The DG Environment project „Dioxin Emissions in Candidate Countries": Scope, approach and first results

Ulrich Quass[1], Tinus Pulles[2], Herman Kok[2]

[1]Institute for Energy and Environmental Technology (IUTA e.V.), Duisburg, Germany
[2]TNO-MEP, Apeldoorn, The Netherlands

Introduction

The European Commission recently has adopted a new European Strategy for Environment and Health focusing on the growing concern over the adverse health effects caused by environmental pollution. Based on the results of various studies carried out in recent years polychlorinated dioxins and furans (PCDD/Fs) and PCBs are playing an important role in this strategy. In view of the enlargement of the European Union (EU) to include Candidate Countries (CCs) the Commission stressed the need to involve the Candidate Countries from an early stage on in the development of such a strategy. Thus two studies have been commissioned which are particularly directed to provide

a) an overview on environmental levels and human exposure of dioxins and PCBs[i] and

b) an harmonised PCDD/F emission inventory for the target matrices air, water and land

The latter study, entitled "Dioxin Emissions in Candidate Countries" is carried out by a consortium of institutes from the Netherlands, Germany, France and Slovak Republic and will be finalised by end of the year 2004. 13 Candidate Countries (the ten new member states entering the EU by 2004 and Bulgaria, Romania and Turkey) are covered. Goals, approaches and first results of this project are presented here.

Goals and approach
Main goal of this study is to evaluate and lay the foundation for a consistent and harmonised dioxin emission estimate for air, land and water emission in CCs. The study, being developed in close cooperation with authorities, institutions and experts within the Candidate Countries will help to build substantial dioxin inventory capacity in CCs. Through extensive feedback and mutual aid, harmonisation of methodologies and institutional strengthening in the CCs will be achieved. These aims are approached by an iterative process of data collection, inventory creation and revision between the parties involved.
The general method for building the inventory is the top-down-approach using the product of national activity rates and already known emission factors to give the annual overall emissions

(dimension g I-TEQ/year). By default, the CEPMEIP[ii] database on activity rates and emission factors provided by the UNEP Toolkit[iii] are used to establish a preliminary inventory. The sectorial split of emission sources has been chosen in accordance with the so-called NFR (Nomenclature For Reporting[iv]).

The second important pillar of the project is an accompanying emission measurement program which aims at

- Identification of potentially relevant industrial emission sources and quantification of their emissions
- Comparison of measured emission factors with those taken from the literature in order to check the accurateness of the emission inventory
- Knowledge transfer on PCDD/F sampling and analysis to authorities and private measurement companies in the Candidate Countries.

Proposals of facilities to be investigated were submitted by the national environmental authorities. Further, information on measurement teams and laboratory capacities for PCDD/F analysis in the CCs was collected. From this information industrial plants are selected for measurements according to their relevance with respect to the first and second purpose mentioned above. To achieve the 3rd goal, if possible, the measurements are commissioned to local or at least CC based institutions or companies. In case of less experienced teams assistance/supervision of sampling and/or analysis by experienced experts from well known European companies is provided.

First results and discussion

Preliminary Air Emission Inventory

During the 2nd project workshop held in February 2004 at Bratislava a first preliminary air emission inventory almost purely based on CEPMEIP activity rates and Toolkit emission factors was presented to the national Candidate Country's experts. Four main sectors are covered so far: Energy production (comprising various types of public power plants and domestic heating appliances further broken down for different fuel types), industrial production (metallurgical and earth&stones facilities), waste treatment (domestic and hospital waste incineration, open burning of agricultural residues and domestic waste) and fires/wood preservation. For the latter source types per-capita emission factors were used, whereas in the other cases production or consumption related activity rates and related emission factors were applied. Overall, an annual emission to air of ca. 3,300 g I-TEQ per year was estimated. This compares quite well to the year 2000 estimates of 2,500 to 4,600 g I-TEQ/year given the for 15 Western European countries[v]. The shares of the four main sectors in each of the candidate countries is shown graphically in figure 1. Among the "total waste" fraction the main contribution stems from hospital waste incineration (16 to 86%). Legal Municipal waste incineration only exist in 4 of the countries and shows the highest share in Slovakia. Burning of agricultural residues plays a minor role with shares ranging from 2 to 9 % of the "total waste" emissions. Regarding the industrial sector iron ore sintering dominates followed by cement production and secondary zinc. Nearly 50% of the emissions from the energy sector have their origin in domestic heating facilities.
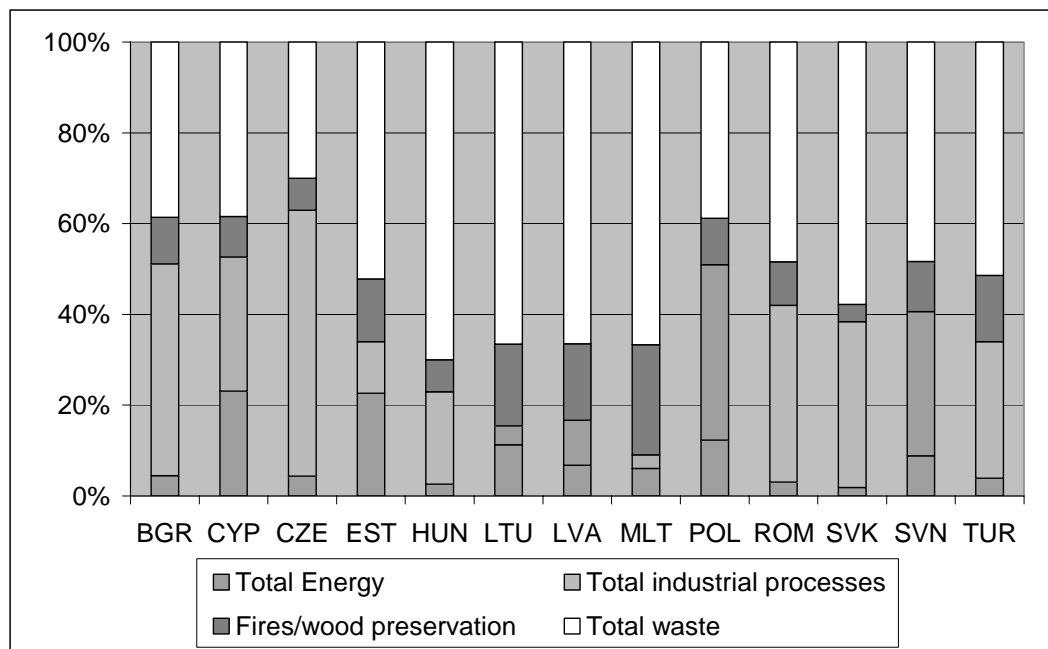
Figure 1: Shares of main emission sectors to total PCDD/F releases to air for the 13 Candidate Countries

The emission data obtained have to be regarded as still being considerably uncertain. This uncertainty is partly due to the fact that appropriate information on the technological split of emission factors (e.g. regarding level of abatement systems as provided in the UNEP toolkit) is lacking and hence could not be accounted for. Therefore in most cases the worst emission factor was applied. Further variance is introduced by uncertain split of activity rates to sub-sectors, particularly in the case of uncontrolled waste incineration. Additionally, at least for some countries the CEPMEIP database apparently does not contain all activity rates needed for a complete inventory. For example no activities for electric arc steel furnaces are included. It will therefore be necessary in the remaining project period to improve the databases by adding missing activities and evaluation of the most accurate emission factors in view of further technological information collected for the most relevant source types.

a) First results from the emission measurement program

Overall 30 industrial facilities located in 10 of the 13 Candidate countries have been proposed for PCDD/F emission measurements. Among these are a number of potentially relevant emission sources like iron ore sintering plants (Poland, Slovakia), iron scrap recovery (Latvia), secondary non-ferrous metal production sites (Poland, Turkey) as well as cement works (Estonia, Cyprus, Lithuania) and various power plants. At the time being, sub-contracts have been established for measurements at 9 plants, results are available so far for 5 measurements. Negotiations for further measurements are ongoing and it is expected that a total of 12 to 14 campaigns will be conducted at the end of the project.

Table 1: results from the first emission measurement phase; *) at operational conditions

Country	Plant	PCDD/F concentration [ng I-TEQ/m³]*)	Annual PCDD/F release [mg I-TEQ/year]	Emission factor [µg I-TEQ/ton]	
				This project	UNEP Toolkit
POL	Iron ore sintering	0.36	467	0.4	0.3
	Zinc recovery from scrap and wastes	3.66	1067	129	100
	Sintering of raw zinc oxide ore	7.29	474	110	100
	Electrolytic zinc melting furnace	0.017	3	0.04	0.3
EST	Cement works	0.018	47	0.07	0.15-0.6

Results of the measurements carried out in Poland and Estonia are shown in table 1. Surprisingly low emissions were found at the iron ore sintering plant compared to plants measured in Western European countries during the 90s[5]. According to information on the plant operation conditions delivered with the measurement report this plant has a re-circulation of waste gas to the sinter strand (about 20% of the flue gas). Further, improvements regarding materials used and other process parameters have been introduced in recent times. Thus the low emissions can be considered as plausible. Not unexpected two of the three zinc processing plants exhibited elevated PCDD/F flue gas concentrations which results in a sum of annual emissions of ca 1.5 g I-TEQ/year. Emissions from the third zinc processing facility was almost negligible; this appears plausible in view that electrolytic processes commonly use quite clean input materials.
A comparison of the emission factors which could be derived from the measurements with those reported for comparable plant technologies in the UNEP toolkit generally shows good agreement.

Conclusions and outlook

With the project "Dioxin emissions in Candidate Countries" a first step towards an harmonised PCDD/F emission inventory for the area of the near future European Union is made. A first preliminary air emission inventory has been presented recently; from the data available so far various needs for further improvements of the underlying databases could be identified. Beside these improvements further evaluations with respect to near future emission trends and recommendations for future action plans will be developed. The emission measurement program so far showed that relevant emission sources can be found in the CCs which should be subject of future abatement measures. In some countries the measurements carried out within this project will be the first PCDD/F emission tests at all and thus are expected to rise the awareness of the dioxin emission problem. Moreover, a considerable training is expected for several yet unexperienced emission measurement teams.

References

[i] Project Dioxins & PCBs: Environmental Levels and Human Exposure in Candidate Countries (ELICC), see http://www.tocoen.cz/elicc

[ii] see http.//www.mep.tno.nl/emissions

[iii] Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, UNEP Chemicals, Geneva, Switzerland, 2001

[iv] DRAFT GUIDELINES FOR ESTIMATING AND REPORTING EMISSIONS DATA, Prepared by the Task Force on Emission Inventories and Projections and the secretariat, URL: http://www.unece.org/env/documents/2002/eb/ge1/eb.air.ge.1.2002.7.e.pdf

[v] U. Quass, M. Fermann, G. Bröker, The European Dioxin Emission Inventory Stage II, LUA-Materialien No. 59, Essen, Germany ,2001