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Evaluation of the Swedish national monitoring program for harmful substances

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The opinions in the report are the authors, and not the opinion of the Finnish Environment Institute (SYKE).

Preface

The Swedish Environmental Protection Agency (EPA) was requested the Finnish Environment Institute (SYKE) and its Contaminant Research Unit to make an evaluation of the Swedish national monitoring of harmful substances.

The Swedish EPA expressed their interest especially to certain aspects of the program to be reviewed and evaluated. The questions concerned;

- Valuableness of historical series of data on contaminants, present reality and prediction of tomorrows risks
- Role of the regional monitoring in supporting the national needs
- Status of national environmental objectives
- International reporting of contaminants
- Swedish-Finnish co-operation

The evaluation was conducted as a peer review based on the information given by the Swedish EPA in the meeting 8. March 2002 in Stockholm and supplemented later via Internet by Dr. Yngve Brodin and dos. Britta Hedlund and their co-workers in the Monitoring Section of EPA. The evaluation itself was based on the 1995 program. The 1999 suggestion "Övervakning av miljögifter" and other newer documents were also reviewed, but more generally because of missing official acceptance.

The evaluation team will thank the experts in the Swedish EPA who delivered material and gave valuable information for the evaluation purposes. Also warm thanks to Dr. Matti Verta in SYKE for his comments on the evaluation report.

Helsinki 20.12.2002

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Conclusions

The Swedish national monitoring system was evaluated to be comprehensive to produce solid information about classical pollutants on both spatial and temporal scales in the environment. Especially, the temporal aspect is well covered. It was also noticed that long-term collection of biota was very valuable part of the monitoring system – the biota series collected into the environment specimen bank (ESB) are of importance, not only to the Swedish, but also to the international environmental assessment work.

Regional monitoring programs were difficult to evaluate as a whole solid system. The programs could be seen as independent designs from each others and from the national monitoring system. It was noted that common management and geographical coverage of regional monitoring should be arranged and fitted better to the national monitoring. Regional resources could be used more effective e.g. for screening of new chemicals and in human health and urban monitoring.

The present monitoring programs on harmful substances are focusing mainly on banned chlorinated pesticides (OCPs) and chlorinated bifenyles (PCBs). However, most of these banned POPs ("old sins") are occurring below the critical concentrations in the Fennoscandian environment. This would allow sparser monitoring of these POPs. The resources will be adjusted more for designing, screening and monitoring of new generation chemicals demanded by the EU and the national policy.

The international reporting, assessment and actions on harmful substances will be based on several international conventions and programs, e.g. the UNEP's Stockholm convention on POPs from 2001. Therefore the continuation of some well established part of long-term monitoring of the banned POPs in biota is important. In addition, some of these classical substances like dioxins and planar PCBs are still an actual threat to the Nordic nature and human and should be monitored also in near future.

The Swedish-Finnish co-operation should be based on-going projects and future needs. Several examples were pointed out. It was recommended to promote approach like development of common databases on pollution loadings and water quality properties over the Northern Baltic Sea. Monitoring system should be prepared also for potential threat caused by 4-6 fold increasing oil and chemical transportation in the Baltic Sea. It was concerned need to make additional monitoring studies on key organisms of the Nordic biota (e.g. top predators – seal, razorbill, falcon, pine marten). There are good experiences to continue and develop monitoring of air pollution and its effects on Boreal ecosystems. Integration of different monitoring networks will increase understanding of combined effects, e.g. under changing climate.

Summary

The Swedish national monitoring (tradition) for environmental pollutants is widely considered as one of the most comprehensive in Europe. First monitoring related studies began in 1960s and the national monitoring program (PMK) was officially started in late1970s. The monitoring system has been developed gradually, according to discovered effects/threats of toxic contaminants to the environment, but the focus has been on concentrations.

The future will set new kinds of demands for monitoring. Already the program has undergone substantial changes since 1995. In addition to monitoring of existing contaminants, data are needed to predict the possible harmfulness of new chemical substances before they can cause damage in the environment. The concept of risk is introduced to the objectives of monitoring in the 1999 paper. Persistent brominated flame retardants (PBDE) are an example of new substance group, which should be monitored more extensively in biota, not only in precipitation.

A relevant way to decrease monitoring intensity of "old sins" including mainly organochlorine pesticides (OCPs), should be a focus for both scientific and policy discussion. Some of the OCPs have reached low levels often below critical limit for aquatic biota. Many time series have shown most of their "slope" already in 1970s and 1980s. This means statistically that you would need more time and data to show significant changes in the future. The importance to show significance has to be put in perspective if the environmental quality standards are not violated.

Many of the "old sins" like PCBs and related substances dioxins should be monitored also in near future because of their toxicity to biota and human in the Baltic Sea and in the circumpolar regions. Elevated dioxin levels in fish is a main reason that the EU Commission has decided to ban all commercial use of herring and Baltic salmon after 2006.

It is recommended to continue with collection of traditional long-time series of biota into the environmental specimen bank (ESB) for retrospective monitoring studies of new unknown chemicals. At the same time, new matrices should be studied. In the Baltic Sea environment, tissue samples (subcutant fat) from seals during legal hunting or when found dead, could be stored and studied. Sediment studies should be utilized fully for mass balance and modeling work. In the freshwater environment, pike should be considered more extensively as a top consumer, especially for Hg monitoring. In the terrestrial environment, the herbivorous reindeer, moose and small rodents are not the best indicator species for organic persistent pollutants. For that reason, top consumers (predators) like pine marten (*Martes martes L.*) or common shrew (*Sorex araneus*) should be considered.

Evaluation of the regional monitoring showed that quality and efficiency of monitoring in the counties gave picture of large variation. Monitoring is well coordinated at least in those counties that have had common projects with EPA. The counties have many monitoring projects of their own. Vast amounts of samples are

taken every year. The geographical coverage of local monitoring could be better. If the meaning really is to have a regional monitoring system that will complete the national monitoring, it will require more common planning and coordinative action by the Swedish EPA.

Evaluation of the international reporting showed that Sweden and Finland are signatories/reporting to same international agreements/programmes relevant to contaminants. It was proposed that razorbill (*Alca torda* L) eggs should be an additional common indicator for monitoring of contaminants in bird colonies in the Baltic Sea area (HELCOM). It was also considered that POPs should be measured at some IM stations in several compartments (deposition, sediment traps, biota). The data analysis and reporting should put more weight on the metals stored in the soil (humus) and risk associated with that (mass balances and modelling) (ECE/ LRTAP). The project "Global Network for monitoring of Chemicals in the Environment" seems to be a forum, to which Sweden, and other Nordic countries, could have plenty of information and experience to give (UNEP POP). In a circumpolar perspective, few lakes with very long-term data (Abisko, Storvindeln) and “master” station at Pallas could represent sufficiently the “clean northern Europe” (AMAP). The so-called Priority Substances (PS) within the Water Framework Directive will be a part of international reporting in near future. Swedish (and Danish) screening programmes have already been started which will benefit all Nordic countries (EU WFD).

The review of Swedish-Finnish co-operation pointed some former and on-going projects on contaminants. One major project is the Bothnian Bay Life -project aiming to establish common database for physical and chemical properties of marine and river water (incl. heavy metals and loading data). Readiness to study and monitor oil pollution should be of interest because of 4 to 6 fold increasing transportation of oil in the Gulf of Finland in 2003 - 2006. It was also supported the possibilities of the Pallas “master” station which should be utilized more and enhance monitoring and research of airborne contaminants both in terrestrial and in aquatic biota. Environmental problems (air pollution, climate change, loss of biodiversity) are more and more understood to link together, and so should be the monitoring activities. The aspect of integrating presently separate monitoring networks on larger (than small catchments) geographical area, should be discussed. Also it is worth to note if some of new EU WFD directed priority chemicals could be screened and monitored together in the common sea areas and the boundary areas of Sweden and Finland – this matter should also be a target for discussion and planning.

1 Introduction

The Swedish Environmental Protection Agency is a central environmental authority under the Swedish government. Its task is to coordinate and drive forward environmental work nationally and internationally.

In the beginning of year 2002 the Swedish Environmental Protection Agency approached The Finnish Environmental Institute (SYKE) with a request for SYKE to evaluate the Swedish monitoring of harmful substances. SYKE agreed to perform an impartial peer review on the current program. An evaluation team of three was chosen (Appendix 1). The main subject was to estimate whether the seven years old program should need changes to better meet the demands of today. The main focus was on national and international needs, but also the regional aspects were to be taken into consideration if they could support national monitoring.

2 Objectives of the evaluation

Since no specific evaluation criteria were given by the commissioner the evaluation team set its own. Criteria were chosen to best describe the character of the program and also on the basis of our expertise.
1. Relevance - Is the program fulfilling the task set to it.
2. Effectiveness - How effectively it does it.
3. Quality - How high is the quality in monitoring.
4. Flexibility - How easily changes can be made to the program.
5. Transparency –The yield of the program; reports, databanks.

Swedish EPA guided the work of the evaluation team by a set of questions. When commissioning evaluation, the Swedish EPA expressed their interest especially to certain aspects of the program to be reviewed. They were presented as following questions.

1. History, present and future:
a) Is the national monitoring able to give valid historical series, describe present reality and predict tomorrow's risks? Long-term series of measurements against the need to have a monitoring that can describe the state of environment and future risks to environment and human health.
b) How should the monitoring be arranged to monitor both substances that are restricted and substances that are not restricted but a possible threat to environmental and human health?
c) And how the regional monitoring should be modified so that it could best support the national needs?

2. Environmental objectives
Is the national and general monitoring of harmful substances organized in a suitable way to give adequate basis to the fulfillment of national environmental objectives?

3.International reporting
Is the Swedish monitoring of harmful substances formed in a suitable way to form a good basis to international reporting? It would also be appropriate to compare Swedish monitoring of harmful substances with some examples from other countries.

4. Swedish-Finnish (and Norwegian) co-operation
Could the Swedish and Finnish national monitoring be modified so that programs are more comparable or complement each other? Also a comparison with the Finnish monitoring program was a possible branch of review.

The original questions:
1. Historia , nutid och framtid
a) Är den nationella miljöövervakningen anpassad till kraven på att ge en god historik, beskriva dagens verklighet och bedöma framtida hot? Långa pågående tidsserier mot behovet att ha en övervakning som ger en bra bild av den aktuella situationen och framtida hotbilden för miljön och människors hälsa.
b) Hur övervakningen skall anpassas till att både bevaka ämnen som är förbjudna och icke förbjudna ämnen där hotet mot miljö och människors hälsa bedöms kunna öka?
c) Hur den regionala övervakningen bör utformas så att den på ett bra sätt stöder nationella behov?

2. Miljömålen
Är den nationella och annan övervakningen av miljögifter samordnad på ett lämpligt sätt för at kunna ge bra underlag för att kunna följa upp de nationella miljömålen?

3. Internationell rapportering.
Är den svenska övervakningen av miljögifter formad på ett sätt att bra underlag för internationell rapportering fås? Det ska också vara lämpligt att jämföra den svenska övervakningen av miljögifter med några exempel från andra länder.

4. Svensk-finsk (och norsk) samordning .
Kan den svenska och finska nationella miljöövervakningen modifieras så att programmen är mer jämförbara eller kompletterar varandra? Också en jämförelse med den finska övervakningen.

3 The evaluation procedure

Method:
The evaluation is conducted as a peer review based on the information given by the Swedish EPA in the meeting 8.March 2002 in Stockholm and supplemented later via Internet (by Britta Hedlund).

Information:
From the many documents we received the most relevant were chosen for a closer examination. These are presented in the Appendix 2.

The evaluation itself will be based on the 1995 program "Övervakning av hälso- & miljöfarliga metaller och organiska miljögifter".

The 1999 suggestion "Övervakning av miljögifter" and other newer documents were taken into consideration as a source of information, but they were evaluated more generally because of missing official acceptance.

In May 2002 a list of questions was sent via E-mail to EPA, which were kindly answered a few days later. Further phone-contacts between Juha-Pekka Hirvi and Britta Hedlund and Yngve Brodin clarified the work during evaluation.

Structure of this review:
The program in general is evaluated at first and after that comes a section where questions are answered in detail. Each question is approached on its own. All recommendations in brief are collected to paragraph 9. The facts behind findings are collected to tables that can be found in appendixes 3 and 4.

Monitoring of harmful substances is referred in this document to as monitoring. The other sectors of monitoring i.e. biodiversity are not considered in this evaluation thus misunderstanding should not arise.

4 Swedish national monitoring of contaminants

4.1 The national program

Findings:

"The aim of the national environmental monitoring in Sweden is to produce information about the state of the environment and provide a basis for following of environmental objectives." (As stated in Environmental Monitoring News 2000, 2).
The Swedish monitoring (tradition) for environmental pollutants is widely considered as one of the most comprehensive in Europe. First studies began in 1960s and the national monitoring program was officially started in late1970s.
The monitoring system has been developed gradually, according to discovered effects/threats to the environment. The historical monitoring is based on key species and best possible knowledge of their physiology and ecology.

The present national monitoring is mainly designed for long-range transported, banned, classical pollutants entering the environment diffusively (toxic heavy metals, organochlorine pesticides and PCB –related substances). Monitoring is concentrated to "clean" reference areas. The focus in 1995 was on concentrations, and only recently to biomarkers/ ecotoxicology.

The objectives of national monitoring of harmful substances were stated in the program in 1995 to be:

1. Measure the load/amounts of harmful metals and organic substances.
2. Discover long-term changes in background levels.
3. Determine background levels.

4. Detect geographically extensive incidents.
5. Fulfill international obligations.
6. Define distribution to a certain amount.
7. Describe prevalence for certain substances.
8. Regularly assess changes in levels of harmful substances in environment.

The impact of substances to environment is also noticed. "It is important that in addition to level measurements also studies for the effects are done."

By 1999 the list of aims has somewhat altered:
The monitoring-program should now be an instrument for international and national needs. Its aims being, (1) to measure the state of environment, (2) to follow the impact, (3) to prioritise actions, (4) to follow the effects of actions and (5) to identify and assess future risks.

Assessment:

Relevance
Measuring the state of environment is the historical task of monitoring. In 1995 the list of substances monitored contained 13 metals and four classical groups of organic pollutants. This monitoring strategy is similar in most other countries, but the risk climate is changing: various new contaminants enter the environment and other aspects have to be considered. New chemical substances are taken into use ceaselessly. Environment is burdened with substances whose behaviour in environment is yet unknown. Measurements of known pollutants alone are not enough. The need for impact-studies is growing. They are not as simple and straightforward method as measuring concentrations and therefore not as popular, but their value in present situation cannot be argued. In the year 2002 there were 3 different impact-studies going on, 2 of them at sea and one in freshwater.
More information is needed to identify and assess risks. The mechanism how the contaminants are spreading through the environment must be known. The present monitoring program is focusing on one or two indicators/matrices per sector. They give a rough estimate of the changes in one part of the environment, but the understanding of the whole ecosystem is lacking. The concept on integrated monitoring was referred to in the proposal of 1999, but no mention of it can be found later. The newer papers are contemplating on the flow of contaminants with the DPSIR-model. That will broaden the view considerably and thus better will enable risks to be predicted. The influence of this thinking is visible in the development of the program in recent years.

Effectiveness
As we studied the program a division between different sections became apparent. The effectiveness of monitoring is of high quality in the marine and freshwater-monitoring, mainly due to the long tradition. Terrestrial monitoring – as in most countries – seems to be still developing. The third distinguishable part was he monitoring of human health and urban environment. In 1995 it was just beginning - today it is progressing vigorously.

Sufficient geographical coverage: The task of national monitoring is to produce data from reference areas all over the country. The regional monitoring is stated (in 1995 program) to fulfil the missing places. As we studied the regional monitoring this does not seem to be the case. But the national net of sampling locations seems to be extensive enough to give a good overview. Only the lack of samples from southern coastal waters is puzzling.

Quality

The quality of monitoring rests on the manual "Handbook för miljöövervakning". It contains instruction for every section of monitoring. An Internet version is updated regularly. Detailed instructions are not to be found in it, but we would like to assume that what is stated in the "Handbook" also is carried out.

Flexibility

Flexibility of the program will be asked for in the future. The future sets new kinds of demands. The program has already undergone substantial changes since 1995. Urban aspects have grown notably. In addition to monitoring of existing concentrations, information is needed to predict the possible harmfulness of new substances before it causes damage in the environment. The concept of risk is introduced to the objectives of monitoring in the 1999 paper.

Transparency

Publications and databanks is the outcome of monitoring. Databanks collect, store and make available to all results from both national and regional monitoring. International co-operation in collecting information. EPA itself releases several publications per year and maintains pages in the Internet. We find this quite sufficient.

(Sustainability and Cost-Efficiency)

This item will not be assessed, but in near future there will be new chemicals/groups according to both EU's WFD priority list (33 substances) and national interest list (50-100 substances), which should be screened, and some of them will be monitored at regional basis and national basis after 2006. Industries and municipalities and "dischargers" will be in the first hand responsible for cost of the "recipient" control activities of new chemicals. The question of pesticide discharges from agricultural areas is still open. But several substances will demand also the attention and resources of national monitoring. Persistent long-range transported brominated flame retardants (PBDE) are an example of substance group, which will be included monitoring program at national basis.

Recommendations:

Will be presented later together with the paragraph of future.

4.2 History

Findings:

Ecotoxicological and monitoring studies began in 1960s when also the concept for environmental specimen banking (ESB) was introduced at the Swedish museum of natural history in Stockholm. ESB became a part of the present national contaminant-monitoring program in 1979 when the monitoring (PMK) officially started under the authority of the Swedish Environmental Protection Agency (EPA) (Odsjö 1993).

First samples for monitoring purposes were pike and starling. In the beginning (Year 1967) the samples were collected from only one or two places but in 1970s several new monitoring sites were added and in 1980s extensive national monitoring was going on. Since then environmental specimens (>130 000) have been collected continually and stored as reference material for long-term monitoring studies of pollution and for future retrospective studies of unknown (new) chemical contamination. Several series of biota are still collected to the specimen bank even after the monitoring has finished.

In 1960s and 1970s, the national monitoring studies were designed for persistent pollutants, mainly organochlorine pesticides (e.g. DDT) and PCB –related substances and mercury (Hg). In 1980s monitoring of lead (Pb) and cadmium (Cd) started. The choice of substances was based on ecotoxicological findings. It was Swedish researchers who discovered that these substances occurred in very high concentrations in biota samples from several different species and thus causing severe effects especially on Baltic Sea biota as seals, white-tailed eagle and osprey. About 80 % of female seals were infertile and showed pathological uterine changes which were mainly correlated to high levels of PCBs. The results of these studies were the banning of all use of PCBs, firstly in “open” products of sealants, paints and plastics, later in “closed systems” like capacitors and transformers. Also use of DDT was banned in 1970. The concentration levels of DDT and PCB in biota have been decreased since 1970s. However, these classical toxic chemicals are still actual threats to Arctic fauna and human health, which was stated, in the main report from the Arctic Monitoring and Assessment Programme *(AMAP 2002)*. There is urgent need to implement international agreements on persistent organic pollutants and heavy metals. Levels of PCBs in some wildlife are high enough to cause subtle effects on the immune system and this may even be true for children in some areas. Other PCB-risks include effects on brain development and reproduction.

The quantities of PCBs in the sediment of the Baltic Sea are calculated to several tens of thousands of kg and there are estimations on annual fluxes being over 1000 kg between sediment – water –air (Bernes 1998). PCB-related substances like dioxins are still occurring in elevated levels in salmon and herring which is a reason that EU Commission will ban all commercial use of these fish species caught in the Baltic Sea after 2006.

Recommendations:

- PCB –related substances are still a major potential toxic group of chemical for the Baltic Sea biota and also for wildlife and human in the circumpolar regions. Thus PCBs must be monitored in near future, too. Levels of PCBs and dioxins detected in fish are following actions from the EU Commission, e.g. banning commercial use of herring and the Baltic salmon.
- There are still many gaps in knowledge about effects of PCBs. More studies are needed.
- Hg was reported to be a threat to wildlife and human in circumpolar regions in the UNEP Assessment and AMAP in 2002. Hg monitoring will be continued also in future. Levels of Cadmium (Cd) in Boreal forest environment and ecosystem are reported to be high enough to cause problem, although the emissions from pollution sources have declined during the 1980s and 1990s.
- Keep ESB ongoing, even after decision of space out the chemical analyses.

4.3 Present program 1995-2002

The aim of this evaluation is to assess the 1995 program, but because the monitoring has changed so much since then – and the information is available – also the later developments are taken into account. Especially, sectors concerning monitoring air and health and urban environment are developing so fast that evaluating just the 1995 program is inefficient.

Since the program itself is divided to sectors, we will follow the same division and approach the subprograms accordingly. Observe that monitoring of human health and urban environment is not included in the mandate of SYKE in Finland, why it was also out of the expertise of the evaluation team. These sectors are therefore less developed.

Sea and coast

Findings:

- The substances measured with high intensity (every year) cover the well known pollutants in 1995 (heavy metals and four organic substances/groups (PCB, DDT, HCH and HCB)
- Guillemot has been monitored for 24 years and has a significant role in open sea monitoring
- PCDD/F (dioxins) are monitored relatively sparsely, both in time and space (herring, guillemot egg)

- Screening of PBDE and HBCD (brominated compounds) has started extensively (herring, guillemot egg, cod, blenny) in 2001 (Redovisning 2002)
- Other new compounds are screened less extensively (PAH, phenols, CBs phthalates, pesticides)
- Impact-studies started in 1995. The health of perch is monitored in two locations and deformations in embryos in *Monoporeia affinis*. These show that though impact-studies are not regarded as an objective in the 1995 program they are taken into account

Swedish coastline is long including a variety of biotypes. Common indicator-species are difficult to find. Furthermore coastal waters receiving pollutants from rivers and human activity in general complicate the finding of comparable unaffected reference sites. That may be the reason for relatively few sampling locations. At the coast perch is sampled only in two locations. The monitoring program states that results from national monitoring are used as reference data to regional monitoring and that the regional monitoring in its turn gives national monitoring more geographical coverage. But - as stated later in the section concerning regional monitoring – that is not exactly the case.

- The top of the food chain for coastal areas is missing (cod is open sea species)
- In the case of seals and sea eagle only changes in the population itself and in their environment are mentioned. No actual samples are taken and analyzed?
- Bottom sediment stratigraphy is a cost-effective way for surveying both spatial and temporal trends. This is mentioned as a pilot program.

Recommendations:

- Consider more sparse analyzing program for banned, classical POPs and most metals (keep Hg and Cd)*
- Sampling to ESB could still be annual
- Keep key species with known physiology and ecology
- Keep few longest and most valuable time series annual (for international forum)
- If possible, in addition to present monitoring also collect and analyze tissue samples from seals, which will be hunted legally or found, killed, for instance subcutant fat. This is mentioned in HELCOM Combine program as Swedish and Finnish activity, but was not found in other documents
- Dioxins are a possible health risk, should be reflected in monitoring more extensively. Recent studies show that careful age determination is crucial to reduce the variability in fish of same nominal size (length). Therefore age should be standardized preferably before chemical analyses
- Contaminant analysis in different age classes (>4yr) would facilitate human exposure assessment
- Sediment studies should be utilized fully for mass balance and modeling work

* Some of the banned POPs (mainly pesticides) have reached low levels in many locations, matrices and species. According to present knowledge, these levels are below critical limit for aquatic biota. The growing populations in the top of the food chains at least indirectly support this. In this situation, the monitoring could be

returned to screening level activity. There are other possibilities in DPSIR circle to assess the risks than looking at the significance of trends in concentrations. Many time series have shown most of their "slope" already in 1970s and 1980s. This means statistically that you would need in future more time and data to show significant changes. The importance to show significance has to be put in perspective if the environmental quality standards are not violated.

Freshwater

Findings:

- Water-samples are analyzed only for metals (incl. Hg), and with a similar extent and intensity as in Finland
- The actual number of sites for chemical monitoring in tissues is difficult to evaluate due to recent cuts (temporary?) in time series (Redovisning 2002) This seems an indication of what we are recommending below
- PBDE has been analyzed retrospectively in pike
- PCDD/F (dioxins) are monitored relatively sparsely, both in time and space
- Screening of PBDE and HBCD (brominated compounds) in perch have been started in 2002 (Redovisning 2002)
- Other new compounds are screened less extensively (PAH, phenols, CBs phthalates, pesticides)
- Sediment survey of 100 lakes gives extensive regional coverage
- Groundwater monitoring seems rationally argumented

Recommendations:

- Consider more sparse analyzing program for banned, classical POPs* and most metals (but keep Hg)
- Sampling to ESB could still be annual
- Keep key species with known physiology and ecology
- Keep few longest and most valuable time series annual (for international forum)
- Pike should be considered more extensively as a top consumer, especially for Hg monitoring. Same species (*Esox lucius*) is also distributed in North America. Mercury is the potential health risk through consumption of freshwater fish.
- Sediment studies should be utilized fully for mass balance and modeling work

*Some of the banned POPs (mainly pesticides) have reached low levels in many locations, matrices and species. According to present knowledge, these levels are below critical limit for aquatic biota. In this situation, the monitoring could be returned to screening level activity. There are other possibilities in DPSIR circle to assess the risks than looking at the significance of trends in tissue concentrations (e.g., emission inventories, air/deposition measurements). Many time series have shown most of their "slope" already in 1970s and 1980s. This means statistically that you would need in future more time and data to show significant changes. The

importance to show significance has to be put in perspective if the environmental quality standards are not violated.

Air

Findings:

-Monitoring of air at background stations provides data mainly to international forums and is thus discussed in section 7. The analyses in EMEP stations cover metals and organic substances (including some flame retardants) both in air and rain. The moss survey serves international purposes similarly and is discussed in section 7.

Terrestrial environment

The tradition of terrestrial monitoring has based on analyses of OCPs and PCBs in starling in the cultivated areas since 1967 and followed with monitoring of heavy metals in moss every fifth year since 1970. Collection of samples from herbivorous reindeer and moose completed the national contaminant monitoring in 1980s and 1990s. The fauna samples are annually collected and stored in the specimen bank. It is important to maintain long-term series of fauna for retrospective studies. Other work done in this sector has been more like screening or contamination studies than real monitoring e.g. monitoring quality of precipitation over land areas, screening pesticides, lead and cadmium in agricultural fields and crops, monitoring geochemical changes in soil and groundwater, and studies on contamination of game birds and some endangerous top raptors of birds (falcons).

It would be noted that although Sweden and Finland together have 200 000 – 300 000 lakes, the water covers only 10 % of the total land area. This means that terrestrial ecosystems will be firsthand targets for persistent air-borne contaminants. It is important to know loadings, mobility, enrichment and effects of these contaminants through terrestrial system. Top predators (end-point animals) will describe tendencies for bioaccumulation via food chains.

In 1995 terrestrial environment was represented as one subprogram. In 1999 it was divided into fjeld (mountainous), forest and agricultural areas. We will follow that division.

Fjeld

Findings:

Monitoring of harmful substances in the fjeld areas consists only of samples from reindeer. PCB, DDT, HCH, HCB and dioxins were measured from 1988 to 1995. Analyses of heavy metals started 1983 and have been continued until to present.

According to information from the national museum of natural history (Naturhistoriska Riksmuseet), analyses of classical organochlorine pesticides (e.g. HCHs) in reindeer were not necessary to continue because of their low concentrations and decreasing trend during 1990s (pers.comm.Tjelvar Odsjö, NRM). However, reindeer tissue samples have been continued to collect into the ESB.

Assessment:

Reindeer as an herbivore animal is living at quite low trophy level in food chain and therefore it does not accumulate very much of loading of persistent organic pollutants with exception of persistent HCB (AMAP 2002). However, toxic heavy metals like Cd can be accumulated in kidney and liver in reindeer and this is a matter for future monitoring and screening of reindeer

Recommendations:

1. Keep specimen banking of fjeld fauna going on. The monitoring, screening and control of heavy metals should be continued by the state food administration (state veterinary institute), because reindeer is an important source of human food and can accumulate heavy metals and radioactivity. Mountainous areas are often very sensitive environments for different kind of pollution situation, e.g. soils and waters have poor buffer capacity against acidity (attacks) with following increase in metal toxicity to biota. Food chains are simply and short and so on are the interactions and pathways of contaminants between biota, soil and air.

2. Also samples of big predators like brown bears (*Ursus arctos* L.) hunted legally should be screened for environmental contaminants – a statement should be included the hunting law.

Forest

Findings:

Survey of forest soil and vegetation: 23 000 sampling stations from which 1000 and 300 samples are taken once in 10 years (i.e. 100 samples/year of humus and 30 of mineral ground).

Measurements of heavy metals and organic pollutants (the famous 4) in moose have been conducted in Grimsö research station since 1980 and in seven monitoring sites since 1996. By the time 2002 the organic substances have been dropped out and only metals are measured at present.

Small rodents (bank voles) have been in focus for indicator studies. Common shrew (*Sorex araneus*) was studied for metal contamination in the middle of 1990s, but it is not including the monitoring.

Assessment:

Top predators are totally missing in the monitoring program. It has been proposed to start monitoring of contaminants in small rodents. However, bank vole and also moose are both herbivorous i.e. 1st level consumers, which have been proven to be poor indicators especially for persistent organic pollutants (POPs).

Recommendations:

1….A top consumer (predator) should be studied and added in the national monitoring of heavy metals and persistent organic pollutants. Such species are e.g. pine marten (*Martes martes L.*) or common shrew (*Sorex araneus*).

Pine marten can be compared to top predator like one-kilo pike in water ecosystem. It is harvesting in quite large area of forest. The hunting is legally allowed and number of animals trapped annually is about 5000 -10 000 in Sweden (see the hunting statistics).

Common shrews are most abundant mammals in boreal forest. Population density is quite stable compared to that of bank voles. Shrews as insectivorous animals will be indicators for contamination of upper layer of forest soil and humus. The contaminants accumulated (deposited) in humus are reflecting in shrews, giving information about potentiality of different toxic substances to bioaccumulate in food chains. Enrichment factors of persistent organic pollutants in shrews related to humus are varying in values from 10 to 200 (Henttonen et.al. 2002). Life span of shrews is short which makes it easier to control accuracy of samples. The results will also show rate of natural cleaning progress of boreal environment after long-term pollution with heavy metals Pb and Cd.

2…If small rodents were taken to monitoring, it would be recommended to monitor also humus in the study areas.

Agricultural land

Findings:

Measurement of chlorinated pesticides in starlings was conducted in one southern site already in 1967, and extended to several monitoring sites in 1980s.Soil and crop inventory from 2400 samplings places.

Recommendations:

Analyses of pesticides are very expensive. Monitoring should be designed separately to every pesticide group. Most of the substances are third generation pesticides; their persistence in natural environment is low which means that occurrence is very dynamic after administration to environment. Analyses on matrixes of biota will not give any response or are below detection limits. However, effects on biota especially in cases of accident can be serious. Monitoring will be based on case studies and risk evaluation in some of well chosen cultivated areas. These activities will be included as a part of the EU WFD process in Sweden.

Health and urban environment

Findings:

In 1995 the program was at the beginning, still forming. Just some pilot studies. But in 1999 situation looked different.
- Metals in the blood of pregnant women and in mother's milk.
is still continuing
- Organic substances in mother's milk.
- Quicksilver in fish – a study on the risk group of people eating large quantities of fish.
- Other risk groups.
- Monitoring the quality of air in urban areas. Several organic substances.
And in 2002 list grew still with:
- Human-biological specimen-bank.
- Lead in blood of young people.
- Carcinogenic substances in urban areas. Exposure and concentrations.
All together 12 subprograms. And listed as one-year project 11 more.

Assessment:

Rest of the national monitoring is concentrating in reference concentrations, how does that approach fit in here? Does this section have a different list of objectives? That we could not find.

Unfortunately, we couldn't evaluate this section adequately, because the evaluation team does not have enough expertise on this field. In Finland Institute of National Health performs monitoring of health.

4.4 Future

The future of monitoring looks quite different to the situation in 1995. The enormous amount of chemical substances in use today and in future affect environment in ways that we have now only a presentiment. To keep up with the situation thorough changes in the monitoring are needed.

Some of the changes are caused by pressure outside EPA i.e. international and national obligations. Monitoring is facing a long list of new substances with demand of information on their existence and concentrations in Swedish environment. New methods and resources are needed. The screening will grow enormously.

But the problem must be approached also from different direction. The monitoring of more concentrations of known pollutants is not enough today. Environment is full of chemical substances. Many of them do never rise to harmful levels, but together combined with different physical and chemical conditions can break the resistance of organism/environment. Most of the "old" pollutants were discovered when animals began to die or deformed young were born. Such dramatic events we do not, hopefully, find anymore, but the key to the state of environment is still in monitoring the well being of organisms in the environment. Internationally used DPSIR-model takes into account all aspects of environmental risk. So far monitoring has taken into account the state of environment. Now "Pressure" appears in the form of a long list. "Impact " must be found out yourself.

As a result monitoring is faced with many new tasks. And that demands new resources and to some extent reorganizing of the old.

One of the questions EPA set for the evaluation team was how could EPA monitor both the substances that are forbidden as well as the substances that are not.
As noticed before, some of the banned POPs (mainly organochlorine pesticides) have reached low levels in many locations, matrices and species. According to present knowledge, these levels are below critical limit for aquatic biota. In this situation, the monitoring could be returned to screening level activity. Thus the monitoring intensity and choice of matrices are concern for discussion. Do we need an emergency level –monitoring (collection and analyses once or more per year) or can we go down in intensity and frequencies to make analyses on specific indicator species every third or fifth year (survey type of monitoring)?

The national environmental objectives set an aim to create a list of 100 chemicals by 2015 and five years later a list of all harmful chemicals in Sweden.
EU WFD has given strict timetable for setting up a preliminary national priority list (e.g. end of the year 2002, Finland). The assessment and possible screening results in environment and recipients will be presented at national bases in the end of year 2004. Setting up monitoring program for those most harmful chemicals which have been chosen for that purposes, must be going–on already in 2006. These tasks will no doubt affect the monitoring more than present-day lists.

Recommendations:

- The present monitoring with its long historical lines of measurements of biological material is valuable and should be continued. ESB will be helpful also for screening of new chemicals.
-Careful planning for screening is needed. Large number of new chemical substances will be screened in near future, which needs careful planning because of limited resources.
- The quantity and quality of impact-studies should be increased.
- New matrices/indicator species could be considered to add to the monitoring program.

5 Regional monitoring of harmful substances in the Counties

5.1 The information

The information we received from EPA

The county-monitoring programs for 2002- 2006 (1)
Regional miljöövervakning – Fördelning av medel år 2002 (2)
Övervakning av hälso & miljöfarliga metaller och organiska miljögifter (1995) (3)
Övervakning av miljögifter (1999) (4)
National Environmental Monitoring , 2000, no. 2 (5)
17.5.2002 a list of questions was sent to NV to which answers were received from Yngve Brodin and Brita Hedlund few days later. (6)

Quality of the information

The county-monitoring programs (1) vary; some contain only plans and scenarios some give more precise information. Some of them don't mention harmful substances at all. None of them gave us financial information.
The "Regional miljöövervakning-paper" (2) contains all monitoring. It is very difficult to find and separate harmful substances. Only those marked "miljögifter" could be separated.

The NV program (3) sets general guidelines, on very non-specific level.
The contact taken to EPA (6) provided much useful information.

Choice of county monitoring programs

There were 19 county programs and not enough time to study them all. Therefore we chose only 8. The selection criteria were geographical location (in the south, middle and north), inland and coast, densely populated areas and sparsely inhabited. The counties thus chosen were: Norrbotten, Västerbotten, Västernorrland, Dalarna, Västra Götaland, Örebro, Jönköpings and Kalmar. In addition from Stockholm-county we included the part that concerns health since that subject seemed to be less represented in county programs.

5.2 Evaluation

Findings

Some observations on the monitoring done by counties. Our findings in more detail can be seen in appendix 4.

Quality (methods, analyses, data)
The grant EPA gives to counties expects that the methods in the Handbook and accredited laboratories for analyses will be used in those studies. The data thus accumulated is sent to national data hosts usually connected with universities. That part of the local monitoring seems to be of good quality.
But the RMHS outside EPA:s control seemed more vague. Only 4 of the counties studied mention the Handbook or any specified methods in their programs. Accredited laboratories were mentioned in 3 programs. Data hosts were mentioned in 6 programs. Either quality control in counties was just not mentioned in the programs or it is not very good. With this material and limited time we cannot know.

Efficiency (the yield)
The EPA receives written reports from at least those monitoring programs they support. The raw data from some monitoring programmes, chosen by the EPA, is sent from the counties to a national data host were it is accessible to all. That part seems to be working well.
The data from local monitoring outside EPA:s funding stays in the counties. How those results are made public is not clear. Anyway it is in the decision of counties themselves. Most of the studies are done as recipient control and therefore are not very interesting in the national scale.

Geographical coverage
The EPA-program (3) states that the aim of local monitoring is
"- to provide information about the state of regional environment, the present situation as well as the trends.
- to give an estimate of the scope of possible threats to environment.
In some cases the local monitoring can add to the national surveys."
The national monitoring program of harmful substances is said to do most of the studies. In the next paragraph however it is said that *"apart of the background-*

measurements it is not necessary to have a national monitoring at all - the local programs cover geographically larger areas than national."

What we found was not quite so. The counties seem to do what they want in MHS. A little quicksilver-measurements here and a little moss-measurements there. The list of MHS projects in the paper Övervakning av Miljögifter (ref 4, p. 21) from 1997 endorses that impression. It looks like the counties are not doing much in monitoring of harmful substances - according to the programs for years 2002-2006 (1) almost half of them nothing. If this is really the case the usefulness of RMHS is not very good and the task of monitoring lies on the national program.

Coordination

The county-programs mention legislation: Miljömåls and Miljöbalken and some of them even EU-directives as guidance of action, but not EPA. The task of EPA is to guide and inform the local municipalities what to do (6) so that they can fulfill those demands. The counties however send their monitoring programs to EPA (only to be noticed?)

The money spent on regional monitoring comes from many sources. EPA grants constitute usually less than 30 % of the money; the rest comes from the counties themselves or other sources. In 2002 EPA granted 10 counties with the total sum of 1,4 mil. SEK. The grants given out are the only way EPA can direct the MHS done locally. Understandably the counties are not willing to accept new tasks if financial support is not included.

Assessment:

The quality and efficiency of the monitoring in counties are at a very good state. At least those counties that have had common projects with EPA are used to produce data that is good enough to be compared with national data. That means that there is a useful "machinery" i.e. stations and competent staff (and laboratories?) capable of producing data. The counties have many monitoring-projects of their own. Vast amounts of samples are taken every year. There is a lot activity going on. That could be used more also by EPA. A possibility to "commission" more researches to be made at local level are worth a look. It would probably also cost less than to hire a special staff for each national monitoring effort separately.

The geographical coverage of local monitoring could be better. If the meaning is really to have a regional monitoring system that covers the whole country it will require some planning from EPA.

The list of environmental objectives affects also the future of regional monitoring. Many of the new substances will require a different kind of monitoring-plan. At the present substances that are produced by human activities and thus best found in urban areas are monitored by regional monitoring or by industry themselves as recipient control. EU WFD gives a strict timetable to follow up, harder than proposed in the Swedish environmental objectives.

Recommendations:

- Enhance the geographical coverage. For instance by:
either a) to use local monitoring to “fill in the gaps” in the national monitoring-net – and/or even partly replace it,
or b) to have a separate plan where the counties all measure the same thing but in turns – few counties per year (to save money). But finally it would yield a big picture that covers the whole country. We believe that is what is happening in the other fields of monitoring. One good case could be the health and urban related monitoring.

- The effect of environmental objectives:
Since the new "lighter" screening-method for new substances is not yet ready it is hard to predict its effects on regional monitoring. Who will take the responsibility of this new screening is one of the main questions. Our recommendation would be to contemplate the possibility of involving regional resources to the task.

6 Environmental objectives

Findings:

In 2000 the Swedish parliament set fifteen objectives, which the authorities should strive to achieve within the next 20 years (Regeringens proposition 2000/01:130). Of them we found the following ones to contain directions concerning harmful substances. Objectives 2,4,9 and 15 concern the human health directly and objectives 2, 4, 8 and 10 the health and production-ability of the natural environment.

2. CLEAN AIR - FRISKT LUFT:
"Luften skall vara så ren att människors hälsa samt djur, växter och kulturvärden inte skadas."

4. A NON-TOXIC ENVIRONMENT - GIFTFRI MILJÖ:
"Miljön skall vara fri från ämnen och metaller som skapats i eller utvunnits av samhället och som kan hota människors hälsa eller den biologiska mångfalden."

8. FLOURISHING LAKES AND STREAMS - LEVANDE SJÖAR OCH VATTENDRAG:
"Sjöar och vattendrag skall vara ekologiskt hållbara och deras variationsrika livsmiljöer skall bevaras. Naturlig produktionsförmåga, biologisk mångfald, kulturmiljövärden samt landskapets ekologiska och vattenhushållande funktion skall bevaras samtidigt som förutsättningar för friluftsliv värnas."

9. GOOD-QUALITY GROUNDWATER - GRUNDVATTEN AV GOD KVALITET
"… uppfylla gällande svenska normer för dricksvatten av god kvalitet med avseende på föroreningar orsakade av mänsklig verksamhet."

10. A BALANCED MARINE ENVIRONMENT - HAV I BALANS SAMT LEVANDE KUST OCH SKÄRGÅRD:

"Västerhavet och Östersjön skall ha en långsiktig hållbar produktionsförmåga och den biologiska mångfalden skall bevaras. Kust och skärgård skall ha en hög grad av biologisk mångfald, upplevelsevärden samt natur- och kulturvärden ..."

15. A GOOD BUILT ENVIRONMENT - GOD BEBYGGD MILJÖ:
"Städer, tätorter och annan bebyggd miljö skall utgöra en god och hälsosam livsmiljö samt medverka till en god regional och global miljö …."

Assessment:

All objectives above require information of the state of the environment. To be able to follow the changes in the state of environment, precise quantitative information is needed and that can monitoring give. Especially the 4th objective – a non-toxic environment - could not be achieved without monitoring. But at the present monitoring concentrates mainly in substances that are already more or less forbidden and thus not in use anymore. The 4th objective requires much broader scale of substances to be monitored; not only substances that have been used but also those that are in use today, but are not yet known to be harmful, and those that will be taken into use in the future. That would require a substantial increase in monitoring.

EU WFD will give a priority list of 33 chemicals for environmental screening. Every member country will also give national priority list for assessment and screening. How well these two lists of chemicals is matched together with a list proposed in the environmental objectives, must be checked and harmonized to avoid double work with near future planning of contaminant screening and monitoring.

The achievement of 4th objective also needs an increase in monitoring-locations. In addition to monitoring of background levels information is needed also about the levels of substances nearer the possible emission-sources. That is, to some extent, done by industry themselves and is now done under regional monitoring but it might need to be enhanced and taken more into national control.

The third notable difference to present monitoring is brought up by the Chemical inspection's report Giftfri miljö. That is broadening of the concept of environment. Chemical-inspection has included in the environment not only natural and urban environment, but also the environment indoor, even the environment in working places.

Recommendations:

- More substances to be monitored:
A priority-list of substances is being made and should be ready 2015. Most likely it will be a long one. Subprogram 5 in the 4th objective calls for a flexible system for monitoring substances in the priority-list. Chemical-inspections report (giftfri miljö) mentions that the same efficiency as in present monitoring is not required. What is meant by not being of same efficiency is not clarified but it is obvious that a different kind of method is needed for monitoring all these substances - a lighter method that begins as screening and then continues longer if considered necessary. Lowering the

standards of the whole monitoring is not recommendable. Though changes will, no doubt, be needed in the old/"actual" monitoring when new harmful substances are found through this process.

A suggestion:
At first a wide screening to find out whether the substance occurs at all. Sample locations need to be carefully chosen. Preliminary information is needed about the substances: their physical properties, possible bioaccumulation and effects. Furthermore where is the emission source and if /how does it spread through the environment. With that information can suitable indicators and locations be chosen? Few locations and one (or two) indicator(s). (The old screening method involves several indicators, but analyzing many samples is costly and employs resources, which will be taken from some other part of monitoring.) And finally if the substance is found then follow the chances in concentrations at suitable intervals at the best places.

- More/new locations:
If the ultimate aim is low concentrations in the environment new substances should be measured near the known emission source. That way sampling location need not be changed later. Who should do the monitoring of these emission-locations remains a question. Two different ways could be applied. Today monitoring of industrial emissions are done outside national monitoring locally by industry themselves or by regional monitoring. In our opinion the possibility that these parties could undertake also this new task is worth investigating. The second way is to do it yourself – as an addition to the current monitoring - at least in the first stage of the screening. If permanent monitoring locations are set up, then co-operation with the local monitoring could be topical.

- The concept of environment:
Today environmental monitoring contains only natural and lately also urban environment. But to include also environments as indoors and workplaces is a novel/strange idea. Monitoring environment indoors can surely be left to authorities that have done it till now.

- Method-development:
New substances will emerge that do not have analyzing methods ready. Co-operation in method-development with other countries could be worth a while.

Screening effort could also be shared, at least in the case of air-borne substances, which could be done together with other northern countries.

7 International reporting

7.1 Comparison to other countries

For several reasons, there are not many relevant countries to compare the Swedish monitoring network as a whole. The geographical neighbours to compare with are the other Nordic countries and in a hemispherical perspective, U.K. U.S. and Canada. These are also socio-economically comparable areas. Of these "benchmark candidates", we feel that we have too little information of the North American monitoring systems to make any comparative analysis. Denmark and U.K. have extensive monitoring on hazardous substances, but their natural geography, biota and e.g. land-use may deviate, as a whole, from the Swedish too much. This characterisation applies to the Netherlands as well.

In this assessment Finland was for practical reasons selected as the reference country.

Finland has lower number of ecoregions, but they all are represented in Sweden. Both countries are also signatories/reporting to same international agreements/programmes relevant to contaminants (HELCOM, ECE /LRTAP, UNEP POPs, AMAP, EU/WFD).

7.2 Relevance of Swedish monitoring for international conventions, programmes and cooperation

7.2.1 HELCOM

The convention on the Baltic Sea is the oldest of those discussed here. Therefore, it has the longest history of building up a comprehensive impact/environmental monitoring for contaminants. The monitoring programme is in continuous process to be harmonized with the OSPAR (JMP). Therefore, we focus here on the monitoring of Baltic Sea, with common cooperative countries with Finland.

Findings:

- Sweden has very long-term monitoring history on the Baltic Sea biota, where the first symptoms of DDT and PCB were discovered
- SWE National programme and earlier research is rather clearly reflected in the HELCOM /MONAS/Combine –monitoring activities (and vice versa?)

- The monitoring recommendations concerning sites, species, frequencies, number of analyses, sample handling have been developed to fairly detailed level and presented in well documented manuals, (with countries commitments)
- The Swedish programme is more comprehensive than that of Finland, and they are not fully compatible with each other and with other countries (how?)

Recommendations:

-Consider seals in open sea monitoring as a top predator (if hunting is allowed) Observation: PCB –related substances occur still in 100 times higher concentrations in the Baltic seals compared to Northern Atlantic seals (Nyman 2000).
-Consider razorbill eggs as a common indicator for monitoring of bird colonies in the Baltic Sea area. Guillemot is classified as threatened species in Finland, and it cannot be used for regular monitoring purposes

7.2.2 CLRTAP

Under the Convention on Long-Range Transboundary Air Pollution, the Protocol on Heavy Metals was signed in 1998. Although monitoring of acidifying pollutants has been continuing in international level since mid 1980s, the reporting on heavy metals has been more common not until ca. 10 years later. Monitoring guidelines/manual for persistent organic pollutants has been developed only in the air-monitoring network EMEP (European Monitoring and Evaluation Programme).

Atmospheric environment:

Findings:

- Part of the EMEP-activities are obligatory to Parties (countries) of the Convention
- Heavy metal deposition is measured at four stations which seems sufficient to get national coverage of background areas in Sweden
- POPs are measured at three stations, which provides at least as good coverage as four stations for heavy metals
- All essential parameters are included in the Swedish programme

WGE
Under Working Group on Effects, There are several International Cooperative Programmes relevant for contaminant monitoring (ICP/Waters, ICP/Forest/, ICP/Vegetation and ICP/IM and ICP Modelling and Mapping). WGEs Programmes are preparing a common assessment on heavy metals for the first time (due 2002). When that report is available, better overview of the countries activities is seen. Considering the POPs, there are presently no active monitoring demands, and no reporting to Data Centres either in ICP Waters (NIVA) or ICP IM (SYKE). However, both groups are considering the aspect in their future work, probably for

2004. To our knowledge, ICP Vegetation, ICP Forest and ICP Modelling and Mapping have no near-future schedule for POP monitoring.

Freshwater environment:

On international level practically only heavy metals in water have been reported and assessed. ICP Waters and ICP IM, both have heavy metals in their manuals, but reporting is not yet well established and the obligations and commitment relatively weak.

Findings:

- Sweden has similar level of activity as FIN in monitoring of metals in water
- SWE has much broader data sources for effect-based approaches concerning heavy metals (e.g. conc. in humus/ soil, sediments, Hg in fish) than FIN.
- Both countries have done heavy metal budgets for small catchments (from IM sites)
- POPs have not yet been under discussion/evaluation (and not in the Manual) in ICP Waters, but is on the working list in 2003-04
- SWE has extensive data on freshwater fish for model calculation for critical loads, if such a procedure takes place

Recommendations:

- Consider POPs to be measured at some IM stations in several compartments (deposition, sediment traps, biota)

Terrestrial environment:

- ICP Vegetation hosts presently the Moss Survey, initiated by Sweden and Norway in 1970s. All Nordic countries are actively participating in that work.

- Recommendation (directed not only to SWE) is that the data analysis and reporting should put more weight on the metals stored in the soil (humus) and risk associated with that (mass balances and modelling)

7.2.3 UNEP POP

The Stockholm Convention on Persistent Organic Pollutants and other international agreements state that monitoring activities should be established to verify the effective implementation of the conventions and the decrease of environmental levels of persistent pollutants. Some monitoring activities are already in place but, as different methodologies are used, the data is often incomparable.

UNEP Chemicals is therefore launching the project "Global Network for monitoring of Chemicals in the Environment", a project that aims to create an electronic forum

and working group on the harmonisation of methodologies and analyses of chemicals in the environment.

The project will initially focus on the twelve POPs subject of the Stockholm Convention and will enlarge its scope to other chemicals that will be considered as priorities by the international community. With the "Global Network for monitoring of Chemicals in the Environment", UNEP Chemicals hosts a discussion group on monitoring issues where existing programs and laboratories are invited to participate and share their experience on this subject.

Recommendations:

At present, there is no information how this has started, but there will be a workshop in March 2003 (Geneva) to start the preparation for common guidance. The project "Global Network for monitoring of Chemicals in the Environment" seems to be a forum, to which Sweden, and other Nordic countries, could have plenty of information and experience to give.

7.2.4 AMAP

Arctic Monitoring and Assessment Programme is not strictly “obligatory” to the member countries of the Arctic Council. Therefore, the implementation in the countries varies still considerably. On the other hand, AMAP is relatively new program with enthusiastic co-operators and has had opportunity to learn and apply knowledge from older and perhaps more “rigid” monitoring programmes. Also, POPs have been the driving force for the whole program, which on its part helped UNEP POP Convention realisation.

Findings:

- SWE time trends of Abisko reindeer and char and Storvindeln pike are unique
- Pallas the most important European background station, as Svalbard has turned out to be more polluted
- Pallas is an exceptional example of cooperation
- Sweden has targeted the activities to few sites with intensive and long-term monitoring, while Finland has more spatial coverage and screening-type activities
- Nordic (Swe) knowledge of POPs in Baltic benefits Arctic research
- Arctic research enhances our knowledge on transport mechanisms, bioaccumulation and perhaps effects

Recommendations:

- Keep key species (reindeer, char) with known physiology and ecology
- Keep few longest and most valuable time series annual (for international forum)

- In a circumpolar perspective, few lakes with very long-term data (Abisko, Storvindeln) and "master" station at Pallas (focus on air measurement, but supplied with other compartments) could represent sufficiently the "clean northern Europe". In a broader meaning, this strategy could apply to UNEP POPs assessment as well; few carefully selected and thoroughly investigated and documented sites per geographical region.
- Try to continue get some POP data on peregrine falcon and sea-eagle

7.2.5 EU/WFD

At present (Oct 2002), there are very few guidelines concerning the monitoring of the so-called Priority Substances within the Water Framework Directive. The working group on Monitoring (2.7) has prepared a document "*Towards a common understanding of the monitoring requirements under the WFD*", but it is not dealing PSs. The task-force group for PS (EAF/Analysing and Monitoring of Priority Substances, AMPS) developing common understanding on this subject has met only once in February 2002. Most of the work has been directed to the problems to be solved before actual monitoring/screening can start, i.e. in analytical work (standards, methods etc.). Therefore, it is premature to evaluate the monitoring/screening strategy of any country.

However, screening programmes for the Union level PS and National PSs will clarify and feed into the process of defining the monitoring needs. In that sense, Swedish (and Danish) screening programmes already started will benefit all Nordic countries and will build baseline information for planning monitoring activities commonly. This could involve "new" matrices for international monitoring like sludge and lake sediments.

Recommendations:

- Close cooperation with Denmark and Finland in defining Nordic priorities concerning monitoring strategies and guidance especially concerning matrices, which in turn affects choice of species, frequency, spatial coverage etc.

8 Swedish-Finnish co-operation

There are quite many branches to be noted but only activities related to monitoring will be reported and described.

8.1 General

Several different monitoring-projects have been carried out to advance co-operation among the countries around Baltic Sea and in Fennoscandia. Good examples are; HELCOM projects i.e. heavy metals and PCB-related compounds in fish and sediment; NCM projects i.e. heavy metals in moss, pesticides in rain in 1991-1993 and latest screening of common priority chemicals. In general Sweden has been an example and designer in several of these projects, with good historical grounds – for it was Sweden that in 1960s discovered the severe damage that PCB, DDT and Hg were causing to Baltic sea biota (seals, otter, white-tailed sea eagle, osprey). At the same time Sweden commenced monitoring of harmful substances in the Baltic Sea and the concept of environmental specimen banking was introduced. The founding of HELCOM in 1979 extended monitoring to the whole Baltic Sea area.

8.2 Co-operation round the Baltic Sea

An example of the bilateral co-operation is research in Quark in the Gulf of Bothnia has been monitoring of the white-tailed sea eagle. Eggs (undeveloped, rotten egg) have been collected from the nests and sent to Sweden for chemical analysis. Also Finnish Natural museum has sent samples from accidentally killed otters found in the coastal areas for chemical analyses to Sweden.

At the moment the largest of the on-going projects in the northern Baltic Sea area is the Bothnian Bay Life - project (costs over 1 million euros) covering the whole northern Sweden and Finland including the sea areas of the Bothnian Bay and the Quark. One of the aims is to collect and establish common database of physical- and chemical properties (including also heavy metals) as well as data on environmental loadings into the sea areas. Within two years also biological data will be attached to database. Partakers are the Counties of Västerbotten and Norrbotten in Sweden and the Environmental Centers of West Finland, Northern Ostrabothnia and Lapland in Finland. Main sponsors are the EU- LIFE -fund, governments and local industries and companies.

Some projects in our joint sea area in the near future would be proposed as follows:

Seals, which are marine top consumers, could be used as indicators for open sea, if seal hunting will be allowed again. There is also possible to perform bioindicator (effect) studies with living individuals, taking blood and subcutant fat samples for biochemical measurements.

Baltic Sea birds like razorbill (*Alca torda*. L.; tordmule) could be used as indicator also in Finland. Guillemot (eggs) is not a very good indicator because it is classified as an endangered species in Finland. Razorbill (eggs) would be a good alternative or additional indicator to monitor harmful substances in the eastern part of the Baltic Sea area.

Salmon fish species, which are passing Baltic Sea area and moving upward the river Torneälven, should be a target for monitoring of contaminants. In the AMAP 2002 it was noted that whitefish captured in the river Torneälven had as high concentrations of organochlorines (5 – 20 μg/kg fw) than the Baltic herring. Only explanation to the results was that whitefish could migrate and feed far a way in the Bothnian Bay and thus accumulate PCBs in the tissues. Total PCB in the Baltic salmon has been reported to be as high as 200 μg/kg (fw) (Vuorinen et.al 1997).

Oil and chemical spill accidents can be a threat to sea biota in near-future in the Gulf of Finland when transport of crude oil, petroleum products and chemicals from St. Petersburg harbor area will be increased 4 to 6 fold of that today. It is worth to make screening and monitoring plans for major oil spill accidents. There should be data on oil hydrocarbons and PAH-derivates in sea biota and sediment to evaluate pollution effects of an oil accident.

Recommendations:

- It is recommended that Sweden and Finland will promote approach for exchange of information and data over their common sea and boundary areas. A concrete example on that kind work is development of a common database for the Bothnian Bay and the Quark, which will be taken in use in 2003. Such a database system is needed also for the areas of the Bothnian Sea and Archipelago Sea.

- There should be monitoring of top consumers as grey seals and/or razorbill (eggs) in the sea areas of the Baltic Sea. Monitoring studies on razorbill (eggs) will complete the results obtained from monitoring of guillemot (eggs) in the Swedish site.

- The Baltic salmon, which is accumulating PCBs and is an important food source for human, should be also monitored for the reason of the species existence. Most of the monitoring/screening in Finland is made with cultivated rainbow trout (by the state Veterinary Institute – food stuff control), and only occasionally, the natural Baltic salmon is screened for levels of POPs.

- Oil and chemical spills should be concerned more as a potential threat to the Baltic proper biota because of the 4 to 6 fold increasing transportation of these products in near future via the Gulf of Finland. There should be national research and monitoring plans for assessment of effects on marine biota.

8.3 Co-operation in Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP/IM)

The overall aim of integrated monitoring was originally to determine and predict the state and change of terrestrial and freshwater ecosystems in a long-term perspective with respect to the impact of air pollutants, especially nitrogen and sulphur. From the very beginning, Sweden has chaired this activity and Finland (SYKE) has been the data center.

The Program provides basis for decisions on emission controls and assessment of the ecological impact of such controls within the UN ECE Convention on Long-range Transboundary Air Pollution. However the full implementation of the Integrated Monitoring Program will allow the ecological effects of tropospheric ozone, heavy metals and persistent organic substances to be determined. Implementation of the Program will provide a major contribution to the international data requirements for examining the ecosystem impacts of climatic change, changes in biodiversity and depletion of stratospheric ozone (ref. LTER, Long Term Ecological Research in U.S.). A primary concern is the provision of scientific and statistically reliable data that can be used in modeling and decision-making. The main emphasis is to establish consistent time series for environmental variables rather than establishing representative surveys across the UN ECE region.

The above-mentioned objectives of the program should be kept in mind, when future bi- and multilateral monitoring of ecosystems are harmonized. Environmental problems (air pollution, climate change, loss of biodiversity) are more and more understood to link together, and so should the monitoring activities. The aspect of integrating presently separate monitoring networks on larger (than small catchments) geographical area, should be discussed.

Recommendation:

- It should be a concern for discussion that integrated monitoring can be geographically much more widely area than understood with small ICP/IM monitoring areas. In global perspective, the whole northern Fennoscandia is one large catchment basin to the Bothnian Bay where we have different kind of monitoring going-on.

8.4 Co-operation in monitoring of airborne contaminants in Lapland

Airborne persistent pollutants are monitored within the AMAP-program. For this purpose a joint international research-station was founded in Pallas in 1994. The station is locating near the boundary area of Finland to Sweden. It is also locating in an (optimal) distance from the large mining and metal industries of Jällivaara in Sweden, Nikel and Monchegorsk in Russia and Tornio in Finland. It can be

classified as a reference station in Fennoscandia for long-range transported persistent contaminants of several origins. The Swedish researchers are using the station for monitoring of POPs, PAHs and Hg in deposition. It is very reasonable and rational to have a common station with multi-disciplinary monitoring and research activities.

The natural environment in the surroundings of Pallas is representing the Boreal spruce/pine forest ecosystem, which is predominant in geographical means in Finland and also in Sweden. Thus the studies on persistent contaminants, their mobility and enrichment in ecosystem structure and "key species" at Pallas can be compared with the studies in southern monitoring areas. There has been detected a clear concentration gradient for several contaminants between North and South (Bernes 1998, AMAP 2002). Only 50-100 km north from Pallas the forest zone declines and behavior and mobility of persistent contaminants in environment will change. How dramatically the changes are, would be also a focus for more studies in near future.
The possibilities of the Pallas station should be utilized more and enhance monitoring and research both in terrestrial and in aquatic biota, and at least in the top consumers (predators, end point-animals of food chains).

Recommendation:

- Concern reasonability and rationality to have a common station with multi-disciplinary monitoring and research activities at Pallas. The Pallas station should be utilized more for contamination studies and development of monitoring both in terrestrial and in aquatic biota.

8.5 Co-operation in screening of new chemicals

EU WFD priority chemicals will be screened and monitored together in the boundary areas of Sweden and Finland – this matter will be a target for discussion and planning. Can we split or factorize activities concerning demands of EU WFD?

8.6 Other co-operation suggestions

- Discussion on development of monitoring strategies in changing environment:
- Integrating different monitoring networks to be able to understand combined effects, e.g. under changing climate.

9 Recommendations

9.1 History (earlier program)

- PCB –related substances are still a major potential toxic group of chemical for the Baltic Sea biota and also for wildlife and human in the circumpolar regions. Thus PCBs must be monitored in near future, too. Levels of PCBs and dioxins detected in fish are following actions from the EU Commission, e.g. banning commercial use of herring and the Baltic salmon.
- There are still many gaps in knowledge about effects of PCBs. More studies are needed.
- Hg was reported to be a threat to wildlife and human in circumpolar regions in the UNEP Assessment and AMAP in 2002. Hg monitoring will be continued also in future. Levels of Cadmium (Cd) in Boreal forest environment and ecosystem are reported to be high enough to cause problem, although the emissions from pollution sources have declined during the 1980s and 1990s.
- Keep ESB ongoing, even after decision of space out the chemical analyses.

9.2 Present program 1995 –2002

Sea and coast

- Consider more sparse analyzing program for banned, classical POPs and most metals (keep Hg and Cd)*
- Sampling to ESB could still be annual
- Keep key species with known physiology and ecology
- Keep few longest and most valuable time series annual (for international forum)
- If possible, in addition to present monitoring also collect and analyze tissue samples from seals, which will be hunted legally or found, killed, for instance subcutant fat. This is mentioned in HELCOM Combine program as Swedish and Finnish activity, but was not found in other documents
- Dioxins are a possible health risk, should be reflected in monitoring more extensively. Recent studies show that careful age determination is crucial to reduce the variability in fish of same nominal size (length). Therefore age should be standardized preferably before chemical analyses
- Contaminant analysis in different age classes (>4yr) would facilitate human exposure assessment
- Sediment studies should be utilized fully for mass balance and modeling work

Freshwater

- Consider more sparse analyzing program for banned, classical POPs* and most metals (but keep Hg)*
- Sampling to ESB could still be annual
- Keep key species with known physiology and ecology
- Keep few longest and most valuable time series annual (for international forum)
- Pike should be considered more extensively as a top consumer, especially for Hg monitoring. Same species (*Esox lucius*) is also distributed in North America. Mercury is the potential health risk through consumption of freshwater fish.
- Sediment studies should be utilized fully for mass balance and modeling work

Terrestrial environment

Fjeld:

1. Keep specimen banking of fjeld fauna going on. The monitoring, screening and control of heavy metals should be continued by the state food administration (state veterinary institute), because reindeer is an important source of human food and can accumulate heavy metals and radioactivity. Mountainous areas are often very sensitive environments for different kind of pollution situation, e.g. soils and waters have poor buffer capacity against acidity, which follows increasing metal toxicity to biota. Food chains are simply and short and so on are the interactions and pathways of contaminants between biota, soil and air.

2. Also samples of big predators like brown bears (*Ursus arctos* L.) hunted legally should be screened for environmental contaminants – a statement should be included the hunting law.

Forest:

1. A top consumer (predator) should be studied and added in the national monitoring of heavy metal and organic pollutants. Such species are e.g. pine marten (*Martes martes L.*) or common shrew (*Sorex araneus*).

Pine marten can be compared to top predator like one-kilo pike in water ecosystem. It is harvesting in quite large area of forest. The hunting is legally allowed and number of animals trapped annually is about 5000 -10 000 in Sweden (see the hunting statistics).

Common shrews are most abundant mammals in boreal forest. Population density is quite stable compared to that of bank voles. Shrews as insectivorous animals will be indicators for contamination of upper layer of forest soil and humus. The contaminants accumulated (deposited) in humus are reflecting in shrews, giving information about potentiality of different toxic substances to bioaccumulate in food chains. Enrichment factors of persistent organic pollutants in shrews related to humus are varying in values from 10 to 200 (Henttonen et.al. 2002). Life span of shrews is short which makes it easier to control accuracy of samples. The results will

also show rate of natural cleaning progress of boreal environment after long-term pollution with heavy metals Pb and Cd.

Agricultural land:
Analyses of pesticides are very expensive. Monitoring should be designed separately to every pesticide group. Most of the substances are third generation pesticides; their persistence in natural environment is low which means that occurrence is very dynamic after administration to environment. Analyses on matrixes of biota will not give any response or are below detection limits. However, effects on biota especially in cases of accident can be serious. Monitoring will be based on case studies and risk evaluation in some of well chosen cultivated areas. These activities will be included as a part of the EU WFD process in Sweden.

9.3 Future program

- Maintain present quality of monitoring. The present monitoring with its long historical lines of measurements of biological material is valuable and should be continued. ESB will be helpful also for screening of new chemicals.
- A new screening plan is needed. Large number of new chemical substances will be screened in near future, which needs careful planning because of limited resources.
- The quantity and quality of impact-studies should be increased.
- New matrices/indicator species could be considered to add to the monitoring program.

9.4 Regional monitoring

- Enhance the geographical coverage. For instance by:

either a) to use local monitoring to “fill in the gaps” in the national monitoring net – and/or even partly replace it,
or b) to have a separate plan where the counties all measure the same thing but in turns – few counties per year (to save money). But finally it would yield a big picture that covers the whole country. We believe that is what is happening in the other fields of monitoring. One good case could be the health and urban related monitoring.

- The effect of environmental objectives:
Since the new "lighter" screening-method for new substances is not yet ready it is hard to predict its effects on regional monitoring. Who will take the responsibility of this new screening is one of the main questions. Our recommendation would be to contemplate the possibility of involving regional resources to the task.

9.5 Environmental objectives

- More substances to be monitored:
A priority-list of substances is being made and should be ready 2015. Most likely it will be a long one. Subprogram 5 in the 4th objective calls for a flexible system for

monitoring substances in the priority-list. Chemical-inspections report (giftfri miljö) mentions that the same efficiency as in present monitoring is not required. What is meant by not being of same efficiency is not clarified but it is obvious that a different kind of method is needed for monitoring all these substances - a lighter method that begins as screening and then continues longer if considered necessary. Lowering the standards of the whole monitoring is not recommendable. Though changes will, no doubt, be needed in the old/"actual" monitoring when new harmful substances are found through this process.

A suggestion:
At first a wide screening to find out whether the substance occurs at all. Sample locations need to be carefully chosen. Preliminary information is needed about the substances: their physical properties, possible bioaccumulation and effects. Furthermore where is the emission source and if /how does it spread through the environment. With that information can suitable indicators and locations be chosen? Few locations and one (or two) indicator(s). (The old screening method involves several indicators, but analyzing many samples is costly and employs resources, which will be taken from some other part of monitoring.) And finally if the substance is found then follow the chances in concentrations at suitable intervals at the best places.

- More/new locations:
If the ultimate aim is low concentrations in the environment new substances should be measured near the known emission source. That way sampling location need not be changed later. Who should do the monitoring of these emission-locations remains a question. Two different ways could be applied. Today monitoring of industrial emissions are done outside national monitoring locally by industry themselves or by regional monitoring. In our opinion the possibility that these parties could undertake also this new task is worth investigating. The second way is to do it yourself – as an addition to the current monitoring - at least in the first stage of the screening. If permanent monitoring locations are set up, then co-operation with the local monitoring could be topical.

- The concept of environment:
Today environmental monitoring contains only natural and lately also urban environment. But to include also environments as indoors and workplaces is a novel/strange idea. Monitoring environment indoors can surely be left to authorities that have done it till now.

- Method-development:
New substances will emerge that do not have analyzing methods ready. Co-operation in method-development with other countries could be worth a while.

Screening effort could also be shared, at least in the case of air-borne substances, which could be done together with other northern countries.

9.6 International reporting

Relevance of Swedish monitoring for international conventions, programs and cooperation

HELCOM
-Consider seals in open sea monitoring as a top predator (if hunting is allowed) Observation: PCB –related substances occur still in 100 times higher concentrations in the Baltic seals compared to Northern Atlantic seals (Nyman 2000).
-Consider razorbill eggs as a common indicator for monitoring of bird colonies in the Baltic Sea area. Guillemot is classified as threatened species in Finland, and it cannot be used for regular monitoring purposes

CLRTAP
- Consider POPs to be measured at some IM stations in several compartments (deposition, sediment traps, biota)

Terrestrial environment:
- ICP Vegetation hosts presently the Moss Survey, initiated by Sweden and Norway in 1970s. All Nordic countries are actively participating in that work.
- Recommendation (directed not only to SWE) is that the data analysis and reporting should put more weight on the metals stored in the soil (humus) and risk associated with that (mass balances and modelling)

UNEP POP

- The project "Global Network for monitoring of Chemicals in the Environment" seems to be a forum, to which Sweden, and other Nordic countries, could have plenty of information and experience to give.

AMAP:
- Keep key species (reindeer, char) with known physiology and ecology
- Keep few longest and most valuable time series annual (for international forum)
- In a circumpolar perspective, few lakes with very long-term data (Abisko, Storvindeln) and “master” station at Pallas (focus on air measurement, but supplied with other compartments) could represent sufficiently the “clean northern Europe”. In a broader meaning, this strategy could apply to UNEP POPs assessment as well: few carefully selected and thoroughly investigated and documented sites per geographical region.
- Try to continue get some POP data on peregrine falcon and sea eagle

EU/WFD
- Close cooperation with Denmark and Finland in defining Nordic priorities concerning monitoring strategies and guidance especially concerning matrices, which in turn affects choice of species, frequency, spatial coverage etc.

9.7 Swedish-Finnish co-operation

Co-operation round the Baltic Sea

- It is recommended that Sweden and Finland will promote approach for exchange of information and data over their common sea and boundary areas. A concrete example on that kind work is development of a common database for the Bothnian Bay and the Quark, which will be taken in use in 2003. Such a database system is needed also for the areas of the Bothnian Sea and Archipelago Sea.

- There should be monitoring of top consumers as grey seals and/or razorbill (eggs) in the sea areas of the Baltic Sea. Monitoring studies on razorbill (eggs) will complete the results obtained from monitoring of guillemot (eggs) in the Swedish site.

- The Baltic salmon, which is accumulating PCBs and is an important food source for human, should be also monitored for the reason of the species existence. Most of the monitoring in Finland is made with cultivated rainbow trout (by the state Veterinary Institute – food stuff control), and only occasionally, natural Baltic salmon is screened for POPs.

- Oil and chemical spills should be concerned more as a potential threat to the Baltic proper biota because of the 4 to 6 fold increasing transportation of these products in near future via the Gulf of Finland. There should be national research and monitoring plans for assessment of effects on marine biota.

Co-operation in Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP/IM)

- It should be a concern for discussion that integrated monitoring can be geographically much more widely area than understood with small ICP/IM monitoring areas. In global perspective, the whole northern Fennoscandia is one large catchment basin to the Bothnian Bay where we have different kind of monitoring going-on.

Co-operation in monitoring of airborne contaminants in Lapland

- Concern reasonability and rationality to have a common station with multi-disciplinary monitoring and research activities at Pallas. The Pallas station should be utilized more for contamination studies and development of monitoring both in terrestrial and in aquatic biota.

Co-operation in screening of new chemicals

- EU WFD priority chemicals will be screened and monitored together in the boundary areas of Sweden and Finland – this matter will be a target for discussion and planning.

Other co-operation suggestions

- Keep discussion on development of monitoring strategies in changing environment.

- Integrating different monitoring networks to be able to understand combined effects, e.g. under changing climate.

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AMAP 2002. Conclusions. The second AMAP international symposium on environmental pollution of the Arctic. Rovaniemi, Finland. October 1-4, 2002.

AMAP
http://www.amap.no
-> Online documents/
- Trends and Effects Programme documentation
- AMAP National Implementation Plans

AMPS
http://ies.jrc.cec.eu.int/Projects/WATER/

Bernes, C. 1998. Persistent organic pollutants. Monitor 16. Swedish Environmental Protection Agency. ISBN 91-620-1189-8.

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EMEP: http://www.nilu.no/projects/ccc/programme.html

De nordiska ländernas kemikalieövervakning och Övervakning av biologisk mångfald i terrestra miljöer i Norden (19 sidor)

EU/WFD
The WFD implementation homepage of DG Environment.
http://europa.eu.int/comm/environment/water/water-framework/implementation.html

Framtidens miljö – allas vårt ansvar, 2000:52, del 1 (sidor 167-168, 183-186 och 299-330)

Förekomst och gradering av 55 olika grundelement i den svenska miljön (Lithner & Holm, Laboratoriet för akvatisk miljökemi)

Genomgång och prioritering av kemiska ämnen för nationell screening inom miljöövervakningen (i Jönköpings län)

Giftfri miljö (miljökvalitetsmål 12), Kemis rapport, BEST.NR: 360 673

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HBCD i Sverige – screening av ett bromerat flamskyddsmedel (IVL rapport 2001)

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Hälsorelaterade miljökvalitetsmål och åtgärder för ett ekologisk hållbart samhälle Miljö- och jordbruksutskottets betänkande 2001/02:MJU3

Hälsorelaterad miljöövervakning (SNV rapport 4555)

Hälsorelaterad miljöövervakning – ett programförslag (IMM rapport 7/92)

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ICP Waters 2002. Proceedings from the Workshop on Heavy Metals (Pb, Cd, Hg) in Surface Waters; Monitoring and Biological Impact. March 18-20, 2002, Lillehammer, Norway. NIVA Report SNO 4563-2002 (ICP Waters report 67). ISBN 82-577-4219-8.

ICP IM
Manual: http://www.vyh.fi/eng/intcoop/projects/icp_im/im.htm

Kadmium och andra spårelement i matpotatis odlad i Sverige – ett utvecklingsprojekt inom miljöövervakningen (slutrapport)

Kadmium – tillstånd och trender (rapport 4759 SNV, SLU, Livsmedelverket)

Kemikaliestrategi för giftfri miljö – Regeringens proposition 2000/01:65 (sidor 1-4, 15, 21, 25, 44 och 54)

Kväveoxider i svenska tätorter- exponeringsförhållanden 1999/2000 (IVL 14.5.2001)

Metaller i avfallsaskor och brännbart avfall – delrapport (IVL 18.6.2001)

Miljöövervakningsprojekt relaterade till påverkan på människors hälsa (SNV rapport 5015)

Miljöfaktorer som påverkar människors hälsa (SNV rapport 4760)

Miljöövervakningsprojekt: Cancerframkallande ämnen i tätortsluft – personlig exponering, individrelaterade stationära mätningar och bakgrundsmätningar i Göteborg 2000

National Environmental Monitoring (Environmental monitoring news 2001, 2)

Nyheter från Miljöövervakningen 2001, 3

Nationell övervakning av metaller och organiska ämnen (Redovisning från nationell miljöövervakning 2002)

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Organiska miljögifter i bröstmjölk från Uppsala 2001-2001 (sakrapport 21.9.2001)

Program för hälsorelaterad miljöövervakning

Redovisning av regeringsuppdrag 6 (M97/2050/5) Att utforma ett nytt program för den framtida miljöövervakningen (rapport 26.2.1999)

Regional (County) programs (from Norrbotten, Västerbotten, Västernorrland, Dalarna, Västra Götaland, Örebro, Jönköpings, Kalmar and Stockholm)

Regional miljöövervakning, fördelning av medel bå 2002

Regionala skillnader i kvinnors kroppsbelastning av persistenta organiska miljöföroreningar (slutrapport)

Regeringens proposition 2000/01:130, Svenska miljömål – delmål och åtgärdsstrategier (sidor 1-5, 38-47, 58-64, 90- 91, 112-113, 171- 172, 223-231 och en sida som hade inte numret, på den var tekst om utsläpp från fartyg)

Regeringens proposition 2000/01:130 Svenska miljömål – delmål och åtgärdssrategier (253 sidor)

Samband hälsa – yttre miljöfaktorer, hälsorelaterad miljöövervakning (SNV rapport 4902)

Sötvatten 2000 och 2001

Tillståndet i svensk åkermark och spannmålsgröda (SNV rapport 5062)

Time series of DDT- and PCB-substances, Hg, Cd, Pb, Cu and Zn in starling from reference areas in Sweden (sakrapport)

Time trends of metals in liver and muscle in reindeer from northern and central Lapland, Sweden 1983-1999 (sakrapport)

Time trends of cadmium in kidney of moose from south-central Sweden 1980-1999 (sakrapport)

Undersökning av kvicksilverexponering hos gravida kvinnor i Uppsala län (slutrapport 5.4.2001)

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Ökade eller minskade miljögiftshalter i den svenska miljön? (SNV rapport 5016)

Övervakning av hälso- & miljöfarliga metaller och organiska miljögifter (SNV rapport 4436)

Övervakning av miljögifter(förslag från 1999)

Övervakning av bekämpningsmedel i vatten från ett avrinningsområde i Skåne (SLU, Ekohydrologi 54)

Appendix 1

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Appendix 2

The information used in evaluation

From the many documents we received the most relevant were chosen for a closer examination. These are presented in boxes.
Box 1 contains documents chosen for the assessment of the program itself.
Box 2 contain documents concerning history of monitoring
Box 3 contains documents concerning environmental objectives.
Box 4 contains documents concerning regional monitoring.
Box 5 contains international monitoring programmes.
Box 6 contains documents of Wsedish-Finnish cooerpationswe fin COOP docs!!

Box 1. Monitoring of harmful substances in Sweden:
Övervakning av hälso- & miljöfarliga metaller och organiska miljögifter (SNV rapport 4436)
Övervakning av miljögifter(förslag från 1999)
Redovisning av regeringsuppdrag 6 (M97/2050/5) Att utforma ett nytt program för den framtida miljöövervakningen (rapport 26.2.1999)

National Environmental Monitoring (Environmental monitoring news 2001, 2)
Nyheter från Miljöövervakningen 2001, 3
verbal information and handouts given in the meeting 8.3.2002
Nationell övervakning av metaller och organiska ämnen (Redovisning från nationell miljöövervakning 2002)

Box 2. History:
AMAP 2002. Conclusions. Arctic Pollution. The second AMAP international symposium on environmental pollution of the Arctic. Rovaniemi, Finland. October 1-4, 2002.
Bernes, C. 1998. Persistent organic pollutants. Monitor 16. Swedish Environmental Protection Agency. ISBN 91-620-1189-8.
Odsjö, T. 1993. The Swedish environmental specimen bank with reference to the national contaminant monitoring programme in Sweden. Appendix 4. In the report: Giege,B., Korhonen, M. Paulsen, G.M. & Poulsen, M.E. Coordination of environmental specimen banking in the Nordic countries. NCM report 1993:609. 58 pages + appendicies 1-4.

Box 3. Regional monitoring
Regional monitoring:The county-monitoring programs for 2002- 2006 (1)
Regional miljöövervakning – Fördelning av medel år 2002 (2)
Övervakning av hälsö & miljöfarliga metaller och organiska miljögifter (1995) (3)
Övervakning av miljögifter (1999) (4)
National Environmental Monitoring , 2000, no. 2 (5)

17.5.2002 a list of questions was sent to NV to which answers were received from Yngve Brodin and Brita Hedlund few days later. (6)

Box 4. Environmental objectives:
Framtidens miljö – allas vårt ansvar, 2000:52, del 1 (sidor 167-168, 183-186 och 299-330)
Regeringens proposition 2000/01:130, Svenska miljömål – delmål och åtgärdsstrategier (sidor 1-5, 38-47, 58-64, 90- 91, 112-113, 171- 172, 223-231 och en sida som hade inte numret, på den var tekst om utsläpp från fartyg)
Regeringens proposition 2000/01:130 Svenska miljömål – delmål och åtgärdssrategier (253 sidor)
Giftfri miljö (miljökvalitetsmål 12), Kemi's rapport, BEST.NR: 360 673
Hälsorelaterade miljökvalitetsmål och åtgärder för ett ekologisk hållbart samhälle
Miljö- och jordbruksutskottets betänkande 2001/02:MJU3

Box 5 : International reporting
- HELCOM COMBINE
- UN/ECE CLRTAP / WGE ICP Waters Manual
- UN/ECE CLRTAP / WGE ICP Integrated Monitoring Manual
- AMAP
- UNEP POP
- EU / WFD

The rest of the many documents received only a brief review.

Kemikaliestrategi för giftfri miljö – Regeringens proposition 2000/01:65 (sidor 1-4, 15, 21, 25, 44 och 54)
De nordiska ländernas kemikalieövervakning och Övervakning av biologisk mångfald i terrestra miljöer i Norden (19 sidor)
Ökade eller minskade miljögiftshalter i den svenska miljön? (SNV rapport 5016)
Genomgång och prioritering av kemiska ämnen för nationell screening inom miljöövervakningen (i Jönköpings län)
Program för hälsorelaterad miljöövervakning
Samband hälsa – yttre miljöfaktorer, hälsorelaterad miljöövervakning (SNV rapport 4902)
Miljöövervakningsprojekt relaterade till påverkan på människors hälsa (SNV rapport 5015)
Miljöfaktorer som påverkar människors hälsa (SNV rapport 4760)
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Hälsorelaterad miljöövervakning – ett programförslag (IMM rapport 7/92)
Miljöövervakningsprojekt: Cancerframkallande ämnen i tätortsluft – personlig exponering, individrelaterade stationära mätningar och bakgrundsmätningar i Göteborg 2000
Undersökning av kvicksilverexponering hos gravida kvinnor i Uppsala län (slutrapport 5.4.2001)
Regionala skillnader i kvinnors kroppsbelastning av persistenta organiska miljöföroreningar (slutrapport
Organiska miljögifter i bröstmjölk från Uppsala 2001-2001 (sakrapport 21.9.2001)

Kväveoxider i svenska tätorter- exponeringsförhållanden 1999/2000 (IVL 14.5.2001)
Tillståndet i svensk åkermark och spannmålsgröda (SNV rapport 5062)
Kadmium och andra spårelement i matpotatis odlad i Sverige – ett utvecklingsprojekt inom miljöövervakningen (slutrapport)
Time series of DDT- and PCB-substances, Hg, Cd, Pb, Cu and Zn in starling from reference areas in Sweden (sakrapport)
Time trends of metals in liver and muscle in reindeer from northern and central Lapland, Sweden 1983-1999 (sakrapport)
Time trends of cadmium in kidney of moose from south-central Sweden 1980-1999 (sakrapport)
Kadmium – tillstånd och trender (rapport 4759 SNV, SLU, Livsmedelverket)
Metaller i avfallsaskor och brännbart avfall – delrapport (IVL 18.6.2001)
Förekoms och gradering av 55 olika grundelement i den svenska miljön (Lithner & Holm, Laboratoriet för akvatisk miljökemi)
HBCD i Sverige – screening av ett bromerat flamskyddsmedel (IVL rapport 2001)
Övervakning av bekämpningsmedel i vatten från ett avrinningsområde i Skåne (SLU, Ekohydrologi 54)
Sötvatten 2000 och 2001
Handbok för Miljöövervakning, pärmar 1-3

Appendix 3.

Summary table for the national monitoring

Appendix 4.

Summary table for the regional monitoring