Dioxins & PCBs: Environmental levels and human exposure in new EU Member States

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Introduction

In January 2003 the European Commission launched the project "Dioxins & PCBs: Environmental Levels and Human Exposure in Candidate Countries". Major objective was the collection of available information on dioxin and PCB related issues in Accession and Candidate Countries (further referred to as AC/CC) in order to develop a overview on the current situation with respect to environmental contamination and related human exposure. Related legislation, enforcement measures, existing capacities and activities in the fields of research and monitoring were included into the evaluation. Aggregation, analysis and comparison of the collected information enabled to identify data and knowledge gaps, to assess the situation in AC/CC in comparison to earlier EU Member States (further referred to as MS) and to contribute to knowledge exchange and capacity building.

The collected information shall serve as a decision basis for the European Commission to take appropriate measures for closing of important data gaps and to develop a common strategy to obtain comparable and reliable results on community level, improved information exchange and a consistent community response system.

Methods and Materials

To assure comparable and reliable data the information collection was based methodologically on a questionnaire to all competent ministries, internet and literature research, personal contacts and a project homepage as communication platform. In order to be able to collect data in an efficient way and closely related to the objectives, required information was structured before starting data collection. The basic structure is a matrix with all AC/CC on the one hand and all relevant fields of interest on the other hand.

The developed structure allows a systematic overview on the current status of facts on environmental levels and human exposure and of knowledge on legislation, science and strategic approaches in the field of PCDD/Fs and PCBs in all AC/CC and enables specific measures to close data gaps and adjust legal, technical and scientific standards. Furthermore, the structure provides detailed information on specific topics such as time trends, local characteristics, transport and fate of PCDD/Fs and PCB congeners.

Results and Discussion

Research and Monitoring Activities

Monitoring of ambient air and vegetation is not common in most of the AC/CC. Only the Czech Republic does perform regular monitoring.

Water monitoring is carried through in a number of the Accession Countries (Cyprus, Czech Republic, Hungary, Lithuania, Poland, Slovak Republic, Slovenia) but is almost completely restricted to classical PCBs.

Monitoring of sediments and soils is more common than monitoring of water but still mostly restricted to PCBs. Only the Czech Republic and Hungary perform monitoring of PCDD/Fs. Sampling is performed in agricultural and forest soils as well as in urban and contaminated (industrial) sites or sites with suspected contamination.

Also monitoring of wildlife is relatively common in AC/CCs especially if looking at fish. Corresponding programmes are carried through in the Czech Republic, Estonia, Latvia, Lithuania, Malta; Poland, Romania, Slovakia, Slovenia. Other marine wildlife such as invertebrates, seals, mussels, water birds or their eggs have been monitored in several countries episodically in order to assess the impact on the aquatic ecosystem. In a number of countries, terrestrial wildlife is included in the national food monitoring programmes. Monitoring for PCDD/Fs and dioxin-like PCBs however is restricted to marine wildlife from Malta, Latvia, Poland and Estonia and to fresh water fish from the Czech Republic.

Monitoring of food is an important part of the national monitoring program in the majority of AC/CC. However, the monitoring until to-date is mostly restricted to classical PCBs. Furthermore, it has to be stated that national monitoring programmes differ quite a bit with respect to foodstuffs included, grouping of food and frequency of monitoring.

Monitoring of feeding stuff is scarce and assessment of dietary intake via total diet studies is not common in most AC/CC.

At least some monitoring of human tissue has been performed in most AC/CC.

Due to the relatively easy accessibility and the WHO initiative human milk is most often monitored. No monitoring of human milk has been carried out in Slovenia, Malta, Cyprus and Turkey so far.

Adipose tissue has been monitored in the Czech and Slovak Republic, Poland, Hungary and recently in Turkey.

Contamination of blood is less often monitored. Besides a research project in Poland and a local monitoring of blood levels in the hot spot region of Bela Krajina in Slovenia, there is only one major monitoring project currently performed in the Slovak Republic. This PCBRISK project (5th Framework: QLK4-CT-2000-00488) is designed as a pilot study for health risk assessment of elevated PCB tissue levels.

Environmental Contamination and Human Exposure

Contamination data are often difficult to compare because of small sampling number and differing key-parameter such as congeners, year of data collection, location of sampling sites, analytical standard, etc. As a consequence the comparison can only provide a first estimation that will have to be re-evaluated from time to time based on more harmonised sampling & analysis. However being aware of these limitations the following statements can be made:

Based on rare contamination data for ambient air it can be concluded that mean contamination levels with PCDD/Fs during the summer month (important period with respect to contamination of food chain) seem to be in the same range as in MS. PCB levels in the Czech Republic seem to be significantly higher than in other European Countries. With respect to PCBs a slight increase of background contamination has been observed between 1996 and 2001 in the Czech Republic. Highest levels of contamination have been reported from the centre and the northern part of the country (1,3).

Reported PCB contamination levels in water in major central European Rivers (Oder, Vistula, Elbe) are at a similar level. High PCB contamination does occur in the Michalovce District a hot spot region in the Slovak Republic. (1,2,3)

Data from sediment show average dioxin and PCB levels that are comparable to MS. Low levels seem to occur at the Turkish coast and in Lithuania, high levels in the hot spot regions of Slovakia and Slovenia due to known contamination sources. Due to high results in some samples sediments in Latvia need further investigation. Contamination levels with PCBs in AC/CC have been stable over the last years. Regional differences in contamination levels are especially strong in the Slovak Republic and Slovenia. (1,2,3)

Soil contamination with PCDD/Fs and PCBs in MS seems to be in the same range or even at the lower edge of the scale for MS. At local hot spots the contamination with PCBs can be extreme. Contamination levels seem to be stable over time A rough comparison of recent contamination data in soil and breast milk is given in the figure below. Data suggest that there might exist a certain correlation between soil and breast milk levels. However data do not allow to draw final conclusions. (1,2,3)
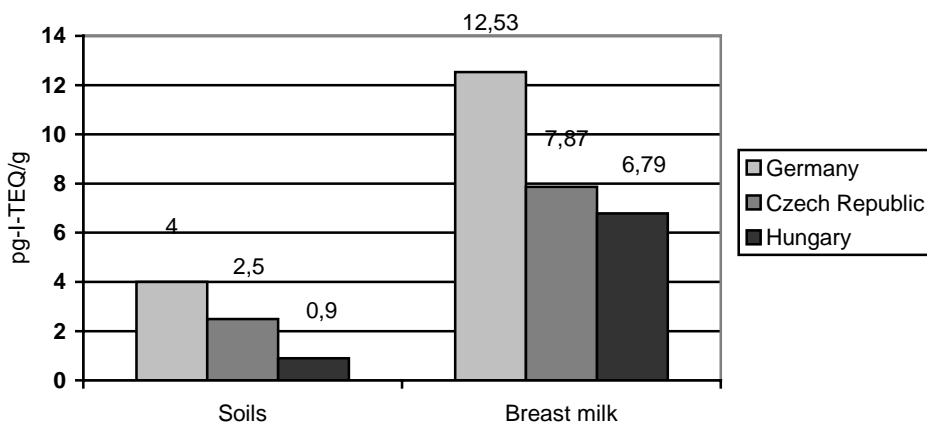

Figure 1: Recent average soil and breast milk (pg PCDD/F-I-TEQ/g fat) contamination levels in some European countries

Monitoring data from <u>vegetation</u> in AC/CC are rare. Reported data show levels in the range of corresponding sites in MS (3,7).

Information on <u>wildlife</u> is mainly based on fish. While PCDD/F levels in marine fish from Estonia, Latvia and Poland seem to be more or less in the range of Scandinavian data (being aware of limited reliability due to the small number of data or differing laboratory standards). Concentrations of PCBs in fish from Czech Republic and Slovak Republic waters seem to exceed values reported for freshwater fish from other European countries. Comparably low contamination levels have been reported for first samples from the Danube Estuary in Romania (1,2,3).

PCDD/F contamination in <u>food</u> from the Slovak Republic show levels below the EU limits except of levels in eggs. The average levels of PCBs in AC/CC seem to be relatively low compared to average contemporary European levels but vary markedly in between different AC/CC and food groups. A decline in contamination can be observed. Regional differences in contamination play an important role in the Slovak Republic. (1,2,3)

<u>Dietary intake</u> of PCDD/Fs in the Czech Republic seems to be in or slightly above the MS range. (1,3)

Data on contamination of <u>human breast milk</u> in AC/CC show comparable or slightly lower levels for PCDD/Fs) compared to MS. Levels of PCB contamination are high in the Czech and Slovak Republic, reflecting relatively high environmental contamination with PCBs in both countries. Recent data on breast milk contamination would urgently be needed for comparison from Latvia, Lithuania, Slovenia and the Mediterranean Countries. In general contamination levels decline in all countries. (5)

Levels of PCDD/Fs and PCBs in <u>adipose tissue</u> seem to be relatively high in the Czech and Slovak Republic whereas, they appear to be low in Hungary, Poland and Turkey. Contamination data from adipose tissue are missing for other AC/CC. (1,2,3)

Rare data for <u>blood</u> show levels in the range of MS. High contamination levels with PCDD/Fs and PCBs which significantly exceed the MS average have been reported from the hot spot region of Michalovce in Eastern Slovakia. PCB levels in this region are comparable to levels found on the Faeroe Islands and Greenland. (1,2,3)

Legislation
Based on the available information most of the relevant regulations of the European Commission have been transposed into national laws. Deficiencies with implementation seem to occur only in the field of waste management, phasing out of PCBs and the IPPC Directive. But it has to be stated that information on separation of licensing and control as well as information on food and feed monitoring has not been complete and problems with the level of awareness on the local administrative level and in the general population have been reported.

Administrative Structure and Capacities
Problems with separation of enforcement and control, laboratory capacity and with quality standards seem to exist in a number of countries especially with respect to dioxin analysis. Environmentally sound storing and destruction capacities are insufficient in the majority of AC/CC.

Priorities and Plannings
The identification and destruction of existing stocks, the establishment or extension of data bases and monitoring systems, the implementation of existing legislation, educational measures and the cleaning up of relevant "hot spots" have been stated as priority actions for the majority of countries.

Capacity Building
In the field of capacity building measures a large number of initiatives has been started and funded by the European Union and the WHO in the last 5 years. Furthermore, the participation in international conventions and databases as well as scientific networking has provided good possibilities for knowledge exchange and capacity building. Awareness at the scientific level is similar to the level in the Member States, but the awareness in the general population and at the local administrative level has been reported to be still relatively low in certain countries.

Conclusions and Recommendations
Generally it can be stated that monitoring of PCDD/Fs and dioxin like PCBs is less established and has started later than in MS whereas information on classical PCBs is more abundant in recent time. The average extent of monitoring activities (number of data, compartments covered) seems to be smaller than in Member States especially in the small Mediterranean and Baltic countries and the three Candidate Countries were activities often only have started recently. Central European Countries (namely the Czech Republic) however have in part developed systematic National Monitoring Systems that can certainly be compared to Middle European or Scandinavian countries.

It can be concluded that, apart from some exceptions (PCBs in Czech and Slovak Republic, Slovenia) the average contamination levels (environmental & human) in the AC/CC do not exceed the levels in MS and might be even significantly lower in some countries (e.g. Hungary, Bulgaria, Romania). However limitations in evidence have to be taken into account. It seems that different compartment data do not match (trends of environmental contamination & food contamination with PCBs, human milk and adipose tissue levels). This indicates that the current level of standardisation in acquiring data needs further improvement. Lower PCDD/F levels in agricultural soils in AC/CC could indicate a lower food chain contamination and therefore would match the overall lower breast milk findings in AC/CC. However further research will be needed to verify a possible relation.

While the PCDD/F contamination does not seem to present a problem in comparison to MS, there exist extremely high-contaminated "hot spots" for PCBs (e.g. Slovak Republic, Slovenia) that urgently need remediation measures to prevent further dissemination and exposure of the local population.

With respect to dioxin emission industrial facilities without abatement devices as well as uncontrolled burning on waste disposal sites or agricultural fields and domestic heating seem to be the major sources for pollution in AC/CC.

Contamination trends from a number of time series show a constant decline over the last decade in food and tissue levels even if slowing down during the last years whereas the environmental contamination seems to be quite stable and in part even slightly increases since 1997.

With respect to legislation, administrative structure and capacity major progress has been made in the last years. However, further effort is needed in some cases with respect to implementation and enforcement, training and capacity for PCDD/F analysis.

As a result the following recommendations are suggested:
♦ The number of measurements in key compartments (soil, sediments, indicator feed and food, human milk) should be increased in all countries that do not dispose of a representative data base

♦ To increase comparability of data AC/CC should be encouraged to participate in international studies and to adopt international standards for sampling and analysis.

♦ AC/CC should be supported in the implementation of waste regulations and IPPC Directive (adequate facilities, technologies) to accelerate environmental sound disposal and destruction.

♦ Possibilities for regional co-operation related to analysis and destruction should be evaluated to improve quality and reduce costs.

♦ Further educational measures should be supported for awareness raising at the local administrative level and in the population

♦ AC/CC should be supported in remediation of major hot spots to avoid further environmental contamination and related human exposure.

Selected References

1.   Albaiges, J., Abousamra, F., De Felip, E.,Picer, M., Barakat, A., Narbonne, J.-F. (2002): Regionally Based Assessment of Persistent Toxic Substance – Mediterranean Regional Report. UNEP Chemicals, December 2002, www.chem.unep.ch
2.   Allsopp, M., Erry, B., Santillo, D., Johnston, P. (2001): POPs in the Baltic, A review of persistent organic pollutants (POPs) in the Baltic Sea, April 2001, www.greenpeace.org
3.   Holoubek, I.; R. Alcock, E. Brorström-Lundén, A. Kočan, V. Petrosjan, O. Roots, V. Shatalov, Z. Amirova, A. Bergman, A. Beyer, L. Bláha, P. Bureaul, P. Coleman, P. Čupr, S. Dutchak, J. Duyzer, J. Falandysz, C. Fuell, E. Heinisch, I. Holoubková, K. Jones, A. Kettrup, J. Kohoutek, S. Koroleyva, M. Krzyzanowski, R. Kubiak, G. Lammel, A. Lecloux, M. Machala, A. Malanichev, M. McLachlan, J. Lulek, A. Palm, A. Sweetman, D. van de

Meent, M. van den Berg, J. Vanderbroght, J. Vijgen, P. Weiss, S. Wenzel (2002): Regionally Based Assessment of Persistent Toxic Substance - European Regional Report. UNEP Chemicals, December 2002. www.chem.unep.ch

4.   Tronvec, T., Langer, P., Sebokova, E., Kocan, A., Petrik, J., Koska, J., Bucekova, K., Tajtakova, M., Hučková, M., Sovcikova E., Chovancová, J., Cervenakova, Z., Ksinantova, L., Drobna, B., Jursa, S., Wimmerova, S., Bencko, V., Wsolova, L., Klimes, I., Hertz-Picciotto, I. (2003): PCPRISK Project Slovakia, Persistent Toxic Substances Contamiantion of the Eruopean Region, Book of Abstracts, November 10-12, 2003, p. 74-78

5.   Van Leeuwen, R. F. X., Malish, R. (2002): Results of the third round of the WHO-coordinated exposure study on the levels of PCBs, PCDDs and PCDFs in human milk. Organohalogen Compounds, 56, 311-316.

6.   Weiss P., Fohringer J., Hartl W., Thanner G., Simoncic P. (2003): Semivolatile organic compounds at remote Forest sites of Slovenia and Carinthia . (Ed. by Horganohalogen Compounds) Environmental Levels Emerging POPs Site Assessment Vol.62 (2003), pp.379-381.