

Passive sampling of emerging pollutants: state of the art and perspectives

NORMAN expert group meeting

**Wednesday, 27 May 2009
Prague, Czech Republic**

**NORMAN - Network of reference laboratories and related
organisations for monitoring and bio-monitoring of
emerging environmental pollutants**

MINUTES

Chair: Branislav Vrana (BV), Water Research Institute, Slovakia

Participants: A full list of meeting participants is provided in Annex 1.

Agenda: The agenda for this meeting is attached in Annex 2

Access to presentations: Documents from the meeting are available for downloading at the NORMAN website www.norman-network.com

The NORMAN expert group meeting on passive sampling of emerging pollutants was organised as a satellite workshop of the 3rd International Passive Sampling Workshop and Symposium (IPSW 2009), held in Prague, Czech Republic. The meeting was held on May 27, 2009.

Participants included experts from the NORMAN network and invited speakers involved in the research, development and application of passive sampling devices for monitoring emerging pollutants. The meeting provided an opportunity for delegates to discuss important developments in passive sampling techniques for monitoring emerging pollutants with the aim of harmonising work in this area, and to plan the development of sound validation procedures for the use of passive sampling devices, including laboratory calibration, handling, field deployment, chemical and ecotoxicological analysis.

Item 1: Welcome - BRANISLAV VRANA (BV)

BV, chair of the expert group meeting, welcomed all participants and set out the meeting objectives. The meeting was focused on passive sampling of emerging pollutants in surface waters. The main issues addressed at the meeting would include:

- the use of PS coupled with ecotoxicity testing/chemical analysis in identification of emerging pollutants
- the capabilities and limitations of the various passive samplers in relation to environmental conditions, ease of operation, cost, detection limits, and quality assurance and quality control
- the problems related to quantification of pollutants, e.g. the development and use of performance reference compounds (PRCs) and sampler/water partition coefficients, and the translation of laboratory calibrations to field deployments

- techniques and materials applicable for sampling "difficult" compounds e.g. labile compounds, surfactants, groups of compounds with a specific toxicological mode of action
- the utility and validity of passive sampling technologies and methodologies within a regulatory context
- a consensus approach to the normation of passive sampling technology
- agreement on an interlaboratory calibration study for 2010 (selection of samplers, prioritisation of analytes, sampling sites).

The Expert Group meeting will deliver before the end of 2009 a **position paper** summarising the position of the NORMAN experts on the topic of passive sampling (dissemination via the web).

Item 2: NORMAN - Network of reference laboratories for monitoring and biomonitoring of emerging environmental pollutants- JAROSLAV SLOBODNÍK (JS)

JS gave a presentation on the NORMAN network, of which he is chairman. This network aims to make information on emerging substances available to all interested stakeholders. Originally an FP6-funded project, NORMAN has been a non-profit association since last March; its activities are funded by its members via annual membership fees.

8 founding members signed the consortium agreement. Ordinary members were invited to join the network.

The mission of the NORMAN network and the NORMAN activities for 2009 were presented:

- Regular feeding of the NORMAN databases (EMPOMAP, EMPODAT and EMPOMASS) with results of recent monitoring campaigns
- Inter-lab exercise on "Perfluorinated Compounds in Water, Fish and Sludge" to be organised by IVM, NORMAN and QUASIMEME (March – Nov 2009)
- Expert Group meeting on "Use of passive sampling for emerging substances" – publication of a NORMAN position paper (Prague, May 2009 - jointly with the 3rd International Passive Sampling Workshop and Symposium - IPSW 2009)
- Workshop on "Metabolites / degradation products of emerging substances": Autumn 2009 – to be announced soon
- Working and Expert Group meetings on the use of biological assays and analytical methods within monitoring programmes, as tools for better understanding of substances bioavailable within the sample, and identification of the toxicants responsible for adverse effects
- WG on "Prioritisation of emerging substances": the mandate of the WG has been approved and the operational work is in its starting phase. More information available on www.norman-network.net .

The NORMAN databases EMPOMAP, EMPODAT and EMPOMASS were presented to the meeting participants. EMPOMAP enables experts in the field of monitoring of emerging pollutants to provide information on their field of expertise. EMPODAT is a database where monitoring data on emerging substances and pollutants in various matrices are being collected, together with information on methods used and their validation status. EMPOMASS provides data on mass spectra of substances found in environmental samples that have not been fully identified but may be relevant as environmental contaminants.

The NORMAN databases present a good potential platform for the systematic collection of data on sampler performance characteristics (e.g. sampling rates, detection limits, range of physicochemical properties) as well as data on emerging substances from field campaigns. If the expert group is interested, a template for passive sampler-related data collection can be designed and made available for data collection by NORMAN members.

Item 3: Combining passive sampling with bioassays and evaluating effects of flow on passive sampler performance under environmental conditions - ETIENNE VERMEIRSSSEN (EV)

An important development, presented by EV, is the linking of passive sampling with toxicological assessments in which passive sampler extracts with compounds accumulated over a period of days to weeks can be assayed in a range of biological screening procedures. Several bioassay techniques were presented that have been used with POCIS extracts, including the yeast oestrogen screen (YES) for the detection of endocrine disruptors and the combined algal test for the detection of Photosystem II inhibitors. Data from bioassays combined with passive sampler calibration data can provide information on "toxicity equivalent concentrations" of compounds with a certain type of toxicity. Additional chemical analysis of the extracts can support the bioassay data by measuring quantities of sampled compounds with known activity. In the second part of his presentation, EV discussed the effect of flow and exposure time on the performance of various passive sampler designs. Presentation available on www.norman-network.net

Item 4: Role of passive sampling in regulatory monitoring - IAN ALLAN (IA)

IA made a presentation on possible applications of passive sampling technology in regulatory monitoring. Several examples were given from field studies, showing how passive sampling can be effectively used to improve sampling representativeness, to measure riverine fluxes, long-term contaminant trends and the challenges in the use of passive samplers in testing for compliance with environmental quality standards in the context of recent legislation (especially the Water Framework Directive). Presentation available on www.norman-network.net

Item 5. A novel approach to passive sampling - continuous flow-integrative passive sampler - IGNACIO VALOR (IV)

For most passive samplers, uptake rates depend to a greater or lesser extent on turbulence of the water. IV made a presentation on the development of a novel sampling device for monitoring hydrophobic organic compounds that can provide information on time-weighted average concentrations of these compounds. Its performance is not affected by field water turbulence. The device is also characterised by a negligible lag phase. Because the flow of water around the receiving phase is controlled by a little peristaltic pump (with low energy consumption), there is no need to use performance reference compounds to correct the uptake for the effect of environmental variables. Presentation available on www.norman-network.net

Item 6. Passive sampling and analysis of cyclic siloxanes - CHRIS SPARHAM (CS)

CS made a presentation on the passive sampling and analysis of cyclic volatile methylsiloxanes. This group of emerging substances has been used in the manufacture of larger siloxane polymers and as base fluid or fragrance 'carrier' for a range of consumer applications, including personal and household care products. Research is currently investigating the environmental fate of these compounds, especially their persistence and bioaccumulation. Environmental monitoring data are needed to support theoretical predictions about the fate of D5 in the environment. Specific challenges in sampling and analysis of cyclic siloxanes in various matrices (sediment, water) were presented and preliminary results from research on the development of a passive sampling device for these substances were shown. Presentation available on www.norman-network.net

Item 7. Passive sampling of pharmaceuticals and other polar emerging pollutants CATHERINE GONZALEZ (CG) and ANNE TOGOLA (AT)

CG and AT made a presentation on passive sampling of pharmaceuticals and other emerging pollutants in aquatic environments. CG presented results from the Chemcatcher passive sampler calibration for pharmaceuticals with a range of physicochemical properties (hydrophobicity, acidobasic properties). Difficulties and challenges with the application of laboratory-derived calibration data in field conditions were discussed. AT presented several case studies of the application of passive samplers in water monitoring of polar

compounds, including pesticides, pharmaceuticals and their metabolites. Presentation available on www.norman-network.net

Item 8. Normation of passive sampling technology - RICHARD GREENWOOD (RG)

RG reported on the state of play in the normation process of the passive sampling technology. A draft of ISO 5667-23 "Water quality - Sampling - Part 23: Determination of priority pollutants in surface water using passive sampling" has been prepared. The standard describes procedures for the determination of time-weighted average concentrations of the free dissolved fraction of pollutants in surface water by passive sampling, followed by analysis. If the revised draft receives sufficient support then it will be developed into an ISO standard and in parallel into a CEN standard. Voting in the ISO/CEN committees began in April 2009 and will close in September 2009.

Presentation available on www.norman-network.net

Meeting participants agreed on the necessity of the norm for the acceptance of the passive sampling technology beyond its use as a research tool.

Item 9. Role of the passive sampling experts in the NORMAN association

Since not all meeting participants were from organisations that had already joined the recently created NORMAN association, BV informed explained how they might become members of the network. Ordinary members can actively participate in activities organised by the association and are decision makers in the planning of future network activities. Observers are informed about the ongoing activities and can take part in them, but they have no vote in decision making.

JS encouraged the meeting participants to inform their organisations about the NORMAN association, to join the network and participate in the ongoing NORMAN activities, especially in the upgrade of the list of emerging substances. Information about membership of the NORMAN association can be found at the website: www.norman-network.net

Participants identified their interest in joining the NORMAN expert group (indicated in Annex 1; list of participants). These experts will provide comments/feedback on various planned activities of the NORMAN association in the field of passive sampling of emerging substances, especially on:

- a) drafting the position paper on passive sampling of emerging substances to be finished by the end of 2009*
- b) the recommendation/outline of the interlaboratory calibration study for 2010.*

Item 10. Position paper.

The Expert Group meeting will deliver a position paper summarising the position of the NORMAN experts on the topic of passive sampling (dissemination via the web). The position paper should be finished before end of 2009. The coordinators of the drafting of the position paper will be Branislav Vrana (WRI, Slovakia) and Ian Allan (NIVA, Norway). Comments and feedback on the draft are welcome/expected from all expert group members.

Item 11. An interlaboratory calibration study for 2010

BV spoke of the importance of an interlaboratory calibration study on passive sampling of emerging pollutants which would aim to demonstrate the reliability of the technology to the scientific community, environment and health agencies and public authorities managing chemical contaminants. In recent years several international projects have performed interlaboratory calibrations or concerted field trials that were aimed at the validation of the passive sampling technology. Most of the projects were aimed at the technology for monitoring priority substances, mainly hydrophobic organic pollutants and heavy metals. Even the most up-to-date passive sampling technology has not yet enabled

sufficient validation of passive sampling methods that are used for monitoring polar substances. There is also an urgent need to **harmonise the various activities** that are being performed across Europe. The NORMAN network may be a good platform to facilitate this task.

BV identified the decisions needed for planning of an interlaboratory calibration study. These include the definition of study objectives, selection of target compound groups, environment/matrix sampled, sampling techniques, study setup, role of the central expert laboratory, and identification of the central expert laboratory and potential participants.

The ensuing expert group discussion identified further crucial issues that need to be addressed for organisation of the study: funding resources/budget for the study and timescale. The discussion also underlined the need to identify the central expert laboratory that would be committed to the coordination of study activities. Several experts confirmed that sampler validation studies have been under preparation at national level. Several meeting participants expressed their interest in participating in the study, but during the meeting none of the participants declared the readiness of their organisation to take on the role of coordinator. Also, some participants indicated that their organisations can support such studies financially and stressed that funding will be available till the end of 2010 but possibly not beyond that date. Therefore, a quick decision should be reached on the possibility of performing the study in 2010.

*The discussion in the expert group meeting will **provide design recommendations to potential organisers** of the study. The draft recommendation is now under review (Foppe Smedes and other meeting participants with experience in organising similar studies) and will be circulated to the expert group for further comments and to identify the key organisations that will organise the study.*

Item 12. Discussion. Where to focus future research?

BV initiated the discussion on various aspects of passive sampling that need to be further investigated in the future. The issues discussed can be found in the presentation available on www.norman-network.net

Other issues

Several other recommendations of meeting participants were made to the scientific community:

a) For samplers used for monitoring non-polar pollutants, the performance reference compounds (PRCs) concept has been developed that can effectively provide *in situ* calibration of the samplers. However, this concept does not seem to be applicable for samplers for monitoring polar organic or inorganic compounds. *Jochen Mueller suggested that an agreement of the scientific community on the use of certain common "performance reference compounds" in all future calibrations and field trials would be very useful. This would provide more comparable data and evidence on the PRC concept in passive samplers for polar compounds.*

b) *Long-term storage of exposed passive samplers/their extracts in environmental specimen banks was recommended.*

ANNEX 1

List of Participants

NORMAN expert group meeting "Passive sampling of emerging pollutants: state of the art and perspectives"
Prague, Czech Republic, 27 May 2009

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ANNEX 2

Meeting agenda

NORMAN expert group meeting "Passive sampling of emerging pollutants: state of the art and perspectives"

Prague, Czech Republic, 27 May 2009

8:30-9:00	Registration
9:00 - 9:15	<p>Welcome and introduction to the expert group meeting objectives <i>Branislav Vrana, Water Research Institute, Bratislava, Slovakia</i></p>
9:15 -9:45	<p>NORMAN - Network of reference laboratories and related organisations for monitoring and biomonitoring of emerging environmental pollutants <i>Jaroslav Slobodnik, chairman of the NORMAN network, Environmental Institute, Slovakia</i></p>
9:45-10:30	<p>Combining passive sampling with bioassays and evaluating effects of flow on passive sampler performance under environmental conditions <i>Etienne Vermeirssen, EAWAG, Switzerland</i></p>
10:30 - 11:00	Coffee break
11:00-11:30	<p>Role of passive sampling in regulatory monitoring <i>Ian Allan, NIVA, Norway</i></p>
11:30-12:00	<p>A novel approach to passive sampling - continuous flow-integrative passive sampler <i>Ignacio Valor, Labaqua, Spain</i></p>
12:00-12:30	<p>Passive sampling and analysis of cyclic siloxanes <i>Chris Sparham, Unilever, United Kingdom</i></p>
12:30-13:00	<p>Passive sampling of pharmaceuticals and other polar emerging pollutants <i>Catherine Gonzalez, EMA, France and Anne Togola, BRGM, France</i></p>
13:00 -14:30	Lunch break
14:30-15:00	<p>Normation of passive sampling technology <i>Richard Greenwood, University of Portsmouth, United Kingdom</i></p>
15:00 -16:00	<p>Discussion: Prioritisation of emerging pollutants - where to focus future research? Discussion: Conversion of passive sampling data into concentrations in the sampled media</p>
15:30 -16:00	
16:00-16:30	Coffee break
16:30-17:30	<p>Discussion: An interlaboratory calibration study for 2010</p>
17:30	Closing of the workshop

