Conference for European Environmental Specimen Banks

Berlin, 21-22 June 2010

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Für Mensch und Umwelt

UMWELTPROBENBANK DES BUNDES

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The German Environmental Specimen Bank is managed by Marike Kolossa-Gehring, André Conrad, Andrea Körner, Jan Koschorreck, Maria Rüther, Christa Schröter-Kermani.

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Introduction

Chair: Andreas Gies (UBA), Rapporteur: Jan Koschorreck (UBA)

Welcome address

Kilian Delbrück, Federal Ministry for Environment, Nature Conservation and Nuclear Safety

Dear colleagues,

we feel honoured to welcome you as distinguished experts in the field of environmental and human monitoring. This conference hosts representatives from 16 European ESBs together with attendants from EU institutions of chemical safety management, EU Member State government bodies, academic institutions and contract laboratories.

It was European Countries who set up the first national ESBs. The first European ESB concepts became established in the 1960s and 1970s. Over the last two decades more and more environmental specimen banks developed. On a global scale, the density of ESB concepts in the European Union is beyond comparison. Today, institutions all over Europe are archiving millions of samples. This number will increase quickly in future: we are practically experiencing a renaissance of the ESB concept. Currently, new ESBs are developing in France, Norway, Poland, Spain - and looking beyond Europe - Australia and a range of Asian countries, including China.

ESBs are founded as an investment in tomorrow's environmental safety. The steadily growing archives have two principal functions: ESB archives provide for samples for yet unknown questions which may not directly be linked to existing environmental legal and scientific safety frameworks. The benefits are expected to occur over a long timescale. The second ESB objective directly supports the existing legal and scientific frameworks of chemical risk management and nature conservation. ESBs are responding to their specific needs with analyses of archived samples.

Being watchtowers of chemical safety, ESBs provide for wide angled views on chemical contamination. It is typically human and ecosystem health concerns which are the drivers for spatial and time trend analysis of the archived samples. In the past these data have proven to be valuable for regulators, industry and scientists and improved the safety assessment of chemicals. Examples of specimen bank analyses are time trends and spatial data for metals, antifoulings, plasticizers, flame retardants and coating materials. Scientists are integrating these results to improve the understanding of the fate and behaviour of chemicals in the environment and human populations. Authorities are using these data to decide whether marketed chemicals need to be regulated or not. These data are also indispensable, when it comes to central questions of chemical safety management: How can we prove the efficacy of existing chemical regulations? And: Is the human and environmental safety of marketed chemicals actually improving with time?

During this conference our main objective is to provide an overview on the individual ESB concepts in Europe. Furthermore, we may investigate the potential benefit of a common vision for the European ESBs. Most ESB concepts developed along with the concepts for EU chemical safety management, including substance and product related marketing provisions and EU environmental media frameworks. It comes by surprise that at present there is very little interaction between ESBs and EU regulatory bodies of chemical safety management.

Questions for this conference could be:

- *How can we concentrate knowledge about ESB monitoring activities?*

With 16 environmental specimen banks present at this meeting we have the unique chance to generate a comprehensive overview on banking activities in Europe. In the open literature there are excellent descriptions of the individual ESB concepts and peer reviewed publications of their results. This conference may be a starting point for a document that compiles the existing knowledge and prepare a monograph on specimen banking in the EU. Such a monograph would facilitate communication with other instruments of environmental policy. It may also lead to a corporate identity of European ESBs.

- *How can we foster cooperation and share monitoring data with chemical safety management?*

Time trends are the unique selling point of environmental specimen banks. These data have great potential to support recent developments in chemical policy. Potential “customers” for ESB time trend data are the new chemical Legislation for industrial chemicals, REACH, and the large EU Framework for European waters.

Environmental policy making is a truly European issue. So far, ESB actions are tailored to national needs. But we need to communicate to the European Commission and the respective European Agencies why ESBs are important and how ESBs can feed into chemical safety management. In that respect, a letter of intent based on the outcome of this workshop could be a major step forward.

- *How can we establish links to other research programmes?*

We have the pleasure to organise this conference together with the NORMAN Network. Without going too much into detail: NORMAN is dedicated to identify emerging substances, which may pose a risk for the environment but are not yet subject of regulatory concern. Links between ESBs and NORMAN are particularly valuable.

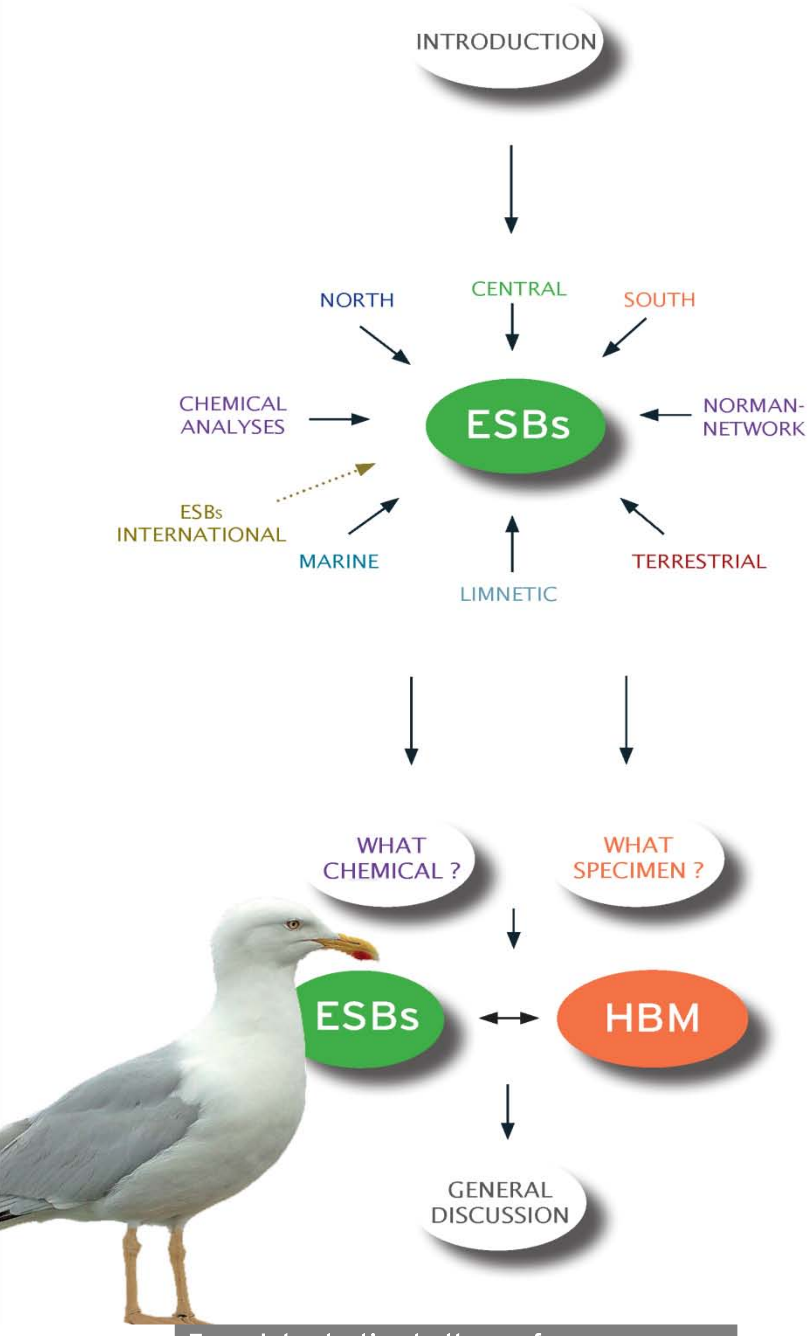
In an ideal world, human and environmental monitoring is a common exercise. The reality is very much different. As yet, human and environmental monitoring largely rely on two different scientific communities. Lately, human biomonitoring has gained momentum. For environmental specimen banks this is encouraging news. Specimen banking is a direct link between environmental and human biomonitoring. We would clearly support closer cooperation on the European level.

I wish you a fruitful conference and an enjoyable time in Berlin!

Introduction to the conference

Speaker: Jan Koschorreck, UBA

The conference programme envisaged overviews on the existing environmental specimen bank programmes in Europe and break-out sessions with reflections on the potential for harmonisation of activities and banking strategies. The underlying theme of the conference is the cooperation with the Norman Network for new environmental contaminants.
Rapporteurs were asked to prepare summaries of the presentations and help to prepare this brochure after the conference.



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An overview on EU chemical safety management

Speaker: Klaus Günter Steinhäuser, UBA

REACH is the legal framework for the Registration, Evaluation, Authorisation and Restriction of Chemicals. Article 1.1of the REACH Regulation explains that the new chemical legislation is "to ensure a high level of protection of human health and the environment, including the promotion of alternative methods for assessment of hazards of substances, as well as the free circulation of substances on the internal market while enhancing competitiveness and innovation." On an operational level this results in the registration and evaluation of all marketed chemicals and their products. By 1 December 2008 all companies were required to report substances that are already on the market and have a marketing volume greater than 1 ton per year. The number of preregistrations outnumbered all expectations: It was more than 2.2 million submissions.

The basic principle for REACH is: No data, no market! However, it has to be taken into account that REACH goes along with a change of paradigm. Nowadays, registrants take full responsibility for correctness of their registration data. In general, authorities only check to completeness of the dossiers provided.

All substances > 1 tons per year per manufacturer/ importer are to be registered. The submitted registration dossier shall contain inter alia study summaries with respect to the properties of the substance, data on exposure and a chemical safety report assessing the exposure, hazards and risks and providing appropriate risk reduction measures if 10 tons per year are exceeded.

Only a selection of registration dossiers will be evaluated by the authorities (agency and member states). It is a stepwise procedure: Dossier evaluation may result in a more detailed substance evaluation and ultimately in risk reduction measures or an authorisation procedure.

What is authorisation? Art. 55 of the REACH Regulation states that „The aim (of authorisation) is to ensure the good functioning of the internal market while assuring that risks from substances of very high concern are properly controlled and these substances are progressively replaced by suitable alternative substances and technologies where these are economically and technically viable...." By this means authorisation promotes the substitution of chemicals of high risks with safer substances.

Restriction measures may be imposed on all substances which pose an unacceptable risk to human health or to the environment. These measures need to be addressed on a Community-wide basis and are proposed by the Commission or a Member State who also prepare the toxicological and ecotoxicological authorisation dossier. The socioeconomic impact of the restriction shall be taken into account and the availability of alternatives.
What makes REACH different to the preceding chemical framework? Basically, industry has the obligation to demonstrate that their substances are safe, there are equal requirements for new and existing substances, there is improved transparency, the so called downstream users are involved and REACH has incentives for substitution of the most hazardous substances.

What is the responsibility of industry? The producers and users need to provide a chemical safety assessment for substances with greater marketing volumes than ten tons per year. This assessment considers the entire lifecycle of the chemical product and information must be provided down the product chain including Safety Data Sheets and exposure scenarios.

The responsibility of authorities, the EU Commission and Member States involves coordination and advice (e.g. helpdesks), the development of guidance documents, modeling tools and standardised test methods. With regards to dossier and substance evaluation it is regulatory bodies which identify substances with a need for regulation (e.g. SVHCs). Authorities also have to enforce the risk mitigation measures and monitor the success of REACH and its product specific risk reduction strategies.

REACH (Art. 57) identifies SVHC when the chemical is carcinogenic or mutagenic or toxic for reproduction. In these cases, the effects characterisation is based on mammalian toxicity studies. The results of environmental fate and effects studies can also flag chemicals as SVHCs: Annex XIII of the REACH legislation contains criteria for persistent, bioaccumulative and toxic (PBT) substances or very persistent and very bioaccumulative (vPvB) substances. Finally, Art 57f considers chemicals to be SVHC when there is an equivalent level of concern and scientific evidence of probable serious effects to human health or the environment, e.g. endocrine disruptors or PBT/vPvB substances that do not meet the criteria of Annex XIII.

Why is there a special awareness for persistence and bioaccumulation? It is caused by experience from environmental monitoring. Chemicals that meet these two criteria have been proven to accumulate in environmental organisms which live in industrialised but also in remote regions far away from emission sources. The fate of these chemicals becomes unpredictable once they have entered the environment. Classical quantitative risk characterisation approaches then fail to be protective. REACH therefore chooses an alternative strategy and sets out lab test based criteria for the assessment of persistence, bioaccumulation and toxicity in a hazard based approach.

There is a gap between the legal framework of the REACH legislation and the PBT/vPvB strategy in Europe. Industrial companies only need to supply certain laboratory test results that enable regulatory bodies to identify PBT/vPvB substances for their chemicals when they are marketed in quantities of 100 tons per year or greater. Therefore, an interim strategy is needed that operates in parallel to the registration process and identifies potential PBT/vPvB candidates among the very large number of substances that do not meet the legal 100 tons criteria. This interim strategy makes use of expert group knowledge, evaluate substance groups with known critical properties (e. g. brominated flame retardants, per- and polyfluorinated compounds, organotin compounds, phthalates), utilise existing priority lists and apply QSAR methodologies.

The interim strategy also stresses the importance of monitoring data. Data from environmental specimen banks are of extra value: The analytical data from biota measurements do not only substantiate the P (persistence) and B (bioaccumulation) properties at the same time. The ESB time trends also help to prioritise the potential need for regulatory action.

The example of perfluorooctanesulfonic acid (PFOS) demonstrates that it is sometimes inevitable to make use of monitoring data in regulatory chemical management. PFOS biomagnifies in food webs. This is hardly indicated by standardised laboratory tests. A risk assessment solely relying on laboratory data would therefore fall short of classifying PFOS as a PBT substance. Monitoring data has proven that PFOS has spread around the globe with highest concentrations being measured in top predators of e.g. arctic food webs. This evidence was convincing and subsequently the EU placed a restriction on the marketing and use of PFOS in 2006 and the Stockholm Convention listed PFOS as a persistent organic pollutant (POP) for global ban. Perfluorooctanoic acid (PFOA) has come under scrutiny quite some time ago and monitoring data may play an important role in the final risk assessment including ESB data. And there is evidence of new challenges for environmental specimen banks: Recently, perfluorinated phosphonic and phosphoric acids (PFPA and diPAPs) have been measured in the environment and human populations.

Session I – Geographical views on Environmental Specimen Banks

Chairpersons and rapporteurs: Marco Grotti (University Genova) and Monica Jürgens (UK Centre for Ecology and Hydrology)

A geographical overview of the European Environmental Specimen Banks (ESBs) is given in Figure 1, which shows the location of 17 banks, including well-established, in development and planned ESBs. The main features of these banks, divided into Northern, Central and Southern regions, are summarized in Table 1.

The North

Speaker: Jon L. Fuglestad

The Swedish ESB has one of the oldest and largest collections of environmental specimens in Europe. The oldest samples were collected in the mid-1960s, and homogeneous and continuous series of samples from the late 1960s up to now are stored. More recently, other environmental specimen banks in the Nordic countries have been developed. The spatial coverage of these ESBs is national and the collection of samples from marine (mainly mammals and fish), limnetic (mainly fish) and terrestrial (higher animals, mosses) ecosystems has been carried out regularly, following standard operating procedures (SOPs). The sampling sites in Denmark and Faroe Islands can be regarded as reference ones, while both reference and "hot spot" sites are considered in the activities of the other Nordic ESBs.

Central Europe

Olivier Donard, Université de Pau et des Pays de l'Adour

In Central Europe, the German specimen banking system provides long terms trends of all major national ecosystems, including marine, riverine, agrarian, forest, urban, suburban and rural environments. Remarkable features of the German ESB are the long term experience (since 1976), variety of the type of ecosystems monitored, quality of the sample collections, standardized SOPs for sample handling, exploitation of the sample collections and long term funding by the German government. The analyses routinely performed include trace metals (e.g. Hg, Ag) and organic contaminants (e.g. PBDEs). In the French marine monitoring network (IFREMER), blue mussels and oysters have been collected since 1976 from some 100 characterized sites along the French shore. The routine analysis includes inorganic and organic pollutants (e.g. trace metals, PBDEs, Pb isotopic ratios). More recently, a project on environmental change in the Aquitaine region in South West France started collecting coastal and terrestrial specimens in 2004. Their analysis includes trace elements (isotopic dilutions), metal species, organic contaminants and biominerals. The assessment of a zero reference level for long term monitoring of a future nuclear storage site is the objective of a third French bank operating at Bure (Northern France). Representative samples of the whole food chain of this area - including birds, earth worms, tree bark, soils, leaves, meat, milk and waters - has been collected and archived for future, not planned yet, analyses. In the United Kingdom, a national fish tissue archive has been started in 2007 for the long term monitoring of rivers. Several hundred roach have been collected each year from the Thames and several rivers in the Anglian region of England. Some samples were also taken of bleak and eels. Samples are frozen on site using liquid nitrogen and stored at -80°C. Some subsamples have so far been analysed for persistent organic pollutants, metals or estrogens. Another central European Environmental Specimen Bank is planned for Poland and will encompass marine, terrestrial and limnic samples, managed by the University of Warsaw.

The South

José Vítor Vingada, Univ. do Minho

Southern ESBs commonly operate in areas characterized by high biological diversity and richness as well as by increasing environmental problems and conflicts, which clearly make the environmental monitoring and the related use of ESBs an actual need. In this region, there are two types of environmental banks, namely “tissue” and “specimen” banks, with the former ones being characterized by occasional sampling strategy (e.g. stranded mammals) and the archiving of marine animal tissues only. The marine animal tissue bank in Galicia and the Portuguese marine animal tissue bank collected thousands of specimens from both unpolluted and polluted sites, including areas affected by oil spills. Metals and organochlorines have been measured and baseline values and trophic magnification are presently being estimated. The Mediterranean marine mammal tissue bank in Padua (Italy) collects and preserves biological material sampled from marine mammals stranded along the Italian coasts of the Mediterranean Sea, with the aim of gathering information about marine mammal biology (genetics, anatomy, physiology, pathology and ethics). Histological samples are embedded in paraffin and samples are preserved in DMSO 20% or frozen. Besides the tissue banks, a further three ESBs are currently operating in Southern Europe. The Galician ESB systematically collected a large number of samples from marine, limnetic and terrestrial environments. Both unpolluted and polluted sites have been considered and the analysis regarded metals and, more recently, dioxins. The Biscay Bay environmental biospecimen bank is a recent project in the Basque country having the aim of protecting, sustaining and restoring the coastal and marine ecosystems of the Bay of Biscay. Finally, the Antarctic environmental specimen bank, placed in Genova (Italy), is operating since 1994 under the Italian Antarctic Research Program by collecting and analyzing (trace elements and organic pollutants) several matrices from coastal and remote sites in Antarctica. Although these samples are not from Europe, they should prove useful for assessing the background levels of contaminants and their natural variability, important for a more appropriate interpretation of results from biomonitoring programmes.

Table 1. European Environmental Specimen Banks: geographical overview

Location and date of operation			Sampling sites		Sampling strategy		Collected samples	
Country	City	Year	Spatial coverage	Type (reference/ polluted)	Frequency	Storage T	Ecosystems	Samples
Sweden	Stockholm	1964	Whole country	Mainly reference	systematic	-25°C -80°C Liquid N_2	Marine Limnetic Terrestrial	seals, fish, mussels, seabird eggs fish, sediment reindeer, moose, birds, voles, earthworms, mosses, sludge
Denmark	Århus	2000	Greenland	Reference	systematic	-21°C	Marine Terrestrial	seals, polar bears, fish, birds birds
Faroe Islands	Torshavn	1998	Whole country	Reference	systematic	-25°C	Marine Limnetic Terrestrial	whales, seal, dolphin, fish fish sheep, hare, grass, soil
Finland	Paljakka / Helsinki	1994	Whole country	Both	systematic	Liquid N_2 Room T	Marine Limnetic Terrestrial	fish fish mosses, lichen, pine bark, seeds, needles
Norway	Oslo	2005	Whole country	Both	systematic	-25°C -80°C	Marine Limnetic Terrestrial	seals, polar bears, fish, mussels, crab, seabird eggs, sediment fish reindeer, birds, mosses, sludge
Germany	Schmallenberg/ Münster	1985	Whole country	Both	systematic	-80°C, Liquid N_2	Marine Limnetic Terrestrial	several types (plants, animals, sediments) from each ecosystem, also human hair and body fluids
France	Nantes	1976	French coastlines		systematic	?	Marine	mussels, oysters
France	Pau	2004	Gironda, Landes, Pyreneen		systematic	-80°C	Marine Terrestrial	oysters, bivalves, eels, sediment pine needles, leaves, lichens, soils, SPM
France	Bure	2009	Bure (future nuclear storage site)	Reference	systematic	-80°C	Terrestrial	leaves, tree bark, soils, birds, earth worms, food products
UK	Wallingford/ Lancaster	2007	Thames and Anglian Region		systematic	-80°C	Limnetic	fish
UK	Cardiff	1992	England and Wales	Both	Occasional	- 80 °C	Terrestrial	otter
Poland	Warsaw	planned	Whole country		-	- 80 °C	Marine Limnetic Terrestrial	Several specimens from each ecosystem, very similar to the German ESB specimen collection
Portugal	Braga / Aveiro	2000	Mediterranean coastlines	Both	occasional	?	Marine	animal tissues
Spain	Pontevedra	1990		Both	occasional	?	Marine	animal tissues
Spain	Plentzia-Bizkaia	2007	Biscay Bay	Both	systematic	- 80°C	Marine Terrestrial	fish, bivalves, eels earths worms
Italy	Padua	2002	Mediterranean coastlines	Both	occasional	-80°C	Marine	animal tissues
Italy	Genoa	1994	Antarctic sites	Reference	systematic	-25°C -80°C -135°C	Marine Limnetic Terrestrial	seawater, sea-ice, SPM, sediment, fish, molluscs, sponges water, macro-algae, sediment snow, firn, soil, mosses, atmospheric particulate matter

Session II – Ecosystem views on European Environmental Specimen Banking

Chairpersons and rapporteurs: Christa Schröter-Kermani (UBA) and Maria Rüther (UBA)

Marine ecosystems

Ylva Lind, Swedish Museum of Natural History

Baltic Sea, North Sea, parts of North East Atlantic and the Mediterranean Sea constitute the European marine environment. These Seas are some of the most trafficked waters in the world and their coasts are in most cases heavily populated areas with large industries.
Two main banking strategies has been developed to follow changes in the respective marine ecosystems: The first one often is linked to environmental monitoring programmes, the chosen specimens are collected actively and cover different levels of the marine food web. Unique species in these kinds of archives are mussels and fish, top predators are represented by seabird eggs or marine mammals. The second strategy is a more or less passive collection of stranded or by-caught marine mammals with parts of them being stored in so called "Tissue Banks". In both cases, specimens are preferentially stored in a frozen state to allow retrospectively the detection of effects of pollutants in addition to the quantification of pollutant levels with time. Several examples from Sweden demonstrate the utility of archived samples to retrospectively detect environmental changes. One of the most impressive is the verification of a change in diet of the Baltic herring between 1980 and 2005 by measuring stable nitrogen isotopes.

Freshwater ecosystems

Heinz Rüdel, Fraunhofer IME, Germany

In Europe, eleven banking activities dealing with freshwater aspects could be identified. The preferred specimen collected and investigated is fish. Sediment and suspended particulate matter (SPM) as well as mussels and birds are relatively rare specimen in European ESBs. Dependent on the differing purposes of the archived material, sampling strategies vary widely between the ESBs. In the Netherlands for example, banking of eel developed from a further food monitoring program while in Sweden banking is an essential part of contaminant and effect monitoring of the Swedish environment and fauna. However, in Germany specimens are archived mainly to follow the efficacy of environmental policy and to identify chemicals of concern. According to this, freshwater specimens are either sampled from rivers or lakes, background versus polluted sites are chosen, and, in case of fish, whole organisms versus target fish tissues are stored. Nevertheless, there are several important findings imposed by the use of archived freshwater specimens, as e.g. (i) the strong increase of brominated flame retardants and the significant decrease of PCB in fish from Swedish lakes between 1968 and 2000, (ii) the decline of polycyclic musk fragrances in bream from German rivers between 1995 and 2003, and (iii) the temporal trend of perfluorinated compounds in eel from three locations in The Netherlands between 1978 and 2008.

Terrestrial ecosystems

Gerhard Wagner, University Trier, Germany

Terrestrial ecosystems are covered by all European environmental specimen banks. However, the heterogeneity of sampled and stored specimens is wide. Considering the producer-consumer-decomposer chain and also the media atmosphere and soil we find following specimens: In the producer's group moss, grass, lichens, leaves and young shoots from deciduous trees, needles and young shoots from conifers, and bark.

The consumer's group is represented by birds and mammals. In addition, (top) predators are sampled by the Nordic Countries and cover birds and mammals. The most sampled and stored specimen in the decomposer's group is the earthworm. Earthworms are one of the most effective links between vegetation (producer) and soil. In eight ESBs soil is sampled and stored, but different approaches are chosen for soil horizons, sampling depth, sample preparation, and storing conditions. To describe the atmospheric burden three ESBs sample particulate matter. One ESB collects wet fallout to investigate its influence on terrestrial ecosystems.

Session III - Special views on Environmental Specimen Banks

Chairpersons and rapporteurs: Maristella Giurisato (University of Padua) and Jarkko Utriainen (Finnish Forest Research Institute)

Temporal and spatial trends of contaminants

Anders Bignert, Swedish Museum of Natural History

There are several programmes and regulating organisations for the contaminant monitoring in north Europe, such as United Nations Environment Programmes Global Monitoring Plan (UNEP/GMP), Arctic Monitoring and Assessment Programme (AMAP), Oslo and Paris Commission (OSPARCOM) and Helsinki Commission (HELCOM).

In Sweden, the national monitoring programme of contaminants in biological samples consists number of heavy metals and different harmful compounds under continuous observation. Average concentrations of the measured substances have tended to decrease within the last few decades. For example, lead concentrations have clearly decreased in both soil and herring (*Clupea harengus*) liver. Similar decreases have shown CB-101/CB-153 ratio and PCBs and HCB contents of herring muscle and PCBs contents of guillemot (*Uria aalge*) eggs. Also a-HCH contents in herring have decreased.

However, spatial differences have been measured in DDE, BCSP and CB-153 contents along coastal Sweden, and some fluctuations have been detected in cadmium contents of herring liver, TCDD-equivalents of herring muscle and in brominated contaminant concentrations of guillemont eggs.

Some increases in the contaminant concentrations have also been detected. HBCD, CB-153 and PFOS contents of guillemont eggs have increased especially in southeast coastal monitor areas, and contents of perfluorinated compounds of Swedish otter (*Lutra lutra*) liver tissues have clearly increased along the Swedish coast. This has been considered as a “new threat” for the Swedish otter population. In addition, decreases in weight of guillemot fledglings and thickness of gray seal (*Halichoerus grypus*) blubber have been detected.

The NORMAN network on emerging substances

Valeria Dulio, INERIS (National Institute for Environment and Industrial Risks), France and Executive Secretary of the NORMAN Association

The NORMAN project started in September 2005 and was funded for three years by the European Commission – DG RTD - 6th Framework Programme, Priority 6.3 - Global Change and Ecosystems. The project and the contract expired at the end of November 2008, leading to the new NORMAN permanent network established as a non-profit organisation and funded by its members. The objective of the NORMAN (Network of Reference Laboratories, Research Centers and Related Organisations for Monitoring of Emerging Environmental Substances) is to create a network of reference laboratories and related organisations to 1) improve exchange of information and data on emerging environmental contaminants between monitoring institutes, research centers and end-users and 2) encourage the validation and harmonisation of common measurement methods and monitoring tools so that the demands of risk assessors and risk managers can better meet.

According to the NORMAN definition, a distinction has to be made between "emerging substances" and "emerging pollutants":

"Emerging substances" can be defined as substances that have been detected in the environment, but which are currently not included in routine monitoring programmes at EU level and whose fate, behaviour and (eco)toxicological effects are not well understood.

"Emerging pollutants" can be defined as pollutants that are currently not included in routine monitoring programmes at the European level and which may be candidates for future regulation, depending on research on their (eco)toxicity, potential health effects and public perception and on monitoring data regarding their occurrence in the various environmental compartments.

The number of emerging substances is increasing and it is not possible for individual countries alone to develop the knowledge and methodologies needed for measuring and evaluating the effects and associated risks. NORMAN network can facilitate the production of good quality data on emerging substances, which are comparable across Europe, thus providing the basis for further identification of newly emerging pollutants and assessment of their potential risks to humans and ecosystems.

In 2010 the NORMAN network consist 45 members from 19 countries. The main activities of the network for 2010 are:

- Prioritization the emerging substances to identify which substances deserve higher priority for further investigations based on agreed criteria (toxicity, persistence, bioaccumulation, spatial and temporal distribution, occurrence levels, use, etc.).
- Defining and standardizing the interpretation of the results of monitoring with bioassays.
- Development and maintenance of databases for collection, evaluation and sharing of data/information on emerging substances. NORMAN improves access to existing methods, data and information from EU research programmes by three web-based databases (EMPODAT, EMPOMAP, EMPOMASS).
- Finding synergies in collaboration to reduce the use of resources for harmonisation and validation of analytical methods and ensure data/quality comparability.
- Inform environmental managers and policy-makers about the possible benefits deriving from the implementation of ESBs as tools for the retrospective monitoring of emerging pollutants.

The NORMAN Joint Programme of Activities (JPA) is defined each year. The aim for the JPA 2009-2011 is to stimulate the discussion and build a more structured common approach for the identification of emerging compounds and risk assessment of emerging substances, including all aspects related to the use of chemical and biological integrated approaches for the identification of relevant pollutants.

The global view

Jochen Mueller, The University of Queensland, Australia

Specimen Banking Programmes and/or specimen banks have been established in every continent. In order to find a good solution for an Australian ESB, seven well-established specimen banks in five countries were studied and compared. These ESBs were CWS in Canada, German ESB programme in Germany, NIST Time-capsule and es-Bank in Japan, Swedish ESB Programme in Sweden and NBSB-NOAA and CASPIR in USA.

In review comparison of the selected specimen banks, following items were emphasized:

- Reasons for establishing and operating the ESB
- Details of sample collection (species, frequency etc.)
- Sampling methodology
- Compounds that are subject to investigations
- Costs related to different components
- Procedures that govern access rights to the samples.

Establishment and development as well as budgets and facilities vary a lot between the studied ESBs, whereas the main purpose of each ESB is rejected to monitor of the condition of environment and/or research. Of the studied specimen banks, American, Canadian and Swedish specimen banks are focused on systematic monitoring and research, whereas German ESB and Japanese NIST (Time-capsule) are focused on systematic monitoring. Japanese ES-bank is established mainly for research purposes. In addition, German ESB and American CASPIR collect and store human samples.

Following questions and thoughts were raised from the review study:

- ESBs are an investment for the future
- ESBs can answer key questions related to human impact
- ESBs have their specific focuses (can be a key strength of the ESBs)
- Are ESBs getting bigger in future?
- Should industry take part in funding of the ESBs?
- ESB meetings and workshops are important to exchange ideas, harmonise methods and support each other as well as establish joint ventures for the future.

Session IV – HUMAN BIOMONITORING

Chairpersons and rapporteurs:
André Conrad (UBA) and Jochen Müller (University of Queensland)

Integrated Concepts in Environmental Specimen Banking

Georg Becher, Norwegian Institute of Public Health

Georg Becher's presentation on "Integrated Concepts in Environmental Specimen Banking" outlined advantages and limitations of human biomonitoring (HBM): HBM considers the overall exposure via different exposure routes. Moreover, it is an appropriate tool for identifying higher exposed risk groups and is able to indicate health threats before diseases become evident. HBM may, however, involve invasive sampling and is likely be costly when applied for large populations. HBM data may have a low informative value due to limited toxicological knowledge. Georg Becher presented several examples of retrospective analysis of stored human samples to environmental pollutants, such as PCB or PCP. He also outlined the current concept for a future Norwegian human specimen bank. Concluding his presentation, he accentuated the need for a harmonized approach on HBM in Europe.

EU developments towards a coherent approach to HBM

Marike Kolossa-Gehring, German Federal Environment Agency

In her presentation "EU developments towards a coherent approach to HBM" Marike Kolossa-Gehring discussed the current situation on HBM in Europe: HBM studies have only been conducted in some countries using different methods for analysing different pollutants. She introduced the COPHES project developing a coherent approach on HBM in the EU, meeting demands of the Environment and Health Action Plan of the European Commission. COPHES, which stands for Consortium to Perform Human Biomonitoring on a European Scale, was started in December 2009 and is scheduled to run for 3 years. A complementing feasibility study named DEMOCOPHES will demonstrate the feasibility of the harmonised approach by a pilot study in 16 EU countries. COPHES will give an overview on existing activities on biobanks in the EU, considers developing a general guidance for processing and storing human specimens, and intends to contribute to the follow up of the network meeting for EU-funded biobanking projects of 2008.

Discussion

In the discussion the participants acknowledged the need for bridging the gap between environmental pollution and health effects by combining human and environmental biomonitoring data. Efforts to internationally harmonize HBM should primarily focus on QA/QC measures. Moreover, extensive metadata complementing HBM results is necessary for sufficiently compare data from different countries. The demand for harmonisation should not lead to less diversity in international monitoring programs. An international variety of studies and approaches is vital for keeping a broad view on environmental and health-related topics.

Report from discussion group – What chemical?

Chairpersons and rapporteurs: Valeria Dulio (INERIS and Exec. Secretary NORMAN Association) and Gert Asmund (NERI Roskilde)

A list of questions was prepared before the discussion session. Special emphasis was given to emerging chemicals (i.e. less investigated chemicals) to show the differences with "well investigated chemicals", for which occurrence levels and time trends in the environment are already well known.

The first discussion topic was a reflection on the usefulness and added value of environmental specimen banks. The question was:

We are banking samples. But why?

The added value of environmental specimen banks can be summarised as follows:
ESBs allow fast analysis of large batches and, thanks to improvements in the performance of analytical techniques, it is now possible to carry out retrospective analysis of new / less investigated compounds with highly performing and harmonised techniques. We are able to better measure substances measured in the past and identify possible increasing trends.
ESBs are a useful support to policy-makers: thanks to the retrospective analysis of samples it is possible to check the effectiveness of emission reduction measures, such as voluntary measures applied by industry, or banning measures imposed by the legislation. And in particular in the case of REACh, ESBs can provide precious monitoring data to prove the effectiveness of the implementation of this regulation.
Impact assessment: the samples from ESBs can provide information on background reference and long-term effects by comparison of "new" samples with "old" (reference) samples: this is very useful in assessing the environmental impact of new industrial activities or accidents (e.g. oil spills).
Climate change: long time series to understand long-term processes and better identify the factors that could affect the changes.
One more advantage from storing the samples is that they can be kept for further analysis in the future: to broaden the scope of analytes (e.g. where we do not have enough resources at present).

What can we do to increase chemical & environment managers' interest in these samples?

A critical analysis was made of the actions to be put in place in order to increase chemical & environment managers' interest in ESBs.
The proposals were about reporting to public authorities and policy-makers not only case studies / success stories, but also examples showing how ESBs could be a vital tool in assessing the impact of, for example, oil spill accidents.
The recommendation was to report the message using simple, clear, policy-oriented communication, but at the same time referring to scientific data, publications.

What chemicals can we expect environment managers to be interested in analysing in future? And: What should we start analysing now that is not part of routine monitoring programmes?

There need to be clearly defined criteria for prioritising chemicals to be analysed. (Samples can, after all, be very valuable). The suggested criteria are:

- Substances that are persistent and suspected to be bioaccumulating (but for which environmental data are lacking).
- Substances that can be found at a great distance from their source of production or emission.

- Substances that “stay in the sample” (not volatile).
- Substances for which there is some evidence / suspicion of a negative effect on the environment.
- Candidates for the Revision of the Stockholm Convention: there is a demand for monitoring data from screening surveys.
- Results from effect-based analysis can also guide the choice of substances to be analysed.

At the same time, samples should be preserved not only for chemical analysis, but also to measure relevant endpoints (e.g. lyophilised samples are not suitable for molecular tests; liquid nitrogen would be more suitable). It is therefore important to consider also the endpoint(s) as a criterion for organising the priorities with which the samples should be analysed: i.e. “What endpoint do we want to measure: how many effects can we expect?”

Is there interest in compiling chemical data from the various ESB programmes for a case study, e.g. for PBDEs, PFCs, organotin compounds?

Participants were invited to express their views on the possibility of compiling chemical data from the various ESBs in order to prepare a case study (for example on PBDEs, PFCs, organotin compounds). There was general agreement on this proposal. However, it was stressed that this exercise should show the added value of ESBs, given that the main added value of storing environmental samples is that these samples can indicate long-term trends, compared to real-time monitoring.
Before starting such an initiative it will be important to first identify the differences among the data and metadata we collect.

Is there interest in generating occurrence data for emerging / less investigated substances for which we lack monitoring data?

This second proposal was also broadly welcomed by the participants. Harmonisation among the different ESBs, in terms of protocols and measurement methods used, will be fundamental for the success of such an initiative.
Possible funding should be looked for to support this initiative. However, participants agreed that it is important to start even if there not yet a large funded project (e.g. the European Commission FP7).

Report from the discussion group - What specimen?

Chairpersons and rapporteurs: Jaroslav Slobodnik (Chairman NORMAN Association) and Bernd Manfred Gawlik (Joint Research Centre IES, Ispra)

Environmental Specimen Banks (ESBs) are the result of a highly standardised sampling regime of environmental and biological/human samples on a routine basis for a distinct number of specimens. These samples are usually stored at very low temperatures or at least under conditions ensuring a maximum of sample stability. At any time the archived samples can be used to look back in time and generate time trends for environmental pollutants. The workshop had as an objective to provide an overview on the individual ESBs in Europe and to establish a Network of European Specimen Banks facilitating the cooperation with EU chemical safety management. The breakout session was addressing the proper choice of specimens to be time-capsulated in the ESBs. During this session, it was discussed how existing ESBs structures could be linked with the other pan-European and pan-regional monitoring campaigns.

A list of questions was prepared before the workshop. A detailed overview of the existing ESB projects and investigated specimens/matrices, selection criteria for ESB sites, SOPs (sampling, transport, storage, analysis) and endpoints was then prepared as a basis for the discussion session.

Special emphasis was given to selection of representative specimen types. It has been generally agreed that the specimen types from the various trophic levels should satisfy the following criteria equally well:

- Wide prevalence;
- Wide ecological valency;
- Sufficient availability;
- Indicator function for ecosystem-typical processes;
- Loyalty to a certain region or habitat;
- Genetic identity;
- High level of information;
- Sufficient resistance to pollutants;
- Sufficient exposure to pollutants;
- Reliable and assured identification.

The representative specimen types should be a set of widespread species which are available in all sampling areas (as far as possible). It is possible to use ecological replacements for these species in areas where they do not occur, however, these "replacement species" must have corresponding indicator functions for the respective ecosystem as ecosystem-typical species.

Among the general considerations discussed during the breakout session were:

What specimens/matrices are investigated in existing ESB programs?
On specimen level: What are the common denominators of the ESB concepts?
What kind of endpoints would we look at in a shared chemical analysis: time trend, spatial comparison, (P - persistence, LRT - long range transport, TMF - trophic magnification factor?)
What quality standards would a shared analysis require?
Would samples be available for a shared chemical analysis?

In the presentation by Heinz Rüdel was provided a comprehensive summary on the common limnetic denominators:

- Several European ESBs are covering limnetic samples as routine operation - sediments/SPM, mussels, fish, birds;
- Currently there are unfortunately only a few common aspects between different ESBs; major issues being:
- regional vs. national focus;
- sampling from rivers vs. lakes;
- background vs. polluted sites;
- usage of different fish tissues vs. whole fish;
- individual vs. pooled samples;
- usage of species from different trophic levels;
- potential to investigate biomagnification in the food web.

Considering that seven out of eleven ESBs with limnetic focus already archive fish samples it was suggested to use fish tissues (muscle, liver) as a common base. Bream and perch were mentioned as possible common species. Mussels (bivalves) were suggested as an alternative.

Otter tissue and eelpout were suggested as possible common denominators for terrestrial and marine specimens, respectively.

It was agreed that a general line of sample collection from terrestrial environment should include atmosphere, vegetation, consumers, predators, decomposers and soil.

Cod and seals were suggested as possible common species for marine environment in Nordic countries, however, it was unclear if the same species are sampled. In general, there was no common agreement on the use of common denominators for terrestrial and marine specimens.

Additional set of questions was targeting the following topics:

- Should new common specimens be added into ESBs?
- Is there a need for link to the policies?
- Is there a need for European atlas of reference sites (maps)?
- Should pilot campaigns/projects organized by NORMAN/JRC be coordinated with ESBs?
- Could data on emerging substances generated by ESBs be shared in common databases and reporting formats developed by NORMAN?
- Is there a need for harmonisation/standardization of sampling/analytical methods or just providing documentation of SOPs?
- Would ESBs need a European coordination?
- Would ESBs need a common communication strategy?

As an outcome of the discussion it was agreed that ESBs should focus on common criteria rather than on a particular specimen and make best use of the existing specimens.

General discussion

Chairpersons and rapporteurs: Valeria Dulio, Andreas Gies, Jaroslav Slobodnik, Jan Koschorreck

The attendants of the conference generally agreed that closer networking would be favourable for environmental specimen banking in Europe. This could lead to joint projects, e.g. chemical investigations utilising the banked specimens from several ESBs to share time trends and generate spatial overviews. Representatives of individual ESBs stressed the need for such projects, which might eventually lead to common objectives and visions. It was also mentioned that the diversity of ESBs is very valuable since it increases the responsiveness to environmental problems.

A communication to clients was recognized as an issue and a need for development of a communication strategy was stressed. ESBs already demonstrated their value within the implementation of the Stockholm Convention, however, it was generally appreciated that future projects need to be linked also to policies such as REACh (SVHC) and Marine Strategy.

Wider application of effect-based approaches and passive sampling were discussed by the participants as possible means to improve qualitative performance of ESBs. Another issue was a collaborative exercise that could gather ESB data for a chemical class or single compound and demonstrate the potential of environmental specimen banks.

An establishment of a Virtual European Specimen Bank was proposed as an organisational basis needed to coordinate activities of the ESBs. Options of an establishment of a NORMAN ESB Working Group or a Working Group of the Society for Environmental Toxicology and Chemistry (SETAC) were considered.

It was agreed to draft a letter of intent defining the scope and objectives of the European Specimen Bank Network (ESBN). In addition, it was decided to draft an ATLAS OF EUROPEAN SPECIMEN BANKs for environmental monitoring. This compendium should aim at a better visualisation of existing ESB monitoring sites. The activity could be linked to the JRC FATE activities. JRC IES was asked to coordinate both of these efforts.

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