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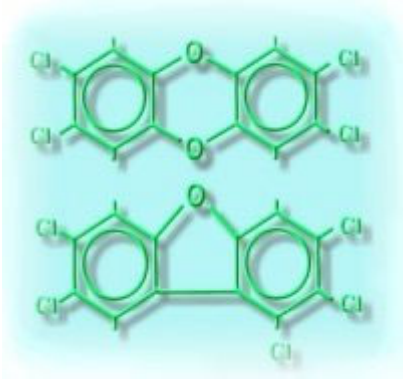
Dioxin Emissions in the Candidate Countries:

Sources, Emission Inventories, Reduction Policies & Measures



by

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0 Key messages

- **Dioxin emission sources profile** is different in the Candidate Countries than in the EU. Waste incineration, with the possible exemption of hospital waste incineration, is not so important as it was in the EU. There is considerable potential for emissions in metallurgical industry, but activities on per capita level are lower than in EU. **Small but numerous diffuse sources mainly in the residential sector due to the widespread use of solid fuels and possible waste co-combustion or open burning have considerable greater potential for dioxin emissions than in EU**. These activities will be most probably recognized in the future as dominant dioxins sources in Candidate Countries. Despite some common circumstances, the dioxin sources profile differs considerably among the Candidate Countries.

- **Dioxin emission inventories** in the Candidate Countries at the present level of development **do not adequately support planning of the policies and measures for emission reduction and subsequent monitoring the effects of their implementation.** In the Central and Eastern European Candidate Countries the coverage with dioxin emission inventories is at a similar level as in the EU. However in most Central and Eastern European Countries only literature derived emission factors are used, which might not reflect specific national circumstances. This results in greater uncertainty of emission estimation and suggests that **reported emissions are most probably underestimated.** The DG-ENV project " Dioxin emissions in Candidate Countries" and the JRC work on better quantification of the emissions from the residential sector will contribute to faster progress in the field of national dioxin emission inventories also due to capacity building.

- The main EU source-oriented dioxin policy instruments (Waste incineration and IPPC directive) do not target non-industrial sources, which are much more important in the Candidate Countries than in EU. **Thus national approaches would have to be developed**, especially if excessive levels of dioxin will be found in ambient, feed and food.

- Less than half of the Candidate Countries have at least one dioxin analysis laboratory and even less groups equipped for sampling of dioxin emissions. **Especially the lack of dioxin sampling groups could be identified as a barrier in implementation of the EU dioxin emission reduction related instruments.**

1 Introduction

1.1 The EU dioxin policy in the context of enlargement

Dioxin emissions and resulting elevated concentrations in environment and human tissues have triggered a deep concern from the international community for their reduction and control. Currently, there is considerable public, scientific and regulatory concern about the negative effects on human health and on the environment of the long-term exposure to even the smallest amounts of dioxins and PCBs.

In the EU there have been continuous activities in order to decrease releases of dioxins into the environment aiming at reducing the human exposure. A strategic target has been set within the 5th Environmental Action Plan to reduce dioxin emissions from known sources by 90% in the period from 1985 to 2005. Waste incineration has been addressed first by prescribing the operational conditions and subsequently by setting emission limits values, which are now prescribed for all types of waste incineration and co-incineration with the new Waste Incineration Directive[1] and will be applied for existing plants by 2005. The IPPC directive[2] is also addressing the dioxin emissions from industry, since the most dioxin relevant industrial installations will have to obtain permits for operation based on the concept of the Best Available Technology. Finally, the Seveso Directive[3] aims at the prevention of major accident hazards involving dangerous substances such as dioxins.

Despite great progress already achieved in dioxin emission reduction there is a pressing need for further action to avoid environmental and adverse health effects from dioxins and PCBs. For that reason the Community Strategy for Dioxins, Furans and PCBs[4] has been developed. The objectives of the strategy are:

- to asses the current state of the environment and the ecosystem
- to reduce human exposure to dioxins and PCBs in the short term and to maintain human exposure at safe levels in medium to long term
- to reduce environmental effects from dioxins and PCBs

with the quantitative objective to reduce human intake below 14 pg WHO-TEQ per kg bodyweight per week.

The Strategy itself has highlighted the EU enlargement issues, since it states that it is likely that the enlargement of the European Union would result in an increase in the average exposure in the EU. Sources and inventories of emissions in general were identified as a gap in knowledge and more specifically the need for identification of

important dioxin sources in Candidate Countries was highlighted[i]. The Environmental Council on its session on 12th December 2001 stressed the need for the Candidate Countries to be involved from an early stage on in the development of such strategy, with special attention to the inventory of sources of dioxins, furans and PCBs and the monitoring of the environmental and human exposure.

In the course of 2002, DG-Environment and the JRC have agreed to work jointly in responding to the environmental council request. The JRC was involved due to its continuing work in the field of enlargement.

1.2 JRC support for EU enlargement

The Joint Research Centre (JRC) is the European Union's scientific and technical research laboratory and an integral part of the European Commission. It is a Directorate General, providing the scientific advice and technical know-how to support EU policies.

The JRC is also playing an important role in providing scientific and technological support for EU enlargement. On the basis of its mission of supporting EU policies, the JRC is actively supporting the 13 candidate countries on their way towards their accession to the European Union.

A special strategy was developed for the enlargement process, including:

- Identifying suitable projects within the JRC's work programme that reflect priority enlargement needs and providing suitable funding to allow the participation of institutions and individuals from the candidate countries;
- Holding workshops on a variety of relevant topics and providing specific training;
- Establishing informal networks of experts in the Candidate Countries.

Out of the more than 100 projects in the JRC 1999-2002 work programme, some 18 projects have received additional funding to support the enlargement process. These allow immediate co-operation with scientific organisations from the Candidate countries, with the aim of facilitating their compliance to the 'acquis communitaire'.

The projects selected reflect priority enlargement needs within the JRC core activity areas and are intended to build on existing institute capabilities and networks. The sectors include harmonisation of measurements, the environment, support to agricultural policy, food and chemical products, prospective analysis and modelling and nuclear safety and safeguards.

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[i] For more information on the EU policy on dioxins see:
http://europa.eu.int/comm/environment/dioxin/index.htm

1.3 The Emission-PECO project and support to the implementation of EU dioxin strategy in Candidate Countries

One such programme is the Emission-PECO project, which was part of the work programme in the Emissions and Health Unit of the Institute for Environment and Sustainability, located in Ispra, Italy. The Emission-PECO project was designed in order to assist Candidate Countries in the implementation of European Standards in the area of mobile and stationary emissions. For this reason a wide network of partners (more than 100 by late 2002) in these countries was established starting in early 2001.

The issue of dioxin emissions was identified early on as a point, which needed special attention, particularly in view of the newly adopted Community Strategy on Dioxins, Furans and PCBs. A special agreement was therefore forged between DG-ENV and the JRC to work jointly in this area.

Since then the JRC has elaborated an extensive work-programme covering various aspects of the dioxin issues. The following activities were part of this work programme funded by the Emission-PECO project:

- Co-organisation of the Workshop on "Dioxins in the Air" held in Bruges, Belgium on November 19-20, 2001.
- Assessment of dioxin inventories in the Central and Eastern European Countries
- Study on policies and measures for dioxin emission reduction in Candidate Countries
- Participation of Candidate Countries laboratories to an International Intercomparison Exercise on Dioxin Analysis
- Training workshop on the “Determination of Dioxins in Industrial Emissions” [5].
- Expert workshop “Contribution of the small sources to the dioxin emissions in Candidate Countries”
- Co-organisation of the Conference on Emission Monitoring CEM-2002 held in Odense, Denmark, September 11-13, 2002
- Preparation of a programme for Air Quality campaigns in the CCs for the assessment of the contribution of solid fuel burning (small sources, stoves, etc.) to dioxin emissions
- Direct assessment of the contribution of solid fuels combustion in small sources at the new JRC facility, developed specifically for this purpose

1.4 Purpose of this report

In the past, the Commission has launched several studies on dioxin emissions (European Dioxin Inventory Stage 1 and 2, Releases of Dioxins and Furans to Land and Water in Europe), as well as studies on the fate and transport, environmental levels and human exposure of dioxins (Compilation of EU Dioxin Exposure and Health Data, Evaluation of the Occurrence of Dioxins and POPs in Wastes and their Potential to Enter the Food Chain, Preparatory Actions in the Field Dioxin and PCBs).

Those studies revealed a harmonised view on dioxin issues across member states, which is apparently lacking for Candidate Countries. The DG-ENV assisted by the JRC has recently launched two studies to fill the gap ("Dioxin Emissions in Candidate Countries" and " Dioxins & PCBs: Environmental levels and human exposure in Candidate Countries"), however these studies will not be completed till 2004.

This report is a first attempt to provide a general overview of the situation of dioxin emissions in Candidate countries as well as policies and measures to reduce them. Comparison with the situation in the EU-15 has been made to understand differences in national circumstances that might require specific measures and instruments to reduce dioxin emissions. Overview is focused on the emissions to the air, since the direct emissions to water and soil have significantly different source profile, which is not covered by the Emission-PECO activities.

Quantification of emissions was beyond the scope of this project. This will be done within the above-mentioned study commissioned by the DG-Environment, which will also take advantage of measurement campaigns. However the uncertainties in emissions will be reduced once there will be more measurements available which will representatively cover relevant activities and a geographical area to account for differences in technologies, input materials and operational practices.

2 Sector profiles of potential emission sources

2.1 Scope

Dioxin emissions are released due to a variety of production and combustion processes. However, some processes, such as waste incineration in older type plants, some metallurgical processes and small residential combustion, contribute the majority of dioxin emissions.

Dioxin emissions inventories in most Candidate Countries are still in the initial stage of development, as will be shown in the next chapter. Their level of comparability is low, as is in general for most of the national dioxin emissions inventories.

Internationally reported emissions are often aggregated without even the most basic sectorial split. Moreover background data such as relevant activity statistics were not required to be reported in the past, and are therefore notoriously difficult to obtain. There is clearly a lack of information on relevant activity data, which would enable the understanding of specific national circumstances relevant to dioxin emissions and their reduction.

Basic information on potential profiles of dioxin sources were collected by means of a questionnaires (Annex 2, Annex 3) send to nominated expert contact point (Annex 1) for the Emission-PECO project. Responses from 11 out 13 Candidate Countries were obtained. Every effort has been made to independently check the responses, however the presence of some relevant activities in Candidate Countries is still uncertain to some extent. Data obtained by the questionnaires were complemented with activity data obtained from the EUROSTAT and other international sources. Wherever possible, a comparison with the EU was made in order to illustrate the differences.

2.2 Waste incineration

Waste incineration (municipal, hazardous and hospital) activities were in the past the most important dioxin sources in the EU. It was estimated that these sources contributed nearly half of total emissions within the EU-15 [i, 6] in 1985.

Waste, especially **municipal waste incineration** is far less common in candidate countries than in EU-15. Municipal waste incinerators were reported only in Czech Republic, Hungary, Poland and Slovak Republic. Only 10 municipal waste incinerators were reported, out of which just one already complies with the waste incineration directive[1] dioxin limit values. However it seems that less than 1 million tons of municipal waste is incinerated in Candidate Countries. For comparison, in the EU –15 around 35 million tons of municipal waste are incinerated yearly [7]. In Czech Republic, Hungary and Slovakia, where the share of incinerated waste is the highest

[i] Including Norway and Switzerland

for the Candidate Countries, slightly more than 30 kg of municipal waste per capita is incinerated annually. This value is three times less than the average in EU-15 and one order of magnitude less than in Denmark, where per capita 350 kg of municipal waste are incinerated.

The situation regarding **hazardous waste incinerators** seems to be very inhomogeneous among the Candidate Countries. Czech republic, Hungary and Poland each have more than 40 of them. On the other hand not a single one exists in Romania and only one in Bulgaria. Reported data on compliance with the Waste Incineration Directive[1] are incomplete, however it is apparent that only a smaller portion of hazardous waste incinerators already satisfies the requirements of the new Waste Incineration Directive.

There are great differences among Candidate Countries also with regard to **hospital waste incinerators**. While in Cyprus, Czech Republic, Hungary, Malta, Poland and Slovak Republic there is one hospital waste incinerator per less than half a million inhabitants, there are countries with only a few of them. The reason for that could be incomplete registries and also hospital waste co-incineration at hospital boilers, as was reported by one country. There is a lack of available information on the percentage of hospital waste incinerators that already comply with the Waste Incineration Directive[1], however it could be assumed that this share is low. Thus the hospital waste incineration and co-incineration could be a potential important source of dioxins. Note that some of the most out-dated hospital waste incinerators were already shutdown.

In most of the countries waste is **co-incinerated at cement kilns**, although co-incineration at power plants and other combustion facilities was also reported. The only exception is Bulgaria, where the Executive Environmental agency reported that they have just recently obtained the first application for waste co-incineration at a cement kiln. All countries reported that a permit is required for waste co-incineration.

It could be concluded that dioxin emissions due to municipal waste incineration in CC do not have the same extend like these sources have had in EU in the past, when municipal waste incinerators were less controlled. Hazardous and hospital waste incinerators might be at least in some countries an important source of emissions.

2.3 Emissions from production processes

Metallurgical activities including processes in secondary metal production are the most important source of dioxin emissions from industrial processes. These sources contributed one quarter of the total dioxin emissions in the EU in the year 1985, when control measures were not yet applied. Such industries are less present in Baltic countries, but are extensive in most of the other Candidate Countries. An overview of the presence of some of the most dioxin relevant production activities is given in table 2.

Iron and steel production have the most significant share in metallurgical processes. This industry is quite developed in Candidate Countries, since Czech Republic, Poland, Slovakia and Turkey are among the 40 largest crude steel producing countries in the world scale.

Iron ore sinter plants are the most important source of dioxin emissions among the metallurgical processes. Their share in EU emissions was 12 % in the year 1985[6]. Iron ore sintering is performed in integrated steelworks, where pig iron is produced. Such plants exist in Bulgaria, Czech republic, Cyprus, Hungary, Poland, Romania, Slovakia and Turkey. Output of the sinter plants could be considered as roughly proportional to the pig-iron production. Per capita pig iron production is on the average smaller in Candidate Countries than in EU-15, however in Czech Republic and Slovakia reached double the average EU-15 per capita value (Table 1)

Another important source of dioxin emissions are **electric arc furnaces for steel production**. Due to the increased production and limited control options these are the only industrial sources of dioxins where a clear increase of emissions is expected in 1985-2005 in the EU. Electric arc furnaces use mainly scrap metal as input. They could be found also in Candidate Countries, where there is no pig-iron production. Per capita scrap iron consumption is on average smaller in Candidate Countries than in EU.

Table 1: Pig iron production and scrap iron & steel consumption in some Candidate Countries and EU 15 in 2000[8]

	BG	CZ	HU	PL	RO	SK	TR	EU
Rank among world crude steel producing countries	**	23	**	19	27	32	17	-
Total crude steel production [million tons]	**	6.2	**	10.5	4.8	3.7	15.0	158.9*
Total pig iron production [million tons]	1.2	4.6	1.3	6.5	3.0	3.2	5.3	95.2
Per capita pig iron production [kg]	150	450	130	170	130	590	80	260
Scrap steel consumption [million tons]	1.1	2.2	0.8	5.3	2.6	1.4	12.4	85.4
Per capita scrap steel consumption [kg]	130	210	80	140	120	260	190	230

*2001 data
** no data reported - not significant producer in the world scale

With the apparent exemption of Baltic States **non-ferrous either primary or secondary metal production** industries are widely present in Candidate Countries. Although not all national experts reported small-scale uncontrolled non-ferrous metal

recovery, it could be expected that such dioxin emission relevant activities – including cable reclamation with burning isolation - are present to a considerable extent.

Table 2: Waste incineration and dioxin relevant industrial activities in Candidate Countries – responses from questionnaires.

	BG	CY	CZ	EE	HU	LV	LT	MT	PL	RO	SK	SI*	TR*
Waste incineration													
Number of municipal waste incinerators	0	0	3	#	1	1	0	2	1	0	2		
Yearly quantity of municipal waste incinerated [Gg]	0	0	339	#	348	13	0	0.16	2.9	0	179		
Number of municipal waste incinerators in compliance	0	0	#	#	#	0	0	0	1	0	0		
Number of hazardous waste incinerators	1	0	47	0	45	0	0	0	44	6	28		
Already in compliance with 2000/76 limits	0	0	#	0	#	0	0	0	8	0	6		
Number of hospital waste incinerators	7	4	21	#	11	0	0	3	130	2	39		
Already in compliance with 2000/76 limits	1	1	#	#	#	0	0	0	20	0	9		
Waste co-incinerated at													
Power plants					+		+						
Cement kilns		+	+		+	+	+		+	+	+		
Other				+									
No waste co-incineration	+							+					
Potential industrial sources													
Iron ore sintering	+		+		+				+	+	+		
Electric arc furnaces	+		+		+	+			+		+		
Primary non-ferrous metal production	+				+				+	+	+		
Secondary aluminium smelters	+	+	+[i]		+				+				
Other non-ferrous metal recovery	+				+				+		+		
Small-scale uncontrolled non-ferrous metal recovery	+	+						+	+		+		

*no response from nominated contact persons
nominated contact persons do not have adequate information
[i] added by the JRC on the basis of the screening the CZ emission inventory

2.4 Residential combustion

Residential combustion is an important source of dioxin emissions, especially solid fuel combustion in small stoves and ovens. Nearly 15 % of total dioxin emissions were attributed to this source in 1985 in the EU-15. In 2005 the share of residential combustion is expected to reach one third of total dioxin emissions due to the pronounced emission reductions in other sectors. In some countries like Austria the residential combustion is already now the most significant source of dioxin emissions[6].

Solid fuel use in the residential sector is much higher in the Candidate Countries than in the EU both on per-capita basis and also in absolute terms. On per capita basis the average consumption of wood is three times higher and that of coal almost ten times. The use of solid fuels in Poland is the most common, where per capita twenty times more coal is used than in EU. On the other hand in Latvia the per capita wood consumption is still ten times higher than EU average (Table 3).

Also the structure of heating appliances is different. On average 38 % percent of the flats in Candidate Countries are not equipped with central heating systems varying from 71 % in Bulgaria to mere 3 % in Czech Republic (1996 data). In the EU the share of flats without central heating is 23 % (1995 data). Most of the non-central heating flats in the EU could be found in countries with warmer climate and lower energy demand for heating like Greece, Spain and Portugal. In countries with similar climate than Candidate Countries the share of central heating is significantly higher. Poor combustion conditions, which are characteristic especially for stoves[6], contribute to elevated dioxin emissions.

Table 3: Solid fuels used by the households and share of flats without central heating[9].

	BG	CZ	EE	HU	LT	LV	PL	RO	SI	SK	CC*	EU**
coal [GJ / capita]	4.3	5.1	1.9	3.7	2.4	1.0	20.3	0.5	1.4	4.6	9.1	0.9
fuel-wood [GJ / capita]	4.2	5.6	18.3	5.1	5.9	15.4	3.3	8.6	7.6	4.1	5.6	1.9
share of flats without central heating [%]	81	3	34	44	8	30	33	60	14	8	38	23

*weighted average for Central and Eastern European Countries, 1996 data

**weighted average for EU-15 without Italy, 1995 data

Data on solid fuel consumption and non-central heating share presented in the table 3 cover a period more than 5 years ago. Their advantage is that they were obtained by a harmonised methodological approach. Moreover it has been shown that the consumption of solid fuels, especially firewood, was usually not adequately addressed by the statistical report based on the supply side data collection, since especially the self and non-commercial supply of wood was not taken into account in many cases.

Besides the combustion of licensed fuels also uncontrolled burning of waste might be an important issue in the Candidate Countries either as co-combustion in solid fuel-fired appliances or the so-called open burning. Co-combustion of waste might be motivated by savings in partly substituting licensed fuels and/or resulting from lower level of awareness on the consequences of such a bad practice. The open burning of waste occurs mainly in the rural areas with less developed waste collection systems. Sound data on these activities are difficult to obtain, however some structural differences point out that these activities might be of much greater relevance in Candidate Countries than in EU due to:

- higher share of solid fuel-fired appliances which offers more possibilities for waste co-combustion,
- higher share of low-income households which might consider energy use of the waste,
- less developed waste collection systems, as for instance in Latvia only about 50-60% of household waste is collected and land filed[10], in Turkey on the other hand around 2 % of the already collected waste is open burned[11].

The emissions of dioxins from non-controlled waste combustion are highly uncertain and potentially very high. US data estimate that after 2002 the so called backyard waste barrel burning will contribute more than half of national dioxin emissions[12]. On the contrary, the EU dioxin inventory[6] estimated the share of uncontrolled household waste combustion to be less than 10 % in 2005.

2.5 Conclusion

Emission profiles are different in the Candidate Countries than in the EU. Waste incineration is most probably not so important as it was in the past in the EU. The exception might be the incineration of the hospital waste. There is considerable potential for emissions in metallurgical industry, but the activities on per capita basis are on average lower than in EU. However the emissions could be higher than they are in EU now since very limited monitoring programmes in the field of industrial emissions imply also limited introduction of primary measures for dioxin emissions reduction. Small but numerous diffuse sources, mainly in the residential sector consumption due to the widespread use of solid fuels and possible waste co-combustion or open burning, have considerable greater potential for dioxin emissions than in the EU. The latter will be most probably shown to be a main source of emissions in most of the Candidate Countries.

3 Emission inventories

3.1 Scope

Emission inventories are a first step towards the preparation of effective policies and measures to reduce pollution. Subsequently emission inventories are also a tool for monitoring the effects of the implemented measures. Reporting the national emission estimates is a commitment upon various international Conventions as well as obligation of the Member states at the EU level. This is why the preparation of the emission inventories has received considerable attention resulting in constantly refined methodologies and emission factors.

The emission estimations of conventional pollutants and air quality data seems to be or will be in the foreseeable future assessed with satisfying uncertainty in most Candidate Countries. The main sources and most polluted areas are identified, as a prerequisite for effectively focusing abatement measures. The uncertainty of persistent organic pollutant emission estimation, their level in the environment and human exposure in some EU countries and in most Candidate Countries requires more attention. To date the gaps in knowledge could be identified as one of the barriers in effective planning of appropriate dioxin emission abatement polices and measures in Candidate Countries.

This chapter refers only to Central and Eastern European Candidate Countries, since Cyprus, Malta and Turkey have not developed their national emission inventory yet.

3.2 Status of National Dioxin Inventories

As of September 2001 the official dioxin emission estimation has been submitted to the UN-ECE Convention on Long Range Transboundary Air Pollution (CLRTAP)[13] by seven out of ten Central and Eastern European Countries (CEEC): Bulgaria, Czech Republic, Hungary, Lithuania, Poland, Slovakia and Slovenia (see Figure 1). These countries represent 75 % of total CEEC population. For comparison eleven out of fifteen EU countries with 78 % of total EU-15 population have submitted their dioxin emissions estimation to the CLTRAP (Figure 1). The coverage of the CEEC countries with official national inventories is only slightly lower than in EU, but the reported time series of CEEC are on the average more complete.

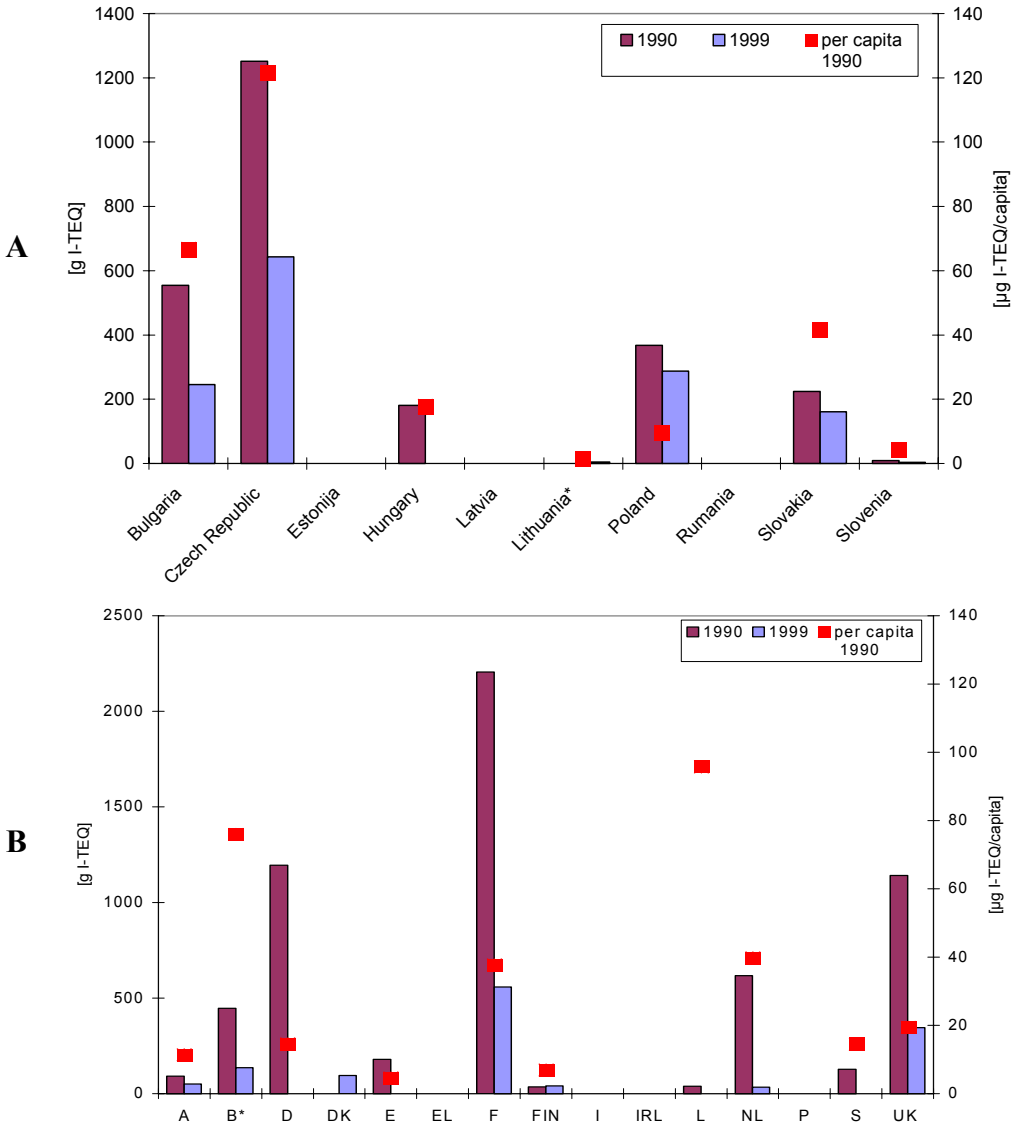

Figure 1: Dioxin emissions of candidate (A) and EU (B) countries as reported to CLRTAP.

3.3 Reported emission levels

In all CEEC having reported the data a continuous decrease of dioxin emissions could be observed with time. From 1990 to 1999 emissions in CEEC countries on the average nearly halved. In six EU countries, which have reported adequate time series, the emissions decreased in the same period by 75 %. Reported weighted average emissions on per capita basis in the CC countries in 1990 were 0,03 mg TEQ per capita, which is more than in the EU, where countries with submitted data have on the average 0.02 TEQ mg per capita.

It should be strongly stressed that this comparison of dioxin emissions should serve as a rough indication only due to the hardly representative geographical coverage,

incomplete time series and in the case of intercomparision between EU Member and Candidate countries also different approaches taken to estimate the emissions.

The preparation of dioxin emission inventories is much more complex than for conventional pollutants. Emissions of dioxins are highly sensitive on specific plant-related technological parameters, composition of input materials, operational practices and in the case of household emissions also on behavioural habits. Measurements to derive or verify the emission factors require well-equipped laboratories and highly skilled personnel. The simplified top-down approach using basic statistical data and default emission factors in the preparation of a dioxin inventory could lead to a great level of uncertainty, especially if emissions factors are taken from studies performed in countries with different specific national circumstances.

The situation of dioxin emissions in the EU countries has been assessed in the European Dioxin Emission Inventory Stage I[14] and Stage II[15] projects. Both projects resulted in a comprehensive review of national data and studies on dioxin emissions and produced national emissions estimations and projections on a comparable basis. However the situation of dioxin emissions in the CEEC was not part of the Stage I project. The Stage II project has included only brief description of some dioxin relevant sources in Estonia, Lithuania, Czech Republic and Poland.

In the UNEP publication "Dioxin and Furan Inventories"[16] the Hungarian and Slovak Inventory are presented, however at that time both countries used only emission factors taken from literature. The only study which covered also dioxin emissions in the whole Europe as a geographical entity on the country level is "The European Atmospheric Emission Inventory of Heavy Metals and Persistent Organic Pollutants for 1990"[17], prepared by TNO on the behalf of German Environmental Agency (UBA) in 1997. This study was based on the data from national emission inventories, which were supplemented by emission estimates for countries, sources and compounds missing in official submissions. The default emission factors used by TNO to estimate dioxin emissions were uniform throughout the Europe. The only exemption was the municipal waste incineration, where a higher value was assumed for Southern, Central and Eastern Europe. Taking into account that municipal waste incineration is far less common in Central and Eastern Europe it could be concluded, that the results derived in this study have not taken into account the specific, dioxin emissions related national circumstances in the CEEC.

It is obvious that considerable gaps exist in knowledge of the dioxin emissions in the CEEC as well as on the approaches, methodologies and emission factors used in national inventories. To collect some basic information a short questionnaire (Annex 4) was sent to the CLRTAP national emission inventories focal points and laboratories, participating in the JRC emission network.

The aim of the questionnaire was to obtain information on the approaches used in preparation of the national dioxin inventory and sources to be considered as a priority in developing national (or plant specific) emission factors in order to decrease overall inventory uncertainty and to focus abatement measures.

From the responses of the national inventory focal points it can be concluded, that only those seven candidate countries, which submitted their dioxin emission estimations to CLRTAP have prepared their inventories. More important is that only two countries prepared their dioxin inventory by using at least some national, measurement derived emission factors. Other counties prepared their emissions inventory exclusively using the various literature sources.

The most complete dioxin inventory has been prepared in the Czech Republic. That country has derived national emission factors for most key dioxin sources. Their inventory is based on the dioxin measurement in power-plants, sinter plants and grey iron foundries in iron & steel industry, combustion in institutional/commercial sector, residential combustion where particularly coal use was addressed as well as municipal and hospital waste incinerators. In Slovakia they have supplemented the data from literature sources with measurement derived emission factors for waste incineration.

Indicative is the comparison of the TNO/UBA[17] emissions assessment and national emission estimates (Figure 2). National dioxin emission estimations from candidate countries, which have not used national emission factors, are close to TNO/UBA estimates. This is valid also for EU countries, partly also due to the fact, that TNO/UBA report used mainly national estimates. In this comparison the emission estimates from Czech Republic and Slovakia stand out, which are more than 5 times greater than the TNO/UBA estimates. Both countries have an extensive measurement programme and used national measurement derived emission factors for the compilation of dioxin emission inventories.

Structural differences in economies and other national circumstances in Candidate Countries do not allow generalised conclusions, although is very likely that the actual emissions of dioxins in Candidate Countries, which have used only literature based emissions factors, are significantly greater than those reported.

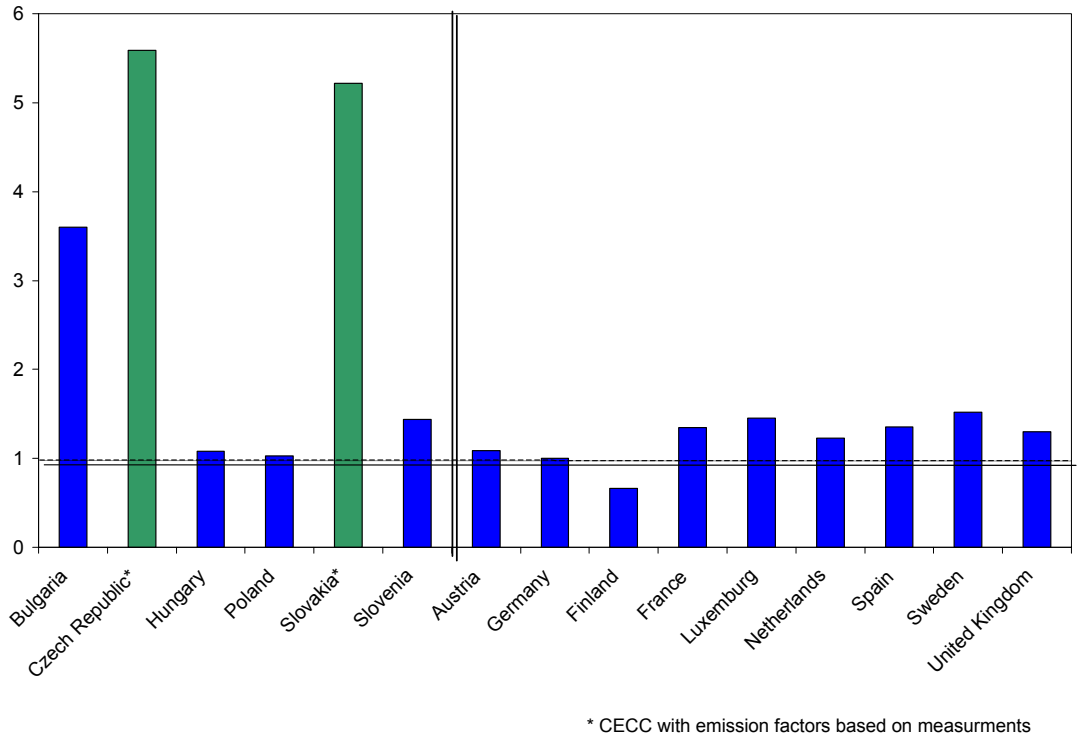

Figure 2: Ratio of national dioxin estimation submitted to CLRTAP and TNO/UBA[17] estimates for 1990.

Another indication of the great differences in approach and used emission factors reveals the comparison of the dioxin to CO_2 emission ratio (Figure 3). In this case the CO_2 emissions indirectly represent the activity data, which are in most cases not reported or difficult to find elsewhere. Such comparison at a low level of sectorial disagregation makes sense only for sectors, where there is a comparable structure of the activities among the countries taken into account. For the Candidate Countries where basic sectorial split of the emissions were reported (Bulgaria, Lithuania, Poland, Slovakia, Slovenia) the electricity production, which is the main source of dioxin and CO_2 emissions in the power generation sector, uses predominately coal as a fuel. Comparable is also the structure of the road transport sector. The data for dioxin emissions are obtained on the EMEP web site for the year 1999. Due to the absence of CO_2 emissions on the EMEP web site for some countries some CO_2 emission data were taken from the National communications to the UN Framework Convention on Climate Change[18,19]. The CO_2 emissions for Bulgaria are for the year 1995, however this does not significantly influence the comparison.

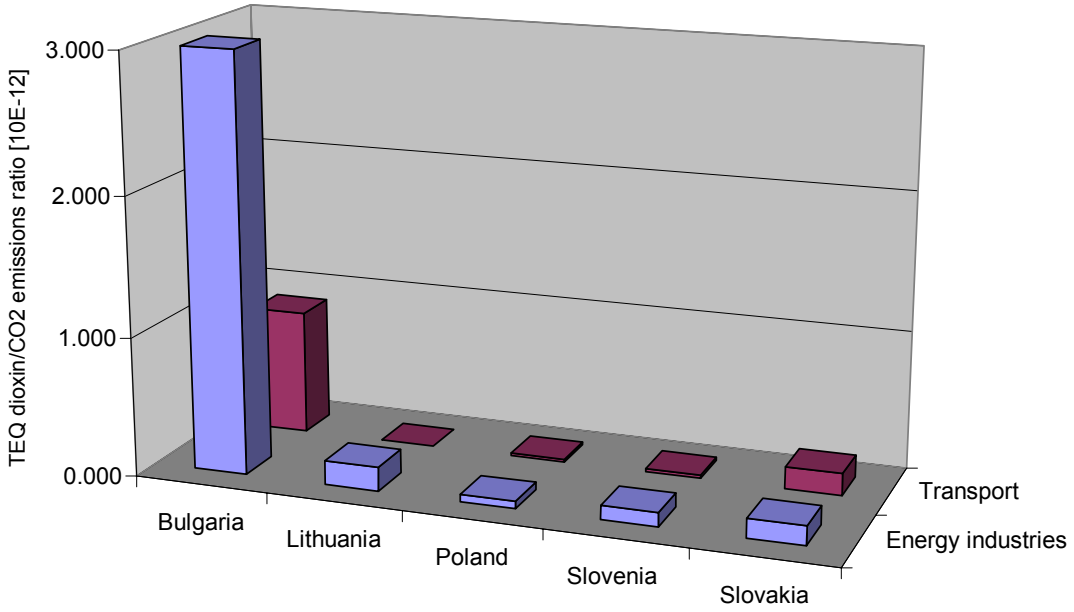

Figure 3: Dioxin to CO_2 emission ratio for certain sectors in CEEC.

The great differences in dioxin to CO_2 emission ratio, which exceed one order of magnitude, indicate the wide range of emission factors used, even though countries compared have used only literature derived emission factors.

3.4 Priority sectors to reduce uncertainty

To screen the opinion of the experts from candidate countries on relevant, yet most uncertain sources, the national emission focal points and Emission-PECO network participants were asked to select four sources, which according to their expert judgement, deserve special attention in order to decrease the overall emission inventory uncertainty and to focus the abatement measures. The basic list of sources was given and the experts could propose also other sources, if they deem to be appropriate. The answers received were not very uniform (Figure 4).

On the top of the list were power plants followed by iron & steel production. In the light of the West European inventories, where power plants are not considered as a key source, the high rank of the power plants was not expected. However, due to different levels of technologies and possibly higher chlorine level in some coals this judgement could have a sound explanation. Considerable attention was given also to the residential combustion of coal and wood, which is supposed to have a greater share than EU countries as well as heating demand might be greater than in EU due to on average colder climate and less efficient thermal insulation of the buildings. The

waste co-incineration in the residential sector was also acknowledged. Considerable focus was given to the hospital waste incineration, whereas municipal waste incinerators were given lower priority. This is the result of the fact that in some countries municipal waste incineration is not yet performed and that on the other hand the emissions from existing plants are already monitored in most cases.

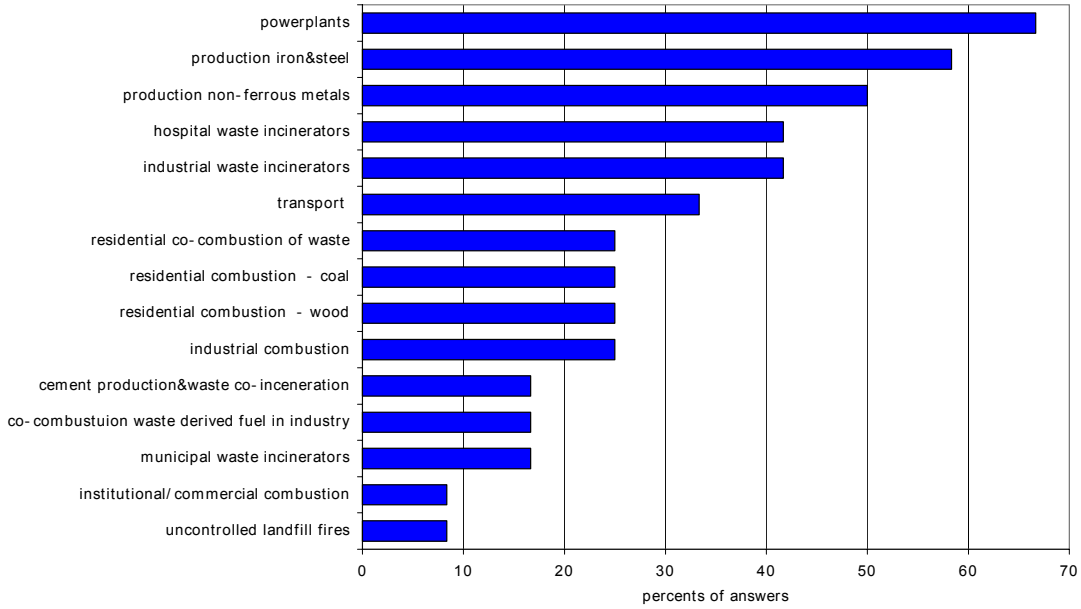

Figure 4: The answers of 12 experts from Candidate Countries on priority sectors in the scope of reducing the overall inventory uncertainty and focusing abatement measures.

3.5 Conclusions

Most Candidate Countries have already prepared their national dioxin inventories. Taking into account the officially submitted dioxin emissions estimations to CTLRAP, the coverage with dioxin emission inventories in ten candidate countries from Central and Eastern Europe is at a similar level in terms of share of the total population covered as in EU-15. However an important difference exists. Only two Candidate Countries have used in the preparation of their inventories at least some measurement-derived national emission factors. Taking into account the high sensitivity of dioxin emissions on specific national circumstances, an approach of estimating emissions on the basis of literature data from other countries clearly leads to a high degree of uncertainty.

What is even more important, without co-ordinated measurement and evaluation programmes it is not possible to effectively plan the policies and measures for emission reduction and to monitor the effects of their implementation. Better co-

ordination and exchange of information between research and monitoring community on one side and agencies and ministries responsible for preparation of the inventories and reduction policies and measures could contribute to faster and more cost-effective progress of candidate countries on this field. On the other hand critical evaluation of the measurements results in order to be used for emission inventories compilation could contribute to the improved practice in dioxin sampling and analysis.

The difficulties in compiling dioxin inventories could be illustrated by the fact, that Austria, an EU country with well established dioxin programs has adjusted its past national dioxin emissions estimation by more than 100 % in its latest submission to CLRTAP.

The recent information obtained has shown that in the nearest future all Candidate Countries will have compiled a dioxin emission inventory, as for instance the dioxin emission inventory in Cyprus is under development[20] and in Malta[21] information and data collection is planned. Furthermore, some of the countries with already prepared inventory are putting additional efforts to take specific national circumstances more into account. Hopefully, the DG-ENV funded project "Dioxin Emissions in Candidate Countries", will go a long way to raise awareness of such issues in the CC and to contribute to improvement in dioxin inventory compilation practices.

In the future the comparability of national dioxin inventories will significantly improve, since UNEP - Chemicals has prepared a Dioxin and Furan toolkit[22] to be used for inventory compilation under the Stockholm Convention on Persistent Organic Pollutants. However it has to be stated that the Dioxin and Furan Toolkit in its currently available draft version does not give enough attention to residential use of solid fuels, which is an important source for Candidate Countries. Moreover it is evident, that data from Candidate Countries were not taken into account in the compilation of the Dioxin and Furan Toolkit emission factors. Default emission factors could be also complemented by measurements results required by the IPPC and waste incineration directive to obtain more accurate results.

Finally, Candidate Countries have successfully initiated the emission estimation process, however more efforts as well as assistance will be needed to progress. It is encouraging, that several countries are putting additional efforts to improve and revise their dioxin emission inventories.

4 Policies and measures to reduce emissions

4.1 Scope

The aim of this chapter is to present an overview on the policies and measures in Candidate Countries aimed to reduce dioxin emissions although not necessarily primarily focused on them. Not only currently implemented measures are described but also measures that are planned or under investigation.

Information in this section is based almost exclusively on the information obtained from questionnaires send to the officially nominated contact points. For that reason such an overview was not possible to prepare for the countries where there was no response.

4.2 General policy context

In most of the Candidate Countries, which responded to the questionnaires, the dioxin issues are not explicitly addressed in their national framework strategic environmental documents (Table 4). Only Bulgaria and Czech Republic have addressed the sectors most important for dioxin emissions reductions in those documents. Out of all countries only Poland has set at least a semi quantitative target, namely a reduction of dioxin emissions by the year 2010 in comparison with the 1990 level.

In most of the countries the preparation of a document dedicated to dioxin issues is not envisaged in their framework strategic documents. However mainly in response to Stockholm POPs Convention, which requires the preparation of the National Implementation Plan, most of the Candidate Countries already started its preparation under the support of the Global Environment Facility.

For such a specific issue, as dioxin emissions and contamination, there is a clear need for coordinated approach at the national level, formalised in the form of a strategic document. At least in the medium term the POPs Convention requirements and its already developed mechanisms for assistance will contribute to the progress in this field across the Candidate Countries.

Table 4: Dioxin policy issues included in framework environmental documents in Candidate Countries.

	BG	CY	CZ	EE	HU	LT	LV	MT[10]	PO	RO	SK
Dioxins issues explicitly addressed	Yes	Yes	Yes	No	No	No	No		Yes	No	No
Identified priority sectors for dioxin emissions reduction	Yes	Yes	Yes	No	No	No	No		No	No	No
Waste incineration	+	+	+								
Metallurgical industry	+		+								
Cement industry			+								
Solid fuel residential heating	+										
Preparation of specific document to address dioxin issues envisaged	Yes[1]	Yes	No	Yes[3]	No[4]	No[5]	No[11]	[12]	Yes[6]	Yes[8]	No
Target for dioxin reductions	Yes[2]	No	No	Yes	No	No	No		Yes[7]	No	No

[1]According to CTLRAP POPs protocol
[2]National program for Reduction of POPs Emissions from Stationary Sources planned to be prepared by 2004
[3]National Chemical Safety Evaluation Plan- draft of the law prepared
[4]POPs program/strategy in preparation
[5]POPs National Implementation Plan planned to be prepared – project proposal for enabling activity funding
[6] National Strategy for POPs Emission Reduction in the process of adoption
[7]Dioxin emission reduction by 2010 compared to the level in 1990- medium term goal
[8] National Implementation Plan as and early action on the Implementation of the POPs Convention in Romania – project already started
[9] Project to develop National Implementation Plan to meet obligation of the POPs Convention
[10] Up to now Malta has prepared only sectoral Environmental Plans
[11] National Implementation Plan under the Stockholm Convention will be prepared
[12] POPs dedicated programme envisaged

4.3 Applied regulatory measures

4.3.1 Waste incineration

The Waste incineration directive[1] (2000/76/EC) has prescribed a general dioxin emission limit of 0.1 ng TEQ of dioxins in exhaust gases from all types of waste incineration. The same directive addresses also waste co-incineration by applying the same dioxin emission limit relative to the share of waste co-incinerated. Enforcement of national legislation based on the waste incineration directive will significantly decrease emissions from this, in the past dominating source of dioxin emissions. In the context of the Candidate Countries, where waste incineration is not so widespread as it is in the EU, this means that the dioxin emissions from these sources would not attain a more important dimension in the future, even if the share of incinerated waste increases.

According to the responses from the questionnaires, 9 out of 11 countries that responded have already transposed the waste incineration directive to their national laws. By the time of publication of this report this number might increase. It is important that transposition has already taken place in those countries, where waste incineration is the most widespread. Some countries have introduced longer transitional periods for compliance for the existing plants.

4.3.2 Industrial sources

None of the Candidate Countries has prescribed any limit values for other industrial processes than waste incineration. Also in the EU there are only a few countries that have specified limit values for some industrial processes, mostly for iron ore sintering plants. Thus the reduction of the industrial emissions will be achieved mainly by the implementation and enforcement of the IPPC Directive[2], which on the EU level is the most important instrument to reduce the industrial dioxin emissions, as envisaged by the EU dioxin Strategy.

The IPPC directive addresses most of the dioxin emissions relevant to industrial processes. IPPC directive among other sectors applies to primary and secondary ferrous and non-ferrous metal production. Installations covered by the directive will have to reach the level of the Best Available Technology (BAT), which includes also operational practices. Thus the emissions of dioxins from industrial sources are expected to be much lower in the future.

In the process of the approximation to the EU legislation the Candidate Countries have to transpose and implement the IPPC directive. As reported in the questionnaire most of them have already transposed the IPPC directive. By the time of publication of this report the number of countries, which have already transposed the IPCC Directive might increase (Table 5). Some Candidate Countries might have longer transition periods for existing plants.

Table 5: Status of the transposition of the IPPC directive in some Candidate Countries.

	BG	CY	CZ	EST	HU	LT	LV	MT	PO	RO	SK
Status of the IPPC directive*	P	P	T	T	T	T	T	T	T	T	P
Longer transition period for some existing plants	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	No

*T – Transposed; P- in Pipeline

In addition to emissions from the plants also small-scale activities, like cable burning, which could have significant dioxin emissions have to be controlled. For such dispersed activities enforcement of the appropriate legislation supported by awareness raising is essential.

4.3.3 Dioxin emission monitoring

Emission monitoring requirements are usually an integral part of the regulatory measures prescribing the limit values. All of the countries that have adopted emission limit values for waste incineration have also prescribed compliance monitoring. However due to limited capacities it is not clear if this is enforced in all countries.

In Czech Republic - in addition to the waste incineration activities - the measurement of the dioxin concentration in exhaust gases from large combustion plants, cement production and sinter plants are regulatory prescribed once every three years. Although no emission limit or target levels exist, this could be identified as an indirect reduction measure. Information on dioxin levels could trigger voluntary measures at the plant level. It has to be stressed that at least the first steps in dioxin emission reductions for some sources are in line with good operational practices, which increase productivity and product quality.[23]

4.4 Residential sector

Residential combustion, either of solid fuels or waste co-combustion in household stoves and ovens, as well as open burning of waste might be a predominant source of dioxin emissions in most of the Candidate Countries. Change of the heating installations is connected with investments, which might be a barrier for making such a decision at the level of an individual household. Thus financial incentives, like soft loans might contribute to the faster structural changes in residential heating sector. Such financial incentives are usually introduced to prevent excessive air pollution. For bad practices as waste co-combustion or backyard waste burning the awareness raising is of high importance.

The situation of financial incentives for households is not uniform across Candidate Countries (Table 6). While some countries have already implemented such measures in other countries they are currently not planned. However it is important that they are already in place in those countries, where the per capita and absolute coal consumption is the highest between Candidate Countries.

Table 6: Financial incentives for households such as soft loans for fuel switch from solid fuels to a more environmental friendly means of heating.

	BG	CY[1]	CZ	EE	HU	LV	LT[2]	MT[1]	PO	RO	SK
not planned					+	+	+				
planned	+			+						+	
already in place			+						+		+

1 not relevant, since on Cyprus and Malta solid fuels are not used for heating purposes

2 Mainly due to fuel prices the solid fuels consumption decreased significantly from 1995 on

Awareness-raising campaigns to reduce co-combustion of the waste and its open burning have been already commenced is some countries (Table 7). In most cases this was an activity of non-governmental organizations (NGOs). Although it is of outmost importance to involve NGOs in these activities, the competent authorities could also play a more active role in this field.

Table 7: Awareness raising campaigns for prevention of waste co-combustion and open burning of the waste in Candidate Countries.

	BG[1]	CY	CZ[2]	EE	HU	LT	LV	MT	PO[3]	RO	SK[2]
waste- co-combustion											
not planned				+	+	+					
planned							+			+	
already in place	+		+						+		+
open burning of waste											
not planned								+			+
planned		+		+	+						
already in place	+		+			+	+		+	+	

1 Instructions prepared for Municipal Authorities and regional inspectorates on these issues
2 NGOs activity
3 Currently mainly NGOs activities, however planned also on other levels

4.5 Integration with other environmental policies

Identification of possible synergistic or/and antagonistic effects and subsequent integrated approach to other environmental policies focused on specific issues might reduce the costs of achieving the environmental objectives. For dioxin emission reduction policies and measures this aspects have not been studied in detail, since dioxin-focused measures do not contribute significantly to decrease of other pollutant emissions or on the other hand the most relevant sources of dioxin emissions have not such important share for other pollutant emissions. This is clearly the case for industrial emissions, however this could also be the case in other sectors, such as residential combustion.

Residential combustion of solid fuels, especially in older types of non-central heating appliances, is characterised by poor combustion conditions, which generate high specific emissions of particulate matter and Volatile Organic Compounds (VOCs). Besides when using coal, the sulphur dioxide emissions could be considerable, since no abatement measures are applicable for these types of appliances. Although emissions from solid fuel used in households might not have an important share in total national emissions, they could have substantial influence on local air quality due to the low height of chimneys.

Air pollution of regulated pollutants due to residential coal use in the EU is more or less a problem of the past, although in some areas excessive SO_2 concentrations are still expected[24]. Due to an order of magnitude higher residential per capita coal combustion in the Candidate Countries, such activities still influence greatly the local air quality. Thus switching from coal to natural gas or gas oil might simultaneously contribute to the improved air quality and reduction of dioxin emissions.

In other sectors the synergistic effects between air quality improvement and dioxin emission reduction measures seem to be lower. However each particulate emissions reduction secondary measure, such as a new installation of abatement measures or upgrade of their efficiency, can contribute also to the dioxin emission reduction, since a part of the dioxins in the exhaust are particle bound.

Up to now only a few countries have already taken into account the synergistic effects of the air quality improvement and dioxin emission reduction (Table 8).

Table 8: Responses of the national contact points on co-ordination of air quality and dioxin emission reduction policies.

	BG	CY[1]	CZ	EE	HU	LIT	LV	MT[1]	PO[2]	RO	SK[3]
considered not relevant	+										
might be relevant, however not taken into account yet			+	+	+	+	+			+	
synergistic effects already taken into account									+		+

[1] not relevant for Cyprus and Malta due to small emissions resulting from heating
[2] switching from coal to natural gas in Krakow given as an example
[3] switching from solid fuels in residential sector

Most of the Candidate Countries[i] will not have significant difficulties in satisfying their commitments on limitations of greenhouse gases emissions under the Kyoto Protocol. Besides the cost of the emission reductions will be lower than in some developed countries. For that reason is expected that the Candidate Countries will participate in the Joint Implementation (JI) projects as host countries, executing projects aimed to reduce greenhouse gas emissions jointly with donor countries, with transferring to them part of the achieved emission reduction.

Fuel switching to less carbon intensive fuels is one of the option to reduce greenhouse gases, since coal releases nearly two times more CO_2 than natural gas per unit of energy. Also other climate change mitigation measures in the residential sector like the improvement of the insulation of the housing reduce the consumption of the fuels

[i] Turkey is not party of the UN Framework Convention on Climate Change yet.

and thus proportionally the dioxin emissions from this sources. The host country government has to approve the Joint Implementation (JI) projects and have thus influence on their selection. However feasibility of the taking into account dioxin issues, especially the cost effectiveness of such JI projects, has yet to be evaluated and depends also on further development of the Kyoto process (see Table 9). Currently in most of the countries such approach is not planned or has nor been investigated yet.

Table 9: Opinions regarding the preparation of the Joint Implementation projects under the Kyoto protocol which might also contribute to the dioxin emission reduction – responses from the national contact points.

	BG	CY[1]	CZ	EE	HU	LT	LV	MT[1]	PO	RO	SK
not planned	+					+					
possibilities have not been investigated			+		+		+		+		+
intended to take into account also dioxin emissions in preparation of JI projects				+						+	

1 of lower importance for Cyprus and Malta due to different national circumstances

Since dioxin reduction policies in Candidate Countries have not been formalised yet, the responses of the national contact points on the integration with other environmental policies have to be seen mainly as a professional view of the policy maker or of an expert close to the policy makers.

4.6 Conclusions

Transposition of EU legislation and its subsequent implementation will contribute to the reduction of dioxin emissions in Candidate Countries. Due to longer transitional periods for existing installations in some cases the effect could be slightly delayed. The current **lack of capacities in the field of monitoring of the emissions** could be identified as a barrier for effective implementation and enforcement of relevant EU legislation in some countries.

Different sectorial profile of the dioxin emissions in Candidate Countries, with more pronounced share of non-industrial sources might have important consequences for policies and measures. The main EU source-oriented dioxin policy instruments (Waste incineration and IPPC directive) do not target small sources. Thus national approaches would have to be developed, especially if excessive levels of dioxin will be found in ambient, feed and food.

An integrated approach towards air quality improvement, climate change mitigation and reduction of dioxin emissions in the residential sector might facilitate the formulation of adequate measures

5 Resources at national level

In order to respond to the dioxin issues it is essential that the capacities are adequately developed at the national level. The existence of properly equipped and trained dioxin stack sampling groups is essential to monitor the dioxin emissions in order to enforce adopted legislation, support the development of the dioxin reduction measures at the plant level and finally to contribute to the quality of the emission inventory. Additionally the adequate analytical infrastructure availability such as a dioxin laboratory and sufficiently trained stuff to operate it properly is a great advantage.

Currently dioxin laboratories exist in Czech Republic, Hungary, Poland, Slovakia and Slovenia. There is a further indication, that one dioxin analysis laboratory might exist in Latvia. So currently only about half of the Candidate Countries possess a dioxin analysis laboratory (Table 10).

In the process of emission quantification, the sampling could be considered to be even more important than the final dioxin analysis. Sampling groups performing dioxin stack gas sampling exist currently only in Czech Republic, Hungary, Poland and Slovenia.

The existence of a dioxin lab and stack testing group at the national level might still not be an absolute prerequisite for successful implementation of the dioxin emission reduction measures. For smaller countries where there are not much dioxin emissions relevant to industrial activities, including waste incineration, it might be more suitable and cost-effective to cooperate with neighbouring countries. However the lack of suitable infrastructure in South- Eastern Candidate Countries (Romania, Bulgaria, Cyprus and presumably also Turkey) might pose additional barriers in implementing and enforcing the relevant Community legislation. But in any case it can be concluded that the existence of dioxin labs and stack-testing groups at the national level contribute to a better understanding and response to dioxin issues.

Table 10: Existence of dioxin laboratories and dioxin stack sampling groups in Candidate Countries.

	BG	CZ	CY	EE	HU	LT	LV	MT	PL	RO	SI	SK	TR
dioxin laboratory	No[1]	Yes	No	NO	Yes	No	No	No	Yes	No	Yes	Yes	#
dioxin stack emissions sampling group	No	Yes	No	No	Yes	No[2]	No	No	Yes	No	Yes	No	#

no information

1 Bulgaria is in the process of setting-up a dioxin laboratory with Phare assistance – personal communication with Ms. Nikolova

2 Lithunian Joint Research Centre within Ministry of Environment recently acquired the necessary instrumentation for dioxin emissions sampling- personal communication with Ms. Gailiuniene

6 JRC Candidate Countries support activities

6.1 Dioxin laboratories intercomparison campaign

The congener specific determination of the dioxins could be considered as one of the most demanding analysis performed on a routine basis. Advanced chemical analytical instrumentation that has to be properly maintained and operated by highly skilled personnel is required. Despite the great progress, the accuracy of the analysis is still a very important issue for regulatory monitoring as well as for research work.

Intercomparison exercises are an especially important QA/QC tool for dioxin analysis in various matrices. Due to inadequately applied procedures or some other technical problems, the results from dioxin analysis could easily deviate more than a factor of one from the actual value. Participation to an intercomparison exercise offers the dioxin laboratory a unique opportunity to assess their performance. It is of great assistance in identifying possible errors in procedures. On the other hand results from intercomparison study could attest the competence of a dioxin laboratory.

Reliable dioxin analysis is crucial in assessing the emissions and their compliance with limits, contamination of the environment and evaluating human intake of the dioxins. In order to support the progress of the Candidate Countries in this field the JRC has organized and supported the participation of four dioxin laboratories from Czech republic, Poland, Slovakia and Slovenia at the 7th round of the international intercomparison exercise organized by UMEA University, Sweden in 2002. Altogether 114 laboratories from 27 countries participated.

The intercalibration study included analysis of incinerator fly ash, soil and fish samples as well as a standard solution. The participating laboratories did not know the concentrations and sources of the samples.

Depending on the sample from 10 to 30 % of the laboratories, among them one from the supported laboratories, did not succeed to report results in time. Around two third of the all laboratories reported also planar and mono-ortho PCBs, enabling the calculation of the total WHO-TEQ. Three out of five supported laboratories reported also TEQ relevant PCBs.

Reported results were evaluated by comparing the reported CC values with the average and median values, the minimum and maximum values and the standard deviation. Since there are no reference samples available, the comparison of the results for each individual laboratory has to be made to the average value or median of all reported results.

Results of one of the supported CC laboratories were significantly deviating from the average or median values for all types of samples. The other three laboratories proved to achieve a much higher accuracy level of analysis.

Evaluation of the intercomparison campaign was presented at 2002 Dioxin Conference in Barcelona Spain and also a special report was prepared [25]. As an example of the performance of supported laboratories, the results from the fly ash study are presented below (Table 11 and Figure 5).

Table 11: Summary results for supported laboratories in the fly ash study. Samples A and C were the same, although this was not known by the laboratories. Bold marked results are outside an average ± standard deviation interval.

Participant code:	**2**	**23**	**58**	**83**	**84**	Average	Median	Min	Max	SD	RSD
						all reported results					
	pg/g										%
ASH SAMPLE A											
TEQ (PCDD/DF)	0.20	0.21	0.19	NA	**0.05**	0.18	0.19	0.002	0.50	0.06	35
TEQ (including PCBs)	0.20	0.21	0.19	NA	NA	0.19	0.20	0.002	0.50	0.08	41
TEQ Total	0.20	0.21	0.19	NA	NA	0.20	0.20	0.002	0.50	0.06	30
ASH SAMPLE B											
TEQ (PCDD/DF)	2.37	2.50	**0.72**	NA	**0.13**	1.87	2.21	0.006	3.04	0.83	44
TEQ (including PCBs)	2.40	2.53	**0.73**	NA	NA	1.97	2.30	0.025	3.07	0.85	43
TEQ Total	2.40	2.53	**0.73**	NA	NA	2.12	2.30	0.092	3.07	0.68	32
ASH SAMPLE C											
TEQ (PCDD/DF)	0.23	0.20	0.15	NA	**0.03**	0.18	0.19	0.000	0.49	0.07	40
TEQ (including PCBs)	0.23	0.20	0.15	NA	NA	0.18	0.19	0.003	0.49	0.08	42
TEQ Total	0.23	0.20	0.15	NA	NA	0.20	0.20	0.003	0.49	0.06	29

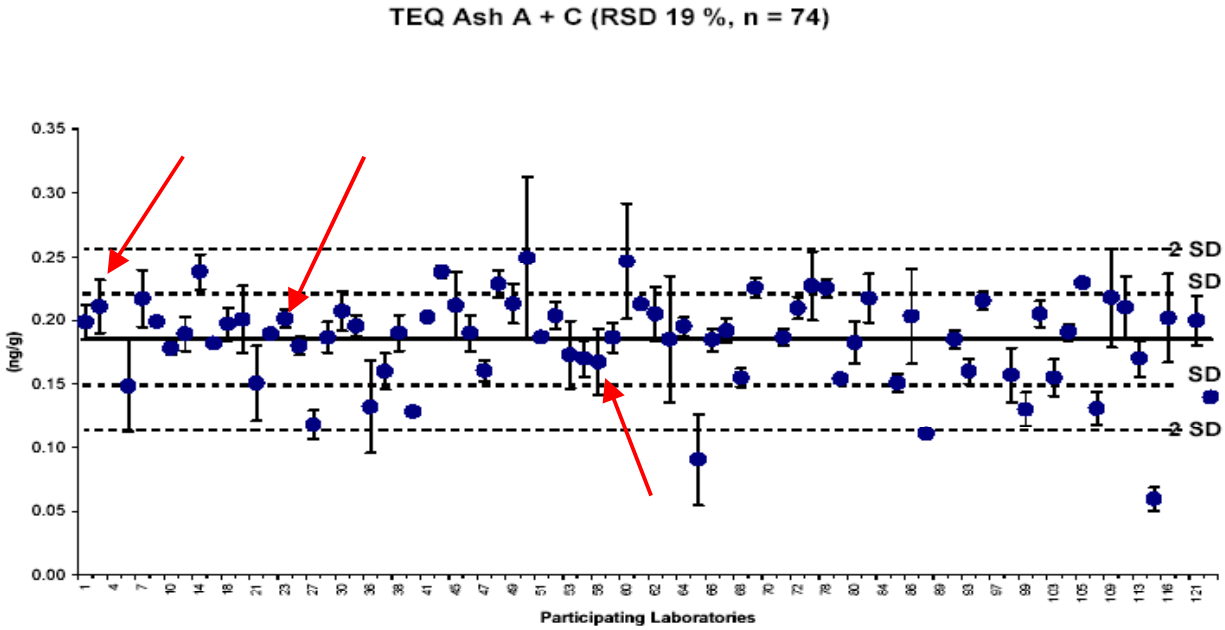

Figure 5: Presentation of the results of analysis of the identical fly ash A and C obtained in 128 laboratories. Among them 6 obvious outliners were omitted from the graph and the determination of the mean and standard deviation. The three supported laboratories included in this presentation are marked with the red arrows.

6.2 Screening of the butter samples

In order to get a first indication on the levels of dioxins in the food, analysis of butter samples from the Candidate countries was organised. Additionally the butter contamination is also an indirect indicator of the levels of dioxins in the environment, although the contamination highly depends on amount of forage composition and breeding practices (grazing, stable breed).

Emission-PECO partners from Candidate Countries were asked to provide two butter samples per country, obtained in local stores. Additional information was requested on the geographical origin of the product to enable possible identification of the contamination sources in the case of elevated concentrations.

The samples were then analysed by the European laboratory, which has also performed the butter study for WHO, in order to guarantee comparability of the results. The analysis of the butter samples is expected to be finished in the second quarter of 2003.

Initial results show that the majority of the samples were in the range of the actual low background contamination for dioxins found in many parts of Europe. Samples which were higher than the rest, were still below the EU action and maximum level.

6.3 Workshop: Determination of Dioxins in Industrial Emissions

Implementation and enforcement of the EU legislation targeted to reduce dioxin emissions from waste incineration (Waste incineration directive) and other industrial sources (IPCC directive) require monitoring of dioxin emissions for compliance reasons. Besides from compliance monitoring, dioxin emission determination is also an integral part of the development of the reduction measures at the plant level.

For this reason a workshop on the determination of Dioxins in Industrial Emissions was organised by the JRC. The workshop took place in Brno, Czech Republic on the 16-19 April 2002. Thirty-four experts from 10 Candidate Countries have participated in the workshop. Since in many Candidate Countries there is no experience in dioxin emission sampling and on the other hand an urgent need exists to develop capabilities that will enable compliance monitoring and permitting, the response of the participants was very positive. The proceedings of the workshop are available as a EUR 20538 EN report[5].

The topics of the workshop were closely related to the implementation and enforcement of dioxin emissions reduction legislation. For this reason mostly the representatives of the National Environmental Inspectorates (Agencies) and representatives of stack testing teams were targeted as an audience.

The workshop focused on the following main topics:

- Presentation of the newly adopted "Community Strategy on Dioxins, Furans and PCBs"
- Influence of operating conditions on dioxin emissions
- Sampling of dioxins
- Requirements on the sampling from the analytical point of view
- Dioxin emission inventories in the Candidate Countries
- Experience with the operation of two modern waste incinerators in the Czech Republic

The particular advantage of the workshop was emphasis on both theoretical and practical part of the emission sampling. There was extensive demonstration of the operation of the sampling system, which enabled also hands-on training. Demonstration of the sampling at a local waste incineration plant was performed in small groups.

6.4 Contribution of small sources to dioxin emissions in Candidate Countries

Potentially low dioxin emissions, which were attributed to small combustion sources in the residential sector at the beginning of the nineties did not stimulate the continuation of further research work in this area. Additionally there was no interest of the business sector, like in the case of waste incineration and metallurgical industry, to stipulate abatement-targeted research. Slightly more emphasis has been given to the biomass combustion, since it is an important option for reduction of CO_2 emissions. As a result there is only a limited set of measurements available, often with controversial results.

However, in recognition to the lack of information in this area, the "Community Strategy for Dioxins, Furans and PCBs" has attributed to the domestic incineration of wood and coal the highest research priority. No other source contributing to the emissions to the air was given that status.

High dioxin emissions in residential combustion are mainly connected with the use of solid fuels - wood and coal. Virgin wood combustion has moderate dioxin emissions, which can be elevated by an order of magnitude when contaminated wood is combusted. In the case of combustion of a PCP treated wood extremely high values of dioxin emissions could be found. For that reason the uncertainty of emissions from wood combustion depends mainly on the activity data, such as the assessment of the share of contaminated wood combusted and the level of its contamination.

The European Dioxin Emission Inventory Stage I[14] has attributed to the coal consumption in the residential sector a share smaller than 1 percent of the total Dioxin emissions in EU. However during the continuation of the study (Stage II)[6] a re-evaluation has been made which highlighted the potential high significance of coal combustion in households. The emission factor has been updated from 2µg I-TEQ per tone of coal to 23µg I-TEQ (upper estimate) and 5µg I-TEQ (lower estimate). This re-evaluation was triggered by the results of Austrian Environmental Agency[26], which has measured an order of magnitude higher specific emissions from polish hard coal combusted in residential stoves than previously published results for coal combustion in residential appliances from other researchers. Within the scope of European Dioxin Emission Inventory Stage II, the North Rhine Westphalia State Environment Agency confirmed elevated dioxin concentrations when using Polish hard coal in stoves. However they found lower concentrations than the Austrian Environment Agency, which could be explained mainly due to the fact that the ignition phase was not included in the dioxin sampling.

It is clear that the current emission factors used for estimation of dioxin emissions released by solid fuels combustion in residential sector are highly uncertain. Results of the measurements are scattered also due to non-defined combustion parameters of existing stoves and problems with iso-kinetic sampling, which is generally not possible to achieve for these sources. Some of the measurements were performed only during steady-state operation, thus neglecting likely increased emissions during start-up phase. Also the memory effect could play an important role, thus influencing the results of subsequent measurement with different fuels on the same stove. The test-

ring configuration could substantially differ from the real-world situation. Moreover dioxin emissions strongly depend on the characteristics of each individual stove and the operational regime. This is another reason, which makes the derivation of representative emission factors for such sources difficult.

As was mentioned before, the importance of the coal consumption in Candidate Countries is much higher than in the EU. In Poland the coal consumption in the residential sector is the highest on per capita basis and in absolute terms, while the type of coal used has very high potential for dioxin emissions. There are no data for coals used in South-Eastern Candidate Countries.

The uncertainty of dioxin inventories could be assessed by comparing the low and high emission estimates. In the European dioxin inventory[6] residential coal combustion accounts for almost 15 % of the difference between high and low overall dioxin emission estimates. Taking into account that per capita residential coal consumption is an order of magnitude higher in the Candidate Countries than in the EU9, we could expect that this sector could have a major contribution to the uncertainty of dioxin emissions in Candidate Countries.

Within the Emission PECO project a programme has been prepared to address domestic combustion of wood and coal. Additionally the influence of waste co-incineration on dioxin emissions from residential appliances needs to be investigated, in preparation to the dioxin risk communication, envisaged by the Strategy.

A two-fold approach has been selected. Dioxin emissions will be measured in the new JRC small sources facility, where different types of stoves are installed. Besides the influence of the different coals also waste co-combustion will be addressed. Part of the experimental programme might be performed also in CC laboratories.

The second approach will be the assessment of emission factors for solid fuel combustion in residential sector based on the inversion modelling of the dioxin ambient air concentration. A robust modelling approach has been selected based on the calibration of the model with regulated pollutant concentrations. To enable application of proposed approach a site has to be selected where domestic solid fuel combustion has the highest contribution in dioxin and regulated pollutant emissions. Besides evaluation of a limited set of available data suitable for application of the modelling approach dedicated measuring campaigns are envisaged in the 2003-2004 heating season. Preliminary results of the inverse modelling performed, using data from Graz[27], Austria, are in line with higher emission factors for solid fuels use in households.

The additional data collected by the JRC project are expected to decrease the uncertainty connected with small combustion in residential sector. If the high dioxin emissions will be confirmed for polish hard coal and found also for other coals used in Candidate countries, proper instruments have to be developed to reduce emissions from these sources.

7 Conclusions

Specific national circumstances, common in most Candidate Countries are reflected also in their dioxin emission profile, which is expected to be different from than in the EU. Due to the lower share of municipal waste incineration, the relevant dioxin emissions are expected to be much lower, than they were in the EU in the past, when those sources were less controlled. Other industrial dioxin relevant activities are also on a lower level if compared with the EU, however current absence of abatement measures and possibly also lower level of maintenance could cause emissions above the current EU level, if a per capita comparison is made. Solid fuels use in the residential sector is much more common in the Candidate Countries than in the EU. For most of the Candidate Countries it could be expected that those sources together with uncontrolled waste co-combustion and open burning could form the dominating share of dioxin emissions into air. Despite some common circumstances, the dioxin sources profile differs considerably among the Candidate Countries.

Most Candidate Countries have already compiled their national dioxin inventory. Mainly literature derived emission factors were used, which might not reflect specific national circumstances. Such an approach could lead to higher uncertainty of emission estimates and thus underestimation of emissions is likely. In the future, improvement and especially harmonization of emission inventories could be expected due to application of UNEP Dioxin and Furan Toolkit, which is intended to support dioxin inventories compilation in the frame of the Stockholm POPs convention. However it could be stated that the Dioxin and Furan Toolikit in its present draft form does not reflect national circumstances in most Candidate Countries. Measurements and reporting of the emissions from the most relevant industrial sources as required by the IPPC Directive will significantly decrease the uncertainty of dioxin emission estimation from industrial sources. Uncertainty of the activity data and emission factors from residential solid fuel use highlight the significance of the residential sector in improving the accuracy of dioxin emissions quantification. The importance of these sources has been already identified by the Community strategy for dioxins, Furans and PCBs, which attributed to the quantification of the emissions from these sources the highest research priority. Coordinated, a multi-country research project might contribute to the clarification of some still open questions of high policy relevance.

The enlargement process will contribute to the decrease of the dioxin emissions in Candidate Countries. However due to the fact that already developed Community instruments for dioxin emission reduction target mainly industrial emissions, national approaches have to be developed to tackle non-industrial sources, which might be more important in the Candidate Countries than in the EU.

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ANNEX 1

National contact points and experts who filled-in the questionnaries

Country	Contact person	Questionaire completed by
Bulgaria	Mr. Angel Kostov	Ms. Evelina Svetoslavova
Czech Republic	Ms. Barbora Cimbalnikova	Ms. Jitka Hlavicova
Cyprus	Mr. Christos Malikkides	Mr. Christos Malikkides
Estonia	Mr. Joel Valge	Mr. Margus Kort
Hungary	Mr. Ákos Fehérváry	Mr. Josef Kutas
Latvia	Mr. Guntis Jansons	Mr. Gunars Civjans
Lithuania	Mr. Vytautas Krusinskas	Mr. Vytautas Krusinskas
Malta	Ms. Charmaine Vassallo	Ms. Charmaine Vassallo
Poland	Mr. Krzystof Olendrzyinski	Ms. Iwona Kargulewicz
Romania	Mrs. Ecaterina Szabo	Mrs. Ecaterina Szabo
Slovakia	Ms. Gabriela Fischerova	Ms. Gabriela Fischerova
Slovenia	Mr. Emil Zerjal	
Turkey	Mr. Kemal Kurusakiz	

ANNEX 2

Policies and Measures to Reduce Dioxin Emissions

Questionnaire

EUROPEAN COMMISSION
JOINT RESEARCH CENTRE (JRC)
Institute for Environment and Sustainability
Emissions and Health Unit

Policies and Measures to Reduce Dioxin Emissions

Questionnaire

Questionnaire completed by:

Name and Surname:	
Title:	
Institution:	
Position:	
Address:	
Country:	
Tel:	
E-mail:	
Date of submission:	

Please complete questionnaire in the electronic form and send it by e-mail to:
bostjan.paradiz@jrc.it.

For documentation reasons please also print the filed-in questionnaire and send it on address:

Joint Research Center of the European Commission
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Boštjan Paradiž TP. 442
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21020 Italy

If you will need some assistance please contact Boštjan Paradiž.
Phone: +39-0332-785416
Fax: +39-0332-86328
e-mail: bostjan.paradiz@jrc.it

Please delete the box □ in front of appropriate answer an replace it with X. Please feel free to provide additional remarks and comments.

1 Strategic documents

1.1.1 Does your country have National Environmental Plan/Programme/Strategy?

- ☐ adopted in the year_____
- ☐ In the process of adoption
- ☐ In the process of preparation
- ☐ Planned to be prepared

Additional remarks:

_____
_____
_____

1.1.2 Does the National Environmental Plan/Programme/Strategy explicitly address the dioxin issues?

- ☐ No
- ☐ Yes

Additional remarks:

_____
_____
_____

1.1.3 Does the National Environmental Plan/Programme/Strategy define any targets and time frames for dioxin emissions reduction?

- ☐ No
- ☐ Yes and they are:_____
  _____
  _____
  _____

Additional remarks:

_____
_____
_____

1.1.4 Does the National Environmental Plan/Programme/Strategy identify priority sectors for dioxin emissions reduction?

- ☐ No
- ☐ Yes, it identifies following sectors/activities
  - ☐ Waste incineration and co-incineration
  - ☐ Metallurgical industry
  - ☐ Solid fuels residential heating
  - ☐ Uncontrolled residential municipal waste & treated waste wood co-incineration
  - ☐ _____
  - ☐ _____

Additional remarks:

_____
_____
_____

1.1.5 Does the National Environmental Plan/Programme/Strategy envisage the preparation of the separate strategic document, which will more specifically address the dioxin-related issues?

- ☐ No
- ☐ Yes, dedicated dioxin programme/strategy is envisaged
  Please specify the document title_____
- ☐ Yes, dioxin issues are envisaged to be addressed within Persistent Organic Pollutants Programme/Strategy.

Additional remarks:

_____
_____
_____

1.1.6 Has your country already had the Persistent Organic Pollutants Programme/Strategy or similar document, which is more specifically targeted to dioxin issues?

- ☐ Yes, it was adopted in the year_____
- ☐ No, but it is in the process of adoption
- ☐ No, but it is in the process of preparation
- ☐ No, but it is planned to be prepared
- ☐ No and currently there are no plans for its preparation

Additional remarks (please specify the title of document, which is more specifically dedicated to dioxin issues if adopted or in process of preparation)

_____
_____
_____

If the Persistent Organic Pollutants Programme/Strategy or alternative document, more specifically targeted to dioxin issues has been adopted, please answer the questions from 1.1.7 to 1.1.10

1.1.7 Does the adopted document define any targets and time frames for dioxin emissions reduction?

- ☐ No specific targets on emissions are set
- ☐ Yes and they are:_____
  _____
  _____
  _____

Additional remarks:

_____
_____
_____

1.1.8 Does the adopted document identify priority sectors for dioxin emissions reduction?

- ☐ No
- ☐ Yes, it identifies following sectors/activities
  - ☐ Waste incineration
    - ☐ Municipal waste incineration
    - ☐ Hazardous waste incineration
    - ☐ Hospital waste incineration
  - ☐ Waste co-incineration
  - ☐ Metallurgical industry
    - ☐ Sintering plants
    - ☐ Electric arc furnaces
    - ☐ Secondary metals smelters
    - ☐ _____
    - ☐ _____

- ☐ Cement production
- ☐ Cable burning and other uncontrolled activities
  Solid fuels residential heating
- ☐ Uncontrolled residential municipal waste & treated waste wood co-incineration
- ☐ _____
- ☐ _____

Additional remarks:

_____
_____
_____

1.1.9 Which policy instruments are envisaged to achieve dioxin emission reductions?

- ☐ No specific policy instruments are envisaged
- ☐ Emission limit values
- ☐ BAT technologies implementation through permitting process
- ☐ Voluntary agreements with industry
- ☐ Awareness raising
- ☐ _____

Additional remarks:

_____
_____
_____

1.1.10 Is the set-up/improvement of dioxin emission inventory envisaged?

- ☐ Yes
- ☐ No

Additional remarks:

_____
_____
_____

2 Policies and measures

2.1 Waste incineration and co-incineration

2.1.1 Has the Directive 2000/76/EC, requiring among other dioxin concentrations in flue gases not to exceed limit value of 0.1 ng TEQ/m^3 already been transposed into the national legislation?

- ☐ Yes, provisions complying with Directive 2000/76/EC have been already adopted.
- ☐ No, but adequate provisions are in the pipeline.
- ☐ No

Additional remarks:

_____
_____
_____

2.1.2 If the directive 2000/76/EC has been already transposed into the national legislation, when the limit value of 0.1 ng TEQ/m^3 will be applied?

- ☐ The Directive 2000/76/EC has not been transposed yet.
- ☐ The 0.1 ng TEQ/m^3 TEQ dioxin limit value will be applied from _____ for new plants and from _____ for existing plants.

Additional remarks:

_____
_____
_____

2.2 Other industrial sources

2.2.1 Has the IPPC Directive 96/61/EC already been transposed into the national legislation?

- ☐ Yes
- ☐ No, but the adequate provisions are in the pipeline and are expected to be adopted in_____
- ☐ No

Additional remarks:

_____
_____
_____

2.2.2 Is it intended to extend the transitional period after 2007 for some existing industrial facilities to comply with Best Available Technology?

- ☐ No
- ☐ Not decided yet
- ☐ Yes, it is intended to extend the transitional period for following sectors (please specify):

_____

- ☐ Yes, it is intended to extend the transitional period for specific plants
  - ☐ They are dioxin emissions relevant (metallurgical industry,)
  - ☐ They are not considered to be dioxin emissions relevant

Additional remarks:

_____
_____
_____

2.2.3 Were in any voluntary agreements achieved with dioxin emissions relevant sectors or plants to reduce their dioxin emissions?

☐ Yes, such agreements were achieved

Please describe:_____
_____
_____

☐ To date no such agreements were achieved, but there is plan to start consultation with relevant sectors or plants
☐ To date no such agreements were achieved and there are no plans to start consultation with relevant sectors or plants

Additional remarks:
_____
_____
_____

2.3 Non-industrial sources

2.3.1 Were there any awareness raising campaigns to reduce non-licensed flues (waste like packaging materials, plastics, treated wood,...) in solid fuel fired residential heating appliances?

☐ To date there were no such awarness raising campagins and currently they are not planned
☐ To date there were no such awarness raising campagins, but they are planned
☐ There were public awarness raising campagins to reduce such misbehaviour

Additional remarks:
_____
_____
_____

2.3.2 Are there any financial incentives provided for households fuel switching from solid fuels to more cleaner means of heating (district heating, natural gas and LPG, fuel oil and modern biomas heating devices)

☐ There are financial incentives like subsidised loans in place
☐ To date there were no such incentives, however they are planned
☐ There are no such inscentives and are currently not planned

Additional remarks:
_____
_____
_____

2.3.3 Were there any awareness raising campaigns to reduce back yard burning of waste?

☐ To date there were no such awareness raising campaigns and currently they are not planned
☐ To date there were no such awareness raising campaigns, but they are planned
☐ There were public awareness raising campaigns to reduce such misbehaviour

Additional remarks:
_____
_____
_____

3 Integration with other environmental policies

3.1.1 Were there any attempts to coordinate Air Quality and dioxin emissions reductions policies?

- ☐ Such co-ordination is believed not to be relevant
- ☐ Such co-ordination could be relevant, however it is not taken into the account yet.
- ☐ Possible synergistic effect for dioxin emissions reduction and Air Quality improvement was already taken into the account for:
  - ☐ Residential heating (switching from solid fuels in individual heating systems)
  - ☐ Industrial processes (please specify)_____
  - ☐ Other (please specify)_____

Additional remarks:

_____
_____
_____

3.1.2 Is it planned to offer as a Joint Implementation under the Kyoto protocol also the projects, which will also contribute to the dioxin reductions?

- ☐ No
- ☐ Such possibilities have not been investigated yet
- ☐ It is intended to take into the account also dioxin emissions when preparing Joint Implementation projects

Additional remarks:

_____
_____
_____

4 Monitoring and research

4.1 Emission inventory

4.1.1 Does your country have dioxin emission inventory?

- ☐ No
- ☐ Yes

Additional remarks:

_____
_____
_____

4.1.2 Is it intended to reduce the uncertainty of emission inventory by using measurement derived emission factors for some key sources (waste incinerators, some processes in metallurgical industry,…).

- ☐ Yes, current emission inventory is based to some extent also on measurement derived local emission factors
- ☐ Yes, current emission inventory is currently based on emission factors taken from literature, but it is planned to improve the assessment of potential key sources by dioxin emissions measurements
- ☐ No, emission inventory is based on literature derived emission factors and there are no plans to use results of measurement for its preparation

Additional remarks:

_____
_____
_____

4.2 Research programmes

4.2.1 Are in your country research programmes targeted to better identification and quantification of dioxin emissions?

- ☐ No such programmes exist currently
- ☐ No such programmes exist, but they are planned
- ☐ Yes, such programmes are in progress
- ☐ Yes, such programmes are in progress and some of them have been already completed

Additional remarks:

_____
_____
_____

ANNEX 3

Applied Regulatory Measures on Dioxin Emissions Questionnaire

EUROPEAN COMMISSION
JOINT RESEARCH CENTRE (JRC)
Institute for Environment and Sustainability
Emissions and Health Unit

Applied Regulatory Measures on Dioxin Emissions

Questionnaire

Questionnaire completed by:

Name and Surname:	
Title:	
Institution:	
Position:	
Address:	
Country:	
Tel:	
E-mail:	
Date of submission:	

Please complete questionnaire in the electronic form and send it by e-mail to bostjan.paradiz@jrc.it.

For documentation reasons please also print the filed-in questionnaire and send it on address:

Joint Research Center of the European Commission
Institute for Environment and Sustainability
Boštjan Paradiž TP. 442
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Ispra (VA)
21020 Italy

If you will need some assistance please contact Boštjan Paradiž.
Phone: +39-0332-785416
Fax: +39-0332-86328
e-mail: bostjan.paradiz@jrc.it

Please delete the box □ in front of appropriate answer an replace it with X. Please feel free to provide additional remarks and comments.

1 Waste incineration and co-incineration

1.1.1 Please fill-in the following table:

		Municipal	Hazardous	Hospital
How many waste incineration plants exist in your country?	total			
What was the quantity of municipal waste incinerated? (thousands tons)	Year*_____			
How many of them already fulfil emission limits of the Directive 2000/76/EC on the incineration of waste?				
What are the current applied and enforced dioxin limit values? (ng TEQ/m^3)	new plants, put into operation after_____			
	old plants, put into operation before_____			

* please report for the most recent year with available data

2 Waste co-incineration

2.1.1 Are in your county waste co-incinerated at :

- ☐ Power-plants
- ☐ Cement kilns
- ☐ Other facilities (please specify):_____
- ☐ Wastes are not co-incinerated

Additional remarks:

_____
_____
_____

2.1.2 Is for waste co-incineration a special permit required?

- ☐ Yes
- ☐ No

Additional remarks:

_____
_____
_____

2.1.3 What is the current dioxin emission limit value applied to waste co-incineration?

- ☐ To date there is no dioxin limit value applied to the waste co-incineration.
- ☐ To date emission limit value of _____ ng/m^3 is applied for waste co-incineration

Additional remarks:

_____
_____
_____

3 Other industrial sources

3.1.1 Does in your country industrial activities exist, which are potentially significant sources of dioxin emissions:

- ☐ Iron ore sintering facilities (common for integrated steelworks, where not only secondary steel is used for metal production)
- ☐ Electric arc furnaces, which produce steel from scrap metal
- ☐ Primary non-ferrous metal production
- ☐ Secondary aluminium smelters
- ☐ Other non-ferrous metal recovery
- ☐ Small scale, uncontrolled non-ferrous metal recovery activities (cable burning, scrap lead recovery,……)_____.
- ☐ Other dioxin emissions relevant industrial activities (please specify)_____

Additional remarks:

_____
_____
_____

3.1.2 What are the current dioxin emissions limit values applied to some industrial processes?

- ☐ To date there are no dioxin limit values applied to industrial sources:
- ☐ Currently are applied for:
  activity:_____emission limit values _____ng/m^3 at ____% O_2
  activity:_____emission limit values _____ng/m^3 at ____% O_2

Additional remarks:

_____
_____
_____

4 Monitoring

4.1.1 Does your country have laboratory(ies) which perform dioxin content determination in samples (food, soil, liquid etc.)

- ☐ Yes and it is approved by state authorities
- ☐ Yes, but it is not approved by the state authorities
- ☐ No

If yes, please give the following information on all of them.

Institution: _____
Contact person _____
Address: _____
_____

Additional remarks:

_____
_____
_____

4.1.2 Does your country have stack-testing groups, which perform sampling for measurement of dioxin concentration in flue gases according to EN 1948 standard?

- ☐ Yes and is approved by state authorities
- ☐ Yes, but it is not approved by the state authorities
- ☐ No

Additional remarks:

_____
_____
_____

4.1.3 According to currently applied legislation dioxin measurements have to be performed at regulatory basis at:

- ☐ Municipal waste incinerators
  - ☐ Regularly _____ per year
  - ☐ On occasionally basis
- ☐ Hazardous waste incinerators
  - ☐ Regularly _____ per year
  - ☐ On occasionally basis
- ☐ Hospital waste incinerators
  - ☐ Regularly _____ per year
  - ☐ On occasionally basis
- ☐ Waste co-incineration
  - ☐ Regularly _____ per year
  - ☐ On occasionally basis
- ☐ Power plants
  - ☐ Regularly _____ per year
  - ☐ On occasionally basis
- ☐ Industrial processes
  - ☐ Regularly _____ per year for_____processes.
  - ☐ On occasionally basis

- ☐ No regulatory dioxin measurements are currently required

Please specify more, if monitoring of dioxins is required

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

ANNEX 4

Short questionnaire on Dioxin and Furan emissions

Short questionnaire on Dioxin and Furan emissions

Questionnaire completed by:

Name and Surname:	
Title:	
Institution:	
Position:	
Address:	
Country:	
Tel:	
E-mail:	

1. Does your country have a Dioxin and Furan emission inventory on the national level?

   - ☐ No
   - ☐ No but its preparation is planed
   - ☐ No but its preparation is in course and the inventory is to be prepared for the following years: _____
   - ☐ Yes, we have prepared national emission inventory for the years: _____

2. If you have prepared the inventory, which kind of emission factors were used?

   - ☐ Exclusively CORINAIR
   - ☐ CORINAIR supplemented by various literature data
   - ☐ Various literatures sources
   - ☐ CORINAIR supplemented by various literature data and by national, measurement derived emission factors
     (please specify the sources, for which national emission factors were derived or emission estimates were based on measurements)
     _____
     _____
     _____
     _____

3. Please select 4 sources from list below (you may also add some if relevant) which are to be considered as a priority in developing national (or plant specific) emission factors in order to decrease overall inventory uncertainty and focus abatement measures?

   - ☐ Energy transformation industry (powerplants)
   - ☐ Industrial Combustion
   - ☐ Co-combustion of waste derived fuel in industry
   - ☐ Production processes-iron&steel
   - ☐ Production processes- non ferrous metals
   - ☐ Institutional/commercial combustion
   - ☐ Residential combustion -coal
   - ☐ Residential combustion - wood
   - ☐ Residential co-combustion of waste
   - ☐ Traffic
   - ☐ Municipal waste incinerators
   - ☐ Industrial waste incinerators
   - ☐ Hospital waste incinerators
   - ☐ Uncontrolled landfill fires
   - ☐ _____
   - ☐ _____

If you would like to add some additional remarks, please insert them bellow.

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