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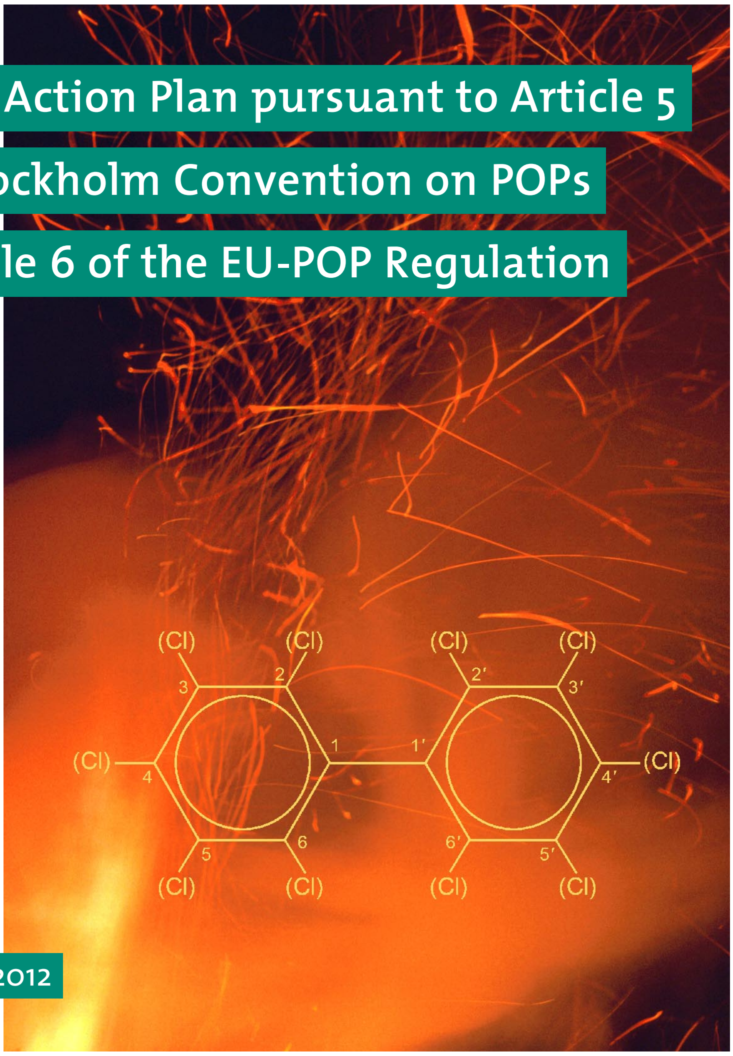
National Action Plan pursuant to Article 5 of the Stockholm Convention on POPs and Article 6 of the EU-POP Regulation



First review, 2012

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UMWELT & GESELLSCHAFT umweltbundesamt

NATIONAL ACTION PLAN PURSUANT TO ARTICLE 5 OF THE STOCKHOLM CONVENTION ON POPS AND ARTICLE 6 OF THE EU-POP REGULATION

First review, 2012

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REPORT
REP-0395

Wien, 2012

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Title photograph

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On behalf of directorates V/1 and VI/5 of the Federal Ministry of Agriculture, Forestry, Environment and Water Management

The first review of the National Action Plan is part of the National Implementation Plan on POPs which has been published by the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The National Implementation Plan contains a German summary of the National Action Plan.

For further information about the publications of the Umweltbundesamt please go to: http://www.umweltbundesamt.at/

Imprint

Owner and Editor: Umweltbundesamt GmbH
Spittelauer Lände 5, 1090 Vienna/Austria

Printed on CO_2-neutral 100%recycled paper.

ISBN 978-3-99004-198-7

CONTENTS

EXECUTIVE SUMMARY ... 11

ZUSAMMENFASSUNG ... 33

1 INTRODUCTION ... 55

1.1 Methodology for Inventories ... 55

1.2 Pollutants of concern ... 56

1.2.1 Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) ... 56

1.2.2 Hexachlorobenzene (HCB) ... 57

1.2.3 Polychlorinated biphenyls (PCB) ... 57

1.2.4 Polycyclic aromatic hydrocarbons (PAH) ... 57

1.2.5 Pentachlorobenzene (PeCB) ... 58

2 SOURCE INVENTORY OF POPS RELEASES INTO AIR ... 59

2.1 Austrian Air emissions Inventory according to UNECE/LRTAP ... 59

2.1.1 Trends for POPs Emissions into Air ... 60

2.2 Releases of polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) – Source categories of the Stockholm Convention ... 62

2.2.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge ... 62

2.2.2 Cement kilns firing hazardous waste ... 63

2.2.3 Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching ... 64

2.2.4 Thermal processes in the metallurgical industry (Secondary copper production; sinter plants in the iron and steel industry; secondary aluminium production; secondary zinc production) ... 64

2.2.5 Open burning of waste, including burning of landfill sites ... 66

2.2.6 Thermal processes in the metallurgical industry not mentioned in Part II ... 67

2.2.7 Residential combustion sources ... 69

2.2.8 Fossil fuel-fired utility and industrial boilers ... 74

2.2.9 Firing installations for wood and other biomass fuels ... 75

2.2.10 Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil ... 75

2.2.11 Crematoria ... 76

2.2.12 Motor vehicles, particularly those burning leaded gasoline ... 76

2.2.13 Destruction of animal carcasses ... 80

2.2.14 Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction) ... 80

2.2.15 Shredder plants for the treatment of end of life vehicles ... 81

2.2.16 Smouldering of copper cables 81
2.2.17 Waste oil refineries 82
2.2.18 Summary of PCDD/F – Releases to Air from Source Categories of the Stockholm Convention 82
2.2.19 Austrian Air Emissions Inventory – Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) 84

2.3 Releases of Hexachlorobenzene (HCB) – Source categories of the Stockholm Convention 85
2.3.1 Motor vehicles, particularly those burning leaded gasoline 85
2.3.2 Summary of Source Categories of the Stockholm Convention: HCB – Releases to Air 87
2.3.3 Austrian Air Emissions Inventory – Hexachlorobenzene (HCB) 89

2.4 Releases of polychlorinated biphenyls (PCB) – Source categories of the Stockholm Convention 90

2.5 Releases of polycyclic aromatic hydrocarbons (PAH) – Source categories of the Stockholm Convention 90
2.5.1 Motor vehicles, particularly those burning leaded gasoline 91
2.5.2 Summary of Source Categories of the Stockholm Convention: PAHs – Releases to Air 93
2.5.3 Austrian Air Emissions Inventory – Polycyclic Aromatic Hydrocarbons (PAH) 94

2.6 Releases of Pentachlorobenzene (PeCB) – Source categories of the Stockholm Convention 95
2.6.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge 96
2.6.2 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron steel industry; secondary aluminum production; secondary zinc production) 97
2.6.3 Fossil fuel-fired utility and industrial boilers 97
2.6.4 Firing installations for wood and other biomass 97
2.6.5 Residential combustion sources 98
2.6.6 Summary of PeCB – Releases to Air from Source Categories of the Stockholm Convention 99

3 SOURCE INVENTORY OF POPS RELEASES INTO WATER 101
3.1.1 Other sources: Contaminated Sites & Persistent Organic Pollutants 102

4 SOURCE INVENTORY OF POPS RELEASES VIA WASTE 104

4.1 Releases of Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) 104
4.1.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge 105
4.1.2 Secondary aluminium production 105
4.1.3 Secondary copper production 106

4.1.4 Secondary lead production ... 106
4.1.5 Thermal processes in the metallurgical industry ... 107
4.1.6 Residential combustion sources ... 107
4.1.7 Fossil fuel-fired utility and industrial boilers ... 108
4.1.8 Firing installations for wood and other biomass fuels ... 108

4.2 Releases of Pentachlorobenzene (PeCB) ... 109
4.2.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge ... 110
4.2.2 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron steel industry; secondary aluminium production; secondary zinc production) ... 111
4.2.3 Residential combustion sources ... 111
4.2.4 Fossil fuel-fired utility and industrial boilers ... 112
4.2.5 Firing installations for wood and other biomass fuels ... 112

5 SOURCE INVENTORY OF POPS RELEASES VIA PRODUCTS ... 113

6 POLICIES (PROVISIONS) AND MEASURES ... 116

6.1 New developments in International and European Legislation since 2008 ... 116
6.1.1 Stockholm Convention ... 116
6.1.2 UNECEConvention on Long-range Transboundary Air Pollution (LRTAP) ... 119
6.1.3 IPPC-Directive (2008/1/EC) and Directive on Industrial Emissions (2010/75/EU) ... 120
6.1.4 Water Framework Directive 2000/60/EC ... 122
6.1.5 Air Quality Directive 2008/50/EC (CAFE) ... 123
6.1.6 Pollutant Release and Transfer Register (PRTR) ... 124
6.1.7 European Regulations aiming at increased Energy Efficiency ... 124
6.1.8 Waste Framework Directive2008/98/EC/EWC ... 125
6.1.9 Other relevant EU legislation ... 125

6.2 Developments in National Legislation since 2008 ... 126
6.2.1 Specific Ordinances ... 126
6.2.2 Austrian Water Act and Specific Ordinances ... 127
6.2.3 Ordinance on Landfills (BGBl. II No. 39/2008) ... 129
6.2.4 Ambient Air Quality Act (Immissionschutzgesetz – Luft, IG-L) ... 130
6.2.5 Plans and programmes under Air Quality Framework Directive ... 130
6.2.6 Residential Combustion Sources ... 130
6.2.7 Open burning of biogenic materials ... 131

6.3 Other measures ... 131
6.3.1 Voluntary Self-Commitment of the Cement Industry (‘Positive List’) ... 131
6.3.2 Paper, paper board and packaging paper ... 131
6.3.3 Biomass plants serving the purpose of centralised district heating ... 132

6.4 Overview on Monitoring activities and Surveys on federal level since 2008 132
6.4.1 Ambient Air Monitoring 132
6.4.2 Emissions Monitoring 133
6.4.3 Food and Feed monitoring 133
6.4.4 Water Monitoring 134
6.4.5 Soil Monitoring 137
6.4.6 Bioindication with tree needles and forest ecosystems 139
6.5 Monitoring activities on States level 140
7 EVALUATION OF THE EFFICACY OF NATIONAL LAWS AND POLICIES AND STRATEGIES FOR MEETING THE OBLIGATIONS OF THE STOCKHOLM CONVENTION AND THE EU POP-REGULATION 141
8 REFERENCES 147
ABBREVIATIONS 153

LIST OF TABLES AND FIGURES

List of Tables

Table 1: Emissions and emission trends for POPs 1985–2009 60

Table 2: PCDD/F-emissions into air from the source category Waste Incineration. 63

Table 3: PCDD/F-emissions from Austrian cement plants 64

Table 4: PCDD/F-emissions from thermal processes in the metallurgical industry – Part II 66

Table 5: PCDD/F-emissions from the source category open burning of waste 67

Table 6: PCDD/F-emissions from the source category thermal processes in the metallurgical industry – Part III 68

Table 7: Fuel mix in the NFR-code „Residential Plants“..................................69

Table 8: PCDD/F emission factors for Residential Plants, Commercial/ Institutional Plants and Plants in Agriculture/Forestry 69

Table 9: Emissions of dioxines/furanes from residential plants 72

Table 10: Share of fuels within the subcategories “Commercial/Institutional” and “Stationary”..73

Table 11: Emissions of Dioxines/Furanes caused by different fuel types..........73

Table 12: PCDD/F-emissions from the source category fossil fuel fired utility and industrial boilers...75

Table 13: PCDD/F-emissions from the source category firing installations for wood and other biomass fuels 75

Table 14: PCDD/F-emissions from the source category crematoria 76

Table 15: Fuel Allocation Road Transportation..77

Table 16: Fuel Allocation Other Mobile Sources and Machinery 78

Table 17: PCDD/F emission factors for Road Transportation and other Mobile Sources and Machinery..78

Table 18: Emissions of dioxins from “Road Transportation”..............................79

Table 19: Emissions of dioxins from “Other Mobile sources and Machinery”....80

Table 20: PCDD/F emissions from Source Categories Part II for 2004 and 2009 83

Table 21: PCDD/F emissions from Source Categories Part III for 2004 and 2009 84

Table 22: Emission factors for road transportation and other mobile sources and machinery 86

Table 23: Emissions of HCB from road transport 87

Table 24: Emissions of HCB from other mobile sources and machinery...........87

Table 25: HCB emissions in Source Category Part II for 2004 and 2009..........88

Table 26: HCB emissions in Source Category Part III for 2004 and 2009.........89

Table 27: Emission factors for Road Transportation and other Mobile Sources and Machinery 91

Table 28: Emissions of PAH from Road Transport...92

Table 29: Emissions of PAH from Other Mobile Sources and Machinery 92

Table 30: PAH emissions in Source Category Part II for 2004 and 2009..........93

Table 31: PAH emissions in Source Category Part III for 2004 and 2009.........94

Table 32: Overview on sectors and their relevance for PeCB emissions..........95

Table 33: PeCB emissions into air from the source category waste incineration 97

Table 34: PeCB emissions from the source category thermal processes in the metallurgical industry...97

Table 35: PeCB emissions of the source category fossil fuel-fired utility and industrial boilers 97

Table 36: PeCB emissions from the source category firing installations for wood and other biomass 98

Table 37: PeCB emissions from the source category residential combustion 98

Table 38: PeCB emissions from Source Category Part II for 2009 99

Table 39: PeCB emissions in Source Category Part III for 2009.....................100

Table 40: Estimation of PCDD/F releases via waste from waste incineration (municipal solid waste, hazardous waste, medical waste). 105

Table 41: Estimation of PCDD/F releases via wastes/residues arising from secondary aluminum production...105

Table 42: Composition of salt slag..106

Table 43: Composition of filter dust...106

Table 44: PCDD/F releases via wastes/residues arising from secondary copper production..106

Table 45: PCDD/F releases via wastes/residues arising from secondary lead production..106

Table 46: PCDD/F releases via waste from thermal processes in the metallurgical industry 107

Table 47: Calculation of PCDD/F releases via waste based on available literature. 107

Table 48: Calculation of PCDD/F releases via ashes from coal combustion based on available literature 108

Table 49: Calculation of PCDD/F releases via ashes from biomass combustion based on available literature..109

Table 50: PeCB discharge into waste in 2009 110

Table 51: PeCB-discharge via waste (fly ash and filter dust) for the source category Waste Incineration 111

Table 52: PeCB discharge to waste of iron and steel mills 111

Table 53: PeCB discharge to waste (ash) of residential combustion 112

Table 54: PeCB discharge to waste of power plants, 2009 112

Table 55: Emissions to ashes from Incinerated wood, source category firing installations for wood and other biomass fuels, 2009 112

Table 56: PCDD/F-Releases via the products cement and pulp and paper – calculations were based on data from literature 113

Table 57: Releases of PCDD/F via products (calculation on the basis of the output of Austropapier and transmitted results of analysis).......115

Table 58: Source Categories according to Annex C of the Stockholm Convention on POPs...117

Table 59: Type of installations listed in Annex I of the IPPC-Directive. 121

Table 60: Environmental quality standards (EQS) as defined in Annex I of directive 2008/105/EC. 123

Table 61: Landfill classes and limit values according to Annex 1 of the Landfill Ordinance 2008 129

Table 62: Summary of the monitoring results for surface waters for hexachlorobenzene (HCB), PAHs (benzo(a)pyrene (B(a)P) and pentachlorobenzene (PeCB)..135

List of Figures

Figure 1: Emission of Persistent Organic Pollutants 1985–2009: PAH in Mg, PCDD/F in g and HCB in kg according to UNECE/LRTAP. 61

Figure 2: Percentage of PCDD/F emissions from residential plants 1990–2009. 72

Figure 3: Percentage of PCDD/F emissions from commercial/institutional and plants in agriculture/forestry1990–2009. 74

Figure 4: Relevant source categories of PCDD/F. 83

Figure 5: Dioxin emission trend per NFR Category 1985–2009 (base year 1985 = 100%) 85

Figure 6: Relevant source categories of HCB. 88

Figure 7: HCB emission trend per NFR Category 1985–2004 (base year 1985 = 100%). 90

Figure 8: Relevant source categories for PAH. 93

Figure 9: PAH emission trend per NFR Category 1985–2004 (base year 1985 = 100%). 95

Figure 10: Relevant source categories for PeCB 99

Figure 11: Releases (although hardly bio-available) of PCDD/F via waste (own calculation). 104

Figure 12: Releases of PeCB via waste (own calculation). 109

Figure 13: Survey of the Austrian Agency for Health and food Safety 2005-2008 134

EXECUTIVE SUMMARY

A Introduction

This report is the first review of the National Action Plan for POPs published in 2008. Article 5 of the Stockholm Convention requires Parties to develop an Action Plan to identify, characterize and address the release of chemicals listed in Annex C. Article 5 further requires a review of the National Action Plan every five years of the strategies and their success in meeting the relevant obligations.

Currently listed in Annex C are polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF), hexachlorobenzene (HCB), polychlorinated biphenyls (PCB) and pentachlorobenzene (PeCB) when produced unintentionally.

In line with the European POP-Regulation (850/2004) polyaromatic hydrocarbons (namely the substances benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene) shall be included in the action plan as well.

The Action Plan, which was to be part of a Party's National Implementation Plan to be developed pursuant to Article 7 of the Convention, included strategies for meeting obligations to reduce or eliminate releases of chemicals listed in Annex C of the Stockholm Convention (including PAH as additional requirement from the EU-POP Regulation), and a schedule for the Action Plan. The plan identified priorities for action, including for those source categories that provide the most cost-effective opportunities for release reduction or elimination. It also included an inventory of releases of chemicals listed in Annex C.

The definition of the term "release" includes emissions of POPs into air, water and soil as well as releases via residues and waste from processes and releases via products.

Within the review of the National Action Plan the inventory (basis: year 2004) of POPs releases will be updated. Based on this inventory instruments and measures aiming at the reduction of POPs releases are going to be described. In particular, the efficacy of national legal regulations will be assessed again and it will be investigated if Best Available Techniques (BAT) in combination with Best Environmental Practices (BEP) have already been applied in the source categories defined by the Stockholm Convention. If applicable, recommendations on how BAT and BEP can be implemented are given. In addition data gaps are again identified and proposals for the improvement of data quality are elaborated.

Concerning emissions into air, the data quality is sufficient to establish an inventory for the POPs PCDD/F, PAH and HCB (in declining order with respect to data quality). However, due to a general lack of data this could not be achieved in the case of PCBs.

Whereas data on environmental concentrations (e.g. air) is available for most of the substances of concern, few data are available concerning releases into water and waste. For the latter a plausible estimation of releases could be made for PCDD/F only.

In general, the data quality in the case of PCBs is not sufficient to establish an inventory (air, water, soil, waste, products).

Direct releases of POPs into soil take place from the source category ”open burning of waste, including burning of landfill sites” (this includes the burning of straw and stubble as well). However, if residues and waste from processes are brought back into the environment, releases of POPs may occur indirectly (e.g. when ashes from small scale residential combustion sources or biomass plants are used for fertilizing purposes).

Releases by accidents and releases from contaminated sites are not covered by this study. However, releases into air from accidental burning of landfill sites and intermediate storage sites for waste may be substantial.

There are some data available in the literature concerning concentrations of POPs in the products cement and pulp and paper which are presented in this report.

In 2011 the Environment Agency Austria accomplished analyses of cardboard boxes which have been produced from waste paper (possibly contaminated with PCDD/F from printer’s ink. The results did not show contamination of PCDD/F in the used printer’s ink.

The Action Plan will be reviewed and updated on a periodic basis.

B Inventory of emissions into air

Trends for POPs emissions into air

Emissions of the three POP categories PAH, PCDD/F and HCB decreased significantly between the years 1985–1994 as a result of legal regulations concerning emission reduction from industry and waste incineration. Emissions increased in the years 1995 and 1996, but steadily declined afterwards until the year 2001.

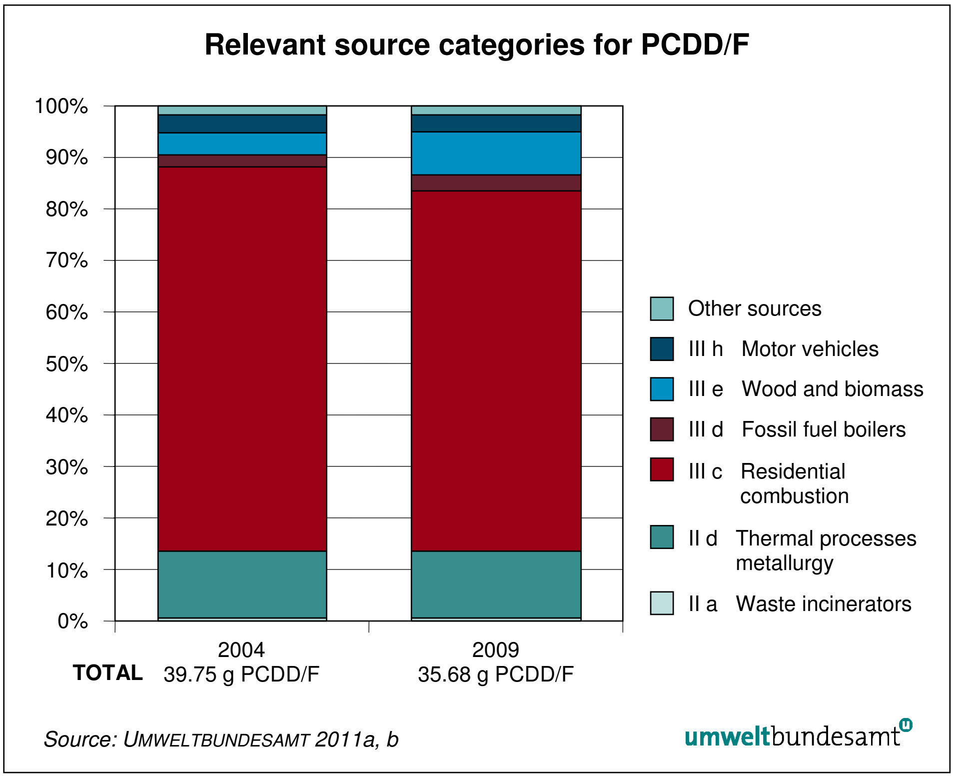
Emissions of PAH and HCB were increasing slightly from 2000 until 2005 and have been dropping from 2006 onwards, whereas emissions of PCDD/F dropped remarkably between 2001 and 2002 (due to a reduction measure in one sinter plant).

In 2009 emissions of PAH, HCB and PCDD/F dropped significantly due to less economic activity.

Dioxins and furans (PCDD/F, I-TEQ)

In the year 2009 a total of 35.7 g of PCDD/F (I-TEQ)were emitted in Austria from source categories listed in annex C of the Stockholm Convention. In the Austrian Air Emissions Inventory (OLI) PCDD/F emissions into air were calculated to be 36.0 g (I-TEQ, 2009). The difference can be explained by the fact that the OLI is more comprehensive as far as activities are concerned. On the other hand some emission factors have been updated for the purpose of this report.

Only a few source categories contribute significantly to the total emissions of dioxins and furans (PCDD/F), the most important being residential combustion sources with a share of 70% and thermal processes in the metallurgical sector with a share of 13%. Other sources are motor vehicles with 3.4%, biomass combustion (8.3%)and fossil fuel use in industry (3.1%) (see figure A and tables A and B).



Source: UMWELTBUNDESAMT 2011a, b

Figure A: Relevant source categories for PCDD/F.

Table A: PCDD/F emissions from Source categories part II for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source category part II	**2004 [g I-TEQ]**	**2009 [g I-TEQ]**
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	0.230	0.229
Cement kilns firing hazardous waste[1]	0.116	0.131
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2]	IE	IE
The following thermal processes in the metallurgical industry		
(i) Secondary copper production	0.279	0.279
(ii) Sinter plants in the iron and steel industry	3.106	2.538
(iii) Secondary aluminium production	1.813	1.813
(iv) Secondary zinc production	NO	NO
Total (Part II)	**5.544**	**4.990**

[1] figures represent total emissions from cement kilns

[2] only process emissions are covered here;
PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.

NO: not occurring

IE: included elsewhere

Table B: PCDD/F emissions from source categories part III for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source category part III	2004 [g I-TEQ]	2009 [g I-TEQ]
Open burning of waste*	0.222	0.136
Thermal processes in the metallurgical industry not mentioned in Part II	0.198	0.190
Residential combustion sources	29.564	24.931
Fossil fuel-fired utility and industrial boilers	0.974	1.117
Firing installations for wood and other biomass fuels	1.644	2.957
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA	NA
Crematoria	0.154	0.164
Motor vehicles, particularly those burning leaded gasoline	1.453	1.200
Destruction of animal carcasses	NA	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA	NA
Shredder plants for treatment of end of life vehicles	NE	NE
Smouldering of copper cables	NO	NO
Waste oil refineries	NO	NO
Total (Part III)	**34.208**	**30.694**

* *Without burning of landfill sites and accidental fires*

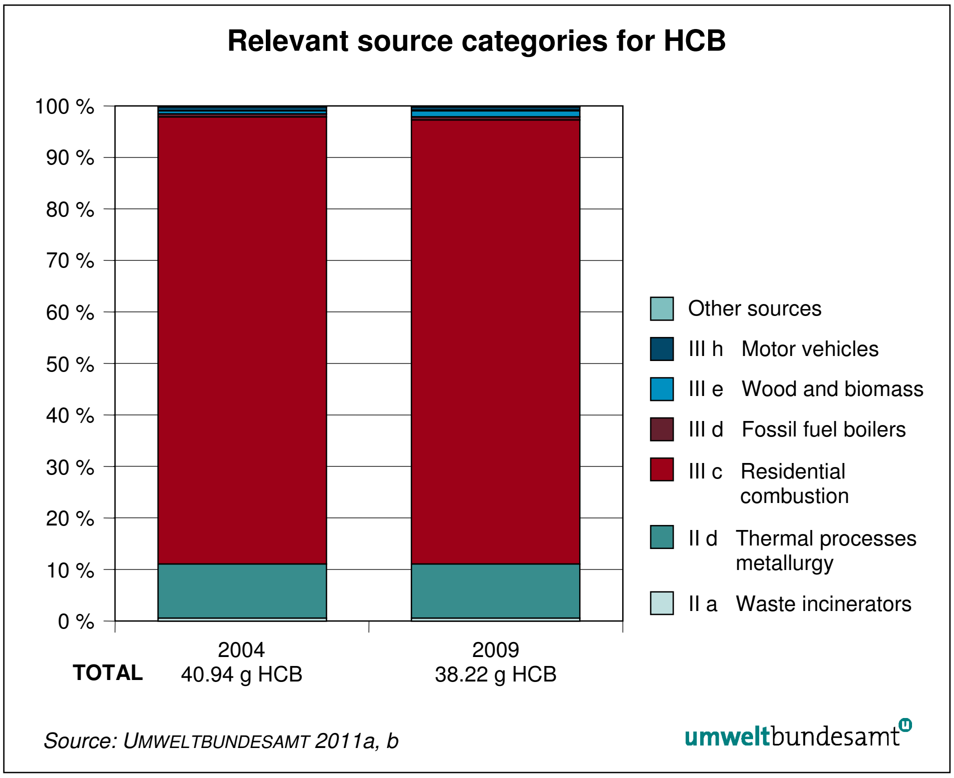
NA: not applicable

NO: not occurring

NE: estimated

Hexachlorobenzene (HCB)

In 2009 total emissions of HCB amounted to 38.2 kg (see Table C, D and Figure B). Residential combustion sources had the lion's share of 86.4% and the thermal processes in the metallurgical sector (predominantly sinter plants) combined accounted for 8.7%. All other sources were below 1%.



Source: UMWELTBUNDESAMT 2011a, b

Figure B: Relevant source categories for HCB.

Table C: HCB emissions in source category part II for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source category part II	**2004 [kg HCB]**	**2009 [kg HCB]**
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	0.290	0.247
Cement kilns firing hazardous waste[1]	0.017	0.020
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2]	IE	IE
The following thermal processes in the metallurgical industry		
(i) Secondary copper production	0.091	0.091
(ii) Sinter plants in the iron and steel industry	3.261	2.926
(iii) Secondary aluminium production	0.907	0.907
(iv) Secondary zinc production	NO	NO
Total (Part II)	**4.566**	**4.189**

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here;*
PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.

NO: not occurring

IE: included elsewhere.

Table D: HCB emissions in source category part III for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source category part III	**2004 [kg HCB]**	**2009 [kg HCB]**
Open burning of waste, including burning of landfill sites	0.044	0.027
Thermal processes in the metallurgical industry not mentioned in Part II	0.016	0.014
Residential combustion sources	35.515	33.012
Fossil fuel-fired utility and industrial boilers	0.194	0.198
Firing installations for wood and other biomass fuels	0.287	0.511
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA	NA
Crematoria	0.031	0.033
Motor vehicles, particularly those burning leaded gasoline	0.291	0.240
Destruction of animal carcasses	NA	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA	NA
Shredder plants for treatment of end of life vehicles	NE	NE
Smouldering of copper cables	NO	NO
Waste oil refineries	NO	NO
Total (Part III)	**36.377**	**34.035**

NA: not applicable; NE: not estimated; NO: not occurring

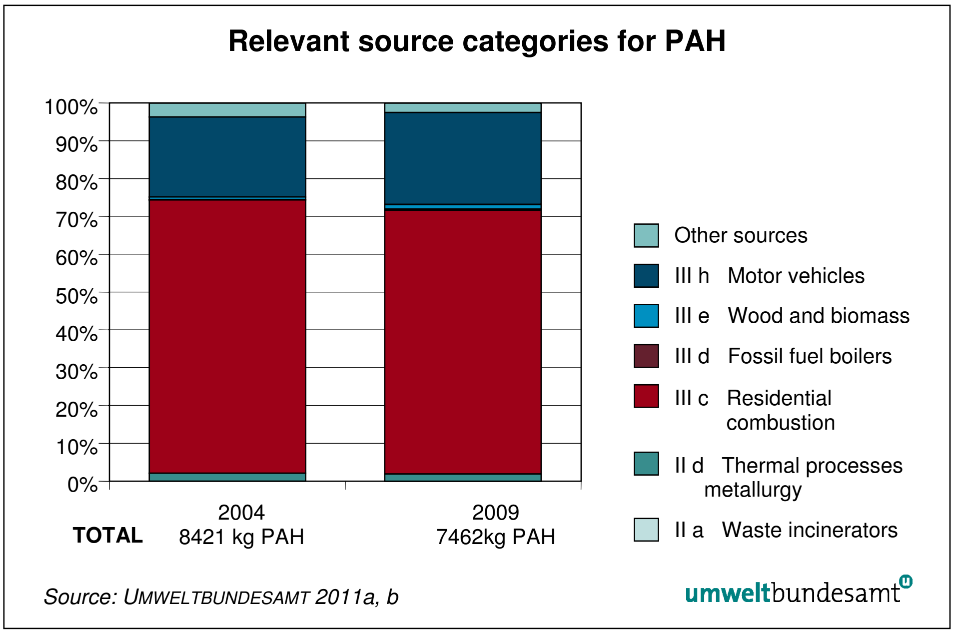
Polychlorinated biphenyls (PCBs)

Due to limited availability of qualified data releases of PCB could not be calculated.

Polycyclic aromatic hydrocarbons (PAHs)

In the year 2009 7,462 kg of PAHs were emitted in Austria. PAH emissions are mainly caused by two source categories (see Figure C, Table E and F). Residential combustion sources accounted for the lion share of 69.7% and mobile vehicles for 24.2%. Other notable sources are open burning of waste (2.5%) and sinter plants (1.9%).

Figure C: Relevant source categories for PAH.



Source: UMWELTBUNDESAMT 2011a, b

Table E: PAH emissions from source category part II for 2004 and 2009 (UMWELTBUNDESAMT 2011 a, b).

Source Category Part II	2004 [kg PAH]	2009 [kg PAH]
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	24.1	11.5
Cement kilns firing hazardous waste[1]	3.2	3.7
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2]	IE	IE
The following thermal processes in the metallurgical industry		
(i) Secondary copper production	NE	NE
(ii) Sinter plants in the iron and steel industry	156.5	140.9
(iii) Secondary aluminium production	NE	NE
(iv) Secondary zinc production	NO	NO
Total (Part II)	**183.8**	**156.1**

[1] figures represent total emissions from cement kilns

[2] only process emissions are covered here; PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.

NO: not occurring

NE: not estimated

IE: included elsewhere.

Table F: PAH emissions in source category part III for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

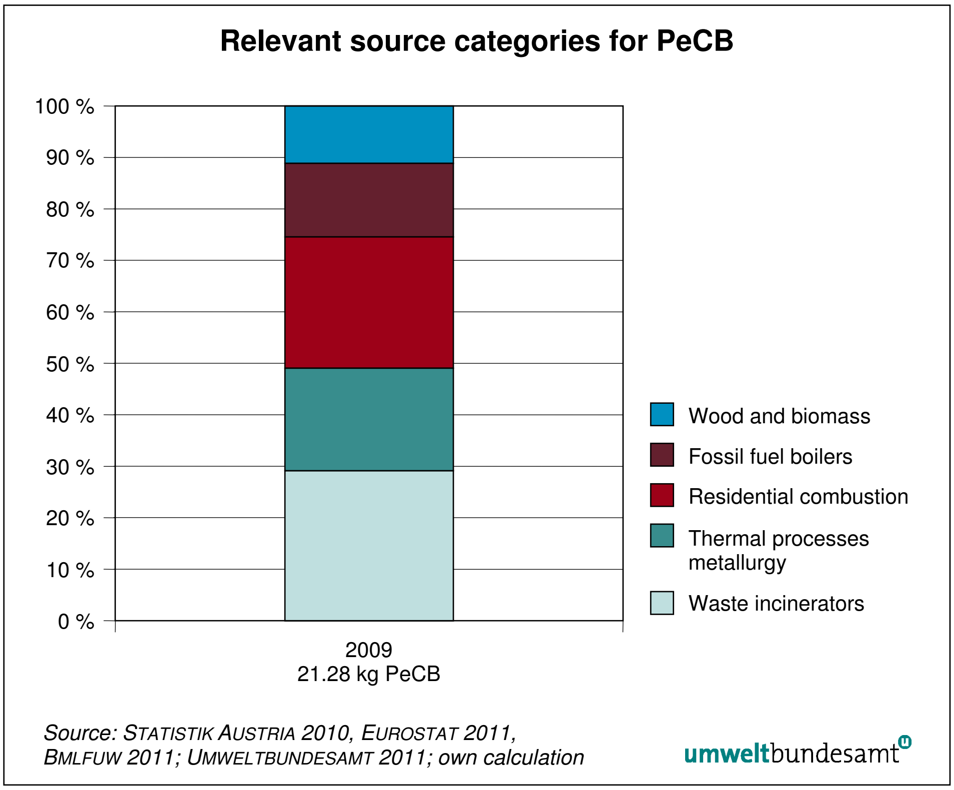
Source category part III	2004 [kg PAH]	2009 [kg PAH]
Open burning of waste, including burning of landfill sites	304.1	183.5
Thermal processes in the metallurgical industry not mentioned in Part II	2.9	2.8
Residential combustion sources	6 080.0	5 198.3
Fossil fuel-fired utility and industrial boilers	16.5	27.1
Firing installations for wood and other biomass fuels	47.0	89.1
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA	NA
Crematoria	<0.1	<0.0
Motor vehicles, particularly those burning leaded gasoline	1 777.9	1 805.6
Destruction of animal carcasses	NA	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA	NA
Shredder plants for treatment of end of life vehicles	NE	NE
Smouldering of copper cables	NO	NO
Waste oil refineries	NO	NO
Total (Part III)	**8 228.3**	**7 306.3**

NA: not applicable; NO: not occurring; NE: not estimated

Pentachlorobenzene (PeCB)

In the year 2009 a total of 21.28 kg PeCB was emitted in Austria from the source categories according to the Stockholm Convention.

Figure D: Relevant source categories for PeCB.



Source: STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011; own calculation

Table G: PeCB emissions in source category part II for 2009 (STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011, own calculation).

Source category part II	2009 [kg PeCB]
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	6.21
Cement kilns firing hazardous waste	NA
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching	NA
The following thermal processes in the metallurgical industry	
(i) Secondary copper production	NA
(ii) Sinter plants in the iron and steel industry	4.2
(iii) Secondary aluminium production	NA
(iv) Secondary zinc production	NO
Total (Part II)	**10.41**

NO: not occurring

NA: not applicable.

Table H: PeCB emissions in source category part III for 2009 (STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011, own calculation).

Source category part III	**2009 [kg PeCB]**
Open burning of waste, including burning of landfill sites	NA
Thermal processes in the metallurgical industry not mentioned in Part II	NA
Residential combustion sources	5.5
Fossil fuel-fired utility and industrial boilers	3.00
Firing installations for wood and other biomass fuels	2.37
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA
Crematoria	NA
Motor vehicles, particularly those burning leaded gasoline	NA
Destruction of animal carcasses	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA
Shredder plants for treatment of end of life vehicles	NA
Smouldering of copper cables	NO
Waste oil refineries	NO
Total (Part III)	**10.87**

NA: not applicable.

NO: not occurring

C Inventory of emissions into water

For the time being, data on sources for POPs releases into water are gathered in two registers in Austria:

In the European Pollutant Release and Transfer Register – PRTR – point sources and emissions to water for all POPs are included in principle. In fact, for most industrial sectors, a reporting obligation to PRTR exists only for facilities exceeding a certain production capacity threshold and for emissions which exceed a pollutant release threshold. For Austria, with its mainly small and medium-sized enterprises and thus lower production capacity thresholds only some 80 facilities with emissions to water or waste water are listed in the PRTR. In 2007, 2008 and 2009 no emissions of POPs were reported for these facilities. So far, no data on diffuse sources of POPs have been available in PRTR.

In 2009 a national inventory on pollutant emissions to surface waters was established. The national register comprises emissions of the following point sources: PRTR facilities, urban waste water treatment plants with a capacity from 2000 population equivalents upwards and waste incineration facilities with a capacity of more than 2 tonnes of waste per hour. There is no release threshold for reporting. In practice, the lower limit is determined by the limit of quantification of the specified analytical method and the waste water discharge. The first reporting cycle for the data of 2009 covered only basic waste water parameters. The second more comprehensive reporting cycle of 2010 was finalized and partly evaluated in 2011.

Additional information on POPs releases was gathered within a supporting project for the setup of the national emissions inventory in 2007/2008. Some 70 substances were analysed for intake and outlet of 15 urban waste water treatment plants of different capacities, purification technologies and waste water-composition. The analytical programme comprised the priority substances and certain other substances according to the daughter Directive 2008/105/EC of the Water Framework Directive and pollutants of national relevance regulated in the Austrian Ordinance on Quality Standards for Surface Waters. DDT, chlordane, aldrin, dieldrin, endrin, heptachlor, hexachlorobenzene and pentachlorobenzene could not be detected in crude waste water. With exception of one facility PAHs were only detectable in crude waste water. Only polybrominated diphenylethers were detectable in effluents in the sub-ng/l range and hexachlorcyclohexane (lindane) in the ng/l range. The use of lindane was allowed in some selected minor applications until January 1st 2008.

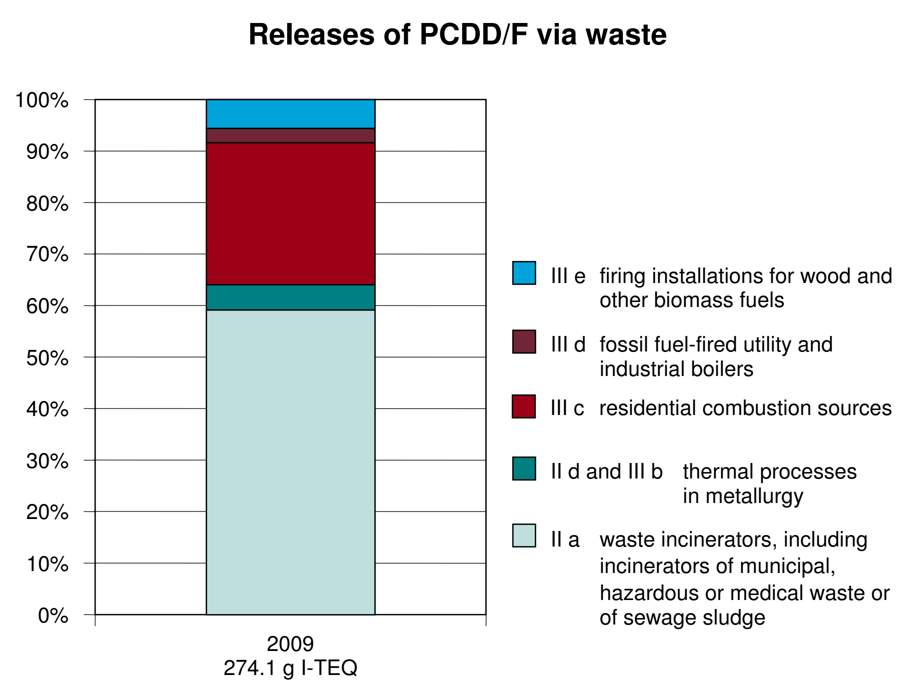
With regard to contaminated sites it can be concluded that underground pollution by PAHs causes in general only local impacts on soil and groundwater.Nevertheless, it must be recognised that, depending on the site-specific situation and where sensitive land uses are concerned, risks to human health or to ecosystems need to be analysed. Regarding PCDD/F, HCB and PCB there are hardly any sites or data available on site pollution or wider environmental impacts.

D Inventory of releases via residues and waste

An inventory of releases via residues and waste can be established in the case of PCDD/F and PeCB.

Dioxins and furans (PCDD/F)

The releases of dioxins and furans via residues and waste remained largely the same compared to the year 2004: In the year 2009 a total of 274.1 g PCDD/F I-TEQ were emitted (in 2004 267.1 g), which is approximately seven times as much as the emissions to air. Solid waste from waste incineration contributes most (59%) to the overall releases. Waste from residential sources presents also a significant release (28%). Other releases come from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion (see Figure E).



Source: UMWELTBUNDESAMT 2011, own calculation

umweltbundesamt

Figure E: Releases (although hardly bio-available) of PCDD/F via waste.

Note: Total releases may be higher since for many source categories (e.g. the metallurgical sector) which have the potential of POPs releases via waste qualified emission factors are not available.

However, there are **distinct differences** to other releases with regard to the uptake by organisms and impacts on human health: Many waste types are disposed of in landfills and thus removed from the regular material flow and are **not bioavailable** anymore, provided that the landfills are properly designed and operated:

Waste from waste incinerators are generally disposed of in landfills (landfills for residual waste, mass waste or underground disposal). 87% of PCDD/F releases occur via fly ash, which is often sent to underground disposal.

Very high PCDD/F concentrations could be found in the soot from small scale combustion sources. It is not known in detail how this type of waste is treated, but it is assumed that the major part is disposed of via the typical municipal solid waste routes. In case of thermal treatment of municipal solid waste POPs will be either oxidised or – if captured in the ashes – sent to landfills. In the case of mechanical-biological treatment soot will accumulate in the fraction which is usually sent to landfills.

Waste from metallurgical processes – which is to some extent contaminated – is either sent back to the process or to external treatment and/or disposal. There are major data gaps with respect to concentrations of POPs and treatment of POP containing waste types.

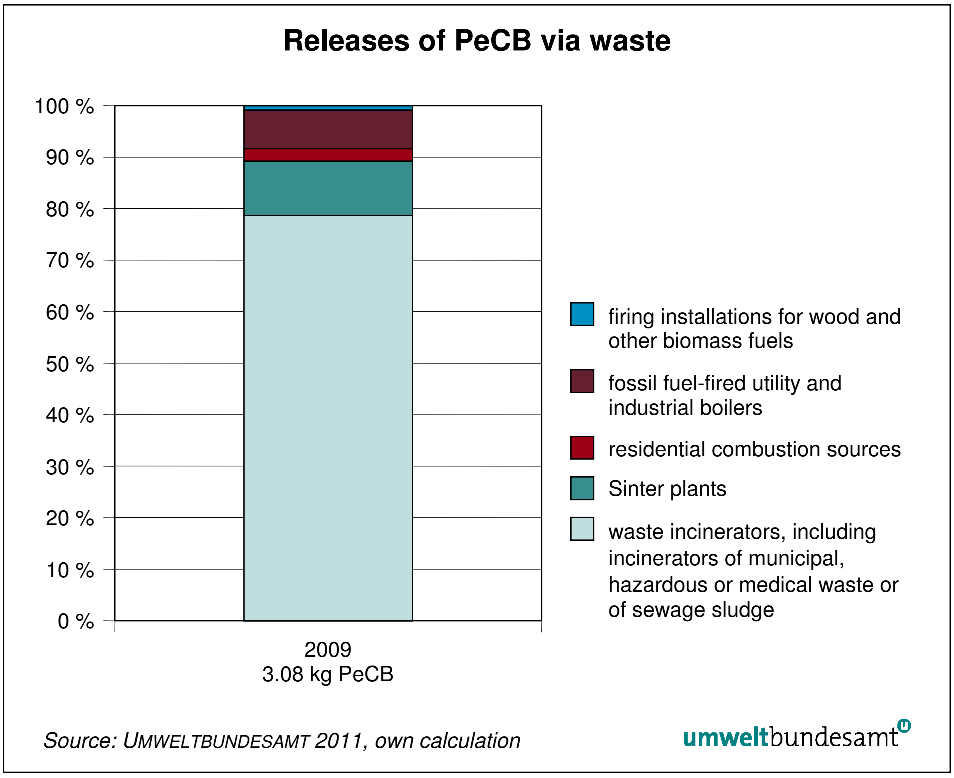
Fly ash from thermal power plants is used in the cement and construction industry, whereas fly ash from biomass plants has to be disposed of in landfills.

Releases of POPs into the environment via waste can occur when POP containing waste types are brought back to the environment. This can be the case-when ash from small scale firing installations (which can contain considerable high concentrations of POPs) is used for “fertilising” purposes or used as an agent for sanding the pavement during the winter season. Coarse ashes from biomass plants are used as additional material for preparing compost. In general there are also major data gaps concerning concentrations of POPs in ashes from residential combustion sources. Release estimations are associated with great uncertainties. Reasons for these uncertainties are (among others) the wide variety of the types (including some types of waste) and quality of fuels used (e.g. water content, ash content, calorific value, chlorine content), the wide variety of firing systems with different combustion conditions and the wide variety of “local” factors (such as manual loading of the firing system, co-incineration of waste).

However, these releases are relevant because a certain part of this waste is retransferred to the environment (e.g. when ash is used as “fertiliser” in private gardens).

Pentachlorobenzene (PeCB)

In the year 2009 a total of 3.08 kg PeCB was emitted, approximately seven times less than to air (see 2.6.6). Solid waste from waste incineration contributes most (81%) to the overall releases. Other releases come from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion. Anyway, it should be mentioned that the availability of data was scarce.



Source: UMWELTBUNDESAMT 2011, own calculation

Figure F: Releases of PeCB via waste.

Table I: PeCB discharge into waste for 2009 (own calculation)

Source category	**2009 [kg PeCB]**
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	2.42
The following thermal processes in the metallurgical industry (ii) Sinter plants in the iron and steel industry	 0.33
Residential combustion sources	0.07
Fossil fuel-fired utility and industrial boilers	0.23
Firing installations for wood and other biomass fuels	0.03
Total	**3.08**

E Releases via products

Action in relation to POPs in products stems from Annex C Part V A (g) of the Convention ("minimization of these chemicals as contaminants in products"). Some data can be found in the literature relating to concentrations of PCDD/F in the sold products cement and pulp and paper (see Table J). Concerning the other POPs described in this report there are no proven data available.

However, for most source categories there are no relevant releases via the product.

Table J: PCDD/F-releases via the products cement and pulp and paper – calculations were based on data from literature (KARSTENSEN 2006, UNEP 2005, GRUBER 1996).

	Release (g I-TEQ/a)
Cement	4.02
Paper	4.98
Pulp exported[1]	0.123

[1] *Releases via pulp occur only via export; releases via pulp which is not exported are included in the value given for paper*

The PCDD/F-releases via the products cement and pulp and paper in 2009 were the same as in 2004 since there were no significant changes in the production.

Concentrations of PCDD/F in cement are considered to be low and can be explained by the fact that filter dust from the clinker process (average PCDD/F concentration: 6.7 ng I-TEQ/kg) is added to the product and that secondary raw materials (e.g. fly ash, gypsum from flue gas desulphurisation) are used. On the other hand, the cement clinker itself is contaminated with low concentrations of PCDD/F (average: 0.9 ng I-TEQ/kg clinker) (KARSTENSEN 2006).

Here again, it should be mentioned that the bio-availability of POPs in cement is greatly reduced.

Austria participates in the revision of the Dioxin Toolkit (UNEP 2005). The current draft states the following: "This section summarizes high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may potentially cause the formation of PCDD/PCDF at various steps of the processes, e.g., during the cooling phase of the gases or in the heat zone. Due to the long residence time in kilns and the high temperatures needed for the product, emissions of PCDD/PCDF are generally low in these processes." Cement kilns firing hazardous waste are a source as mentioned in Annex C Part II (b) of the Convention concerning emissions of PCDD/F, HCB, PAH and PeCB. Therefore the quantification of these POPs in the media as well as residues and products is desirable.

In the case of the pulp- and paper production PCDD/F is introduced into the products mainly via bleached (Kraft-)pulp and via recycled papers.

In Austria total pulp production (reference year 2009) amounted to 1,514 kt (2004: 1,509 kt) with bleached sulphite pulp (TCF bleaching) having a share of 24%, bleached Kraft-pulp (ECF-bleaching) 26%, unbleached Kraft-pulp for 32% and textile pulp for 18% (AUSTROPAPIER 2009).

Calculation of releases from pulp was based on emission factors of 0.5 µg/t (bleached Kraft-pulp) and 0.1 µg/t (other pulp) (UNEP 2005). Thus total releases via pulp amounted to 0.28 g in the year 2009.

Relevant raw materials for paper production are pulp (both from national production and from imports), wood pulp and recovered paper (either de-inked or not de-inked).

In addition to the pulp produced in Austria (see above) imported pulp has to be taken into account: In 2009 about 690,000 t of bleached (Kraft-)pulp was imported, part of the imported pulp came from countries where chlorine is still used as a bleaching agent (AUSTROPAPIER 2009). For the calculation of the PCDD/F content it is assumed that 10% of the imported pulp has an emission factor of 0.5 µg/t, whereas the other imported pulp is less contaminated (0.1 µg/t). This leads to a total import of 0.096 g I-TEQ via pulp. In the year 2009 about 0.123 g I-TEQ were exported via pulp.

Input of PCDD/F via wood-pulp has been calculated using an emission factor of 0.1 µg/t (UNEP 2005; total input: 0.044 g I-TEQ).

On the other hand PCDD/F is introduced via the recycled paper and more specific via impurities in the used inks. In case de-inking is applied (about 40% of recovered paper is de-inked in Austria) PCDD/F will be reduced by a factor of 3 (GRUBER 1996). Comparably high concentrations (up to 12 ng/kg) were found in packaging papers and paper board in the early nineties. In general, a sharp decline in average concentrations could be observed between 1989 and 1994 whereas concentrations have been decreasing slowly since 1994 (GRUBER 1996).

Based on that information and on data given in the Dioxin Toolkit (UNEP 2005) it has been assumed that the PCDD/F concentration in recovered paper is 3 µg/t (without de-inking) and 0.99 µg/t (with de-inking). These assumptions result in an average emission factor of 2.18 µg/t (averaged over paper which undergoes a de-inking step and which does not). Thus the total release via paper amounts to 4.98 g (reference year: 2004).

Publications in scientific literature give some indication, that waste paper could be contaminated by printing inks containing significant residues of PCDD/F, e.g. through pigments. In 2011 the Environment Agency Austria accomplished a survey assessing the PCDD/F contents of cardboard-boxes known to be produced from waste paper as the predominant raw material. Comparing the PCDD/F contents of brand-new non-printed cardboard-boxes with used cardboard-boxes with amount of ink printed on them this limited study did not show any indication of PCDD/F input via printing inks. The cardbox samples analysed for this study showed PCDD/F contents in a range of 1.2 to 1.9 ng TEQ/kg (UMWELTBUNDESAMT 2011c).

In 2010 Austropapier, the Association of the Austrian Paper Industry, submitted new data on PCDD/F contents of selected paper products in order to refine calculations based on the emissions factors taken from the Dioxin Toolkit (UNEP 2005). Emission factors derived from the new data indicate a reduction of the overall PCDD/F release via paper products by a factor of three. Although there are still certain concerns about the representativeness of the data presented by Austropapier this information will be forwarded to the expert panel of the Dioxin Toolkit to initiate a discussion about a revision of the respective emission factors.

A new calculation was performed in 2011:

Table K: Releases of PCDD/F via products (calculation on the basis of the output of Austropapier and transmitted results of analysis).

Product	**Production (t/a)**	**Emission factor (µg TEQ/t)**	**Releases (g PCDD/F TEQ/a)**	**Percentage (%)**
Newspaper printing paper	299,205	0.068	0.02	1.2
Printing and writing paper				
● deinked	902,421	0.068	0.06	3.7
● from pulp	1,346,070	0.050	0.07	4.0
Folding box cardboard	487,214	0.723	0.35	21.1
Packaging paper	676,177	1.141	0.77	46.2
Kraft paper				0.0
● with recovered paper	374,855	0.858	0.32	19.3
● only from pulp	250,743	0.050	0.01	0.8
Thin- and special papers				0.0
Sanitary paper	128,660	0.068	0.01	0.5
Others	126,896	0.050	0.01	0.4
Packing and spezial board	13,299	0.858	0.01	0.7
Market pulp exported	95,471	0.070	0.01	0.4
Market pulp (ECF)	313,818	0.090	0.03	1.7
Total	**5,014,829**		**1.67**	**100.0**

F Evaluation of the efficacy of national laws and policies and strategies for meeting the obligations of the Stockholm Convention and the EU POP-Regulation

As already stated in the National Action Plan 2008 Austria complies to a great extent with the provisions of the Stockholm Convention and the EU POP Regulation. Nevertheless, as one of the goals of the Convention is the “continuous reduction of POPs releases” further efforts are necessary.

POP emissions of major (industrial) sources have considerably declined in the past years. Between 2004 and 2009 a further decrease of air emissions of POPs took place, partly due to a decline in economic activities in the years 2008 and 2009. Still, if changes in the best available techniques allow for lower or zero emissions from relevant sources policy makers have to react and to adapt the relevant legal provisions accordingly (e.g. by laying down stricter emission limit values).

In general, the findings of the NAP 2008 remain valid for the near future:

The NAP 2008 identified small residential combustion plants as an important target area. They still hold responsible for 70.0% of the PCDD/F emissions, 86.4% of the HCB emissions and for 69.7% of the PAH emissions into air. All possible measures have to be investigated and exploited to reduce the POP emissions from these sources.

Anotherset of measures is concerned with awareness-raising to encourage ”low emission” incineration in household stoves or e.g. the use of ashes from these plants for fertilising purposes. Here, an important initiative was launched in 2009 and 2010 (see below).

It should be mentioned that in order to comply with certain national and international obligations a variety of comprehensive and to some extent cross-sectoral measures and instruments are being developed in Austria. These measures are aiming at the reduction of greenhouse gases, NO_x and (fine) particulate matter. Some of these measures (described e.g. in the Climate Strategy 2007 (FEDERAL MINISTRY OF AGRICULTURE, FORESTRY, ENVIRONMENT AND WATER MANAGEMENT 2007) or in the Programme of the Federal Government (FEDERAL GOVERNMENT 2007)) will lead to an indirect reduction of POPs releases (by e.g. reduction of energy consumption or prescription of stricter air emission limit values for dust), others (such as the increased use of biomass in small scale firing installations) will lead to an increase of POPs releases.

Further, it is important to gain a still deeper knowledge in fields where reliable data are limited or missing. Specific studies e.g. on POP concentrations in certain wastes as well as further POP related monitoring activities are mentioned below.

PeCB Management Options: It is common knowledge, that measures which are effective for PCDD/F removal or elimination are also effective for a minimisation of PeCB releases. Here, the reader is referred to Annex V of the Stockholm Convention on POPs and in particular to the technical guidelines on best available techniques and guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention.

Therefore, no particular management actions for PeCB are required.

Evaluation and Proposal of Measures (according to § 20 (2) Chemicals Act 1996)

The NAP 2008 listed a variety of measures which on the one hand contribute to lower POPs emissions from relevant sources and which would, on the other hand, improve the availability of data on POPs in the environment.

Releases of POPs from source categories

The following table provides an overview which of the measures proposed in the NAP 2008 had been implemented in the period 2008–2011.

National legislation	**Contents with respect to POPs**	**Measures proposed in NAP 2008**	**Current status**
Act on Emissions of Boiler Plants (BGBl. I No. 150/2004); Clean Air Ordinance on Boiler Plants (BGBl. No. 19/1989 as amended by BGBl. II No. 2005/55); as amended by Emission Measurement Ordinance (Fed.Law Gaz. II No.153/2011)	ELVs for dust, CO, Corg, NO_x	Adaptation to BAT necessary	Adaptation done through Act on Emissions of Boiler Plants as applicable
Industrial Code 1994 and specific ordinances according to Article 82 para 1, for example Ordinance on sinter plants (Fed. Law. Gaz. II No. 1997/163)	ELV for various air pollutants, eg dust, PCDD/F	Continuous evaluation with regard to BAT	Routine Evaluation
Ordinance on combustion plants (BGBl. II No. 331/1997)	ELVs for dust, CO, Corg, NO_x	Adaptation to BAT necessary (stricter ELVs for dust)	Measure was implemented by amendment (BGBl. II No. 312/2011)
Waste incineration ordinance (Fed. Law. Gaz. II No. 2002/389)	ELVs for dust, CO, Corg, NO_x, heavy metals, PCDD/F	stricter ELVs for dust for co-incineration plants	Revised ordinance Fed.LawGaz. II No. 2010/476, but no stricter ELV for dust
Austrian Water Act and specific Ordinances:	ELVs for AOX and POX in the sector specific ordinances		
Ordinance on the limitation of waste water emissions from flue gas treatment (BGBl. II No. 271/2003)	ELVs for PCDD/F	Continuous evaluation with regard to BAT	none
Ordinance on the limitation of waste water emissions from processing of coal (BGBl. II No. 346/1997)	ELVs for PAHs	Continuous evaluation with regard to BAT	none
Ordinance on the limitation of waste water emissions from the production of plant protecting agents and crop sprayings (BGBl. No. 668/1996)	ELVs for AOX and specific POPs	Continuous evaluation with regard to BAT	none
Ordinance on the determination of the target state for surface waters (BGBl. II No. 96/2006)	Environmental quality standard for HCB	For PAHs community environmental quality standards were determined (in 2008)	ordinance was amended in 2010 according to directive 2008/105/EC (BGBl. II No. 461/2010)
Other relevant legal provisions			
Ordinance on landfills (BGBl. II No. 39/2008)	Limit values for the content of PAH in wastes		Amended with BGBl. II No. 185/2009 und II 178/2010
Compost ordinance (BGBl. II No. 292/2001)	Limit values for the content of POPs in composts	Continuous evaluation of the limit values necessary	none
Ordinances on sewage sludge and compost of the Federal Provinces	Limit values for POP	Continuous evaluation of the limit values necessary	None, some Austrian provinces limit POPs in sewage sludge
Soil Protection Laws of the Federal Provinces: Burgenländisches Bodenschutzgesetz (LGBl. Nr. 87/1990) Niederösterreichisches Bodenschutzgesetz (LGBl. Nr. 6160-0) Oberösterreichisches Bodenschutzgesetz (LGBl. Nr. 63/1997) Bodenschutzgesetz Salzburg (LGBl Nr. 80/2001) Steiermärkisches landwirtschaftliches Bodenschutzgesetz (LGBl. Nr. 66/1987)		Elaboration of target values for organic pollutants (including polybrominated diphenylethers, perfluorinated tensides and pesticides) with the aim to reduce pollution of soils	Not realised

National legislation	**Contents with respect to POPs**	**Measures proposed in NAP 2008**	**Current status**
Ambient Air Quality Act (IG-L)	§ 21 IG-L: Legal basis for an ordinance	Evaluation whether generally binding ELVs for crematoria in an ordinance according to § 21 IG-L are necessary	Not implemented, no general binding rule for crematoria
Laws of the Federal Provinces concerning residential combustion sources		Agreement pursuant to Art. 15a Federal Constitution Law concerning the placing on the market and the inspection of combustion installations, rapid transposition of the requirements of this agreement into the law of the federal provinces	Agreement was signed in 2011
Act on Air Pollution Prevention (BGBl. I No. 137/2002, as amended (BGBl. I No. 50/2012))	Prohibition of burning of biogenic materials, many exemptions possible	Evaluation with respect to the exemptions	Prohibition integrated in Act on Air Pollution Prevention
Permitting process	*Contents with respect to POPs*	*Comments/Specific Steps*	
Landfill sites	Fire protection requirements	Implementation of effective fire protection requirements for landfills and intermediate storage sites for waste	No new information

Bearing in mind that the sector **residential combustion** is responsible for 70% of the PCDD/F emissions into air the Federal Ministry of agriculture and forestry, environment and water management in cooperation with the federal guild of chimney sweepers, the tile stove alliance, the Austrian Medical Chamber and the association of doctors for a healthy environment published a booklet entitled "Richtig heizen" ("Proper Heating") in 2010. The booklet contains information on the effects of emissions from household stoves on human health and the environment as well as advice on how low emissions heating can be achieved. It has been distributed to the public via chimney sweepers and medical doctors. Furthermore an internet-site has been created (www.richtigheizen.at), where the proper use of household stoves as well as legal considerations are described.

Furthermore, the rapid implementation of the following measures is of utter importance:

- Establish compliance with the requirements of the agreement between the federal provinces pursuant to Article 15a of the Federal Constitutional Law concerning the setting of consolidated quality standards to support the establishment and refurbishment of residential buildings for the purpose of the reduction of greenhouse gases
- Effective financial funding for the replacement of coal fired small scale firing installations

  Periodic reviews and improvements of the criteria for the funding of biomass plants (including biomass plants operated in the agricultural sector) with respect to operating conditions, energy efficiency (including district heating systems), the quality of fuels and emission limit values for dust → emission limit values for dust were changed in 2007 and 2009.
- Further information with respect to the prevention of co-incineration of waste in small scale firing installations

- Further information with respect to the final disposal of ashes/soot from small scale firing installations
- Implementation of appropriate measures to ensure that the target value for benz(a)pyrene in ambient air (1 ng/m^3) will be complied with. This target value will be converted into a limit value as of 31.12.2012.

  → different measures in the provinces

For the following sources the availability of data is **still** very limited or missing. Therefore, to assess whether releases of POPs are relevant and to improve and complete the Austria Inventories on POPs, the following **specific steps to improve data quality** are desirable/necessary. However, the implementation of these measures may often be subject to available budget resources.

- Emission behaviour of small scale combustion installations (esp. in the case of firing straw and cereals)

  → still partly unknown with regard to POPs, but a project is envisaged which will investigate certain emission parameters of small scale combustion installations (residential combustion, "EnEm Tech project")
- Measurement of emissions of motor vehicles and update of emission factors to improve quality of the forecasts

  → The Handbook Emission Factors for Road Transport (HBEFA) provides emission factors for all current vehicle categories (PC, LDV, HGV, urban buses, coaches and motor cycles), each divided into different categories, for a wide variety of traffic situations. Emission factors for all regulated and the most important non-regulated pollutants as well as fuel consumption and CO_2 are included.The last version HBEFA 2.1 dates back to 2004 and was updated in 2010 (HBEFA 3.1). All emission factors have been recalculated (based on a broader set of emission data, on new measurements of motor vehicle emissions; new emission factor models have been applied). For calibrating the model, a broad set of emission measurements up to Euro 4 has been used. Emission factors for the new standards of Euro 5 and 6 are mainly based on assumptions in view of future legislation.
- Improvement of data quality with respect to releases of POPs from landfills and abandoned industrial sites and known contaminated sites (e.g. PAH content oflandfill gases)
- Assessment of the contamination and treatment of waste and residues in non ferrous metals and secondary steel production as well as in sinter plants

  → no new assessment
- Determination of POP-concentrations in waste streams from small scale combustion installations in the sectors residential combustion, services and agriculture which have a high probability of being released into the environment (e.g. bottom ash and fly ash)
- Determination of POP-concentrations in waste streams from fossil fuel fired utility and industrial boilers (including co-incineration of waste) which are recovered in other production processes or which have a high probability to be released into the environment (e.g. fly ash from co-incineration plants)
- Determination of POP-concentrations in waste streams from biomass fired combustion installations which are recovered in other production processes or which have a high probability to be released into the environment (e.g. bottom ash)

- Determination of concentrations of PCDD/F and relevant precursors especially in bleached (Kraft-)pulp (imported and domestic production), paper (packaging paper, paper board, paper made from recovered fibres), colours and inks, de-inking sludge

  → In 2011 the Environment Agency Austria accomplished a survey assessing possible PCDD/F input into cardboard boxes via contaminated printing inks. The results of this limited study did not show any indication of PCDD/F contamination of currently used printing inks
- Quantification of POPs in filter dusts from the clinker process (Austrian cement kilns)

  → quantification after consultation talks with Environment Agency Austria, Federal Economic Chamber/cement industry and other stakeholders; support of the revision of the Dioxin Toolkitrelating to „mineral products“
- Quantification of POPs emissions (esp. PCDD/F and PCB) of Platformer 3 of the OMV refinery in Schwechat

  → quantification of POPs emissions of Platformer 3 still unknown

Data availability on POP emissions into the environment

The following table lists specific measures designed to improve the quality of available data regarding POPs emissions into the environment:

Specific steps	**Timetable**
Improvement of data quality with respect to releases of HCB and PCB into air (e.g. by planning and carrying out measurement programmes for sources with high priority, such as residential combustion sources, industrial processes).	Review of available (literature) data, identification of (suspected) relevant sources
Establishment of monitoring programmes in the neighbourhood of POP relevant emitters	Identification of relevant sites for sampling sampling and measurements (winter/summer)
Continuation of monitoring programmes using Norway spruce needles close to POP sources	Continued sampling

Data availability on POP concentrations in the environment

The following table lists specific measures designed to improve quality of available data regarding POPs concentrations in the environment:

Specific steps	**Timetable**
Continuation of ambient air and deposition monitoring for POPs at Alpine summits (Sonnblick)	Continued sampling and analysis
Ambient air and deposition monitoring for POPs in the Austrian-Czech border region	Sampling in 2011/12 and analysis
Development of transfer factors to improve knowledge of interrelations between POP concentrations in the environment and bioavailable concentrations.	Establishment of a scientific panel to elaborate a study design
Development and adaptation of passive sampling methods to improve the comparability of available data	Method/Instrument selection and development, pilot study Evaluation of the pilot study and selection of an appropriate method
Implementation of a national monitoring programme to investigate the distribution of deposited POPs	2008 – selection of sampling sites From 2009 onwards – implementation

ZUSAMMENFASSUNG

A Einleitung

Dieser Bericht ist der 1. Review des Nationalen Aktionsplans POPs, der 2008 veröffentlicht wurde.

Artikel 5 des Stockholmer Übereinkommens verpflichtet die Vertragsparteien zur Erarbeitung eines Aktionsplanes der die unbeabsichtigt entstandenen POPs (laut Anlage C) beschreibt und näher behandelt. Artikel 5 sieht darüber hinaus eine regelmäßige Überprüfung (Revision) desAktionsplanes und der erfolgreichen Umsetzung der Verpflichtungen des Übereinkommens alle 5 Jahre vor.

In Anlage C sind derzeit folgende unbeabsichtigt freigesetzte Chemikalien enthalten: polychlorierte Dibenzo(p)dioxine (PCDD), polychlorierte Dibenzofurane (PCDF), Hexachlorbenzol (HCB), Pentachlorbenzol (PeCB) und polychlorierte Biphenyle (PCBs).

Ferner behandelt der Nationale Aktionsplan auch die Freisetzung von polyzyklischen aromatischen Kohlenwasserstoffen (Benzo(a)pyren, Benzo(b)fluoranthen, Benzo(k)fluoranthen und Indeno(1,2,3-cd)pyren), da diese in der EU-POP-Verordnung (EG) Nr. 850/2004 genannt sind.

Der Nationale Aktionsplan war Teil des Nationalen Durchführungsplanes gemäß Artikel 7 des Übereinkommens und hatte Strategien zur Verminderung oder Eliminierung der Freisetzung der in Anlage C genannten Chemikalien (einschließlich PAHs) sowie einen Zeitplan zu enthalten. Der Nationale Aktionsplan sollte den möglichen Handlungsbedarfaufzeigen sowie Quellverzeichnisse und Emissionsabschätzungen für diese Chemikalien enthalten. Der Plan identifiziert Handlungsprioritäten, unter anderem für diejenigen Quellkategorien, die eine möglichst kosteneffiziente Verringerung oder Eliminierung von Freisetzungen versprechen. Zudem enthält er Freisetzungsinventare für die in Anhang C gelisteten Chemikalien.

Die Bezeichnung „Freisetzung" umfasst POP-Emissionen in Luft, Wasser und Boden sowie Freisetzungen über Abfälle, Rückstände und Produkte.

Die Revision des Nationalen Aktionsplanes enthält eine Aktualisierung der Quellverzeichnisse und der Emissionsabschätzungen (Basisjahr 2004). Auf deren Grundlage werden Instrumente und Maßnahmen vorgeschlagen, die zur Reduzierung von POPs Freisetzungen führen sollen. Die Wirksamkeit der bisherigen gesetzlichen Regelungen und auch die Anwendung von BAT (Best Available Techniques – Beste Verfügbare Techniken) und BEP (Best Environmental Practice – Beste Umweltschutzpraktiken) in den Quellkategorien des Stockholmer Übereinkommens (laut Anhang C) werden überprüft. Zudem werden Empfehlungen gegeben, wie BAT und BEP einzusetzen sind. Weiters werde noch bestehende Datenlücken identifiziert und Vorschläge zur Verbesserung der Datenqualität ausgearbeitet.

Ein Quellverzeichnis für Emissionen von PCDD/F, PAHs und HCB in die Luft kann erstellt werden, für PCBs ist dies aufgrund mangelnder Daten jedoch nicht möglich.

Zur Freisetzung von POPs in das Wasser und in Abfälle existieren wenig Daten. In Bezug auf Abfälle kann lediglich für PCDD/F eine Abschätzung getroffen werden. Für PCBs können aufgrund mangelnder verfügbarer Daten keine Quellverzeichnisse für Luft, Wasser, Boden, Abfall und Produkte erstellt werden.

Eine direkte Freisetzung von POPs in den Boden erfolgt durch die Quellkategorie "offene Verbrennung von Abfällen, einschließlich Verbrennung auf Deponien" (dies beinhaltet auch die offene Verbrennung biogener Materialien wie etwa Stroh). Jedoch können auch POPs in den Boden freigesetzt werden, wenn Prozessrückstände wieder in die Umwelt gelangen (Beispiel: Verwendung von Asche aus Kleinfeuerungsanlagen für Düngezwecke).

Freisetzungen aufgrund von Unfällen und aus kontaminierten Flächen werden im Nationalen Aktionsplan nicht behandelt. Sie können jedoch im Fall von Bränden in Deponien oder Abfallzwischenlagern beträchtlich sein.

Der Nationale Aktionsplan enthält weiters einige Literaturdaten zu Gehalten von POPs in den Produkten Zement, Zellstoff und Papier.

Das Umweltbundesamt untersuchte im Jahr 2011 Kartonagen aus recycliertem Papier auf eine mögliche Kontaminationmit PCDD/F durch Druckfarben. Allerdings konnte keine Verunreinigung nachgewiesen werden.

Der Nationale Aktionsplan wird periodisch überarbeitet.

B Emissionsverzeichnis Luft

Allgemeine Trends

Aufgrund der gesetzlichen Regelungen zur Reduktion von Emissionen aus industriellen Prozessen und Abfallverbrennung sind die Emissionen an PAHs, PCDD/F und HCB von 1985 bis 1994 signifikant gesunken. 1995 und 1996 stiegen die Emissionen an, wurden aber bis 2001 kontinuierlich geringer.

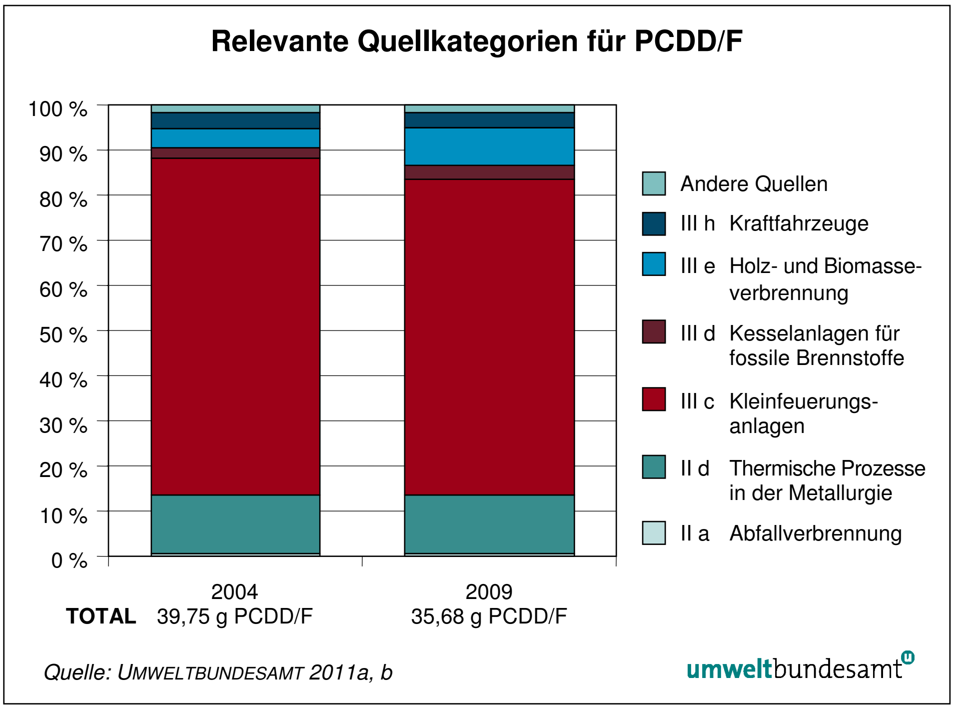
Von 2000 bis 2005 stiegen die PAK- und HCB-Emissionen geringfügig an, seit 2006 ist eine Verringerung feststellbar. Die Emissionen an PCDD/F verringerten sich zwischen 2001 und 2002 deutlich, was auf Reduktionsmaßnahmen in einer Sinteranlage zurückzuführen ist.

Durch die verringerte Wirtschaftstätigkeit im Krisenjahr 2009 fielen die PAK-, HCB- und PCDD/F-Emissionen in signifikantem Ausmaß.

Dioxine und Furane (PCDD/F; I-TEQ)

Im Jahr 2009 wurden 35,7 g PCDD/F (I-TEQ) aus den in Anlage C des Stockholmer Übereinkommens angeführten Quellkategorien emittiert. Gemäß der Österreichischen Luftschadstoffinventur (OLI) betrugen die PCDD/F-Emissionen in die Luft im Jahr 2009 36,0 g (I-TEQ). Diese Differenz ergibt sich einerseits durch den weiteren Anwendungsbereich der OLI, andererseits durch teilweise adaptierte Emissionsfaktoren, die für diesen Bericht verwendet wurden.

Einen wesentlichen Beitrag zur Emission von Dioxinen und Furanen liefern nur einige wenige Quellkategorien, am größten ist hierbei der Anteil der Kleinfeuerungsanlagen (häusliche Quellen) mit 70 % und jener der thermischen Prozesse in der metallurgischenIndustrie mit 13 %. Andere Verursacher sind Kraftfahrzeuge (3,4 %),die Verbrennung von Biomasse (8,3 %) und der Einsatz von fossilen Brennstoffen in der Industrie (3,1 %) (siehe Abbildung A und Tabelle A und B).



Quelle: UMWELTBUNDESAMT 2011a, b

Abbildung A: Relevante Quellkategorien für PCDD/F

Tabelle A: PCDD/F-Emissionen aus Quellkategorien Teil II für 2004 und 2009 (UMWELTBUNDESAMT 200116 a, b).

Quellkategorien Teil II	**2004 [g I-TEQ]**	**2009 [g I-TEQ]**
Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm	0,230	0,229
mit gefährlichen Abfällen befeuerte Zementöfen*	0,116	0,131
Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke **	IE	IE
folgende thermische Prozesse in der metallurgischen Industrie:		
(i) Sekundärkupferproduktion	0,279	0,279
(ii) Sinteranlagen in der Eisen- und Stahlindustrie	3,106	2,538
(iii) Sekundäraluminiumproduktion	1,813	1,813
(iv) Sekundärzinkproduktion	NO	NO
Gesamt (Teil II)	**5,544**	**4,990**

* *Gesamt PCDD/F-Emissionen der österreichischen Zementöfen*

** *nur Prozessemissionen; PCDD/F-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

NO: not occurring (Emissionsquelle in Österreich nicht vorhanden);

IE: inkludiert in anderer Emissionsquelle

Tabelle B: PCDD/F-Emissionen aus Quellkategorien Teil III für 2004 und 2009 (UMWELTBUNDESAMT 2011a, b).

Quellkategorien Teil III	**2004 [g I-TEQ]**	**2009 [g I-TEQ]**
offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien*	0,222	0,136
in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie	0,198	0,190
häusliche Verbrennungsquellen	29,564	24,931
mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen	0,974	1,117
Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe	1,644	2,957
spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil	NA	NA
Krematorien	0,154	0,164
Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff	1,453	1,200
Tierkörperbeseitigung	NA	NA
Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder	NA	NA
Shredderanlagen zur Behandlung von Altfahrzeugen	NE	NE
Kupferkabelverschwelung	NO	NO
Altölaufbereitungsanlagen	NO	NO
Gesamt (Teil III)	**34,208**	**30,694**

** ohne Brände (einschließlich Deponiebrände)*

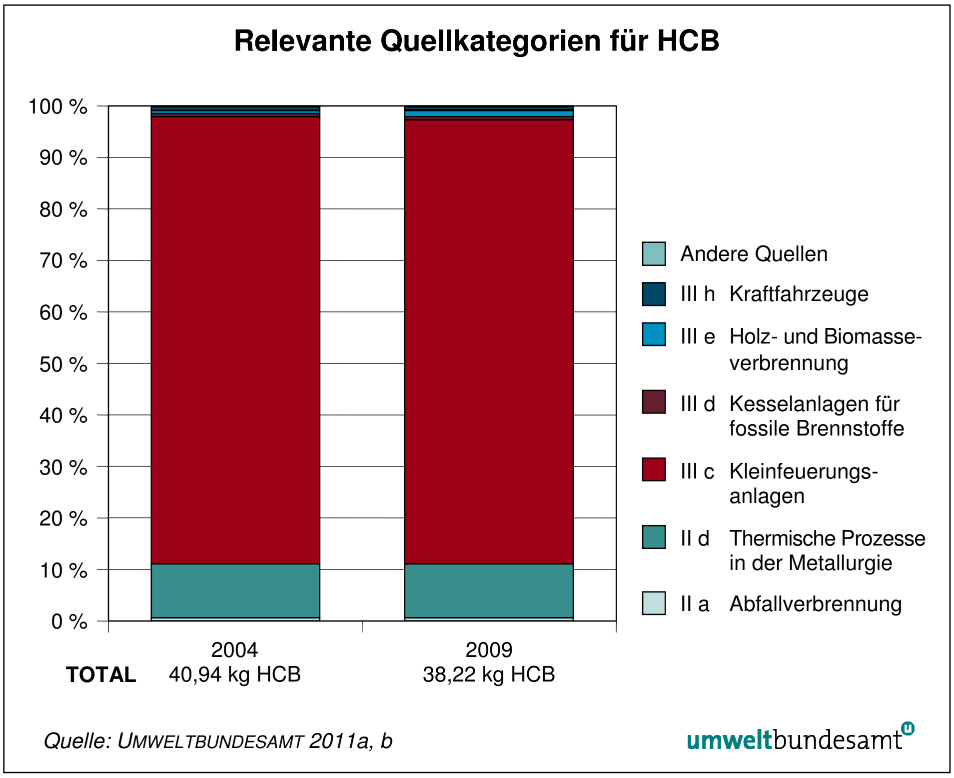
NA: not applicable – als vernachlässigbar betrachtet.

NE: not estimated – nicht abgeschätzt

NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden

Hexachlorbenzol (HCB)

Im Jahr 2009 wurden 38,2 kg HCB emittiert (siehe Tabelle C, D und Abbildung B). Hauptverantwortliche Quellkategorie sind die Kleinfeuerungsanlagen mit 86,4 %, danach thermische Prozesse in der metallurgischen Industrie (v. a. Sinteranlagen) mit 8,7 %. Der Anteil aller anderen Quellkategorien beträgt unter 1 %.



Quelle: UMWELTBUNDESAMT 2011a, b

Abbildung B: Relevante Quellkategorien für HCB

Tabelle C: HCB-Emissionen aus Quellkategorien Teil II für 2004 und Prognose für 2009 (UMWELTBUNDESAMT 2011a, b).

Quellkategorien Teil II	2004 [kg HCB]	2009 [kg HCB]
Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm	0,290	0,247
mit gefährlichen Abfällen befeuerte Zementöfen*	0,017	0,020
Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke **	IE	IE
folgende thermische Prozesse in der metallurgischen Industrie:		
(i) Sekundärkupferproduktion	0,091	0,091
(ii) Sinteranlagen in der Eisen- und Stahlindustrie	3,261	2,926
(iii) Sekundäraluminiumproduktion	0,907	0,907
(iv) Sekundärzinkproduktion	NO	NO
Gesamt (Teil II)	**4,566**	**4,189**

* *Gesamt HCB-Emissionen der österreichischen Zementöfen*

** *nur Prozessemissionen; HCB-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

IE: inkludiert in anderer Emissionsquelle

NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden.

Tabelle D: HCB-Emissionen aus Quellkategorien Teil III für 2004 und 2009 (UMWELTBUNDESAMT 2011a, b).

Quellkategorien Teil III	**2004 [kg HCB]**	**2009 [kg HCB]**
offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien*	0,044	0,027
in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie	0,016	0,014
häusliche Verbrennungsquellen	35,515	33,012
mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen	0,194	0,198
Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe	0,287	0,511
spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil	NA	NA
Krematorien	0,031	0,033
Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff	0,291	0,240
Tierkörperbeseitigung	NA	NA
Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder	NA	NA
Shredderanlagen zur Behandlung von Altfahrzeugen	NE	NE
Kupferkabelverschwelung	NO	NO
Altölaufbereitungsanlagen	NO	NO
Gesamt (Teil III)	**36,377**	**34,035**

IE: inkludiert in anderer Emissionsquelle; NA: not applicable – als vernachlässigbar betrachtet

NE: not estimated – nicht abgeschätzt; NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden

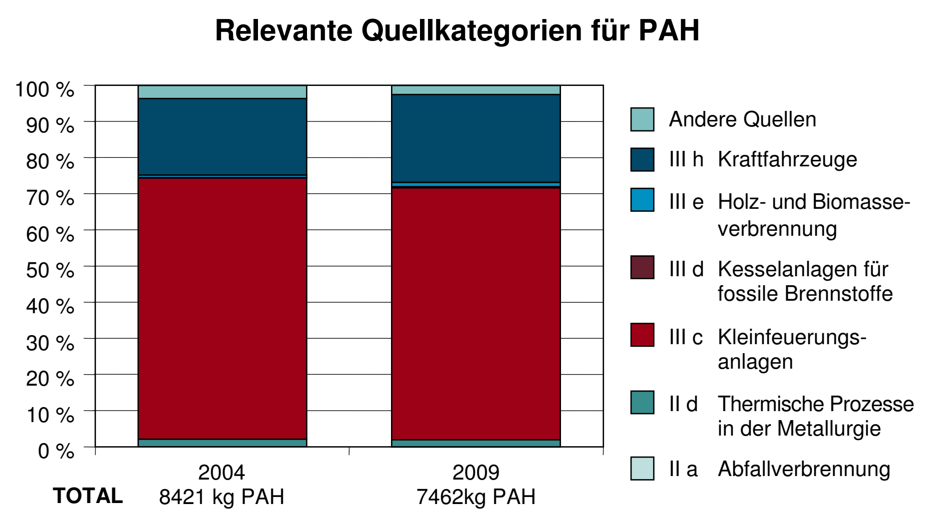
Polychlorierte Biphenyle (PCBs)

Aufgrund der beschränkten Verfügbarkeit an Daten konnte für diese Stoffgruppe kein Freisetzungsinventar erstellt werden.

Polyzyklische aromatische Kohlenwasserstoffe (PAHs)

Im Jahr 2009 wurden 7.462 kg PAHs emittiert. Hauptverantwortlich für die PAH-Emissionen sind v. a. die Kleinfeuerungsanlagen mit 69,7 % Anteil sowie Kraftfahrzeuge mit einem Beitrag von 24,2 % an den Gesamtemissionen (siehe Abbildung C, Tabelle E and F). Andere nennenswerte Verursacher sind die offene Verbrennung von Abfällen (2,5 % sowie Sinteranlagen (1,9 %).

Abbildung C: Relevante Quellkategorien für PAHs



Quelle: UMWELTBUNDESAMT 2011a, b

Tabelle E: PAH-Emissionen aus Quellkategorien Teil II für 2004 und 2009 (UMWELTBUNDESAMT 2011a, b).

Quellkategorien Teil II	2004 [kg PAH]	2009 [kg PAH]
Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm	24,1	11,5
mit gefährlichen Abfällen befeuerte Zementöfen*	3,2	3,7
Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke **	IE	IE
folgende thermische Prozesse in der metallurgischen Industrie:		
(i) Sekundärkupferproduktion	NE	NE
(ii) Sinteranlagen in der Eisen- und Stahlindustrie	156,5	140,9
(iii) Sekundäraluminiumproduktion	NE	NE
(iv) Sekundärzinkproduktion	NO	NO
Gesamt (Teil II)	**183,8**	**156,1**

* *Gesamt PAK-Emissionen der österreichischen Zementöfen*

** *nur Prozessemissionen; PAK-Emissionen aus Verbrennungsprozessen werden bei den relevanten Quellkategorien des Teil III betrachtet.*

IE: inkludiert in anderer Emissionsquelle

NE: not estimated – nicht abgeschätzt

NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden

Tabelle F: PAH-Emissionen aus Quellkategorien Teil III für 2004 und 2009 (UMWELTBUNDESAMT 2011a, b).

Quellkategorien Teil III	2004 [kg PAH]	2009 [kg PAH]
offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien*	304,1	183,5
in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie	2,9	2,8
häusliche Verbrennungsquellen	6.080,0	5.198,3
mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen	16,5	27,1
Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe	47,0	89,1
spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil	NA	NA
Krematorien	<0,1	<0,0
Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff	1.777,9	1.805,6
Tierkörperbeseitigung	NA	NA
Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder	NA	NA
Shredderanlagen zur Behandlung von Altfahrzeugen	NE	NE
Kupferkabelverschwelung	NO	NO
Altölaufbereitungsanlagen	NO	NO
Gesamt (Teil III)	**8.228,3**	**7.306,3**

NA: not applicable – als vernachlässigbar betrachtet.

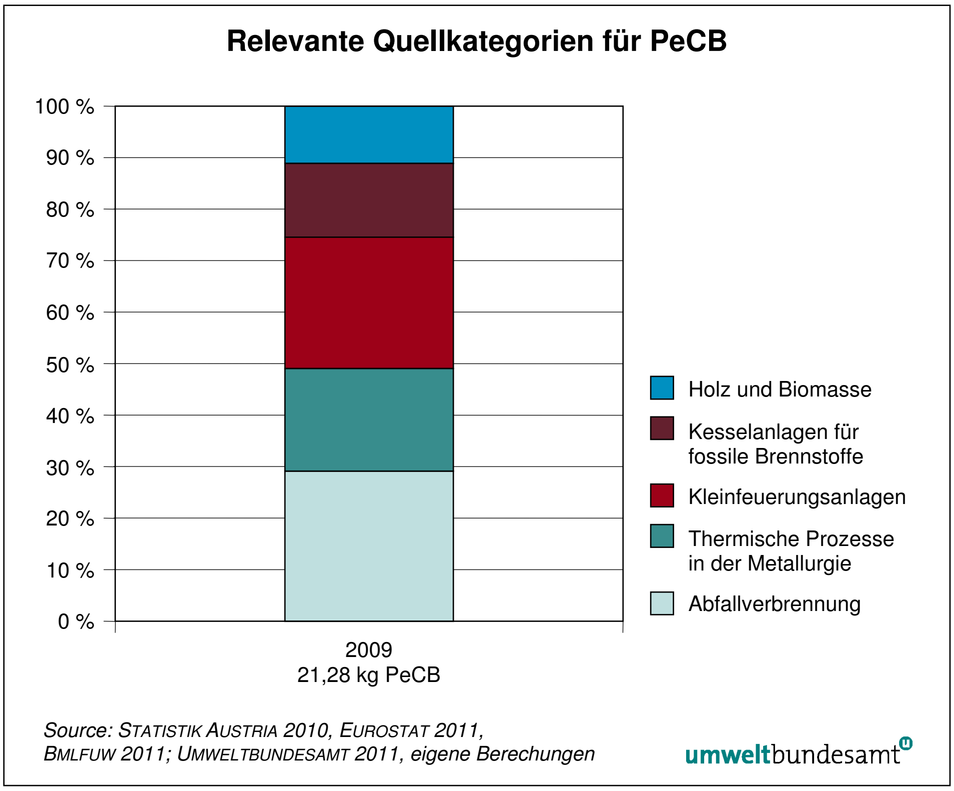
NE: not estimated – nicht abgeschätzt

NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden

Pentachlorbenzol (PeCB)

Im Jahr 2009 wurden 21,28 kg an PeCB emittiert.

Abbildung D: Relevante Quellkategorien für PeCB.



Source: STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011, eigene Berechungen

Tabelle G: PeCB-Emissionen aus Quellkategorien Teil II für 2009 (STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011, eigene Berechnung).

Quellkategorien Teil II	**2009 [kg PeCB]**
Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm	6,21
mit gefährlichen Abfällen befeuerte Zementöfen	NA
Zellstoffproduktion unter Verwendung von elementarem Chlor oder von Chemikalien, bei denen elementares Chlor erzeugt wird, für Bleichzwecke	NA
folgende thermische Prozesse in der metallurgischen Industrie:	
(i) Sekundärkupferproduktion	NA
(ii) Sinteranlagen in der Eisen- und Stahlindustrie	4,2
(iii) Sekundäraluminiumproduktion	NA
(iv) Sekundärzinkproduktion	NO
Gesamt (Teil II)	**10,41**

NA: not applicable – als vernachlässigbar betrachtet.

NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden

Tabelle H: PeCB-Emissionen aus Quellkategorien Teil III für 2009 (STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011, eigene Berechnung).

Quellkategorien Teil III	**2009 [kg PeCB]**
offene Verbrennung von Abfall, einschließlich Verbrennung auf Deponien*	NA
in Teil II nicht genannte thermische Prozesse in der metallurgischen Industrie	NA
häusliche Verbrennungsquellen	5,5
mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen	3,0
Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe	2,37
spezifische chemische Produktionsprozesse, bei denen unbeabsichtigt gebildete persistente organische Schadstoffe freigesetzt werden, insbesondere bei der Produktion von Chlorphenolen und Chloranil	NA
Krematorien	NA
Kraftfahrzeuge, insbesondere bei Verbrennung von verbleitem Ottokraftstoff	NA
Tierkörperbeseitigung	NA
Färben (mit Chloranil) und Endbehandlung (durch alkalische Extraktion) von Textilien und Leder	NA
Shredderanlagen zur Behandlung von Altfahrzeugen	NA
Kupferkabelverschwelung	NO
Altölaufbereitungsanlagen	NO
Gesamt (Teil III)	**10,87**

NA: not applicable – als vernachlässigbar betrachtet.

NO: Not occurring – Emissionsquelle in Österreich nicht vorhanden

C Emissionsverzeichnis Wasser

In Österreich werden Freisetzungen von POPs in zwei verschiedenen Registern erfasst:

- Im Europäischen Schadstofffreisetzungs- und Verbringungsregister (Pollutant Release and Transfer Register – PRTR) werden prinzipiell für alle POPs Punktquellen und Emissionen in Oberflächengewässer erfasst. In der Praxis unterliegen allerdings die meisten Industriezweige nur dann einer Berichtspflicht, wenn bestimmte Produktionskapazitäten oder Emissionsschwellen überschritten werden. Aufgrund der in Österreich bestehenden Betriebsstruktur(hauptsächlich kleine und mittlere Unternehmen) sind nur ungefähr 80 Anlagen mit Freisetzungen in Wasser oder Abwasser im PRTR gelistet. In den Jahren 2007, 2008 und 2009 wurden in diesen Anlagen keine POPs emittiert. Derzeit sind auch noch keine Daten über diffuse Quellen verfügbar.
- Im Jahr 2009 wurde ein nationales Emissionsverzeichnis (als Teil des Wasserinformationssystems WISA gemäß §§ 59, 59a Wasserrechtsgesetz 1959 i.d.g.F.) eingerichtet. Dieses Verzeichnis umfasst folgende Punktquellen: Anlagen gemäß PRTR, städtische Wasseraufbereitungsanlagen mit einer Kapazität von mehr als 2000 Einwohnergleichwerten (EGW) und Müllverbrennungsanlagen mit einer Kapazität von mehr als 2 t Abfall pro Stunde. Es gibt keine Freisetzungsschwellen für die Berichtspflicht. Die untere Grenze ergibt

sich allerdings in der Praxis aus der Bestimmungsgrenze der jeweiligen Analysemethode und aus der Ablaufmenge des Abwassers. Im ersten Berichtszeitraum (2009) wurden nur grundlegende Abwasserparameter erfasst. Der zweite, umfassendere Berichtszyklus wurde 2010 angeschlossen, die Ergebnisse wurden 2011 teilweise evaluiert.

In den Jahren 2007 und 2008 wurden im Rahmen der Erstellung eines nationalen Emissionsinventars zusätzliche Daten zu POPs Freisetzungen in Wasser erhoben. Einlauf und Abfluss von 15 städtischen Abwasserreinigungsanlagen mitverschiedener Kapazität, unterschiedlicher Reinigungsverfahren und Abwasserzusammensetzung wurden auf ca. 70 Stoffe hin untersucht. Das Analyseprogramm umfasste prioritäre Stoffe und bestimmte andere Stoffe gemäß der Tochterrichtlinie 2008/105/EG der Wasserrahmenrichtlinie, aber auch national relevante Schadstoffe gemäß der österreichischen Qualitätszielverordnung Chemie[1]. DDT, Chlordan, Aldrin, Dieldrin, Endrin, Heptachlor, Hexachlorbenzol und Pentachlorbenzolwurden im Rohabwasser nicht gefunden. PAHs wurden mit einer Ausnahme nur im Rohabwasser gefunden. Im Abwasserauslauf konnten nur PBDEs (< ng/l) und Lindan (γ-Hexachlorcyclohexan – ng/l) analysiert werden. Die Verwendung von Lindan war für einige Verwendungen im pharmazeutischen Bereich bis 1. Jänner 2008 zugelassen.

Mögliche Freisetzungen von PAHs auf kontaminierten Flächen können zu lokalen Beeinträchtigungen des Bodens und des Grundwassers führen. Abhängig von der spezifischen Situation und der Frage, auf welche Weise das betroffene Gebiet genutzt wird, müssen mögliche Risiken für die menschliche Gesundheit und das Ökosystem untersucht und sodann hintangehalten werden. Im österreichischen Altlastenregister sind nur sehr wenige mit den Schadstoffen PCDD/F, HCB und PCB kontaminierte Altlasten erfasst, Daten zum Ausmaß der Kontamination oder Auswirkungen auf die Umwelt liegen nicht vor.

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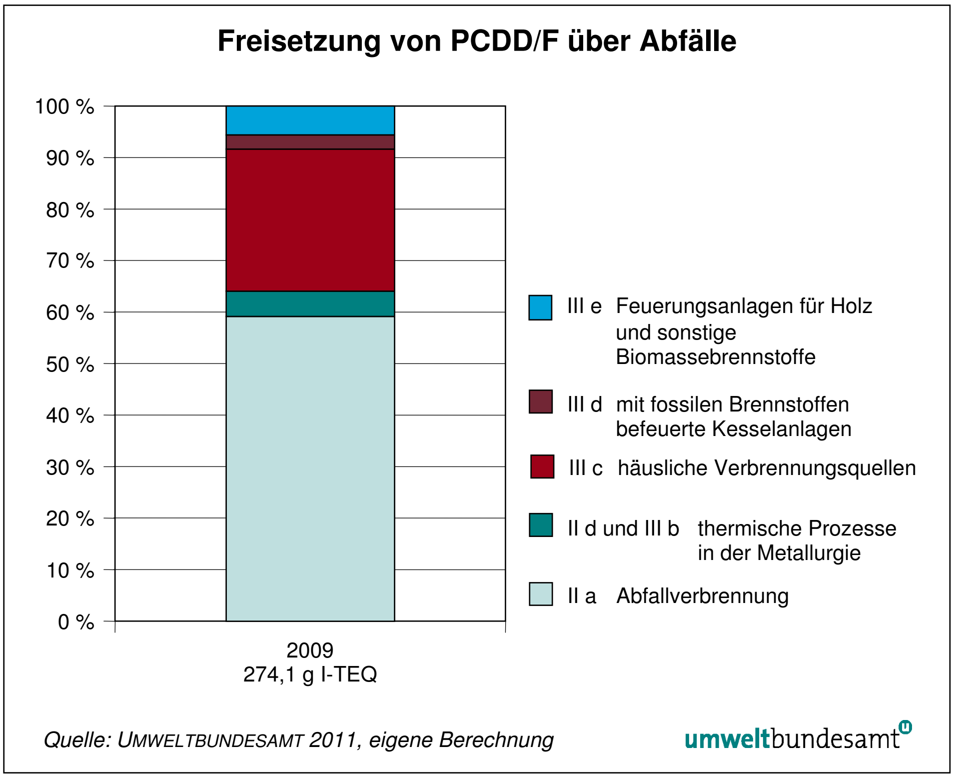
[1] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Festlegung des Zielzustandes für Oberflächengewässer (Qualitätszielverordnung Chemie Oberflächengewässer – QZV Chemie OG) BGBl. II Nr. 96/2006; geändert durch BGBl. II Nr. 267/2007 und BGBl. II Nr. 461/2010

D Emissionen über Abfälle und Rückstände

Ein Emissionsverzeichnis kann nur für PCDD/F und PeCB erstellt werden.

Dioxine und Furane

Die Freisetzungen von Dioxinen und Furanen über Abfälle und Rückstände sind seit 2004 weitgehend gleich geblieben. Im Jahr 2009 wurden insgesamt 274,1 g PCDD/F I-TEQ (Im Jahr 2004 267,1 g) emittiert, ein Siebenfaches der Emissionen in die Luft. Der Anteil fester Abfälle aus der Abfallverbrennung ist hierbei mit 59 % am größten, erheblich ist auch der Anteil von Abfällen aus Kleinfeuerungsanlagen (28 %). Andere Quellen sind Abfälle aus thermischen Prozessen der metallurgischen Industrie sowie aus dem Einsatz fossiler Brennstoffe und Biomasse (siehe Abbildung E).



Quelle: UMWELTBUNDESAMT 2011, eigene Berechnung

Abbildung E: Freisetzungen (jedoch überwiegend nicht bioverfügbar) von PCDD/F über Abfälle.

Es muss jedoch hervorgehoben werden, dass POP-Freisetzungen über Abfälle grundsätzlich anders zu betrachten sind als Freisetzungen über die Medien Luft und Wasser: Die überwiegende Mehrheit der Abfälle wird auf Deponien abgelagert. Eine Bioverfügbarkeit der möglicherweise enthaltenen POPs ist dadurch nicht mehr gegeben, vorausgesetzt die Deponien wurden und werden ordnungsgemäß errichtet und betrieben.

Rückstände aus der Abfallverbrennung werden im Allgemeinen auf Deponien entsorgt (Restmülldeponien, oder Untertagedeponien. Die Flugasche, in der 87 % der PCDD/F enthalten sind, wird oft einer Untertagedeponie zugeführt.

Sehr hohe PCDD/F-Konzentrationen finden sich in Ruß aus Kleinfeuerungsanlagen. Vermutlich wird ein Großteil des Rußes über den Hausmüll entsorgt. Bei der thermischen Behandlung dieses Hausmülls werden die POPs entweder oxidiert oder mit der Asche auf Deponien entsorgt. Auch im Fall einer mechanisch-biologischen Behandlung des Hausmülls gelangen die POPs letztendlich in jene Fraktion, die auf der Deponie endgelagert wird.

Abfälle aus der metallurgischen Industrie, die zu einem gewissen Ausmaß kontaminiert sein können, werden entweder wieder in den Prozess zurückgeführt oder einer externen Behandlung/Entsorgung zugeführt. Diesbezüglich bestehen jedoch noch Unklarheiten über die Höhe der POP-Konzentrationen und die in Österreich praktizierte Behandlung der Abfälle.

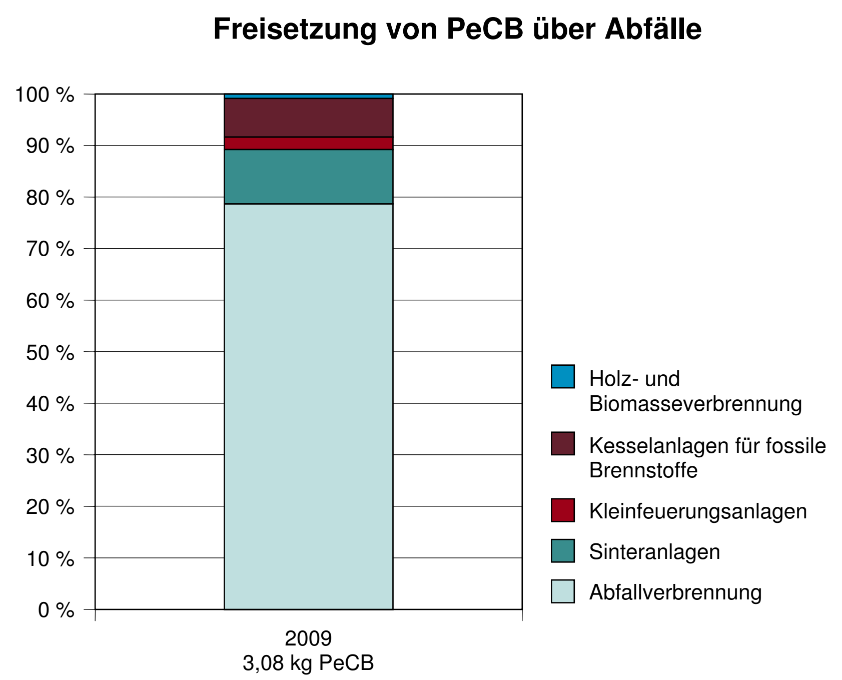
Die Flugasche aus Kraftwerken wird in der Zement- und Baustoffindustrie weiterverwendet, Flugasche aus der Verbrennung von Biomasse muss jedoch über Deponien entsorgt werden.

Abfälle, die in die Umwelt gelangen, können zur Freisetzung von POPs führen. Ein Beispiel wäre die Verwendung von Aschen aus Kleinfeuerungsanlagen (die beträchtliche Mengen an POPs enthalten können) für Düngezwecke oder für Streuzwecke im Winter. Weiters werden etwa grobe Aschen aus Biomasseverbrennungsanlagen als Zusatzstoffe für Kompost genutzt. Da große Datenlücken hinsichtlich der Höhe der POP-Konzentrationen in Aschen existieren, sind Freisetzungsabschätzungen generell mit hohen Unsicherheiten behaftet. Ausschlaggebend für die Höhe der POP-Konzentrationen in Aschen sind insbesondere die unterschiedliche Art und Qualität des Brennstoffes (Feuchtegehalt, Aschegehalt, Heizwert, Chlorgehalt), das verwendete Feuerungssystem sowie die Menge mitverbrannter Abfälle.

Jedoch sind diese Freisetzungen relevant, weil ein Teil der Rückstände/Abfälle in die Umwelt rückgeführt wird (z. B. Verwendung von Asche als Dünger in Privatgärten).

Pentachlorbenzol (PeCB)

Im Jahr 2009 wurden insgesamt 3,08 g PeCB emittiert, ungefähr ein Siebtel der Emissionen in die Luft.Der Anteil fester Abfälle aus der Abfallverbrennung ist hierbei mit 81 % am größten. Andere Quellen sind Abfälle aus thermischen Prozessen der metallurgischen Industrie sowie aus dem Einsatz fossiler Brennstoffe und Biomasse (siehe Abbildung F). Es ist allerdings anzumerken, dass für Freisetzungen an PeCB nur wenige Daten verfügbar sind.



Quelle: Umweltbundesamt 2011, eigene Berechnung

Abbildung F: Freisetzungen von PeCB über Abfälle.

Tabelle I: PeCB Freisetzung über Abfälle für 2009 (eigene Berechnung)

Quellkategorie	**2009 [kg PeCB]**
Abfallverbrennungsanlagen, einschließlich Anlagen zur Mitverbrennung von Siedlungsabfällen, gefährlichen Abfällen, Abfällen aus dem medizinischen Bereich oder Klärschlamm	2,42
folgende thermische Prozesse in der metallurgischen Industrie:	
(ii) Sinteranlagen in der Eisen- und Stahlindustrie	0,33
häusliche Verbrennungsquellen	0,07
mit fossilen Brennstoffen befeuerte Kesselanlagen von Versorgungs- und Industrieunternehmen	0,23
Feuerungsanlagen für Holz und sonstige Biomassebrennstoffe	0,03
Gesamt	**3,08**

E Freisetzungen über Produkte

Der Handlungsbedarf betreffend POP in Produkten ergibt sich u. a. aus Anhang C Teil V A (g) des Übereinkommens („minimization of these chemicals as contaminants in products“).In der Literatur finden sich einige Daten zu Gehalten von PCDD/F in den Produkten Zement, Zellstoff und Papier (siehe Tabelle J). Zu anderen POPs existieren keine Daten. Freisetzungen über Produkte sind jedoch bei den meisten Quellkategorien nicht relevant.

Tabelle J: PCDD/F-Gehalte in den Produkten Zement, Zellstoff und Papier. Berechnungen basieren auf Literaturdaten (KARSTENSEN 2006, UNEP 2005, GRUBER 1996).

Produkt	Freisetzung(g I-TEQ/a)
Zement	4,02
Papier	4,98
exportierter Zellstoff[1]	0,123

[1] Freisetzungen über exportierten Zellstoff; Freisetzungen über den heimischen Zellstoff sind in den Angaben zu Papier enthalten.

Da es keine Änderungen der Produktionsweise gegeben hat, ist das Ausmaß der Freisetzungen von PCDD/F über Zement, Zellstoff und Papier seit 2004 gleich geblieben.

PCDD/F-Gehalte im Zement sind gering und lassen sich durch die Tatsache erklären, dass die Filterstäube aus der Klinkerproduktion (durchschnittliche PCDD/F-Konzentration: 6,7 ng I-TEQ/kg) dem Produkt beigemengt werden und weiters auch sekundäre Rohstoffe eingesetzt werden (z. B. Flugasche, Gips aus der Rauchgasentschwefelung). Auch der Zementklinker selbst kann mit PCDD/F verunreinigt sein (durchschnittlich: 0,9 ng I-TEQ/kg Klinker) (KARSTENSEN 2006). Die Bioverfügbarkeit von im Zement gebundenen POPs ist jedoch sehr gering.

Österreich arbeitet aktiv an der Revision des Dioxin Toolkit (UNEP 2005) mit. Im aktuellen Entwurf wird festgehalten: „Wegen der langen Verweilzeiten im Brennofen und der erforderlichen hohen Temperatur zur Herstellung dieser Produkte ist die Bildung von Dioxinen bei diesem Prozess relativ gering“.[2]Zementöfen, die mit gefährlichen Abfällen befeuert werden, sind eine Quellkategorie gemäß Anhang C Teil II litera (b) des Übereinkommens für Emissionen von PCDD/F (Tab. 6), HCB (Tab. 8), PAKs (Tab. 10) und PeCB (Tab. 12). Daher ist die Quantifizierung der verschiedenen POP in den Umweltmedien sowie in Rückständen und Produkten wünschenswert.

Im Fall von Zellstoff und Papier können PCDD/F über die Zellstoffbleiche oder über Altpapier eingetragen werden. Im Bezugsjahr 2009 betrug die Gesamtproduktion an Zellstoff in Österreich 1,514 kt (2004 waren es 1,509 kt). 24 % davon wurden nach dem Sulfitverfahren mit TCF (total chlorine free) Bleiche hergestellt, 26 % nach dem Sulfatverfahren mit anschließender ECF (elemental chlorine free) Bleiche, 32 % sind ungebleichter Sulfatzellstoff und 18 % Zellstoff auf textiler Basis (AUSTROPAPIER 2009).

Die Berechnung der Freisetzungen aus Zellstoff basieren auf folgenden Emissionsfaktoren: 0,5 µg/t für gebleichten Sulfatzellstoff und 0,1 µg/t für andere Zellstoffe (UNEP 2005). Die Freisetzung von PCDD/F über Zellstoff betrug daher 0,28 g im Jahr 2009.

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[2] Zitat aus Dioxin Toolkit (Entwurf 2012) Kapitel 4 Mineral Products

„This section summarizes high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may potentially cause the formation of PCDD/PCDF at various steps of the processes, e.g., during the cooling phase of the gases or in the heat zone. Due to the long residence time in kilns and the high temperatures needed for the product, emissions of PCDD/PCDF are generally low in these processes.”

Als Rohstoffe in der Papierzeugung werden Zellstoff (heimisch oder importiert), Holzstoff und Altpapier (de-inkt oder nicht de-inkt) verwendet. Daher ist auch der Eintrag über importierten Zellstoff in Betracht zu ziehen. Im Jahr 2009 wurden ungefähr 690.000 t gebleichter Zellstoff importiert, teils aus Ländern, in denen Chlor noch zum Bleichen des Zellstoffs verwendet wird (AUSTOPAPIER 2009). Zur Berechnung des PCDD/F-Gehalts wird für 10 % der Importware ein Emissionsfaktor von 0,5 µg/t angenommen und für den Großteil des importierten Zellstoffs ein Emissionsfaktor von 0,1 µg/t. Damit ergibt sich eine Gesamteinfuhr von 0,096 g I-TEQ über Zellstoff. Im Gegenzug wurden im Jahr 2009 ca. 0,123 g I-TEQ exportiert. Der Eintrag von PCDD/F über Holzstoff wurde mit einem Emissionsfaktor von 0,1 µg/t berechnet, daraus ergibt sich ein Gesamteintrag von 0,044 g I-TEQ).

Zusätzlich ist auch ist der Eintrag von POPs über das Altpapier (insbesondere über Verunreinigungen in den verwendeten Druckfarben) relevant. Ein De-inking reduziert die PCDD/F-Konzentrationen um den Faktor 3 (ungefähr 40 % des Altpapiers in Österreich wird de-inkt) (GRUBER 1996). Vergleichsweise hohe Konzentrationen von bis zu 12 ng/kg wurden in den frühen Neunzigerjahren in Verpackungspapieren und Karton gefunden. Im Allgemeinen konnte ein drastischer Rückgang zwischen 1989 und 1994 verzeichnet werden, seither sinken die Konzentrationen nur mehr geringfügig. Auf Basis dieser Studien sowie der im UNEP DioxinToolkit (UNEP 2005) angegebenen Emissionsfaktoren wurde die Konzentration an PCDD/F in Altpapier auf 3 µg/t ohne De-inking und auf 0,99 µg/t in de-inktem Papier geschätzt. Daraus ergeben sich ein durchschnittlicher Emissionsfaktor von 2,18 µg/t für Altpapier und eine Gesamtfreisetzung über Papier von 4,98 g I-TEQ (Referenzjahr: 2004).

Diverse wissenschaftliche Publikationen zeigen, dass Altpapier möglicherweise durch Verunreinigungen mit Druckerfarben (z. B. Pigmente) signifikante Spuren von PCDD/F enthalten kann. Im Jahr 2011 führte das Umweltbundesamt eine stichprobenartige Untersuchung der PCDD/F-Gehalte von Kartonagen aus Altpapier durch. Der Vergleich von neuen, unbedruckten Faltschachtelkartons mit bedruckten Schachteln aus der Altpapiersammlung ergab keinen Hinweis auf einen PCDD/F-Eintrag durch Druckerfarben. Die Kartonagenproben enthielten PCDD/F in einem Bereich von 1,2 bis 1,9 ng TEQ/kg (UMWELTBUNDESAMT 2011c).

Im Jahr 2010 legte die Austropapier, die Vereinigung der österreichischen Papierindustrie, neue Daten zum PCDD/F-Gehalt bestimmter Produktsorten vor, mit dem Ziel die im Dioxintoolkit (UNEP 2005) enthaltenen Emissionsfaktoren zu optimieren. Die daraus abgeleiteten Emissionsfaktoren würden die Gesamtfreisetzung von PCDD/F über Papiererzeugnisse um den Faktor 3 reduzieren. Obwohl es noch unklar ist, inwieweit diese Daten repräsentativ sind, werden diese Informationen an die Experten des Dioxintoolkits weitergegeben, um eine Überprüfung der bestehenden Emissionsfaktoren zu diskutieren. Im Jahr 2011 erfolgte daher eine neuerliche Berechnung der PCDD/F-Freisetzungen über Papier:

Tabelle K: Freisetzungen vonPCDD/F über Produkte
(eigene Berechnung auf Basis der Statistik von Austropapier und der übermittelten Analyseergebnisse).

Erzeugnis	Produktion (t/a)	Emissionfaktor (µg TEQ/t)	Freisetzungen (g PCDD/F TEQ/a)	Prozentsatz (%)
Zeitungsdruckpapier	299.205	0,068	0,02	1,2
Druck- und Schreibpapiere				
● de-inked	902.421	0,068	0,06	3,7
● aus Zellstoff	1.346.070	0,050	0,07	4,0
Faltschachtelkarton	487.214	0,723	0,35	21,1
Verpackungspapiere	676.177	1,141	0,77	46,2
Kraftpapiere				0.0
● mit Altpapieranteil	374.855	0,858	0,32	19,3
● aus reinem Zellstoff	250.743	0,050	0,01	0,8
Dünn und Spezialpapiere				0.0
Hygienepapier	128.660	0,068	0,01	0,5
Sonstige	126.896	0,050	0,01	0,4
Wickel- und Spezialpappe	13.299	0,858	0,01	0,7
Marktzellstoff – exportiert	95.471	0,070	0,01	0,4
Marktzellstoff (ECF-gebleicht)	313.818	0,090	0,03	1,7
Gesamt	**5.014.829**		**1,67**	**100,0**

F Bewertung der Wirksamkeit der Rechtsvorschriften und Politiken in Bezug auf die Verpflichtungen des Stockholmer Übereinkommens und der EU-POP-Verordnung

Wie bereits im Nationalen Aktionsplan von 2008 festgehalten, erfüllt Österreich die Vorschriften des Stockholmer Übereinkommens und der EU-POP-Verordnung bereits zu einem großen Teil. Nichtsdestotrotz sind weitere Anstrengungen notwendig, da das Stockholmer Übereinkommen „die kontinuierliche Verringerung von POP-Freisetzungen“ zum Ziel hat.

POP-Emissionen großer stationärer (industrieller) Quellen wurden in den letzten Jahren stark reduziert. Zwischen 2004 und 2009 gingen die Emissionen weiter zurück, was aber teilweise durch die geringere Wirtschaftsaktivität in den Jahren 2008 und 2009 zu erklären ist. Sollten jedoch Weiterentwicklungen im Stand der Technik geringere Emissionen oder sogar eine vollständige Vermeidung derselben bewirken, muss die Politik darauf reagieren und die relevanten Rechtsvorschriften entsprechend anpassen (z. B. durch Einführung strengerer Emissionsgrenzwerte).

Im Allgemeinen gelten die Schlussfolgerungen des NAP 2008 auch für die nächsten Jahre:

So wurden bereits 2008 (häusliche) Kleinfeuerungsanlagen, die für 70 % der PCDD/F-Emissionen, 86,4 % der HCB-Emissionen und 69,7 % der PAK-Emissionen in Luft verantwortlich sind, als eine sehr wichtige Emissionsquelle identifiziert. Alle möglichen Maßnahmen müssen untersucht und ausgeschöpft werden, um eine Reduktion dieser POP-Emissionen zu bewirken.

Weitere notwendige Maßnahmen betreffen die Bewusstseinsbildung in Hinblick auf die Verbrennung von Abfällen in Haushaltenoder etwa die Verwendung von Aschen und Ruß aus Kleinfeuerungsanlagen z. B. für die Düngung. In diesem Zusammenhang wurde bereits 2009 und 2010 eine wichtige Initiative gestartet (s. unten).

Derzeit werden in Österreich eine Reihe von umfassenden und sektorenübergreifenden Maßnahmen und Instrumenten entwickelt, um verschiedene nationaleund internationale Verpflichtungen zu erfüllen. Ziel dieser Maßnahmen (enthalten etwa in der Klimastrategie 2007 (BMLFUW 2007[3]) ist die Reduktion von Treibhausgasen, NO_x und Feinstaub. Dadurch kann teilweise auch eine indirekte Reduktion von POP-Freisetzungen erreicht werden (z. B. durch die Reduktion des Energieverbrauchs oder durch strengere Luftemissionsgrenzwerte für Staub). Andere Maßnahmen wie etwa der vermehrte Einsatz von Biomasse für Kleinfeuerungsanlagen könnten jedoch auch zu einem Anstieg von POP Emissionen führen.

Außerdem erscheint es wichtig, bessere Kenntnis in Bereichen zu erlangen, in denen bisher nur sehr begrenzt zuverlässige Daten zur Verfügung stehen. Deshalb wurden im Folgenden konkrete Vorschläge für Studien z. B. betreffend POP-Konzentrationen in bestimmten Abfällen oder weitere Monitoringaktivitäten formuliert.

Management von PeCB-Emissionen: Es ist eine allgemein bekannte Tatsache, dass Maßnahmen zur Eliminierung von PCDD/F auch zu einer Minimierung von PeCB führen. Dies ist auch dem Anhang V der Stockholmer Konvention über POPs und im besonderen den Richtlinien über beste verfügbare Techniken und beste Umweltschutzpraktiken zu entnehmen. Es ist daher nicht notwendig, spezifische Aktivitäten für PeCB zu setzen.

Evaluierung des NAP 2008 und weiterer Handlungsbedarf (gemäß § 20 Abs. 2 Chemikaliengesetz 1996 i.d.g.F)

Im Nationalen Aktionsplan 2008 wurde bereits eine Reihe von Maßnahmen angeführt, die einerseits eine Verringerung der POPs-Emissionen erzielen und andererseits mehr Informationen bezüglich POPs in der Umwelt generieren sollen.

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[3] Klimastrategie 2007; wird derzeit überarbeitet – Klimastrategie 2013–2020 (Arbeitstitel)

Freisetzungen von POPs aus den Quellkategorien

Die folgende Tabelle enthält eine Übersicht der im NAP 2008 vorgeschlagenen Maßnahmen und den derzeitigen Stand der Umsetzung:

Nationale Gesetze und Verordnungen	POP-relevante Inhalte	Kommentar/ konkrete Schritte	Derzeitiger Status
Emissionsschutzgesetz für Kesselanlagen – EG-K (BGBl. I Nr. 150/2004); Luftreinhalteverordnung für Kesselanlagen (BGBl. Nr. 19/1989 i.d.F. BGBl. II Nr. 55/2005), beide zuletzt geändert durch Emissionsmessverordnung-Luft – EMV-L (BGBl. II Nr. 153/2011)	EGW für Staub, CO, Corg, NO_x	Anpassung an BAT notwendig	Anpassung erfolgte durch EG-K i.d.g.F.
Gewerbeordnung 1994 und Verordnungen gemäß § 82 Abs. 1 GewO 1994, beispielsweise Verordnung des Bundesministers für wirtschaftliche Angelegenheiten über die Begrenzung der Emission von luftverunreinigenden Stoffen aus Anlagen zum Sintern von Eisenerzen – Sinteranlagenverordnung (BGBl. II Nr. 163/1997)	EGW für unterschiedliche Schadstoffe, z.B. Staub, PCDD/F	Regelmäßige Überprüfung der Konformität mit BAT	Laufende Überprüfung
Feuerungsanlagen-Verordnung BGBl. II Nr. 331/1997	EGW für Staub, CO, Corg, NO_x	Anpassung an BAT notwendig (strengere EGW für Staub)	Die Maßnahme wurde 2011 durch Änderung der FAV (BGBl. II Nr. 312/2011) umgesetzt.
Abfallverbrennungsverordnung (BGBl. II Nr. 389/2002)	EGW für Staub, CO, Corg, NO_x, Schwermetalle, PCDD/F	Strengere EGWs für Staub bei Mitverbrennungsanlagen wünschenswert	Novelle Abfallverbrennungsverordnung BGBl. II Nr. 476/2010, aber ohne strengere EGWs für Staub
Wasserrechtsgesetz und Verordnungen	EGW für AOX and POX sowie spezifische POPs in den branchenspezifischen Abwasseremissionsverordnungen		
Abwasseremissionsverordnung Verbrennungsgas (BGBl. II Nr. 271/2003)	EGW für PCDD/F	Regelmäßige Überprüfung der Konformität mit BAT notwendig	Keine Änderungen
Abwasseremissionsverordnung Kohleverarbeitung (BGBl. II Nr. 346/1997)	EGW für PAHs	Regelmäßige Überprüfung der Konformität mit BAT notwendig	Keine Änderungen
Abwasseremissionsverordnung Pflanzenschutzmittel (BGBl. Nr. 668/1996)	EGW für AOX und spezifische POPs	Regelmäßige Überprüfung der Konformität mit BAT notwendig	Keine Änderungen
Qualitätszielverordnung Oberflächengewässer (BGBl. II Nr. 96/2006)	Umweltqualitätsziel für HCB	Für PAHs werden voraussichtlich noch 2008 gemeinschaftsweite Qualitätsziele festgelegt.	Änderung der Qualitätszielverordnung (BGBl. II Nr. 461/2010) gemäß der RL 2008/105/EG
Andere relevante Rechtsvorschriften			
Deponieverordnung (BGBl. Nr.39/2008)	Grenzwerte für PAH-Konzentrationen in Abfällen		Änderung der Deponieverordnung BGBl. II Nr. 185/2009 und BGBl. II Nr. 178/2010
Kompostverordnung[1] (BGBl. II Nr. 292/2001)	Grenzwerte für POP-Konzentrationen in Komposten	Regelmäßige Evaluierung der Grenzwerte notwendig	Keine Änderung

Nationale Gesetze und Verordnungen	POP-relevante Inhalte	Kommentar/ konkrete Schritte	Derzeitiger Status
Klärschlamm- und Kompostverordnungen der Bundesländer	Grenzwerte für POP	Regelmäßige Evaluierung der Grenzwerte notwendig	Keine Änderung
Bodenschutzgesetze der Bundesländer: Burgenländisches Bodenschutzgesetz LGBl. Nr. 87/1990 Niederösterreichisches Bodenschutzgesetz LGBl. Nr. 6160-0 Oberösterreichisches Bodenschutzgesetz LGBl. Nr. 63/1997 Bodenschutzgesetz Salzburg LGBl Nr. 80/2001 Steiermärkisches landwirtschaftliches Bodenschutzgesetz LGBl. Nr. 66/1987		Festlegung von Zielwerten für organische Schadstoffe (einschließlich polybromierte Diphenylether, perfluorierte Tenside und Pestizide) zur Verminderung von Bodenkontaminationen zweckmäßig	Keine Änderung
Immissionsschutzgesetz – Luft (IG-L)	§ 21 IG-L: Verordnungsermächtigung	Überprüfung, ob allgemein verbindliche EGW für Krematorien in einer Verordnung gemäß § 21 IG-L notwendig sind	Nicht umgesetzt, keine generellen Verpflichtungen für Krematorien
Rechtsakte der Bundesländer betreffend häusliche Verbrennungsanlagen (Kleinfeuerungsanlagen)		Entwurf einer Vereinbarung gemäß Art. 15a B-VG über das Inverkehrbringen und die Überprüfung von Feuerungsanlagen Zeitplan: ehestmögliche Umsetzung dieser Vereinbarung in das Länderrecht	Die Vereinbarung wurde 2011 unterzeichnet.
Bundesluftreinhaltegesetz[2] mit dem Ziel der Erhaltung der natürlichen Zusammensetzung der Luft in einem Ausmaß, welches den dauerhaften Schutz der Gesundheit und des Lebens von Tieren und Pflanzen soweit wie möglich sicherstellt	Verbot des Verbrennens biogener Materialien – viele Ausnahmen möglich	Überprüfung der Ausnahmebestimmungen	Integration des Verbots im Bundesluftreinhaltegesetz – BLRG
Genehmigungsverfahren	*POP-relevante Inhalte*	*Kommentare/Konkrete Schritte*	
Deponien	Anforderungen an die Brandverhütung	Implementierung wirksamer Brandverhütungsmaßnahmen für Deponien und Abfallzwischenlager	Keine neuen Informationen

EGW: Emissionsgrenzwert; BAT: Best Available Technique

[1] *Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über Qualitätsanforderungen an Komposte aus Abfällen (Kompostverordnung) gemäß AWG i.d.g.F.*

[2] *Bundesgesetz über das Verbrennen von Materialien außerhalb von Anlagen (Bundesluftreinhaltegesetz – BLRG), BGBl. I Nr. 137/2002, zuletzt geändert durch BGBl. I Nr. 50/2012.*

Da **häusliche Verbrennungsanlagen** 70 % der PCDD/F-Emissionen in die Luft verursachen, veröffentlichte das Lebensministerium in Zusammenarbeit mit der Bundesinnung der Rauchfangkehrer Österreichs, dem österreichischen Kachelofenverband, der Österreichischen Ärztekammer und den Ärztinnen und Ärzten für eine gesunde Umwelt im Jahr 2010 eine Broschüre mit dem Titel „Richtig heizen“: der Folder informiert über die Auswirkungen von Emissionen aus Holzöfen auf die menschliche Gesundheit und die Umwelt und gibt Hinweise darauf, wie diese Emissionen durch die Bedienungsweise verringert werden können. Die Broschüre wurde über Rauchfangkehrer und Ärzte verteilt. Zusätzlich wurde auch eine Internetseite eingerichtet (www.richtigheizen.at), die weitere Informationen über die richtige Verwendung von Öfen und über rechtliche Belange bietet.

Weiters ist die zügige Implementierung der folgenden Maßnahmen von besonderer Wichtigkeit:

- Umsetzung der Anforderungender Vereinbarung gemäß Art. 15a B-VG zwischen dem Bund und den Ländern über gemeinsame Qualitätsstandards für die Förderung der Errichtung und Sanierung von Wohngebäuden zum Zweck der Reduktion des Ausstoßes an Treibhausgasen;
- Effiziente Förderung des Austausches von kohlebefeuerten Öfen;
- Regelmäßige Überprüfung und Verbesserung der Förderkriterien für Biomasseverbrennungsanlagen (einschließlich derartiger landwirtschaftlicher Anlagen) in Hinblick auf Betriebsbedingungen, Energieeffizienz (einschließlich Fernwärmesysteme), Brennstoffqualität und EGW für Staub

  → EGW für Staub wurden 2007 und 2009 geändert
- Weiterführung derInformationskampagnen zur Verhinderung der Verbrennung von Abfällen in Kleinfeuerungsanlagen,
- Weiterführung der Informationskampagnen zur Entsorgung von Ruß und Asche aus Kleinfeuerungsanlagen (insbesondere im Haushalt und in der Landwirtschaft);
- Implementierung geeigneter Maßnahmen, die eine Einhaltung des Zielwertes für Benzo(a)pyren in der Umgebungsluft (1 ng/m^3) sicherstellen (Zielwert wird mit 31.12.2012 in einen Grenzwert umgewandelt). →verschiedene Maßnahmen der Bundesländer

Für die im Folgenden genannten Quellen existieren **bisher** nur unzureichend Daten. Um die Relevanz dieser Quellen abschätzen zu können sowie um die österreichischen Quellverzeichnisse zu vervollständigen, erscheinen die unten angeführten **Maßnahmen** notwendig oder zumindest wünschenswert. Allerdings bleibt die Umsetzung dieser Maßnahmen oft abhängig von der Finanzierbarkeit:

- Untersuchung des Emissionsverhaltens von Kleinfeuerungsanlagen (insb. Stroh- und Getreideverbrennung)

  → bezüglich POPs noch teils nicht bekannt; ein Projekt („EnEmTech“) zur Untersuchung bestimmter Emissionsparameter bei häuslichen Kleinfeuerungsanlagen befindet sich derzeit in der Entwicklungsphase;
- Emissionsmessungen bei Kraftfahrzeugen und Überprüfung der Emissionsfaktoren, um genauere Trendprognosen zu ermöglichen

  → Das Handbuch für Emissionsfaktoren des Straßenverkehrs (HBEFA) stellt Emissionsfaktoren für die gängigsten Fahrzeugtypen zur Verfügung (PKW, leichte und schwere Nutzfahrzeuge, Linien- und Reisebusse sowie Motorräder), differenziert nach Emissionskonzepten sowie nach verschiedenen Verkehrssituationen. HBEFA liefert Emissionsfaktoren für alle reglementierten sowie eine Reihe von nicht-reglementierten Schadstoffen, einschließlich CO_2 und Kraftstoffverbrauch. Die Version HBEFA 3.1 ist die neueste verfügbare Version. Die Emissionsfaktoren der PKW wurden gänzlich überarbeitet. (neue Modellansätze, breitere empirische Grundlagen, neue Emissionsmessungen). Für die Eichung des Modells wurden modale Emissionsmessungen (in Sekundenauflösung) bis Euro 4 verwendet. Die Emissionsfaktoren für künftige Konzepte (Euro 5, 6) wurden in Anlehnung an die künftige Gesetzgebung abgeschätzt.

- Verbesserung der Datenqualität der POP-Freisetzungen aus Deponien und aufgelassenen Industriestandorten sowie kontaminierten Flächen (z. B. PAH-Anteile im Deponiegas);
- Bewertung der POP-Konzentrationen in Abfällen und Rückständen aus der Nichteisenmetallerzeugung, Elektrostahlerzeugung und aus Sinteranlagen

  → keine neue Bewertung
- Bestimmung der POP-Konzentrationen in Abfällen aus Kleinfeuerungsanlagen (Haushalt, Versorgungsunternehmen, Landwirtschaft), die mit hoher Wahrscheinlichkeit in die Umwelt gelangen (z. B. Bodenasche und Flugasche);
- Bestimmung der POP-Konzentrationen in Abfällen aus mit fossilen Brennstoffen befeuerten Kesselanlagen (einschließlich Mitverbrennung von Abfällen), die in andere Produktionsprozesse Eingang finden oder mit hoher Wahrscheinlichkeit in die Umwelt gelangen (insb. Flugasche aus Mitverbrennungsanlagen);
- Bestimmung der POP-Konzentrationen in Abfällen aus Biomasseverbrennungsanlagen, die in andere Produktionsprozesse Eingang finden oder mit hoher Wahrscheinlichkeit in die Umwelt gelangen (z. B. Bodenasche);
- Bestimmung der Konzentrationen von PCDD/F und relevanten Vorläufersubstanzen in gebleichtem Kraft-Zellstoff (importiert und heimisch erzeugt), in Papier (Verpackungspapier, Karton,Papier mit Altpapieranteil), in Farben und Druckfarben und in De-inking-Schlämmen

  → Im Jahr 2011 führte das Umweltbundesamt eine Überblicksstudie zur Abschätzung möglicher PCDD/F-Einträge in Kartonagen über Druckfarben durch. Die Ergebnisse zeigten keine Hinweise auf eine PCDD/F-Kontamination durch die derzeit verwendeten Druckfarben.
- Quantifizierung der POP-Gehalte im Filterstaub aus der Zementklinkerherstellung

  → Quantifizierung in Abstimmung mit Umweltbundesamt GmbH, WKÖ/Zementindustrie und anderen Stakeholdern; Unterstützung bei der Revision des Dioxin Toolkits bezüglich „Mineral Products“
- Quantifizierung der POP-Emissionen (insb. PCDD/F und PCBs) des Platformer 3 der OMV Raffinerie in Schwechat

  → Quantifizierung noch nicht erfolgt.

Daten zu POP-Emissionen in die Umwelt

Die folgende Tabelle enthält konkrete Maßnahmen zur Verbesserung der verfügbaren Daten über POP-Emissionen in die Umwelt:

Konkrete Schritte	Zeitplan
Verbesserung der Datenqualität in Hinblick auf HCB- und PCB-Freisetzungen in die Luft (z. B. durch Planung und Durchführung von Messprogrammen bei prioritären Quellen wie z. B. häuslichen und industriellen Quellen)	Prüfung der verfügbaren (Literatur-)Daten, Identifizierung möglicherweise relevanter Quellen
Einrichtung von Monitoringprogrammen in der Nähe POP-relevanter Quellen	Identifizierung relevanter Standorte Probenahme und Messung (Winter/Sommer)
Weiterführung des Monitorings mit Fichtennadeln in der Nähe von POP-Quellen	Kontinuierliche Probenahme und Beginn der Analysen

Daten zu POP-Konzentrationen in der Umwelt

Die folgende Tabelle enthält konkrete Maßnahmen zur Verbesserung der verfügbaren Daten über POP-Konzentrationen in der Umwelt:

Konkrete Schritte	Zeitplan
Weiterführung des Monitorings der Umgebungsluft und der Deposition auf Alpengipfeln (Sonnblick)	Weiterführung der Probenahme und Analyse
Monitoring der Umgebungsluft und der Deposition von POPs in der Grenzregion Österreich-Tschechische Republik	Probenahme 2011/12 und Analyse
Entwicklung von Transferfaktoren zur Verbesserung der Kenntnis über Wechselbeziehungen zwischen POP-Konzentrationen in der Umwelt und bioverfügbaren Konzentrationen	Einrichtung eines wissenschaftlichen Panels
Entwicklung bzw. Anpassung von passiven Probenahmemethoden zur Verbesserung der Vergleichbarkeit von Daten	Auswahl und Entwicklung der Methoden/Instrumente, Pilotstudie Evaluierung der Pilotstudie und Auswahl geeigneter Methoden
Implementierung eines nationalen Monitoringprogrammes zur Untersuchung der Verteilung der Deposition von POPs	2008 – Auswahl relevanter Standorte 2009 – Implementierung

1 INTRODUCTION

This report is the first review of the National Action Plan for POPs published in 2008. Article 5 of the Stockholm Convention requires Parties to develop an Action Plan to identify, characterize and address the release of chemicals listed in Annex C. Article 5 further requires a review of the National Action Plan every five years of the strategies and their success in meeting the relevant obligations.

Currently listed in Annex C are polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF), hexachlorobenzene (HCB), polychlorinated biphenyls (PCB) and pentachlorobenzene (PeCB) when produced unintentionally.

In line with the European POP-Regulation (850/2004) polyaromatic hydrocarbons (namely the substances benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene) shall be included in the action plan as well.

The Action Plan, which was to be part of a Party's National Implementation Plan to be developed pursuant to Article 7 of the Convention, included strategies for meeting obligations to reduce or eliminate releases of chemicals listed in Annex C of the Stockholm Convention (including PAH as additional requirement from the EU-POP Regulation), and a schedule for the Action Plan. The plan identified priorities for action, including for those source categories that provide the most cost-effective opportunities for release reduction or elimination. It also included an inventory of releases of chemicals listed in Annex C.

The definition of the term "release" includes emissions of POPs into air, water and soil as well as releases via residues and waste from processes and releases via products.

Within the review of the National Action Plan the inventory (basis: year 2004) of POPs releases will be updated. Based on this inventory instruments and measures aiming at the reduction of POPs releases are going to be described. In particular, the efficacy of national legal regulations will be assessed again and it will be investigated if Best Available Techniques (BAT) in combination with Best Environmental Practices (BEP) have already been applied in the source categories defined by the Stockholm Convention. If applicable, recommendations on how BAT and BEP can be implemented are given. In addition data gaps are again identified and proposals for the improvement of data quality are elaborated.

The Action Plan will be reviewed and updated on a periodic basis.

1.1 Methodology for Inventories

The inventory is based on activity data which is multiplied with activity specific emission factors. Activity data – units are preferably given in GJ in the case of combustion processes or in Mg in the case of production processes – have been taken from the Austrian Energy Balance (UMWELTBUNDESAMT 2011a). Data are given for the year 2009.

Both types of activity data are given in specific formats which are called SNAP[4]- and NFR[5]-Codes. Both formats show relevant differences to the Stockholm Convention with respect to the classification of source categories. Therefore, activity data on individual processes had to be identified and re-classified in order to obtain source specific activity data in line with the requirements of the Stockholm Convention.

In addition to that data from literature and further information from recent studies were used where available (see description of releases from individual source categories).

Emission factors for air emissions have been taken from the Austrian Air Emissions Inventory ("Österreichische Luftschadstoffinventur – OLI") which gives a yearly update of emissions of air pollutants, among them PCDD/F (I-TEQ), HCB and PAH (4 congeneres). Where necessary emission factors have been recalculated to reflect recent developments in data quality (see description of releases from individual source categories).

1.2 Pollutants of concern

1.2.1 Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)

Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) are formed unintentionally in industrial-chemical processes, such as chemical manufacture, and thermal processes, such as waste incineration. PCDD/PCDF are the only POPs whose mechanism of formation has been studied extensively in combustion-relatedprocessesand to a lesser extent in non-combustion-relatedchemical processes; even so, the mechanisms and the exact formation conditions are not fully resolved.

Carbon, oxygen, hydrogen and chlorine, whether in elemental, organic or inorganic form, are needed. At some point in the synthesis process, whether present in a precursor or generated by a chemical reaction, the carbon must assume an aromatic structure.

There are two main pathways by which these compounds can be synthesized: from precursors such as chlorinated phenols or de novo from carbonaceous structures in fly ash, activated carbon, soot or smaller molecule products of incomplete combustion. Under conditions of poor combustion, PCDD/PCDF can be formed in the burning process itself.

The mechanism associated with this synthesis can be homogeneous (molecules react all in the gas phase or all in the solid phase) or heterogeneous (involving reactions between gas phase molecules and surfaces).

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[4] SNAP: Standard Nomenclature of Air Pollutants

[5] NFR: Nomenclature for Reporting

PCDD/PCDF can also be destroyed when incinerated at sufficient temperature with adequate residence time and appropriate mixing of combustion gases and waste or fuel feed. Good combustion practice includes management of the “3 Ts” – time of residence, temperature and turbulence. Use of a fast temperature quench and other known processes are necessary to prevent reformation.

In addition to the primary measures there are a variety of well proven and effective secondary measures to reduce emissions of once formed PCDD/F, including different techniques of adsorption on activated coke or oxidation with the help of a catalyst.

1.2.2 Hexachlorobenzene (HCB)

Hexachlorobenzene (HCB) has been widely employed as a fungicide on seeds, especially against the fungal disease 'bunt' that affects some cereal crops. The marketing and use of hexachlorobenzene as a plant protection product was banned in the European Union in 1988.

As hexachlorobenzene is no longer produced in the EU, the only man-made release of hexachlorobenzene is as unintentionally produced pollutant. HCB can still be found as an impurity in certain active ingredients of some plant protection products and biocides, although in much smaller amounts than there used to be. Further, it is emitted from the same chemical and thermal processes as dioxins and furans and formed via a similar mechanism.

There is far less information on the formation of PCB and HCB, especially in combustion processes. Since there are similarities in the structure and occurrence of PCDD/PCDF, PCB and HCB, it is usually assumed that, with the exception of oxygen-containing species, those parameters and factors that favour formation of PCDD/PCDF also generate PCB and HCB.

1.2.3 Polychlorinated biphenyls (PCB)

Polychlorinated biphenyls (PCB) have been widely used as additives in transformer oils, in capacitors, as hydraulic fluids and as softeners in lacquers and plastics.

As PCB is no longer produced in the EU, the only man-made release of PCB is as unintentionally produced pollutant; it is emitted from the same chemical and thermal processes as dioxins and furans and formed via a similar mechanism.

There is far less information on the formation of PCB and HCB, especially in combustion processes. Since there are similarities in the structure and occurrence of PCDD/PCDF, PCB and HCB, it is usually assumed that, with the exception of oxygen-containing species, those parameters and factors that favour the formation of PCDD/PCDF also generate PCB and HCB.

1.2.4 Polycyclic aromatic hydrocarbons (PAH)

Polycyclic aromatic hydrocarbons (PAH) are molecules built up of benzene rings. PAHs are a group of approximately 100 compounds. Most PAHs in the environment arise from incompletecombustion of carbon-containing materials like oil, wood, garbage or coal. Fires are able toproduce fine PAH particles, which bind to ash particles and are considered long range airpollutants. Thus PAHs have been ubiquitously distributed in the environment for thousands of years.

The four compounds benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene are used as indicators for the purposes of emission inventories.

1.2.5 Pentachlorobenzene (PeCB)

PeCB belongs to a group of chlorobenzenes that are characterized by a benzene ring in which the hydrogen atoms are substituted by one or more chlorines.

PeCB was previously used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. for the production of quintozene. PeCB might still be used as an intermediate. PeCB is also produced unintentionally during combustion, as well as during thermal and industrial processes. It is also present as an impurity in products such as solvents or pesticides.

PeCB is persistent in the environment, highly bioaccumulative and has a potential for long-range environmental transport. It is moderately toxic to humans and very toxic to aquatic organisms.

The production of PeCB was phased out in the main producer countries some decades ago as efficient and cost-effective alternatives are available. Applying Best Available Techniques and Best Environmental Practices would significantly reduce the unintentional production of PeCB.

(webpage Stockholm Convention on Persistant Organic Pollutants, **http://chm.pops.int/Convention/tabid/54/language/en-US/Default.aspx**)

2 SOURCE INVENTORY OF POPS RELEASES INTO AIR

In this section two inventories are described: the Austrian air emissions inventory ("Österreichische Luftschadstoff-Inventur OLI") according to UNECE/LRTAP and the inventory developed according to the source categories of Annex C of the Stockholm Convention (including PAH as required by the EU-POP Regulation).

There are distinct methodological differences between these two inventories: The OLI includes a variety of air pollutants, among them PCDD/F (I-TEQ), HCB and PAH (4 congeners). Source categories are combined in SNAP codes (SNAP: Standard Nomenclature for Air Pollutants) and in NFR codes (NFR: Nomenclature For Reporting).

On the other hand the inventory required by the Stockholm Convention should help to identify major sources of POPs emissions and therefore follows a more source-based approach: Emissions to air (but also emissions to water, soil and releases via residues and waste) should be given for individual processes which have been identified by the relevant Technical Working Group as having the potential for substantial POPs releases (refer to 6.1.1).

The National Action Plan according to Article 5 of the Stockholm Convention should also present an inventory of PCB releases. However, due to a general lack of data, this requirement could not be fulfilled.

With respect to emissions into air there are specific differences in the results of the two inventories. These can be explained by the different formats used for activity data and by the incorporation of updated emission factors for the Action Plan's inventory. Relevant discrepancies will be described in detail in the source specific sections.

2.1 Austrian Air emissions Inventory according to UNECE/LRTAP

The Umweltbundesamt, in its capacity as the Environment Agency Austria, has been designated by law as the national entity which is responsible for the preparation of the annual air pollutant inventory. The Environmental Control Act (BGBl. Nr. (Federal Law Gazette No.) 1998/152) regulates the responsibilities of environmental control in Austria and lists the tasks of the Umweltbundesamt. One of these tasks is to provide technical expertise and the data basis for the fulfilment of the emission related reporting obligations under the UNECE LRTAP Convention.

To this end, the Umweltbundesamt prepares and annually updates the Austrian air emissions inventory ("Österreichische Luftschadstoff-Inventur OLI"), which covers

- Greenhouse gases (CO_2, N_2O, CH_4, F-gases)
- SO_x, NO_x, NH_3, NMVOC (under the NEC Directive) and CO
- POPs (PAHs, HCB, PCDD/F)
- Heavy metals (Pb, Cd, Hg)
- Particulate matter (TSP, PM10 and PM2.5).

For the Umweltbundesamt a national air emission inventory that identifies and quantifies the sources of pollutants in a consistent manner has a high priority. Such an inventory provides a common basis for comparing the relative contributions of different emission sources and hence can be a basis for policies to reduce emissions.

2.1.1 Trends for POPs Emissions into Air

Emissions of the three POP categories PAH, PCDD/F and HCB decreased significantly between the years 1985–1994 as a result of legal regulations concerning emission reduction from industry and waste incineration. Emissions increased in the years 1995 and 1996, and steadily declined afterwards until the year 2001. As can be seen in Figure 1 and Table 1 emissions are well below their 1985 level, which is the requirement to be met for Austria as a Party to the POPs Protocol (see 6.1.2).

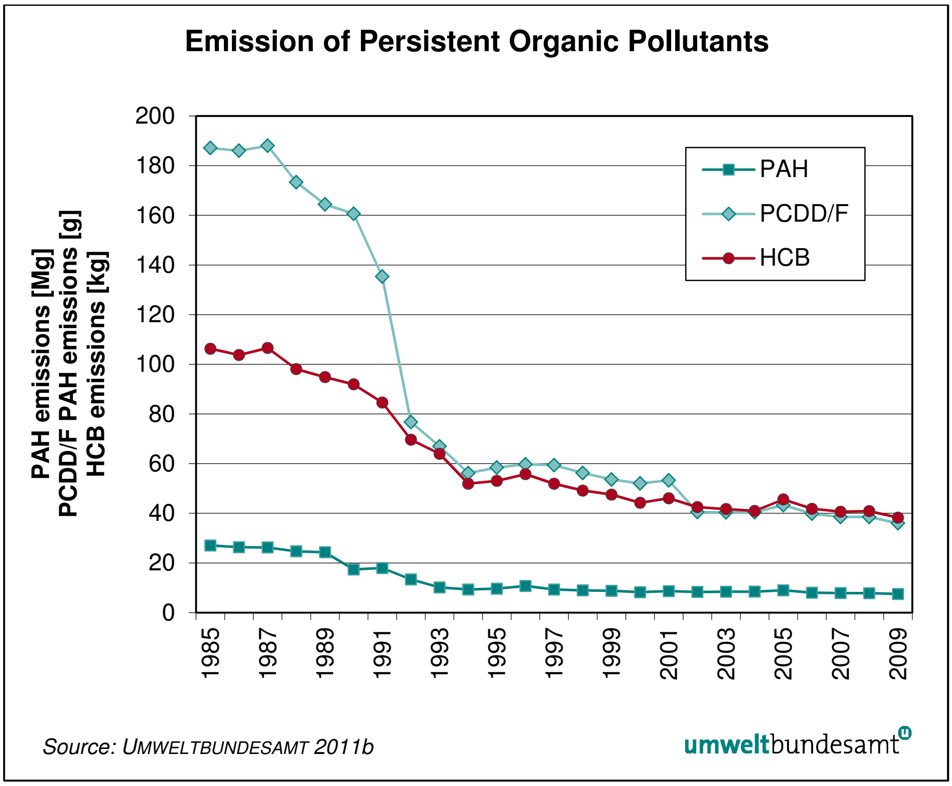
Emissions of PAH and HCB have increase slightly since 2000, whereas emissions of PCDD/F dropped remarkably between 2001 and 2002 (due to a reduction measure in one sinter plant). In 2009, emissions of PAH, HCB and PCDD/F dropped significantly due to a decline in economic activities.

Table 1: Emissions and emission trends for POPs 1985–2009 (Umweltbundesamt 2011b)

	Emission		
Year	**PAH [Mg]**	**PCDD/F [I-TEQ, g]**	**HCB [kg]**
1985	27.055	187.127	106.315
1986	26.326	186.036	103.764
1987	26.246	188.038	106.575
1988	24.683	173.361	98.073
1989	24.293	164.425	94.840
1990	17.364	160.649	91.937
1991	17.946	135.342	84.616
1992	13.388	76.776	69.684
1993	10.162	66.976	64.001
1994	9.316	56.206	51.931
1995	9.652	58.429	53.081
1996	10.746	59.744	55.787
1997	9.317	59.372	51.917
1998	8.972	56.259	49.159
1999	8.807	53.614	47.564
2000	8.218	52.035	44.248
2001	8.685	53.279	46.056
2002	8.313	40.481	42.506
2003	8.420	40.396	41.727

Year	Emission PAH [Mg]	 PCDD/F [I-TEQ, g]	 HCB [kg]
2004	8.454	40.437	40.983
2005	8.996	43.303	45.583
2006	8.029	39.864	41.812
2007	7.878	38.532	40.662
2008	7.845	38.535	40.889
2009	7.501	35.995	38.258
Trend 1985–2009	**-72%**	**-80%**	**-64%**
Trend 1990–2009	**-57%**	**-78%**	**-58%**

Remark: Please note different units used for different groups of pollutants!



Source: UMWELTBUNDESAMT 2011b

Figure 1:
Emission of Persistent Organic Pollutants 1985–2009:
PAH in Mg, PCDD/F in g and HCB in kg according to UNECE/LRTAP.

Remark: Please note different units used for different groups of pollutants!

2.2 Releases of polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) – Source categories of the Stockholm Convention

2.2.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

The following description of this source category is given in the Stockholm Convention's Technical Guidebook (UNEP 2006):

"This section deals only with the dedicated incineration of wastes and not with other situations where waste is thermally treated, for example co-incineration processes such as cement kilns and large combustion plants, which are dealt with in the sections relating to those processes."

2.2.1.1 Emission Factors and Emissions

PCDD/F emissions into air are in the range of 0.0013 to 0.05 ng/Nm^3 (I-TEQ; at 11% oxygen), which is within (or in some cases even below) the ranges associated with Best Available Techniques (0.01–0.1 ng/Nm^3; EUROPEAN COMMISSION 2006). Most of the measurements are done on a discontinuous basis. However, in some cases PCDD/F-emissions were measured on a semi-continuous basis (i.e. continuous sampling of flue-gas followed by an analyses of the filter cartridge every two weeks).

Municipal Solid Waste

An amount of about 4.9 million t municipal solid waste was generated in 2009 (EUROSTAT 2011). About 1.172 million t were incinerated in municipal waste incineration plants (BMLFUW 2011).

Hazardous Waste

In 2009, 0.975 million t of hazardous waste were treated (BMLFUW 2011), 0.16 million t were incinerated in 2008 (EUROSTAT 2011). The assumption was made that the same amount of hazardous waste was incinerated in 2009 since there was no significant change during the last years.

Sewage sludge

In 2008 an amount of 0.26 million t of sewage sludge was produced in Austria. Since there were no significant changes in the amounts of sewage sludge generation within the last few years it has been assumed that in 2009 the same amount was generated. 7% of this amount was landfilled, 36% incinerated, 15% applied on land, 19% treated in another way and 23% was stored (BMLFUW 2011).

Table 2 lists the PCDD/F-Emissions into air of the source category Waste Incineration for the years 2004 and 2009.

Table 2: PCDD/F-emissions into air from the source category Waste Incineration (UMWELTBUNDESAMT 2007a, UMWELTBUNDESAMT 2011b, own calculation).

	Emissions 2004 (g I-TEQ)	**Emissions 2009 (g I-TEQ)**
Municipal Solid Waste	0.214	0.210
Hazardous Waste	0.013	0.017
Sewage Sludge	0.002	0.002
Sum	**0.230**	**0.229**

2.2.2 Cement kilns firing hazardous waste

The following description of this source category is given in the Stockholm Convention's Technical Guidebook (UNEP 2006):

"The following draft guidelines shall provide guidance on best available techniques and guidance on best environmental practices for cement kilns relevant to Article 5 and Annex C, Part II of the Convention. This section also considers requirements of Article 6 of the Convention addressing destruction of POPs containing waste.

Within the scope of this document co-incineration of alternative fuels and hazardous wastes in cement kilns is dealt with as well. It should be kept in mind when reading these guidelines that stringent definitions of both terms do not exist at this moment.

2.2.2.1 Emission Factors and Emissions

In all Austrian cement plants waste is co-incinerated with an upward trend. Emission factors used in the OLI were assessed using reported emissions from Austrian cement kilns (ENVIRONMENTAL IMPACT STATEMENT WIETERSDORF (2003), ENVIRONMENTAL IMPACT STATEMENT RETZNEI (2004), ENVIRONMENTAL IMPACT STATEMENT LEUBE (2005), KARSTENSEN (2006)).

In 2009 3.43 million t of clinker were produced in nine plants. In total about 382,000 t of waste were co-incinerated in 2009 (VÖZ 2009). Data from single measurements (done in 2009) show emission concentrations between 0.001–0.0042 ng/Nm^3 (I-TEQ), which is considerably below the BAT ranges of <0.05-0.1 ng PCDD/F I-TEQ/Nm^3 (10 vol-% O_2, dry flue gas, standard state, average over the sampling period (6–8 hours), EUROPEAN COMMISSION 2010). In the AVV (relevant law for co-incineration of waste in cement plants) the ELV for PCDD/F for cement plants is 0.1 ng/Nm^3.Results from literature show, that PCDD/F emissions are not primarily depending on the type of fuel or waste but on the operating conditions and on the prevention of conditions which favour de-novo synthesis.

The next table presents calculated emissions loads from Austrian cement kilns:

Table 3: PCDD/F-emissions from Austrian cement plants (UMWELTBUNDESAMT 2011b).

	Emissions 2004 (g I-TEQ)	Emissions 2009 (g I-TEQ)
Cement kilns (total emissions)	0.116	0.131

It should be mentioned, that PAH-emissions such as benzene or naphthalene may arise from cement plants. These emissions have so far been reported by a small number of Austrian cement plants. PAHs mainly escape from preheating raw meal and to some extent from the rotary kiln (see PRTR data on the website of the Environment Agency Austria: www.prtr.at).

2.2.3 Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching

The production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"The main processes involved in making pulp and paper products are raw material handling and preparation, storage (and preservation for non-woods), wood debarking, chipping and agricultural residue cleaning, deknotting, pulping, pulp processing and bleaching if required and, finally, paper or paperboard manufacturing. Most of the formation of the 2,3,7,8-TCDD and 2,3,7,8-TCDF is generated in the C-stage of bleaching via the reaction of chlorine with precursors of TCDD and TCDF. HCB and PCB are not formed during pulp bleaching".

2.2.3.1 Emission Factors and Emissions

Emissions into air are released by recovery boilers (incineration of black liquor and fuel oil), fluidised bed reactors (incineration of bark, sludge, coal, fuel oil, biomass and waste), lime kilns (incineration of gas and fuel oil) and other fossil fuel fired incineration plants (UMWELTBUNDESAMT 2007b). Although PCDD/F-emissions are not measured in most of the above mentioned incineration plants (emissions are routinely measured at fluidised bed reactors when waste in co-incinerated) emissions are generally considered to be low (UNEP 2005). Emissions of these incineration plants are reported in section 2.2.8 (fossil fuel-fired utility and industrial boilers).

2.2.4 Thermal processes in the metallurgical industry (Secondary copper production; sinter plants in the iron and steel industry; secondary aluminium production; secondary zinc production)

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Secondary copper smelting involves pyrometallurgical processes dependent on the copper content of the feed material, size distribution and other constituents. Feed sources are copper scrap, sludge, computer scrap, drosses from refineries and semi-finished products. These materials may contain organic materials like coatings or oil, and installations take this into account by using de-oiling and de-coating methods or by correct design of the furnace and abatement system."

"Iron sintering plants may be used in the manufacture of iron and steel, often in integrated steel mills. The sintering process is a pretreatment step in the production of iron whereby fine particles of iron ores and, in some plants, secondary iron oxide wastes (collected dusts, mill scale) are agglomerated by combustion."

"Processes used in secondary aluminium smelting are dependent on feed material. Pretreatment, furnace type and fluxes used will vary with each installation. Production processes involve scrap pretreatment and smelting/refining. Pretreatment methods include mechanical, pyrometallurgical and hydrometallurgical cleaning. Smelting is conducted using reverberatory or rotary furnaces. Induction furnaces may also be used to smelt the cleaner aluminium feed materials."

"Secondary zinc smelting involves the processing of zinc scrap from various sources. Feed material includes dusts from copper alloy production and electric arc steel making (both of which have the potential to be contaminated with chemicals listed in Annex C of the Stockholm Convention), residues from steel scrap shredding, and scrap from galvanizing processes. The process method is dependent on zinc purity, form and degree of contamination. Scrap is processed as zinc dust, oxides or slabs. The three general stages of production are pretreatment, melting and refining."

The latter process is not applied in Austria.

2.2.4.1 Emission Factors and Emissions

Secondary copper plant

In Austria only one secondary copper plant is in operation with a production capacity of 74,000 t/a copper cathodes and 100,000 t/a of bolts (UMWELTBUNDESAMT 2004).

Emissions are reduced via fabric filter and regenerative afterburner after the shaft furnace. The general ELV for PCDD/F according to the Ordinance on non ferrous metals and refractory metals (BGBl. II No. 86/2008) is 0.4 ng/Nm^3; for copper plants already approved at the date of coming into effect of the Ordinance (1.4.2008), the ELV is 0.6 ng/Nm^3 until 1.4.2013.

There are no dioxin emission reduction measures installed after the converter and the anode furnace.

Sinter Plants

In Austria two sinter plants are in operation with a production capacity of 1.5 million t/a (VA Donawitz) and 2.75 million t/a (VA Linz), respectively. Both plants are equipped with fabric filter. For the larger plant the emission limit value is 0.1 ng/Nm^3 PCDD/F (as I-TEQ; EIA 2004), reported emissions are < 0.05 ng/Nm^3 PCDD/F (BREF review Iron and Steel Production, Final Draft 2011). The other plant emits less than 0.1 ng/Nm^3 PCDD/F (BREF review Iron and Steel Production, Final Draft 2011). However no limit value has been set, as there are no limit values or monitoring requirements for existing sinter plants in the Ordinance for sinter plants.

Secondary aluminium smelting plants

In Austria the following companies are producing secondary aluminium (UMWELTBUNDESAMT 2004):

- AMAG casting GmbH (84 000 t/a (UMWELTBUNDESAMT 2010))
- AMAG rolling GmbH (170 000 t/a (UMWELTBUNDESAMT 2010))
- Aluminium Lend GmbH & Co KG (SAG): capacity: 40.000 t/a http://www.sag.at/Zahlen-Fakten.524.0.html
- Hütte Klein-Reichenbach: capacity: 10.000 t/a.

Different furnaces are used in the secondary aluminium production in Austria like reverberatory furnace, rotary furnace, tilting rotary furnace, induction furnace. Emissions of PCDD/F are reduced via afterburning, dry sorption technique ($NaHCO_3$, coke) or injection of sorbalite (lime and coke). Measured PCDD/F emissions are in a range of <0.01–0.4 ng/Nm^3, (UMWELTBUNDESAMT 2004) which is below the emission value associated with Best Available Techniques (<0.1–0.5 ng/Nm^3, EUROPEAN COMMISSION 2001).

Actual limit values of PCDD/F from the different secondary aluminium plants in Austria are in a range of 0.1–0.4 ng/Nm^3.

Benzo(a)pyrene is limited in the non ferrous metals Ordinance with an emission limit value of 0.05 mg/Nm^3. Measured values (as far as they are available) are far below this limit value.

Emissions

Table 4 gives an overview of calculated emissions from the processes described above:

Table 4: PCDD/F-emissions from thermal processes in the metallurgical industry – Part II (UMWELTBUNDESAMT 2011b).

Source Category	2004 [g I-TEQ]	2009 [g I-TEQ]
Secondary copper production	0.279	0.279
Sinter plants in the iron and steel industry	3.106	2.538
Secondary aluminium production	1.813	1.813

2.2.5 Open burning of waste, including burning of landfill sites

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Open burning covers a wide range of different uncontrolled waste combustion practices, including dump fires, pit burning, fires on plain soil and barrel burning."

2.2.5.1 Emission Factors and Emissions

This source category includes on-field burning of stubble, straw, etc. and open burning of agricultural waste. Releases are taken from the Austrian National Inventory (see Table 5).

Intentional fires like bonfires bear a risk of abuse when used as a method of domestic waste disposal. This issue has been addressed in a single case study showing the effectiveness of current regulation in this field of activity. The situation with unintentional fires is more unclear. Emission factors reported in literature show high uncertainty due to limited sets of data.

In addition releases from accidental burning of landfill sites (esp. landfills for the intermediate storage of waste) should be added here as well as releases during accidental fires of houses and other facilities. In recent years burning of intermediate storage facilities of waste has occurred relatively often. However, due to missing data on the quantities of burnt waste and the great uncertainties associated with the relevant emission factors no quantification of emissions has been done for these types of unwanted emissions.

Nevertheless, it can be assumed that these incidents contribute substantially to the overall emissions of PCDD/F into air: The Dioxin Toolkit (UNEP 2005) gives a default emission factor of 1 mg per tonne of burnt material.

Table 5: PCDD/F-emissions from the source category open burning of waste (UMWELTBUNDESAMT 2011b).

Source Category Part III	2004 [g I-TEQ]	2009 [g I-TEQ]
Open burning of waste*	0.222	0.136

** without burning of landfill sites and accidental fires*

2.2.6 Thermal processes in the metallurgical industry not mentioned in Part II

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Secondary lead smelting involves the production of lead and lead alloys, primarily from scrap automobile batteries, and also from other used lead sources (pipe, solder, drosses, lead sheathing). Production processes include scrap pretreatment, smelting and refining."

"Primary aluminium is produced directly from the mined ore, bauxite. The bauxite is refined into alumina through the Bayer process. The alumina is reduced into metallic aluminium by electrolysis through the Hall-Héroult process (either using self-baking anodes – Söderberg anodes – or using prebaked anodes)."

"Magnesium is produced either from raw magnesium chloride with molten salt electrolysis, or magnesium oxide reduction with ferrosilicon or aluminium at high temperatures, as well as through secondary magnesium recovery (for example, from asbestos tailings)."

"Secondary steel is produced through direct smelting of ferrous scrap using electric arc furnaces. The furnace melts and refines a metallic charge of scrap steel to produce carbon steels, as well as high alloyed and stainless steels at non-integrated steel mills. Ferrous feed materials mainly consists of scrap. Scrap may be added to other melting furnaces and in particular in the primary iron and steel sectors."

"Primary base metals smelting involves the extraction and refining of nickel, lead, copper, zinc and cobalt. Generally, primary base metals smelting facilities process ore concentrates. Most primary smelters have the technical capability to supplement primary concentrate feed with secondary materials (e.g. recyclables)."

2.2.6.1 Emission factors and emissions

Secondary lead production

Only one plant in Austria (BMG Metall & Recycling GmbH in Arnoldstein/Kärnten) produces secondary lead from old batteries with a production capacity of 26 900 t/a. (UMWELTBUNDESAMT 2004, UMWELTERKLÄRUNG 2009). An afterburner has been installed after the furnaces. An emission limit value of 0.4 ng/Nm^3 for PCDD/F exists in the current ordinance (BGBl. II Nr. 86/2008). Measured values are well below this ELV. Benzo(a)pyrene is limited by ordinance (BGBl. II No. 86/2008) with an emission limit value of 0.05 mg/Nm^3,a measured value of 0.00685 mg/Nm^3 (UMWELTERKLÄRUNG 2009) is far below the limit value.

Primary aluminium production

Primary aluminium is no longer produced in Austria (1992 – change to secondary aluminium production).

Secondary steel production

Secondary steel (Electric Arc Furnace) is produced in three plants (Böhler Uddeholm, Marienhütte, Breitenfeld). Total production was 723,000 t in the year 2008 and 588,000 t in the year 2009. www.worldsteel.org.

Primary base metals

Nickel oxide is produced from old nickel containing catalysts and other nickel containing wastes and by-products (Treibacher TIAG in Althofen). Measured PCDD/F-emissions are well below <0.1 ng/Nm^3 (UMWELTBUNDESAMT 2004).

Emissions

Releases have been taken from the Austrian National Inventory (see Table 6).

Table 6: PCDD/F-emissions from the source category thermal processes in the metallurgical industry – Part III (UMWELTBUNDESAMT 2011b).

Source Category Part III	2004 [g I-TEQ]	2009 [g I-TEQ]
Thermal processes in the metallurgical industry not mentioned in Part II	0.198	0.190

2.2.7 Residential combustion sources

Residential combustion plants are defined in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"This section considers the combustion of wood, coal and gas, mainly for residential heating and cooking. Combustion takes place in hand-fired stoves or fireplaces or, in the case of larger central heating systems, in automatically fired installations."

Activity data for residential combustion plants can be found within the Austrian National Energy Balance in the NFR-codes (NFR: Nomenclature for Reporting) "Commercial/Institutional" (NFR: 1A4a, SNAP: 0201), "Residential Plants" (NFR: 1A4b1, SNAP: 0202) and "Plants in Agriculture/Forestry" (NFR: 1A4c1, SNAP: 0203). Since these plants are regarded as small scale installations, their emissions are allocated to the source category "Residential combustion sources".

2.2.7.1 Activity data – NFR-code: "Residential Plants"

In 2009 total energy consumption under the NFR-code "Residential Plants" was 174 PJ. Major fuels were oil (light and extra light heating oil and liquified petroleum gas) with a share of 32.3%, followed by natural gas (28.5%), wood (31.7%), wood waste (5.6%). Coal (1.9%) is of minor importance.

Residential Plants	2004	2009
Coal	3.1 %	1.9 %
Oil	37.4 %	32.3 %
Gas	27.4 %	28.5 %
Wood waste	3.6 %	5.6 %
Wood	28.5 %	31.7 %
Sum	**100 %**	**100 %**
Total Energy Consumption	**180 PJ**	**174 PJ**

Table 7: Fuel mix in the NFR-code „Residential Plants“ (UMWELTBUNDESAMT 2011a).

2.2.7.2 Emission factors – NFR-code: "Residential Combustion Sources"

In the next table emission factors of relevant fuels are compiled:

EF PCDD/F [µg/GJ]	UMWELTBUNDESAMT 2011A	UMWELTBUNDES-AMT 2002	UNEP Toolkit
1A4a Commercial/Institutional plants (SNAP 020103)			
Coal: 102A, 104A, 105A, 106A, 107A	0.24		
203B Light fuel oil 203C Medium fuel oil	0.002		0.01 (general)
203D Heavy fuel oil	0.0009		
204A Heating oil 206A Petroleum	0.0012		

Table 8: PCDD/F emission factors for Residential Plants, Commercial/ Institutional Plants and Plants in Agriculture/ Forestry

EF PCDD/F [µg/GJ]	**UMWELTBUNDESAMT 2011A**	**UMWELTBUNDES-AMT 2002**	**UNEP Toolkit**
1A4a Commercial/Institutional plants (SNAP 020103)			
224A Other Oil Products	0.0017		
301A Natural gas	0.0016		0.0015 (general)
303A LPG 310A Landfill gas	0.0017		
309A Biogas 309B Sewage sludge gas	0.0006		
111A Wood (IEF 2008)	0.186		
115A Industrial waste	0.3		
116A Wood wastes (IEF 2008)	0.430		1.5 (general)
1A4c i Plants in Agriculture/Forestry/Fishing (SNAP 020302)			
Coal (102A, 104A, 105A, 106A, 107A)	0.24		
203B Light fuel oil 204A Heating oil	0.0015		0.01 (general)
301A Natural gas 303A LPG	0.0025		Natural gas 0.0015 (general)
111A Wood (IEF 2008)	0.223		
116A Wood wastes	0.38		1.5 (general)
1A4b Residential plants: central and apartment heating (SNAP 020202)			
Coal 102A, 105A, 106A, 107A	0.38		
203B Light fuel oil 204A Heating oil	0.0015		0.01 (general)
224A Other Oil Products	0.0017		
301A Natural gas 303A LPG	0.0025		Natural gas 0.0015 (general)
111A Wood, 116A Wood wastes Central heating (IEF 2008) Apartment heating	 0.223 0.38		1.5 (general)
1A4b Residential plants: stoves (SNAP 020205)			
Coal 102A, 104A, 105A, 106A, 107A	0.75	Coal: 7.74 (stoves, fireplaces) Coke: 1.47 (stoves, fireplaces)	15 (stoves; high chlorine coal) 0.1 (stoves; low chlorine coal)
204A Heating oil	0.003		
301A Natural gas	0.006		
111A Wood 113A Peat 116A Wood wastes	0.75	0.32 (stoves, fireplaces)	Wood 0.1 (general) Wood waste 1.5 (general)

For the purpose of this calculation, emission factors used in the Austrian air emission inventory (OLI) have been updated subject to available literature (see IIR 2011, p. 168):

Residential plants

For residential plants the dioxin emission factors for coal and wood were taken from (HÜBNER & BOOS 2000); for heating oil a mean value from (PFEIFFER et al. 2000), (BOOS & HÜBNER 2000) and measurements by FTU (FTU 2000) were used. Combustion of waste in stoves was not considered, as no activity data was available.

"Commercial and Institutional plants" and "Plants in Agriculture/Forestry/Fishing"

The same emission factors as those for central heating in the residential sector and for small (and medium-sized) plants of category 1 A 2 were used (the share of the different size classes is based on expert judgement). The values given in the following Table are averaged values per fuel category.

As emission factors for heavy fuel oil and other oil products the same factors as for *1 A 2 Manufacturing and Construction* were used.

Emission factors for dioxin were taken from (FTU 1997) and measurements carried out at Austrian plants (FTU 2000).

Coal:

In the OLI two different emission factors are used to calculate emissions from central and apartment heating systems and from stoves. However, in a recent study (UMWELTBUNDESAMT 2002) a ten-fold higher emission factor (7.74) was published for stoves (see Table 8). In the Dioxin Toolkit (UNEP 2005) emission factors for coal (0.1 µg/GJ) and coal with a high chlorine content (15 µg/GJ) are listed. Because it is assumed that coals used in Austrian residential plants are of a medium to high chlorine content, the emission factor published in the most recent study is used.

Coke:

In line with the recent study (UMWELTBUNDESAMT 2002) an emission factor of 1.47 µg/GJ has been used for calculating emissions from stoves.

Wood:

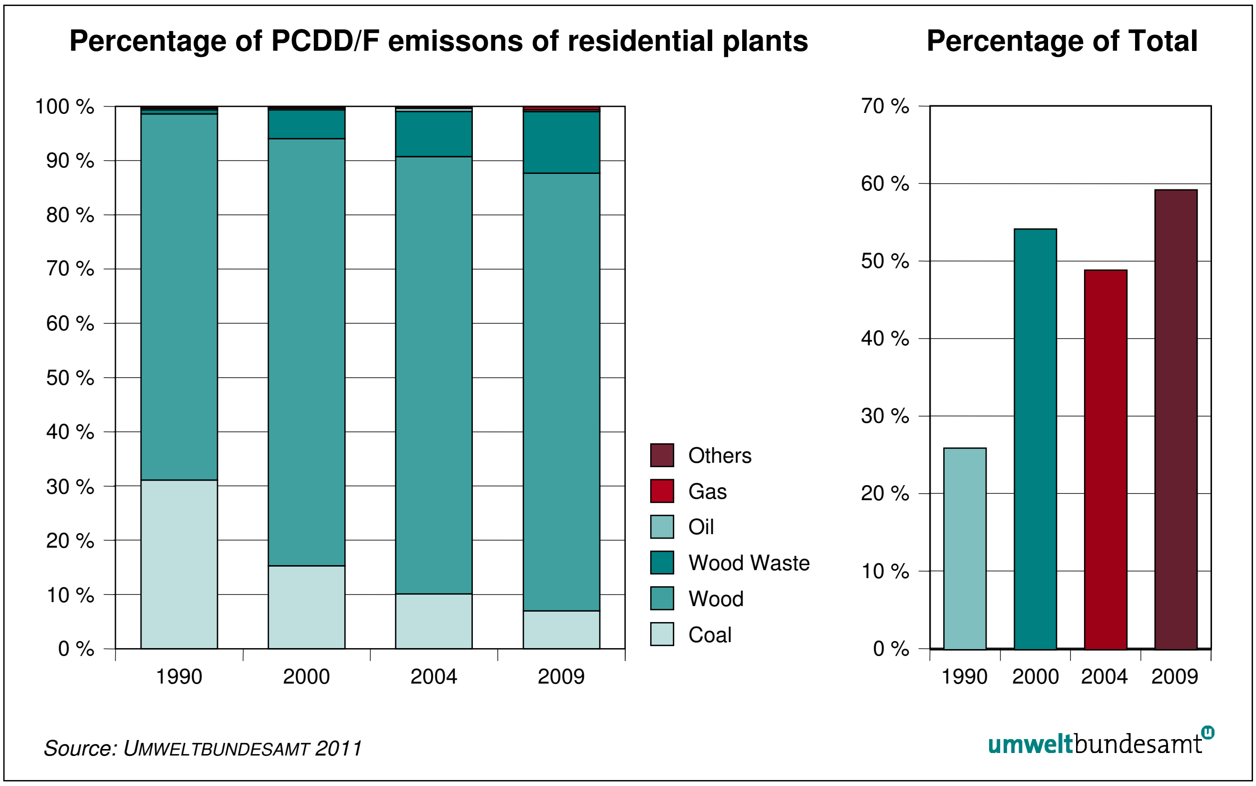
No distinction is made between different firing systems. The emission factor has been taken from UMWELTBUNDESAMT 2002 (0.32 µg/GJ).

2.2.7.3 Emissions – NFR-code: "Residential Plants"

In the table below emissions of residential plants are listed in relation to the fuel input. The largest part of the emissions stems from the incineration of wood. The incineration of fossil solid fuels (coal, lignite, coke) contributes significantly to the overall emissions from this source category. However, emissions from fossil solid fuels are expected to decrease due to a decline in fuel consumption.

Table 9: Emissions of dioxines/furanes from residential plants (UMWELTBUNDESAMT 2011b, own calculation)

Residential Plants	**2004 (g I-TEQ)**	**2009 (g I-TEQ)**
Coal	2.59	1.49
Wood	20.86	17.17
Wood waste	2.24	2.40
Oil	0.11	0.09
Gas	0.13	0.13
Others	0.00	0.00
Sum	**25.93**	**21.28**



Source: UMWELTBUNDESAMT 2011

Figure 2: Percentage of PCDD/F emissions from residential plants 1990–2009.

2.2.7.4 Activity data – NFR-code "Commercial/Institutional" and "Plants in Agriculture/Forestry"

In the year 2009 the total input within these subcategories was 54.1 PJ. The major fuels were natural gas and other gases (57%), followed by oil (sum of heating oils and LPG: 30.6%). Wood waste (11.9%), industrial waste (0.8%), biomass (7.8%) and other solid fuels (total of coke, coal and lignite: 0.6%) were of minor importance. Activity data in this sector suffer from substantial uncertainties which are the result of a lack of qualified data.

Commercial/Institutional + Plants in Agriculture/Forestry	2004	2009
Coal	1.2 %	0.6 %
Oil	29.7 %	22.0 %
Gas	56.7 %	57.0 %
Wood waste	7.5 %	11.9 %
Industrial waste	0.7 %	0.8 %
Wood	4.7 %	7.8 %
Others (biogas, sewage gas, landfill gas)	0.6 %	0.5 %
Sum	**100 %**	**100 %**
Total Energy Consumption	**79 PJ**	**54 PJ**

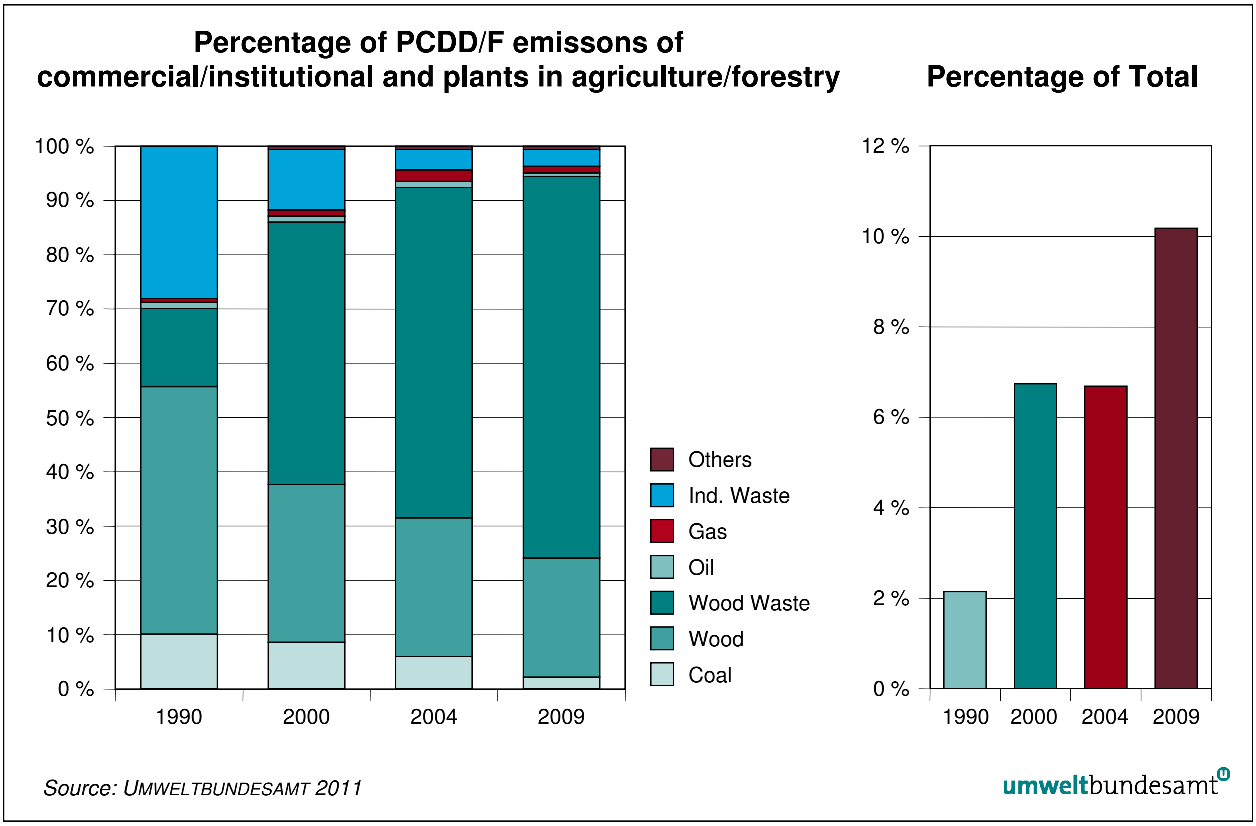
Table 10: Share of fuels within the subcategories "Commercial/Institutional" and "Stationary" (UMWELTBUNDESAMT 2011a).

2.2.7.5 Emissions of PCDD/F – NFR-code "Commercial/Institutional" and „Plants in Agriculture/Forestry"

Emission factors were taken from the OLI. Due to the high activity rate of wood waste this type of waste contributes most to the overall emissions.

Commercial/Institutional + Stationary	2004 (g I-TEQ)	2009 (g I-TEQ)
Coal, lignite, coke	0.22	0.08
Heating oil	0.03	0.01
Wood waste	2.22	2.57
Wood	0.92	0.81
Gas	0.07	0.05
Ind. Waste	0.16	0.13
Others	0.01	0.00
Sum	**3.63**	**3.65**

Table 11: Emissions of Dioxines/Furanes caused by different fuel types (UMWELTBUNDESAMT 2011b, own calculation).



Source: UMWELTBUNDESAMT 2011

Figure 3: Percentage of PCDD/F emissions from commercial/institutional and plants in agriculture/forestry1990–2009.

2.2.8 Fossil fuel-fired utility and industrial boilers

Fossil fuel-fired utility and industrial boilers are described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Boilers are facilities designed to burn fuel to heat water or to produce steam. The majority of boilers use fossil fuels to provide the energy source, although boilers can also be designed to burn biomass and wastes. The steam produced from the boiler can be used for electricity production or used in industrial processes; likewise hot water can be used in industrial processing, or for domestic and industrial heating."

2.2.8.1 Emission Factors and Emissions

Emission factors used by the Austrian Air Emissions Inventory are consistent with data from literature (UMWELTBUNDESAMT 2003, EUROPEAN COMMISSION 2003, 2006). In general emission concentrations of investigated boilers are (far) below 0.1 ng/Nm^3. However, because of the high total activity number (total energy input: about 390 TJ in the year 2004 and 357 in the year 2009) the emitted load is in the range of 1 g per year (see Table 12).

Table 12: PCDD/F-emissions from the source category fossil fuel fired utility and industrial boilers (UMWELTBUNDESAMT 2011a).

Source Category Part III	2004 [g I-TEQ]	2009 [g I-TEQ]
Fossil fuel-fired utility and industrial boilers	0.974	1.117

2.2.9 Firing installations for wood and other biomass fuels

Firing installations for wood and other biomass fuels are described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"The main purpose of firing installations for wood and other biomass fuels is energy conversion. Large-scale installations for firing wood and other biomass fuels mainly use fluidized bed combustion and grate furnaces. Technologies for small-scale plants include underfeed furnaces and cyclone suspension furnaces. Recovery boilers in the pulp and paper industry apply specific combustion conditions. Technology selection is related to fuel properties and required thermal capacity. In the present section only large-scale applications in, for example, industry, power generation and district heating are covered".

2.2.9.1 Emission Factors and Emissions

Some emission factors used by the Austrian Air Emissions Inventory have been updated according to available literature (UMWELTBUNDESAMT 2007c). For example emission factors for industrial firing installations have been reduced from 0.08 µg/GJ to 0.03 µg/GJ. Due to the increasing number of commercial biomass firing installations emissions from this source category have risen to almost double those from 2004.

Table 13: PCDD/F-emissions from the source category firing installations for wood and other biomass fuels (UMWELTBUNDESAMT 2011b).

Source Category Part III	2004 [g I-TEQ]	2009 [g I-TEQ]
Firing installations for wood and other biomass fuels	1.644	2.957

2.2.10 Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"This section focuses on processes for the manufacture of industrial chemicals that could theoretically give rise to persistent organic pollutants (particularly those chemicals listed in Annex C of the Stockholm Convention). Most of the processes described share common steps, including chlorination of organic or inorganic raw materials, purification of the products, separation of product streams (usually by distillation), destruction of high-molecular-weight side products and recycle or sale of hydrogen chloride."

2.2.10.1 Emission Factors and Emissions

No national emission factors are available. It is assumed that – if any – emissions are negligible due to low activity figures.

2.2.11 Crematoria

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Cremation is the disposal of a cadaver by the process of burning. This can be undertaken in either an uncontrolled, open burning fashion on funeral pyres, or in a controlled fashion within a cremator, installed within a crematorium or crematory. For the purposes of this document, only the cremator installations are discussed with respect to preventing releases of persistent organic pollutants, and not open burning."

2.2.11.1 Emission factors and emissions

In the year 2004 three of ten Austrian crematoria were equipped with emission reduction techniques, two of which with PCDD/F reduction techniques. The emission limit value given in the permits for these two plants is 0.1 ng/Nm^3 (11% O_2) (communication from operators). There exists no generally binding rule concerning emission reduction for crematoria in Austria.

Due to a general lack of data emission factors from the Austrian Air Emissions Inventory have been used (Table 14).

Table 14: PCDD/F-emissions from the source category crematoria (UMWELTBUNDESAMT 2011b).

Source Category Part III	2004 [g I-TEQ]	2009 [g I-TEQ]
Crematoria	0.154	0.164

2.2.12 Motor vehicles, particularly those burning leaded gasoline

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"The major fuels used in motor vehicle transportation are gasoline and diesel. Liquefied petroleum gas, vegetable oil-based and other biofuels, and alcohol-oil mixtures are gaining importance."

2.2.12.1 Methodology

Activity data for motor vehicles can be found within the Austrian National Energy Balance in the NFR-codes:

Road Transportation (SNAP: 07):

- Passenger cars
- Light duty vehicles <3.5 t
- Heavy duty vehicles >3.5 t and buses (r)
- Mopeds and motorcycles <50 cm^3
- Motorcycles >50 cm^3

Other Mobile Sources and Machinery (SNAP: 08):

- Military
- Railways
- Inland waterways
- Agriculture
- Forestry
- Industry
- Household and gardening

2.2.12.2 Activity data – Road Transportation

In 2009 total energy consumption in the category "Road Transportation" was 304 PJ. The major source category with a share of 54% was passenger cars, followed by heavy duty vehicles (30%), followed by light duty vehicles, motorcycles and mopeds (8%) excluding the relative proportions of liquid biofuels.

Table 15: Fuel Allocation Road Transportation (Hausberger 1997, Umweltbundesamt 2011a)

	Activity 2004		Activity 2009	
Source Category	**(PJ)**	**(%)**	**(PJ)**	**(%)**
Passenger cars	176.2	54.9	164.3	54.1
Gasoline	*84.7*	*26.4*	*70.7*	*23.3*
Diesel	*91.5*	*28.5*	*93.6*	*30.8*
Light duty vehicles <3.5 t (r)	23.4	7.3	23.5	7.7
Liquid biofuels	-	-	21.6	7.1
Heavy duty vehicles >3.5 t and buses (r)	119.7	37.3	92.2	30.4
Mopeds and Motorcycles <50 cm^3	0.2	0.1	0.2	0.1
Motorcycles >50 cm^3	1.4	0.4	1.7	0.6
Total	**321.9**	**100**	**303.5**	**100**

2.2.12.3 Activity data – Other Mobile Sources and Machinery

In 2009 total energy consumption in the category "Other Mobile Sources and Machinery" was 40.5 PJ.

Table 16: Fuel Allocation Other Mobile Sources and Machinery (HAUSBERGER 1997, UMWELTBUNDESAMT 2011a).

Source Category	Activity 2004 (PJ)	Activity 2004 (%)	Activity 2009 (PJ)	Activity 2009 (%)
Military	0.6	1.9	0.6	1.5
Railways	1.9	6.2	2.2	5.3
Inland Waterways	0.8	2.7	0.5	1.2
Agriculture	9.7	31.6	10.6	25.7
Forestry	1.2	3.8	1.4	3.4
Industry	14.5	47.5	24.2	58.4
Household and gardening	1.9	6.2	1.8	4.5
Total	**30.6**	**100.0**	**41.4**	**100.0**

2.2.12.4 Emission factors – NFR-code: "Road Transportation, Other Mobile Sources and Machinery"

The emission factors used in the Austrian air emission Inventory are also used for the emission projection. These emission factors are based on a study entitled "Österreichische Emissionsinventur für POPs, Forschungsgesellschaft Techn. Umweltschutz GmbH" financed by the Umweltbundesamt and completed in 2001.

In the next table emission factors for fuels are compiled:

Table 17: PCDD/F emission factors for Road Transportation and other Mobile Sources and Machinery (HÜBNER 2001).

Source Category	NFR Code	SNAP Code	Split	Fueltype	EF µg/GJ
Passenger cars (r)	1 A 3 b 1	701	Conventional	Gasoline	0.046
Passenger cars (r)	1 A 3 b 1	701	Catalyst	Gasoline	0.001
Passenger cars (r)	1 A 3 b 1	701	XXX	Diesel	0.001
Passenger cars (r)	1 A 3 b 1	701	XXX	Liquid Biofuels	0.001
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Diesel	0.001
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Gasoline	0.046
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Liquid Biofuels	0.001
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	HDV > 3.5 conv.	Diesel	0.006
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	Buses convent.	Diesel	0.006
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	XXX	Gasoline	0.046
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	XXX	Liquid Biofuels	0.006
Mopeds and Motorcycles < 50 cm^3	1 A 3 b 4	704	737	Gasoline	0.003
Mopeds and Motorcycles < 50 cm^3	1 A 3 b 4	704	738	Gasoline	0.001
Motorcycles > 50 cm^3	1 A 3 b 4	705	XXX	Gasoline	0.003
Military	1 A 5 b	801	XXX	Diesel	0.006
Military	1 A 5 b	801	XXX	Gasoline	0.000
Military	1 A 5 b	801	XXX	Liquid Biofuels	0.006

Source Category	**NFR Code**	**SNAP Code**	**Split**	**Fueltype**	**EF µg/GJ**
Shunting locs	1 A 3 c	80201	XXX	Diesel	0.006
Rail-cars	1 A 3 c	80202	XXX	Diesel	0.006
Locomotives	1 A 3 c	80203	XXX	Coal	0.380
Locomotives	1 A 3 c	80203	XXX	Diesel	0.006
Inland waterways	1 A 3 d 2	80303	XXX	Liquid Biofuels	0.006
Personal watercraft	1 A 3 d 2	80303	XXX	Diesel	0.000
Personal watercraft	1 A 3 d 2	80303	XXX	Gasoline	0.046
Inland goods carrying vessels	1 A 3 d 2	80304	XXX	Diesel	0.006
Agriculture	1 A 4 c 2	806	XXX	Diesel	0.006
Agriculture	1 A 4 c 2	806	XXX	Gasoline	0.046
Agriculture	1 A 4 c 2	806	XXX	Liquid Biofuels	0.006
Forestry	1 A 4 c 2	807	XXX	Diesel	0.006
Forestry	1 A 4 c 2	807	XXX	Gasoline	0.046
Forestry	1 A 4 c 2	807	XXX	Liquid Biofuels	0.006
Industry	1 A 2 f 1	808	XXX	Diesel	0.006
Industry	1 A 2 f 1	808	XXX	Gasoline	0.046
Industry	1 A 2 f 1	808	XXX	Liquid Biofuels	0.006
Household and gardening	1 A 4 b 2	809	XXX	Diesel	0.006
Household and gardening	1 A 4 b 2	809	XXX	Gasoline	0.046
Household and gardening	1 A 4 b 2	809	XXX	Liquid Biofuels	0.006

2.2.12.5 Emissions of dioxins/ – NFR-code “Road Transportation” and ”Other Mobile Sources and Machinery“

Table 18: Emissions of dioxins from “Road Transportation” (UMWELTBUNDESAMT 2011b).

Source category	**Emissions 2004**		**Emissions 2009**	
	(g)	**(%)**	**(g)**	**(%)**
Passenger cars	0.455	36	0.320	34
thereof Gasoline conventional	*0.391*	*31*	*0.247*	*26*
thereof Diesel (incl. biofuels)	*0.064*	*5*	*0.074*	*8*
Light duty vehicles <3.5 t(r)	0.119	9	0.068	7
Heavy duty vehicles >3.5 t and buses (r)	0.673	54	0.555	58
Mopeds and Motorcycles <50 cm^3	0.000	<1	0.000	<1
Motorcycles >50 cm^3	0.004	<1	0.005	1
Total	**1.252**	**100**	**0.949**	**100**

Table 19: Emissions of dioxins from "Other Mobile sources and Machinery" (UMWELTBUNDESAMT 2011b).

Source category	**Emission 2004**		**Emission 2009**	
	(g)	**(%)**	**(g)**	**(%)**
Military	<0.001	<1	<0.001	<1
Railways	0.013	6	0.014	6
Inland Waterways	0.010	5	0.008	3
International Sea Traffic	0.001	<1	0.002	<1
Agriculture	0.063	31	0.068	27
Forestry	0.015	8	0.016	7
Industry	0.046	23	0.093	37
Household and gardening	0.054	27	0.050	20
Total	**0.201**	**100**	**0.251**	**100**

2.2.13 Destruction of animal carcasses

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Destruction of animal carcasses is generally achieved by incineration, rendering or a combination of these two activities. Incineration techniques may include pyrolysis, gasification or other forms of heat treatment, and may involve burning of complete carcasses or parts of carcasses. Rendering covers a range of activities for processing of carcasses to recover materials."

2.2.13.1 Emission Factors and Emissions

No national emission factors are available. It is assumed that emissions, if any, are negligible due to the low activity figures.

2.2.14 Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Woven and knit fabrics cannot be processed into finished goods until the fabrics have passed through several water-intensive wet processing stages (also known as finishing) such as fabric preparation, dyeing, printing and finishing. Natural fibres typically require more processing steps than artificial fibres. Relatively large volumes of wastewater are generated, containing a wide range of contaminants, which must be treated prior to disposal. Significant quantities of energy are used in heating and cooling chemical baths and drying fabrics and yarns."

2.2.14.1 Emission Factors and Emissions

No national emission factors are available. It is assumed that emissions, if any, are negligible due to the low activity figures.

2.2.15 Shredder plants for the treatment of end of life vehicles

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Shredder plants for treatment of end-of-life vehicles are listed in Annex C of the Stockholm Convention as a source that has the potential to form and release chemicals listed in Annex C. Shredders are large-scale machines equipped inside with one or more anvils or breaker bars and lined with alloy steel wear plates. An electric motor drives the rotor with the freeswinging alloy steel hammers. Beneath the shredder is a vibratory pan, which receives the shredded material dischargedthrough the grates. Typically a ferrous metal stream is produced, which is relatively clean and consists of small (50 mm) pieces of steel and a "fluff" stream, which contains the fragments of non-ferrous metals and other materials that entered the shredder (also known as fragmentiser). Very few data on stack emission measurements at shredder plants are available. However, the results of some studies have shown levels of dioxin compounds greater than 0.1 ng I-TEQ/m^3.

At present there is not sufficient evidence that new formation of polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF) or polychlorinated biphenyls (PCB) occurs in the (mechanical) shredding of vehicles, household electrical equipment or other electrical appliances. The data available indicate that the PCDD/PCDF and PCB released from shredderplants are from industrial, intentional production and have been introduced with oils, dielectric fluids, and other materials contained in these vehicles or consumer goods and which are simply set free through this mechanical process."

2.2.15.1 Emission Factors and Emissions

According to BMLFUW 2011, six shredder plants and three post-shredder plants are in operation in Austria.

No national emission factors are available for this activity.

2.2.16 Smouldering of copper cables

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"Smouldering of copper cables involves the open burning of plastic coatings from electrical cable and wiring to recover scrap copper and other constituents of the cables. This process is labour intensive, and is performed by individuals or in small facilities without any abatement measures for air emissions. Smouldering is conducted in burn barrels or on open ground. No means of temperature control or oxygen addition are used to achieve complete combustion of plastic compounds."

2.2.16.1 Emission Factors and Emissions

This process is not applied in Austria.

2.2.17 Waste oil refineries

This source category is described in the Stockholm Convention's Technical Guidebook (UNEP 2006) as follows:

"For the purpose of this guidance section, waste oils (or used oils) are defined as any petroleum-based, synthetic, or plant- or animal-based oil that has been used. Waste oils may originate from two large sources: industrial waste oils, and vegetable and animal waste oils. Among the industrial waste oils, three main oil streams can be identified: industrial oil (e.g. hydraulic oil, engine lubricant, cutting oil); garage or workshop oil; and transformer oil.

Waste oils have been found to be contaminated with PCDD, PCDF and PCB. At present there is no available evidence that PCDD/PCDF or PCB are newly formed in waste oil refineries. The data available indicate that the PCDD/PCDF and PCB released from waste oil refineries or waste oil handling and management plants are from industrial, intentional production of PCB or chlorobenzenes that are present in the waste oils either by contamination in the synthesis process (of these chemicals) or have become contaminated during the use phase or earlier recycling processes. In this sense, waste oil refineries represent a distribution source of chemicals listed in Annex C rather than a formation source. According to available information, waste oil management options include reuseor regeneration; thermal cracking; and incineration or use as fuel. It should be noted that dumping and open burning are also practised in many countries."

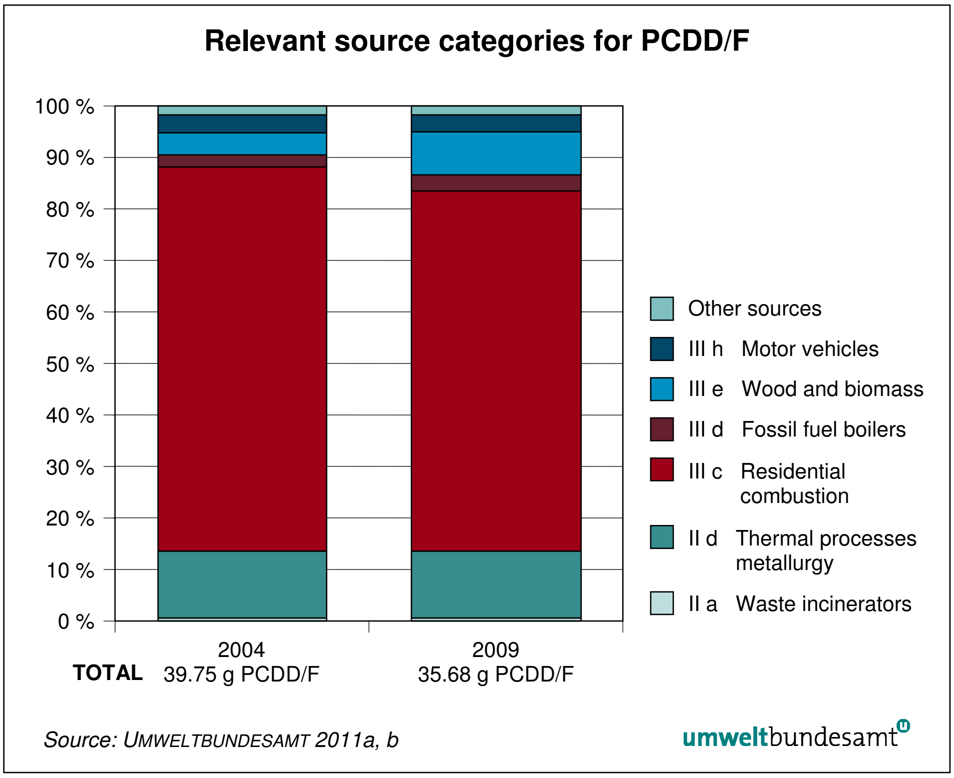
2.2.17.1 Emission Factors and Emissions

This process is not applied in Austria.

2.2.18 Summary of PCDD/F – Releases to Air from Source Categories of the Stockholm Convention

In the year 2009 a total of 35.7 g PCDD/F (I-TEQ) were emitted in Austria from source categories according to the Stockholm Convention. In the Austrian Air Emissions Inventory (OLI) PCDD/F emissions into air were calculated to be 36.0 g (I-TEQ, 2009). The difference can be explained by the fact, that the OLI is more comprehensive as far as activities are concerned. On the other hand some emission factors have been updated in the course of thisreport (see description of source categories).

Only a few source categories contribute significantly to the total emissions of dioxins and furans, the most important being residential combustion sources with a share of 70% and thermal processes in the metallurgical sector with a share of 13%. Other sources are motor vehicles with 3.4%, biomass combustion (8.3%) and fossil fuel use in industry (3.1%) (see Table 20, Table 21 and Figure 4).



Source: UMWELTBUNDESAMT 2011a, b

Figure 4: Relevant source categories of PCDD/F.

Table 20: PCDD/F emissions from Source Categories Part II for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source Category Part II	**2004 [g I-TEQ]**	**2009 [g I-TEQ]**
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	0.230	0.229
Cement kilns firing hazardous waste[1]	0.116	0.131
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2]	IE	IE
The following thermal processes in the metallurgical industry		
(i) Secondary copper production	0.279	0.279
(ii) Sinter plants in the iron and steel industry	3.106	2.538
(iii) Secondary aluminium production	1.813	1.813
(iv) Secondary zinc production	NO	NO
Total (Part II)	**5.544**	**4.990**

[1] figures represent total emissions from cement kilns

[2] only process emissions are covered here;
PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.

NO: not occurring

IE: included elsewhere

Table 21: PCDD/F emissions from Source Categories Part III for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source Category Part III	**2004 [g I-TEQ]**	**2009 [g I-TEQ]**
Open burning of waste*	0.222	0.136
Thermal processes in the metallurgical industry not mentioned in Part II	0.198	0.190
Residential combustion sources[1]	29.564	24.931
Fossil fuel-fired utility and industrial boilers	0.974	1.117
Firing installations for wood and other biomass fuels	1.644	2.957
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA	NA
Crematoria	0.154	0.164
Motor vehicles, particularly those burning leaded gasoline	1.453	1.200
Destruction of animal carcasses	NA	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA	NA
Shredder plants for treatment of end of life vehicles	NE	NE
Smouldering of copper cables	NO	NO
Waste oil refineries	NO	NO
Total (Part III)	**34.208**	**30.694**

[1] NFR 1A4b1 Residential – stationary including NFR 1A4a1 Commercial/Institutional – Stationary as well as NFR 1A4c1 Agriculture/Forestry/Fisheries – Stationary

** without burning of landfill sites and accidental fires*

NA: not applicable

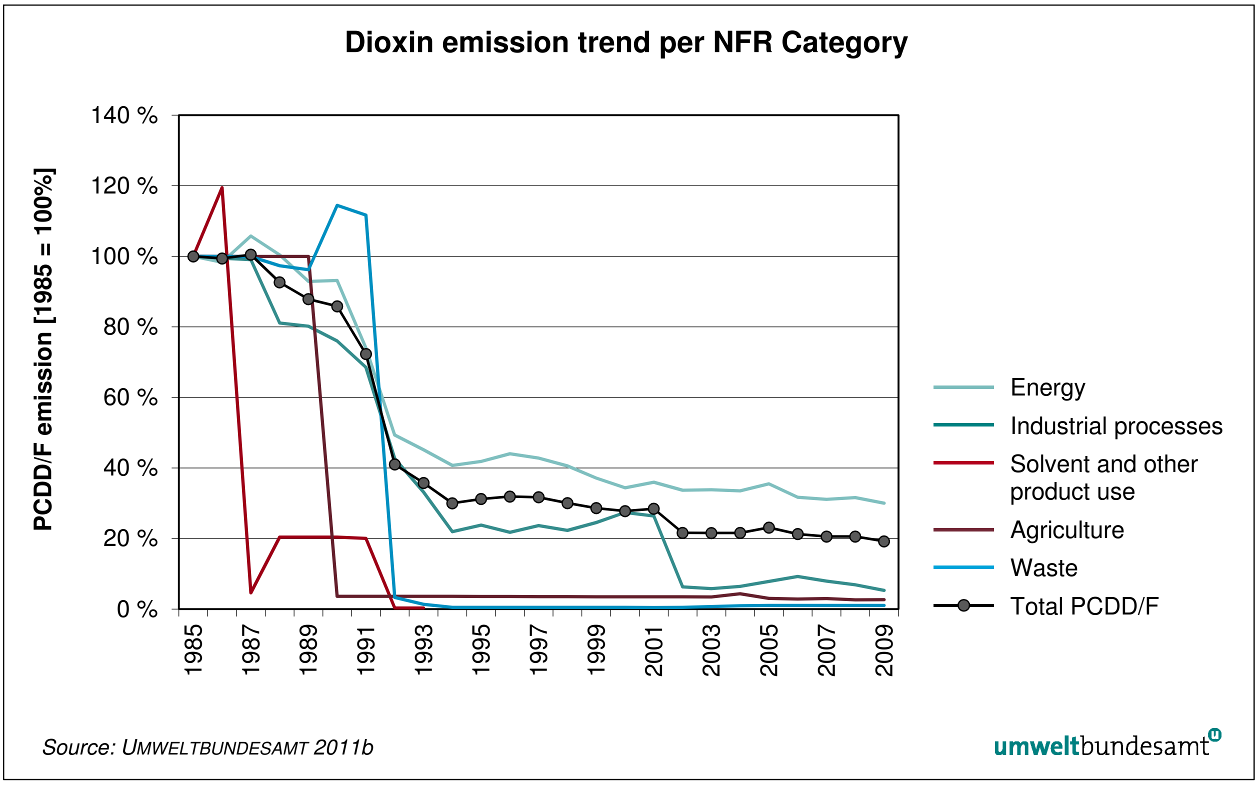
NO: not occurring

NE: not estimated

2.2.19 Austrian Air Emissions Inventory – Polychlorinated dibenzo(p)dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)

In 1985 national total dioxin/furan emissions amounted to about 187 g and in 1990 they amounted to about 160 g; emissions have decreased steadily and by the year 2009 emissions were reduced by about 80% (to 36 g in 2009).

In 1985 the main sources for dioxin/furan (as I-TEQ) emissions were the NFR-Sectors *Energy* (59%; note: the NFR-code *Energy* includes Energy consumption in industry and energy as well as in the traffic sector) and *Industrial Processes* (especially iron and steel production) (27%). In 2009 the main sector regarding PCDD/F (as I-TEQ) emissions was *Energy* with a share of 92% of the National Total.



Source: UMWELTBUNDESAMT 2011b

Figure 5: Dioxin emission trend per NFR Category 1985–2009 (base year 1985 = 100%) .

2.3 Releases of Hexachlorobenzene (HCB) – Source categories of the Stockholm Convention

Emission factors used by the Austrian Air Emissions Inventory for calculating emissions have been checked and considered appropriate. Minor changes were observed in the source category “Motor vehicles” only.

2.3.1 Motor vehicles, particularly those burning leaded gasoline

2.3.1.1 Activity data – “Road Transportation, Other Mobile Sources and Machinery”

Activity data can be found in chapter 2.2.12.2.

2.3.1.2 Emission factors – NFR-code: “Road Transportation, Other Mobile Sources and Machinery”

The emission factors used in the Austrian air emission inventory are also used for emission projection. These emission factors are based on the study “Österreichische Emissionsinventur für POPs, Forschungsgesellschaft Techn. Umweltschutz GmbH”.

In the next table emission factors for relevant fuels are compiled:

Table 22: Emission factors for road transportation and other mobile sources and machinery (HÜBNER 2001).

Source Category	NFR Code	SNAP Code	Split	Fueltype	EF µg/GJ
Passenger cars (r)	1 A 3 b 1	701	Conventional	Gasoline	5.3
Passenger cars (r)	1 A 3 b 1	701	Catalyst	Gasoline	0.3
Passenger cars (r)	1 A 3 b 1	701	XXX	Diesel	6.4
Passenger cars (r)	1 A 3 b 1	701	XXX	Liquid Biofuels	6.4
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Diesel	6.4
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Gasoline	5.3
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Liquid Biofuels	6.4
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	HDV > 3.5 conv.	Diesel	6.4
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	Buses convent.	Diesel	6.4
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	XXX	Gasoline	5.3
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	XXX	Liquid Biofuels	6.4
Mopeds and Motorcycles < 50 cm3	1 A 3 b 4	704	737	Gasoline	21.0
Mopeds and Motorcycles < 50 cm3	1 A 3 b 4	704	738	Gasoline	2.1
Motorcycles > 50 cm3	1 A 3 b 4	705	XXX	Gasoline	33.0
Military	1 A 5 b	801	XXX	Diesel	6.4
Military	1 A 5 b	801	XXX	Gasoline	0.0
Military	1 A 5 b	801	XXX	Liquid Biofuels	6.4
Shunting locs	1 A 3 c	80201	XXX	Diesel	6.4
Rail-cars	1 A 3 c	80202	XXX	Diesel	6.4
Locomotives	1 A 3 c	80203	XXX	Coal	85.0
Locomotives	1 A 3 c	80203	XXX	Diesel	6.4
Inland waterways	1 A 3 d 2	80303	XXX	Liquid Biofuels	6.4
Personal watercraft	1 A 3 d 2	80303	XXX	Diesel	0.0
Personal watercraft	1 A 3 d 2	80303	XXX	Gasoline	5.3
Inland goods carrying vessels	1 A 3 d 2	80304	XXX	Diesel	6.4
Agriculture	1 A 4 c 2	806	XXX	Diesel	6.4
Agriculture	1 A 4 c 2	806	XXX	Gasoline	5.3
Agriculture	1 A 4 c 2	806	XXX	Liquid Biofuels	6.4
Forestry	1 A 4 c 2	807	XXX	Diesel	6.4
Forestry	1 A 4 c 2	807	XXX	Gasoline	21.0
Forestry	1 A 4 c 2	807	XXX	Liquid Biofuels	6.4
Industry	1 A 2 f 1	808	XXX	Diesel	6.4
Industry	1 A 2 f 1	808	XXX	Gasoline	21.0
Industry	1 A 2 f 1	808	XXX	Liquid Biofuels	6.4
Household and gardening	1 A 4 b 2	809	XXX	Diesel	6.4
Household and gardening	1 A 4 b 2	809	XXX	Gasoline	21.0
Household and gardening	1 A 4 b 2	809	XXX	Liquid Biofuels	6.4

2.3.1.3 Emissions HCB – NFR-code "Road Transportation" and "Other Mobile Sources and Machinery"

Table 23: Emissions of HCB from road transport (UMWELTBUNDESAMT 2011b).

	Emissions 2004		Emissions 2009	
Source category	**(g)**	**(%)**	**(g)**	**(%)**
Passenger cars	91.06	36	64.07	34
thereof Gasoline conventional	*78.25*	*31*	*49.33*	*26*
thereof Diesel (incl. biofuels)	*12.81*	*5*	*14.7*	*8*
Light duty vehicles <3.5 t (r)	23.75	9	13.65	7
Heavy duty vehicles >3.5 t and buses (r)	134.62	54	111.02	58
Mopeds and Motorcycles <50 cm^3	0.08	<1	0.07	<1
Motorcycles >50 cm^3	0.88	<1	1.04	<1
Total	**250.39**	**100**	**189.85**	**100**

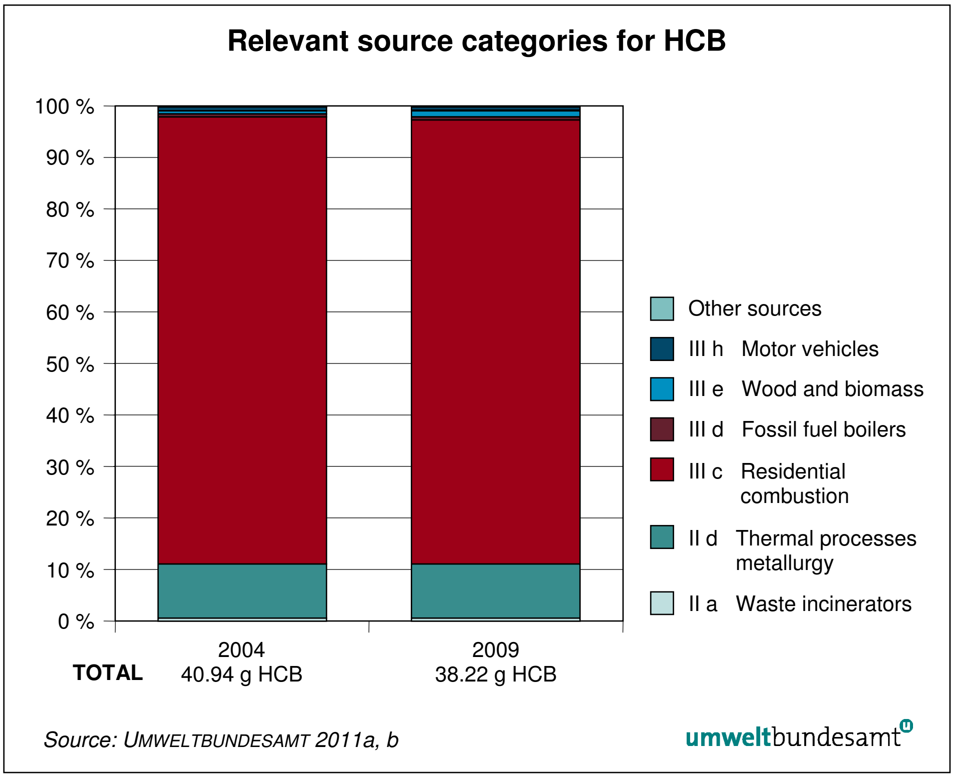
Table 24: Emissions of HCB from other mobile sources and machinery UMWELTBUNDESAMT (2011b)

	Emissions 2004		Emissions 2009	
Source category	**(g)**	**(%)**	**(g)**	**(%)**
Military	0.03	<1	0.03	<1
Railways	2.55	6	2.76	6
Inland Waterways	1.94	5	1.53	3
International Sea Traffic	0.26	1	0.46	1
Agriculture	12.53	31	13.53	27
Forestry	3.02	8	3.28	7
Industry	9.11	23	18.56	37
Household and gardening	10.76	27	9.95	20
Total	**40.20**	**100**	**50.11**	**100**

2.3.2 Summary of Source Categories of the Stockholm Convention: HCB – Releases to Air

In Austria only a few source categories contribute significantly to the total emissions of HCB. Inthe year 2009 a total of 38.2 kg were emitted (Table 25, Table 26 and Figure 6). Residential combustion sources had the lion's share of 86.4% and thermal processes in the metallurgical sector (predominantly sinter plants) had a combined 8.7%. All other sources are below 1%.

Figure 6:
Relevant source categories of HCB.



Source: U*MWELTBUNDESAMT 2011a, b*

*Table 25: HCB emissions in Source Category Part II for 2004 and 2009 (*U*MWELTBUNDESAMT 2011a, b).*

Source Category Part II	2004 [kg HCB]	2009 [kg HCB]
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	0.290	0.247
Cement kilns firing hazardous waste[1]	0.017	0.020
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2]	IE	IE
The following thermal processes in the metallurgical industry		
(i) Secondary copper production	0.091	0.091
(ii) Sinter plants in the iron and steel industry	3.261	2.926
(iii) Secondary aluminium production	0.907	0.907
(iv) Secondary zinc production	NO	NO
Total (Part II)	**4.566**	**4.189**

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here;*
PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.

NO: not occurring

IE: included elsewhere.

Table 26: HCB emissions in Source Category Part III for 2004 and 2009(UMWELTBUNDESAMT 2011a, b).

Source Category Part III	2004 [kg HCB]	2009 [kg HCB]
Open burning of waste, including burning of landfill sites	0.044	0.027
Thermal processes in the metallurgical industry not mentioned in Part II	0.016	0.014
Residential combustion sources	35.515	33.012
Fossil fuel-fired utility and industrial boilers	0.194	0.198
Firing installations for wood and other biomass fuels	0.287	0.511
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA	NA
Crematoria	0.031	0.033
Motor vehicles, particularly those burning leaded gasoline	0.291	0.240
Destruction of animal carcasses	NA	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA	NA
Shredder plants for treatment of end of life vehicles	NE	NE
Smouldering of copper cables	NO	NO
Waste oil refineries	NO	NO
Total (Part III)	**36.377**	**34.035**

NA: not applicable

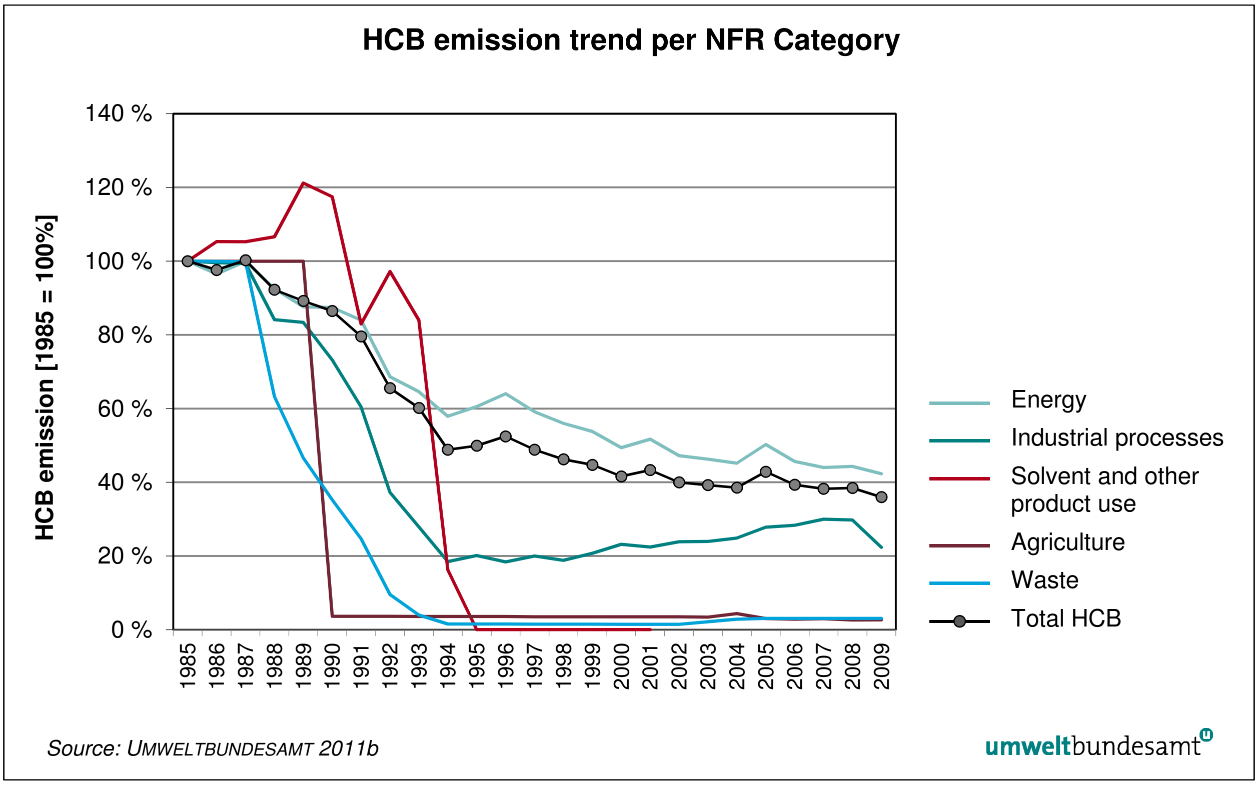
NE: not estimated

NO: not occurring

2.3.3 Austrian Air Emissions Inventory – Hexachlorobenzene (HCB)

In 1985 national total HCB emissions amounted to 106 kg. They decreased to 92 kg in 1990. Emissions have decreased steadily and by the year 2005 emissions were reduced by about 58% (to 38 kg in 2009).

In 1985 the two main sources for HCB emissions were the NFR-sectors Energy (78%; note: the NFR-code *Energy* includes Energy consumption in industry and energy as well as in the traffic sector) and Industrial processes (12%). In 2009 the main NFR-sector for HCB emissions was Energy with a share of 92% of the National Total.



Source: UMWELTBUNDESAMT 2011b

Figure 7: HCB emission trend per NFR Category 1985–2004 (base year 1985 = 100%).

From 1985 to 2009 HCB emissions from the NFR-sectors Waste and Agriculture as well as Solvents and Other Products decreased remarkably by 97% andmore due to stringent legislation and modern technology. HCB emissions from the NFR-sectors Industrial processes decreased until 1994; since then they have been increasing slightly but steadily.

2.4 Releases of polychlorinated biphenyls (PCB) – Source categories of the Stockholm Convention

Due to limited availability of qualified data releases of PCB could not be calculated.

2.5 Releases of polycyclic aromatic hydrocarbons (PAH) – Source categories of the Stockholm Convention

Emission factors used by the Austrian Air Emissions Inventory for calculating emissions have been checked and considered appropriate. Minor changes were observed in the source category “Motor vehicles” only.

2.5.1 Motor vehicles, particularly those burning leaded gasoline

2.5.1.1 Activity data – "Road Transportation, Other Mobile Sources and Machinery"

Activity data can be found in chapter 2.2.12.2.

2.5.1.2 Emission factors – NFR-code: "Road Transportation, Other Mobile Sources and Machinery"

The emission factors used in the Austrian air emission inventory are also used for emission projection. These emission factors are based on a study "Österreichische Emissionsinventur für POPs, Forschungsgesellschaft Techn. Umweltschutz GmbH".

In the next table emission factors for relevant fuels are compiled:

Table 27: Emission factors for Road Transportation and other Mobile Sources and Machinery (HÜBNER 2001).

Source Category	NFR Code	SNAP Code	Split	Fueltype	EF [mg/GJ]
Passenger cars (r)	1 A 3 b 1	701	Conventional	Gasoline	5.3
Passenger cars (r)	1 A 3 b 1	701	Catalyst	Gasoline	0.3
Passenger cars (r)	1 A 3 b 1	701	XXX	Diesel	6.4
Passenger cars (r)	1 A 3 b 1	701	XXX	Liquid Biofuels	6.4
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Diesel	6.4
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Gasoline	5.3
Light duty vehicles < 3.5 t (r)	1 A 3 b 2	702	XXX	Liquid Biofuels	6.4
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	HDV > 3.5 conv.	Diesel	6.4
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	Buses convent.	Diesel	6.4
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	XXX	Gasoline	5.3
Heavy duty vehicles > 3.5 t and buses (r)	1 A 3 b 3	703	XXX	Liquid Biofuels	6.4
Mopeds and Motorcycles < 50 cm^3	1 A 3 b 4	704	737	Gasoline	21.0
Mopeds and Motorcycles < 50 cm^3	1 A 3 b 4	704	738	Gasoline	2.1
Motorcycles > 50 cm^3	1 A 3 b 4	705	XXX	Gasoline	33.0
Military	1 A 5 b	801	XXX	Diesel	6.4
Military	1 A 5 b	801	XXX	Gasoline	0.0
Military	1 A 5 b	801	XXX	Liquid Biofuels	6.4
Shunting locs	1 A 3 c	80201	XXX	Diesel	6.4
Rail-cars	1 A 3 c	80202	XXX	Diesel	6.4
Locomotives	1 A 3 c	80203	XXX	Coal	85.0
Locomotives	1 A 3 c	80203	XXX	Diesel	6.4
Inland waterways	1 A 3 d 2	80303	XXX	Liquid Biofuels	6.4
Personal watercraft	1 A 3 d 2	80303	XXX	Diesel	0.0
Personal watercraft	1 A 3 d 2	80303	XXX	Gasoline	5.3

Source Category	NFR Code	SNAP Code	Split	Fueltype	EF [mg/GJ]
Inland goods carrying vessels	1 A 3 d 2	80304	XXX	Diesel	6.4
Agriculture	1 A 4 c 2	806	XXX	Diesel	6.4
Agriculture	1 A 4 c 2	806	XXX	Gasoline	5.3
Agriculture	1 A 4 c 2	806	XXX	Liquid Biofuels	6.4
Forestry	1 A 4 c 2	807	XXX	Diesel	6.4
Forestry	1 A 4 c 2	807	XXX	Gasoline	21.0
Forestry	1 A 4 c 2	807	XXX	Liquid Biofuels	6.4
Industry	1 A 2 f 1	808	XXX	Diesel	6.4
Industry	1 A 2 f 1	808	XXX	Gasoline	21.0
Industry	1 A 2 f 1	808	XXX	Liquid Biofuels	6.4
Household and gardening	1 A 4 b 2	809	XXX	Diesel	6.4
Household and gardening	1 A 4 b 2	809	XXX	Gasoline	21.0
Household and gardening	1 A 4 b 2	809	XXX	Liquid Biofuels	6.4

2.5.1.3 Emissions PAH – NFR-code "Road Transportation" and "Other Mobile Sources and Machinery"

Table 28: Emissions of PAH from Road Transport (UMWELTBUNDESAMT 2011b).

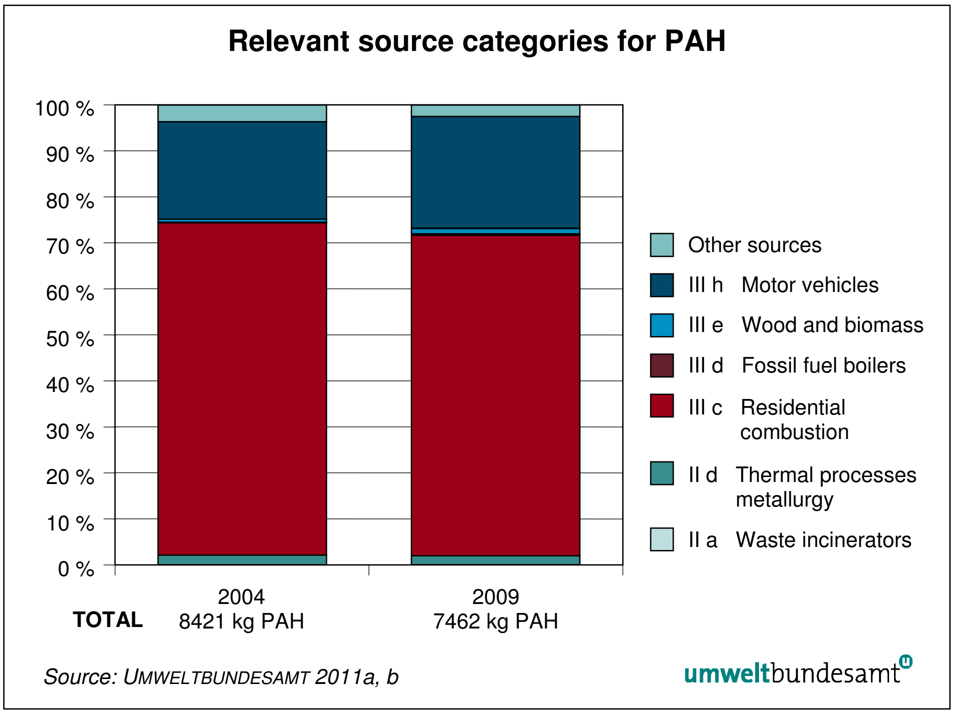
Source category	2004	%	2009	%
Passenger cars	644.74	29	714.33	31
thereof Gasoline conventional	*59.30*	*3*	*40.61*	*2*
thereof Diesel (incl. biofuels)	*585.43*	*26*	*599.16*	*29*
Light duty vehicles <3.5 t (r)	147.55	7	161.56	7
Heavy duty vehicles >3.5 t and buses (r)	765.66	34	640.51	28
Mopeds and Motorcycles <50 cm^3	2.17	0	1.57	0
Motorcycles >50 cm^3	47.05	2	55.60	2
Emissions [kg]	**1607.17**	**100**	**1573.57**	**100**

Table 29: Emissions of PAH from Other Mobile Sources and Machinery (UMWELTBUNDESAMT 2011b).

Source category	2004	%	2009	%
Military	0.2	0	0.2	0
Railways	12.6	7	14.3	6
Inland Waterways	5.2	3	3.2	1
International Sea Traffic	1.5	1	2.67	1
Agriculture	61.7	36	67.8	30
Forestry	10.6	6	12.1	5
Industry	51.0	30	105.7	46
Household and gardening	27.8	16	26.1	11
Emissions [kg]	**170.71**	**100**	**232.01**	**100**

2.5.2 Summary of Source Categories of the Stockholm Convention: PAHs – Releases to Air

In the year 2009 7,462 kg PAH were emitted in Austria. PAH emissions are mainly caused by two source categories (Figure 8, Table 30 and Figure 9). Residential combustion sources accounted for the lion's share of 69.7% and mobile vehicles for a share of 24.2%. Other notable sources were open burning of waste (2.5%) and sinter plants (1.9%).



Source: UMWELTBUNDESAMT 2011a, b

Figure 8: Relevant source categories for PAH.

Table 30: PAH emissions in Source Category Part II for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source Category Part II	2004 [kg PAH]	2009 [kg PAH]
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	24.1	11.5
Cement kilns firing hazardous waste[1]	3.2	3.7
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching[2]	IE	IE
The following thermal processes in the metallurgical industry		
(i) Secondary copper production	NE	NE
(ii) Sinter plants in the iron and steel industry	156.5	140.9
(iii) Secondary aluminium production	NE	NE
(iv) Secondary zinc production	NO	NO
Total (Part II)	**183.8**	**156.1**

[1] *figures represent total emissions from cement kilns*

[2] *only process emissions are covered here; PCDD/F emissions from combustion processes are included in fossil fuel fired utility and industrial boilers and in firing installations for wood and other biomass fuels.*

NO: not occurring; NE: not estimated; IE: included elsewhere.

Table 31: PAH emissions in Source Category Part III for 2004 and 2009 (UMWELTBUNDESAMT 2011a, b).

Source Category Part III	2004 [kg PAH]	2009 [kg PAH]
Open burning of waste, including burning of landfill sites	304.1	183.5
Thermal processes in the metallurgical industry not mentioned in Part II	2.9	2.8
Residential combustion sources	6 080.0	5 198.3
Fossil fuel-fired utility and industrial boilers	16.5	27.1
Firing installations for wood and other biomass fuels	47.0	89.1
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA	NA
Crematoria	<0.1	<0.0
Motor vehicles, particularly those burning leaded gasoline	1 777.9	1 805.6
Destruction of animal carcasses	NA	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA	NA
Shredder plants for treatment of end of life vehicles	NE	NE
Smouldering of copper cables	NO	NO
Waste oil refineries	NO	NO
Total (Part III)	**8 228.3**	**7 306.3**

NA: not applicable

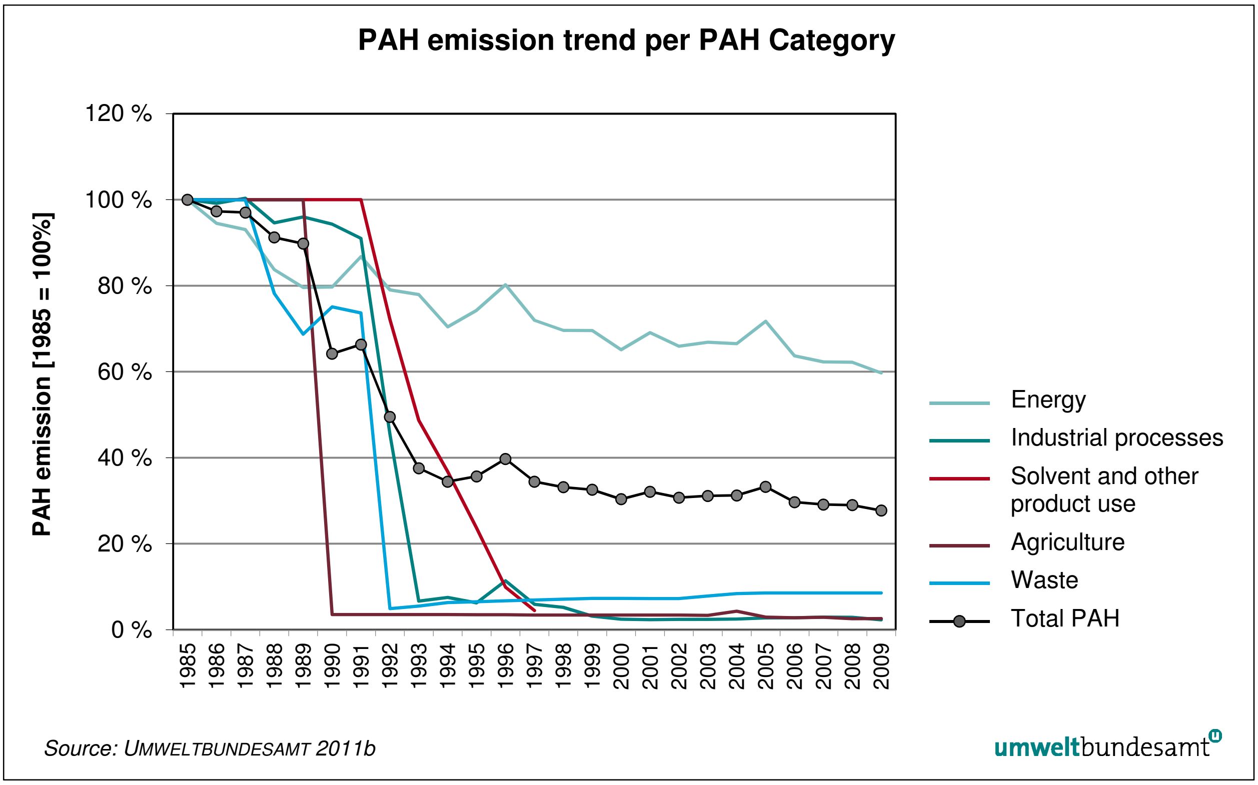
NE: not estimated

NO: not occurring

2.5.3 Austrian Air Emissions Inventory – Polycyclic Aromatic Hydrocarbons (PAH)

In 1985 national total PAH emissions were 27 Mg; they decreased to 17 Mg in 1990; emissions have decreased steadily since then and by the year 2009 emissions had gone down by about 72% (to 7.5 Mg in 2009).

In 1985 the main emission sources for PAH emissions were the NFR-sectors Energy (44%; note: the NFR-code *Energy* includes Energy consumption in industry and energy as well as in the traffic sector), Industrial processes (29%) and Agriculture (26%). In 2009 the main NFR-sector regarding PAH emissions was *Energy* with a share of 95% of the national total. From 1985 to 2009 PAH emissions from Agriculture decreased remarkably by 97% due to a prohibition of open field burning, PAH emissions from the sector Industrial processes decreased by 98% due to the shut down of primary aluminium production plants in Austria, a main source for PAH emissions.



Source: UMWELTBUNDESAMT 2011b

Figure 9: PAH emission trend per NFR Category 1985–2004 (base year 1985 = 100%).

2.6 Releases of Pentachlorobenzene (PeCB) – Source categories of the Stockholm Convention

The most relevant source of PeCB emitted to the environment is caused by unintentional production due to different processes (i.e. municipal solid waste incineration, hazardous waste incineration, power production from coal, domestic burning and waste water treatment which leads to the generation of sewage sludge containing PeCB). Table 32 shows which sectors are considered relevant for the emissions of PeCB and which are considered of low relevance due to the low amounts (BIPRO 2011).

Table 32: Overview on sectors and their relevance for PeCB emissions (BIPRO 2011).

Sector	Considered relevant	Not considered relevant
Municipal solid waste incineration (MSWI) including incineration of biomass	x	
Hazardous waste incineration (HWI)	x	
Power production (coal) including power production in iron and steel industry	x	
Domestic burning	x	
Sewage sludge (waste water treatment)	x	
Chemical industry		x
Non-ferrous metal industry (aluminium, secondary copper, magnesium)		x

2.6.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

Municipal solid waste

Since PeCB is not commercially used anymore within Europe it can be assumed that municipal solid waste (MSW) is not contaminated with PeCB. But due to the heterogeneous composition of municipal solid waste PeCB can be formed unintentionally when municipal solid waste is burned since PeCB is produced whenever organic compounds are burned or exposed to high energy in the presence of a chlorine source (BIPRO 2011).

There exist only few data on PeCB concentrations in the flue gas of municipal waste incineration facilities. Kato and Urano found, that under normal operating conditions PeCB correlated with PCDD/F within a factor of 3 (KATO & URANO 2001). Both authors derived from emission data on 24 municipal solid waste incinerators in Japan an emission factor for PeCB of 7 mg/t. However, other studies found other factors significantly influencing concentration levels in the flue gas such as combustion conditions and fuel composition. Investigations performed between 1983 and 2001 resulted in emission factors in the range of 3–273 mg/t incinerated waste.

REIMANN et al. (2006) measured a value of 750 ng/m^3 PeCB in the flue gas of a municipal waste incineration plant. This value would correspond to an emission factor of 4 mg/t of incinerated waste.

Given the available data it is suggested that, for the purpose of this emission inventory, an emission factor of **4 mg/t of waste** should be used, independent of the source (i.e. household or industrial waste). This emission factor should also be used for sewage sludge.

In 2009, an amount of about 4.9 million t of municipal solid waste was generated in Austria (EUROSTAT 2011), 1.172 million t were incinerated (BMLFUW 2011).

Hazardous waste

For hazardous waste it has been reported that an average of 7 mg PeCB is found in flue gas per tonne HW incinerated (KAUNE et al. 1994).

In 2009, 0.975 million t of hazardous waste were treated (BMLFUW 2011), 0.16 million t were incinerated in 2008 (EUROSTAT 2011). The assumption was made that the same amount of hazardous waste was incinerated in 2009 since there were no significant changes during the last few years.

Sewage sludge

In 2008 an amount of 0.26 million t of sewage sludge was produced in Austria (BMLFUW 2011). Since there were no significant changes in the amounts of sewage sludge generated it is assumed that the same amount was generated in 2009. 7% of the sewage sludge was landfilled, 36% incinerated, 15% applied on land, 19% treated in another way and 23% stored (BMLFUW 2011).

Emission into air caused by the incineration of sewage sludge is calculated by using the emission factor for municipal solid waste (4 mg/t of sewage sludge).

Table 33: PeCB emissions into air from the source category waste incineration (EUROSTAT 2011, BMLFUW 2011; UMWELTBUNDESAMT 2011, own calculation).

	Mio t incinerated 2009	**PeCB Emissions [kg]**
Municipal Solid Waste	1.172	4.69
Hazardous Waste	0.16	1.12
Sewage Sludge	0.09	0.4
Sum		6.21

2.6.2 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron steel industry; secondary aluminum production; secondary zinc production)

In iron and steel industries an amount of 1.69 million t of coal was used in 2009 (STATISTIK AUSTRIA 2010).

In the case of coal combustion, the emission factor available in the literature is 2.5 mg/t of coal (HOGENDOORN et al 2009).

Table 34: PeCB emissions from the source category thermal processes in the metallurgical industry (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Million t incinerated 2009	**PeCB emissions [kg]**
Coal	1.69	4.2

2.6.3 Fossil fuel-fired utility and industrial boilers

In 2009 about 1.2 million t of coal were incinerated in coal fired power plants (STATISTIK AUSTRIA 2010).

In the case of coal combustion, the emission factor which can be found in the literature is 2.5 mg/t of coal (HOGENDOORN et al. 2009).

Table 35: PeCB emissions of the source category fossil fuel-fired utility and industrial boilers (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Million t incinerated 2009	**PeCB emissions [kg]**
Coal	1.2	3.0

2.6.4 Firing installations for wood and other biomass

For biomass incineration, emission data are scarce as well. Zimmermann et al. reported a value of 87 ng/nm^3 (ZIMMERMANN et al. 2001) corresponding to an emission factor of 54 mg/TJ. However, this emission value was obtained under controlled incineration processes in a 1 MW combustion plant to study emission profiles of products of incomplete combustion with shredded waste wood contaminated with plastics and paints as feed materials. Thus this value might not be representative for the incineration of biomass in general.

Table 36: PeCB emissions from the source category firing installations for wood and other biomass (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Incinerated wood 2009 [TJ]	**PeCB emissions [kg]**
Wood	43,857	2.37

2.6.5 Residential combustion sources

Domestic burning of wood, fossil fuels and mixed wastes is private burning in single stoves or open burning places. Domestic burning is associated with higher levels of air emissions as no flue gas treatment is performed. In addition, process conditions can vary strongly due to specific oven characteristics and the properties of the used fuel. As a consequence, measured contamination and emission data as well as derived emission factors, are highly inhomogeneous within a wide range of possible results. In general it can be assumed that the emissions exceed the discharge via residues by far and that burning of treated wood or co-combustion of waste significantly increases formation and discharge of PeCB (BIPRO 2011).

Information about emissions of PeCB from residential combustion is scarce as well. For domestic burning of wood, an emission factor of 1.2 mg/t of wood burned is used (ZIMMERMANN et al.2001).

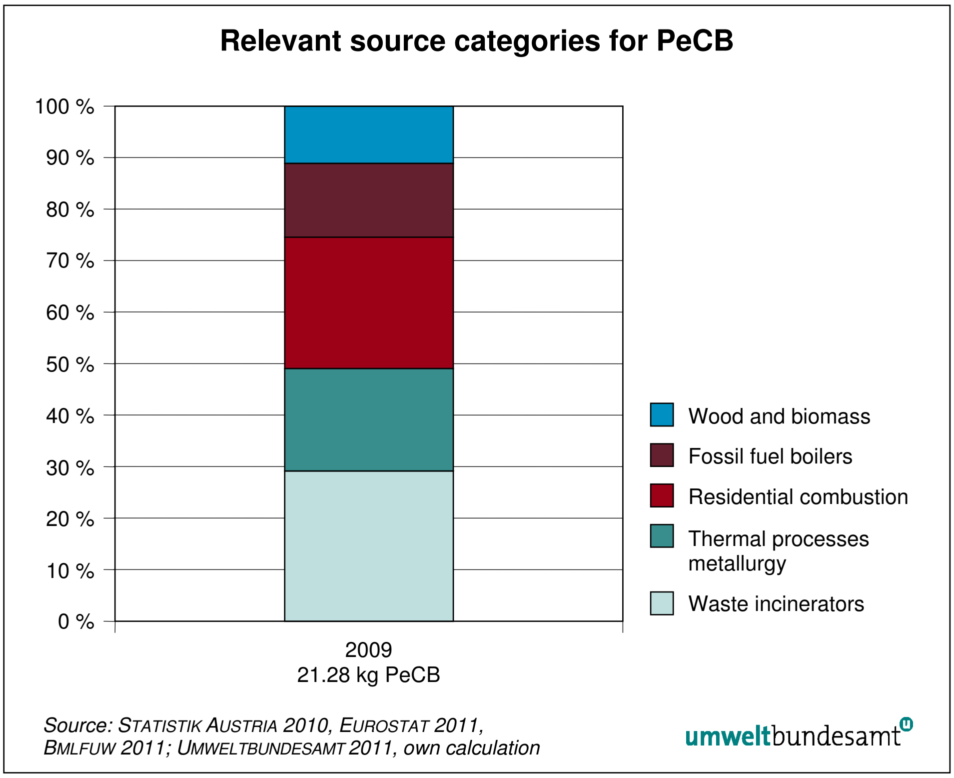
Residential combustion of coal is not considered relevant in Austria since the amounts are low.

Table 37: PeCB emissions from the source category residential combustion (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Incinerated biomass 2009 [million t]	**PeCB emissions [kg]**
Wood	4.6	5.5

2.6.6 Summary of PeCB – Releases to Air from Source Categories of the Stockholm Convention

In the year 2009 a total of 21.28 kg of PeCB were emitted in Austria from the source categories according to the Stockholm Convention.



Source: *Statistik Austria 2010, Eurostat 2011, BMLFUW 2011; Umweltbundesamt 2011, own calculation*

Figure 10: Relevant source categories for PeCB.

Table 38: PeCB emissions from Source Category Part II for 2009 (Statistik Austria 2010, Eurostat 2011, BMLFUW 2011; Umweltbundesamt 2011, own calculation).

Source Category Part II	**2009 [kg PeCB]**
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	6.21
Cement kilns firing hazardous waste	NA
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching	NA
The following thermal processes in the metallurgical industry	
(i) Secondary copper production	NA
(ii) Sinter plants in the iron and steel industry	4.2
(iii) Secondary aluminium production	NA
(iv) Secondary zinc production	NO
Total (Part II)	**10.41**

NO: not occurring

NA: not applicable.

Table 39: PeCB emissions in Source Category Part III for 2009 (STATISTIK AUSTRIA 2010, EUROSTAT 2011, BMLFUW 2011, UMWELTBUNDESAMT 2011, own calculation).

Source Category Part III	**2009 [kg PeCB]**
Open burning of waste, including burning of landfill sites	NA
Thermal processes in the metallurgical industry not mentioned in Part II	NA
Residential combustion sources	5.5
Fossil fuel-fired utility and industrial boilers	3.00
Firing installations for wood and other biomass fuels	2.37
Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil	NA
Crematoria	NA
Motor vehicles, particularly those burning leaded gasoline	NA
Destruction of animal carcasses	NA
Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)	NA
Shredder plants for treatment of end of life vehicles	NA
Smouldering of copper cables	NO
Waste oil refineries	NO
Total (Part III)	10.87

NA: not applicable.

NO: not occurring

3 SOURCE INVENTORY OF POPS RELEASES INTO WATER

For the time being data on sources for POPs releases into water are gathered in two registers in Austria:

In the European Pollutant Release and Transfer Register – PRTR[6] point sources and emissions to water for all POPs are included in principle. In fact for most industrial sectors a reporting obligation to PRTR exists only for facilities exceeding a certain production capacity threshold and for emissions which exceed a pollutant release threshold. For Austria, with its mainly small and medium-sized enterprises and thus lower production capacity thresholds, only some 80 facilities with emissions to water or waste water are listed in the PRTR. In 2007, 2008 and 2009 no emissions of POPs were reported for these facilities. So far no data on diffuse sources of POPs have been available in the PRTR.

In 2009 a national inventory on pollutant emissions to surface waters was established[7]. The national register comprises the emissions of the following point sources: PRTR facilities, urban waste water treatment plants with a capacity from 2000 population equivalents upwards and waste incineration facilities with a capacity of more than 2 tonnes of waste per hour. There is no release threshold for reporting. In practice the lower limit is determined by the limit of quantification of the specified analytical method and the waste water discharge. The first reporting cycle for the data of 2009 covered only basic waste water parameters. The second more comprehensive reporting cycle in 2010 was finalized and partly evaluated in 2011.

Additional information on POPs releases was gathered within a supporting project for the setup of the national emissions inventory in 2007/2008[8]. Some 70 substances were analysed for intake and outlet of 15 urban waste water treatment plants of different capacity, purification technology and waste water composition. The analytical programme comprised the priority substances and certain other substances according to the daughter Directive 2008/105/EC[9] of the Water Framework Directive [10] and pollutants of national relevance regulated in

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[6] Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC, http://prtr.ec.europa.eu/.

[7] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über ein elektronisches Register zur Erfassung aller wesentlichen Belastungen von Oberflächenwasserkörpern durch Emissionen von Stoffen aus Punktquellen (EmRegV-OW), BGBl. II Nr. 29/2009, (Web based inventory, for the time being only with limited access)

[8] Qualitätszielverordnung ChemieOberflächengewässer:Emissionen aus kommunalen Kläranlagen, Endbericht, Umweltbundesamt 2009.

[9] Directive 2008/105/EC of the European Parliament and of the Councilof 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC andamending Directive 2000/60/EC of the European Parliament and of the Council.

[10] Directive 2000/60/ECof the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

the Austrian Ordinance on Quality Standards for Surface Waters[11]. DDT, chlordane, aldrin, dieldrin, endrin, heptachlor, hexachlorobenzene and pentachlorobenzene could not be detected in crude waste water. With the exception of one facility, PAHs were only detectable in crude waste water. Only polybrominated diphenylethers were detectable in effluents in the sub-ng/l range and hexachlorocyclohexane (lindane) in the ng/l range. The use of lindane was allowed for some selected minor applications until 1. January 2008.

3.1.1 Other sources: Contaminated Sites & Persistent Organic Pollutants

The most important problem regarding POPs and especially HCB stems from a contaminated site resulting from the production of chloroalkanes. The production was shut down in 1992. A nearby river has ben affected by the contaminated site via groundwater exchange. Remediation measures to reduce the spreading of contaminants have been under way since 1995.

Other most commonly recognised and wide spread contaminated sites problems correlated to persistent organic pollutants in Austria are old gaswork sites and tar manufacturing facilities. Regarding PCDD/F, HCB and PCB, hardly any data on site pollution or wider environmental impacts is available.

Most gasworks in Austria were shut down during the early 1960ies. Due to the usual practices of operation and closure it is in general likely that severe soil and groundwater contamination exists. Persistent organic pollutants of concern stem from tar oil spills and losses. The main components of tar oils are PAH (~ 85%), heterocyclic PAH (N,S,O-PAH 5 to 13%), phenols (1–10%). The fate and transport of those pollutants in the underground environment is governed by their physical-chemical properties and interactions to a specific geological and hydrogeological situation. According to the available literature and experiences in Austria the environmental impacts of sites contaminated with PAH are generally limited. Especially benzo(a)pyrene and also other regulated PAH substances are to be characterised by hardly any significant volatilisation to soil vapour, only a low solution to groundwater but a strong sorption to the solid phase. Also because of the high retardation of these higher molecular PAHs, reports on travel distances show that pollutant plumes in groundwater are rather short (<100 m) even after several decades. It can be concluded that underground pollution by PAH causes in general only local impacts to soil and groundwater. Nevertheless, it must be recognised that, depending on the site-specific situation and where sensitive land uses are concerned, risks to human health or to ecosystems need to be analysed.

Investigations at a coking plant near the Danube proved that major local groundwater damage exists, which for already more than 60 years provides a continuous PAH-input in the order of 0.2 kg per day.Although the water quality of the Danube meets the respective environmental target criteria for PAH, a remediation project to reduce groundwater pollution and thereby PAH inputs to the Danube is under preparation.

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[11] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt undWasserwirtschaft über die Festlegung des Zielzustandes für Oberflächengewässer (Qualitätszielverordnung Chemie Oberflächengewässer – QZV Chemie OG), BGBl. II Nr. 96/2006 i.d.F. BGBl. II Nr. 461/2010.

Whereas underground pollution by PAH is a well known problem the available information on sites contaminated by PCDD/F, HCB and PCB is scarce. As for the sites recorded in the register of polluted sites (www.umweltbundesamt.at/prtr) the share of such sites can be estimated as being rather low (<5%). Referring to the experiences regarding fate and transport of PAH in the underground environment and given the physical-chemical properties of PCDD/F, HCB or PCB wider environmental impacts seem to be unlikely in general, but may appear in the presence of sensitive land use patterns in the surroundings of a specific site.

As for old municipal landfill sites, where it is likely that ashes and slags have been disposed of, there are hardly any data on PCDD/F, HCB and PCB. Regarding PAHs, which might be addressed as an ‘indicator’ for POPs, the available data do not show significant loads in percolating water or groundwater. Apart from old landfill sites which were built before 1997, there is no information available on new landfills in compliance with the Landfill Ordinance.

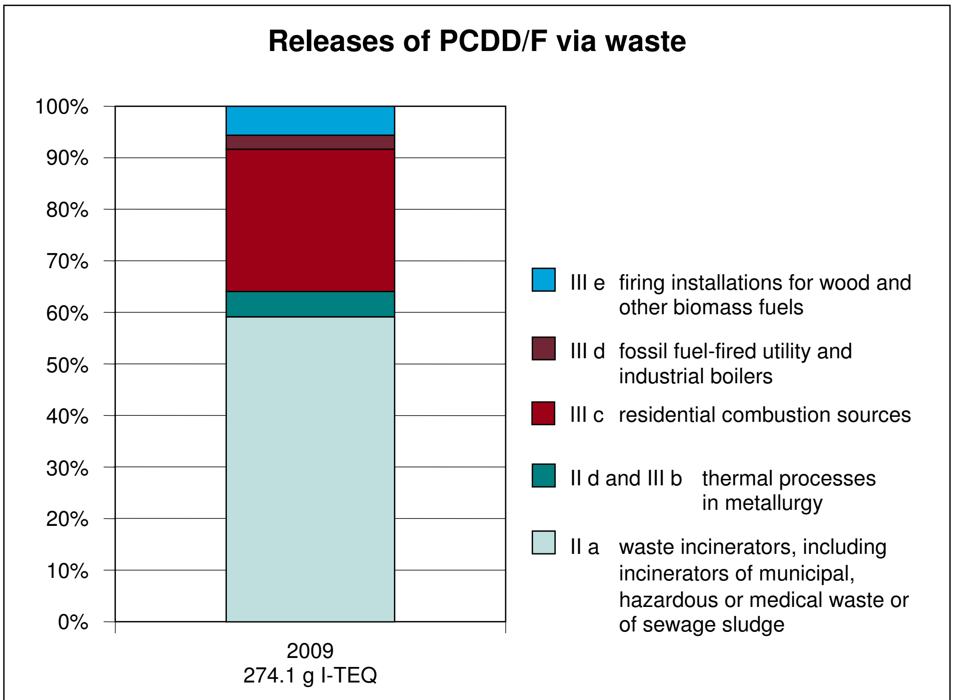
4 SOURCE INVENTORY OF POPS RELEASES VIA WASTE

With regard to waste an estimation of releases can be done for PCDD/F and PeCB. In the case of the other POPs qualified data are not available.

4.1 Releases of Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)

Figure 11 gives an overview of the contribution of the source categories to PCDD/F emissions via waste. In the year 2009 a total of 274.1 g I-TEQ were emitted, which is approximately seven times as much as the emissions to air (see 2.2.18). Solid waste from waste incineration contributes most (59%) to the overall releases. Waste from residential sources also presents a significant release (28%). Other releases come from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion.

Figure 11: Releases (although hardly bio-available) of PCDD/F via waste (own calculation).



Source: UMWELTBUNDESAMT 2011

Note: Total releases may be higher since for many source categories (e.g. the metallurgical sector) which have the potential of POPs releases via waste qualified emission factors are not available.

4.1.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

Table 40 gives an estimation of PCDD/F releases via waste. Concentrations as well as loads are considerably high and follow an upward trend. However, it must be statedthat all waste streams resulting from waste incineration are sent to landfills (mass waste, residual waste, underground disposal) and in case provided they are properly designed and operated, these landfills no longer present a risk for the environment.

Table 40: Estimation of PCDD/F releases via waste from waste incineration (municipal solid waste, hazardous waste, medical waste; own calculation).

	PCDD/F		
Type of Waste	**Average concentration (µg/kg)**	**Total mass 2004 (g/a)**	**Total mass 2009 (g/a)**
Bottom Ash	0.046	11.4	15.04
Fly Ash	2.95	138.29	140.24
Filtercake	4.0	6.68	6.77
Total		**156.37**	**162.05**

4.1.2 Secondary aluminium production

Wastes/residues from secondary aluminium production are salt slag, filter dust, furnace linings and drosses/skimmings (UMWELTBUNDESAMT 2000).

The following table gives an overview of wastes/residues arising from secondary aluminum production, as well as their treatment and disposal.

Estimated releases using the reported values of "Stand der Technik in der Sekundäraluminiumerzeugung im Hinblick auf die IPPC-Richtlinie" (UMWELTBUNDESAMT 2000) and the BREF "Non Ferrous Metals Industries" (EUROPEAN COMMISSION 2001) are given in the next table:

Table 41: Estimation of PCDD/F releases via wastes/ residues arising from secondary aluminum production (UMWELTBUNDESAMT 2000).

Waste/Residue	Release (g/a)	Treatment
Filter dust	1.25	Underground disposal, disposal with pre-treatment, partly reconditioned with salt slag, use in steel industry.
Salt slag	0.175	Treatment via dissolution and crystallization technique → reusable substances Al-granulate, mixed salt, non metallic products. Also other treatment techniques are used which are not state of the art.
Furnace lining	No data available	Leaching and landfill, potential for reconditioning with skimmings
Drosses/skimmings	No data available	Recovery

Table 42: Composition of salt slag (UMWELTBUNDESAMT 2000).

Pollutant	Typical value	Range
PCDD/F	5 ng/kg	2–20 ng/kg

Table 43: Composition of filter dust (UMWELTBUNDESAMT 2000).

Pollutant	Typical value	Range
PCDD/F	5 µg/kg	3–10 µg/kg

No new values for the year 2009 were calculated or estimated.

4.1.3 Secondary copper production

In Austria there is one secondary copper plant in operation which produces approximately 74,000 t of copper-cathodes and 100,000 t of bolts per year (UMWELTBUNDESAMT 2004). Wastes/residues from the secondary copper plant are given in the table below. Releases in g/a could not be estimated due to a lack of data.

Table 44: PCDD/F releases via wastes/residues arising from secondary copper production (UMWELTBUNDESAMT 1999b).

Residue	Treatment
Filter dust from the shaft furnace	Exported
Filter dust from the converter	exported
Filter dust from the anode furnace	Use in shaft furnace
Furnace linings	Use in furnace
Slag from the shaft furnace	Construction material
Slag from the converter	Use in shaft furnace
Slag from the anode furnace	Use in shaft furnace

4.1.4 Secondary lead production

The only secondary lead plant in Austria produces approximately 23,000 t lead/a. Residues/wastes from the secondary lead plant are given below (UMWELTBUNDESAMT 2004). Releases in g/a could not be estimated due to a lack of data.

Table 45: PCDD/F releases via wastes/residues arising from secondary lead production (UMWELTBUNDESAMT 2004).

Residue	Treatment
Filter dust	Reuse in furnace
Furnace linings	Landfill
Slag	Landfill

4.1.5 Thermal processes in the metallurgical industry

PCDD/F releases are summarised in Table 46:

Table 46: PCDD/F releases via waste from thermal processes in the metallurgical industry (own calculation).

Residue	Release (g/a)
Sinter plant – residue from flue gas cleaning	n.a.
Electric arc furnace – slag	0.08
Electric arc furnace – residue from flue gas cleaning	9.78
Ferrous metal foundries – residue from flue gas cleaning	1.90
Ferrous metal foundries – sand	0.10
Total	**11.86**

No new values for the year 2009 were calculated or estimated. As regards the sinter plant residues from flue gas cleaning, a release of 2.0 g/a has been reported from the larger plant (ENVIRONMENTAL IMPACT STATEMENT 2006, ENVIRONMENTAL IMPACT ASSESSMENT 2004). However, the fine scrubber, which had been installed at the larger plant, was replaced by a fabric filter in 2007. There are no values available for the fabric filter.

4.1.6 Residential combustion sources

The Dioxin Toolkit reports concentrations of PCDD/F in the ash of 10 µg/kg ash for clean biomass and 1,000 µg/kg ash for contaminated biomass, respectively. Both values seem to be unreasonably high (UNEP 2005).

Another study (UMWELTBUNDESAMT 2002) gives emission factors based on the fuel input for chimney soot of 5 ng/kg fuel (coal) and 1 ng/kg fuel in the case of biomass combustion. According to this study, releases via bottom ash are below 1 ng/kg combusted fuel (both for biomass and coal).

BIPRO based their calculations on average values of 0.11 µg/kg (ash from wood combustion) and 0.056 µg/kg (ash from coal combustion). As regards chimney soot BIPRO uses values of 6.15 µg/kg (coal) and 3.19 µg/kg (wood) (BIPRO 2005).

In the field tests described in (UMWELTBUNDESAMT 2002) untreated beech wood was used, whereas the value used by (BIPRO 2005) includes all kind of treated and untreated wood.

The ash content of biomass is in the range of 1% (wood) and 5% (bark). Normally, only bottom ash accumulates in residential plants.

Estimated releases based on reported values are given in the next table:

Table 47: Calculation of PCDD/F releases via waste based on available literature (UMWELTBUNDESAMT 2002, BIPRO 2005, own calculation).

Residue	Release (g/a)	Treatment
Bottom ash from biomass combustion	0.1–6.98[1]	Disposal with MSW; spreading on land
Bottom ash from coal combustion	0.24–0.589[1]	Disposal with MSW; spreading on land
Chimney soot – wood combustion	6.34–60.69[1]	Disposal with MSW; spreading on land; others?
Chimney soot – coal combustion	1.18–7.25[1]	Disposal with MSW; spreading on land; others?

[1] *Higher value more often supported by data from the literature.*

MSW: municipal solid waste

As can be seen from the results given in the table above, the calculation of releases via waste from residential combustion sources is associated with great uncertainties. The reasons for these uncertainties are (among others) a wide variety of types (including some types of waste) and quality of fuels used (e.g. water content, ash content, calorific value, chlorine content), the wide variety of firing systems with different combustion conditions and a wide variety of "local" factors (such as the manual loading of the firing system).

However, these releases are relevant because a certain part of this waste is retransferred to the environment (e.g. when ash is used as "fertiliser" in private gardens).

No new values for the year 2009 were calculated or estimated.

4.1.7 Fossil fuel-fired utility and industrial boilers

Few data are available on POPs concentrations of solid residues/wastes from fossil fuel fired utility and industrial boilers. The Dioxin Toolkit (UNEP 2005) gives a value of 14 µg/TJ for the combustion of coal and a value of 15 µg/TJ for biomass combustion. Concentrations in fly ash from coal combustion range from 0.23–8.7 ng/kg and for bottom ash from 0.02–13.5 ng/kg (UNEP 2005). For the following calculation concentrations of 5 ng/kg (fly ash) and 10 ng/kg (bottom ash) have been used. The total emission factors for coal and lignite combustion reported by BIPRO do not differentiate between fly ash and bottom ash and result in much higher release estimations (see Table 48).

Table 48: Calculation of PCDD/F releases via ashes from coal combustion based on available literature (UNEP 2005, BIPRO 2005, own calculation).

Type of Residue/Waste	Release (g/a)	Treatment
Fly ash (coal combustion)	0.70	Use in cement, brick and construction industry
Bottom ash (coal combustion)	0.46	Use in cement, brick and construction industry
All ashes from coal combustion – BIPRO	3.00	Use in cement, brick and construction industry
Ashes from lignite – BIPRO (other data not available)	3.52	Backfilling of coal mine

Total releases are estimated to be in the range of 1.16 g/a (UNEP 2005) and 6.62 g/a (BIPRO 2005).

No new values for the year 2009 were calculated or estimated.

4.1.8 Firing installations for wood and other biomass fuels

For biomass combustion a wide range of emission factors are reported:

- UNEP (2005): Fly ash: 30–23,300 ng/kg; bottom ash: 30–3,000 ng/kg
- BIPRO (2005): all ashes: 1,135 µg/kg
- UMWELTBUNDESAMT (2002): 0.03 µg/kg (both for fly ash and bottom ash)

The results (using the concentration figures described) are presented in the table below:

Table 49: Calculation of PCDD/F releases via ashes from biomass combustion based on available literature (UNEP 2005, BIPRO 2005, UMWELTBUNDESAMT 2002, own calculation).

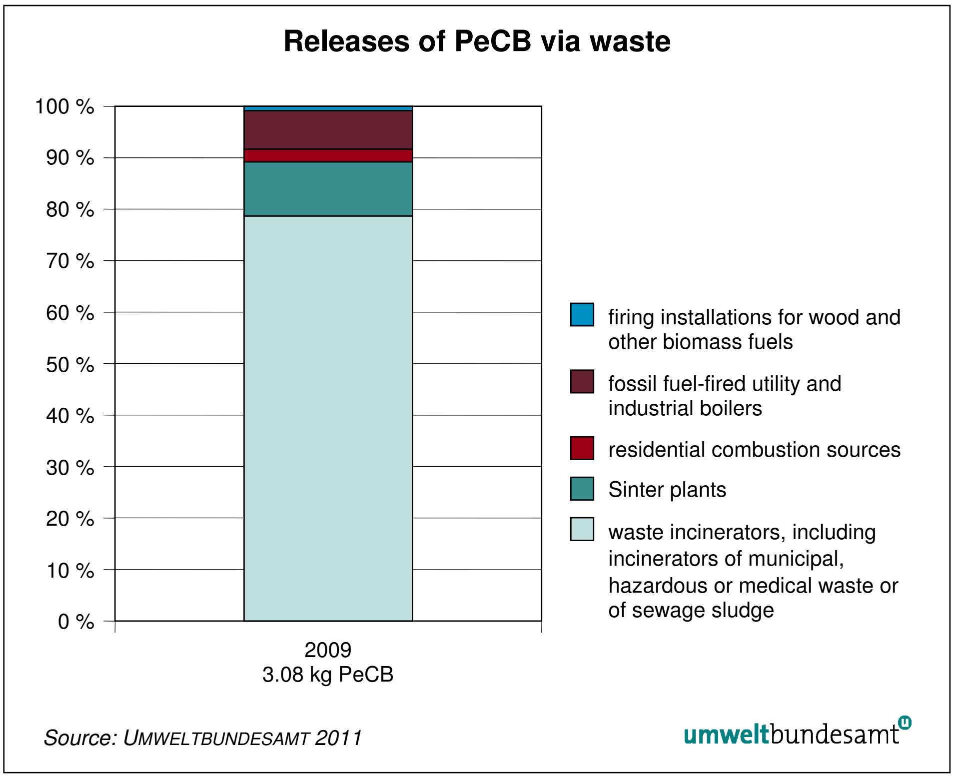
Type of Residue/Waste	Release (g/a)	Treatment
Fly ash (conc: 0.03 µg/kg)	0.67	Landfill
Bottom ash (conc: 0.03 µg/kg)	2.67	Application on land; composting
Ashes from Biomass combustion (conc: 0.11 µg/kg)	12.21	Fly ash: landfilled; bottom ash: use as composting agent

These releases are potentially relevant because some part of bottom ash is used as composting agent and applied on soil.

No new values for the year 2009 were calculated or estimated.

4.2 Releases of Pentachlorobenzene (PeCB)

Table 50 and Figure 12 give an overview of the contribution of the source categories to PeCB emissions to waste. In the year 2009 a total of 3.08 kg PeCB was emitted, which is approximately seven times less than the emissions to air (see 2.6.6). Solid waste from waste incineration contributes most (81%) to the overall releases. Other releases come from thermal processes in the metallurgical sector and from fossil fuel and biomass combustion. However, it should be mentioned that the availability of data was scarce.



Source: UMWELTBUNDESAMT 2011

Figure 12: Releases of PeCB via waste (own calculation).

Table 50: PeCB discharge into waste in 2009 (own calculation).

Source Category	2009 [kg PeCB]
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	2.42
The following thermal processes in the metallurgical industry	
(ii) Sinter plants in the iron and steel industry	0.33
Residential combustion sources	0.07
Fossil fuel-fired utility and industrial boilers	0.23
Firing installations for wood and other biomass fuels	0.03
Total	**3.08**

4.2.1 Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge

Solid waste from waste incineration contributes most to the overall releases.

Significant amounts of PeCB have been found in fly-ash samples. Korenkova et al. reported that PeCB concentrations in a fly-ash sample taken from an Italian municipal solid waste incinerator amounted to 31 ng/g of fly-ash (IPEN 2007); in Norway fly-ash samples from a municipal solid waste incinerator contained 50 ng/g (VIAU et al. 1983), in the UK 11.5 ng/g (BALAMPANIS et al. 2010), in Sweden 240 ng/g (ÖBERG et al. 2007) and in Germany 39.6 ng/g (SCHREINER et al. 1986). An average contamination factor of 74.4 ng PeCB/g fly ash has been used for the calculation of the mass flows (BIPRO 2011).

Through incineration of municipal waste, residues amounting to 37.75 kg/t are generated. Of these, 22.25 kg/t are fly ash and filter dust and 15.5 kg/t are remaining ACP residues (BIPRO 2011).

As regards the hazardous waste reported PeCB values in fly ash amount to an average of 9.57 ng PeCB/g fly ash (SCHREINER et al. 1986). It has been assumed that the amount of fly ash and filter dust generated is the same as for municipal waste (22.25 kg/t MW incinerated).

Sewage sludge

As PeCB tends to adsorb on particles, a relevant share of the PeCB content of waste water accumulates in sewage sludge during waste water treatment.

In terms of PeCB contamination data on sewage sludge, a median of 4.85 mg PeCB/t sewage sludge has been used according to a study of Wang et al. for sewage sludge samples analysed in the UK (WANG et al. 1994).

In 2008 an amount of 0.26 million t of sewage sludge was produced in Austria (BMLFUW 2011). Since this amount has not changed significantly in the last few years, it has been assumed that in 2009 the same amount of sewage sludge was generated. The PeCB content of this amount is 1.26 kg/a.

7% of sewage sludge was landfilled, 36% incinerated, 15% applied on land, 19% treated in another way and 23% was stored (BMLFUW 2011).

The following table shows the amounts PeCB in fly ash and filter dust:

Table 51: PeCB-discharge via waste (fly ash and filter dust) for the source category Waste Incineration (BMLFUW 2011, UMWELTBUNDESAMT 2011, own calculation).

	Incinerated waste 2009 [Million t]	PeCB Emissions [kg]
Municipal Solid Waste	1.172	1.94
Hazardous Waste	0.16	0.03
Sewage Sludge	0.09	0.45
Sum		**2.42**

4.2.2 Thermal processes in the metallurgical industry (secondary copper production; sinter plants in the iron steel industry; secondary aluminium production; secondary zinc production)

Compared to incineration and combustion processes, industrial processes, where PeCB can be produced as a by-product are of comparatively low relevance. Nevertheless, it should be mentioned that most industrial processes use incineration or combustion processes, e.g. the industrial production of steel and iron, which according to Eurostat data uses more than 50% of the coal finally consumed within Europe (BIPRO 2011).

In iron and steel mills an amount of 1.69 million t of coal was used in 2009 (STATISTIK AUSTRIA 2010).

Contamination values for fly ashes from coal incineration range from 0.0004 to 7.0 ng/g. The PeCB flow is calculated on the basis of an estimated average of 2.40 ng/g (SCHREINER et al.1986; BIPRO 2011).

The available data and assumptions allow an estimation of PeCB emissions to solid residues (general estimation for ashes: bottom ash, fluidised bed ash, fly ash including FGT residues) resulting from power production from coal. An average of 80 kg ash (no differentiation of ashes) per tonne solid fuel has been taken as the basis for the calculation of the PeCB flow into waste (BIPRO 2011).

Table 52: PeCB discharge to waste of iron and steel mills (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Incinerated Coal [Million t]	PeCB Emissions [kg]
Coal	1.69	0.33

4.2.3 Residential combustion sources

For wood, the waste generation factor amounts to 0.017 t ash/t wood and 0.0003 t soot/t wood. A contamination factor of 0.2 ng/g for the resulting ash has been used according to Schreiner et al. (SCHREINER et al. 1986). No information has been available on the PeCB contamination in soot. Since the generation factor of soot for wood is relatively small, it is considered as insignificant (BIPRO 2005).

The available data and assumptions allow an estimation of PeCB discharge to ashes:

Table 53: PeCB discharge to waste (ash) of residential combustion (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011; own calculation).

	Incinerated wood 2009 [Million t]	**PeCB Emissions [kg]**
Wood	4.6	0.07

4.2.4 Fossil fuel-fired utility and industrial boilers

The available data and assumptions allow an estimation of PeCB concentrations in solid residues (general estimation for ashes: bottom ash, fluidised bed ash, fly ash including FGT residues) resulting from power production from coal.

An average of 80 kg of ash (no differentiation of ashes) per tone of solid fuel has been taken as the basis for the calculation of the PeCB flow into waste (BIPRO 2011).

Contamination values for fly ashes from coal incineration range from 0.0004 to 7.0 ng/g. The PeCB flow is calculated on the basis of an estimated average of 2.40 ng/g (SCHREINER et al.1986; BIPRO 2011).

In 2009 about 1.2 million t were incinerated in coal fired power plants (STATISTIK AUSTRIA 2010).

Table 54: PeCB discharge to waste of power plants, 2009 (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Incinerated coal [Million t]	**PeCB Emissions [kg]**
Coal	1.2	0.23

4.2.5 Firing installations for wood and other biomass fuels

For wood, the waste generation factor amounts to 0.017 t ash/t wood and 0.0003 t soot/t wood. A contamination factor of 0.2 ng/g for the resulting ash has been used according to Schreiner et al. (SCHREINER et al. 1986). No information was available on PeCB contamination of soot.

The available data and assumptions allow an estimation of PeCB discharge to ashes.

Table 55: Emissions to ashes from Incinerated wood, source category firing installations for wood and other biomass fuels, 2009 (STATISTIK AUSTRIA 2010, UMWELTBUNDESAMT 2011, own calculation).

	Incinerated wood 2009 [Million t]	**PeCB Emissions [kg]**
Wood	1.6	0.03

5 SOURCE INVENTORY OF POPS RELEASES VIA PRODUCTS

Action in relation to POPs in products stems from Annex C Part V A (g) of the Convention (“minimization of these chemicals as contaminants in products”). Some data can be found in the literature relating to concentrations of PCDD/F in the sold products cement and pulp and paper (KARSTENSEN 2006, UNEP 2005, GRUBER 1996). Concerning the other POPs described in this report there are no proven data available.

However, for most source categories there are no relevant releases via the product.

Table 56: PCDD/F-Releases via the products cement and pulp and paper – calculations were based on data from literature (KARSTENSEN 2006, UNEP 2005, GRUBER 1996).

	Release (g I-TEQ/a)
Cement	4.02
Paper	4.98
Pulp exported[1)]	0.123

[1)] *Releases via pulp occur only via export; Releases via pulp which is not exported is included in the figure for paper.*

The PCDD/F-releases via the products cement and pulp and paper in 2009 were the same as in 2004 since there were no significant changes in production.

Concentrations of PCDD/F in cement are considered to be low and can be explained by the fact that filter dust from the clinker process (average PCDD/F concentration: 6.7 ng I-TEQ/kg) is added to the product and that secondary raw materials (e.g. fly ash, gypsum from flue gas desulphurisation) are used. On the other hand the cement clinker itself is contaminated with low concentrations of PCDD/F (average: 0.9 ng I-TEQ/kg clinker) (KARSTENSEN 2006).

Here again, it should be mentioned that the bio-availability of POPs in cement has been greatly reduced.

Austria participates in the revision of the Dioxin Toolkit (UNEP 2005). The current draft states the following: „This section summarizes high-temperature processes in the mineral industry. Raw materials or fuels that contain chlorides may potentially cause the formation of PCDD/PCDF at various steps of the processes, e.g., during the cooling phase of the gases or in the heat zone. Due to the long residence time in kilns and the high temperatures needed for the product, emissions of PCDD/PCDF are generally low in these processes.” Cement kilns firing hazardous waste are a source as mentioned in Annex C Part II (b) of the Convention concerning emissions of PCDD/F, HCB, PAH and PeCB. Therefore the quantification of these POPs in the media as well as residues and products is desirable.

In the case of the pulp and paper production PCDD/F are introduced into the products mainly via bleached (Kraft-)pulp and via recycled papers.

In Austria total pulp production (reference year 2009) amounted to 1,514 kt (2004: 1,509 kt) with bleached sulphite pulp (TCF bleaching) having a share of 24%, bleached Kraft-pulp (ECF-bleaching) 26%, unbleached Kraft-pulp for 32% and textile pulp for 18% (AUSTROPAPIER 2009).

Calculation of releases from pulp was based on emission factors of 0.5 µg/t (bleached Kraft-pulp) and 0.1 µg/t (other pulp) (UNEP 2005). Thus total releases via pulp amounted to 0.28 g in the year 2009.

Relevant raw materials for paper production are pulp (both from national production and from imports), wood pulp and recovered paper (either de-inked or not de-inked).

In addition to the pulp produced in Austria (see above) imported pulp has to be taken into account: In 2009 about 690,000 t of bleached (Kraft-)pulp was imported. Part of the imported pulp came from countries where chlorine is still used as a bleaching agent (AUSTROPAPIER 2009). For the calculation of the PCDD/F content it is assumed that 10% of the imported pulp has an emission factor of 0.5 µg/t, whereas the other imported pulp is less contaminated (0.1 µg/t). This leads to a total import of 0.096 g I-TEQ via pulp. In the year 2009 about 0.123 g I-TEQ were exported via pulp.

Input of PCDD/F via wood pulp has been calculated using an emission factor of 0.1 µg/t (UNEP 2005; total input: 0.044 g I-TEQ).

On the other hand PCDD/F is introduced via the recycled paper and more specific via impurities in the used inks. In case de-inking is applied (about 40% of recovered paper is de-inked in Austria) PCDD/F will be reduced by a factor of 3 (GRUBER 1996). Comparable high concentrations (up to 12 ng/kg) were found in packaging papers and paper board in the early nineties. In general a sharp decline in average concentrations could be observed between 1989 and 1994 whereas concentrations have been decreasing slowly since 1994 (GRUBER 1996).

Based on that information and on data given in the Dioxin Toolkit (UNEP 2005) it has been assumed that the PCDD/F concentration in recovered paper is 3 µg/t (without de-inking) and 0.99 µg/t (with de-inking). These assumptions result in an average emission factor of 2.18 µg/t (averaged over paper which undergoes a de-inking step and which does not). Thus the total release via paper amounts to 4.98 g (reference year: 2004).

Publications in scientific literature give some indication, that waste paper could be contaminated by printing inks containing significant residues of PCDD/F, e.g. through pigments. In 2011 the Environment Agency Austria accomplished a survey assessing the PCDD/F contents of cardboard-boxes which are known to be produced from waste paper as the predominant raw material. Comparing the PCDD/F contents of brand-new non printed cardboard-boxes with used cardboard-boxes imprinted to a large extent this limited study did not show any indication of PCDD/F input via printing inks. The cardboard-box samples analysed in this study showed PCDD/F contents in the range of 1.2 to 1.9 ng TEQ/kg (UMWELTBUNDESAMT 2011c).

In 2010 Austropapier, the Association of the Austrian Paper Industry, submitted new data on PCDD/F contents of selected paper products in order to refine the calculations based on the emissions factors taken from the Dioxin Toolkit (UNEP 2005). Emission factors derived from the new data indicate a reduction of the overall PCDD/F release via paper products by a factor of three. Although there are still certain concerns about the representativeness of the data presented by Austropapier this information will be forwarded to the expert panel of the Dioxin Toolkit to initiate a discussion about a revision of the respective emission factors.

A new calculation was performed in 2011:

Table 57: Releases of PCDD/F via products (calculation on the basis of the output of Austropapier and transmitted results of analysis)

Product	**Production (t/a)**	**Emission factor (µg TEQ/t)**	**Releases (g PCDD/F TEQ/a)**	**Percentage (%)**
Newspaper printing paper	299,205	0.068	0.02	1.2
Printing and writing paper				
● deinked	902,421	0.068	0.06	3.7
● from pulp	1,346,070	0.050	0.07	4.0
Folding box cardboard	487,214	0.723	0.35	21.1
Packaging paper	676,177	1.141	0.77	46.2
Kraft paper				0.0
● with recovered paper	374,855	0.858	0.32	19.3
● only from pulp	250,743	0.050	0.01	0.8
Thin- and special papers				0.0
Sanitary paper	128,660	0.068	0.01	0.5
Others	126,896	0.050	0.01	0.4
Packing and spezial board	13,299	0.858	0.01	0.7
Market pulp exported	95,471	0.070	0.01	0.4
Market pulp (ECF)	313,818	0.090	0.03	1.7
Total	**5,014,829**		**1.67**	**100.0**

6 POLICIES (PROVISIONS) AND MEASURES

This chapter gives an overview of the relevant international, European and national legislation applicable to unintentionally produced POPs. It should be noted that chapter 6 of the National Action Plan 2008 (UMWELTBUNDESAMT 2008b) already contained comprehensive information on policies and measures. Therefore, this review of the National Action Plan only focuses on new developments or amendments of the relevant policies. For more general information please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

6.1 New developments in International and European Legislation since 2008

6.1.1 Stockholm Convention

The Stockholm Convention on POPs was formally adopted on 22–23 May 2001 and entered into force 17 May 2004.

This international regime promotes global action on a cluster of 21 POP substances:

- *Pesticides:* aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene; chlordecone, alpha hexachlorocyclohexane (HCH), beta hexachlorocyclohexane, lindane, pentachlorobenzene;
- *Industrial chemicals:* hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs), hexabromobiphenyl (HBB), tetra-, penta-, hexa-, and heptabromodiphenyl ether (PBDEs), pentachlorobenzene(PeCB), perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride;
- *By-products:* HCB; PCDD/PCDF, PCBs, alpha- and beta-HCH and PeCB.

Releases of unintentionally produced by-products listed in Annex C (dioxins, furans, PCBs, HCB and PeCB) are subject to continuous reduction with the objective to achieve ultimate elimination where feasible. The main tool for this is the National Action Plan which should cover the source inventories and release estimates as well as plans for release reductions.

Under the Stockholm Convention on Persistent Organic Pollutants, Parties shall promote in some cases and prescribe in others the use of best available techniques, and promote the application of best environmental practices. In short, each Party shall:

- Develop, within two years of the date of entry into force of the Convention, an action plan (national or regional) where releases of chemicals listed in Annex C of the Convention are identified, characterized and addressed; the plan shall include source inventories and take into consideration the source categories listed in Parts II and II of Annex C (subparagraph (a) of Article 5);
- For new sources:
  - Promote and, in accordance with the schedule in its action plan, prescribe the use of best available techniques within the source categories identified as warranting such action, with particular initial focus on sources categories identified in Part II of Annex C; the requirement to use best available tech-

  niques for Part II source categories shall be phased in a soon as practicable, but no later than four years after entry into force of the Convention for the Party (subparagraph (d) of Article 5);
  - Promote, for those categories identified above, the use of best environmental practices (subparagraph (d) of Article 5);
  - Promote in accordance with the action plan, best available techniques and best environmental practices within source categories such as those listed in Part III of Annex C which a Party has not addressed above (subparagraph (d) (ii) of Article 5);
- For existing sources:
  - Promote, in accordance with the action plan the use of best available techniques and best environmental practices for source categories listed in Part II of Annex C and such sources as those in Part III of the Annex (subparagraph (d) (i) of Article 5).

Table 58: Source Categories according to Annex C of the Stockholm Convention on POPs.

Part II: Source categories	**Part III: Source categories**
Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge	Open burning of waste, including burning of landfill sites
Cement kilns firing hazardous waste	Thermal processes in the metallurgical industry not mentioned in Part II
Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching	Residential combustion sources
The following thermal processes in the metallurgical industry: (i) Secondary copper production; (ii) Sinter plants in the iron and steel industry; (iii) Secondary aluminium production; (iv) Secondary zinc production	Fossil fuel-fired utility and industrial boilers
	Firing installations for wood and other biomass fuels
	Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil
	Crematoria
	Motor vehicles, particularly those burning leaded gasoline
	Destruction of animal carcasses
	Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)
	Shredder plants for the treatment of end of life vehicles
	Smouldering of coppper cables
	Waste Oil Refineries

When applying best available techniques and best environmental practices for the activities listed above, Parties should take into consideration the general guidance on prevention and release reduction measures in Annex C and guidelines on best available techniques and best environmental practices. These Guidelines were finalised by an international Expert Group in November 2006 and were adopted by the Conference of the Parties (May 2007).

6.1.1.1 EU POP-Regulation

The main legal instrument for implementing the Stockholm Convention and the UNECE Protocol in the EU is the Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and the amending Directives 79/117/EEC[12], 757/2010/EEC and 756/2010/EEC[13].

The Regulation obliges Member States to draw up and maintain comprehensive release inventories for dioxins, furans, PCBs and polyaromatic hydrocarbons (PAH) and to communicate their national action plans on measures to identify, characterise and minimise total releases of these substances to the Commission and to the other Member States. The action plan shall include an evaluation of the efficacy of the laws and policies related to the management of the releases.

The action plan shall also include measures to promote the development of substitute or modified materials, products and processes to prevent the formation and releases of POPs. Producers and holders of waste are obliged to undertake measures to avoid contamination of waste with POP substances. The control measures on waste follow closely those of the Stockholm Convention and provide more details in some aspects.

For detailed information on the POP Regulation please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

Amendment of the POP Regulation

On 26 August 2010, a number of amendments of the EU POP Regulation entered into force.These amendments implement the international agreement reached at the 4th Conference of the Parties (COP) to the Stockholm Convention in 2009, which also entered into force on the same date. The dangerous chemicals newly added to the EU Regulation on POPs have already been subject to prohibition or severe restrictions in the EU. With the new amendments certain restrictions go further than previously in order to comply with the new international commitments.

The new chemicals listed are: 4 types of polybromodiphenyl ether (PBDEs), alpha hexachlorocyclohexane, beta hexachlorocyclohexane, perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride and pentachlorobenzene. The original POPs are mainly pesticides but some of the new substances have been widely used in consumer products, such as perfluorooctane sulfonic acid (PFOS) which is used for example in metal plating and fire fighting foams but also in stain repellents.[14]

New legislation:

Commission Regulation (EU) No 757/2010 of 24 August 2010 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes I and III

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[12] OJ L 229, 29.6.2004, p. 5.

[13] http://ec.europa.eu/environment/pops/index_en.htm

[14] http://ec.europa.eu/environment/pops/index_en.htm

Commission Regulation (EU) No 756/2010 of 24 August 2010 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes IV and V

6.1.2 UNECEConvention on Long-range Transboundary Air Pollution (LRTAP)

Since 1979 the Convention on Long-range Transboundary Air Pollution (LRTAP)[15] has addressed some of the major environmental problems of the UNECE region through scientific collaboration and policy negotiation. The Convention has been extended by eight protocols that identify specific measures to be taken by Parties to cut their emissions of air pollutants.

The aim of the Convention is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Parties develop policies and strategies to combat the discharge of air pollutants through exchange of information, consultation, research and monitoring.

The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs)

The Executive Body to the UNECE (United Nations Economic Commission for Europe) Convention on Long-Range Transboundary Air Pollution (LRTAP) adopted the Protocol on POPs[16] on 24 June 1998 inAarhus, Denmark. The Protocol entered into force on 23 October 2003. By January 2011, 30 Parties, including the European Community, 22 Member States and two Acceding Countries had ratified the Protocol.

The Protocol comprises currently a list of 16 substances including eleven pesticides, two industrial chemicals and three unintentional by-products. The ultimate objective is to eliminate any discharges, emissions and losses of these POP substances.

For detailed information on the POP Protocol please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

On 18 December 2009, Parties to the Protocol on POPs adopted decisions 2009/1, 2009/2 and 2009/3 to amend the Protocol to include seven new substances: hexachlorobutadiene, octabromodiphenyl ether, pentachlorobenzene, pentabromodiphenyl ether, perfluorooctane sulfonates, polychlorinated naphthalenes and short-chain chlorinated paraffins. Furthermore, the Parties revised obligations for DDT, heptachlor, hexachlorobenzene and PCBs as well as emission limit values (ELVs) from waste incineration. Parallel to this, with a view to facilitating the Protocol's ratification by countries with economies in transition, the Parties introduced a certain amount of flexibility for these countries regarding the time frames for the application of ELVs and best available technologies (BAT). Finally, the Parties adopted Decision 2009/4 to update guidance on BAT

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[15] http://www.unece.org/env/lrtap/welcome.html

[16] http://www.unece.org/env/lrtap/pops_h1.htm

for controlling emissions of POPs in Annex V and turned parts of it into a guidance document (ECE/EB.AIR/2009/14). These amendments have not yet entered into force in the countries that adopted them[17].

6.1.3 IPPC-Directive (2008/1/EC) and Directive on Industrial Emissions (2010/75/EU)

The Directive on Integrated Pollution Prevention and Control (IPPC Directive; 96/61/EC codified 2008/1/EC) aims at preventing or at least reducing pollution based on the best available technologies in order to achieve a high level of protection for the environment as a whole.

The IPPC Directive has been under revision since 2007. The new Directive on Industrial Emissions 2010/75/EU (IED) was adopted on 24 November 2010 and published in the Official Journal on 17 December 2010. It entered into force on 6 January 2011 and has to be transposed into national legislation by Member States by 7 January 2013.

Seven Directives have been integrated in the Industrial Emissions Directive (IPPC-Directive, Waste Incineration Directive, Large Combustion Plants Directive, VOC-Directive, three TiO_2-Directives). The IPPC-Directive (2008/1/EC) will be repealed with effect from 7 January 2014.

For detailed information on the IPPC Directive and the original Directives on Waste Incineration and Large Combustion Plants please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

The Directive on Industrial Emissions is like the IPPC Directive based on several principles, namely an integrated approach, best available techniques, flexibility and public participation.

The **integrated approach** means that the permits must take into account the whole environmental performance of the plant, covering e.g. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure. The purpose of the Directive is to ensure a high level of protection of the environment taken as a whole.

The permit conditions of a permit have to include emission limit values (ELVs) for those substances which are likely to be emitted in significant quantities. They must be based on ***Best Available Techniques*** (***BAT***), as defined in the IED. To assist the licensing authorities and companies to determine BAT, the Commission organises an exchange of information between experts from the EU Member States, industry and environmental organisations. This work is co-ordinated by the **European IPPC Bureau** of the Institute for Prospective Technology Studies at the EU Joint Research Centre in Seville (Spain). This results in the adoption and publication by the Commission of the **BAT Reference Documents** (the so-called BREFs).

It must be noted that the types of installations listed in Annex I of the IPPC-Directive do not directly correspond to the source categories of Annex C of the Stockholm Convention. Annex I of the IPPC-Directive gives a list of major indus-

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[17] http://www.unece.org/env/popsxg/welcome.html

trial activities which may give cause to general environmental impacts, whereas Annex C of the Stockholm Convention lists source categories which have the potential to release POPs. Therefore the Stockholm Convention is more specific with regard to pollutants, covering also small scale sources (e.g. residential combustion plants, crematoria, open burning).

The BAT Reference Documents (BREFs) give a detailed overview of what represents Best Available Techniques for the sectors in question together with emission and consumption levels.

Table 59: Type of installations listed in Annex I of the IPPC-Directive.

Name of European BREF	**Corresponding Source category of Stockholm Convention (annex C)**	**BAT associated emission level for PCDD/F**	**BAT associated emission level for PAH**
Waste incineration	II a (Waste incinerators, …) II b (Cement kilns …)	air: 0.01–0.1 ng TEQ/Nm^3 (split view 0.01–0.05) water: 0.01–0.1 ng TEQ/l (split view <0.01)	
Non-Ferrous Metals	II d i (Sec. copper prod.) II d iii (Sec. aluminium prod.) II d iv (Sec. zinc prod.) III b (Thermal processes in metallurgy …)	air: < 0.1–0.5 ng TEQ/Nm^3 **)	air: <200 µgC/Nm^3)*
Iron and Steel	II d ii (Sinter Plants) III b (Thermal processes …)	air: <0.05 – 0.2 ng I-TEQ/Nm^3 (bag-filter); <0.2 – 0.4 ng-ITEQ/Nm^3 (advanced electrostatic precipitator***) EAF: <0.1 ng I-TEQ/Nm^3	
Large Combustion Plants	III e (biomass fuels)	air: < 0.1 ng/Nm^3 **)	
Wastewater and Waste Gas	III f (Specific chemical prod. ...)	air: 0.1 ng TEQ/Nm^3 (combustion exhaust gas treatment)	

* *for the 11 compounds (phenanthrene, anthracene, fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3,-cd)pyrene, benzo(ghi)perylene*

** *BREF is under review, values will change/might be changed*

*** *where bag filters are not applicable*

No specific BREF is available for the source categories III a (Open burning of waste, including burning of landfill sites), III c (Residential combustion sources), III g (Crematoria), III h (Motor vehicles, particularly those burning leaded gasoline), III i (Destruction of animal carcasses), III k (Shredder plants for the treatment of end of life vehicles) and III l (Smouldering of copper cables). For Shredder plants a BREF will have to be written according to Annex I of the new Industrial Emission Directive (2010/75/EU).

On the other hand the relevant BREFs for the source categories II b (Cement kilns firing hazardous waste; BREF "Cement and Lime"), II c (Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching; BREF "Pulp and Paper"), III d (Fossil fuel-fired utility and industrial boilers; BREF LCP), III j (Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction); BREF “Textile Manufacturing”) and III m (Waste oil refineries; BREF “Waste Treatment”) do not define BAT associated emission levels for PCDD/F or PAH.

Large Combustion Plants

The Large Combustion Plants Directive (LCPD, 2001/80/EC) has been integrated in the Industrial Emissions Directive (2010/75/EC). It does not cover POP emission directly. However, it has some effect on emissions of POPs as it sets definition of emission limit values for dust. Some of these values have been made stricter in the IED.

Waste Incineration Plants

The WID has been integrated in the Industrial Emissions Directive (2010/75/EU).**Annex VI of the IED** lists special provisions for cement kilns, combustion plants and for industrial sectors co-incinerating waste. In comparison to the Waste Incineration Directive 2000/76/EC some of the POP relevant air emission limit values for dust have been made stricter. The emission limit values for dioxins and furans have remained the same (0.1 ng/Nm^3) as well as the emission limit values for discharges of waste water from the cleaning of exhaust gases.

6.1.4 Water Framework Directive 2000/60/EC

The Water Framework Directive has three major goals:

- prevent deterioration, enhance and restore bodies of surface water, achieve good chemical and ecological status of such water and reduce pollution from discharges and emissions of **hazardous substances**;
- protect, enhance and restore all bodies of groundwater, prevent the pollution and deterioration of groundwater, and ensure a balance between abstraction and recharge of groundwater;
- preserve protected areas.

The Commission submitted a **list of priority substances** selected amongst those which present a significant risk to or via the aquatic environment (2455/2001 EC). This list forms Annex X to the present Directive. For these priority substances environmental quality standards have been established by Directive 2008/105/EC) and measures to control such substances have to be proposed. The aim of such measures is to reduce, stop or eliminate discharges, emissions and losses of priority substances.

In the list of priority hazardous substances the following POPs are listed as “priority substance” (PS) and some are even identified as “priority hazardous substances” (PHS):

- hexachlorobenzene (PHS)
- polyaromatic hydrocarbons (all PHS) (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene)
- pentachlorobenzene (PHS)

The environmental quality standards for these pollutants as defined in Annex I of Directive 2008/105/EC are summarised below.

Table 60: Environmental quality standards (EQS) as defined in Annex I of directive 2008/105/EC.

Pollutant	**AA-EQS* Inland surface waters**	**AA-EQS* Other surface waters**	**MAC-EQS** Inland surface waters**	**MAC-EQS** Other surface waters**
Hexachlorobenzene	0.01 µg/l	0.01 µg/l	0.05 µg/l	0.05 µg/l
Pentachlorobenzene	0.007 µg/l	0.007 µg/l	Not applicable	Not applicable
Polyaromatic hydrocarbons (PAH)				
Benzo(a)pyrene	0.05 µg/l	0.05 µg/l	0.1 µg/l	0.1 µg/l
Benzo(b)fluoranthene Benzo(k)fluoranthene	Σ=0.03 µg/l	Σ=0.03 µg/l	Not applicable	Not applicable
Benzo(g,h,i)perylene Indeno(1,2,3-cd)-pyrene	Σ=0.002 µg/l	Σ=0.002 µg/l	Not applicable	Not applicable

** AA-EQS … Annual average value for the EQS*

*** MAC-EQS … maximum allowable concentration*

In 2006 the Directive of the European Parliament and of the Council on the Protection of Groundwater against Pollution and Deterioration (2006/118/EC) was adopted. Article 6 describes the measures which shall be established by the Member States in order to achieve the objective of preventing or limiting inputs of pollutants into groundwater.

6.1.5 Air Quality Directive 2008/50/EC (CAFE)

The **Clean Air For Europe (CAFE) Directive** (2008/50/EC) was published in May 2008. It has now entered into force and replaces the Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107EC) will be included in the CAFE legislation at a later stage.

This new Directive includes the following key elements:

- the merging of most of the existing legislation into a single directive (except for the fourth daughter directive) with no change to existing air quality objectives
- new air quality objectives for PM2.5 (fine particles) including the limit value and exposure related objectives – exposure concentration obligation and exposure reduction target
- the possibility to discount natural sources of pollution when assessing compliance against limit values
- the possibility for time extensions of three years (PM10) or up to five years (NO_2, benzene) for complying with limit values, based on conditions and an assessment by the European Commission

Also the new Air Quality Directive does not address POPs directly but might be of relevance as it covers pollutants associated with combustion processes.

The **4th Daughter Directive 2004/107/EC** deals with arsenic, nickel, cadmium, mercury and PAHs[18].

The fourth Daughter Directive specifies limit or target values together with deadlines for meeting these values. In addition obligations are laid down for monitoring these pollutants in ambient air.

POPs are not addressed directly with the exception of PAH. However, as unintentionally produced POPs are mostly formed during combustion processes and emitted into air either in gaseous form or bound to particles, every measure aiming at the reduction of emissions of particulate matter, metals and CO has the co-benefit of reducing POPs emissions. For benzo(a)pyrene a target value of 1 ng/m³ has been laid down in the 4th Daughter Directive. From 2013 onwards this target value shall not be exceeded. Member States shall take all necessary measures not entailing disproportionate costs to ensure this.

6.1.6 Pollutant Release and Transfer Register (PRTR)

Regulation No. 166/2006(EC) of the European Parliament and of the Council of 18 January 2006 provided for the setting up of a Pollutant Release and Transfer Register (PRTR) at European Union (EU) level in the form of a publicly accessible electronic database. This database meets the requirements of the UNECE Protocol on Pollutant Release and Transfer Registers, signed by the Community in May 2003.

The public is able to access this register free of charge on the internet and is able to find information using various search criteria (type of pollutant, geographical location, affected environment, source facility, etc.).

The register contains information on releases of pollutants to air, water and land, as well as transfers of waste and pollutants, where emissions exceed certain threshold values and result from specific activities. The register also covers releases of pollutants from diffuse sources (such as transport). The UN-ECE Protocol and the European PRTR have the same structure as the former EPER (European Pollutant Emission Register) but are more comprehensive as they cover a greater number of pollutants and activities as well as releases to land, releases from diffuse sources and off-site transfers.

Apart from their releases of pollutants to air, water, land and wastewater destined for treatment in external wastewater treatment plants, industrial facilities subject to the IDE regime have to report their transfers of waste if they exceed annual threshold levels as laid down in the Regulation. Reporting obligations include also PeCB (BIPRO 2011).

6.1.7 European Regulations aiming at increased Energy Efficiency

Reduction of energy demand and increase of energy efficiency are indirect but very effective tools to minimise fuel consumption and emissions. On an European level the **Action Plan for Energy Efficiency** (SEC(2006) 1173, 1174,

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[18] Environmental targets were defined for Ni, As, Cd and benzo(a)pyrene.

1175) has been published, which outlines a framework of policies and measures with a view to intensify the process of realising the over 20% estimated savings potential in EU annual primary energy consumption by 2020.

The purpose of the **Directive on Energy end-use efficiency and energy services (2006/32/EC)** is to make the end use of energy more economic and efficient. Indicative targets for the increase of the energy efficiency (9% within nine years; from 2008–2017) are given and Member States are obliged to develop national Energy Action Plans.

Directive **2002/91/EC** on the energy performance of buildings requires Member States to apply minimum requirements as regards the energy performance of new and existing buildings, ensure the certification of their energy performance. It requires the regular inspection of boilers and air conditioning systems in buildings. The four key points of the Directive are:

- a common methodology for calculating the integrated energy performance of buildings;
- minimum standards on the energy performance of new buildings and existing buildings that are subject to major renovation;
- systems for the energy certification of new and existing buildings and, for public buildings, prominent display of this certification and other relevant information. Certificates must be less than five years old;
- regular inspection of boilers and central air-conditioning systems in buildings and in addition an assessment of heating installations in which the boilers are more than 15 years old.

6.1.8 Waste Framework Directive2008/98/EC/EWC

At EU level, the basic legislation with respect to waste management is the Waste Framework Directive 2008/98/EC (replacing and repealing the former Waste Framework Directive 2006/12/EC with effect of 12 December 2010).

The Directive contains definitions for waste as well as waste categories and disposal and recovery operations; inter alia it sets for the first time criteria for end-of-waste-status of items and introduces “reuse” as favorable option within the waste hierarchy.

Furthermore properties and characteristics rendering waste hazardous as well as specific obligations for hazardous wastes are introduced in the new Waste Framework Directive.

PeCBs are addressed in this directive.

6.1.9 Other relevant EU legislation

The following EU Directives or Regulations are potentially relevant for the control of POPs releases:

- Directive of the European Parliament and of the Council on the Protection of Groundwater against Pollution and Deterioration (2006/118/EG)
- Sewage sludge Directive (86/278/EEC)
- Directives concerning Motor Vehicles

- Directive on Waste Electrical and Electronic Equipment (WEEE) 2002/95/EC
- Directive on the landfill of waste (1999/31/EG)
- Council Regulation (EC) No 1013/2006 on the supervision and control of shipments of waste within, into and out of the Community

For detailed information please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

6.2 Developments in National Legislation since 2008

The following legislation has not undergone any changes. Therefore, for detailed information refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

- Emission Protection Act (BGBl. I No. 2004/150 as amended by BGBl. I No. 85/2005, I No. 84/2006, I No. 65/2010 and II No. 153/2011) as well as the Clean Air Ordinance for Steam Boilers (BGBl. No. 1989/19 as amended by BGBl. II 2005/55, II No. 292/2007, II No. 153/2011)
- Industrial Code 1994 (GewO 1994), BGBl. No. 1994/194
- Ordinance on Iron and Steel Production (BGBl. II No. 160/1997 as amended by BGBl. II No. 2007/290)
- Ordinance on Non Ferrous and Refractory Metals Production (BGBl. II No. 2008/39)

6.2.1 Specific Ordinances

6.2.1.1 Ordinance on Combustion Plants (BGBl. No. II 1997/331 as amended by BGBl. No. II 2011/312)

The Ordinance applies to combustion installations >50 kW in the trade and industrial sector that are not connected to a steam boiler. It describes requirements concerning the monitoring of emissions, operating conditions, inspections of installations and emission limit values for certain pollutants depending on the fuels (such as coal, biomass, oil, and gas) used. Emissions of PCDD/F are not regulated directly. However, the ordinance has some effect on emissions of POPs due to the determinationof emission limit values for dust and CO regarding the combustion of gas, oil and coal. In addition to the mentioned pollutants, there is a limit value for organic carbon which applies to the combustion of biomass.

The amendment in 2011 led to some modifications: The emission limit values for dust became more stringent and the ordinance provides for the first time emission limit values for dust, CO, HC, and NO_x for the combustion of biomass other than wood (such as straw or miscanthus).

6.2.1.2 Ordinance on Sinter Plants (BGBl. II No. 1997/163)

The ordinance covers air emissions from sinter plants. For PCDD/F a limit value (0.4 ng/Nm^3) is set (referred to measured oxygen content), however this limit value is not applicable for installations, which are permitted before 01/2004. A revision of this Ordinance started in 2010.

6.2.1.3 Ordinance on Foundries (BGBl. No. 1994/447)

The Ordinance gives limit values (mass flow and/ or concentration) for dust and organic substances for different furnace types (steel and cast iron, aluminium, lead, other metals, heat treatment). Limit values are also given for these pollutants for activities such as sand regeneration, mould production, cleaning and fettling and core production. Some general limit values are given for special organic substances and heavy metals.There is no general reference oxygen content, in most cases the oxygen content of the exhaust gas is chosen as reference value. A revision of the Ordinance started in spring 2011.

6.2.1.4 Waste Incineration Ordinance (BGBl. II No. 2002/389)

The Waste Incineration Ordinance requires waste incineration and co-incineration plants (such as large combustion plants, cement kilns and industrial boilers) to be built and operated according to Best Available Techniques (= State of the Art). It defines among others operational requirements (such as the minimum temperature for combustion and the residence time of flue gas within a given temperature level), requirements for input control of waste, monitoring and reporting obligations and prescribes emission limit values for a variety of pollutants including PCDD/F. In general the ELV for PCDD/F for incineration and co-incineration plants is 0.1 ng/nm^3 (11% oxygen).

Due to the limitation of emissions of dust, CO and C_{org} (and to a certain extent of NO_x) the Waste Incineration Ordinance also has an indirect influence on the reduction of POP emissions.

Concerning PCDD/F concentrations in wastes from waste incineration or co-incineration plants the Ordinance provides for the environmentally sound disposal where the total content exceeds a limit value of 100 ng/kg PCDD (I-TEQ).

The Ordinance has been amended by BGBl. II No. 475/2010.

Wastes which are incinerated in co-incineration plants have to reach the limit values specified in Annex 8, for waste oils and solvents the limit value for PCB is 10 mg/kg.

6.2.2 Austrian Water Act and Specific Ordinances

The basic document for water-related legislation is the Water Act 1959 (BGBl. No. 215/1959).

For an overviewof the Austrian Water Act and its relevant ordinances please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

New developments:

Based on the requirement to define environmental quality standards (EQS) codified in §30(a) of the Austrian Water Act the Ordinance on the determination of the target state for surface waters (BGBl. No. 96/2006) prescribes environmental quality standards for 72 substances and groups of substances. These EQS determine the criteria for the good chemical status of surface waters and the chemical parameters for the good biological status. Also POPs and POP like substances are included, e.g. hexachlorobenzene, DDT, aldrin, dieldrin, endrin, heptachlor, etc. In 2010 the Ordinance was amended and the environmental quality standards according to Directive 2008/105/EC were adopted (BGBl. II No. 461/2010).

In order to continuously assess, to monitor and to adapt monitoring programmes to actual necessities the Ordinance on the monitoring of the status of water bodies (BGBl. II No. 479/2006, amended 2010 by BGBl. II No. 465/2010) (originally issued in 1991) was amended in 2006 and 2010. The aim of the monitoring programme is to assess the status of water bodies. The parameters to be considered by the monitoring programme include all pollutants for which EQS have been defined (e.g. POPs and POP like substances such as HCB, PAH, etc.). Beside surface waters, these pollutants also have to be analysed in lake samples and groundwater samples.

In 2010, the Ordinance on Chemical Quality Targets for Groundwater ("Qualitätszielverordnung Chemie Grundwasser" – Austrian Federal Law Gazette II No 98/2010) replaced the former Ordinance on groundwater threshold values ("Grundwasserschwellenwertverordnung" – Austrian Federal Law Gazette No 502/1991). The new Ordinance now fully implements the legal requirements of the new EU Groundwater Daughter Directive (2006/118/EC).

Among other things, the new Ordinance lays down the criteria (groundwater threshold values) and the methodology (compliance regime) for assessing the chemical status of groundwater bodies thus providing a basis for establishing necessary measures.

The new Ordinance gives individual threshold values for a limited number of POPs only (e.g. sum of PAHs, sum of TRI and PER, Aldrin, Dieldrin etc.) and a general groundwater threshold value for pesticides (0.1 µg/l) and the sum of pesticides (0.5 µg/l).

Furthermore, POPs are also mentioned in Annex 2 which lists those substances where direct input into groundwater has to be prevented according to Article 6.

The Ordinance on the establishment of an electronic register for the collection of relevant discharges from point sources into surface water (BGBl. II Nr. 29/2009) entered into force in 2009. The Ordinance requires industrial dischargers as well as municipal wastewater treatment plants with a capacity of more than 10,000 population equivalents to report emissions of relevant pollutants into register. For example, discharges of Pentachlorobenzene have to be measured and reported. Such discharges are attributed to the following industrial activities (classification according to E-PRTR Regulation Annex I):

- 4d, Chemical installations for the production on an industrial scale of basic plant health products and biocides
- 5a, Installations for the recovery or disposal of hazardous waste
- 5c, Installations for the disposal of non-hazardous waste
- 5d, Landfills
- 5g, independently operated industrial waste-water treatment plants
- 6b, Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)

A first evaluation of data in 2011 showed, that concentrations in industrial effluent discharges aldrin, benzo(a)pyren, polybrominated diphenylether, chlordan, chlordecon, dieldrin, endrine heptachlor and mirex are below the respective limit of detection. For benzo(g,h,i)perylen, dioxine, fluoranthen, hexachlorcyclohexane including lindane, PCB, pentachlorbenzene and toxaphen quantifiable concentrations were found in a number of waste water discharges. A more detailed analysis of these results is not possible for the time being as tools for data retrieval and assessment are still being developed.

For more information on the General Ordinance on Waste Water Emissions (BGBl. No. 186/1996) and on relevant sector specific waste water emission ordinances (e.g. ordinance on waste water emissions from flue gas treatment (BGBl. II No. 271/2003) please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

6.2.3 Ordinance on Landfills (BGBl. II No. 39/2008)

(Amended by BGBl. II No. 185/2009 and 178/2010)

According to the Ordinance on landfills only the disposal of waste with the lowest possible reactivity has been permitted since 2004 (or, in exceptional cases, since 1 January 2009). A large part of waste materials, among them municipal solid waste, must therefore undergo thermal and mechanical-biological pretreatment before being landfilled.

The Landfill Ordinance 2008 implements the EU Directive 1999/31/EG and Council Decision 2003/33/EG.

It determines the following classes of landfills:

1. Landfill for excavated soils
2. Landfill for inert waste
3. Landfill for non hazardous waste
   a) Landfill for demolition waste
   b) Landfill for residual materials
   c) Mass waste landfill
4. Landfill for hazardous waste (exclusively underground waste storage)

Annex 1 of the Landfill Ordinance 2008 gives limit values for the acceptance of different waste streams of landfills.The POP relevant limit valuesforthe landfill classes are listed below. PAHs are defined as the sum of 16 substances according to EPA (naphthalene; acenaphthylene; acenaphthene; fluorene; phenanthrene; anthracene; fluoranthene; pyrene; benzo(a)anthracene; chrysene; benzo-(b)fluoranthene; benzo(k)fluoranthene; benzo(a)pyrene; dibenzo(a,h)anthraxcene; indeno(1,2,3-c,d)pyrene; benzo(g,h,i)perylene).

Table 61: Landfill classes and limit values according to Annex 1 of the Landfill Ordinance 2008

Landfill class	Pollutants, POP relevant	Limit value [mg/kg dry matter]
Landfill for excavated soils	PAH thereof benzo(a)pyrene	4 0,4
Landfill for inert waste	PAH thereof benzo(a)pyrene	20 2
Landfill for demolition waste	PAH	30
Landfill for residual materials	PAH	300
Landfill for mass waste	PAH	300

For detailed information on the Compost Ordinance (BGBl. II No. 2001/292), on Ordinances on Sewage Sludge and Compost and on the protection of soil of the Federal Provinces please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

6.2.4 Ambient Air Quality Act (Immissionschutzgesetz – Luft, IG-L)

The legal regulations for air quality assessment and management in Austria are stipulated in Ambient Air Quality Act (IG-L; BGBl. I No. 115/1997, as amended, implementing Directive 2008/50/EC on ambient air quality and cleaner air for Europe and Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air) and its ordinances. In the case of exceedances of air quality limit values abatement measures have to be applied. Like the Air Quality Directive and the 4th Daughter Directive, the Ambient Air Quality Act does not cover POPs directly, with the exception of benzo(a)pyrene for which a target value (1 ng/m^3) is given (this target value will be a limit value from 31.12.2012 on). However, as unintentionally produced POPs are mostly due to combustion processes, this type of POPs is strongly related to gaseous and particle pollutants for which abatement measures have to be applied in case of exceedances. For benzo(a)pyrene obligations for monitoring are laid down in an ordinance related to the IG-L. Since 2007 monitoring has been conducted at 15 sites across Austria; in 2009 20 sites were operated.

6.2.5 Plans and programmes under Air Quality Framework Directive

In case of an exceedance of the air quality limit value plus margin of tolerance for one or more pollutants, Member States shall take measures to ensure that a plan or programme is prepared or implemented for attaining the limit value within the specific time limit (Air Quality Framework Directive, Article 8 (3)). Plans or programmes have to be sent to the European Commission no later than two years following the year the exceedance has been observed.

Most plans and programmes reported so far to the Commission deal with PM10 and NO_2, some also with SO_2. In most cases, traffic was identified as the main source for PM10 and NO_2 exceedances, followed by industry, commercial and residential sources. The abatement measures foreseen in the plans and programmes therefore also deal with these polluters.

6.2.6 Residential Combustion Sources

The responsibility for regulating the operation of residential combustion sources lies with the federal provinces. As a consequence requirements concerning product certificates, emission limit values, monitoring of emissions and inspections vary.

An agreement pursuant to Article 15a of the Federal Constitution Act concerning the placing on the market and the inspection of combustion plants/firing installations was concluded in January 2011.

It establishes uniform requirements for the operation of these types of installations in all provinces and will help to reduce environmental impacts from these sources. The agreement includes requirements concerning

- placing on the market
- type tests, conformity tests and labelling
- emission limit values for dust, NO_x, CO and TOC
- inspection of combustion installations
- efficiency requirements
- requirements on permitted fuels
- refurbishment
- advisory service

Another relevant agreement (agreement pursuant to Article 15a of the Federal Constitution concerning the setting of consolidated quality standards to support the establishment and refurbishment of residential buildings for the purpose of the reduction of greenhouse gases) aims to reduce energy consumption in residential buildings. It is thus intended to reduce fuel consumption and emissions from combustion installations in this source category.

6.2.7 Open burning of biogenic materials

The Federal Act on Air Pollution Prevention (BGBl. I No. 137/2002, as amended BGBl. I No. 50/2012) imposes a ban on open burning of biomass and other materials. The provincial governor may grant exemptions from this ban in specific cases.

6.3 Other measures

6.3.1 Voluntary Self-Commitment of the Cement Industry (‘Positive List’)

The voluntary self-commitment is now partly integrated in the revised Waste Incineration Ordinance (BGBl. II No. 475/2010), (see chapter 6.2.1.4).

6.3.2 Paper, paper board and packaging paper

The German Federal Institute for Risk Assessment has published recommendations concerning input, used auxiliary materials, filling agents and additives for paper, paper boards and packaging papers which get in contact with food (BfR-Recommendation No. XXXVI, No. XXXVI/1 and No. XXXVI/2). These recommendations comprise a list of materials which can be used for the described purposes, in line with upper concentration limits for a wide range of chemicals. However, Annex C POPs are not regulated here.

6.3.3 Biomass plants serving the purpose of centralised district heating

Biomass plants serving the purpose of centralised district heating are funded by environmental support schemes when certain requirements with regard to energy efficiency, operating conditions, emissions and reporting of emissions are fulfilled. Plants subject to this funding scheme have to meet ELVs for dust, NO_x, CO and C_{org} depending on their size. However, since most ELVs are the same as prescribed in e.g. the Ordinance on combustion installations (see 6.2.1.1) any additional effect on reduction of POPs emissions is caused by requirements concerning energy efficiency.

6.4 Overview on Monitoring activities and Surveys on federal level since 2008

6.4.1 Ambient Air Monitoring

As described in chapter 6.2.4 benzo(a)pyrene in PM10 is required at 15 monitoring sites at least. At the rural background site Illmitz in addition to benzo(a)-pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene and dibenz(a,h)anthracene as well as the deposition of benzo(a)pyrene are monitored. Results of all monitoring activities are published in an annual air quality report (see e.g. UMWELTBUNDESAMT 2010c, d). The target value of the 4th Daughter Directive of 1 ng/m³ for benzo(a)-pyrene was exceeded in the year 2009 mostly in alpine valleys and basins. The reasons for these exceedances are high emissions due to wood burning and adverse dispersion conditions in winter.

In 1997 a monitoring programme started with the objective to observe long term trends ofPCDD/F and additionally PCB in the air. The monitoring programme comprised eight sampling sites representing urban, rural, industrial and remote locations. (MOCHE & THANNER 2002).

Datasets of 1992/93 compared with those of the monitoring programme showed a slight decrease of PCDD/F in the air during winter, whereas the summer levels are almost equal. The monitoring programme shows that there is still a clear seasonal trend for ambient air concentrations of PCDD/F with a maximum during the winter season. PCDD/F-data compared with ambient temperatures clearly indicates that domestic heating is the major source for increasing dioxin levels in ambient air during winter. Also PCBs show a seasonal trend, but contrary to PCDD/F the PCBs show highest concentrations during the summer season. This observation indicates different sources for PCB in ambient air than for PCDD/F. Since the start of the monitoring programme no significant change, neither increase nor decline, of the annual PCDD/F and PCB levels in ambient air could be observed. The last monitoring cycle has been completed in 2010. An extension of the monitoring scheme is currently under evaluation.

Since 2005 and with the international project MONARPOP (see 6.4.6) the concentrations of all POPs of the Stockholm Convention and the POPs Protocol and of some emerging POPs in ambient air and deposition at three Alpine summits (in Austria: Sonnblick, in Germany: Zugspitze, in Switzerland:

Weißfluhjoch) have been monitored (OFFENTHALER et al. 2008). Air sampling is carried out continuously throughout the year (in subsequent three-months sampling periods) but separately according to source regions of the arriving air masses. Sampling is distributed between separate filters assigned to one of four source regions. Filters are switched according to daily trajectory forecasts.The selected source regions (possibly important for the Alps) are

1. the industrial regions of Germany, Great Britain, Belgium, The Netherlands in the Northwest of the Alps,
2. the industrial region of Czech Republic, Slovakia and Poland in the North East of the Alps,
3. the industrial region of the Po basin in Italy and
4. the remaining source regions.

With its ambient air monitoring activities for POPs at remote sites, MONARPOP has been included in the "Global Monitoring Plan" for the "Effectiveness Evaluation" of the "Stockholm Convention". The results of the air measurements at remote summits until 2007 were included in the 1st Global Monitoring Report under the UN Stockholm Convention (UNEP 2009). Recently an analysis and interpretation of the results of the monitoring period 2008 to 2010 has been carried out.

The detected active air concentrations of POPs at the Alpine summits document well that an air transport of these compounds exists across the Alps – even though it is reduced according to the enhanced deposition of POPs at the peripheral parts. All SOCs (OCPs, PCDD/F, PCB, PBDE, PAH), and even compounds that have been banned in Europe for decades (e.g. DDT) or have not even been used in significant amounts in Central Europe (e.g. mirex), have been detected in air and deposition indicating their steady deposition at the remote summits by atmospheric transport.

Annual mean air concentrations at the summits were somewhat higher than Arctic values (compiled in UNEP 2009). So far (until 2007), no source direction had been correlated with higher air concentrations – a recent analysis of the time period 2008 to 2010 will show if this finding holds also for the last monitoring period.

6.4.2 Emissions Monitoring

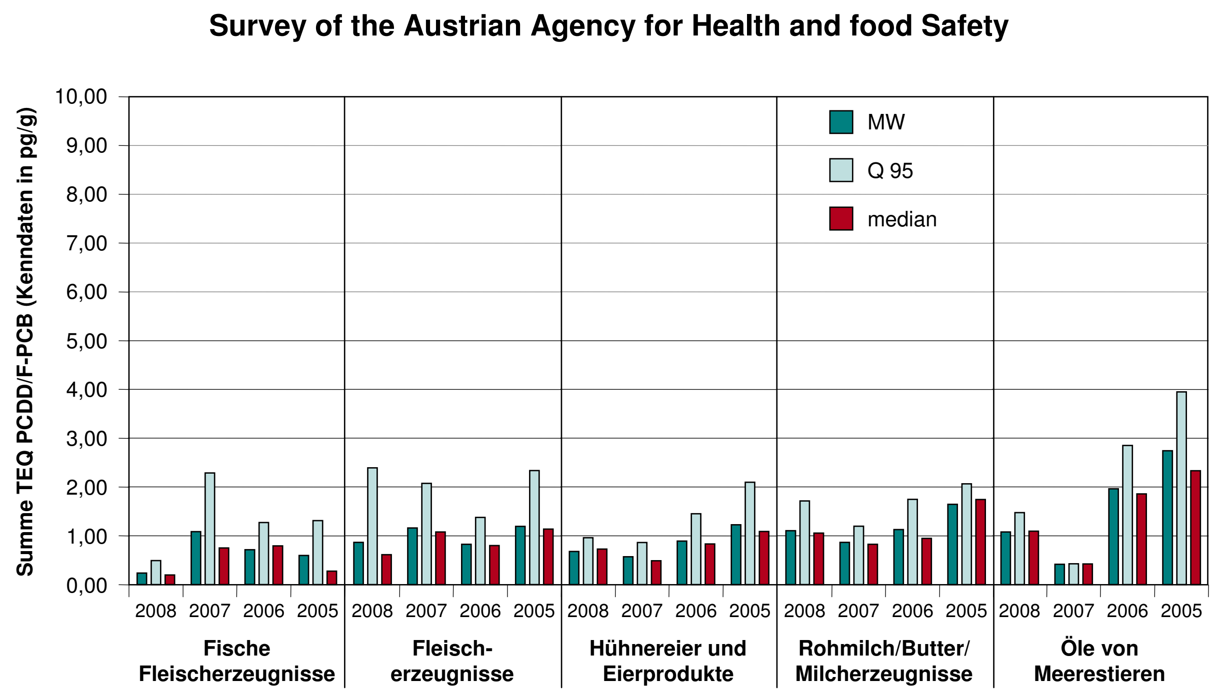
For monitoring measures undertaken in previous years please refer to the National Action Plan 2008 (UMWELTBUNDESAMT 2008b).

6.4.3 Food and Feed monitoring

In 2003 the Environment Agency Austria carried out a first Austria-wide milk monitoring study (THANNER &MOCHE 2004) with the objective to obtain an overview of average PCDD/F levels in cow's milk. Additionally dioxin-like PCBs, according to the WHO, and indicator PCBs, as listed by national regulations, were analysed. The results showed that Austrian milk samples are clearly below the current EC limit value of 3 pg WHO-TEQ/g fat. No significant differences, with respect to PCDD/F and dioxin-like PCB, could be found between milk samples originating from dairy factories and alpine dairies with a smaller local collection area. The differences between the levels of indicator PCBs in cow's milk are a clear indication of a still continuing industrial influence: significantly lower levels were measured in milk samples from remote alpine regions.

In addition to its obligations as competent authority for food safety and control, the Austrian Agency for Health and Food Safety carries out a food monitoring programme once a year. Samples are collected from all nine provinces of Austria covering all components of average Austrian diet. All samples investigated since 2004 were well below the EU-limits for food. Estimates of dietary intakes of dioxins and furans based on a combination of food consumption data amount to 209 pg WHO-TEQ/day which on a body weight basis would correspond to approximately 3 pg WHO-TEQ/kg bw/day (Hofstädter & Grossgut 2006). This is within the range of the TDI (TDI: tolerable daily intake) range of 1–4 pg WHO-TEQ/kg bw/day as defined by the WHO.

Feed and food monitoring for PCDD/F and dioxinlike-PCBs is an ongoing process undertaken with the aim to comply with obligations arising from EC- and national legislation.



Source: based on Ages 2011

Figure 13: Survey of the Austrian Agency for Health and food Safety 2005-2008.

6.4.4 Water Monitoring

6.4.4.1 Surface water bodies

All large surface water bodies are tested for pollutants – including POPs. Analyses are carried out mostly in water. Some monitoring programmes are accompanied by biomonitoring programmes (accumulation monitoring of fish). The monitoring programmes are constantly updated and focus increasingly on the substances (substances, that describe the ecological and chemical status of the water bodies) listed in the Water Framework Directive and in the respective national implementation (e.g. *Ordinance on the determination of the target state for surface waters, BGBl. II No. 2006/96*). Of the chemicals listed in the Stockholm Convention or the POPs Protocol, the list of priority substances (Annex X of WFD – chemical status) includes HCB, hexachlorocyclohexane and PAHs. In terms of chemicals with POP-like properties, the list includes polybrominated diphenyl ethers, short-chained chlorinated paraffins, pentachlorophenol and hexachlorobutadiene. POPs and POP-like substances must be taken into consideration in evaluating the chemical and the ecological status of a specific water body. The Directive on environmental quality standards (2008/105/EC) covers HCB, PAH, cyclodiene pesticides (aldrin, dieldrin, endrin and isodrin), DDT and hexachlorcyclohexane.

Monitoring is predominantly based on the *Ordinance on the monitoring of the status of water bodies (BGBl. II No. 2006/479).* In addition to the regular monitoring activities on large surface water bodies, several operative programmes were performed on behalf of the Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management in the course of the analysis of the current status in line with Art. 5 of the WFD. These monitoring programmes are pressure specific and include pollutants such as hexachlorobenzene and PAH, as well as DDT, aldrin, dieldrin endrin, heptachlor and others.

Concentrations of pollutants in surface water bodies – including a number of substances of the Stockholm Convention – are measured in Austria in the context of various obligations and monitoring programmes and are available to the public on the Internet (http://wisa.lebensministerium.at). The monitoring results for the relevant POPs (beside dioxins and PCBs) are summarized in the following table:

Table 62: Summary of the monitoring results for surface waters for hexachlorobenzene (HCB), PAHs (benzo(a)pyrene (B(a)P) and pentachlorobenzene (PeCB).

	2000			**2003**			**2010**		
	in water			**in water**			**in biota (fish)**		
	n	**n>LOQ**	**max [µg/l]**	**n**	**n>LOQ**	**max [µg/l]**	**n**	**n>LOQ**	**max [µg/kg]**
HCB	68	0	-	341	0	-	32	28	5.1
PeCB	97	0	-	341	0	-	32	23	3.3
B(a)P	133	4	0.009	356	127	0.019			
B(b)F	133	5	0.01	356	57	0.019			
B(k)F	133	3	0.006	356	14	0.012			
BP	133	2	0.005	356	45	0.014			
IP	133	1	0.001	356	48	0.016			

Results of the monitoring programme are published as bi-annual reports. Access to data as well as to the reports is provided via the webpage of the Environment Agency Austria – http://www.umweltbundesamt.at/en/umweltschutz/wasser/.

Furthermore, specific substances are analysed in investigative monitoring programmes (run by i.e. regional authorities) and as part of measuring obligations prescribed by international river basin commissions (e.g. ICPDR, Joint Danube Survey). The measuring programmes are constantly updated and increasingly focused on the priority substances specified in the Water Framework Directive.

6.4.4.2 Municipal Wastewater Treatment Plants

Currently no continuous monitoring of effluents of municipal wastewater treatment plants for POPs or POP like substances is performed and the database on emissions of these substances from wastewater treatment plants is very poor. In order to improve the knowledge basis and to generate data on those emissions, a monitoring programme was performed in 2007 and 2008. Besides dioxins and PCBs the relevant POPs hexachlorobenzene, polycyclic aromatic hydrocarbons as well as pentachlorobenzene were investigated. None of these pollutants were detectable in the effluents of municipal wastewater treatment plants (UMWELTBUNDESAMT 2009).

6.4.4.3 Industrial Dischargers

According to the Austrian Federal Ordinance on the establishment of an emission register industrial dischargers have to measure and report emissions of defined pollutants. The Ordinance entered into force in 2009 and the first measurements were performed in 2010. A first evaluation of data in 2011 showed, that concentrations in industrial effluents dischargers of aldrin, benzo(a)pyren, polybrominated diphenylether, chlordan, chlordecon, dieldrin, endrine heptachlor and mirex were below the respective limits of detection. For benzo(g,h,i)perylen, dioxin, fluoranthen, hexachlorcyclohexane including lindane, PCB, pentachlorobenzene and toxaphen quantifiable concentrations were found in a number of waste water discharges. A more detailed analysis of these results is not possible for the time being as tools for data retrieval and assessment are still being developed.

6.4.4.4 Groundwater

In Austria standardised groundwater quality monitoring, based on legal provisions, was established in 1991. Its aim was to ensure the collection of consistent and reliable data to assess the current status of Austrian groundwaters and detect increasing concentrations at an early stage. This information was also to be used as a basis for designing and implementing measures for the protection of groundwater.

The resulting monitoring programme covers groundwater in porous media and in karst and fractured (fissured) rock systems. In total about 2000 groundwater sites are investigated and monitored. Groundwater areas were delineated as monitoring units and the monitoring was carried out on a quarterly basis (up to four times per year) for the whole of Austria.

To comply with the new requirements of the WFD the Austrian Federal Water Act was amended and provided the basis for a new Ordinance for Water Quality Monitoring (BGBl. No. 479/2006). Consequently the groundwater quality monitoring network in Austria was assessed for compliance with the new requirements and, where necessary, the network was amended accordingly. The most important impact resulted from the introduction of WFD groundwater bodies as groundwater management units.

To comply with the WFD and the Austrian Ordinance on Water Quality groundwater monitoring is carried out according to a six year cycle. The cycle starts with an ‘initial investigation’ under a surveillance monitoring programme. This includes monitoring of an extensive number of parameters.

The parameters monitored in groundwater, about 160 in total, are grouped into two parts:

- part 1: important inorganic parameters with relevance to the environment, e.g. nitrate, nitrite, ammonium, phosphate, boron, alkali metaland alkaline earth metal (e.g. potassium, calcium, magnesium);
- part 2: the heavy metal group (e.g. arsenic, mercury, cadmium) and lightly volatile halogenated hydrocarbons (e.g. tetrachloroethylene) and the broad group of pesticide substances (e.g. triazine, phenoxy alkane carbon acids).

For the following substances of concern PCDD and PCDF, PCBs and PAHs there are no monitoring data available, however there are data on HCB in groundwater available. Most of the values are below the limit of detection and below the limit of quantification. In addition the Monitoring programme includes the following POPs as aldrin, chlordan, DDT, dieldrin, endrin, heptachlor and lindan.

In addition the option for “extra-investigations” exists. This is intended to allow for consideration of chemical parameters not mentioned in the Ordinance on Water Quality Monitoring.

Various elements of quality assurance have been integrated in the monitoring programme to ensure confidence in the analytical results. The implementation of the Austrian Water Quality Monitoring System is a shared responsibility between the Federal and Provincial Authorities.

Results of the monitoring programme are published as bi-annual reports. Access to the data as well as to the reports is provided via the webpage of the Environment Agency Austria – http://www.umweltbundesamt.at/en/umweltschutz/wasser/.

6.4.5 Soil Monitoring

There is no common soil monitoring system on organic substances established in Austria. However, several studies were carried out which aim to determine the contents of selected POPs in soil (according to different land uses).

Within the environmental soil surveys of the federal provinces in Austria, some organochlorine pesticides and herbicides were partly analysed in 3 federal provinces (Carinthia, Styria, Upper Austria). These studies were carried out in the 1990ies.

In addition, various screening studies were carried out around potential sources and in industrial conurbations to identify the load of POPs in soils of various uses (e.g. UMWELTBUNDESAMT 1991).

Grassland Soil Monitoring

More up to date data are provided by a study on POPs in grassland soils far away from emission sources. At the moment results from 24 grassland sites under extensive use are available (UMWELTBUNDESAMT 2008a and 2010). Soil samples were taken at depths of 0–5 cm and 5–10 cm and the range of analysed parameters covers the following substances or groups of substances: organochlorine compounds (aldrin, cis- and trans-chlordane, dieldrin, endrine, mirexe, heptachlorine, hexachlorobutadien, endosulfan, DDX, α-, β-, γ-, δ-HCH, HCB), polychlorinated biphenyls (PCBs), dioxins, furans and dl-PCBs, polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ether (PBDE), nonylphenol and bisphenol A, nitrophenols, chlorophenols, phthalates, organotin compounds, hydrocarbon index, perfluorinated tensides (PFTs)inorganic pollutants, general soil parameters (pH value, humus content, texture, carbonate content).

Overview of the results for PCBs, doxins and furans and PAHs:

Polychlorinated biphenyls (PCBs): Contents of individual PCB congeners are above the chosen limits of determination for all samples. The range for the total content from the sum of the six congeners according to Ballschmiter is between 0.13 and 3.52 µg/kg DS and all values can therefore be considered background concentrations.

DL-PCBs: Contents of coplanar and mono-ortho-substituted PCBs were detected in most of the soil samples. They are within the range of a few nanograms. What is noticeable is that either low chlorinated PCBs are found together on a few sites, or higher chlorinated PCBs. Total values from the sum of PCBs TE-WHO for the sampled grassland sites are between 0.01 and 0.74 ngTE WHO/kg.

Polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs): Total contents from the sum of PCDD/Fs in grassland samples range between 12.5 and 298 ng/kg DS. In order to take into account the varying toxicity of the congeners, PCDD/F contents are assessed according to international toxicity equivalents (I-TEQs). These are between 0.16 and 9.33 ng I-TEQ/kg DS. The upper values are considered high and need further clarification.

Polycyclic aromatic hydrocarbons (PAHs): Contents of EPA PAHs range between 2.4 and 1818.3 µg/kg DS. On 11 sites, values below 100 µg/kg DS were determined. Although none of the grassland sampling sites used for this study showed PAH contents above international background or intervention values, further clarification appears to be necessary with respect to ΣEPA PAH and BaP contents on three sites. For all other sites, PAH contents can be classified as background values.

The results of this study show that persistent organic pollutants can be detected, occasionally in considerable concentrations (e.g. PCDD/F), even in grassland soils under extensive use. On the one hand the substances concerned are those whose use and production have been banned in many countries for several years or decades (e.g. certain pesticides), and on the other hand these substances are so-called upcoming pollutants (e.g. flame retardants, phthalates, chlorophenols), whose environmental relevance is gaining more and more importance at international level.

The study thus provides an initial overview of the verifiability and magnitudes of the levels of selected organic pollutants. Although a more detailed analysis in the light of a correlation between individual soil parameters, or pollutant groups, has not been possible here, it would be an important next step allowing for a better description of the fate and behaviour of these substances in grassland soils.

In general, the data on organic pollutants in soils are considered incomplete. Only a few pollutant groups such as PAHs, PCBs or PCDD/Fs are well documented in the literature. For many other substances however, hardly any comparable data on background values in soils are available. In other mediums such as sewage sludge, sediments and surface waters, these pollutant groups have already been analysed in several studies.

The next part of the study will include further sampling sites throughout Austria and a focus on flame retardants like PBDEs and PFOS.

Forest soils

Several studies on concentrations of POPs in remote forest ecosystems included also forest soils as sampled matrix (see chapter 6.4.6).

6.4.6 Bioindication with tree needles and forest ecosystems

Two major earlier studies (UMWELTBUNDESAMT 1998, 2001) focused on POP concentrations in remote forest ecosystems. The international project "MONARPOP", (an initiative of ministries and institutes in Austria, Germany, Italy, Slovenia and Switzerland started the project MONARPOP in 2004[19)] investigated POPs in Norway spruce needles and soils of remote forests in alpine regions of Europe (Austria, Germany, Italy, Slovenia, Switzerland) from 2004 to 2007. The studies focused on POP background levels at remote sites. The investigations provide information about the following compounds – formerly or still – intentionally produced POPs (organochloropesticides = OCP, PCB, PBDE, chloroparaffins, PFOS and related compounds) and unintentionally released organic pollutants (PCDD/F, PAH). The MONARPOP project also includes extensive air and deposition monitoring (see chapter 6.4.1). The MONARPOP survey on needle and soil concentrations had been finished by end of December 2007, while air and deposition monitoring is still carried out on a continuous basis.

One of the most significant results of MONARPOP is the clear documentation of the barrier effect of the Alps for the long range transport of POPs. Concentrations were higher in the peripheral parts of the Alps than in the more shielded central parts. The location of the lateral parts with higher concentrations (northern, western, southern and/or eastern parts of the Alps) could vary from compound to compound and between the studied matrices (soil, needles). For some compounds like PCDD/F, sites with higher soil concentrations were located in areas of higher precipitation (OFFENTHALER et al. 2009), while the observed regional concentration gradients for other compounds (e.g. single PBDEs, KNOTH et al. 2008) showed no correlation with precipitation and are likely the result of different emission gradients in the neighboring regions of the Alps. These findings from the Alps, given their location in the centre of Europe, may give some general indications of similar differences on a larger geographic scale.

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[19] http://www.monarpop.at; co-founded by the EU INTERREG IIIb "Alpine Space Programme", the Austrian Ministry for Agriculture, Forestry, Environment and Water Ressources; Bavarian State Ministry of the Environment, Public Health and Consumer Protection; Regional Agency for Environmental Protection of Lombardia; Regional Agency for Environmental Prevention and Protection of Veneto; Swiss Federal Office for the Environment; Swiss Federal Institute for Forest, Snow and Landscape Research; German Helmholtz Research Center for Environmental Health, Munich; German Federal Environment Agency; Environment Agency Austria; Slovenian Forestry Institute

A comparison between POPs bound in the forests of the Alps and their emissions in this region supports the assumption that significant contributions to the POPs load in the Alps comes from sources outside the Alps and suggests that the Alps represent a net sink for these compounds (BELIS et al. 2009).

Industrial chemicals like chlorinated paraffins were detected at remote sites of the Alps, in similar concentration ranges as unintentionally emitted SOCs like PAHs (IOZZA et al. 2009).

Selected MONARPOP sites, which were also studied in previous studies, showed significantly lower loads of some compounds in needles and soil than approximately ten years ago.

Along the remote vertical MONARPOP profiles of the northern and central Alps, marked altitudinal increases in soil concentrations of organochlorine pesticides (including those with suspected faraway sources like mirex) have been detected (e.g. up to 10-fold for DDT). The statistical results suggest temperature as the key parameter for this increase, while it has been found that precipitation is not correlated with the observed gradients (KIRCHNER et al. 2009). Other compounds like chlorinated paraffins (IOZZA et al. 2009), PCDD/F and PCB (OFFENTHALER et al. 2009), PBDE (KNOTH et al. 2008) and PAH (BELIS et al. 2007) have not shown a uniform trend along or among these slopes. Other than with pesticides, local sources as well as the impact of meteorological phenomena like temperature inversions are assumed to be responsible for these findings.

Apart from surveys in remote forest ecosystem, POP levels (PAH, PCB, PCDD/F, OCPs) close to local pollution sources were obtained by some bioindication studies in industrial areas or conurbations using Norway spruce needles (e.g. UMWELTBUNDESAMT 2009). The Austrian Umweltbundesamt also has an archive of perennial spruce needle samples from selected industrial neighborhoods.

6.5 Monitoring activities on States level

Studies and monitoring programmes on POPs are carried out on the level of the federal provinces (Länder) as well.

7 EVALUATION OF THE EFFICACY OF NATIONAL LAWS AND POLICIES AND STRATEGIES FOR MEETING THE OBLIGATIONS OF THE STOCKHOLM CONVENTION AND THE EU POP-REGULATION

As already stated in the National Action Plan 2008 Austria complies to a great extent with the provisions of the Stockholm Convention and the EU POP Regulation. Nevertheless, as one of the goals of the Convention is the "continuous reduction of POPs releases" further efforts are necessary.

POP emissions of major (industrial) sources have considerably declined in the last few years. Between 2004 and 2009 a further decrease in air emissions of POPs took place, partly due to a decline in economic activities in the years 2008 and 2009. Still, if changes in the best available techniques allow for lower or zero emissions from relevant sources policy makers have to react and to adapt the relevant legal provisions accordingly (e.g. by laying down stricter emission limit values).

In general, the findings of the NAP 2008 remain valid for the near future:

The NAP 2008 identified small residential combustion plants as an important target area. They still are responsible for 70.0% of the PCDD/F emissions, 86.4% of the HCB emissions and for 69.7% of the PAH emissions into air. All possible measures have to be investigated and exploited to reduce the POP emissions from these sources.

Anotherset of measures is concerned with awareness-raising to encourage "low emission" incineration in household stoves or e.g. the use of ashes from these plants for fertilising purposes. Here, an important initiative was launched in 2009 and 2010 (see below).

It should be mentioned that in order to comply with certain national and international obligations a variety of comprehensive and to some extent cross-sectoral measures and instruments are being developed in Austria. These measures are aiming at the reduction of greenhouse gases, NO_x and (fine) particulate matter. Some of these measures (described e.g. in the Climate Strategy 2007 (FEDERAL MINISTRY OF AGRICULTURE, FORESTRY, ENVIRONMENT AND WATER MANAGEMENT 2007) or in the Programme of the Federal Government (FEDERAL GOVERNMENT 2007)) will lead to an indirect reduction of POPs releases (by e.g. reduction of energy consumption or the prescription of stricter air emission limit values for dust), others (such as the increased use of biomass in small scale firing installations) will lead to an increase of POPs releases.

Further, it is important to gain a still deeper knowledge in fields where reliable data are limited or missing. Specific studies e.g. with regard to POP concentrations in certain wastes as well as further POP related monitoring activities are formulated below.

PeCB Management Options: It is common knowledge, that measures which are effective for PCDD/F removal or elimination are also effective for minimisation of PeCB releases. Here, the reader is referred to Annex V of the Stockholm Convention on POPs and in particular to the technical guidelines on best available techniques and guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention.

Therefore, no particular management actions for PeCB are required.

Evaluation and Proposal of Measures (according to § 20 (2) Chemicals Act 1996)

The NAP 2008 listed a variety of measures which on the one hand contribute to lower POPs emissions from relevant sources and which on the other hand would improve the availability of data on POPs in the environment.

Releases of POPs from source categories

The following table shows an overview which of the measures proposed in the NAP 2008 were implemented in the period 2008-2011.

National legislation	Contents with respect to POPs	Measures proposed in NAP 2008	Current status
Act on Emissions of Boiler Plants (BGBl. I No. 150/2004); Clean Air Ordinance on Boiler Plants (BGBl. No. 19/1989 as amended by BGBl. II No. 2005/55); as amended by Emission Measurement Ordinance (Fed.Law Gaz. II No.153/2011)	ELVs for dust, CO, Corg, NO_x	Adaptation to BAT necessary	Adaptation done through Act on Emissions of Boiler Plants as applicable
Industrial Code 1994 and specific ordinances according to Article 82 para 1, for example Ordinance on sinter plants (Fed. Law. Gaz. II No. 1997/163)	ELV for various air pollutants, eg dust, PCDD/F	Continuous evaluation with regard to BAT	Routine Evaluation
Ordinance on combustion plants (BGBl. II No. 331/1997)	ELVs for dust, CO, Corg, NO_x	Adaptation to BAT necessary (stricter ELVs for dust)	Measure was implemented by amendment (BGBl. II No. 312/2011)
Waste incineration ordinance (Fed. Law. Gaz. II No. 2002/389)	ELVs for dust, CO, Corg, NO_x, heavy metals, PCDD/F	stricter ELVs for dust for co-incineration plants	Revised ordinance Fed.LawGaz. II No. 2010/476, but no stricter ELV for dust
Austrian Water Act and specific Ordinances:	ELVs for AOX and POX in the sector specific ordinances		
Ordinance on the limitation of waste water emissions from flue gas treatment (BGBl. II No. 271/2003)	ELVs for PCDD/F	Continuous evaluation with regard to BAT	none
Ordinance on the limitation of waste water emissions from processing of coal (BGBl. II No. 346/1997)	ELVs for PAHs	Continuous evaluation with regard to BAT	none
Ordinance on the limitation of waste water emissions from the production of plant protecting agents and crop sprayings (BGBl. No. 668/1996)	ELVs for AOX and specific POPs	Continuous evaluation with regard to BAT	none

National legislation	**Contents with respect to POPs**	**Measures proposed in NAP 2008**	**Current status**
Ordinance on the determination of the target state for surface waters (BGBl. II No. 96/2006)	Environmental quality standard for HCB	For PAHs community environmental quality standards were determined (in 2008)	ordinance was amended in 2010 according to directive 2008/105/EC (BGBl. II No. 461/2010)
Other relevant legal provisions			
Ordinance on landfills (BGBl. II No. 39/2008)	Limit values for the content of PAH in wastes		Amended with BGBl. II No. 185/2009 und II 178/2010
Compost ordinance (BGBl. II No. 292/2001)	Limit values for the content of POPs in composts	Continuous evaluation of the limit values necessary	none
Ordinances on sewage sludge and compost of the Federal Provinces	Limit values for POP	Continuous evaluation of the limit values necessary	None, some Austrian provinces limit POPs in sewage sludge
Soil Protection Laws of the Federal Provinces: Burgenländisches Bodenschutzgesetz (LGBl. Nr. 87/1990) Niederösterreichisches Bodenschutzgesetz (LGBl. Nr. 6160-0) Oberösterreichisches Bodenschutzgesetz (LGBl. Nr. 63/1997) Bodenschutzgesetz Salzburg (LGBl Nr. 80/2001) Steiermärkisches landwirtschaftliches Bodenschutzgesetz (LGBl. Nr. 66/1987)		Elaboration of target values for organic pollutants (including polybrominated diphenylethers, perfluorinated tensides and pesticides) with the aim to reduce pollution of soils	Not realised
Ambient Air Quality Act (IG-L)	§ 21 IG-L: Legal basis for an ordinance	Evaluation whether generally binding ELVs for crematoria in an ordinance according to § 21 IG-L are necessary	Not implemented, no general binding rule for crematoria
Laws of the Federal Provinces concerning residential combustion sources		Agreement pursuant to Art. 15a Federal Constitution Law concerning the placing on the market and the inspection of combustion installations, rapid transposition of the requirements of this agreement into the law of the federal provinces	Agreement was signed in 2011
Act on Air Pollution Prevention (BGBl. I No. 137/2002, as amended (BGBl. I No. 50/2012))	Prohibition of burning of biogenic materials, many exemptions possible	Evaluation with respect to the exemptions	Prohibition integrated in Act on Air Pollution Prevention
Permitting process	*Contents with respect to POPs*	*Comments/Specific Steps*	
Landfill sites	Fire protection requirements	Implementation of effective fire protection requirements for landfills and intermediate storage sites for waste	No new information

Bearing in mind that the sectorresidential combustion is responsible for 70% of the PCDD/F emissions into air the Federal Ministry of Agriculture and Forestry, Environment and Water management in cooperation with the Federal Guild of Chimney sweepers, the tile stove alliance, the Austrian Medical Chamber and the association of doctors for a healthy environment published a booklet entitled “Richtig heizen” (“Proper Heating”) in 2010. The booklet contains information on the effects of emissions from household stoves on human health and the environment as well as advice on how low emissions heating can be achieved. It has been distributed to the public via chimney sweepers and medical doctors. Furthermore an internet-site has been created (www.richtigheizen.at), where the proper use of the household stoves as well as legal considerations are described.

Furthermore, the rapid implementation of the following measures is of utter importance:

- Establish compliance with the requirements of an agreement between the federal provinces pursuant to Article 15a of the Federal Constitution Law concerning the setting of consolidated quality standards to support the establishment and refurbishment of residential buildings for the purpose of the reduction of greenhouse gases.
- Effective financial funding for the replacement of coal fired small scale firing installations
- Periodic reviews and improvements of the criteria for the funding of biomass plants (including biomass plants operated in the agricultural sector) with respect to operating conditions, energy efficiency (including district heating systems), quality of fuels and emission limit values for dust

  → emission limit values for dust were changed in 2007 and 2009.
- Further information with respect to the prevention of co-incineration of waste in small scale firing installations
- Further information with respect to the final disposal of ashes/soot from small scale firing installations
- Implementation of appropriate measures to ensure that the target value for benz(a)pyrene in the ambient air (1 ng/m^3) will be complied with. This target value will be converted into a limit value as of 31.12.2012.

  → different measures in the provinces.

For the following sources the availability of data is still very limited or missing. Therefore, to assess whether releases of POPs are relevant and to improve and complete the Austria Inventories on POPs, the following specific steps to improve data quality are desirable/necessary. However, the implementation of these measures is often subject to available budget resources.

- emission behaviour of small scale combustion installations (esp. in case of firing straw and cereals)

  → still partly unknown in the case of POPs, but a project is envisaged which will investigate certain emission parameters of small scale combustion installations (residential combustion, “EnEm Tech project”)
- measurement of emissions of motor vehicles and update of emission factors to improve the quality of forecasts

  → The Handbook Emission Factors for Road Transport (HBEFA) provides emission factors for all current vehicle categories (PC, LDV, HGV, urban buses, coaches and motor cycles), each divided into different categories, for a wide variety of traffic situations. Emission factors for all regulated and the most important non-regulated pollutants as well as fuel consumption and CO_2 are included.The last version HBEFA 2.1 dates back to 2004 and was updated in 2010 (HBEFA 3.1). All emission factors have been recalculated (based on a broader set of emission data, on new measurements of motor vehicle emissions; new emission factor models have been applied). For calibrating the model, a broad set of emission measurements up to Euro 4 has been used. Emission factors for the new standards of Euro 5 and 6 are mainly based on assumptions in view of future legislation.

- improvement of data quality with respect to releases of POPs from landfills and abandoned industrial sites and known contaminated sites (e.g. PAH content oflandfill gases)
- assessment of the contamination and treatment of waste and residues in non ferrous metals and secondary steel production as well as in sinter plants

  → no new assessment
- determination of POP-concentrations in waste streams from small scale combustion installations in the sectors residential combustion, services and agriculture which have a high probability of being released into the environment (e.g. bottom ash and fly ash)
- determination of POP-concentrations in waste streams from fossil fuel fired utility and industrial boilers (including co-incineration of waste) which are recovered in other production processes or which have a high probability to be released into the environment (e.g. fly ash from co-incineration plants)
- determination of POP-concentrations in waste streams from biomass fired combustion installations which are recovered in other production processes or which have a high probability to be released into the environment (e.g. bottom ash)
- determination of concentrations of PCDD/F and relevant precursors especially in bleached (Kraft-)pulp (imported and domestic production), paper (packaging paper, paper board, paper made from recovered fibres), colours and inks, deinking sludge

  → In 2011 the Environment Agency Austria accomplished a survey assessing possible PCDD/F input into cardboard boxes via contaminated printing inks. The results of this limited study did not show any indication of PCDD/F contamination of currently used printing inks.
- quantification of POPs in filter dusts from the clinker process (Austrian cement kilns)

  → quantification after consultation talks with Environment Agency Austria, Federal Economic Chamber/cement industry and other stakeholders; support of the revision of the Dioxin Toolkit relating to „mineral products“
- quantification of POPs emissions (esp. PCDD/F and PCB) of Platformer 3 of the OMV refinery in Schwechat

  → quantification of POPs emissions of Platformer 3 still unknown.

Data availability on POP emissions into the environment

The following table lists specific measures designed to improve the quality of available data regarding POPs emissions into the environment:

Specific steps	Timetable
Improvement of data quality with respect to releases of HCB and PCB into air (e.g. by planning and carrying out measurement programmes for sources with high priority, such as residential combustion sources, industrial processes).	Review of available (literature) data, identification of (suspected) relevant sources
Establishment of monitoring programmes in the neighbourhood of POP relevant emitters	Identification of relevant sites for sampling Sampling and measurements (winter/summer)
Continuation of monitoring programmes using Norway spruce needles close to POP sources	Continued sampling

Data availability on POP concentrations in the environment

The following table lists specific measures designed to improve quality of available data regarding POPs concentrations in the environment:

Specific steps	Timetable
Continuation of ambient air and deposition monitoring for POPs at Alpine summits (Sonnblick)	Continued sampling and analysis
Ambient air and deposition monitoring for POPs in the Austrian-Czech border region	Sampling in 2011/12 and analysis
Development of transfer factors to improve knowledge of interrelations between POP concentrations in the environment and bioavailable concentrations.	Establishment of a scientific panel to elaborate a study design
Development and adaptation of passive sampling methods to improve the comparability of available data	Method/Instrument selection and development, pilot study Evaluation of the pilot study and selection of an appropriate method
Implementation of a national monitoring programme to investigate the distribution of deposited POPs	2008 – selection of sampling sites From 2009 onwards – implementation

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ABBREVIATIONS

AVV	Abfallverbrennungsverordnung (BGBl. II Nr. 476/2010)
CORINAIR	Core Inventory Air
CORINE	Coordination d´information Environmentale
CRF	Common Reporting Format
DKDB	DampfkesseldatenbankAustrian annual steam boiler inventory
EEA	European Environment Agency
EIONET	European Environment Information and Observation NETwork
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EPER	European Pollutant Emission Register
GLOBEMI	Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor(Global Modelling for Emission- and Fuel consumption Scenarios of the Transport Sector) see [HAUSBERGER 1998]
GPG	Good Practice Guidance (of the IPCC)
HCB	Hexachlorobenzene
HM	Heavy Metals
IEA	International Energy Agency
IEF	Implied emission factor
IIR	Informative Inventory Report
IPCC	Intergovernmental Panel on Climate Change
NACE	Nomenclature des activites economiques de la Communaute Europeenne
NEC	National Emissions Ceiling (Directive 2001/81/EC of The European Parliament And Of The Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants – NEC Directive)
NFR	Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention)
NIR	National Inventory Report (Submission under the United Nations Framework Convention on Climate Change)
NISA	National Inventory System Austria
OECD	Organisation for Economic Co-operation and Development
OLI	Österreichische Luftschadstoff InventurAustrian Air Emission Inventory
PAH	Polycyclic Aromatic Hydrocarbons
PCDD/F	Polychlorinated Dibenzodioxins and Dibenzofurans
PM	Particular Matter
POP	Persistent Organic Pollutants
PRTR	Pollution Release and Transfer Register
SNAP	Selected Nomenclature on Air Pollutants
UNECE/CLRTAP	United Nations Economic Commission for Europe.Convention on Long-range Transboundary Air Pollution
UNFCCC	United Nations Framework Convention on Climate Change
WFD	Waste Framework Directive 2000/60/EC

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This report is the first review of the National Action Plan (NAP) pursuant to Article 5 of the Stockholm Convention on persistent organic pollutants (POPs). For the review emission data from relevant source categories in different environmental media have been updated and compared to the data in the NAP 2008. An assessment of the efficacy of national legal regulations was made as well as an analysis if Best Available Techniques (BAT) in combination with Best Environmental Practices (BEP) have been applied. The report also contains recommendations and measures in order to reduce emissions of POPs in the future.
In general, the findings of the NAP 2008 remain valid for the next years: Measures to reduce emissions from residential combustion sources should be continued. Monitoring programmes should be continued.

ISBN 978-3-99004-99004-198-7