called Short Term Scientific Missions (STSM). I see STSMs as a good tool to foster interactions between scientists in Europe and between industry and academia.

I have to express my sincere thanks to Daniela Schönauer-Kamin who collected and managed all the contributions – in addition to finalizing her doctoral thesis. I sincerely hope that you find this issue of the Newsletter interesting.

Prof. Dr.-Ing. Ralf Moos  
Editor-in-chief

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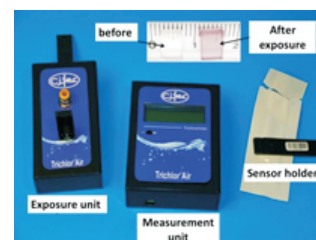
## Focus On

### TRICHLOR'AIR to detect $\text{NCl}_3$ in indoor swimming pools

Thu-Hoa Tran-Thi

An innovative chemical and colorimetric sensor for the detection of nitrogen trichloride,  $\text{NCl}_3$ , a harmful pollutant present in indoor swimming pools, has been developed in the Francis Perrin Laboratory ([www-lfp.cea.fr](http://www-lfp.cea.fr)), a CEA-CNRS research unit. This sensor is based on a nanoporous matrix doped with specific probe-molecules. The porous matrix acts as a sponge to both trap and concentrate the targeted pollutant. The probe-molecules then react efficiently with  $\text{NCl}_3$  to produce a detectable pink-violet product. These sensors can detect  $\text{NCl}_3$  at the ppb level (5-250 ppb) within 25 minutes in the humid atmosphere and ambient temperature of indoor swimming pools. The

technology has been transferred to ETHERA ([www.etheralabs.com](http://www.etheralabs.com)), a CEA-CNRS spin-off, and has been commercialized by CIFEC ([www.cifec.fr](http://www.cifec.fr)) since December 2012.



## Brief news from the vice-chair

A. Lloyd-Spetz

The new improved layout of the SiC-FET gas sensor devices was presented in an invited talk at the SPIE conference in Baltimore, April 29th - May 3rd, together with the latest results from the development of a portable particle detector. The presentation was also recognized in the SPIE News

<http://spie.org/x93728.xml>

At University of Oulu, a new particle generator is almost running. It is a particle disperser, PALAS, RGB 1000. Furthermore, the collaboration on the cell clinic with Maryland University has continued. The PhD student Niina Halonen is right now visiting Maryland University

to assemble and test CMOS based cell clinics intended for electrical measurements of cells during exposure to nanoparticles.

From Linköping University, the Post Docs Jens Eriksson and Donatella Puglisi will visit Saarland University in Saarbrücken starting from May 20th. These are two STSM activities approved by the EuNetAir. The facility at Saarland University for detection of ultra-low concentrations of VOCs will be tested for graphene/SiC based sensors by Jens and SiC-FET sensors by Donatella.

Focus On

## Using Amperometric Electrochemical Gas Sensors to Reliably Measure ppb Gas Concentrations

J. Saffell, R. Jones

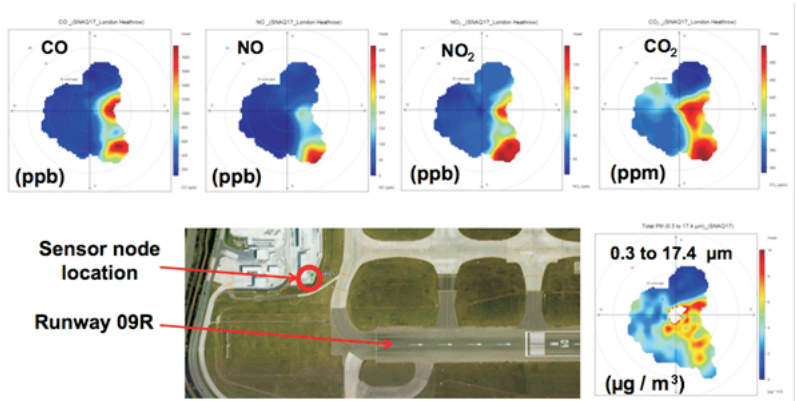


The figure shows one of the sensor nodes deployed at Heathrow Airport as part of the ongoing UK Natural Environment Research Council (NERC) Sensor Networks for Air Quality at Heathrow Airport (SNAQ-Heathrow) project. Each sensor node measures every 10 seconds the concentrations of CO, NO, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, CO<sub>2</sub>, VOCs, particulate matter and key meteorological variables: T, RH, wind speed and wind direction.

This project, which involves deploying around 50 of these sensor nodes is

led by the University of Cambridge and involves a consortium of UK universities (Imperial College, Hertfordshire, Manchester), CERC and NPL, with assistance from Alphasense, Heathrow Airport Ltd and British Airways.

The bivariate polar plots display CO, NO, NO<sub>2</sub> (all as ppb), CO<sub>2</sub> (as ppm) and integrated aerosol mass (as g/m<sup>3</sup>) – these were recorded at the N/E node at the west end of the southern Heathrow runway. This typical data shows clear evidence of aircraft emissions signatures.



## Air Pollution and Climate Change: two sides of the same coin

C. Borrego

There is increasing recognition that the problems of air pollution and climate change need to be treated together. Air pollution regulations are an important component of strategies to protect human health and ecosystems. However, some air pollution emission controls, such as sulfur reductions, have adverse effects on climate



change mitigation efforts. Equally, measures to mitigate climate change can have adverse effects on air quality. Therefore, simultaneous solutions that offer net benefits for both air quality and climate taking into account the possible trade-offs between human health, food and water security and ecosystems would be advantageous. A sound scientific foundation is an integral part of developing such solutions. Over the last 15 years, efforts have been made to quantify the air pollution “co-benefits” of various climate policies. In the last 5 years, an increasing body of scientific evidence has demonstrated that air pollution and their mitigation strategies can have significant effects, both positive and negative, on medium-term climate change at the local, regional and global scales. Increasing evidence also shows that global warming aggravates existing air pollution problems, but most climate change mitigation efforts could have significant co-benefits for air pollution reduction, a “win-win” opportunity. These findings have led both the climate change and air pollution science and policy communities to pay more attention to one another.

## News from Working Groups

### Working Group 1 - J. Lappalainen Sensor Materials and Nanotechnology: Recent trends and hot topics in sensor materials research

Despite of quite extensive research already carried out in the discipline, implementation, combining, and integration of the conventional sensor materials, such as various metal oxides and carbon based nanomaterials, in forms of different nanostructures including thin films, nanoparticles, nanowires, nanotubes, nanoneedles, and nanoporous structures still offers a huge potential to be exploited in gas sensor applications. This also includes entirely new perspectives among the more conventional approaches. Realization of metal oxide ( $MO_x$ ) sensor materials in nanostructured forms and utilization of the subsequent increase of specific surface area lead to possible changes in detection mechanisms. In

addition to that, the usage of CNMAT - Carbon Nano Materials - and their functionalization, i.e. CNT and graphene, in combination of metal and  $MO_x$  nanoparticles, and their integration, for example on transistor structures, further increases sensitivity and selectivity of the sensor devices. In larger picture, use of heterostructures and mixed phase materials as sensing elements in gas sensors including heterostructures of semiconductors and polymers in Schottky junctions, and mixed phase  $MO_x$  structures creating p-n-junctions deserves more detailed attention due to very promising results obtained recently. Application of biomaterials, enzymes, and antibodies, e.g. in combination with other afore-mentioned materials enables even more complex smart sensor systems.

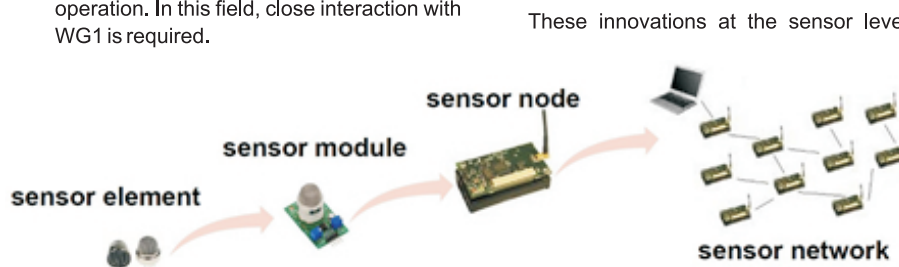
### Working Group 2 - A. Schütze Sensors, Devices and Systems for AQC

The discussion in WG2 at the Rome meeting highlighted the fact that very different applications are addressed from immission monitoring (outdoor and indoor air quality) to emission monitoring and control. Thus, novel sensor systems can provide the basis for information of citizens (outdoor monitoring), improved health and reduced energy consumption (controlled ventilation based on indoor air quality), identification of sources in emission monitoring and minimization of emissions based on closed loop control in various fields (industrial, home, transportation). To cover this wide range, the sensor systems need to be improved across the whole technological range:

- Micro-transducers for integration of various nanomaterials allowing application specific adaptation, low cost and low power operation. In this field, close interaction with WG1 is required.

principles of temperature cycling and impedance spectroscopy, new methods have to be studied, i.e. optical excitation, pulsed polarization, mass and dissipation in QCM etc. This approach has to be supported by modelling of the interaction between sensing layer and gas as well as dust and aerosols.

- Additional considerable improvements of the performance are expected for example with selective filters integrated in sensors or sensor modules for improved selectivity and stability or by making use of the dosimeter approach, i.e. integrating sensors.
- In addition to gas detection, identification and quantification, nanoparticle detection for dust and aerosols is of extreme importance and no low cost sensor systems are available today. These should not only allow sum quantifications, i.e. total mass per volume, but also characterization, i.e. size and type of particles as well as contamination with adsorbed compounds such as PACs.



- Dynamic operation of sensors to obtain more information from a single sensor for higher selectivity and stability as well as possible self-monitoring. Besides the (at least for  $MO_x$  sensors) well-known

These innovations at the sensor level have to be integrated in intelligent sensor modules with high priority for  $NO_x$ , ozone,  $NH_3$ ,  $H_2S$ ,  $SO_2$  and VOC (both total as well as specific) by combining electronics with sensor elements in intelligent sensor nodes and (heterogeneous) networks with energy efficient communication. Data pre-processing in the individual node and processing in the distributed network by parallel and distributed computing will allow addressing the application goals outlined above.

## News from Working Groups

### Working Group 3

## Environmental Measurements and Air-Pollution Modeling: Recent trends and hot topics in sensor materials research

The focus of WG3 is on the following points:

#### Environmental measurements should be defined:

- Various portable sensor-systems will be explored as personal sensors and wearable sensors in the life of every day (e.g., bikes, pedestrians, cars, smart cities, etc.)
- Sensors for air quality monitoring at outdoor applications
- Sensors for air quality monitoring at indoor

applications (green buildings, low CO<sub>2</sub> emissions, offices, air-ventilation systems, HVAC devices, open spaces, indoor energy efficiency, etc.)

- Wireless sensors and wireless sensor networks

#### Air-quality modelling should be defined:

- Air-pollution dispersion modelling at local, urban, regional and global range
- Chemical weather forecasting (gases, vapours and particulate matter)

### Working Group 4

## Protocols and Standardisation Methods

During Rome meeting the following main pollutants for Air Quality monitoring have been defined:

- Odorants: H<sub>2</sub>S and organic thiols (mercaptans)
- PM, Particulate Matter: PM10, PM2.5, ultrafine PM and BC

- VOC, Indoor air: CH<sub>2</sub>O methanal (formaldehyde) and C<sub>6</sub>H<sub>6</sub> benzene
- Inorganic gases:
  - NO<sub>2</sub> nitrogen dioxide & O<sub>3</sub> trioxygen (ozone), analysed simultaneously
  - CO<sub>2</sub> carbon dioxide (ventilation indicator and greenhouse gas)

## News from Special Interest Groups

### Special Interest Group 1

## Networks of spin-offs

The priorities of SIG1 are defined and updated during Rome meeting:

- Contribute to the state-of-the-art report focusing on actual technology needs, future perspectives (new customer market) integration possibilities, standards, protocols and guidelines for future agenda
- Mapping similar or complementary

industrial organizations

- Define and propose new cooperative instruments for EU spin-offs and innovative SMEs (screening of available EU instruments and evaluate their effectiveness, etc.)
- Support to define Action position papers in the knowledge transfer in air quality control (AQC) issues for future research and innovation agenda

### Special Interest Group 2

## Smart Sensors for Urban Air Monitoring in Cities

SIG2 is concerned with the following topics:

- Discussion of 'smart': Self-monitoring - e.g. fault detection; Clever design/manufacturing - e.g. self-calibrating; Smart use of 'stupid' (not educated) sensors
- Sensor Systems: sensors, analysis, correction, archiving, data mining, mapping, interpretation, dissemination

- Deliver answers to: General public (low pollution routes/traffic flow); Legislature/compliance; Health impacts community
- Other issues: Transferring A/Q knowledge from one environment to another; Use of modelling; Philosophy of testing models; Combining model/sensor network outputs; Applicability; Highly cross-disciplinary

## News from Special Interest Groups

### Special Interest Group 3 - E. Llobet

## Guidelines for Best Coupling Air Pollutants and Transducer

During the Meeting in Rome SIG3 partners presented their activities and set the priorities within this interest group. Partner activities range from the synthesis and functionalization of materials such as metal oxides, molecular organic semiconductors or carbon nanomaterials (including graphene and carbon nanotubes) to the development of devices employing a wide spectrum of transducing principles (e.g. resistive / conductometric, impedimetric, potentiometric or resonant mass-sensitive) implemented in rigid or flexible substrates. With the aforementioned technologies, different sensors and dosimeters for the indoor/ outdoor monitoring of air pollutants (sulphur compounds, nitrogen oxides, VOCs, ozone, ammonia and carbon monoxide) are being developed.

The joint activities of SIG3 are oriented towards three priorities as follows:

- To identify which are the physical parameters being affected by the interaction between the gas sensitive material and air pollutants in view of implementing a rationale design of the transducer
- To determine in which cases continuous or exposure/recovery measurements are more advantageous
- To establish some guidelines for achieving an optimal coupling between the target air pollutants and the transducers employed

### Special Interest Group 4

## Expert Comments for the Revision of the Air Quality Directive

The updated priorities of SIG4 are summarised as:

- Review of AQD implementation problems and proposals how these could be targeted by application of sensors

- Recommendations on:
  - New metrics
  - Data quality requirements

- Use for model improvements

- Specific research needed

- Guidelines on data quality requirements for sensors to be used in relation to AQD (e. g. support indicative screening or complementary modelling).

## News from Ad-Hoc Groups

## Short Term Scientific Missions (STSMs)

J. Theunis

A Call for Short Term Scientific Missions was launched on November 2012 to give opportunity to young researchers, PhD-students and graduated early-scientists to apply for scientific missions in host laboratories of Action partners in MoU-signed COST. Until now, 11 STSMs have already been approved. 10 of them were granted to Early Stage Researchers. Five STSMs deal with applied air quality monitoring and modelling; four deal with the development of novel sensors for gas detection; one deals with odour monitoring and one with the use of biological organisms as sensors.

### Titles of coming STSMs of the 1st year:

- Spatial processing of AQ monitoring data for the support of chemical weather modelling
- Environmental measurements and air-pollution modelling
- Air Quality Modelling on Particulate Matter

- Short Course "Measurements of atmospheric aerosols: Aerosol physics, sampling and measurement techniques"
- Building and calibration of high resolution carbon dioxide sensors for UAV
- Graphene sensors for environmental gas detection
- SiC-FET sensors for environmental gas detection
- Microstructured optical fibres as sensors for chemical trace detection
- Evaluation of odour impact, caused by industrial sources, through an integrated approach
- Application of lichens as ecological indicators of atmospheric nitrogen deposition

In the second year of the Action, another 15 STSMs will be funded, of which about 9 STSMs for 1 week and 6 STSMs for 1 month (or equivalently in budget for flexible period of 2 or 3 weeks).

## News from Ad-Hoc Groups

### Gender Balance

I. Steinberga

Despite this action (TD1105) is male-dominated, we can see growing interest and participation of female. During December meeting in Rome only about 20 % of speakers were female, but it should be noted that Special Interest Group 4 has the

highest percentage (about 60 %) of female speakers. During Joint Scientific meeting (COST TD1105 and AirMonTech) in Duisburg significant progress in gender balance was achieved, about 45 % of speakers were female.

## Science & Tech Talk: STSM reports

### Spatial processing of AQ monitoring data for the support of chemical weather modelling

Victor Epitropou

In the scope of the STSM visit to the Finnish Meteorological Institute, the applicability of new image reconstruction methods applied to chemical weather and pollen heatmaps was investigated. Such data is issued by several modellers and air quality studies institutions all over Europe [1], and recovering it is important in order to use it in free web-based services, in particular personalized air quality forecasting services [2].

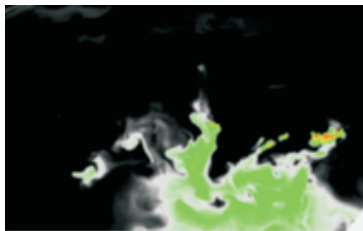
After several meetings and testing on sample data, cross-checked with model data supplied by the FMI, the theoretical soundness and practical applications of these methods were ascertained, and a publication on the result of their applications

to a large, representative dataset is due within the end of June. The proposed methods will allow reconstructing chemical weather and pollen data (a) from web-published heatmaps with greater precision (c) than it is currently possible (b) [2].

The overall experience and feedback received by the STSM was very positive and I expect that it will contribute to my research.

[1] Karatzas K., Kukkonen J., Bassoukos A., Epitropou V. and Balk T. (2011), A European Chemical Weather forecasting Portal, 31st ITM - NATO/SPS International Technical Meeting on Air Pollution Modelling and its Application, Torino, 28 Sept. 2010.

[2] Epitropou V., Karatzas K., Kukkonen J. and Vira J. (2012), Evaluation of the accuracy of an inverse image-based reconstruction method for chemical weather data, International Journal of Artificial Intelligence, Vol. 9/S12, pp. 152-171.



Visualization of original, unaltered model data from SILAM (courtesy of FMI).



Data recoverable after web publishing process.



Data recoverable after enhancement with proposed algorithm..

### Application of lichens as ecological indicators of atmospheric nitrogen deposition and organic pollutants

Simona Catino

**Smart is good... and green is better! Small, smart and... green!**

The first STSM was carried out by Simona Catino (Lenviro Ltd, Italy) and supervised by Professor Cristina Máguas at the SIIAF - Stable Isotopes and Instrumental Analysis Facility, Centre for Environmental Biology, University of Lisbon (Lisbon, Portugal).

Lichens are symbiotic associations of a fungus and a photosynthetic partner (algae or cyanobacteria). Lacking roots, they depend on the atmosphere for their nutrition, assimilating all the elements present in the air. Therefore, elemental levels in lichens often reflect air composition, making them effective biomonitors of atmospheric quality.

Among the other, lichens are used as bioindicators of different forms of reactive nitrogen (N).

The STSM aimed at 1) establishing the origin of N through the isotope signature of N compounds in lichens and in passive samplers (ALPHA); 2) investigating how ergosterol (the principal component of fungal plasma membranes) level changes in relation to the different ammonia concentrations.

To that, a transplant experiment was carried out collecting lichens of the pollution-sensitive genus *Usnea* from an uncontaminated site and putting them in a site with high N availability (cow barn) and a site with low availability of N (natural park with some human activities), together with 10 and 15 ALPHA devices respectively. After 15 days, both the transplants and the Alphas were recollected, transported to the lab and analysed.

Science &  
Tech Talk:  
STSM reports

## Short Course: Measurements of atmospheric aerosols: Aerosol physics, sampling and measurement techniques

Vânia Martins

I am an ESR at the Institute of Environmental Assessment and Water Research (IDAEA-CSIC) within "Human Exposure to Aerosol Contaminants in Modern Microenvironments" (HEXACOMM) project in the framework of the FP7 Marie Curie Initial Training Network (ITN). A short-term scientific mission in the framework of the COST Action TD1105 EuNetAir allowed me to participate in a training course related to WG3, with a special focus on the harmonisation of air pollution monitoring strategies across Europe. The training

course on "Measurements of atmospheric aerosols: Aerosol physics, sampling and measurement techniques" was held on 4-10 May in Hyttiälä, Finland, and it covered several aspects for atmospheric aerosol particles. This course was an excellent opportunity for me to deepen my knowledge and share experiences about atmospheric aerosol measurements, which is essential for the further development of my research as a PhD student. This training served also as a first contact with the University of Helsinki for future planned collaboration. Overall, the STSM was very successful since it provided me further knowledge and expertise.

## Building and calibration of high resolution CO<sub>2</sub> sensors for UAV

Martin Kunz

Everybody listened attentively when Henrik Rödjegård from SenseAir AB introduced a new gas sensor prototype at the Duisburg meeting in March. I made no exception, as this device promised to be exactly what I need for my PhD project: A small, lightweight sensor with high precision at ambient CO<sub>2</sub> levels. At that time, it had only been tested for ethanol and methane, but a CO<sub>2</sub> version was on the to-do list. Moreover, SenseAir was willing to host me for a short term scientific mission!

Six weeks later, I arrived in Delsbo, 300 km north of

Stockholm, kindly supported in every way by the SenseAir staff. I learned a lot about gas measurements, sensor design and production. During my four-week stay, I analysed and optimised components, built CO<sub>2</sub> sensors, and tested them. The weekends gave me time to explore Sweden's stunning nature and the romantic villages of the Dellenbygd region.

On my return to Jena, I brought not only several sensors and comprehensive know-how, but also a bunch of new ideas and many contacts that will be valuable for future cooperation. I am indebted to both SenseAir and the COST TD1105 representatives for making this felicitous stay possible.

## Environmental measurements and air-pollution modelling

Ana Sofia Godinho da Fonseca

The first purpose of my STSM visit, in the frame of the COST Action TD1105 EuNetAir, was to attend the 9th Summer School on Atmospheric Aerosol Physics, Measurement and Sampling held on 4-10 May in Hyttiälä, Finland.

The summer school was an excellent opportunity and very helpful in broadening my knowledge and gain new skills on aerosol research field, such as: (i) atmospheric aerosols measurement techniques and (ii) physical and chemical characterization of aerosols. In addition, the topic of aerosol measurements in indoor environments, with

conventional and state-of-the-art instrumentation is carried through in my PhD research and the information and insights gained in the training course will be integrated in my work.

Getting in touch with the COST Action Members as well as other PhD students researching in the same field provided new and inspiring insights in the different ways for working on the aerosol research field organised in Europe.

I would like to take this opportunity to thank COST Action TD1105 for making this fruitful STSM possible. I would also like to thank my host Prof. Dr. Kaarle Hämeri for allowing me to participate in this summer school. The actual duration of the STSM visit is 1 month and therefore, my training is going on.

## Short Course: Measurements of atmospheric aerosols

Mariola Brines Pérez

The STSM was aimed to strengthen collaboration within the Action's transnational network, to investigate technologies for environmental monitoring at two of the Action's partner institutions, CSIC and University of Helsinki. Attending the training course on "Measurements of atmospheric aerosols: Aerosol physics, sampling and measurement techniques" held on 4-10 May in

Hyttiälä, Finland has been of great profit for me. The extensive lectures on the physical, chemical, mechanical and electrical properties of aerosol measuring instruments, as well as the practical cases developed, has provided me with a deeper knowledge of the different sampling techniques. Moreover the interaction with other European scientists in the aerosol field has been very valuable both in the professional and personal ends. I am grateful to the STSM Grant for having provided me with this wonderful opportunity.

## Overview on EuNetAir Events

### Summary of the 1st scientific meeting in Rome, December 2012

Significant scientific breakthroughs from Action partnership were recorded in science and technology for air quality monitoring applications such as new sensor nanostructured materials (n-type and p-type metal oxides, carbon-nanostructures, hybrid materials, nanocomposites), gas sensors and sensor-systems, wireless sensor networks, air-quality modelling, methods and protocols for AQC sensor technologies. Results were presented during the

first Scientific Meeting of COST Action TD1105 EuNetAir in Rome (ENEA Headquarters) on 4-6 December 2012.

**This important meeting defined the priorities, R&D needs, strategies, joint-activities and roadmap for future activities in each WG and SIG as summarized above.**

An updated plan for scientific priorities of the Action TD1105 is available on Action webpages ([www.cost.eunetair.it](http://www.cost.eunetair.it), see section Organization/Documents). Here, also the general programme is available.

### SME Dinner debate at the European Parliament, 29th Jan. 2013

In the events organized by COST Office, **“How can networking in Science and Technology help SMEs meet the Innovation Union goals?”**

the Chair (Michele Penza, ENEA, Italy) of the COST Action TD1105 EuNetAir was invited to participate to this event including other SMEs representatives (John Saffell, Alphasense Ltd, UK; Radu Adrian Ionica, IPA SA - CIFATT Craiova, Romania) from COST Action TD1105 EuNetAir.

There, members of the European Parliament, experts of the EC, member states permanent representations to the EU, stakeholders in research policy, SMEs managers have been involved for discussions on the role of SMEs for science and technology

innovations. A personal opinion from Prof. Carlos Borrego, IDAD, Aveiro, Portugal, and Action PT MC Member, has been reported and can be found below.

A letter from Dr. Ángeles Rodríguez-Peña, President of the COST Committee of Senior Officials, to the meeting participants of the COST Actions in the event organized by COST and Knowledge4Innovation was reported as well.



More info:

[http://www.cost.eu/events/k4i\\_dinnerdebate](http://www.cost.eu/events/k4i_dinnerdebate)

### How to involve SMEs in the EU research programme and in COST networking

C. Borrego

COST is committed to help SMEs meet the Innovation Union goals through multi-disciplinary, bottom-up, open and inclusive networking initiatives in science and technology.

- How to promote the role that SMEs can play in Science and Technology innovations?
- How to involve SMEs from all European countries?
- Can fewer administrative constraints motivate SMEs to participate in European programmes?
- How participation of European SMEs in EU-funded research networking programmes can be enhanced?



The main research programmes that are being designed for the 2014-2020 period are much more target to the market, where innovation plays a key role in setting up the framework for the R&D strategies to be defined. The increase of Europe's competitiveness and job creation is a main goal of the EU2020 Strategy and boots the next framework programme Horizon 2020 towards SME and industry as key actors to sustainable development through the social, economic and environmental pillars.



Horizon 2020 perspectives support opportunities in all types of innovation. Innovation is at the centre of the H2020 objectives and technological, organisational and systemic innovations will be fundamental to pursued sustainability objectives. In addition, promoting the economic development is an urge aim and increasing the competitiveness of the European R&D SME is a fundamental step forward to effectively overcome this crisis while protecting our resources through eco-innovation and resource-efficiency.



## Overview on EuNetAir Events

Horizon 2020 societal challenges will put great effort in eco-innovation and this is a strong tool to effectively support sustainability. Horizon 2020 will bring together FP7 and CIP programmes in a common vision of bringing innovation to the market. The greatest challenge is engaging our universities and research institutes in developing innovations that will increase the economic, social and environmental value of our society. In addition, SME have to be prepared to bring this innovation to the market and transform it in solutions to our daily problems related to natural resources degradation and depletion.

Promoting synergies between all R&D&I financial instruments at national, regional (cohesion funds) and European level (e.g., Horizon 2020) is a vital approach to effectively create local value with European potential and this may give to SME the scaling up to engage the R&D programmes at EU level.

Horizon 2020 has set the target of minimum funding going to SME, which is a very important tool to pursue the engagement of SME in creating high value products and services to be delivered to the market.

### Highlights on how to engage SMEs in EU research programmes:

- a simplification of the application process should be pursued
- incentives to overcome the costs of application (money, man power, time) in EU research programmes
- enhancing the international collaboration of SME. SME having no or limited experience with international collaboration should be addressed by providing them with better information about benefits of participating in EU research programs and engaging them in programmes, like COST, that promote the networking at EU level
- stimulating innovation and especially eco-innovation in specific COST action initiatives
- boost eco-innovation for resource efficiency namely on water, air and soil resources within COST actions
- engage SME in eco-innovative areas like primary and secondary raw materials through launching strategic COST actions within these thematic
- setting up minimums of SME participation in COST consortia that area mainly devoted to innovation and eco-innovation aspects
- create an inter-COST programme through COST that facilitates the access to information related to EU R&D financing programmes and to SME R&D performers

## Summary of joint meeting of WG3 & WG4 inside AirMonTech

The major example of interdisciplinary networking can be found in our Action as the Joint Scientific Meeting of WG3-WG4 at Duisburg (Germany) on 4-6 March 2013. In the framework of the Joint Scientific Meeting of COST Action TD1105 inside AirMonTech FP7 project workshop - Air Pollution Monitoring Technologies for Urban Areas - a special session on "Environmental Case Studies from Mediterranean, Central and Eastern Europe", co-chaired by Dr. Hans-Guido Mucke (WHO Collaborating Centre for Air Quality Management and Air Pollution Control at Federal Environment Agency, Berlin, Germany), created some stronger links with various communities such as the environmental technologies, air-quality modelling and standardised methods. This special session hosted 12 Speakers of 10 Countries from Eastern

Europe (Poland, Latvia, Ukraine, Russia), Central Europe (Slovenia, Hungary, Bulgaria, Macedonia) and the Mediterranean Area (Italy) including Annette Borowiak (JRC-Ispra) that gave an overview of the AQUILA network on air QA/QC programmes in Europe.

A fruitful session on exchange of best practises, methods, case-studies and critical hot-spots was successful and well-attended (80+ participants).

The Joint Scientific Meeting of Action TD1105 was finalized with a cross-disciplinary joint-meeting WG3-WG4 on 6th March 2013 with at least 20 presenters from 15 COST Countries by giving specific lectures devoted to environmental measurements, air-pollution modelling, protocols and standardisation methods, including a round table on environmental research for innovation to support harmonization of measurements and environmental sustainability in Europe.

Summaries of the talks are below:

### Assessment of Air Quality in Cities of Russian Federation: Monitoring, Modelling, Health Aspects

Sergey Chicherin

Systematic observations of chemical composition of ambient air were started in the country 50 years before. Dissemination of any information on air pollution was strictly restricted to up to 1992. By 1st January 2012, regular observations are carried on in 683 fixed stations in 252 cities. Total number of pollutants under instrumental observation counts about 40 species, whereas AQ limits are established for more than 600 species. Priority pollutants are selected for each city by index CAC (Clean Air Consumption) = Total emission / AQ

Limit Value. Manual short-term samples are analysed in 150 accredited laboratories. In the year 2011, air pollution level in 119 cities (58 %) is in grades "High" or "Very High". More than 53 % of urban population lives in these cities. 27 cities (16.3 million people) are in the grade "Very High". Major pollutants in these cities are formaldehyde, BaP, PM, nitrogen dioxide, and phenol. Information on air quality is available for general public through local mass media and internet. Annual report for 2011 is prepared and published at MGO and is available in internet at

[www.voeikovmgo.ru/images/stories/publications/ejegodnik\\_zagr\\_atm\\_2011\\_color.pdf](http://www.voeikovmgo.ru/images/stories/publications/ejegodnik_zagr_atm_2011_color.pdf)

## Overview on EuNetAir Events

### Environmental Measurements at Laboratory and In-Field Air-Quality Stations in Spain

María Cruz Minguillón

The partner activities related to the COST Action are a) implementing field validation at outdoor and indoor levels, b) harmonising environmental measurements, c) training students and early stage researchers, and d) assessing on guidelines for outdoor and indoor air quality. An overview of some recent results from the research activities on NH<sub>3</sub>, NO<sub>2</sub>, particulate matter (PM), particle number (N) and black carbon (BC) concentrations is presented. Urban ammonia is shown to have road traffic, waste, and sewer system influence. The

main identified NO<sub>2</sub> source was road traffic.

Long time series of particulate matter chemical composition allows to perform source apportionment studies, such as those for the city of Barcelona or for specific environments such as schools (including indoor and outdoor). PM concentrations in schools were found in levels close to those at traffic sites. BC and N do not vary simultaneously in Spain, as opposed to other European areas, and the midday N increase may be attributed to nucleation due to photochemical activity. The advantages of real time data, as opposed to off-line data, are evidenced, and hence the necessity to develop different sensors is emphasized.

### Air Quality in Ukraine: Measurement Methods and Applied Technologies

Olena Turos

The presentation outlines key issues of the indoor and outdoor air quality assessment and related health impact studies in Ukraine. Today ambient air quality monitoring network is functioning in 53 cities and consists of 163 monitoring stations registering 31 pollutants. Air pollution monitoring is performed by the Ukrainian Hydrometeorological Agency and Sanitary and Epidemiologic Departments. Major air quality and health studies difficulties predetermined by the following current challenges are listed:

difficulties in harmonization of regulatory documentation and methodical guidelines for the ambient air pollution assessment in accordance

with EU regulations, absence of PM10 and PM2.5 monitoring, lack of qualified technical personnel, techniques for calibration and standardisation of equipment as well as its service maintenance, absence of the unified databases, lack of cooperation between agencies responsible for air pollution monitoring, no single approach to health impact and human health risk assessment.

The presentation also provides a summary of the current research priorities, ongoing activities, available facilities and major achievements of the Air Pollution and Risk Assessment Laboratory of the State Institution "O.M. Marzeiev Institute for Hygiene and Medical Ecology of the National Academy of Medical Sciences of Ukraine". Future planned activities as well as open problems of air quality and environmental health research in Ukraine is outlined.

### Using Mobile Measurements for Air Quality Mapping: Methodological Issues

Joris Van den Bossche

Mobile monitoring can range from a van, which is equipped with expensive devices, to a small and cheap smartphone add-on. In the context of this work, a portable device that can be carried by bike or on foot is meant. With such a portable device, spatially and temporally resolved data can be obtained to perform high resolution mapping of the air quality in an urban environment. A single mobile run will be highly influenced by the large spatial and temporal variability in the urban air quality and the collected data will also show a large variability.

Therefore, care has to be taken to the methodology and the interpretation of the results.

Based on an extensive measurement campaign, we can conclude that mobile measurements have the potential to map the air quality. Significant differences are found between street level concentrations and mobile measurements are comparable to the average of stationary measurements in the same street. However, a lot of repetitions are needed to get a representative image. In this regard, strategies to increase the number of measurements and repetitions, such as participatory monitoring and larger deployment via low cost sensors, are being explored.

### Air Quality Monitoring System in the Moscow Region: Measurement Methods and Techniques

Olga Kislova

Air quality monitoring in Moscow is based on automatic monitoring and currently includes 38 automatic monitoring stations (AMS) in different functional areas of the city. Lists of controlled pollutants differs for each station depending on its specifics, but basic list includes NO, NO<sub>2</sub>, CO, O<sub>3</sub>, CH<sub>4</sub>. PM10 is currently measured at 9 AMS, PM2.5 at 2 AMS. Measurement methods are in most

cases reference or equivalent. QA/QC procedures are based on recommendations of WHO (Monitoring ambient air quality for health impact assessment, 1999). Data is available on-line: [www.mosecom.ru/hannover](http://www.mosecom.ru/hannover). Future plans include expansion of monitoring network on new territories, expansion of PM10, PM2.5 monitoring network, intercomparisons, development of statistical forecasts, and air quality model for Moscow etc.

## Overview on EuNetAir Events

### Air Quality Modelling in Slovenia

Rahela Žabkar

Slovenia is known for its large topographical and climate diversity, where over an area of only 20 thousand square kilometres mediterranean, continental, and alpine climate zones are present. With the help of in-line coupled WRF/Chem model, off-line coupled ALADIN/CAMx modelling system, as well as with statistical regression model, the characteristics of the temporal and spatial dynamics of the high ozone (O<sub>3</sub>) and PM10 episodes in Slovenia are investigated.

According to measurements, the highest ozone daily maxima occur at mediterranean stations, while at continental stations daily maxima are

exceeded only exceptionally. Model results show that high measured mediterranean ozone levels are related to the formation of ozone rich layer over the area of the Northern Adriatic Sea and its coastal regions during favourable synoptic and mesoscale meteorological conditions. With the southwestern advection, these ozone rich air masses can be advected towards interior of Slovenia and can impact ozone levels at interior stations.

The characteristics of high PM10 episodes are related to complex topography and geographical location of Slovenia in the lee side of the Alpine barrier, which blocks the predominant westerly flows. As a consequence, frequent low wind conditions with temperature inversions enable effective accumulation of pollutants in populated basins and valley of Slovenia.

### Measurements of PM Pollutants Accumulated on Plants Leaves in Poland

Helena Gawronska

Urbanisation during the past decades leads to a significant increase in energy, people, and goods transportation. This resulted in deterioration of large scale of air quality. The adverse effect of air pollution on the well-being, health, and human life has been documented in a number of medical publications. One of the most dangerous pollutants inhaled by man is particular matter - PM.

In cases where pollution has been emitted to the atmosphere in outdoor the only possible option to clean the air is environmental biotechnology - phytoremediation. It involves cultivation plants, on leaves and branches of which, PM is accumulated.

Aims of this presentation is to show results of several studies focused on (i) comparison of genetic ability of various plant species in PM capturing, (ii) estimation of the potential of selected species for „harvesting” PM from air, (iii) evaluation of effects of PM presence on leaves on leaf vital processes and (iv) option of using plants to clean up air in places where we live, work and play including indoor.

A plant of 22 trees species recommended for cultivation in urban areas was evaluated for their ability and potential for PM accumulation. PM was determined gravimetrically in two categories (accumulated on leaf surface – sPM and trapped in epicuticular waxes – wPM) and in three size fractions in both (0.2 – 2.5, 2.5-10 and 10-100 µm).

The effect of PM on plant processes of 7 plant species grown in three locations differing in PM levels in air was evaluated based on measurements of (i) intensity of photosynthesis, (ii) internal CO<sub>2</sub> concentration, (iii) stomatal resistance, (iv) chlorophyll content, (v) fluorescence of chlorophyll a), and (vi) intensity of transpiration using Portable Photosynthesis Systems (Licor 6200, Lincoln, Nebraska, USA), Handy PEA Portable Fluorescence Measurement System (Hansatech, UK) and chlorophyll Meter (CCM-200, Opti-Science, USA).

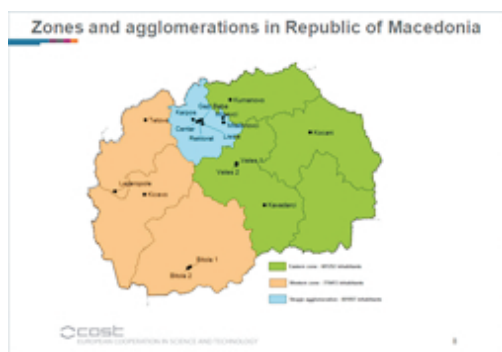
Results showed that significant genotypic differences exist between examined species both in ability to accumulate PM and in potential to “harvest” PM from air. In most cases, these differences can be attributed to specific species leaf characteristics as for example amount of waxes, hairiness and leaf and tree morphology/architecture. Presence of PM on leaves lowers efficiency of photosynthetic apparatus but there are species that are almost not affected.

In sum vegetation plays an important role in PM phytoremediation from air together with toxic compound deposited on PM. Therefore, vegetation plays a barrier and biological filter on way of PM travelling with air. Thus, there is a potential to get cleaner air to inhale and to reduce man health risk. Additionally, if plant biomass collected by city managers will be composted and incinerated in a controlled manner, as in polluted material should be, it would be possible not only lower PM level in air but also to remove this pollutants from the environment.

## Overview on EuNetAir Events

### Air Quality Monitoring in the Republic of Macedonia

Igor Atanasov



An Air Quality Automatic Monitoring System was established in the Republic of Macedonia in 1998. With several projects and donations through EU funds, till 2011 were installed: 17 automatic monitoring stations for air quality, 6 low volume and 4 high volume samplers, Air Quality calibration laboratory, balance room, and an Air Quality data management/ collection system –AIRVIRO.

In order to assess air quality, the Republic of Macedonia is divided into one agglomeration (Skopje) and two zones. Macedonia's main problem is the high concentration of PM10. In order to provide information for citizens and to provide different means to improve air quality, an intersectorial group of experts to define short and long term recommendations and measures has been formed from different institutions.

For details see: [www.airquality.moepp.gov.mk](http://www.airquality.moepp.gov.mk)

## 1st Training School: 13-15 June 2013

COST Action TD1105 EuNetAir organises the first TRAINING SCHOOL on Environmental Technologies and Air-Quality Monitoring, held in Barcelona (Spain) on 13-15 June 2013 under management of Prof. Albert Romano-Rodriguez (Action coordinator of the training schools) and Dr. Daniel Prades, Universitat de Barcelona (UB), Department of Electronics, MIND-group, in cooperation with CSIC-IDAEA, Barcelona (Dr. Mar Viana and Dr. Mariacruz Minguillon).

36 trainees (at least 20 reimbursed trainees) and 14 trainers (at least 4 reimbursed trainers), mainly from COST partnership, participate at the three-day Training School, lasting from Thursday to Saturday. The Training School has been devoted to the fundamentals of the specific core-issues of COST Action TD1105 such as nanostructures, sensor materials, gas sensors, sensing technologies, environmental modelling of air-pollution, models, standards, and protocols.

Lessons in classroom from international experts and practical experience in the air-quality station of CSIC-IDAEA in Barcelona have been successfully performed.

Graduated students, Master students, PhD students, Post-Doc, Early Stage Researchers have been involved from COST partnership and COST Countries signing Memorandum of Understanding (MoU) in open way. A fruitful exchange of knowledge and research experiences from senior teachers to young trainees has been highly addressed. Trainees and Trainers from at least 15 COST Countries are involved in the Training School.

Additionally, the Training School is connected not only to the Action Workshop 1 (20th June 2013) as Open Satellite Event of Transducers 2013 but also to the 3rd MC Meeting to be held at Barcelona as well on 21th June 2013. More details on Training School are available in the section Training School of Action webpages ([www.cost.eunetair.it](http://www.cost.eunetair.it)).

We are pleased to announce that our event of Training School at Barcelona has been labelled 'Green Week 2013 satellite event' by the Directorate-General for the Environment of the European Commission.

Green Week 2013, Brussels, 4 - 7 June 2013. Visit the link: <http://ec.europa.eu/environment/greenweek/>

## 1st Action Workshop as Open Satellite Event inside Transducers 2013, Barcelona: 20 June 2013

The COST Action TD1105 EuNetAir organises the 1st International Workshop on New Sensing Technologies and Transducers for Air-Quality Monitoring, that takes place in Barcelona (Spain) on 20 June 2013 as Open Satellite Event inside Transducers 2013 - Eurosensors XXVII Conference to be held at Barcelona on 16-20 June 2013.

Two Oral Sessions (9 Invited Speakers from at

least 6 COST Countries) and one Poster Session are held inside the Action Workshop with European Speakers from COST Action partnership and External International Experts (e.g., Australia) as Non-COST Countries membership, including an European Commission Joint Research Center presenter.

More details are available in the section Workshops of the Action webpages ([www.cost.eunetair.it](http://www.cost.eunetair.it)), including the Final Programme: <http://transducers-eurosensors2013.org/>

## Overview on EuNetAir Events

### 3rd MC Meeting at IREC, Barcelona: 21 June 2013

The COST Action TD1105 EuNetAir has planned the 3rd Management Committee Meeting, that will take place in Barcelona (Spain) on 21 June 2013 at IREC (walking distance from Satellite Workshop venue inside Transducers 2013).

All MC Members and Substitutes have been invited to participate by e-COST official invitation.

More details are available in the section Meetings of the Action webpages ([www.cost.eunetair.it](http://www.cost.eunetair.it)),

including the Meeting Agenda. The MC meeting will be participated by MC members and substitutes, COST Science Officer, COST Domain Committee Rapporteurs and Action participants.

Moreover, an invited talk from two MC members as Dr. Nicolas Moser (SGX-Sensortech, Switzerland) and Prof. Carlos Borrego (Institute of Environment and Development, Aveiro, Portugal) are planned on issues of the sensor technologies and challenges of the new Air Quality EU Directive.

## Announcements **JSSS launched**



The recently launched Journal of Sensors and Sensor Systems (JSSS) is an international, peer-reviewed open access journal. The emphasis is on sensor principles, measuring systems, sensor technologies and applications. It covers also the EuNetAir activities. With Michele Penza (Italy), Anita Lloyd Spetz (Sweden), and Andreas Schütze

(Germany) three EuNetAir participants are involved in the editorial board. JSSS is published on behalf of the AMA Association for Sensor Technology. According to AMA, JSSS is to be indexed in Scopus, Web of Science, and others. As an introductory offer, no service charges apply! For details see <http://www.journal-of-sensors-and-sensor-systems.net/>

## Upcoming Events

1st Iberian Meeting on Aerosol Science and Technology (RICTA2013)  
1-3 July 2013, Évora, Portugal  
<http://www.ricta2013.cge.uevora.pt/>

Environment and Health – Bridging South, North, East and West Conference of ISEE, ISES and ISIAQ  
20-23 August 2013, Basel, Switzerland  
<http://www.ehbasel13.org/>

Euroanalysis XVII  
25-29 August 2013, Warsaw, Poland  
<http://www.euroanalysis2013.pl/>

European Aerosol Conference (EAC 2013)  
1-6 September 2013, Prague, Czech Republic  
<http://eac2013.cz/>

The 13th International Conference on Environmental Science and Technology  
5-7 September 2013, Athens, Greece  
<http://cest2013.gnest.org/>

16th IUAPPA World Clean Air Congress,  
29 September - 4 October 2013, Cape Town, South Africa  
<http://www.iuappa.org/>

224th ECS Meeting  
27 October- 1st November 2013, Hilton San Francisco, CA, USA  
[http://www.electrochem.org/images/pdf/sf\\_call\\_papers.pdf](http://www.electrochem.org/images/pdf/sf_call_papers.pdf)

The IEEE Sensors 2013 Conference (IEEE-Sensors'13)  
3-6 November 2013, Baltimore, MD, USA  
<http://ieee-sensors2013.org/>

The 10th Asian Conference on Chemical Sensors (ACCS 2013)  
11-14 November 2013, Chiang Mai, Thailand  
<https://www.accs2013.org/>

11. Dresdner Sensor-Symposium  
9-11 December 2013, Dresden, Germany  
[http://www.fms-dresden.de/Veranstaltungen/Sensor\\_Symposien/11\\_+Dresdner+Sensor\\_Symposium.html](http://www.fms-dresden.de/Veranstaltungen/Sensor_Symposien/11_+Dresdner+Sensor_Symposium.html)

E-MRS 2014, including EuNetAir Action Symposium  
26-30 May 2014, Lille (France)  
<http://www.emrs-strasbourg.com/index.php>

# EuNetAir

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Newsletter COST Action TD1105 EuNetAir

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