Technical report No 52

Annual European Community CLRTAP emission inventory 1980-1998

Submission to the Executive Body of the UNECE Convention on Long-range Transboundary Air Pollution

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1. Introduction

1.1. Reporting by the European Community

This report was prepared by the European Commission, on behalf of the European Community (EC) in fulfilment of its obligations as a Party to the Convention on Long Range Transboundary Air Pollution (CLRTAP). It is submitted to the Environment and Human Settlements Division of the United Nation's Economic Commission for Europe in its function as the Secretariat for the Executive Body of the Convention. The UNECE requests Parties to report their 1998 emission data on SO_x (as SO_2), NO_x (as NO_2), NH_3, NMVOCs, CO, heavy metals (HMs), and persistent organic pollutants (POPs) and for CO_2 and CH_4 the same data as reported under the United Nations Framework Convention on Climate Change (UNFCCC).

The European Community is Party to the LRTAP Convention and is furthermore Party to the 1988 NO_x Protocol, and the 1994 Protocol on Further Reduction of Sulphur Emissions. In addition the European Community has signed, but not yet ratified, the 1991 Protocol on Volatile Organic Compounds, the 1998 Heavy Metals Protocol, and the 1998 Protocol on Persistent Organic Pollutants.

Apart from the European Community, all of its Member States are individual Parties to CLRTAP. The Member States of the European Union and the European Communities are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. The Member States also report their emission data directly to the UNECE.

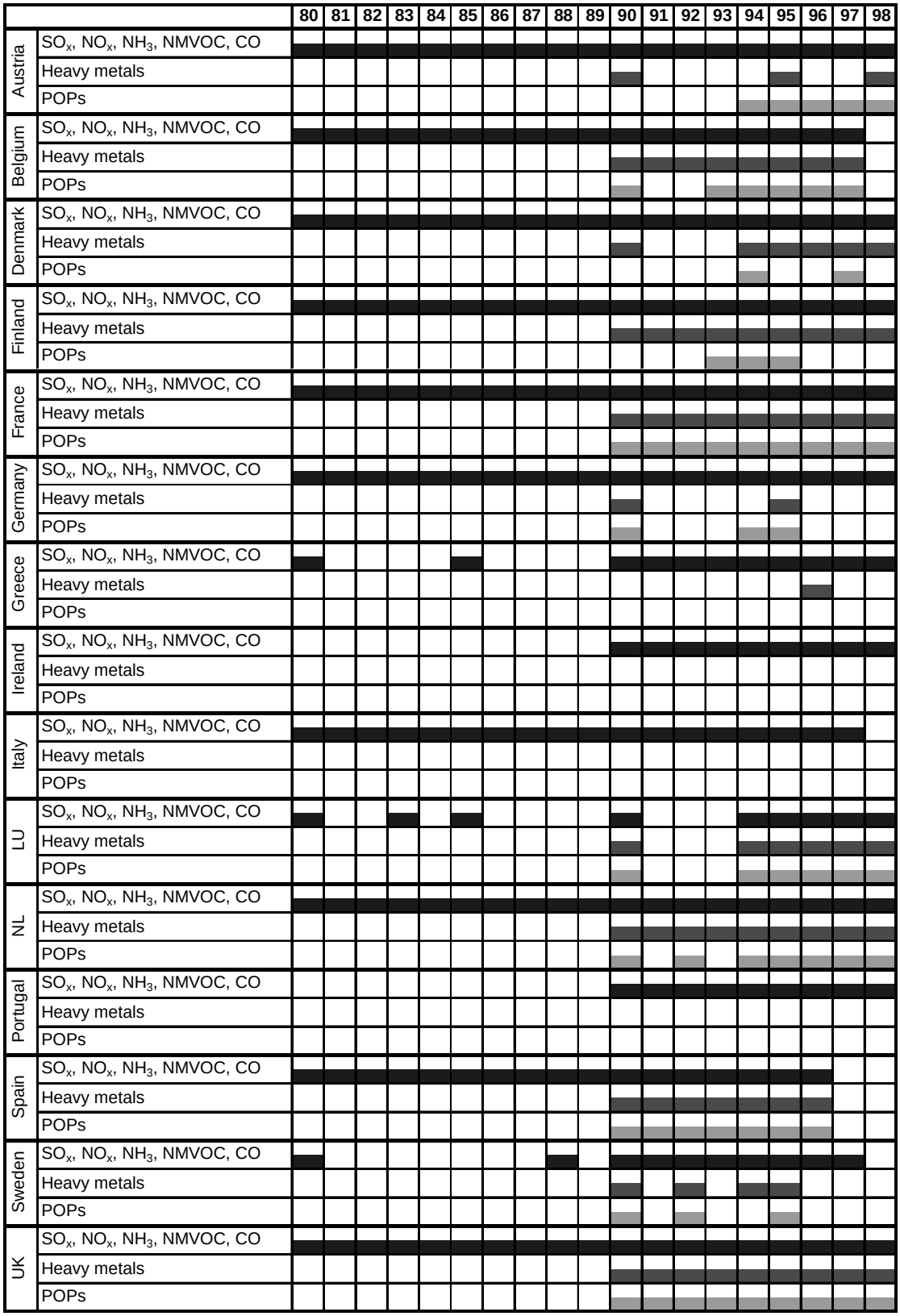
The EC CLRTAP emission inventory is based on the same data that Parties (EU Member States) submit to UNECE. EU Member States are requested by the European Commission to provide a copy of their submission to UNECE to the European Commission and to the European Environment Agency (EEA). EEA assists the Commission in the compilation of the annual EC CLRTAP inventory, based on the Member States data, through the work of its European Topic Centre on Air Emissions (ETC/AE).

This report presents air emission inventories for the European Community as a whole (EU15) and for its individual Member States for 1990-1998 (and 1980 to 1990 where available). It contains data on CO_2, CH_4, SO_x (as SO_2), NO_x (as NO_2), NH_3, NMVOCs, CO, heavy metals (HMs), and persistent organic pollutants (POPs). Since the data have been revised and updated this submission replaces any previous EC inventory data submitted to UNECE/CLRTAP.

1.2. Data basis

Although the European Community fully recognises the reporting obligations under the LRTAP Convention, reporting complete EC inventories has been difficult. Because the EC compiles its inventories based on Member States emission data, the EC needs to rely on the availability of Member States data in order to compile complete and timely EC inventories. The MS data are however not complete (see **Table 1**).

Table 1: Data availability (data submitted by Member States, by 15 September 2000)



The data basis for this report is as follows:

1. For all **pollutants, except CO_2 and CH_4** direct inventory submissions of the Member States to the Commission have been used (copies of these submissions were provided to the EEA).

2. For **CO_2 and CH_4** the inventories, as compiled by EEA and ETC/AE for the inventory submission by the European Commission to UNFCCC, have been used (*Annual European Community Greenhouse Gas Inventory 1990-1998, EEA Technical Report 41, May 2000*). This report therefore includes data for CO_2 and CH_4 that were available to the European Commission (copies available at EEA) by 1 April 2000.

Complete EC inventories are provided if data are available for each Member State. For CO_2 and CH_4 complete EC inventories could be compiled for 1990-1998 because all Member States delivered data for that period (only for Luxembourg no data was available for 1991-1993). For other groups of pollutants, Table 1 gives an overview of data availability from EC Member States. This shows that for most pollutants complete EC inventories could only be compiled for a limited number of years. In this report no gap filling procedures have been used, mainly because there is no agreement, within the EC, on the methodology and procedure for such gap filling.

It is expected that future EC submissions of CLRTAP emission inventories to UNECE will be more complete.

1.3. Reporting format

The report follows the draft reporting procedures described in document EB.AIR/GE.1/1997/5 and the ECE Environment and Human Settlements Division's explanatory letter of 14 December 1999 requesting the submission of 1998 emission data by the Parties to the CLRTAP.

As required under the reporting procedures the emissions of all pollutants, except CO_2 and CH_4, are presented in SNAP level 1 split (CLRTAP/EMEP reporting format) for the EC and its individual Member States.

Furthermore, as required under the reporting procedures, for CO_2 and CH_4 the same data as reported under the United Nations Framework Convention on Climate Change (UNFCCC) are presented, following the UNFCCC reporting guidelines (FCCC/CP/1999/7) and the IPCC 1996 Guidelines for National Greenhouse Gas Inventories (UNFCCC summary table 1A which corresponds to IPCC table 7A).

The report provides in Annex A tables for emissions of the EC for the period 1990 to 1998.

Annex B provides tables of emission data for each Member State for the period 1990 to 1998, and where available also for the period 1980 to 1990.

2. Annex A: European community CLRTAP emission data

2.1. Anthropogenic annual emissions SO_2, NO_x, NH_3, NMVOC, CO, CH_4, CO_2 1980-1998

Party: European Community, Sector: All sectors

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
SO_x (as SO_2)											19127				13072	12278	10181		
NO_x (as NO_2)											13289				11828	11470	11350		
NH_3											3788,7					3530,2			
NMVOC											16888						14026		
CO											50008				41861	40574	39353		
CH_4											20878	20380	19701	18908	18399	18274	17766	17572	17489
CO_2											3309	3337,5	3263,1	3199,2	3214,4	3252,7	3329	3269	3314,9

Notes:
SO_2, NO_2, NMVOCs, NH_3, CO and CH_4 in thousands of tonnes per year; CO_2 in millions of tonnes per year.
For CH_4 and CO_2 data has been used from the 2000 submission of the European Community to the UNFCCC Secretariat *Annual EC greenhouse gas inventory 1990-1998, EEA Technical report No 41/2000.*

2.2. Anthropogenic annual emissions of CO_2 and CH_4 1990-1998

European Community 1990-1998: Emissions of CO_2 and removals by sinks in thousand tonnes (UNFCCC/IPCC format)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998
	(Gg)								
1. Energy	**3152903**	**3188043**	**3117437**	**3059513**	**3066880**	**3101414**	**3180043**	**3119430**	**3163289**
A. Fuel Combustion (Sect. Approach)	3127416	3164329	3093973	3036224	3041560	3077914	3156158	3096063	3130079
1. Energy Industries	1147542	1132348	1115931	1061059	1063530	1070436	1077356	1041633	1074739
2. Manufacturing Ind. and Constr.	634748	599382	589844	570503	594131	606369	595906	611688	600651
3. Transport	690892	691847	727273	732756	742131	748829	766738	777853	798165
4. Other Sectors	633429	671465	647436	657020	629095	638230	703752	648285	652449
5. Other	20366	98887	13119	14577	12481	13853	12310	16470	14075
B. Fugitive Emissions from Fuels	25447	23724	23473	23241	25361	23529	23883	23367	23210
1. Solid Fuels	6500	5800	5676	5440	5287	5486	5128	5256	5207
2. Oil and Natural Gas	18946	17924	17797	17801	20074	18043	18756	18111	18003
2. Industrial Processes	**151549**	**142959**	**139590**	**134196**	**142395**	**145813**	**142946**	**145713**	**148271**
A. Mineral Products	108928	102381	100984	96445	100520	101215	101246	106909	110507
B. Chemical Industry	12366	11640	10669	10659	10769	11547	11556	11490	11235
C. Metal Production	24516	21333	19370	19332	22267	24464	23743	24298	23416
D. Other Production	1264	1054	1335	1168	1155	1233	1675	1177	1163
E. Production of Halocarbons and SF_6	-	-	-	-	-	-	-	-	-
F. Consump. of Halocarbons and SF_6	-	-	-	-	-	-	-	-	-
G. Other	4454	2897	3077	2597	3050	2865	4725	1844	1954
3. Solvent and Other Product Use	6820	6762	6526	6187	6207	6173	6250	6416	6260
4. Agriculture	-	-	-	-	-	-	-	-	-
A. Enteric Fermentation	-	-	-	-	-	-	-	-	-
B. Manure Management	-	-	-	-	-	-	-	-	-
C. Rice Cultivation	-	-	-	-	-	-	-	-	-
D. Agricultural Soils	1570	1425	1303	1414	1405	1287	1352	1412	1376
E. Prescribed Burning of Savannas	-	-	-	-	-	-	-	-	-
F. Field Burning of Agricult. Residues	-	-	-	-	-	-	-	-	-
G. Other	-	-	-	-	-	-	-	-	-
5. Land-Use Change and Forestry	-	-	-	-	-	-	-	-	-
A. Changes in Forest and Other Woody Biomass Stocks	-	-	-	-	-	-	-	-	-
B. Forest and Grassland Conversion	11950	11053	10893	11903	11326	11217	10844	11496	11491
C. Abandonment of Managed Lands	-	-	-	-	-	-	-	-	-
D. CO_2 Em. and Removals from Soil	29479	29732	29384	28712	25703	25390	25899	26767	27158
E. Other	2808	2783	2735	2687	2759	2783	2666	-	-
6. Waste	**5322**	**5439**	**5630**	**5628**	**5362**	**6139**	**6634**	**6631**	**6539**
A. Solid Waste Disposal on Land	263	321	369	357	290	124	82	65	62
B. Waste-water Handling	-	-	-	-	-	-	3	-	-
C. Waste Incineration	5058	5117	5261	5271	5072	4413	4681	4083	4165
D. Other	-	-	-	-	-	1642	1868	2483	2312
7. Other	640	615	608	556	692	699	698	558	2869
Total Emissions/Rem. with LUCF	**3100807**	**3113163**	**3049164**	**2982389**	**3006079**	**3048466**	**3115636**	**3061671**	**3113655**
Total Emissions without LUCF	**3308987**	**3337539**	**3263112**	**3199218**	**3214375**	**3252691**	**3328988**	**3268989**	**3314926**
Memo Items:									
International Bunkers	**166762**	**166284**	**172492**	**182409**	**180485**	**184486**	**195102**	**210356**	**222810**
Aviation	58891	58908	64442	70791	72100	74630	77977	82741	89822
Marine	108212	107718	108391	111960	108386	109856	117125	128276	133792
Multilateral Operations	-	-	-	-	-	-	-	-	-
CO_2 Emissions from Biomass	138076	120867	120168	121893	125426	132711	160880	162381	158160

Source: EC submission to the UNFCCC Secretariat Annual EC greenhouse gas inventory 1990-1998, EEA Technical report No 41/2000

European Community 1990-1998: Emissions of CH_4 in thousand tonnes (UNFCCC/IPCC format)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998
	(Gg)								
Total Emissions	**20878**	**20380**	**19701**	**18908**	**18399**	**18274**	**17766**	**17572**	**17489**
1. Energy	**4813**	**4720**	**4594**	**4152**	**3788**	**3779**	**3639**	**3580**	**3540**
A. Fuel Combustion (Sect. Approach)	790	784	734	718	681	670	685	650	688
1. Energy Industries	32	32	34	36	38	42	45	46	69
2. Manufacturing Ind. and Constr.	58	52	53	52	53	54	52	53	60
3. Transport	206	193	190	185	181	176	170	163	162
4. Other Sectors	491	486	452	442	405	396	417	387	395
5. Other	2	20	3	3	3	2	2	3	2
B. Fugitive Emissions from Fuels	4023	3936	3860	3434	3107	3109	2953	2929	2853
1. Solid Fuels	2426	2319	2246	1810	1511	1567	1391	1411	1347
2. Oil and Natural Gas	1597	1617	1614	1624	1597	1542	1562	1519	1506
2. Industrial Processes	**22**	**22**	**22**	**24**	**25**	**24**	**23**	**20**	**27**
A. Mineral Products	0	0	0	0	1	1	0	0	0
B. Chemical Industry	7	7	7	7	7	12	13	10	8
C. Metal Production	11	11	10	10	10	10	10	10	18
D. Other Production	-	-	-	-	-	-	0	0	0
E. Production of Halocarbons and SF_6	-	-	-	-	-	-	-	-	-
F. Consump. of Halocarbons and SF_6	-	-	-	-	-	-	-	-	-
G. Other	4	4	4	5	6	1	1	0	0
3. Solvent and Other Product Use	2	2	2	2	2	2	2	2	2
4. Agriculture	**9072**	**8851**	**8677**	**8602**	**8584**	**8594**	**8581**	**8556**	**8526**
A. Enteric Fermentation	6733	6593	6433	6391	6353	6349	6342	6339	6307
B. Manure Management	2010	1932	1924	1900	1909	1927	1911	1893	1897
C. Rice Cultivation	109	107	106	106	115	114	119	119	117
D. Agricultural Soils	194	194	195	194	195	194	194	192	192
E. Prescribed Burning of Savannas	-	-	-	-	-	-	-	-	-
F. Field Burning of Agricult. Residues	25	26	20	13	12	11	13	13	13
G. Other	-	-	-	-	-	-	-	-	-
5. Land-Use Change and Forestry	**170**	**190**	**133**	**128**	**126**	**169**	**133**	**113**	**152**
A. Changes in Forest and Other Woody Biomass Stocks	54	79	25	18	18	62	26	9	48
B. Forest and Grassland Conversion	18	12	13	16	14	13	12	14	14
C. Abandonment of Managed Lands	-	-	-	-	-	-	-	-	-
D. CO_2 Em. and Removals from Soil	-	-	-	-	-	-	-	-	-
E. Other	98	98	95	95	94	94	95	90	90
6. Waste	**6800**	**6596**	**6273**	**6000**	**5874**	**5706**	**5389**	**5301**	**5241**
A. Solid Waste Disposal on Land	6357	6166	5839	5476	5430	5256	4909	4782	4714
B. Waste-water Handling	328	310	302	384	300	299	303	310	311
C. Waste Incineration	40	47	45	44	43	43	44	46	47
D. Other	75	74	87	95	101	109	133	163	169
7. Other	-	-	-	-	-	-	-	-	-
Memo Items:									
International Bunkers	**10**	**10**	**10**	**10**	**10**	**11**	**11**	**12**	**13**
Aviation	5	5	5	5	6	6	6	6	7
Marine	5	5	5	5	5	5	5	6	6
Multilateral Operations	-	-	-	-	-	-	-	-	-
CO_2 Emissions from Biomass									

Source: EC submission to the UNFCCC Secretariat Annual EC greenhouse gas inventory 1990-1998, EEA Technical report No 41/2000

Notes:

Totals and sub-totals of the EC inventory are the sum of Member States' emissions. In case totals and sub-totals do not add up, this is due to different completeness of Member States' submissions.

Category 5 'Land-Use Change and Forestry' provides 'net' emissions (Member States emissions minus Member States removals) of CO_2 following UNFCCC/CRF recommendations.

2.3. Anthropogenic annual emissions of heavy metals 1990-1998

Party: European Community, Sector: All sectors

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Lead (Pb)									
Cadmium (Cd)									
Mercury (Hg)									
Arsenic (As)									
Chromium (Cr)									
Copper (Cu)									
Nickel (Ni)									
Selenium (Se)									
Zinc (Zn)									

Pb, Cd and Hg are the heavy metals referred to in article 3, paragraph 1, and in annex I to the 1998 Protocol on Heavy Metals.
The rest are to be reported on a voluntary basis.

Units: tonnes per year.

2.4. Anthropogenic annual emissions of persistent organic pollutants 1990-1998

Party: European Community

ANNEX I[1/]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Aldrin (CAS: 309-00-2)									
Chlordane (CAS: 57-74-9)									
Chlordecone (CAS: 143-50-0)									
Dieldrin (CAS: 60-57-1)									
Endrin (CAS: 72-20-8)									
Heptachlor (CAS: 76-44-8)									
Hexabromobiphenyl (CAS: 36355-01-8)									
Mirex (CAS: 2385-85-5)									
Toxaphene (CAS: 8001-35-2)									
ANNEX II[2/]									
Hexachlorocyclohexane (HCH) (CAS: 608-73-1)									
DDT (CAS:50-29-3)***									
Polychlorinated biphenyls (PCBs)****									
ANNEX III[3/]									
Dioxins & Furans									
Polyaromatic hydrocarbons (PAHs)*									
Hexachlorobenzene (HCB)** (CAS: 118-74-1)									
OTHER[4/]									
Pentachlorophenol (PCP) (CAS: 87-86-5)									
Short chained chlorinated parraffins (CAS: 85535-84-8)									

Units in kg per year except for dioxins and furans, which are reported in grams toxic equivalents (Teq) per year (as defined by NATO CCMS international toxic equivalent scheme). For PAHs, units tons per year. Please list PAHs and sources included in this inventory. All air emissions should be reported in this table (e.g. HCB can be used as pesticide but can also be emitted as a byproduct of combustion and as a contaminant in other pesticides).

Notes:

[1/] The POPs listed in annex I to the Protocol on POPs are substances scheduled for elimination.

[2/] The POPs listed in annex II to the Protocol on POPs are substances scheduled for restriction use.

*** DDT is also listed in annex I.

**** PCBs are also listed in annex I.

[3/] The POPs listed in annex III to the Protocol on POPs are substances referred to in article 3, para. 5 (a), of the Protocol.

* Polycyclic aromatic hydrocarbons (PAHs): For the purposes of the emission inventories, the following four indicator compounds shall be used: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene

** HCB is also included in annex I to the Protocol as a substance scheduled for elimination.

[4/] See article 8 of the Protocol (Research, development and monitoring; reporting voluntary).

2.5. Anthropogenic annual use and production of persistent organic pollutants 1990-1998

Party: European Community

ANNEX I[1/]	1990		1991		1992		1993		1994		1995		1996		1997		1998	
	use	prod.	use	prod.	use	prod.	use	prod.	use	prod.	use	prod.	use	prod.	use	prod.	use	prod.
Aldrin (CAS: 309-00-2)																		
Chlordane (CAS: 57-74-9)																		
Chlordecone (CAS: 143-50-0)																		
Dieldrin (CAS: 60-57-1)																		
Endrin (CAS: 72-20-8)																		
Heptachlor (CAS: 76-44-8)																		
Hexabromobiphenyl (CAS: 36355-01-8)																		
Mirex (CAS: 2385-85-5)																		
Toxaphene (CAS: 8001-35-2)																		
ANNEX II[2/]																		
Hexachlorocyclohexane (HCH) (CAS: 608-73-1)																		
DDT (CAS:50-29-3)***																		
Polychlorinated biphenyls (PCBs)****																		
ANNEX III[3/]																		
Dioxins & Furans																		
Polyaromatic hydrocarbons (PAHs)*																		
Hexachlorobenzene (HCB)** (CAS: 118-74-1)																		
OTHER[4/]																		
Pentachlorophenol (PCP) (CAS: 87-86-5)																		
Short chained chlorinated parraffins (CAS: 85535-84-8)																		

Units kg per year except for dioxins and furans, which are reported in grams toxic equivalents (Teq) per year (as defined by NATO CCMS international toxic equivalent scheme). For PAHs, units tons per year. Please list PAHs and sources included in this inventory. State use and/or production with X in the table if exact quantity uncertain.

Notes:

[1/] The POPs listed in annex III to the Protocol on POPs are substances referred to in article 3. Para 5 (a) of the Protocol.
Polycyclic aromatic hydrocarbons (PAHs): For the purposes of the emission inventories, the following four indicator compounds shall be used: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene.
HCB is also included in annex I to the Protocol as a substance scheduled for elimination.

[2/] The POPs listed in annex II to the Protocol on POPs are substances scheduled for restriction on use.
DDT is also listed in annex I.
PCBs are also listed in annex I.

[3/] The POPs listed in annex I to the Protocol on POPs are substances scheduled for elimination.

[4/] See article 8 of the Protocol (Research, development and monitoring)

3. Annex B: EC Member States CLRTAP emission data

(Published only on the EEA web site)